

THE ROLE OF LAND USE IN MEETING CALIFORNIA'S ENERGY AND CLIMATE CHANGE GOALS

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ABSTRACT

California's land use patterns shape energy use and the consequent production of greenhouse gas emissions. Land use planning can influence the reduction of greenhouse gas emissions and energy use by encouraging walking, mixed use, and energy-efficient housing design. Issues such as housing, transportation planning, and local greenhouse gas reduction planning are well suited to a regional approach, and California's metropolitan planning organizations are involved in long-range planning efforts to develop transportation plans that better incorporate land use considerations. These plans are changing the landscape of planning in the state and are expected to reduce projected energy and climate impacts in the regions. Other states have similar regional planning programs and have instituted regulatory and incentive structures to support the implementation of the plans.

The passage of the Governor's Strategic Growth Infrastructure Bond package represents an opportunity to influence the energy efficiency and environmental friendliness of communities and new growth through project funding criteria. Utilities are playing a small but growing role in collaborative planning efforts with local governments. The potential for mutual benefit from planning efforts between these groups is great, but may need regulatory relief to achieve.

The body of research on the impact of land use on energy and climate is relatively small but receiving significantly more attention with the growing interest in climate change. The California Energy Commission is dedicating significant resources to studying opportunities and barriers to integrated energy planning.

KEYWORDS: Land use planning, IEPR, Integrated Energy Policy Report, land use planning models, energy infrastructure, global climate change, blueprint planning, role of land use in climate change, role of utilities in land use planning, land use planning research

EXECUTIVE SUMMARY

California's land use patterns have shaped energy use in the state and have contributed to the production of greenhouse gases. These patterns include the excessive use of land per household, location away from transit and jobs, preferences for less dense housing, and site designs that require driving rather than walking to meet every day needs. With the state's population expected to grow by 20 million additional residents by 2050, how future land use patterns develop will either help or hinder California in achieving its ambitious energy and climate change goals.

Recent California laws and policies set the stage for how the state will develop its land, use energy, and emit greenhouse gases in the future. Governor Schwarzenegger's Executive Order S-3-05 established greenhouse gas emission reduction targets for 2010, 2020, and 2050; Assembly Bill 32 (Nuñez and Pavley, Chapter 488, Statutes of 2006) implements the 2020 greenhouse gas emission reduction target.

Transportation accounts for about 41 percent of California's 2004 total greenhouse emissions; gasoline use alone accounts for 27 percent of the 2004 total. For this reason, the state has initiated efforts to reduce petroleum use, reduce emissions from light-duty vehicles, reduce the carbon intensity of fuels, improve transportation energy efficiency and incorporate smart land use and intelligent transportation.

Population growth, gasoline consumption, and vehicle miles traveled are interrelated and may grow in similar or diverging paths depending on the success of the above initiatives. Measures to reduce vehicle miles traveled will be particularly important.

Land use patterns play a direct role in vehicle miles traveled, as a result of the distance that people travel and the mode of travel they choose. Density may have the most profound effect on travel and transportation outcomes, with higher density reducing vehicle miles traveled. The jobs-housing balance will also reduce vehicle miles traveled by shortening commute distances. In addition, the type of housing that California's aging population chooses may affect whether Californians drive more or less as it ages.

State Propositions 13 and 218 have reduced the role of property-based taxation as a local government revenue source and have resulted in a bias towards large retail establishments that require substantial vehicle travel. However, opportunities still exist for integrated land use and transportation planning that would reduce energy demand and greenhouse gas emissions. At the regional level, hundreds of millions of dollars are spent annually on transportation, land use, and air quality planning. At the local level, general plans and zoning codes are incorporating more growth management and consideration of energy elements. At the state level, policies and requirements relating to the California Environmental Quality Act, the California Transportation Plan, housing

element updates, the California Water Plan, and stormwater plans can all affect local land use planning and development.

Examples of Better Land Use Planning

A number of exemplary programs to encourage better land use planning exist at the state, regional, and local levels in California, and examples outside the state are also plentiful. California's Regional Blueprint Planning Program is providing funding to help regional governments create more efficient land use patterns. The Blueprint Learning Network helps state agencies make better infrastructure investment decisions.

Energy is not a stated component of Blueprint Planning but is often addressed; for example, both the Southern California and Sacramento Area Associations of Governments are evaluating the risk of long-term disruption in transportation fuels.

By incorporating better land use decisions, Blueprint Planning could significantly reduce future vehicle miles traveled. The differences between the business-as-usual case and a preferred scenario developed by Sacramento stakeholders showed that the latter scenario would use 46 percent less acreage, reduce vehicle miles traveled by 12.3 miles per household per day, and produce 15 percent less carbon dioxide and particulate matter per capita, as compared to the former. A similar planning effort in the San Francisco Bay Area showed that the smart-growth land use scenario would reduce, as compared to the business-as-usual case, the urbanized footprint of the area by 16,000 acres (2 percent), reduce per capita water consumption by 50 gallons per day (17 percent), and increase the proportion of new affordable housing from 16 percent to 41 percent.

Oregon, New Jersey, and Maryland are conducting similar smarter land use planning efforts, some of which are specifically targeted toward greenhouse emission reductions. Regional programs in Portland and Salt Lake City are using stakeholder-developed land use scenarios to generate better land use plans that are already showing reductions in vehicle miles traveled: Portland residents decreased their vehicle miles traveled by 11 percent between 1996 and 2002, while the nation and California both increased vehicle miles traveled.

California local governments are responding to the concern for climate change and are being assisted by the Institute for Local Government and the California League of Cities.

Infrastructure funding policies directly and indirectly affect transportation and land use. California has a unique opportunity to direct infrastructure investments contained in the strategic growth and approved by voters in November 2006. Funding criteria for Propositions 1B, 1C, 1D, and 84 will determine the extent to which bond monies

contribute to better land use and reduce vehicle miles traveled. An unwarranted outcome of reducing congestion could be an increase in vehicle miles traveled, should people decide to use their personal vehicles again instead of transit.

Electric utilities in California are playing a larger and more explicit role in land use planning. State utilities are actively planning for new large-scale infrastructure (for example, intrastate transmission lines) through the Senate Bill 1059 (Escutia, Chapter 638, Statutes of 2006) effort spearheaded by the California Energy Commission. On a more local scale, how transmission lines are extended to new developments could influence what growth type is preferred. California Public Utilities Commission Rules 15 and 16 govern the provision of natural gas and electricity to new residences; although density is not considered under these rules, a de facto incentive to create high-density units may exist. New Jersey, however, has issued regulations that specifically integrate smart growth principles into utility service policies. Anyone building in non-smart growth areas must pay the full cost of utility line extensions.

Utilities are realizing that they must play a greater role in local government land use planning, and a number of utilities are now actively engaged in the process. Utilities also have a unique opportunity to plan new developments from inception. Particular opportunities exist on former military bases, where large expanses of land are becoming available for residential and commercial development. Utilities are involved in redevelopment planning at El Toro Marine Corps Air Station, Treasure Island, and Hunters Point, for example. Pacific Gas and Electric Company's involvement with the latter two was the springboard for its Sustainable Communities Program.

For all aspects of future land use and transportation, research and development remains critical to reducing energy use and vehicle miles traveled and meeting climate change targets. The *2006 Integrated Energy Policy Report Update* charged the Energy Commission's Public Interest Energy Research (PIER) group with providing tools and conducting research to assist the energy and greenhouse gas reduction planning efforts of local governments. A number of currently funded projects support this charge. In the next year, over \$2 million will be allocated for sustainable communities research. This funding will support initiatives designed to better understand the interaction between energy demand and environmental design principles, to identify infrastructure design impacts on energy and the environment, and to identify design improvements that would reduce energy use in California. Land use modeling tools will be key to these initiatives.

Transportation research is also underway at PIER, with research designed to reduce petroleum consumption and greenhouse gas emissions through increased vehicle efficiency. Creation of new, and validation of existing, transportation modeling tools used in these and similar research efforts are important elements. Understanding the

role of smart communities—those that employ information technology to change how the community uses its physical space—in reducing vehicle miles traveled would also be beneficial.

Findings and Conclusions

Staff identified the following key findings and conclusions that the state and the Energy Commission should consider for reducing energy use and greenhouse gas emissions related to land use:

1. With over 40 percent of California’s greenhouse gas emissions coming from the transportation sector, significant efforts to reduce vehicle miles traveled are needed to meet the state’s emission reduction goals. The state must find a way to not only slow the current 3 percent annual vehicle miles traveled growth rate, but begin to reduce it.
2. The research reviewed shows that increasing a community or development’s density and accessibility to job centers are the two most significant factors for reducing vehicle miles traveled through design.
3. Existing tax polices, largely developed in response to Proposition 13, promotes commercial sprawl, that can provide local governments with much needed revenue for public services and infrastructure, at the expense of smart growth strategies.
4. Dealing with issues such as housing, transportation mobility, economic development, and local climate change planning requires a regional approach.
5. While the state has limited land use authority it does have some key leverage points (California Environmental Quality Act, housing elements, and others) that can be used to assist local governments in reducing energy use and greenhouse gas emissions that result from land use planning choices. Thus, while land use authority is nearly completely vested with local government, the state can use the disbursement of transportation funds to motivate collaborative planning at a regional level.
6. The state-sponsored Blueprint Planning Program has engaged nearly all of the state’s metropolitan planning organizations in a long-range planning effort that will have many of them adopting plans to better coordinate land use and transportation development. The plans accommodate housing needs, reduce vehicle miles traveled, and identify priority planning areas. The plans are in early stages of implementation and may require technical, financial, and regulatory assistance to achieve their goals.
7. Other states and regional governments have adopted preferred growth scenarios that better coordinate land use and transportation development while

accommodating housing needs, reducing vehicle miles traveled, and identifying priority planning areas. Some of the states and regions have restricted financial and technical assistance to the identified priority planning areas in efforts to support the plan goals.

8. Infrastructure funding policies influence the design and use of infrastructure projects. The Governor's Strategic Growth Plan contained numerous programs to encourage energy efficient, climate friendly land use but project criteria (where they exist) for many of the programs contain no energy or climate considerations. The next federal transportation bill, if implemented, could significantly bolster the Blueprint planning effort if it accounts for energy and climate considerations.
9. Utilities have historically played only a limited role in local government planning efforts. Coordinated planning between a utility and local government can produce many mutual benefits in terms of demand management, infrastructure deployment, distributed generation, and installation of renewable energy generation. California investor-owned utilities have begun to engage with local and regional governments in mutual planning efforts, but these partnerships are prevented from reaching their full potential since the utilities cannot recoup the costs of their efforts.
10. Land use impacts on energy demand, generation, and transmission and on greenhouse gas emissions are in the early stages of exploration. Further research and development is necessary to explain and quantify the impacts land use has on energy systems, including: the correlation between land development patterns and vehicle miles traveled, the potential for low energy design principles, and the use of community-scale distributed and renewable generation technologies. In the context of local government decision making, there is a need for research to develop modeling and decision-support tools to allow the integration of energy considerations into future research and planning efforts. The Energy Commission is engaging in a new area of research that will look at the integrated relationships between land use, human behavior, urban design, environmental impacts, and energy under its new Sustainable Communities research program.

CHAPTER 1: INTRODUCTION

California's land use patterns have significantly shaped our use of energy and production of greenhouse gases. With the state's population expected to grow by 20 million additional residents by 2050, how we manage that growth will determine whether we meet our energy and greenhouse gas (GHG) emission reduction goals.

The energy choices embedded in the location and design of the new homes, schools, industry, offices and transportation infrastructure that will be planned and built over the next 50 years to accommodate California's new residents will last into the next century. These choices will determine our future energy demand and will affect the degree to which our climate is changed by human forces.

Many of the policies currently being pursued to reduce the use of energy and the production of GHG associated with land use are directed at the transportation sector and are technology-based, such as the Low Carbon Fuel Standard (LCFS) and the California Air Resources Board's (ARB) GHG regulations for vehicles. If the state is to meet its energy and GHG emission reduction goals, it must also harness the potential of wise land use choices to forward these goals.

Most urban growth over the last 30 years has been characterized by travel-inducing features: low-density; a lack of balance and accessibility between housing, jobs and services; inefficient infrastructure design; and not designed for any mode of transportation except the single-occupancy vehicle. This growth pattern has resulted in vehicle miles traveled (VMT) by California residents increasing at a rate of over 3 percent a year between 1975 and 2004, markedly faster than the population growth rate over the same period, which was less than 2 percent.¹ This increase in VMT directly correlates to an increase in petroleum use and GHG production and has led to the transportation sector being responsible for 41 percent of the state's GHG emissions in 2004². In 2005, California's gasoline consumption was essentially the same as 2004, and in 2006, gasoline demand declined slightly as a result of high prices.

The California Department of Transportation (Caltrans) estimates that VMT will continue to increase at nearly 3 percent per year for the foreseeable future. Even with significant penetration of ARB's greenhouse gas regulations and implementation of the LCFS, the increase in GHG emissions from the increased travel will outweigh the

¹ State of California, Department of Finance, *Race/Ethnic Population with Age and Sex Detail, 1970–2004*. Sacramento, CA, December 1998 and United States Government, Federal Highway Authority, *Highway Statistics 1975–2004*, Washington D.C., 2005.

² *State of California, California Energy Commission, Inventory of California Greenhouse Gas Emission and Sinks: 1990–2004*, Sacramento, CA, December 2006, CEC-600-2006-013, p. 8.

policies combined benefits. The state, in partnership with regional planning organizations, local governments and utilities, must address VMT growth and the most effective way to do so is through better land use planning and development. However, VMT reductions alone will still not be sufficient to meet the state's ambitious GHG reduction goals. Fortunately, smart growth has the potential to reduce energy through many avenues, not just transportation.

As the *2006 Integrated Energy Policy Report Update* noted, "By including energy demand, supply, and infrastructure as central factors in the land use planning equation, the state and local governments can make intelligent use of all resources and meet energy related goals. Broadening the definition of smart growth to encompass *all* energy saving strategies is a first step in that direction. Increasing on-site production of renewable energy, using distributed generation (DG), orienting residences in relation to the sun, increasing shading, incorporating roofs that reflect heat, and installing energy efficient appliances are but a few non transportation-related strategies that would fall under a broader definition and produce significant energy savings."³

Better land use choices are possible and examples are beginning to emerge across the state. Partnerships, involving the state, regional planning organizations, and local governments, are developing plans for regional transportation and land use development that are projected to result in less VMT growth than if current or "business-as-usual" growth plans are adopted. The development and effective implementation of these new, collaborative "Blueprint" plans could lead to growth that provides adequate housing and jobs for California's increasing population and helps meet our climate and energy goals while maintaining and enhancing quality of life.

The ability of regional planning agencies and local governments to develop and implement new land use plans will depend greatly on government (both state and federal) and utility activities, policies and assistance (both technical and financial). While the state has very limited land use authority, the policies it develops in regard to new infrastructure, utility funding, environmental review and housing allocation are but a few of the leverage points that the state can use to assist local governments in growing in an energy efficient and climate friendly manner.

In addition to policies and financing, there is a significant need to understand the effects of current development practices and the potential for better practices to inform land use decision making. One pressing example is the need for more research that allows the state to quantitatively assess the impacts of growth decisions and the tools and

³ State of California, California Energy Commission, *Integrated Energy Policy Report*, Sacramento, CA, 2006, p. 73.

analytical models to help regional and local agencies develop and implement more energy efficient plans. The California Energy Commission (Energy Commission) and other agencies are beginning to address this need, but more resources must be invested to plan and assess the effectiveness of the state's current and future land use policies.

This report examines: the role of land use in the state's generation, demand for and use of energy and emission of GHGs; possible growth scenarios and their associated impacts; the role of regional planning organizations and utilities in shaping energy-aware land use plans; opportunities for the state to change infrastructure and development policies to better facilitate energy-efficient and climate-friendly growth; the current state of land use, energy and climate research and future research needs; and staff findings.

The Energy Commission addressed the interaction between land use and energy in its *2006 Integrated Energy Policy Report (IEPR) Update* and offered a series of policy recommendations. The appendix provides the current status of the recommendations.

Land Use, Energy, and Climate Policy Context

A number of recent laws and policies will significantly impact the way in which the state develops its land, uses energy and emits GHGs. This section discusses the various state policies that will influence and direct California's efforts to reduce energy and climate impacts resulting from land use.

Executive Order S-3-05

On June 1, 2005, Governor Arnold Schwarzenegger signed Executive Order S-3-05, establishing GHG emissions reduction targets for 2010, 2020 and 2050. The Order established targets to: reduce 2010 emissions to 2000 levels; reduce 2020 emissions to 1990 levels; and to reduce 2050 emissions to 80 percent below 1990 levels. The order directed the Secretary of the California Environmental Protection Agency (CalEPA) to coordinate efforts to meet these targets.

Climate Action Team

In order to implement Executive Order S-3-05, the Secretary of CalEPA created the Climate Action Team (CAT). The CAT is comprised of, but not limited to, representatives from the following agencies:

- Business, Transportation and Housing (BTH)
- Department of Food and Agriculture
- Resources Agency
- Air Resources Board

- California Energy Commission
- Integrated Waste Management Board
- Public Utilities Commission

The CAT has developed a list of over 40 strategies to meet the goals of the Executive Order, including strategies to reduce the carbon intensity of vehicular travel and also to reduce VMT. Specifically included in VMT reduction strategies are “Measures to Improve Transportation Energy Efficiency” and “Smart Land Use and Intelligent Transportation,” both to be implemented by BTH through Caltrans.

These strategies build on current efforts to provide a framework for expanded and new initiatives, including incentives, tools and information that advance cleaner transportation and reduce climate change emissions. Combined, the two strategies are expected to reduce 27 million metric tons carbon dioxide CO₂ equivalent per year by 2020.⁴ This represents nearly 16 percent of the total reductions needed to meet the Governor’s 2020 target.⁵ The Energy Commission is playing an integral role in these efforts, with Chairman Pfannenstiel chairing the CAT’s Local Government/Smart Growth subcommittee.

The measures include the following:

Measures to Improve Transportation Energy Efficiency

- Incorporating energy efficiency and climate change emissions reduction measures into the policy framework governing land use and transportation, including framework for developing energy element in state transportation and regional planning documents. Better coordination on cross-agency climate change and energy policy framework to ensure a concerted effort and synergy among state agencies’ climate change emission reduction activities.
- Increasing incentives and accelerating technology applications to improve transportation system productivity and move toward cleaner and more efficient vehicles, especially for the public sector fleet. Enhancing outreach and educational programs to bring a coordinated message of sustainable transportation and root causes of climate change emissions.
- Diversifying transportation energy infrastructure and advancing measures to slow the growth rate of vehicle miles traveled and excessive reliance on petroleum.

⁴ State of California Environmental Protection Agency, *Climate Action Team Report to Governor Schwarzenegger and the California Legislature*, Sacramento, CA, 2006, p. 57.

⁵ *ibid.*, pp. 57 and 64.

Smart Land Use and Intelligent Transportation

“Smart” land use is an umbrella term for strategies that integrate transportation and land-use decisions. Such strategies generally encourage jobs/housing proximity, promote transit-oriented development, and encourage high-density residential/commercial development along transit corridors. These strategies develop more efficient land-use patterns within each jurisdiction or region to match population increases, workforce and socioeconomic needs for the full spectrum of the population.

Assembly Bill 32

AB 32 (Nuñez and Pavley, Chapter 488, Statutes of 2006) was signed into law by Governor Schwarzenegger on September 27, 2006. This legislation implements the 2020 GHG emissions reduction target of Executive Order S-3-05. The act requires ARB to do the following:

- By July 1, 2007, to adopt a list of discrete, early action measures that can be implemented by regulation before January 1, 2010.
- By January 1, 2008, to establish a statewide GHG emissions cap for 2020, based upon 1990 emissions.
- By January 1, 2008, to adopt mandatory reporting requirements for “significant sources.”
- By January 1, 2009, to adopt a plan indicating how emission reductions will be achieved from significant GHG sources via regulations, market mechanisms and other actions.
- By January 1, 2011, to adopt regulations to achieve the maximum technologically feasible and cost-effective reductions in GHGs.

AB 32 gives wide authority to ARB to take action to reduce GHGs from all “significant sources.” At the present time, ARB does not plan to regulate land use and will depend on the CAT to make recommendations on land use matters.

Petroleum Reduction Goal

In a joint report submitted to the Legislature and Governor in August 2003, the Energy Commission and the ARB presented an overarching strategy to reduce California’s dependence on petroleum fuels for transportation energy. Based on the use of reduction measures that were shown to be technically feasible and cost-beneficial, the agencies proposed a goal to reduce on-road petroleum fuel demand to 15 percent below 2003 levels by 2020. The key recommendations to achieve this goal were to increase new vehicle fuel economy and increase the use of non-petroleum fuels (alternative fuels). The Energy Commission incorporated this goal and key recommendations into its *2003 Integrated Energy Policy Report*, which was adopted in December 2003.

Assembly Bill 1493

AB 1493 (Pavley, Chapter 200, Statutes of 2002) directs the ARB to achieve the maximum feasible and cost-effective GHG reductions from light-duty motor vehicles. ARB adopted a rule limiting emissions from passenger cars and light trucks according to a schedule that begins in the 2009 model year (MY) and is fully implemented by MY 2016. This rule is currently being challenged by automobile manufacturers that argue that ARB has exceeded its regulatory authority. Assuming the rule adopted pursuant to AB 1493 is fully implemented and gasoline use reduction is accomplished in the manner modeled by the Energy Commission staff for the *2005 Integrated Energy Policy Report*, the reductions in emissions will be equivalent to reducing gasoline consumption to a rate of 31 percent over 1990 gasoline consumption (and associated GHG emissions levels) by 2020. If the automobile manufacturers win their lawsuit and the ARB rule-making is reversed, gasoline demand from light-duty vehicles (and associated GHG emissions) is expected to exceed 1990 levels by 46 percent in 2020.

Low Carbon Fuel Standard

The Governor's Executive Order S-01-07, signed on January 18, 2007, calls for a reduction in the carbon intensity of fuel used on California roadways. The objective is to achieve at least a 10 percent reduction in the carbon intensity of California fuels used in passenger vehicles by 2020. The Executive Order directs the Secretary of the CalEPA to oversee development of a "life-cycle carbon intensity protocol" for measuring carbon intensity. Participants in the protocol include the Energy Commission, ARB, University of California (UC) scientists and other state agency staffs. This analysis will become part of the state Implementation Plan for alternative fuels as required by AB 1007 (Pavley, Chapter 371, Statutes of 2005) and will be submitted to the ARB for consideration as an "early action" item under AB 32. Potential low-carbon fuels include biodiesel, hydrogen, electricity, compressed natural gas, liquefied petroleum gas and biofuels.

The ARB will complete its review of the LCFS protocols for adoption as an early action no later than June 2007. Upon adoption as an "early action" by the ARB, the regulatory process at ARB will begin to put the new standard into effect. It is expected that the regulatory process will be completed no later than December 2008. GHG emissions reductions from the low-carbon fuel requirement have yet to be determined and may vary depending on the results of the court challenge to AB 1493. Early action rules are expected to become effective in 2010.

One provision of the rulemaking implementing AB 1493 allows for an alternative compliance option to meet its requirements. The low-carbon fuel standard may be used by fuel suppliers and/or automobile manufacturers to meet a portion of the AB 1493 requirements. If an alternative compliance strategy is used, then the low-carbon fuel standard may not achieve fuel use reductions beyond those attributable to AB 1493. This

concern is discussed below, based on the report, *A Low-Carbon Fuel Standard for California; Part 1: Technical Analysis*, May 29, 2007, authored by Alexander Farrell of UC Berkeley and Daniel Sperling of UC Davis.⁶

Historical and Projected VMT, Gasoline Demand, and Population

Figure 1 shows California's growth in historical VMT, population, and gasoline and on-road diesel consumption, all indexed to their 1990 value. Values plotted reflect growth from 1990. As stated above, this is the year that AB 32 GHG control measures are required to be met by 2020. Thus, Figure 1 can be used to see the historical growth in transportation fuel use (and associated GHG emissions) relative to the historical growth in the population and VMT and the degree of reduction needed to return to 1990 levels. Also plotted in Figure 1 are projected gasoline and on-road diesel use, population growth and VMT projected by Energy Commission staff for the *2005 Integrated Energy Policy Report*. The model used to generate this data incorporates existing conditions and business-as-usual assumptions about where and how people travel. Transportation fuel use is plotted both with and without the effect of the AB 1493 rule and one line shows the result with AB 1493 and with the low-carbon fuel standard, assuming it is entirely additive to reductions obtained by implementing AB 1493.

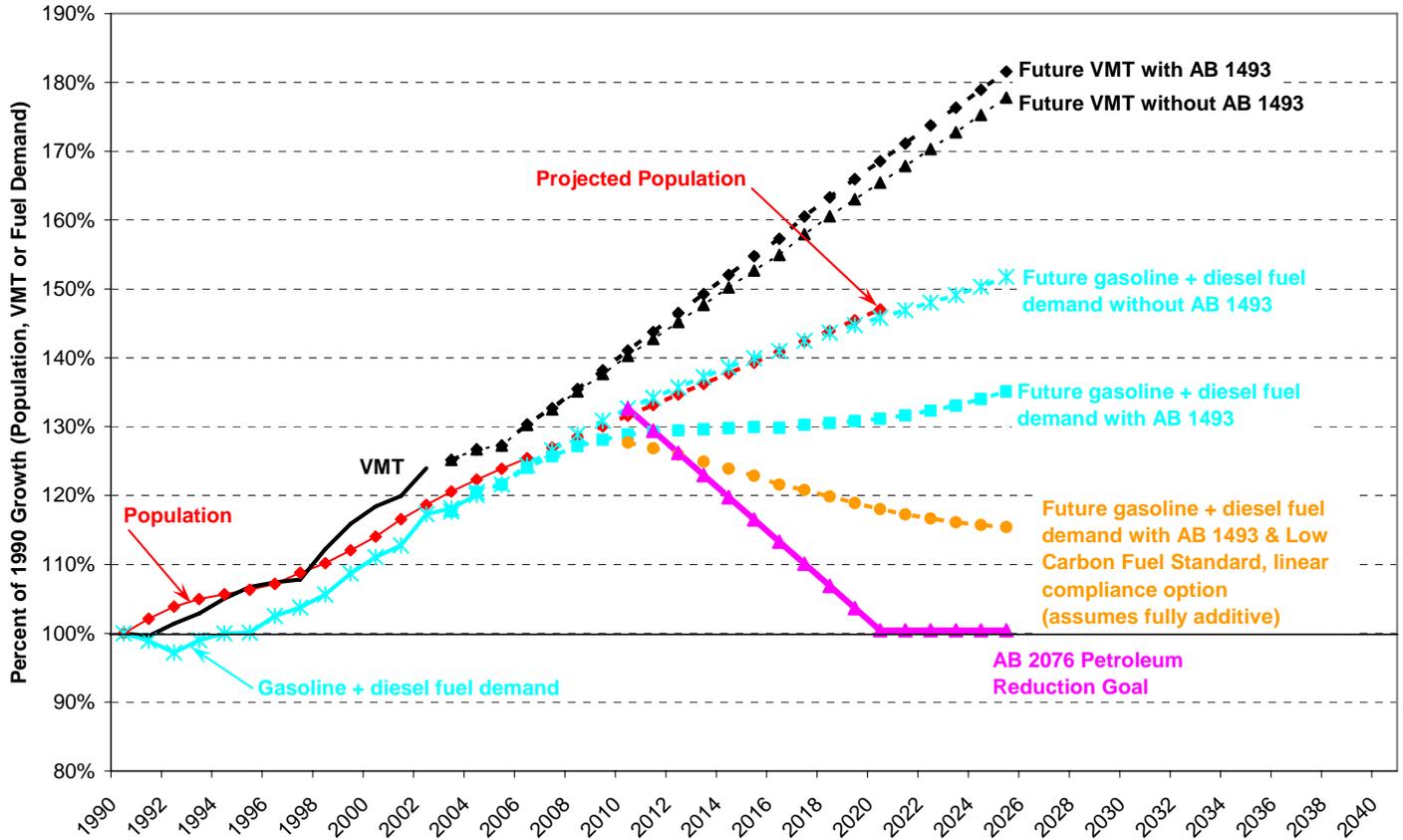
One observation from Figure 1 is that during 1990 to 2004, and as projected to about 2008, California's transportation fuel use grows more slowly than its population or VMT. This implies that Californians are driving vehicles with increasing fuel efficiency. A second observation from Figure 1 is that transportation fuel use under

Business-as-usual conditions is growing steadily and expected to be more than 150 percent of 1990 levels by 2025. This growth trend closely matches projected population growth rates.

⁶ In this report, four options for a compliance schedule are provided in Table 2-2. Staff's analysis is based upon the linear compliance option of Table 2-2.

Figure 1. Historical and Projected Population, VMT, and Fuel Demand

Historical and Projected Population, VMT and Fuel Demand, with and without AB 1493 and including Low Carbon Fuel Standard (all values scaled to 100% in 1990, AB 32 Goal for 2020)



Source: Energy Commission staff, 2007

Since gasoline GHG emissions from gasoline are such a large fraction of total GHG emissions (27 percent), it is likely that these emissions will have to be controlled to meet the goals of AB 32. The goals have yet to be established for specific energy end use sectors such as transportation, but the overall goal represents about a 29 percent reduction in projected 2020 emissions. This percentage can be used to compare the historical and projected gasoline demand. From Figure 1 it can be seen that the gallons of transportation fuel used in 2004 grew 20 percent above 1990 usage. Projected usage in 2020 is about 45 percent over 1990 consumption if the AB 1493 rule is not approved by the courts, and about 31 percent if the rule is upheld and implemented on the schedule adopted by ARB. This is problematic because the computer modeling used to develop

the forecast indicates that some changes would need implementation before 2009 to make the 2009 target, as shown in Figure 1 by the separate tracks during 2005 to 2009 with and without AB 1493. The forecast also includes the effect of the ARB's Zero Emissions Vehicle Program.

Figure 1 also shows the effect of the LCFS, assuming implementation of the "linear" compliance schedule and assuming that these reductions are fully additive to fuel use reductions accomplished by AB 1493 and the Zero Emissions Vehicle Program. Table 2-2 of the LCFS technical report shows annually decreasing carbon intensity, but the effects of the LCFS are projected only to 2020. For purposes of Figure 1, staff assumed that the linear decrease continues until 2025. The additive effect of these strategies reduces future transportation fuel consumption such that by 2025, transportation fuel consumption is only about 15 percent above 1990 consumption. This indicates that further efforts would be needed to reduce the transportation sector fuel consumption and greenhouse gas emissions to their 1990 levels.

The degree to which transportation GHG emissions must be reduced is uncertain given the status of several approaches to reduce transportation GHG emissions. However, it is apparent that reduced VMT growth will be required to meet GHG reductions goals. It is imperative that land use planning and infrastructure investments place a high priority on reducing VMT. Meeting Executive Order S-3-05's long-term goal, which requires a reduction by 2050 to 80 percent below 1990 emissions levels, would certainly require nearly carbon-free fuel use and most likely even stronger actions to reduce VMT.

CHAPTER 2: LAND USE AND ENERGY: TRENDS AND DRIVERS

Many researchers have studied the relationship between land use and energy. This section identifies and examines the different trends that they suggest impel land use related energy use and some of the drivers shaping current development patterns. These trends and drivers are critical to understanding how different land use patterns can affect VMT and energy use.

Vehicle Miles Traveled

As previously noted, VMT has been growing by 3 percent a year, and Caltrans expects a similar growth into the future. Caltrans modeling estimates assume current population growth rates and the continuation of current development and transportation practices. Research on the effect of land use practices on transportation patterns suggests that different development patterns could reduce VMT growth rate.

A 2002 U.S. Environmental Protection Agency study compared the impacts of compact and sprawling counties on transportation patterns. Sprawl was defined as:

- A population widely dispersed in low density residential development.
- A rigid separation of homes, shops, and workplaces.
- A lack of distinct, thriving activity centers, such as strong downtowns or suburban town centers.
- A network of roads marked by very large block size and poor access from one place to another.

Sprawl was measured for 83 of the nation's largest metropolitan areas.⁷

The research suggests that counties with an inverse proportion of the above sprawl characteristics had significantly less: average vehicle ownership, daily VMT per capita, annual traffic fatality rate, and maximum ozone level days. At the same time, shares of work trips by transit and walk modes increased to a significant degree.

Density, Mixed Use, and Vehicle Miles Traveled

Ewing and Cervero have examined the variables that have a significant effect on the overall VMT and vehicle trips of individuals and households, mostly through their effect on the distance people travel and modes of travel they choose.⁸

⁷ Ewing R., R. Pendall, and D. Chen, "Measuring Sprawl and Its Impact," Smart Growth America/ U.S. Environmental Protection Agency, Washington D.C., 2002.

⁸ Ewing R. and R. Cervero, "Travel and the Built Environment," *Transportation Research Record*, Vol. 1780, pp. 87–114, 2001.

Their research suggests that of the many factors that can be used to quantitatively analyze development and transportation interactions, density may have the most significant relationship to travel and transportation outcomes. Controlling for other factors, the difference between low and high density U.S. metropolitan areas is more than 40 percent daily per capita VMT. They found that doubling of neighborhood density can be expected to result in approximately a 5 percent reduction in both vehicle trips and VMT.

According to the research, accessible, highly dense, mixed use communities exhibited a shorter length of trips in the research. Of particular note was the difference between centrally located developments and development along the outskirts of established areas. Areas of high accessibility – such as center cities⁹ – seemed to produce substantially lower VMT than dense mixed-use developments in the exurbs¹⁰. They found that trip frequencies seemed to depend mostly on socioeconomic and demographic factors, but overall VMT and vehicle trips declined as accessibility, density, and/or land-use mixing increased.

Regarding mixed use development, a San Francisco Bay Area study found that, all else being equal, “[e]very 10 percent increase in the number of retail and service jobs within 4 miles of one’s residence is associated with a 1.68 percent reduction in shopping and personal-service VMT... [Also,] a doubling of accessibility to retail and service activities was associated with a 13.7 percent decline in daily hours spent getting to and from shops and consumer-service outlets” (p. 483).¹¹

⁹ A city’s downtown and adjacent neighborhoods.

¹⁰ Prosperous rural communities beyond the suburbs that become commuter towns for an urban area.

¹¹ Cervero, Robert and Michael Duncan, 2006, Which Reduces Vehicle Travel More: Jobs-Housing Balance or Retail-Housing Mixing? *Journal of the American Planning Association*, Autumn 2006, Vol. 72, No. 4.

Finally, the results of a travel model that compared VMT between high-density and business-as-usual growth scenarios showed that miles traveled in privately owned vehicles would be 7.5 percent less in a high-density growth development than a business-as-usual development (see Table 1, below). Also, transit miles traveled were 39 percent more.¹²

Table 1. Additional Daily Travel Miles in Privately Owned Vehicles (POV) and Transit— Business-as-Usual and High-Density Urbanization Scenarios, California, 2000 to 2025

Business-as-usual	POV Miles	163,957
	Transit Miles	5,857
High-density	POV Miles	151,582
	Transit Miles	8,157
Difference— Absolute	POV Miles	12,375 less
	Transit Miles	2,300 more
Difference— Percent	POV Miles	7.5 percent less
	Transit Miles	39.0 percent more

Source: Burchell, Robert W., et al., 2002, *Costs of Sprawl—2000*, Transit Cooperative Research Program, Washington, DC, TCRP Report 74 (modified from Table 11.30).

Jobs-Housing Balance and Vehicle Miles Traveled

The length of work trips seems to be growing because of jobs-housing imbalances in new communities, including a lack of affordable housing.¹³ In the San Francisco Bay Area, average commuting vehicle miles grew by 23 percent between 1980 and 1990 as rising housing prices forced more and more people to move to other communities and commute into San Francisco. If jobs were brought into balance with housing, “[a]ll

¹² Burchell, Robert W., George Lowenstein, William R. Dolphin, Catherine C. Galley, Anthony Downs, Samuel Seskin, Katherine Gray Still, and Terry Moore, 2002, *Costs of Sprawl—2000*. Transit Cooperative Research Program, Washington, D.C., TCRP Report 74.

¹³ Cervero, Robert, 2003, *Growing Smart by Linking Transportation and Land Use: Perspectives from California*, *Built Environment* Vol. 29 No. 1, pp. 66-78.

things being equal, every 10 percent increase in the number of jobs in the same occupational category within 4 miles of one's residence [would be] associated with a 3.29 percent decrease in daily work-tour VMT."¹⁴

According to the National Household Travel Survey 2001 Highlights Report, 45 percent of daily trips were made for family and personal reasons, such as shopping and running errands, 27 percent were made for social and recreational purposes, and 15 percent were made for commuting to work.¹⁵ "Nonwork is the major reason for travel even in peak travel periods. It may also be linked to the rapidly increasing numbers of commercial vehicles in service"(p. 2).¹⁶

In contrast, Handy¹⁷ believes that the data showing increases in non-work VMT are convincing, but not conclusive. The relationships between possible explanations and travel behavior are complex, and researchers are just beginning to try to understand them.

Aging Population

As of July 1, 2005, an estimated 78.2 million people were between the ages of 45 and 54.¹⁸ Researchers are not sure if this population will drive more or less as they age. Retired people tend to travel less, but better health and mobility could mean that they will travel more.¹⁹

Surveys of home buyers over the age of 45—who will account for 31 percent of total homeowner growth during the 2000-2010 period and twice the same segment's market

¹⁴ Cervero, Robert and Michael Duncan, 2006, Which Reduces Vehicle Travel More: Jobs-Housing Balance or Retail-Housing Mixing?, *Journal of the American Planning Association*, Autumn 2006, Vol. 72, No. 4, p. 482.

¹⁵ U.S. Department of Transportation and Bureau of Transportation Statistics, 2003, NTHS 2001 Highlights Report, BTS03-05, Washington, D.C.

¹⁶ Nelson, Dick and John Niles, January 9-13, 2000, Observations on the Causes of Nonwork Travel Growth, Transportation Research Board 79th Annual Meeting, Washington, D.C., Paper No. 00-1242.

¹⁷ Handy, Susan, Andrew DeGarmo, and Kelly Clifton, 2002, Understanding the Growth in Non-Work VMT, Southwest Region University Transportation Center, Center for Transportation Research, Texas A&M University System, Texas, Research Report SWUTC/02/167802-1.

¹⁸ http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/006105.html.

¹⁹ Handy, Susan, Andrew DeGarmo, and Kelly Clifton, 2002, Understanding the Growth in Non-Work VMT, Southwest Region University Transportation Center, Center for Transportation Research, Texas A&M University System, Texas, Research Report SWUTC/02/167802-1.

share during the 1990s,²⁰—showed that home buyers’ highest priorities are good access to shopping, family, friends, and medical care. If home buyers move, it will be to smaller houses with smaller yards.²¹

Residential Energy Consumption

According to Rong,²² “[a]fter controlling for household characteristics, the physical characteristics of housing units are found to have a strong relationship to residential energy use. Residents of single-family detached housing, for example, are expected to consume 22 percent more primary energy than those of multifamily housing and 9 percent more than those of single-family attached housing” (p. 62).

In addition, the type of housing (such as multifamily) and the size of the house have a strong relationship to the density of a county. Housing in compact counties is more likely to be multifamily and smaller than housing in business-as-usual counties. Depending on the household, energy consumption could be about 13 percent less in a compact county.

At least two other studies have validated this finding, as discussed by McGeogh et al. (2004) in their review of sustainable urban design features.²³ However, the relationship between higher density and lower energy use may not be linear. Some studies indicate that if cities are too noisy and there are local air quality concerns, instead of using natural ventilation people will use their air conditioners.²⁴ One study also suggests that if cities become too dense, in addition to less use of natural ventilation, the need for electric lighting goes up and the use of natural lighting goes down. Further research is needed to understand the implications of smart growth planning on building energy use.²⁵

²⁰ Myers, Dowell, Elizabeth Gearin et al., 2001, Current Preferences and Future Demand for Denser Residential Development.

²¹ International City/County Management Association (ICMA) with Geoff Anderson, 1998, Why Smart Growth: A Primer, Smart Growth Network and ICMA.

²² Rong, Fang, 2006, Impact of Urban Sprawl on U.S. Residential Energy Use, University of Maryland, <http://hdl.handle.net/1903/3848>.

²³ McGeogh, U, D, Newman, and J. Wrobel, (2004) “Model for Sustainable Urban Design: With Expanded Sections on Distributed Energy Resources,” Prepared for the Oak Ridge National Laboratory by the Sustainable Energy Planning Office of the Gas Technology Institute; released February 28, 2004, GTI Project # 303803-23. Available online at http://www.necsc.us/docs/ORNL_Design_Final.pdf

²⁴ Cooper, J. T. R., and A. Smyth. 2002. “Energy trade-offs and market responses in transport and residential land-use patterns: Promoting sustainable development policy.” *Urban Studies* 38(9): 1573–1588.

²⁵ Koen Steemers (2003), “Energy and the city: density, buildings and transport,” *Energy and Buildings* 35(1): 3-14. This paper discusses land use affects on both transport and energy use,

Finance

Land use patterns, and the VMT resulting from them, are influenced by the funding available to local governments. One of the largest impediments to local governments' embracing of energy-efficient and climate-friendly growth patterns is the structure of local-government finance. Proposition 13 and the subsequent Proposition 218 reduced the role of property-based taxation as a local government revenue source and increased reliance on other sources, particularly local sales taxes. Before Proposition 13, property tax rates were individually levied according to the city, county, school district, and state's assessed value. Each entity could independently assess the value of a property and levy a tax based on that value. Overall tax rates were often in the range of 2 percent to 3 percent of a property's assessed value. Proposition 13 restricted the property tax rate to 1 percent of assessed value, and it prohibited reassessment of property except when it was sold. Thereafter, annual increases can amount to no more than 2 percent of the rate of inflation, whichever is less.

Proposition 13 significantly cut local tax revenue and altered the way local governments fund public services and infrastructure. In particular, it encouraged cities and counties to impose heavier exactions — sometimes known as developer fees or impact fees — to pay for roads, sewers, parks, and schools.

Local governments receive 1 percent of the state's 7 percent sales tax for sales in their local districts. So in addition to exacting fees on developers, local governments also started encouraging development that increased sales tax revenue, such as shopping malls, car dealerships and hotels. By contrast, land uses that produce only property taxes and have a high public service cost, such as moderately priced housing, became less desirable. This is believed to cause counties and cities to favor sales-tax generating retail development rather than property-tax-bound residential uses. This is commonly referred to as “the fiscalization of land use.”

Other revenue demands, particularly education, have also crowded the property-tax base, making it less available for local government purposes and reducing incentives to improve the base through residential development. In 1992 and 1993, facing a \$14 billion

particularly in the UK context. It points out that increasing density does not necessarily produce energy savings; in fact, moderately high densities (more on the order of European cities than Asian ones) may be the best from an energy standpoint. The authors point out that the two are linked—that in a city where the noise and pollution from cars is minimized, the buildings can be opened up, replacing powered ventilation, cooling and lighting with passive ventilation, cooling and lighting.

shortfall in revenue, the Legislature shifted billions of dollars in local property tax revenues to schools to meet the state's minimum funding obligation to schools under Proposition 98. The shifted property taxes went into a fund established by the Legislature called the Educational Revenue Augmentation Fund.

As a result of these property tax policies, local land use planning and decision making may demonstrate a bias toward tax revenue-driven development. Such development often may pit one community against another in an effort to attract businesses that generate sales tax. Local competition for retail and auto malls rarely balances community housing needs with the benefits of non-retail business and industry, and may exacerbate transportation and associated environmental problems. The competition for the sales tax revenue can lead to local governments in the region offering escalating incentives to attract retail establishments, often through waiver of fees, favorable zoning and other means. This competition for expected sales tax revenue is commonly referred to as "the race to the bottom."

CHAPTER 3: LAND USE AND TRANSPORTATION PLANNING OPPORTUNITIES TO REDUCE ENERGY DEMAND AND GREENHOUSE GAS EMISSIONS

Land use and transportation planning are linked and must be viewed together to understand how they can jointly reduce energy demand and GHG emissions. This section provides an overview of current land use and transportation planning, funding methods, obstacles to resource-efficient planning, and some of the leading efforts to better integrate transportation and land use planning and the estimated reduction in energy demand and GHG emissions. These various plans discussed below showcase the many areas in which land use and energy interact and could provide many opportunities for energy and GHG considerations to enter the land use planning process.

Current Approach to Integrated Land Use and Transportation Planning

Authority for transportation and land use planning is divided unevenly among state, regional and local governments. Cities, counties and Metropolitan Planning Organizations (MPOs) spend hundreds of millions of dollars annually on transportation, land use and air quality planning²⁶. Much of this planning is done to allocate hundreds of billions of dollars of federal and state transportation funds via Metropolitan Transportation Plans (MTPs). This massive planning effort going on in each MPO in the state, working with air district and local governments partners, can contribute in a coordinated way to successful improvements in energy demand reduction and GHG emission reductions or it can produce transportation funding plans and general plans²⁷ that will work against resource efficiency for many years to come. Air quality, housing, employment, open space, farmland, fuel demand and mobility, and global warming are some of the quality of life factors that depend on coordination among MPOs and local governments and are directly affected by the allocation of transportation dollars.

²⁶ Metropolitan Planning Organizations are often also the Council of Governments. MPO is a federal designation related to responsibility for preparing the RTP and RTIP and receiving and allocating transportation funding. Councils of Government are joint powers agencies established to analyze the relationship between policies in one subject area and its impact upon other regional issues. SACOG, SANDAG and SCAG, for example, are all both the COG and the MPO. ABAG and MTC are separately the COG and the MPO, respectively, serving the Bay Area.

²⁷ A document containing a statement of development policies including a diagram and text setting forth the objectives of the plan. The general plan must include certain state mandated elements related to and use, circulation, housing, conservation, open-space, noise and safety.

Land Use Planning Process

Local governments hold the lion's share of land use authority in California and express their legally enforceable policies through required general plans and zoning codes. State law requires these general plans to address land use, circulation, housing, open space, conservation, safety and noise. There is no requirement to address energy although a few cities and counties have adopted an energy element making its provisions mandatory within their jurisdiction. Of the approximate 500 cities and counties in California that prepare general plans, in 2003, 52 had energy elements of which only 5 had been written since 2000.²⁸ By 2006, 7 of the original 52 had been dropped and 11 more added for a total of 56 general plan energy elements. Some of the dropped elements may have become part of the required Land Use Element or simply discarded.

It is interesting to note that over the same time intervals, local governments in California have adopted many more Growth Management Elements to General Plans, also not required by the state but once adopted become enforceable. Of the same 500 cities and counties in California by 2003, 80 had adopted growth management elements, with 25 of these dated 2000 or later. Between 2003 and 2006, 10 more growth management elements were adopted and 7 dropped for a total of 83.

This is significant as it indicates that local governments are investing in managing energy and growth, which greatly affects energy demand. It also indicates that fewer than 10 percent of the cities and counties currently are likely to be addressing energy within their adopted General Plans.

Issues such as housing, transportation and congestion, economic development and air pollution and reducing GHGs lend themselves to, and in some cases require, a more regional approach. City and county boundaries and authority can limit an agencies ability to affect change as it may require collaboration from regional peers to effectively attain its policy goals. An example of this is the adoption of smart growth principles by a city attempting to reduce sprawl by limiting low-density development on its boundaries. If the city's regional partners do not support the city's efforts by adopting similar policies and allowing the same kind of low-density, sprawling development in its jurisdiction than the region will still suffer from the negative impacts of the development.

The state has typically played a limited role in direct land use planning, rather conducting activities that more indirectly influence land use decisions. State officials prepare functional plans to guide department programs, decisions and projects. The

²⁸ The California Planners' Book of Lists 2005, Governor's Office of Planning and Research, Sacramento, CA. Compiled from results of 2004 survey of local governments.

Governor's Office of Planning and Research (OPR) is responsible for coordination and direction for the state's functional plans.

The state took a major step toward smart growth with the passage of AB 857 (Wiggins, Chapter 1016, Statutes of 2002), which laid out three planning priorities: promote infill development and social equity in existing communities; protect and conserve environmental and agricultural resources; and achieve more efficient use of land, transportation, energy and public resources outside the infill areas. AB 857 also requires the Governor's *Environmental Goals and Policy Report* (EGPR) to be consistent with these planning priorities. The EGPR is intended to provide a 20 to 30 year overview of state growth and development as well as articulate the Governor's environmental goals and policies including, but not limited to, land use, population growth and distribution, development, the conservation of natural resources, and air and water quality. The EGPR forms the basis for judgments about major state investments and capital projects, including the allocation of state resources through the budget and appropriations process.

Additional areas where the state plays a role in land use planning include the California Environmental Quality Act updates (OPR), the California Transportation Plan (Caltrans), housing element updates (Department of Housing and Community Development), the California Water Plan (Department of Water Resources), stormwater planning (State Water Resources Control Board) and infrastructure construction and financing.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires state and local agencies to identify and reduce, if feasible, the significant, negative environmental impacts of land use decisions. The documents prepared under CEQA (Environmental Impact Reports, or EIRs) rarely address energy consequences or greenhouse gas emissions. In late 2006, the Center for Biological Diversity filed a lawsuit against the City of Banning, seeking to overturn the approval of a large housing development, because the City did not evaluate the effect of GHG emissions from the increased vehicle trips on global warming. The California Attorney General and others sued San Bernardino County in April 2007 for failing to address the impact of GHG on climate change in the county's new 25-year General Plan and for violating CEQA.

OPR's State Clearinghouse coordinates the state level review of environmental documents pursuant to the CEQA and provides technical assistance on land use planning and CEQA matters. OPR is responsible for updating CEQA, as appropriate. CEQA guidelines do not currently state if and how emissions of CO₂ are to be evaluated. The ARB, as the implementing agency for AB 32, has not issued any guidance to

counties or other agencies on how GHG emissions and AB 32 should be evaluated in CEQA documents. The Association of Environmental Professionals (AEP) has prepared a draft white paper on how to analyze GHG emissions and global climate change in CEQA documents. A range of possible approaches are identified; however, critics have stated that it is premature for local governments to define significance thresholds, quantify emissions and mandate mitigation measures for GHG emissions without guidance from the state.

California Transportation Plan

The California Transportation Plan (CTP) is a statewide, long-range transportation policy plan that provides for the movement of people, goods, services, and information. The CTP offers a blueprint to guide future transportation decisions and investments that is intended to ensure California's ability to compete globally, provide safe and effective mobility for all persons, better link transportation and land use decisions, improve air quality, and reduce petroleum energy consumption.

The CTP provides a vision for California's transportation system and explores major trends that will likely influence travel behavior and transportation decisions over the next 20-plus years. In the context of these future trends and challenges, it provides goals, policies, and strategies to reach the vision. To fulfill the CTP's vision of improved mobility and to reduce congestion, the Schwarzenegger Administration launched a comprehensive transportation mobility initiative—"GoCalifornia." GoCalifornia is a mobility action plan designed to decrease congestion, improve travel times, and increase safety, while accommodating future growth in the population and the economy. It provides a roadmap to target transportation dollars to those improvements and investments that yield the greatest benefit for all Californians now and in the future.

Housing Element Updates

State law requires each city and county to adopt a general plan containing at least seven elements including housing. Unlike the other mandatory general plan elements, the housing element, required to be updated every five years, is subject to detailed statutory requirements and mandatory review by the state Department of Housing and Community Development (HCD). HCD is charged with reviewing local housing elements for compliance with state law and to report its written findings to the local government. Housing element law requires local governments to adequately plan to meet their existing and projected housing needs including their share of the regional housing need.

HCD must assess a county's Regional Housing Need Plan (RHNP) that is to promote the following objectives:

- Increase the housing supply and the mix of housing types, tenure and affordability in all cities and counties within the region in an equitable manner.
- Promote infill development and socioeconomic equity, the protection of environmental and agricultural resources and encourage efficient development patterns.
- Promote an improved intraregional relationship between jobs and housing.

California Water Plan

The California Water Plan is the state's strategic plan for managing water resources statewide. It is updated every five years, as required by the California Water Code. The Water Plan is a key element in the Governor's Strategic Growth Plan. The last update, released in 2005, outlined two key initiatives:

- Promote integrated regional water management through regional partnerships and diversified management strategies.
- Maintain and improve statewide water management systems.

California Water Plan Update 2009 will track and report progress on action plan items and initiatives, and will address the potential impacts of climate change. The update will be prepared in partnership with 16 other state agencies.

Stormwater Plans

In early 2005, the State Water Resources Control Board adopted sustainability as a core value for all California Water Boards' activities and programs, and directed California Water Boards' staff to consider sustainability in all future policies, guidelines and regulatory actions. One of the outcomes of this is Low Impact Development (LID). Unlike traditional stormwater management, which collects and conveys storm water runoff through storm drains, pipes, or other conveyances to a centralized storm water facility, LID takes a different approach by using site design and storm water management to maintain the site's pre-development runoff rates and volumes. The goal of LID is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate and detain runoff close to the source of rainfall. LID is seen as an alternative to conventional storm water management. This can reduce the amount of stormwater needed to be treated as well as recharging groundwater supplies, which can reduce the need to import energy intensive water supplies.

The Water Boards are advancing LID in California through the following:

- Regulation through site-specific and general permits.
- Providing advocacy and outreach to local governments through the Water Board's Training Academy and regional workshops.

- Researching how to incorporate LID language in to Standard Urban Storm Water Mitigation Plan (SUSMP) requirements.
- Funding LID related projects through the consolidated grants program.
- Funding through CWA 319 funds to provide for further researching applicability of Impervious Surface Analysis Tool (ISAT) for land use planners and for the California Water and Land Use partnership (CaWaLUP) Center at U.C. Davis.

Transportation Planning Process

Several mandatory transportation infrastructure, mobility, and funding reports and air quality management reports affect transportation decision-making in California. These reports include:

- Regional Transportation Plans (RTPs). Produced by MPOs,²⁹ RTPs meet the long-term (25-year planning horizon) transportation needs of the metropolitan population. The plans outline the development of mass transit, highway, airport, port, railroad, bicycle, and pedestrian facilities. RTPs can promote construction of roads or transit to areas previously less accessible thereby inducing growth into undeveloped land and/or they can help to reduce pressure to grow outward by enhancing mobility within and adjacent to the established urban footprint. RTPs are updated once every seven years. The level of sophistication of models, quality of data, and planning that contributes to RTPs varies widely throughout California.
- Regional Transportation Improvement Plans (RTIPs). Also produced by MPOs, RTIPs lay out short-term projects and funding in priority order. RTIPs are given to Caltrans to constitute a state plan. RTIPs link funding to projects and can affect the value of land thereby inducing investment either within or near the existing urban footprint or in outlying areas. Funding order rules may provide an incentive for sustainable projects within a region.
- State Transportation Improvement Plan (STIP).³⁰ STIPs are the aggregate of all of the individual RTIPs with the projects identified by Caltrans in its Inter-Regional Transportation Improvement Program (ITIP) into one document. Projects within the STIP receive 75 percent of the STIP funds Caltrans controls only 25 percent of the STIP funds through ITIP projects and MPOs control 75 percent of the funds.

²⁹ Metropolitan Planning Organizations are often also the Council of Governments. MPO is a federal designation related to responsibility for preparing the RTP and RTIP and receiving and allocating transportation funding. Councils of Government are joint powers agencies established to analyze the relationship between policies in one subject area and its impact upon other regional issues. SACOG, SANDAG and SCAG, for example, are all both the COG and the MPO. ABAG and MTC are separately the COG and the MPO, respectively, serving the Bay Area.

³⁰ The STIP is funded with both federal (seventy percent) and state (thirty percent) dollars. Although the amount varies each year, about \$1.5–\$2.0 billion total is allocated annually for the projects prioritized in the STIP.

- State Air Quality Management Plan (AQMP). AQMPs are produced by Air Quality Management Districts (AQMD) to project future air quality and address necessary measures to attain or maintain federal and state health-based ambient air quality standards.

RTPs and RTIPs integrate the transportation plans of all of the cities and counties within their jurisdictions. Once the RTIPs are funded and set into motion, transportation fuel demand is essentially set for many decades. Transportation energy consumption associated with the actions included in the RTIP can then only be affected by changes in end-use technology or regulatory intervention.

Federal air quality regulations also affect the transportation planning process. When a metropolitan area does not meet National Ambient Air Quality Standards (NAAQS), federal Clean Air Act Amendments (CAAA) require local AQMDs to work with MPOs to develop plans that bring RTIPs and the projected air pollution emissions from those projects into conformity with CAAA. The CAAA allow the US Environmental Protection Agency to impose sanctions or penalties, such as blocking federal highway funds and imposing more stringent pollution offsets, when projects do not conform.

The urgent need to reduce vehicle emissions to attain conformity drives the effort to reduce the number and length of vehicle trips, which is the only, albeit de facto, land-use-linked transportation energy conservation program in place today.

CHAPTER 4: INTEGRATING TRANSPORTATION AND LAND USE ANALYSIS, PLANNING, AND PROCESS

California Regional Blueprint Planning Program

The Regional Blueprint Planning Grants Program³¹ was initiated in 2005 by the Secretary of Building, Transportation and Housing and is managed by Caltrans. This grant program, distributing nearly \$5 million annually in the last two years in Regional Blueprint Planning Grants, is intended to better inform regional and local decision-making. The program involves the pro-active engagement of all segments of the population as well as critical stakeholders in the community, business interests, academia, builders, environmental advocates, to foster consensus on a vision and preferred land use pattern. It is anticipated that the Regional Blueprint Planning Grants will build capacity for regional collaboration and integrated planning that will in turn enable regions to plan to accommodate all their future growth, thereby reducing sprawl. Regional Blueprint Planning is underway in 14 of 18 MPOs within California.³² Two key goals are to:

- Foster a more efficient land use pattern that (a) supports improved mobility and reduced dependency on single-occupant vehicle trips, (b) accommodates an adequate supply of housing for all incomes, (c) reduces impacts on valuable habitat, productive farmland, and air quality, (d) increases resource use efficiency, and (e) results in safe and vibrant neighborhoods.
- Provide consumers more housing and transportation choices.

Blueprint Learning Network

- The Business, Transportation and Housing Agency established the Blueprint Learning Network (BLN) to work with the MPOs and Councils of Government (COGs) to further advance regional blueprint planning. BLN is a team that includes, but is not limited to: the Resources Agency, Caltrans, the California Department of Housing and Community Development, the California Center for Regional Leadership (CCRL), and the University of California at Davis. The goal of the program is to help state agencies make better infrastructure investment decisions and lead to a better quality of life in California based on the environment, economy, and equity. The purpose of the BLN is to work with regional teams (MPOs and

³¹ State of California, Department of Transportation, *California Regional Blueprint Program, 2005 Grant Application Package*, Sacramento, CA, 2005.

³² Presentation, Blueprint Learning Network annual meeting, November 29–30, 2007, Anaheim, CA.

stakeholders) in a series of workshops on overcoming the challenges and obstacles to effective regional blueprint planning.

Energy in Blueprint Planning – Current and Potential

Energy was not a stated component of the Blueprint Planning Grant Program. However, MPOs have been independently working on energy issues in an attempt to understand the risk imposed on regional mobility from energy supply disruptions, peak oil, cost increases, and emission regulation changes, including GHG emission reduction. For example, the Executive Director of the Southern California Association of Governments (SCAG) hosted a Peak Oil Seminar to discuss risk associated with long-term disruptions in transportation fuels to the Los Angeles basin.³³ Sacramento's MPO has published an energy issue paper and article in the Regional Report to inform citizens and decision makers about the possible scope of the issue.³⁴ SANDAG has partnered with the Energy Commission to update its Regional Energy Plan to incorporate the state's electricity sector "loading order", Renewable Portfolio Standard, GHG goals and other state policies that have been enacted since 2002. The MPOs are beginning to address long term energy planning. Energy Commission staff are developing relationships with the BLN to better integrate energy planning into the Blueprint planning process.

The California investment in regional blueprint planning could have tremendous benefits to both transportation and building energy savings and GHG gas emissions reduction. This program could serve as the analytical regional and local government backbone of the state's efforts to affect sustainability energy use and greenhouse gas production in multiple disciplines.

Of key importance is the fact that Blueprint Plans are the joint product of MPO and local government collaboration. MPOs hold transportation planning and funding authority. Cities and counties possess land use authority. The MPO Board of Directors is comprised of elected officials from the cities and counties of the MPO's jurisdiction. The MPO, then, is an ideal forum to build consensus and political will, deploy legal authority to take action and schedule funding to implement sustainable land use, transportation and energy plans.

Below are descriptions of three of the leading Blueprint projects.

³³ Peak Oil Seminar, personal conversation with Mark Pisano, Executive Director, SCAG, November 2006.

³⁴ Sacramento Area Council of Governments, *Regional Report, February/March 2007*, Sacramento, CA, 2007, (pp. 4-8).

Sacramento Blueprint Project

In 2002, the Sacramento Area Council of Governments (SACOG) board of directors created the Blueprint Project, in response to the region's projected congestion and poor air quality. Citizens and elected officials worked together, using interactive computer software and extensive outreach, to improve land use decision making. All cities and counties of the Sacramento region voluntarily chose to participate in Blueprint. Many began to implement local portions of the results in advance of the final adoption, and several SACOG members are integrating the Blueprint workshop findings into the update of their general plans.

Ultimately, the region's elected leaders will use the detailed technical data developed during the study to make land use decisions that will influence how growth will happen now and in years to come. The SACOG Board will use the data to make choices about the transportation projects that will best serve the region as it changes.

Developing the Regional Blueprint Study

To begin the project, a detailed long-term Base Case scenario was developed. The Base Case provided data and maps depicting the region in 2050, assuming the present regional growth patterns, transportation system, air quality, and other parameters were not significantly changed. The Base Case was used as a benchmark from which to compare net change created by the other scenarios. During the outreach efforts a overwhelming majority of participants determined that the sprawl, air pollution, traffic congestion and VMT projected by the Base Case were unacceptable.

A series of 37 neighborhood level and county level workshops ultimately produced a set of regional scenarios that quantified the nature of the relationship between fuel demand and land use options over time (to 2050), using parcel-level land use data that was integrated with real transportation data and modeling. The population and job growth projections were held constant among all the scenarios; each scenario accommodated the same number of new people (about 1.5 million by 2050) and the same number of new jobs (about 750,000 by 2050). A Preferred Scenario was ultimately developed and analyzed by locally elected city and county officials.

Land Use Related Transportation Fuel Demand Findings

The Base Case scenario required 661 square miles of new land to be developed to accommodate growth, most of which would occur in outlying areas where land is cheaper and homes and lots can be large. The Preferred scenario, on the other hand, required 46 percent less new land to be developed than the Base Case. Much of the new housing and jobs was located in already developed areas, either on vacant parcels or on less desirable existing properties. The Preferred scenario reduced CO₂ and particulate emissions by about 14 percent compared to the Base Case scenario. VMT dropped lower

than the 2005 per household number (41.7 miles per day) down to 34.9 miles per day even with an additional 1.7 million people. Table 2 compares the two scenarios.

Table 2. Key Statistics Comparing Base Case Scenario 2050 and Regional Preferred Scenario 2050

PARAMETER	BASE CASE 2050	ADOPTED PLAN 2050	DIFFERENCE
VMT per household per day	47.2	34.9	12.3 fewer miles per household per day
People Living in Areas with Good Mix of Jobs and Housing	26%	53%	27% increase
Growth Near Transit	5% New Jobs 2% New Housing	41% New Jobs 38% New Housing	36% more new jobs near transit 36% more new homes near transit
Additional Urbanized Land	666 square miles	304 square miles	362 fewer square miles urbanized
Daily Vehicle Minutes of Travel (per household per day)	81 minutes	67 minutes	14 fewer minutes per day (more than two 40 hour work weeks per year)
Per Capita Carbon Dioxide and Small Particulate Emissions (from vehicles 2050)	Set at 100%	85% of Base Case	15 % less than the Base Case per capita

Source: SACOG, Blueprint Program, 2005.

San Diego Association of Governments

In 2004, the San Diego Association of Governments (SANDAG) Board of Directors unanimously adopted the Regional Comprehensive Plan (RCP) for the San Diego region. The RCP serves as the strategic framework for how the region can grow in a smarter, more sustainable manner to the year 2030. The RCP is based on three guiding principles:

- Better connect transportation and land use plans using smart growth principles.
- Use transportation and land use plans to guide environmental and infrastructure decisions.
- Use collaboration and incentives to implement regional goals.

Smart Growth Map

The Urban Form chapter of the RCP calls for the development of a smart growth map. In June 2006, the SANDAG Board accepted the first-ever “Smart Growth Concept Map” in the San Diego region. The Concept Map identifies locations within the region that can support smart growth and transportation investments and will be used to identify transportation and transit needs in the 2007 RTP. It also will be used to determine eligibility to participate in the region’s long-term \$280 million Smart Growth Incentive Program (SGIP) funded through TransNet, the half-cent sales tax approved by voters in 1987 to finance transportation improvements.

The Smart Growth Concept Map contains almost 200 existing, planned, or potential smart growth locations in seven categories of smart growth “place types” identified in the RCP. About 40 percent of the areas on the map qualify as Existing/Planned smart growth areas, and the remaining 60 percent represent potential smart growth areas. The map is dynamic and will be updated periodically to reflect changes in local land use plans or regional transportation plans that may influence the designations of the smart growth locations.

2007 Regional Transportation Plan Update

The RCP recommends that the next update of the regional transportation plan (RTP) incorporate smart growth principles from the RCP, placing an emphasis on public transit and other modes of transportation associated with smart growth. SANDAG currently is in the process of updating the RTP, with adoption of the 2007 RTP update scheduled later this year. Smart growth areas will receive higher priority for transportation investments, lending additional support to the smart growth principles contained in the RCP.

San Francisco Bay Area

Smart Growth Strategy/Regional Livability Footprint Project

In 1999, San Francisco Bay Area regional agencies responsible for transportation planning, environmental protection, and regional planning came together to promote and nurture smart growth efforts in the region. At the same time, the Bay Area Alliance for Sustainable Development, a coalition of 40 organizations representing business, the environment, social equity and government, began an ambitious effort to develop public consensus and support for a “regional livability footprint,” that is, a preferred land-use pattern that could direct the Bay Area toward a more sustainable future. In 2000, the regional agencies and the Bay Area Alliance combined their outreach efforts and created the Smart Growth Strategy/Regional Livability Footprint Project.³⁵

³⁵ Bay Area Joint Commission, *Smart Growth Strategy Regional Livability Footprint Project: Shaping the Future of the Nine-County Bay Area*. Final Report, Bay Area, CA, 2002.

From 2000 to 2002 in countless meetings stakeholders conceptualized how future growth should occur in their individual neighborhoods and counties, and in the region as a whole. Business-as-usual growth to 2020 would convert 83,000 acres (more than twice the size of San Francisco) of undeveloped land to urban use and result in insufficient housing within the nine Bay Area counties for the number of workers expected by 2020. Housing would be needed outside the Bay Area, requiring 45,000 acres in neighboring counties, significantly increasing VMT.

By contrast, the smart growth land-use scenario, calling for compact, mixed-use communities that are close to transit lines and employment centers, would increase the urbanized footprint of the Bay Area by less than 16,000 acres, or 2 percent, and provide substantially more housing. The scenario increases the proportion of new housing affordable to very low- and low-income households, from 16 percent to 41 percent. The smart growth scenario emphasized development in cooler, Bay-side parts of the region, and in multi-family units, thus lowering heating and cooling demand. This combination of changes is expected to result in a 17 percent reduction in water consumption — down from a current 300 gallons a day to an average 250 gallons a day — in new housing units. Under the smart growth scenario, the Metropolitan Transportation Commission estimates the number of public transit riders to increase by one third over current levels.

FOCUS

FOCUS, short for the Focusing Our Vision initiative, follows up on the 2002 livability project. It is a regional planning effort partially funded by a Blueprint grant, and led by the Association of Bay Area Governments (ABAG) in coordination with the Bay Area AQMD and the Bay Conservation and Development Commission (BCDC).

Local governments in the nine county San Francisco Bay Area can apply for regional designation of an area within their community as a priority development area. Designation informs regional agencies which areas want and need assistance and expresses the region's priorities for growth, which can help connect with state efforts and programs.

Although specific incentives are not yet available, the regional agencies are committed to securing incentives and providing technical assistance to designated priority areas so that the Focusing our Vision's principles and policies can be achieved in communities working to advance smart growth goals. In return, the expectation is that local jurisdictions will commit to expedite development and support local policies that advance smart growth goals and local community aspirations in these areas.

MTC Transportation for Livable Communities and Housing Incentives Program

The MTC assists local developments that support the goals of the Vision through its Transportation for Livable Communities (TLC) grant program. This program also incorporates a Housing Incentive Program (HIP). TLC provides funding for projects that are developed through an inclusive community planning effort, provide for a range of transportation choices, and support connectivity between transportation investments and land uses. As part of the TLC program, MTC's Housing Incentive Program (HIP) rewards local governments that build housing near transit stops.

Local Government

There are many individual efforts in local governments throughout California to incorporate smart growth, address climate change concerns and reduce energy demand. By implementing innovative voluntary strategies local communities can both reduce greenhouse gas emissions and prepare for the consequences of climate changes that are already underway. Two state-wide entities supporting local government efforts are described below.

League of California Cities

The League of California Cities is an association of California city officials who work together to enhance their knowledge and skills, exchange information, and combine resources so that they may influence policy decisions that affect cities.

The California League of Cities is currently considering the adoption of a policy and guiding principles on climate change that incorporate the following topics:³⁶

- Energy efficiency in buildings and new residential or commercial developments
- Use of alternative fuels or low emission vehicles in city fleets
- CEQA
- Updating general plans to reflect climate change impacts
- Water supply impacts from climate change
- Land use planning
- Recycled content procurement policies

The League has endorsed the United States Conference of Mayors Climate Protection Agreement. This Agreement (1) calls on the federal government to ratify and implement the necessary policies to meet the Kyoto Protocol's U.S. GHG emissions reduction targets of 7 percent below 1990 levels by 2012 and (2) commits signatories to the same targets for their cities and to achieving the targets through the following transportation

³⁶ California League of Cities Web site, www.cacities.org.

and land use policies (but not limiting signatories exclusively to these policies):

- Inventory global warming emissions in city operations and in the community, set reduction targets and create an action plan.
- Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities.
- Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car pooling and public transit.

Institute for Local Government

The Institute for Local Government serves as a source of independent research and information for California's communities and their leaders. It is the nonprofit research affiliate of the League of California Cities and the California State Association of Counties. The Institute specializes in addressing issues of topical and practical concern to local agencies in California. A key aspect of this involves developing practical "nuts and bolts" materials that help local officials formulate policies that meet the needs of their communities.

To assist local officials, the Institute for Local Government recently launched a new Climate Action Program.³⁷ The Institute is working closely with the League of California Cities and the California State Association of Counties to partner on climate action activities with a wide range of local officials and staff. The program will:

- Provide information and access to strategies that local officials can use in their communities to address climate change. This will include climate action resources, best practices, and case studies. A Climate Action Network will actively link local officials to a wide variety of climate change programs and resources.
- Create incentives for local officials to set high goals for energy efficiency and climate change programs. This includes developing a certification and awards program for exemplary local efforts, along with criteria and a methodology to certify three tiers of local "best practices" to combat global warming.

Non-California Initiatives

Several non-California efforts to reduce fuel use were also studied. The following states have made efforts to reduce land use related energy use and GHG emissions.

Massachusetts Greenhouse Gas Emissions Policy

The Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs Greenhouse Gases Emissions Policy requires that certain projects undergoing review by the Massachusetts Environmental Policy Act (MEPA) Office quantify GHG

³⁷ California Institute for Local Government website, www.ca-ilg.org/climatechange.

emissions generated by proposed projects, and identify measures to avoid, minimize, or mitigate such emissions. A project will be subject to this policy if an environmental impact report (EIR) is required for the project, and if it falls into one or more of the following four categories:

- The Commonwealth or a state agency is the proponent.
- The Commonwealth or a state agency is providing financial assistance.
- The project is privately funded, but requires an air quality permit from the Department of Environmental Protection.
- The project is privately funded, but will generate 3,000 or more new vehicle trips per day for office projects; 6,000 or more vehicle trips per day for mixed use projects that are 25 percent office space; or 10,000 vehicle trips per day for other projects.

An advisory group has been convened to develop a standardized quantification and reporting protocol and upon completion MEPA will require the quantification of greenhouse gas emissions. The analysis will include both "direct" GHG emissions (e.g., stack and fugitive emissions from the proposed operation) and "indirect" emissions (e.g., emissions from vehicles driven by employees and generating plants supplying electricity to the proposed operation).

In addition to the quantification of project-related GHG emissions, MEPA will also require that proponents consider a project alternative in the EIR that incorporates measures to avoid, minimize, or mitigate such emissions. Possible mitigation measures could include:

- Energy efficiency improvements in buildings.
- Layout of the site and building orientation to make best use of natural light , natural heating and cooling, and solar energy potential.
- Incorporation of low impact development techniques (including green roofs) to reduce the amount of asphalt and provide greater shading
- Transportation demand management, including locating the project near mass transit, access to shuttle or bus services (preferably using alternative fuels), ridesharing programs, bicycle and pedestrian accommodations, provision of Zip Car spaces.
- On-site renewable energy and combined heat and power generation.
- Use of clean and alternative fuels.
- Establishment of systems for on-site reuse and recycling of construction and demolition materials and recycling of occupant waste materials.

Oregon Land Conservation Program

Oregon's statewide land-use planning program, originated in 1973 under Senate Bill 100, was passed to provide protection for farm and forest lands, conservation of natural resources, orderly and efficient development, coordination among local governments, and citizen involvement. The Department of Land Conservation and Development (DLCD) administers the program. A seven-member volunteer citizen board known as the Land Conservation and Development Commission (LCDC) guides the DLCD. Oregon's LCDC, assisted by DLCD, adopts state land-use goals and implements rules, assures local plan compliance with the goals, coordinates state and local planning, and manages the coastal zone program.

Under the program, all cities and counties have adopted comprehensive plans that meet mandatory state standards. The standards are 19 Statewide Planning Goals that deal with land use, development, housing, transportation, and conservation of natural resources. Goal 13, Energy Conservation, addresses energy efficient land use planning and buildings and Goal 14 addresses Urbanization. Periodic review of plans and technical assistance in the form of grants to local jurisdictions are key elements of the program.

Oregon's statewide goals are achieved through local comprehensive planning. State law requires each city and county to adopt a comprehensive plan and the zoning and land-division ordinances needed to put the plan into effect. The local comprehensive plans must be consistent with the statewide Planning Goals. Plans are reviewed for such consistency by the LCDC. If approved, the plan then becomes the controlling document for land use in the area covered by that plan.

New Jersey State Development and Redevelopment Plan and Smart Growth Program

The New Jersey State Planning Commission developed and approved the State Development and Redevelopment Plan (State Plan) and the State Plan Policy Map. The State Plan provides a vision for the future intended to preserve and enhance the quality of life for the state's residents. The State Plan is the result of hundreds of public forums, where the plan's goals, strategies, policies and application were discussed. This bottoms-up approach to planning was designed to encourage consistency between municipal, county, regional, and state plans to create a meaningful, up-to-date and viable State Plan.

The purpose of the New Jersey State Plan is to coordinate planning activities and establish statewide planning objectives in the following areas: land use, housing, economic development, transportation, natural resource conservation, agriculture and farmland retention, recreation, urban and suburban redevelopment, historic

preservation, public facilities and services, and intergovernmental coordination.³⁸

The State Plan provides a balance between growth and conservation by designating planning areas that share common conditions with regard to development and environmental features:

- Areas for Growth: Metropolitan Planning areas.
- Areas for Limited Growth: Fringe Planning Areas, Rural Planning Areas, and Environmentally Sensitive Planning Areas. In these planning areas, planning should promote a balance of conservation and limited growth—environmental constraints affect development and preservation is encouraged in large contiguous tracts.
- Areas for Conservation: Fringe Planning Area Rural Planning Areas and Environmentally Sensitive Planning Areas.

Maryland Economic Growth, Resource Protection, and Planning

The Maryland Economic Growth, Resource Protection, and Planning Act of 1992 (the Planning Act) was enacted to organize and direct comprehensive planning, regulating, and funding by state, county, and municipal governments in furtherance of a specific economic growth and resource protection policy. The policy is organized around seven statutory vision statements which must be pursued in county and municipal comprehensive plans, where priorities for land use, economic growth, and resource protection are established. The visions must also be followed by the state in undertaking its various programs. Both state and local funding decisions on public construction projects must adhere to the visions. The Act also established an Economic Growth, Resource Protection, and Planning Commission (the Commission) to oversee, study, and report on progress towards implementation of the visions.

The State of Maryland reports that the work of state, county, and municipal governments, as well as that of the Commission from 1992 to 2002 has succeeded in the widespread integration of the visions in local and state government plans and actions.³⁹ The work accomplished under the Act helped to give shape and form to Maryland's smart growth program. The 1997 Maryland General Assembly passed five pieces of legislation and budget initiatives—Priority Funding Areas, Brownfields, Live Near Your Work, Job Creation Tax Credits and Rural Legacy - known collectively in Maryland as "Smart Growth."

The Maryland Smart Growth Program has four goals:

- Support existing communities by targeting resources to support development in areas where infrastructure exists.

³⁸ New Jersey State Smart Growth Program Website, <http://www.state.nj.us/dca/osg/>

³⁹ Maryland Smart Growth Program Website, <http://www.mdp.state.md.us/smartintro.htm>

- Save the most valuable natural resources before they are forever lost.
- Save taxpayers from the high cost of building infrastructure to serve development that has spread far from our traditional population centers.
- Provide Marylanders with a high quality of life, whether they choose to live in a rural community, suburb, small town, or city.

Smart Growth directs the state to target programs and funding to support established communities and locally designated growth areas, and to protect rural areas. The Priority Funding Areas Act provides a geographic focus for the state's investment in growth-related infrastructure.

Portland Metro Regional Transportation and Land Use Planning

In 2000, Portland Metro completed a planning process meant to look 50 years into the region's future, dubbed "the 2040 Growth Concept." The Portland area expected a large increase in population by 2040, which according to past trends would have meant a large increase in the "urban growth boundary" which defines the boundary between urban and rural areas in Portland. The impending growth clashed with what Portland residents value: access to natural beauty and comfortable communities. Regional projections showed that under existing land use policies, land used for urban development would increase more than 50 percent in the region.

Metro is the regional government of the Portland Metropolitan area. It has the responsibility to coordinate land use policies in the 27-jurisdiction region and write binding development policies. Metro undertook a major public involvement campaign for the 2040 planning process. It mailed livability questionnaires to every household in the region (over 500,000), conducted dozens of workshops and forums, and a variety of public education tools including distributing videos and maps about the planning at local businesses. This process was important because the planning decisions are being based on the values of Portland area residents.

The 2040 Growth Concept being planned for in Portland consists of only a modest increase in the urban growth boundary, while at the same time making more efficient use of existing urban land, protecting natural resources and green spaces, supporting regional centers, and ensuring a balanced transportation system. The most important focus has been protecting residents' access to nature, and to do this through efficient use of urban infrastructure.

While it is still quite early, Metro released a report on performance measures in 2004. Development projects and policies have focused on urban and regional centers. Annual land converted to urban use was 40 percent lower in 2002 than it was in 1999. Metro acquired 8,000 acres of parks and open space through a 1995 bond measure, and 60

percent of the population is located within one-quarter-mile of a park. One of the most striking statistics concerned their transportation system: while the nation experienced a 6 percent increase in per capita vehicle miles traveled, Portland residents have decreased their VMT by 11 percent between 1996 and 2002⁴⁰.

Envision Utah

Envision Utah is a public/private partnership engaged in a “visioning process” for growth in the Greater Wasatch Area, a corridor stretching 100 miles north and south of Salt Lake City along the Wasatch mountain range. By 2050, this area is expected to triple in population to 5 million from the 1995 baseline of 1.6 million residents. Growth in the Salt Lake City region is challenging, however, because of arid and mountainous land and the large amount of federally-controlled land in the area.

While Envision Utah based its methods on past experiences in California, Portland and Denver, it concluded that it needed different methods. Local control is a very important value in Utah, making regional authority, as in Portland Metro, an infeasible political approach. Instead, Envision Utah is paid for and run by a mix of public and donated funds and seeks to build community support for environmental protection and quality growth through voluntary processes. Statewide land use laws had experienced heavy opposition in the 1970s, and a different approach was deemed necessary.

Similar to other visioning efforts, Envision Utah went through an extensive research effort to determine what residents value. It then developed scenarios and solicited public involvement in deciding between scenarios. Implementation of its plans has included the development of tools and guides for communities to pursue quality growth strategies and public education campaigns about the process and growth strategies.

⁴⁰ Portland Metro, *A Profile of the Regional Pedestrian System in the Portland Metropolitan Region*, Portland, OR, 2007, p. 22.

CHAPTER 5: INFRASTRUCTURE FUNDING

Overview

Infrastructure funding policies and decisions can affect energy demand in many ways. The provision of roads, bridges and tunnels can affect the efficiency of travel, the type of travel, and the demand for travel as well as cause many environmental impacts, such as habitat dis-connectivity. The construction of power lines can determine the viability of renewable sources of energy generation, whether a new development can turn on the lights, and which power plants might come online first. Sewer lines are a key prerequisite for new development, and the State Water Project is one of the largest infrastructures in the world, using up to 3 percent of the state's electricity to provide Californians with the water they need to drink, to conduct business, and to water their lawns.

Infrastructure funding comes from the federal, state and local levels. The funding policies and project choices made at any of these levels can determine the long term energy and climate impacts of a community's infrastructure for decades. For instance, funding policies that support mixed use, transit oriented, dense communities can reduce energy use, commute time and GHG emissions while increasing transit ridership. The Bay Area MTC has determined that locating housing and hence population closer to existing points of transit access will have a greater positive impact on transit ridership than new investment in transit infrastructure.⁴¹ To give another example, building a transmission system than can handle intermittent generation from wind resources is a necessary first step to large-scale deployment of wind generation. The following sections discuss infrastructure funding at the national, state and local level.

National

The Center for Clean Air Policy Federal Highway Bill Reauthorization Effort

The Center for Clean Air Policy (CCAP) is leading a partnership to try to integrate land use, energy and climate considerations into the next Federal Highway bill. CCAP is attempting to: 1) build a partnership focused on adding travel demand strategies to the national climate policy debate and 2) create a linkage between federal climate legislation and the reauthorization of the Surface Transportation Bill (SAFETEA-LU) in 2008.

In February, 2007, CCAP kicked-off a policy discussion about integrating climate change mitigation strategies into the next U.S. federal transportation bill (hence Green –

⁴¹ Bay Area Joint Vision Web site, (<http://www.bayareavision.org/focus/housingemphasis.html>)

Transportation Equity Act, or Green-TEA) and addressing travel demand in national climate policy, by hosting a web-based seminar attended by more than 40 U.S. transportation and land use experts. CCAP is asking all interested parties to support the effort by providing a summary of how the effort is valuable to their own specific interests. The Energy Commission has been tracking CCAP's efforts and providing information when available. In particular, CCAP is interested in the SACOG Blueprint program as an example of how climate change and energy can be successfully integrated into Federal Highway funding decisions. If CCAP and the interested parties are successful in integrating green planning requirements into the federal highway bill, California's MPOs will have increased responsibility and funding power to implement their Blueprint plans and the state should have substantial help reducing VMT, energy demand and GHG emissions from mobile sources.

California

Strategic Growth Plan

In November 2006, California voters authorized infrastructure bonds totaling about \$40 billion dollars. The largest portion (\$19 billion) is for public transportation and traffic congestion relief. But significant dollars will go to other areas as well: school repairs and expansion (\$10.4 billion); water quality improvements and natural resource protection (\$5.4 billion) levee improvements and flood control (\$4.1 billion); and affordable housing (\$2.85 billion). The state has a major opportunity to direct these infrastructure investments towards land use choices that take energy and climate change into consideration.

The Planning and Conservation League (PCL), in conjunction with other organizations, is leading a "greening the bonds" effort. PCL has identified 10 principles to guide bond implementation, one of which encourages smart growth and makes cities more livable:

Current state law (AB 857, 2002) requires that "any infrastructure associated with development" must use land efficiently, avoid leapfrog development, be located only in areas planned for growth with existing essential services, and minimize ongoing costs to taxpayers. Any proposed infrastructure bond must follow these requirements in AB 857, and should help achieve, not undermine, our state's land use objectives. The infrastructure bonds should create financial and regulatory incentives for growth patterns that accommodate needed housing as well as reduce vehicle miles traveled and protect valuable habitat and important farmland. Growth policies that reduce vehicle miles traveled will promote housing closer to jobs and commercial

centers, provide more housing choices and reduce commute burdens on families. These policies will also reduce air pollution, greenhouse gas emissions and the consumption of oil.

To ensure that regional agencies are equipped to make sound decisions consistent with smart growth principles and resource conservation, the state should update its transportation models to provide accurate information and should authorize bond funding for regional blueprints including funds to assist regions to collect and utilize adequate biological and geographical data on the region's natural resource infrastructure. Incentives for local and regional blueprints should be made available to all regions of California.⁴²

The Urban Land Institute (ULI) is undertaking a public infrastructure initiative, encompassing a series of forums, to make the case for linking infrastructure and land use. ULI is also meeting with state officials to ensure bond implementation supports smart growth principles. The William and Flora Hewlett Foundation, in partnership with the Energy Foundation and the Packard Foundation, recently hosted a Global Warming, Land Use and Investment Policy meeting to allow members of the governor's administration, state Senate and Assembly members, and climate and urban growth experts to discuss how bond funding could be implemented.

The following is a summary of the infrastructure bonds, a brief discussion of fund status, and the implications for effective land use planning and reduction in VMT.

Transportation Bonds

Proposition 1B (Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006) provides \$19.925 billion in general obligation bonds in projects intended to relieve congestion, facilitate goods movement, improve air quality and enhance safety and security of transportation. It includes \$4.5 billion for projects that would improve corridor mobility (called the Corridor Mobility Improvement Account, or CMIA). CIMA guidelines, prepared by Caltrans, provide general guidelines on funding priorities for CMIA funds. One guideline factor calls for evaluation of "project benefits" but energy benefits are not explicitly considered. These may be considered under "optional benefits." Project eligibility criteria include projects that "improve access to jobs, housing, markets, and commerce."

Proposition 1B funding also includes \$4 billion for transit, \$3.2 billion to improve goods

⁴² The Planning and Conservation League Web site, http://action.nwf.org/campaign/infrastructure_bond_principles/explanation

movement and air quality, and \$1.475 billion to improve transportation safety and security.

Proposition 1B explicitly allows the Legislature to provide oversight over the expenditure of approximately \$5.1 billion, including goods movement trade corridors, transit security, air quality, state-local partnership grants and port security. None of the implementing agencies are responsible for energy matters or air quality, except the \$1 billion identified for ongoing bus replacements.

The Legislative Analyst's Office (LAO) recommended that the Legislature provide eligibility guidelines where such guidelines are not clearly established by Proposition 1B. The LAO recommended that Proposition 1B funds be limited to projects with long-term benefits and that air quality impacts be considered for new capacity projects and appropriating all funds through the annual budget bill.

The California Transportation Commission (Commission) has been charged, by a January 2007 letter from Senator Don Perata, with developing a plan for incorporating strategies to reduce mobile source GHG emissions in the RTP Guidelines. These guidelines shape the RTPs projects that will be funded through Prop 1B programs and this initiative represents a significant opportunity to integrate climate and energy considerations into the implementation of Proposition 1B, as well as serve as a model for development of criteria for the other infrastructure bonds.

Proposition 1C (Housing and Emergency Shelter Trust Fund Act of 2006) provides \$2.85 billion in general obligation bonds to support a variety of housing and development programs. The proposition has a smart growth focus for some of its funding as it provides \$850 million for infill development grants and brownfield cleanup and \$300 million to develop higher densities along transit stations. Both funds require Legislative appropriation. While the LAO recommends that the Legislature needs to provide guidance or definition of project selection criteria, no specific selection criteria are identified for the remaining funds noted above.

Proposition 1D (Kindergarten-University Public Education Facilities Bond Act of 2006) provides \$10.4 billion to fund repair and upgrade of public schools, including kindergarten through grade 12, community colleges, and state universities. This proposition provides \$100 million for environmentally-friendly school facility projects, including those that promote the efficient use of energy and water, incorporate recycled materials and/or maximize the use of natural lighting. The LAO recommends that a community impact analyses be conducted to mitigate off campus impacts of campus facility growth. The scope of that impact assessment is not identified by LAO.

Proposition 84 (Water Quality, Safety and Supply. Flood Control. Natural Resource Protection. Park Improvements) provides \$5.4 billion in general obligation funding for a variety of water, flood control, natural resources, park and conservation projects. Of this total, \$620 million is continuously appropriated and does not need Legislative approval for projects. The remaining funds require Legislative approval through either the annual budget act or other legislation. These monies could be used to provide infrastructure enhancements to offset the expected impacts of global warming. This includes \$800 million for flood control; \$580 million for sustainable communities and climate change reduction; \$540 million for protection of beaches, bays, and coastal waters; and \$65 million for statewide water planning.

The LAO identified a need for Legislative direction for expenditure of at least the regional planning, housing, and infill funding.

Implications for Land Use, Climate Change, and VMT

Project funding criteria must be developed to effectively distribute the funds identified in Table 3.

Table 3. Strategic Growth Funds

Prop 1B	\$1 billion for state-local partnership program account
Prop 1C	\$850 million for infill local infrastructure and parks \$200 million for urban rural and suburban regional parks \$300 million for transit oriented development
Prop 1D	\$100 million for green schools
Prop 1E	\$290 million for protection, creation and enhancement of flood protection corridors and bypasses \$300 million for stormwater flood management projects
Prop 84	\$1 billion for water projects that integrate water management with land use planning \$90 million for sustainable communities \$400 million for parks

Careful thought and analysis is needed for maximum bond expenditure effectiveness. There is a possibility that well-intentioned funding could have unexpected repercussions. For example, funding intended to relieve congestion can induce people to return to their cars rather than to continue to use public transit by reducing the social cost (congestion-induced delays are a form of social cost) of travel. This “rebound effect” could increase personal vehicle use from 3 percent to as much as 14 percent or more,

when the “cost of travel” is cut in half,⁴³ thus negating some of the benefits that could arise from the expenditures identified in Table 3.

⁴³ Small, Kenneth A. and Kurt Van Dender, *Fuel Efficiency and Motor Vehicle Travel: The Declining Rebound Effect*, UC Irvine Economics Working Paper #05-06-03, Corrected July 17, 2006 (to be published in *Economic Journal*, vol 28, no 1 (2007) pp. 25-51.

CHAPTER 6: UTILITY ROLE IN LAND USE

Electric utilities in California are beginning to play a larger and more explicit role in the planning and use of land. This role includes planning for utility infrastructure (long-range and near-term), sources of energy. This section examines a number of cutting-edge endeavors by utilities, both in California and the U.S., that serve as models for a greater interplay of energy and land use. Energy efficiency, solar roofs and green building endeavors are not specifically highlighted here, both because they are receiving extensive coverage in other areas (and will be discussed in other IEPR workshops and reports) and because they are not as directly tied to the specific use of land.

Utility Infrastructure Planning and Development

Long-Term Planning for Utility Infrastructure

Perhaps the most significant involvement of utilities in the planning for new large-scale infrastructure is the SB 1059 Transmission Corridors effort spearheaded by the Energy Commission. The focus of this program is to integrate transmission corridor zone planning at the state level with local planning.

SB 1059 requires the Energy Commission as the lead agency to work with cities, counties, state and federal agencies, and California tribes in designating transmission line corridors. It requires cities and counties to consider designated corridors when making land use decisions that could affect corridor viability.

California utilities were active participants in the “early-listening” process designed to better understand stakeholder concerns and to determine how the corridor designation process could be implemented to meet the needs of utilities and other stakeholders. Utility comments presented at the March 5, 2007 Joint Committee Workshop on SB 1059 Implementation included: the need to coordinate among local, state and federal agencies; importance of including existing land use planning (for example, habitat conservation plans and local general plans); and the need to include other initiatives such as County Blueprints, and military joint land use plans.

Line Extension Policies

The process and costs for extending power lines and other utility infrastructure to new developments can help or hinder the smarter use of land. California Public Utility Commission (CPUC) Tariff Rules 15 (Distribution Extensions) and 16 (Service Extensions) govern the provision of natural gas and electricity to new residences. These rules are self-regulating and a set dollar amount is provided for the cost of service for each new account. In the case of electric service, \$1,300 is allotted to a developer to pay for the wiring from the transmission line, to the transformer and then to the residential

unit. Although density is not considered under the rules, a de facto incentive to create higher-density units may exist. A developer would receive \$1,300 for each single-family home to provide electric service. If there is a great distance between single-family homes, the \$1,300 may not be sufficient to cover the costs. On the other hand, if there are 50 housing units in a high-rise building, the developer would receive \$65,000 (\$1,300 x 50 units) and the actual costs would likely be considerably less than the total received. The basic structure of Rules 15 and 16 was created over 20 years ago and there is no discussion at the CPUC regarding modification of these rules.⁴⁴

The New Jersey Board of Public Utilities (NJBPUB), in March 2006, issued regulations requiring integration of “smart growth” principles into utility service policies. These regulations change how utilities (gas, electric, telephone, water, and wastewater) can invest in line extensions and customer services. Developers in designated smart growth areas will now be refunded monies (according to a specific methodology) for line extensions and services needed to supply electric services. For developments in other areas, builders and developers will be required to pay the full costs of pipes, conduits, wire, poles, transformers, regulators, service lines and meters.

Inclusion of Utility Infrastructure in CEQA Documents

New electric and gas transmission and distribution lines, and substations will be needed to accommodate load growth associated with new industrial, commercial and residential development. CEQA documents for these types of developments typically have not addressed the associated electrical and gas components of proposed developments. Pacific Gas and Electric (PG&E), Southern California Edison (SC&E), and San Diego Gas and Electric (SDG&E) are promoting a revision to the CEQA Guidelines Environmental Checklist through the auspices of the California Council of Environmental & Economic Balance (CCEEB). All of the investor-owned utilities (IOUs) have identified a major issue with the currently adopted CEQA Environmental Checklist in the State Guidelines. The Initial Study Checklist does not currently require discussion of a project’s electric and gas infrastructure requirements. However, most proposed development projects require construction of new electric and gas utility infrastructure. CEQA requires evaluation of impacts associated with the “whole action.” Any subsequent CEQA process to cover the gas and utility infrastructure can result in significant cost and schedule impacts. The IOUs, through CCEEB, have proposed the following addition to the CEQA Guidelines Checklist, Appendix G:

⁴⁴ Werner Blumer, California Public Utilities Commission, personal communication, June 15, 2007.

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Would the project:

h) Require or result in the construction of new electrical or gas facilities, such as power lines, substations, pipelines, compressor stations, or related access roads, or require relocation or expansion of existing electrical or gas facilities, the construction of which could cause significant environmental effects?

The utilities believe the benefits to be as follows:

- Fully discloses electric and gas infrastructure impacts.
- Provides equal treatment of gas and electrical systems relative to the infrastructure.
- Minimizes “piecemealing.”⁴⁵
- Eliminates unnecessary secondary CEQA processes.

Local Land Use Planning and Development

Utilities are becoming more directly involved in local land use planning, from the general plan stage to actual new developments. For the most part, local governments are not responsible for the delivery of energy to their constituents and so the planning for energy delivery to new homeowners and businesses tends not to be considered to any great degree in the development and implementation of general plans. Yet, the utilities are greatly affected by these plans, particularly in terms of understanding where and how much new growth is expected.

Southern California Edison

A large utility like SCE must cover multiple regional and local government planning activities since its service area encompasses multiple jurisdictions. SCE has an ongoing effort to more closely coordinate with local and regional government planning.⁴⁶ Local governments typically do not need utility input to their general plans but utilities do need the general plans since utility forecast plans must be consistent with adopted land use plans. SCE’s four-pronged approach to local and regional coordination includes the following elements:

- Participate in general plan development and review third-party environmental impact studies in a more comprehensive and consistent manner.
- Improve load forecasting by incorporating community information.

⁴⁵ Piecemealing is the division of a single project into smaller projects to avoid the responsibility for considering the impact of the project as a whole

⁴⁶ Mary Deming, Southern California Edison, personal communication, June 8, 2007.

- Develop educational materials, especially directed at local government planning staff, that provide detailed information on issues directly related to energy delivery (e.g., undergrounding of transmission lines).
- Create stronger relationships with local governments.

Utility communications with local governments could be enhanced through use of an updated Energy Commission Energy Aware Planning Guide. SCE informed Energy Commission staff that this material was very useful in the past as a source of neutral, unbiased information. An update of the Guide should include new examples of energy planning such as the transmission line element developed, with Energy Commission funding, for the Colusa County General Plan.

San Diego Gas and Electric

SDG&E shares common geographic boundaries with SANDAG. The utility has participated in and provided funding to SANDAG's Energy Working Group and is involved in its energy planning program.⁴⁷ The Energy Working Group provides a forum for the utility to meet with affected stakeholders.

SANDAG invited SDG&E to attend training sessions for the Energy Commission's PLACE3S energy module. A key issue for SANDAG was whether the energy module could incorporate zoning and other issues related to energy infrastructure planning. SANDAG expects SDG&E to be involved in the update of the San Diego regional energy strategy.

In addition to its involvement with SANDAG, SDG&E has reached out over the last few years to several local agencies to ensure the integration of utility system needs in its General Plan updates. Examples include:

- SDG&E worked with the City of Chula Vista to identify new distribution substations that would be needed based on the preferred growth scenario as well as identify existing utility corridors in accordance with State General Plan Guidelines. Transmission corridors that may require expansion based on local and system-wide growth were also identified. SDG&E also provided the city with draft General Plan policies for consideration. This General Plan Update was adopted in 2005.
- SDG&E worked with the City of San Diego to provide general substation location mapping and existing utility corridors in accordance with State General Plan Guidelines. SDG&E also provided the city with draft General Plan policies for

⁴⁷ Susan Freedman, San Diego Association of Governments, personal communication, June 11, 2007.

consideration which were modified for city use and included in the General Plan Update.

- SDG&E is currently working with the County of San Diego on the General Plan 2020 Update by providing input to its Power and Energy Background Report which will form the basis of its Energy Element. SDG&E also provided the county with the 2007 Transmission Planning Map requested by the CEC in the 2007 *IEPR* as a bridge between state and local planning efforts.

Pacific Gas and Electric

PG&E envisions sustainable communities that ultimately strive for zero net carbon emissions, sustainable land-use and transportation planning, sustainable water use, and elimination of the concept of waste. PG&E and the other IOUs have existing programs that promote energy efficiency, solar electricity, and demand response at the individual building scale. However, PG&E believes that to effectively address California's Climate Change challenge and promote sustainability, it is necessary to take a more holistic approach to energy planning and delivery.⁴⁸

Such an approach would include working collaboratively with local governments, irrigation districts and water supply companies on land-use and water infrastructure planning policies that promote energy efficient infrastructure. It would include working collaboratively with waste management companies to provide potential community-scale energy solutions from landfill methane, agricultural and other biomass "waste". It would also include collaborating with developers throughout the planning and development process to implement:

- Master planning strategies that optimize site design and community energy performance,
- Building design measures that significantly reduce energy demand, and
- Sustainable energy supply strategies at the neighborhood and community scale.

PG&E is in the process of developing a Sustainable Communities Program that will encompass two components:

- A building level approach where existing programs (energy-efficiency, solar homes, etc.) are bundled and packaged more effectively to building owners and developers to incorporate sustainability concepts and reduce carbon; and
- A community/regional approach where the utility will work with local governments on updates to general plans and building codes and standards, on the development of climate change action plans, and on new development projects.

⁴⁸ Darren Bouten, Pacific Gas and Electric, personal communication, June 11 and 18, 2007.

The first component is essentially a building-by-building approach, which more closely track's current CPUC requirements for program management and delivery. The second component, currently under development, envisions a much broader approach, incorporating direct water-energy and land use-energy links in order to enable communities to significantly reduce their carbon footprint. Both building scale programs with shorter lead times and neighborhood and/or community scale programs that promote significant greenhouse reductions, but have longer lead times, are necessary to achieve California's aggressive greenhouse gas reduction targets. However, the CPUC energy efficiency requirements that allow investor-owned utilities to recoup costs under the first component are not conducive to the type of planning and implementation activities that are envisioned in the second component.

Municipal Utilities

Municipal utilities and those directly owned by local government have smaller boundaries to contend with and presumably, are more able to participate fully in how general plans are developed and implemented. In its General Manager's Report and Recommendation on Rates and Services (April 5, 2007), the Sacramento Municipal Utility District (SMUD) states, "The District is committed to work regionally to ensure that our planning supports smart growth principles, and that (our) process will engage the regional planning authorities to facilitate wise energy use in future planning processes" (p. 11).

SMUD has been an active participant in the ongoing Sacramento County General Plan Update. SMUD's participation directly led to the addition of a objective in the County's Land Use Element: new development in existing communities in new growth areas and improvements to existing buildings and housing stock that are designed and constructed to be energy efficient and incorporate renewable energy technologies where cost-effective and feasible.

The City of Palo Alto Utilities (CPAU) has developed a close working relationship with City planning and building departments over the last several years. This allows the utility to recognize and correct zoning and municipal codes that impede more efficient energy delivery. CPAU is currently providing input on proposed zoning ordinance changes that will exempt thermal energy storage systems from restrictions on total square footage limitations for lots.⁴⁹

New Development Opportunities

Utilities have a unique opportunity to participate in new developments from the ground-up, especially those associated with very large tracts of land such as former

⁴⁹ Karl Knapp, City of Palo Alto, personal communication, May 16, 2007.

military bases. As an example, energy issues are taking front and center in a partnership effort involving the redevelopment of the El Toro Marine Corps Air Station in Irvine, California. The City of Irvine envisioned the Great Park development as a multi-use development with sustainability and environmental stewardship as core values.

SCE and Southern California Gas Company have joined forces with the City of Irvine, Lennar Corporation, and energy and land use experts (the “Green Team”), to design and develop a new energy infrastructure for the proposed Irvine Great Park. The Irvine Great Park Energy Subteam Update (November 2006) states that:

As with any substantial development, the Orange County Great Park and surrounding communities will have significant impacts on regional energy resources. California’s already strained electrical grid will be further taxed; limited natural gas resources will be stretched thinner, and demand for dwindling transportation fuels will grow. These challenges present unique opportunities to the Great Park, opportunities to improve the diversity, resiliency, and efficiency of energy resource production and use within the community. (p. 1).

The new infrastructure associated with the Park will “...be designed and built from the ground up, fostering opportunities to enhance efficiency, increase flexibility and diversity, and prepare for future energy sources. A new transportation system will be developed, opening the door for advanced system designs, monitoring, and linkages between Park, community, and mass transit.”⁵⁰

The Green Team is working with stakeholders to develop consensus goals, consisting of the following outcomes:

- Strive toward net zero energy usage through energy efficiency and fuel diversification.
- Maximize self reliance and security for critical energy services.
- Construct responsive buildings that help the electric utility reduce costs of imports and plant capacity through energy management.
- Provide diverse and secure energy sources and technologies that offer ample choice for residents and businesses.
- Offer a forward-looking, adaptive approach to design that helps everyone learn how to improve their performance, and sustain a high quality of life in the face of unexpected change through education.

⁵⁰ The Irvine Great Park Energy Subteam Update, November 2006.

PG&E has partnered with the City of San Francisco to create the “cleanest and greenest city in the U.S. (PG&E, 2006).” The plan will include alternative energy sources, a reduction in greenhouse gas emissions and a commitment to sustainability. One of the six key elements involves the creation of model urban communities in Treasure Island and Hunters Point from their existing brown-fields condition:

...we can bring these communities to the absolute cutting edge of green energy and technology, not only in the provision of energy, but in their entire planning, design and development. These communities can be conceived and built as zero net energy urban environments (p. 14).⁵¹

⁵¹ PG&E, A Partnership for a Greener San Francisco, August, 2006.

CHAPTER 7: LAND USE PLANNING RESEARCH AND DEVELOPMENT

To accommodate the 50 percent rise in population expected in California by 2050 and still reduce energy use, reduce VMT growth, and meet climate change targets, critical research and development is needed. Land-use decisions impact energy in many ways and the interconnections between land-use and energy are poorly understood. For example, California's Million Solar Roofs Initiative is moving forward with outfitting the state with home solar panels. To what extent have neighborhoods been designed with south-facing roofs ideally suited for solar generation? Are there obstructions that will reduce the effectiveness of the photo voltaic systems? The water-energy nexus has reinforced the fact that water use is energy use. To what extent can neighborhood design be optimized to save water and simultaneously recharge aquifers vital to California's water supply? Such design strategies could have significant energy, CO₂ reduction, and multiple other environmental benefits that typically would not be considered. These propositions are but two of the many that connect land-use decisions and long-term energy usage, and which are under consideration by the Energy Commission's Public Interest Energy Research (PIER) program.

By including energy demand, supply, and infrastructure as central factors in the land use planning equation, state and local governments can make intelligent use of energy resources and meet energy-related goals.

The 2006 *IEPR* provided policy direction for research that helps "identify, quantify, evaluate, and verify sustainable energy planning practices and designs and help[s] explain the associated complex energy interdependencies, efficiency, and environmental enhancement opportunities of these practices and designs." It also states that this research should be used to develop "analytic tools" that model these same relationships. More specifically, the *IEPR* directed the Public Interest Energy Research (PIER) arm of the Energy Commission to "provide tools and conduct research to assist local government's energy and greenhouse gas reduction planning efforts" (p. 96).

Such tools are a critical part of the planning process. Planners have a host of constraints placed on them in making land use decisions, including zoning, federal air quality mandates, tax revenue projections, demographic projections, etc. If they do not have reliable information on the energy impacts of their decisions at hand, they are not likely to take energy use into account.

The Energy Commission funds research advancing science and technology not adequately supported by the private or regulatory markets. Current and planned land use-related research, particularly sustainable communities, is, and will be, largely

focused on developing initiatives intended to improve regulatory decision-making and inform energy policy. In particular, this research is, and will be, addressing the following:

- Evaluating the correlation between land development patterns and vehicle miles traveled.
- Determining whether petroleum use in the transportation sector can be reduced through changes in the design of development patterns.
- Identifying the energy and resource efficiency impacts associated with various community design options, as well as identifying what reference guidelines and case studies are needed by design and building professionals in planning more sustainable communities,
- Finding useful feedback that can be given on the energy impacts (HVAC, solar water heating, PV) of various street layouts and house orientations to the developer or planner.
- Outlining ways to better quantify, evaluate, and verify complex energy relationships, as well as environmental enhancement (including CO₂ reduction) and efficiency opportunities of sustainable energy planning designs and practices.
- Identifying the tools and models or improvements to these tools and models that are needed to set and achieve sustainability goals, as well as incorporate energy and the environment into planning and design decisions.

Because of the long-lasting energy impacts related to community design, it is increasingly important to optimize natural environmental design features, energy efficiency, and opportunities for emerging energy technologies, and to use these tools in synchrony with each other. Beyond these considerations, achieving sustainability will ultimately require coordination across the entire energy sector. There is clearly a need for further planning that will integrate current environmental and building efficiency research with industry efficiency, demand response, renewable energy, distributed generation, and transportation into a single, comprehensive research plan.

In fiscal year 2007-08, the Energy Commission's Research, Development and Demonstration Committee has allocated over \$2 million for sustainable communities research. This funding will support a broad-based research program including initiatives identifying, quantifying and verifying the complex energy relationships, interdependencies, and environmental enhancement opportunities of alternative practices and designs; and conducting basic research to assess impacts associated with environmental features of sustainable communities (e.g. optimize urban canopy and PV). The benefits from this research will include a better understanding of the holistic

interaction between energy demand and environmental design principles as well as identification of underlying infrastructure design impacts on energy and the environment, and identification of design improvements that would reduce energy use in California.

Land Use and Transportation Research

PIER is sponsoring transportation research to reduce petroleum consumption and associated GHG emissions through increased vehicle efficiency. Research is needed to establish the scientific basis for, and make appropriate judgments about, the relationships between development patterns and VMT and the energy conservation benefits of more dense development patterns. The GHG reducing potential of land use hinges on its ability to either 1) reduce distance traveled or 2) shift travel from carbon-intensive to less carbon-intensive modes.

The effect of land use on travel behavior is currently one of spirited discussion among academics; Ewing and Cervero provide an excellent research summary.⁵² In general, residents in dense neighborhoods or neighborhoods with grid patterns appear to drive less than those living in traditional low-density suburbs, but some studies have shown these reductions in VMT to be relatively minor. Following up on concern raised earlier in this report, others have shown that while VMT may decrease, the rate of trip-making remains relatively constant over land use types, which suggests the reductions in VMT may not translate fully into emissions reductions.⁵³

Possible Areas of Future Transportation Research

Smart Land Use and Intelligent Transportation Systems

The Governor's Climate Action Team identified smart land use and intelligent transportation systems as major elements of a unified program to meet the goals of the Governor's climate policy. In the Climate Action Report,⁵⁴ smart land use and intelligent transportation systems are projected to result in reductions of roughly 2 million metric tons CO₂ equivalent by 2010 and roughly 15 million metric tons by 2020. These projected reductions are significant and represent a major portion of the total GHG reduction goal. However, there is no discussion in the report as to how these projections were made. Validation of the modeling tools being used to estimate GHG reductions from smart

⁵² Ewing, R, and R Cervero, 2001, "Travel and the built environment: A synthesis," *Transportation Research Record* 1780: 87–114.

⁵³ 'Cold starts' account for a disproportionate amount of emissions (at least, for NO_x and SO_x, this may not be true for CO₂) and therefore reducing the number of trips may be as important as reducing VMT in terms of effecting emissions reductions.

⁵⁴ California Environmental Protection Agency, 2006, *Climate Action Team Report to Governor Schwarzenegger and the Legislature*, March 2006.

land use and intelligent transportation systems should be pursued.

The California Partnership for Advanced Transit and Highways (PATH) and UC Davis Energy Efficiency Center are conducting research on Intelligent Transportation Systems and looking for ways to increase ridership on public transportation systems as a way to reduce vehicle miles traveled. Through case studies and pilot projects, this research explores ways to get people out of their cars and into regional transit systems. Many of the projects have met with success, but it remains to be seen whether the programs can be scaled up effectively.

Transportation Modeling Tools

The Natural Resources Defense Council (NRDC) concluded in a recent study that transportation modeling tools do not accurately characterize the effects of higher density developments in transit rich areas. The models also do not allow communities to accurately assess the cost effectiveness of mixed-use or transit oriented development. This finding highlights the potential need for more research into the validity and improvement of transportation modeling tools. The NRDC study may mean that regional models employed by MPOs, while designed for their particular region, would be a more accurate planning tool if they were modified to better account for location efficient policy choices. Researching the information and data needed so that transportation modeling tools can include capabilities to assess CO₂ reduction potential offers additional room for improvement in these tools. Given that the transportation sector is the largest single sector of GHG emissions in California, it becomes increasingly important that these tools use the best data and approaches available.

Some key research questions that must be addressed to give transportation models more predictive power are:

- What is the association between trip types (home-work, work-home, home-shop, shop-home, other) and fuel use/GHG emissions?⁵⁵
- How are these types of trips expected to change as the population ages (retirees) and how does this affect Smart Growth choices?
- Should more emphasis be placed on reducing work-related trips or other trips, or is a balance best?
- How can modeling take into consideration the different urban densities and availability of public transit that varies throughout California cities?

⁵⁵ Cervero, Robert and Michael Duncan, Which Reduces Vehicle Travel More: Jobs-Housing Balance or Retail-Housing Mixing? Journal of the American Planning Association, Autumn, 2006.

- Smart Growth is designed to provide people with more transportation choices, but how effective will this actually be in getting people to drive less?
- How do people's attitudes and behaviors impact the effectiveness of policy decisions to encourage smart growth?

Density and Urban Building Energy Use

Research is needed to study the implications of densification on urban building energy use? Some studies indicate that if cities are too noisy and there are local air quality concerns, instead of using natural ventilation people will use their air conditioners.⁵⁶ One study also suggests that if cities become too dense, in addition to less use of natural ventilation, the need for electric lighting goes up and the use of natural lighting goes down. Further research is needed to understand the implications of smart growth planning on building energy use.⁵⁷

Smart Growth and Smart Communities

There is also a need to explore the relationship between smart growth and "smart communities." Smart communities are those that use information technology to change how their physical space is used. Similar to smart growth, smart communities can reduce VMT, although that would be accomplished through broadband systems of communications connecting homes, offices, schools, and health care facilities, rather than primarily through transportation infrastructure design. Research may be warranted on the potential of smart communities to reduce VMT. Generally, research should examine the potential benefits of:

- Information and education programs for state and local officials (including planning officials) on the potential for energy savings through planning, design, development, and infrastructure decisions.
- Incorporation of location efficiency models in transportation infrastructure planning and investments.
- Transportation policies and strategies to help transportation planners manage the demand for travel, including trips reducing the number and length of vehicle trips and promoting trips that increase the viability of other means of travel.

⁵⁶ Cooper, J. T. R., and A. Smyth. 2002. "Energy trade-offs and market responses in transport and residential land-use patterns: Promoting sustainable development policy." *Urban Studies* 38(9): 1573–1588.

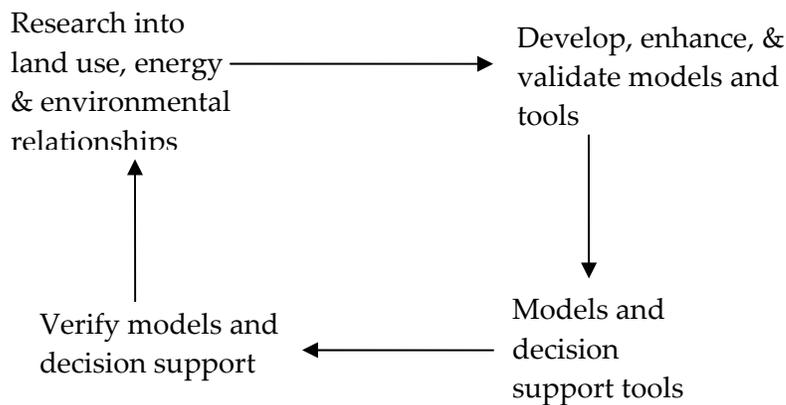
⁵⁷ Koen Steemers (2003), "Energy and the city: density, buildings and transport," *Energy and Buildings* 35(1): 3-14.

Scientific Research and Modeling Tools to Better Understand Land Use, Energy and Environmental Relationships

It is anticipated that at the highest level, PIER Sustainable Communities projects⁵⁸ will fit into either or both of two broad research areas: scientific studies and/or modeling and decision support tools. Both areas are designed to provide a better understanding of land use, energy and environmental relationships and to improve the decision-making ability of local government officials, developers, builders, and others.

This process is not necessarily linear, however, but at times a feedback cycle between these goals, as illustrated in Figure 2 below.

Figure 2. Priority Research Areas



Examples of Current PIER-Funded Land Use, Energy, and Environmental Research

The Energy Commission, through the PIER program, is funding work to integrate a building and generation energy planning capacity into the existing regional and local transportation and land use planning software tool, I-PLACE3S⁵⁹. The goal of this effort is to empower local government planners, COGs and MPOs, and decision makers across

⁵⁸ For PIER funding, a public interest research need must be demonstrated. The development of tools must be geared toward a public interest benefit and the advancement of science and/or technology.

⁵⁹ I-PLACE3S is an acronym for Internet accessed PLAnning for Community Energy, Environmental and Economic Sustainability.

a region to view the outcomes of energy analyses alongside established key planning data such as housing costs, VMT, infrastructure cost assessments, and air emissions.

Within the next 25 years, the U.S. will design and construct more than 213 billion square feet of new built space, presenting an opportunity to design and incorporate higher levels of energy and resource efficiency.⁶⁰ The Energy Commission is funding research in Chula Vista, California, to look at more efficient site design for new planned communities. The project will demonstrate the use of four different modeling tools (Building Energy Analyzer, Energy-10, City Green and CommunityViz) combined together to optimize energy, economic, and environmental parameters; analyze impacts of efficient community designs on utility infrastructure; and identify solutions to institutional and market barriers. The project will include stakeholder reviews and feasibility analyses that incorporate input from city officials, builders, developers and others.

A new analytic tool under development is the Subdivision Energy Analyzer Tool. At the subdivision scale, this analytical tool will allow developers to examine and optimize different street layouts and housing orientations that enhance the ability to generate solar electricity and reduce energy use.

Areas for Possible Future PIER-Funded Land Use, Energy and Environmental Research

In fiscal year 2007-2008, PIER will initiate research to improve understanding of the relationships between land use, energy and environment.⁶¹ In particular, this research will address the need to identify and validate community-level design principles for land-use decision making by local and regional governments. An example includes research that provides a better understanding of the relative tradeoffs between residential-scale solar and the urban tree canopy. Urban shade trees can reduce a home's energy use by reducing the energy required to cool (and heat) the home, but trees can also reduce the efficiency and output of a home's solar panels by blocking sunlight. The tradeoffs including overall energy, environmental, and economic benefits between shade trees and PV production has yet to be quantified. These are complicated tradeoffs, affected by regional climate, a house's orientation, size, type and placement of trees, and many other factors. Because the state is investing in both residential solar energy

⁶⁰ Nelson, Arthur, *Toward a New Metropolis: The Opportunity to Rebuild America*, Virginia Polytechnic Institute and State University – A Discussion Paper Prepared for The Brookings Institution Metropolitan Policy Program, December, 2004.

⁶¹ It is worth noting that for PIER generally *short-term* refers to a 1- to 5-year time frame; *mid-term*, 3 to 10 years; and *long-term*, 10 to 20 years.

systems⁶² and urban canopy programs, it would be beneficial to understand how these policies can be optimized to provide maximum benefits while understanding potential tradeoffs.

Another broad subject area in community-level design principles addresses water and energy. In Southern California, for example, the difference between energy needed to pump groundwater can be as much as 2500 kilowatt-hours/acre-foot less than the energy needed to import water⁶³. Landscaping can be modified or designed to maximize groundwater infiltration, both improving the amount contained and quality of groundwater in the aquifers and reducing the need to pump and treat run-off, both energy intensive processes. Larger groundwater reserves can allow water agencies to pump groundwater rather than rely on electricity intensive imported water. The ability of landscape design to effectively recharge aquifers, and the potential energy savings and environmental benefit from increased local pumping versus long-range transport and pumping is research planned for this year.

The *2006 IEPR Update* states that the Energy Commission should “develop tools and methods to identify and set energy sustainability goals and to verify that these goals are met” (p. 96). Some tools exist and are being used already and, as a starting point for research, it may be useful to study some of these existing tools and methods. For example, local governments are building LEED (Leadership in Energy and Environmental Design) certified buildings to assist in meeting their sustainability goals. Additionally, LEED–Neighborhood Design (LEED-ND) is being developed in partnership with the NRDC and the Congress for New Urbanism. Development projects will be rated based upon their location efficiency; environmental preservation; compact, complete and connected neighborhoods; and resource efficiency. The Energy Commission may be able to leverage the LEED–ND program in a way that assists in establishing standards or priorities for growth in California. Some potential research opportunities include:

- For cities with LEED certified projects, conduct monitoring and validation studies to demonstrate how well the projects are meeting their projected goals, including CO₂

⁶² The New Solar Homes Partnership is a component of the California Solar Initiative, which was signed into law in 2006 under Senate Bill 1 (SB 1) by Governor Arnold Schwarzenegger. SB 1 establishes three goals for the California Solar Initiative: create 3,000 megawatts of new solar-produced electricity by 2017, establish a self-sufficient solar industry in which solar energy systems are a viable mainstream option in 10 years, and to place solar energy systems on 50 percent of new homes in 13 years.

⁶³ Cohen, Ronnie, Gary Wolff, and Barry Nelson, 2004, *Energy Drown the Drain: The Hidden Costs of California’s Water Supply*, Natural Resources Defense Council, Available at <http://nrdc.org/water/conservation/edrain/edrain.pdf> .

reductions and to evaluate the scoring criteria to see if certain credit areas warrant a higher weighting because of embedded energy savings.⁶⁴

- Once the LEED-ND standards are final, research projects could include monitoring and validating the impact of LEED-ND certified projects and analyzing and quantifying the benefits for California cities and California as a whole.

Land use planners and other city officials sometimes use models to calculate/estimate the impacts of their decisions. For example, decision-makers currently have models forecasting transportation trends for the next 50 years, but they have few reliable models that forecast energy use at the community level for the next decade, given various land use practices. Thus, developing energy use models at the community level will assist in informed land use decision making.

Tools are currently in use that could help the state understand optimal energy-related environmental community planning and design approaches. Such tools, focused on particular sub-systems within a community, include: CITYgreen, Harmonize Emissions Analysis Tool (HEAT) and Construction Technology Group's Sustainable Communities Model. A survey of functionality for all existing tools and quality and consistency of their input data sources would assist in determining if better data is needed to ensure that such models produce as reliable and consistent outputs as possible.

Communities are looking for tools that can address climate change at the local and regional level.⁶⁵ The 2006 *IEPR* states that the Energy Commission (through PIER) should "Provide tools and conduct research to assist local governments' energy and greenhouse gas reduction planning efforts" (p. 96). Tools exist to support local governments in reducing their GHG emissions. For example, HEAT is an internet-based resource for storing, tracking, modeling, and reporting emissions and reductions of GHGs and criteria air pollutants.

Research is warranted to investigate the quality of data used in the models, validate the modeling capabilities, and assess the strengths and weaknesses of tools. In the coming years, PIER will conduct research in support of local governmental efforts on climate protection. If these tools are being used to estimate achievements of state energy policy goals, research that strengthens the science and technology behind and within these

⁶⁴ For example, water efficiency credits for LEED-NC may result in energy savings as well, and perhaps should be considered for a higher weighting to encourage such activities in achieving LEED certification.

⁶⁵ Sixty-six California cities have signed on to the U.S. Mayors' Climate Protection Agreement, which commits signatories to reducing their carbon emissions to 7 percent below 1990 levels by 2012.

tools may be of consideration.

Critical research questions that will allow for better planning and effectiveness at reducing GHG emissions at the local level may include:⁶⁶

- Exploratory study: Urban Forestry and carbon sinks - how to account for GHG reductions from sequestration by trees as well as other energy/environmental benefits.
- Methodologies - ensuring consistency and scientific soundness. What science research is needed to make the methodologies robust as well as transparent? Using this information what are the recommendations for developing a California Standard? (in coordination with Air Resources Board)
- What are the benefits and potential impact of making offsets local and what ways can they be made verifiable? How far can a city go to achieve Kyoto-like goals within its own jurisdiction and authority?
- Why are cities not investing more in short and medium term energy savings projects? And what potential impact in reducing GHG emissions would this approach have?
- What are the recommended energy savings projects and their potential impacts?
- What is the best way to develop a robust database and information exchange among (California) Kyoto Cities?
- What data is needed to accurately report emissions on a community-wide and municipal scale?
- How should monitoring, tracking and validation of progress occur?
- For the cities that are implementing GHG emission programs, what are the quantifiable differences they are making compared to those that do not have programs?
- What role can cities play in achieving the state emissions reduction target?

The knowledge produced from the research described above will provide the information needed and enable the development of models and decision-support tools

⁶⁶ The Institute for Local Reliance just published a report "Lessons from the Pioneers: Tackling Global Warming at the Local Level" (Jan 2007). It surveyed the climate change activities in 10 cities (2 in California) to find out how well these "Kyoto cities" were doing in meeting their goals and what strategies and methodologies they were using. The overriding conclusion is that, despite commitments and elaboration of significant programs, reducing GHG emissions below 1990 levels "will be a major challenge." Several research recommendations were made and some are included in this list.

to promote more comprehensive energy-aware planning. Such efforts represent a broadening of the scale of the research, moving from an individual object (building) level to the aggregate level (e.g., moving from the energy efficiency of a house to the energy efficiency of a neighborhood), as well as considering energy as part of smart growth, including transportation energy, as well as other forms of energy demand and supply. Achieving this broadening of scope will begin to place energy planning at the appropriate level for local and regional governments to design their land use practices and policies around more energy and resource efficient communities.

Land use changes may be able to reduce driving for necessity by “bringing destinations closer to origins and improving the viability of alternative modes” but studies show that people choose to drive more than necessary.⁶⁷ If people will choose to drive more even when land use changes offer less need to drive, land use change may have limited power to produce savings from the transportation sector. Investigating ways to ensure that the land use changes have a better chance of achieving the desired effect is an important area for research.

⁶⁷ Handy, Susan, 2003, “Driving Less,” *Access* 23: 20-25.

CHAPTER 8: STAFF FINDINGS AND CONCLUSIONS

The following are key findings and conclusions that the state and Energy Commission should consider in their attempts to reduce energy use and GHG emissions related to Land Use:

1. With over 40 percent of California's greenhouse gas emissions coming from the transportation sector, significant efforts to reduce vehicle miles traveled are needed to meet the state's emission reduction goals. The state must find a way to not only slow the current 3 percent annual vehicle miles traveled growth rate, but begin to reduce it.
2. The research reviewed shows that increasing a community or development's density and accessibility to job centers are the two most significant factors for reducing vehicle miles traveled through design.
3. Existing tax policies, largely developed in response to Proposition 13, incentivize commercial sprawl, which can provide local governments with much needed revenue for public services and infrastructure, at the expense of smart growth strategies.
4. Dealing with issues such as housing, transportation mobility, economic development, and local climate change planning requires a regional approach.
5. While the state has limited land use authority it does have some key leverage points (California Environmental Quality Act, housing elements, and others) that it can use to assist local governments in reducing energy use and greenhouse gas emissions that result from land use planning choices. Thus, while land use authority is nearly completely vested with local government, the state can use the disbursement of transportation funds to motivate collaborative planning at a regional level.
6. The state-sponsored Blueprint Planning Program has engaged nearly all of the state's metropolitan planning organizations in a long-range planning effort that will have many of them adopting plans to better coordinate land use and transportation development. The plans accommodate housing needs, reduce vehicle miles traveled, and identify priority planning areas. The plans are in early stages of implementation and may need technical, financial, and regulatory assistance to achieve their goals.
7. Other states and regional governments have adopted preferred growth scenarios that better coordinate land use and transportation development while accommodating housing needs, reducing vehicle miles traveled, and identifying priority planning areas. Some of the states and regions have restricted financial and technical assistance to the identified priority planning areas in efforts to support the plan goals.

8. Infrastructure funding policies influence the design and use of infrastructure projects. The Governor's Strategic Growth Plan contained numerous programs to encourage energy efficient, climate friendly land use but project criteria (where they exist) for many of the programs contain no energy or climate considerations. The next federal transportation bill, if implemented, could significantly bolster the Blueprint planning effort if it accounts for energy and climate considerations.
9. Utilities have historically played only a limited role in local government planning efforts. Coordinated planning between a utility and local government can produce many mutual benefits in terms of demand management, infrastructure deployment, distributed generation, and installation of renewable energy generation. California investor-owned utilities have begun to engage with local and regional governments in mutual planning efforts, but these partnerships are prevented from reaching their full potential since the utilities cannot recoup the costs of their efforts.
10. Land use impacts on energy demand, generation, and transmission and on greenhouse gas emissions are in the early stages of exploration. There is a great need for further research and development to elucidate and quantify the impacts land use has on energy systems, including: the correlation between land development patterns and vehicle miles traveled, the potential for low energy design principles, and the use of community-scale distributed and renewable generation technologies. In the context of local government decision making, there is a need for research to develop modeling and decision-support tools to allow the integration of energy considerations into future research and planning efforts. The Energy Commission is engaging in a new area of research that will look at the integrated relationships between land use, human behavior, urban design, environmental impacts, and energy under its new Sustainable Communities research program.

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APPENDIX: 2006 ENERGY REPORT UPDATE POLICY RECOMMENDATIONS UPDATE

Require Local Governments to Adopt Green House Gas Emission Reduction Plans

The state's Assembly Bill 32 plan should require local governments to develop greenhouse gas reduction plans and finance such efforts through the Assembly Bill 32 administrative fee at a level commensurate with the greenhouse gas savings expected from improved land use planning.

Update: The CARB is currently developing the AB 32 implementation plan. It will be released by January 1, 2009.

Promote and Facilitate Efficient Land Use Practices That Save Energy and Reduce Green House Gas Emissions

The Energy Commission should invite stakeholders to participate in an ongoing land use/energy working group that would convene on a regular basis to guide the State's land use and energy research and program development.

Update: The Energy Commission is chairing the Climate Action Team Sub-Group on Land use and Local Government. The Sub-Group is tasked with coordinating climate change mitigation and adaptation efforts in cross-cutting areas that are crucial to meeting the state's greenhouse gas (GHG) emissions reduction goals related to local government and land use activities. The Sub-Group is made up of state agencies and will work with local governments and other stakeholders to develop the tools, and programs necessary to achieve the State's climate and energy goals.

Working with their partners, the Energy Commission should establish a central repository for efficient land use information resources. The Energy Commission should produce case studies and best practices guides that describe the successes of local government land use efforts that reduce energy needs and greenhouse gas emissions.

Update: The Energy Commission has entered into partnerships with national, regional and local government entities to produce case studies and tools that will help local governments and their partners to develop plans to reduce

energy usage and GHG emissions. These partnerships will produce the following, but not limited to, products:

- **Model Regional Energy Strategy**
- **Model General Plan Energy Element**
- **Model Local Climate Action Plan**
- **Alternative Fuel Infrastructure Toolkit**
- **An annual conference on smart growth and climate change**
- **Local Government GHG analysis tool**

The legislature should pass legislation that would require local governments to include an energy element in their General Plans.

Update: At the time of the release of this document there is no legislation in the 2007-2008 legislative session that would require a local government in California to adopt a mandatory Energy Element in its General Plan.

The PUC should require investor owned utilities to partner with local governments to incentivize smart growth in their service territories. The PUC should allow IOUs to recover the cost of the partnerships.

Update: At the time of the release of this document there is no activity to report on this recommendation.

Under the authority granted to them by AB 2021 (Levine, 2006) the Energy Commission should assist municipal utilities in partnering with local governments to incentivize smart growth in their service territories

Update: At the time of the release of this document there is no activity to report on this recommendation.

Provide New Tools and Conduct Research to Assist Local Government's Energy and Greenhouse Gas Reduction Planning *Efforts*

The Energy Commission should complete the update of the PLACE3S energy module and then continue to provide research and analytical tool development that will allow the state and its partners the ability to:

- Better understand the relationships, processes, and outcomes that underlie smart growth and energy.

- Identify, quantify, evaluate, and verify sustainable energy planning practices and designs.
- Understand the associated complex energy relationships, interdependencies, efficiency, and environmental enhancement opportunities of these practices and designs.
- Develop tools and methods to identify and set energy sustainability goals, as well as to verify that these goals are met.
- Take a comprehensive approach, using life cycle studies or system analyses, to identify the costs, benefits, and trade offs of achieving these goals and to allow for more informed decision and policy making.

Update: The PLACE3S energy module is currently still in the development phase. The PIER program has started a new research approach that draws from current program areas for an integrated analysis of Sustainable Communities. The research from this effort will provide a better understanding of land use, energy and environmental relationships and attempt to improve the decision-making ability of local government officials, developers, builders, and others. The PIER program is engaged in the development of a number of tools, and research, that will enable local governments to better account for energy and climate impacts of growth scenarios, as identified earlier in this paper.

For the 2007 IEPR, the State Should Analyze the Role of the State's Infrastructure Planning and Financing Activities in Promoting Smart Growth

The state should assess compliance with Assembly Bill 857 and provide an assessment of successes and barriers to action.

Update: At the time of the release of this paper there was no activity to develop and release a report an assessment of successes and barriers to action on AB 857 compliance.

The state should develop criteria for smart growth development and prioritize infrastructure funding towards development that meets the criteria.

Update: The Energy Commission is chairing the Climate Action Team Sub-Group on Land use and Local Government. The Sub-Group will be examining the state's role in infrastructure financing and planning and developing smart growth, energy and climate criteria for state agencies to consider for incorporation into their infrastructure programs.