ENERGY

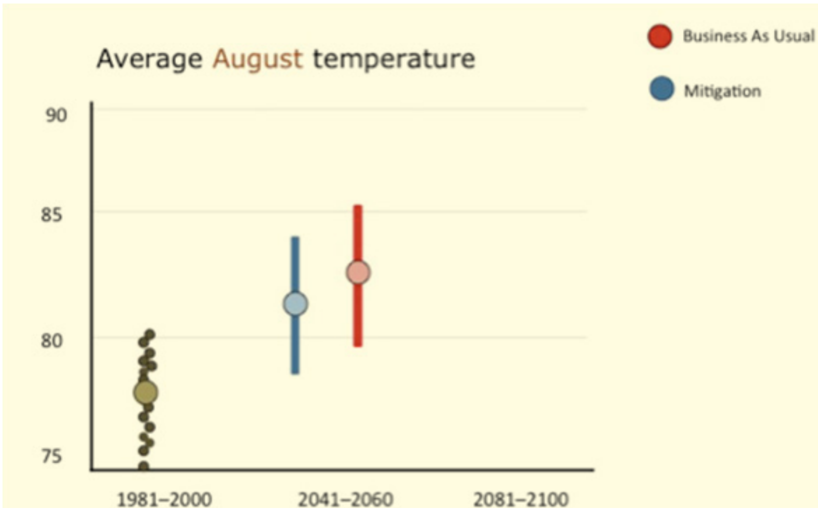
REGIONAL CONTEXT

Energy is essential for the economic, social, and environmental vitality of communities. Yet the current generation, transmission, and distribution of energy creates greenhouse gas emissions, air pollution, and negative land use impacts. In Los Angeles County, 40% of greenhouse gas emissions come from electricity and natural gas used in buildings, similar to the transportation sector in both emissions and urgency of the need to decarbonize this sector. Furthermore, the existing centralized energy system that concentrates large generation infrastructure in few locations (as opposed to a distributed, renewable one) results in approximately 65% of the energy being lost across generation and transmission processes. The current energy system is aging, inefficient, and vulnerable to system-wide outages. Reducing emissions from energy usage in buildings, and creating an energy system that is efficient and resilient, can significantly reduce the region's carbon footprint and increase the sustainability of the region's energy supply and environment. This progress will happen in three ways: 1) by improving the efficiency of energy use to encourage conservation, 2) by optimizing energy demand, and 3) by reducing the carbon intensity of energy. While officials throughout the Los Angeles metropolitan area have taken leadership steps in all three areas, the region faces many challenges to success.

The Framework describes a set of goals, strategies, and actions to aid in the regional transition to a decarbonized, sustainable energy future. Many of these recommendations are backed by state mandates. Yet compliance will offer regional benefits. Implemented thoughtfully, a sustainable energy system based on these goals will bring economic, public health, equity, and environmental benefits to Los Angeles.

Los Angeles has significant opportunities to leverage to reduce energy emissions and increase overall resilience to climate-related events through an improved energy sector. Due to its climate and geography, Los Angeles has abundant renewable sources of energy, particularly solar. If captured efficiently, these resources have the potential to not only reduce the region's greenhouse gas emissions but also increase energy security and create new economic development opportunities.

The region also faces challenges to this vision. Los Angeles is home to 40% of the state's disadvantaged communities, despite the county making up only 25% of California's total population. As the impacts of climate change increase, the risks to these populations will also increase. In the coming decades, Los Angeles will face an increasing number and intensity of extreme heat events (discussed in greater detail in this section as well as the Public Health section below).



On the graph above, the large brown dot shows present day average temperatures in August in Los Angeles, based on several years of monthly average (brown dots). The blue dot shows the expected future average temperature in August under a scenario with global greenhouse gas mitigation. The red dot shows expected future average August temperature under a scenario with no major global effort to reduce greenhouse gas emissions. The red and blue bars show the range between the individual global climate models with the largest and smallest increases, representing the range of possible future averages within each scenario.[90]

Vulnerable populations living in poor housing conditions without access to air conditioning, weatherized buildings, or quality transportation to escape oppressive conditions may be at greater risk for health impacts from these events. In addition, increased energy demand during heat events can cause brownouts and blackouts, which creates additional vulnerability. Current UCLA research is investigating grid vulnerabilities to determine the likely locations of these events and to see how vulnerable populations could be impacted. Finally, increased heat will mean reduced air quality. Vulnerable populations already face disproportionate risks from air pollution; climate change will only exacerbate this effect. Any efforts to reform the energy sector to reduce emissions and improve resilience should, therefore, ensure the equitable distribution of benefits.

THE ROLE OF REGIONAL COLLABORATION

In developing the Framework, research revealed three key obstacles that hinder the transition to climate resilience: 1) lack of information, 2) political and regulatory constraints that work at cross-purposes with renewable energy and greenhouse gas mandates, and 3) lack of funds (these obstacles are discussed in more detail in the introduction). These three issues are also barriers to meeting many of the specific energy strategies laid out in this chapter. A lack of data related to building energy consumption hampers energy efficiency program decision making. Entrenched jurisdictional and agency and utility sunk investments and business models limit the creative and adaptive planning necessary to pilot innovative projects. A lack of upfront capital limits the ability to invest in energy efficiency measures.

Collaboration can help agencies and municipalities overcome these barriers and lead to a greater benefit for the region. Partnerships between public sector actors and universities can make data more accessible. Cooperation among multiple agencies, NGOs, and municipalities can lead to a more flexible vision and set of planning goals to overcome political obstacles. Joint funding applications can make partners more competitive to receive the grant awards necessary to fund critical planning efforts and pilot projects. Finally, new and innovative alternatives to current energy utilities should be explored. The current development of CCAs, the potential of "Sustainable Energy Utilities," and other new institutional forms and paradigms should be part of an ongoing dialogue about how to make the region more energy self-reliant, while using renewable sources of energy and ensuring high penetration of energy conservation retrofits in existing buildings.

POLICY LANDSCAPE

The energy sector is a fundamental component of the state's climate action goals. Energy policy in California is both complex and broad. The summary below covers three overarching areas of policy. These three themes are repeated throughout several pivotal pieces of legislation as well as the fundamental state guidance documents, including the California Energy Commission's Integrated Energy Policy Report, the California Public Utility Commission's Energy Efficiency Strategic Plan, and the Department for Natural Resources Safeguarding California Plan.

Policies aim to reduce greenhouse gas emissions by increasing renewable generation, storage, energy efficiency, and conservation

California has a long history of policies aimed at reducing pollution from energy generation and increasing energy efficiency. Electricity generators are required to participate in California's greenhouse gas emissions cap-and-trade program. This system requires utility companies (and other regulated entities) to obtain allowances (through initially free allocation, as occurred in the State of California) to emit carbon. If an entity emits fewer emissions than its supply of allowances, it can sell its excess allowances to other emitters. If it emits more, it must purchase additional permits from another entity willing to sell.

Another way that California's energy supply is decarbonizing is through the state's Renewable Portfolio Standards (RPS). Established in 2002 by Senate Bill 1078 (Sher, 2002) and accelerated in 2006 under Senate Bill 107 (Simitian), the standards required that as of 2010, 20% of retail electricity sales must come from renewable sources. The standards were extended again by Executive Order S-14-08 and Senate Bill X1-2 (Simitian, 2011) to require 33% renewables by 2020. Most recently, under Senate Bill 350 (de Leon, 2015) mandates 50% of all electricity purchased in California must come from renewable sources by 2030.

In addition to reducing the carbon intensity of energy production, the state aims to reduce greenhouse gas emissions by making buildings more efficient. California's energy efficiency policies were first passed in 1974 and have been updated regularly since. Under Title 24, California created the most far-reaching energy efficiency codes in the nation, including a requirement for all new residential buildings to be net zero energy by 2020. More recently, Senate Bill 350 requires the state to now double the energy efficiency of buildings over the next 15 years, through 2030. Stakeholders are currently working to plan how to meet this target. Assembly Bill 802 (Williams, 2015), a complementary piece of legislation, states that energy savings should be measured according to actual meter-level savings, rather than based on the current practice of estimated savings. This practice, and the underlying technology that enables it, will help ensure that investments in energy efficiency are directed at the most effective measures, building confidence and trust in the marketplace to facilitate more investments and possibly larger-scale financing, and providing local governments and other actors with valuable information. Assembly Bill 802 also directs the California Energy Commission to establish a "Statewide Benchmarking and Transparency" program, through which building owners must report energy benchmarking data for public disclosure. It also directs the California Public Utilities Commission to work with utility providers to offer whole building aggregated energy data so owners can comply with the program. The data will ensure that local governments and other actors can make data-driven decisions on energy policies and investments.

Drive to increase data transparency

Better data can lead to better decision making in the complex field of energy policy. Although energy efficiency policies have been in place in California since the 1970s, as discussed above, few long-term before-and-after studies exist to detail how these investments have impacted actual consumption over time. Most studies rely on modeled results rather than actual data. While these models have provided valuable information, they are limited by their underlying source data.[91] Advanced computing and information technologies can open up new avenues for utilizing data, rather than just modeling, for decision making. As a result, several state guidance documents call for better access to data, a more transparent data process, and a move towards data-driven decision making.

Los Angeles is particularly well-positioned to lead the state in data-driven decision making. The LA Energy Atlas (energyatlas.ucla.edu), a collaboration between UCLA, Los Angeles County, and the SoCal Regional Energy Network, provides Los Angeles decision makers, utilities, and property owners with granular and historic energy consumption data across the region over the past decade. This project provides a variety of energy and building statistics, disaggregated to the neighborhood level. Individual account data are kept private, aggregated for the website and highly protected. The project provides a platform by which decision makers in the Los Angeles region can collaborate with researchers to gain tailored, specific, and accurate analysis.

Focus on social equity

Low-income communities often have the least efficient buildings and homes, despite having populations who would benefit the most from lower bills (if they are not on subsidized rates) and less physical discomfort from building retrofits. State efforts seek to correct this inequity. The California Public Utilities Commission's Energy Efficiency Strategic Plan, Safeguarding California, and the 2015 IEPR all emphasize the importance of expanding, and even directing, the programs and benefits of sustainable energy programs, specifically energy retrofits, into disadvantaged communities. In addition, several state policies are aimed at increasing the equity outcomes of energy programs. Senate Bill 535 (De Leon, 2012) required 25% of the state's Greenhouse Gas Reduction Funds be directed to disadvantaged communities.[92] Senate Bill 350 (De Leon, 2015) directed state agencies to give preference to communities with high poverty and unemployment in deploying renewable energy, prioritizes job training in disadvantaged communities, and requires agencies to coordinate with environmental justice organizations.[93] These programs would benefit from greater access to data and processes to then base decision making on the data.

GOALS, STRATEGIES, ACTIONS

In order to meet state mandates and municipal greenhouse gas targets, and to increase regional sustainability, Los Angeles must reduce and manage energy demand and diversify the energy supply. Regional efforts that build collaborations between municipalities, agencies, NGOs, and researchers should leverage the resources of multiple partners to ensure success and to maximize benefits equitably.

The Framework sets forth the following goals for the energy sector, as well as an accompanying set of strategies and actions for each, which will lead to reduced greenhouse gas emissions and increased resilience.

Goal 1 — Diversify and decarbonize the energy supply to reduce climate vulnerability and greenhouse gas emissions

Goal 2 — Promote demand-side measures and energy conservation that support resilience and reduce greenhouse gas emissions, prioritizing commercial, industrial, and institutional sectors first

Goal 3 — Deploy distributed energy storage technologies in the already built environment of Los Angeles as a first priority to integrate intermittent renewable energy and reduce peak demand

Due to the interconnected nature of the energy sector, several actions can benefit all three goals. For example, energy efficiency upgrades can lead to both reduced greenhouse gas emissions and buildings that are cooler and more resilient to heat from a warming climate. If targeted appropriately, distributed solar can reduce greenhouse gas emissions while improving grid reliability.

The discussion of the goals, strategies, and actions follows below. The best practices compendium contains additional information including case studies and steps for implementation.

GOAL 1 — Diversify and decarbonize the energy supply to reduce greenhouse gas emissions and climate vulnerability

As discussed above, reducing carbon in California's energy supply is a state priority and foundational component of the Assembly Bill 32 scoping plan. A more diversified and decarbonized energy supply will also decrease vulnerability to climate impacts. In addition, distributed generation can provide opportunities for resilience by shielding communities from power outages, particularly during extreme weather events.

Distributed energy provides local governments and communities an opportunity to create local, reliable, and clean energy located closer to where the energy is needed. Centralized energy systems lose efficiency due to waste heat rejected into the atmosphere, as well as line loss in transmission. Therefore, diversifying the energy supply to include local distributed energy through generation, energy storage, efficiency, and demand response, in configurations that ensure long term savings, represents an important solution for providing clean, reliable, and cost-competitive energy to any building or system connected to it.

Regional collaboration is essential to maximizing the benefits and potential of a more diversified energy supply. While energy providers are responsible for meeting renewable portfolio standards, the greatest regional benefits from a diversified supply will come from the collaborative efforts that focus on increasing regional resilience, equitable benefits, energy reliability, and public health. Such direct regional benefits are otherwise not guaranteed simply from meeting state mandates. Instead, regional leaders will need to develop cross-jurisdictional, inter-agency, and cross-sectoral partnerships that identify and implement the optimum solutions for Los Angeles County specifically. The recommended strategies and actions below address this need.

Strategy 1.1 — Source 100% of electricity sold in Los Angeles County from renewable sources, with an interim goal of 50% by 2025

The region needs to completely decarbonize its electricity supply to meet long-term climate goals. In the interim, as discussed above, Senate Bill 350 (De Leon) mandates utilities to source 50% of electricity they sell from renewables by 2030. This target increases the state's Renewable Portfolio Standard and requires significant effort by utilities and other stakeholders to implement.[94] The Framework adopts a more aggressive policy mandate as the energy sector's top strategy, with an interim goal of 50% renewables by 2025. Notably, two proposed Community Choice Aggregation (CCA) programs for the region have set goals to provide 100% renewable power within 10 years of forming. If these efforts are successful, Los Angeles County would likely meet this more aggressive renewables supply target.

Beyond the state mandates, important regional benefits result from increasing renewable energy. Los Angeles has abundant solar resources, with an estimated 19,000 megawatts of annual solar potential. Nearly 97% of these resources remain untapped.[95] According to UCLA's Luskin Center for Innovation, if just 10% of Los Angeles's solar capacity was used to generate energy, it could create 47,780 jobs and reduce nearly 2.5 million tons of carbon dioxide annually, the equivalent of taking almost 500,000 cars off the road.[96]

More renewable energy generation also has the potential to improve air pollution in the region in two specific ways. First, tailpipe emissions from transportation are a leading cause of air pollution. New solar resources can provide the additional grid capacity needed to transition to electric vehicles, thus reducing transportation-related air pollution. Second, if managed properly and integrated into the grid supply efficiently, regional renewable resources, coupled with bulk energy storage technologies, have the potential to replace both the natural gas "peaker" plants located within Los Angeles and the diesel back-up generators used by hospitals, universities, industries, and others during power outages. To make such opportunities a reality, renewables will need to be connected to energy storage, which is still an emerging market, as well as demand response programs.

Actions to increase renewable generation to 50% include:

Action 1.1.1 — Expand the local feed-in tariff program (e.g. offering additional capacity and opening the program to larger projects).

Action 1.1.2 — Simplify state and municipal Net Energy Metering requirements to identify areas of improvement to encourage greater customer participation.

Action 1.1.3 — Promote the implementation of asset-owning Community Choice Aggregation in investor-owned utility territories and explore other alternative utility models.

Action 1.1.4 — Identify opportunities for community solar projects and support the implementation of such projects in both the Southern California Public Power Authority (SCPPA) and Southern California Edison (SCE) areas of Los Angeles.

Action 1.1.5 — Identify barriers to increasing solar generation in disadvantaged communities and develop programs to overcome them.

Action 1.1.6 — Assess grid modernization needs based on more renewable and distributed technologies, and develop equitable financing and funding programs

Strategy 1.2 — Increase the percentage of energy derived from distributed energy to 33% of the total renewable mix

RESOURCES

Increasing distributed energy resources is an important state strategy that has strong regional benefits. Distributed generation has the potential to provide direct benefits to Los Angeles residents. Collaboration between multiple stakeholders will help to fully leverage regional opportunities and maximize the benefits of distributed generation. Distributed generation can be located on blighted or underutilized land, provide shade and cooling via solar canopies in parking lots (which are a major contributor to urban heat island), add to cooling roofs, create local jobs, and, if properly planned and assessed, increase energy reliability in vulnerable areas. The greatest regional benefit will come through regionally coordinated action between community groups, academics, nonprofits, local government, and energy providers to determine optimum locations, technologies, and financing structures for distributed renewables in Los Angeles.

Actions to increase distributed energy include:

Action 1.2.1 — Expand the SCPPA utilities' feed-in tariff program to allow larger and more sources to participate.

Action 1.2.2 — Create permitting and other financial incentives (such as strong net metering programs) to develop more locally generated renewable energy.

Action 1.2.3 — Ensure that storage resources are created to reduce dependence on natural gas peaker power plants.

Strategy 1.3 — Increase percentage of renewable natural gas

While solar energy is and will likely remain the predominant source for renewable generation, policy makers must tap into a diverse set of renewable resources. Renewable natural gas in particular may hold potential because of the existing infrastructure in place for transmission. Local governments also own and operate many landfills that could provide renewable natural gas from methane.

Recommended action to increase the supply of renewable natural gas:

Action 1.3.1 — Identify opportunities to produce agricultural and biological waste-capture and renewable natural gas in Los Angeles, and develop and support incentive programs to implement such projects, based on adequate cost-effectiveness and emissions performance, among other metrics.

GOAL 2 — Promote demand-side measures, particularly in the commercial, industrial, and institutional sectors, and energy conservation that support resilience and thermal comfort, and reduce greenhouse gas emissions

Reducing electricity and natural gas consumption is a fundamental component of climate action. "Demand-Side Management" (DSM) involves electric utilities engaging in planning, implementing, and monitoring activities to encourage customers to modify their level and pattern of electricity usage to match grid needs.[97] According to research conducted by UC Berkeley, which reviewed 49 greenhouse gas reduction policies, successful implementation of the California Public Utilities Commission's Energy Efficiency Strategic Plan is essential to meeting the state's goals. The study found that successful implementation of this plan had the most significant long-term reduction impact of any of the 49 policies studied.[98] The regional benefits, however, provide even more compelling reasons to implement the plan than simply meeting state mandates. Measures to reduce energy consumption can increase regional climate resilience, reduce air pollution, and provide economic opportunities. For these reasons, demand-side measures should be a key part of climate action in Los Angeles. To maximize benefits, efforts should be far-reaching, innovative, and focus on performance outcomes. Strategic regional collaborations that leverage knowledge and resources across partners will maximize benefits.

REDUCING PEAK DEMAND THROUGH DEMAND RESPONSE

Reducing the carbon intensity of energy consumption is related not only to energy supply but also to the amount, time, and location of energy usage. The dirtiest electricity is typically generated to meet peak demand, usually from about 10am to 6pm, when consumers typically use the most energy.[99]

Demand also varies by season, with higher demand in the summer and winter months when more air conditioning and heating are used. During these times, the grid is most constrained and requires carbon-intensive back-up natural gas "peaker" plants to meet demand reliably. In addition to more greenhouse gases, diesel generation also emits serious health-impairing particulate matter into the air. The three plants that burn diesel in Los Angeles are all located in disproportionately impacted, low-income communities where the majority of residents are people of color.[100] Reducing peak load, particularly during the summer and winter months, is critical for climate action and for public health, and in particular as more solar resources come on-line during the day, creating a potential mid-day glut, as well as a related need to ramp up fossil fuel-based resources to serve the evening load. Solutions that encourage energy conservation, storage commensurate with demand, and optimal shifts in times of consumer demand could address these challenges.

Further underscoring the need to reduce demand, and in particular peak demand, the California Energy Commission predicted in 2014 that electricity usage will increase between .8% and 1.5% per year.[101] This increase is mainly due to a growing population and number of electric vehicles on the road. Over the course of their life cycle (including manufacturing of batteries and parts), electric vehicles emit roughly half the greenhouse gas emissions of standard internal combustion engine cars.[102] As the electricity supply is decarbonized, this benefit will increase. At the same time, grid capacity must expand to meet this new and expanding load. Reducing demand, particularly among large commercial customers and through residential retrofits and advanced software to respond to grid signals, is an important first step to providing increased capacity and allowing Los Angeles to experience the multiple and significant benefits of transportation electrification.

Strategy 2.1 — Focus on data-driven decision making

> *"The single biggest weakness in our energy efficiency policies in this country is our failure to properly analyze, incorporate, and account [for] the benefits."*
>
> —Steve Crowell, chairman and CEO of the Conservation Services Group[103]

Limited access to data and information represents a key barrier to transitioning to a more sustainable energy supply. As discussed above, several state guidance documents and recent pieces of legislation emphasize the importance of data to improved decision making. While important at the state level, improved data access will be imperative at the regional level. Many state energy mandates must be implemented at the local and regional level, which is also where the benefits of success will accrue and have the greatest impact.

The Los Angeles region can play an important role in forming collaborations that better enable data-driven decision making. Partnerships among the various local governments, municipal utilities, and utility associations involved in program development and implementation could improve outcomes in Los Angeles, while providing an example that could be replicated and tailored throughout the state. The recommended actions below will improve the capacity for data-driven decision making in Los Angeles.

Action 2.1.1 — Support energy performance disclosure and data management. Accurate energy performance data must be collected, organized, analyzed, integrated, and made appropriately available to market actors and decision makers. Use the data collected to establish baselines.

Action 2.1.2 — Utilize standardized and open source tools for benchmarking, energy assessments and audits, and building retro commissioning in commercial and public buildings, such as ENERGY STAR Portfolio Manager, the Department of Energy Building Energy Data Exchange Specification, and the Building Energy Asset Score. Support California-specific tools that are compatible with these federal tools and standards.

Action 2.1.3 — Develop a region-wide energy data portal that tracks energy consumption among residential and other users, monitors impacts of implemented policies, and provides decision making support, building on the UCLA Energy Atlas (energyatlas.ucla.edu).

Action 2.1.4 — Focus energy retrofits in neighborhoods and building types with the lowest efficiency.

Action 2.1.5 — Develop performance-based policies, programs, and incentives.

Action 2.1.6 — Develop standards for Title 24 permit tracking software in order to organize and standardize the vast amount of data not electronically captured by the majority of land use and retrofit permitting jurisdictions (i.e. local governments).

Strategy 2.2 — Improve energy performance of the existing building stock through targeted programs

Improving the energy performance of buildings will be fundamental to reducing greenhouse gas emissions and increasing regional climate resilience. As stated above, the successful implementation of the California Public Utilities Commission's Energy Efficiency Strategic Plan is essential to meeting the state's greenhouse gas reduction goals. Senate Bill 350 mandates a doubling of energy efficiency in buildings throughout California by 2030. In Los Angeles, where the majority of energy consumption occurs in existing buildings (rather than in new construction), policy makers must focus on retrofitting and improving the performance of existing buildings and in newer, large buildings that have significant energy consumption based on their higher square footage.

While the benefits of energy efficiency are clear (lower utility bills, less need for expensive new generation infrastructure, and less pollution in general), improving energy efficiency is challenging. The effectiveness of California's aggressive energy efficiency goals and policies will involve myriad factors, including human behavior, technology, and adequate funding and financing. Key challenges to energy efficiency are described below. Regional coordination and collaboration will offer an important means of addressing many of these challenges, meeting state goals, and realizing the benefits of reduced energy use.

DATA ACCESS AND MEASURING EFFECTIVENESS

Since 2002, California has spent over $13 billion in PUC required-investor owned utility ratepayer dollars on energy efficiency programs. The California Public Utilities Commission funds evaluation of these efforts. Because utility data are private and protected under the California Public Utilities Code, third parties have difficulty conducting additional evaluations. Most studies also rely on modeled savings, rather than actual before-and-after savings, as discussed above. These models, while helpful, have limitations such as an inability to determine how long reduced energy usage continues after retrofits. In addition, human behavior is difficult to model, which is otherwise a key determinant of the success of energy efficiency upgrades.

UCLA is beginning to develop a data repository that tracks consumption and retrofit programs over time that will be an invaluable resource for providing real returns on investments for energy upgrades. However, this initiative must be institutionalized to be a long-term resource.

REBOUND EFFECT

When buildings become more energy efficient, building occupants may decide to use more energy, which can outpace the reduction benefits of the efficiency upgrades (notably, this dynamic can also occur in the transportation sector, with improved fuel economy encouraging more vehicle miles traveled).[104] This dynamic is commonly referred to as "the rebound effect." While analysts generally agree that the rebound effect is real and poses distinct challenges, policy makers will need more study on the size and impact of the effect.[105] Certain retrofits are likely to be more sensitive to this rebound than others. For example, evidence indicates that more efficient air conditioners can cause increased use by 30%, while more efficient refrigerators have nearly no rebound.[106] The rebound effect can also be both direct and indirect. A direct effect is exemplified by the air conditioner dynamic referenced above, while an indirect effect happens when increased efficiency in one system leads to increased energy consumption elsewhere. As an example, the reduced consumption from lighting upgrades may lead a customer to purchase a new piece of equipment that increases overall on-site consumption. Rebound effects can also occur by encouraging people to purchase or lease larger buildings, which have greater overall energy consumption.

SPLIT INCENTIVES

Split incentives are one of the fundamental challenges faced by energy efficiency providers. The split occurs when one party is responsible for paying the cost of the energy efficiency upgrade, while another receives the benefit. A classic example is in rental housing, when the landlord pays for a retrofit (such as double-paned windows) but the tenant benefits by paying less in utility costs. This dynamic also happens frequently in commercial properties, when the cost of upgrades comes out of one department's budget but another department pays the energy bills and, thus, realizes the savings. In these examples, the building or company owners have no incentive to invest in energy efficiency because they will not benefit, barring any options for shared savings.

CODE ENFORCEMENT AND COMPLIANCE PATHWAYS

Though Title 24 created aggressive statewide energy efficiency standards, municipal building departments are often under-resourced and unable to track and enforce code compliance regularly. While many cities recognize the importance of building performance, they may not have the means to retrofit their own government buildings. One innovative approach is "Measured Performance Compliance Pathways to Title 24" as an alternate compliance pathway. To align with Assembly Bill 802, Title 24, and the Building Energy Efficiency Standards, the pathway provides an opportunity to streamline and simplify the permitting, compliance, and enforcement process. It allows building owners to submit 12 months of measured performance data in order to comply with the energy code by demonstrating they have energy use intensity targets. The California Energy Commission will likely further develop and integrate this approach into the next cycle of the code rulemaking process.

In addition to the environmental and economic benefits of reduced energy consumption in buildings, retrofitting buildings can improve thermal comfort, health, and well-being. These improvements can improve social equity, as most of Los Angeles's least-performing buildings are in disadvantaged communities with greater vulnerability to health impacts from heat and the changing climate. As a result, reducing consumption in these buildings through improved building performance can save residents and businesses money, while insulating them from extreme weather. These improvements, therefore, can increase equity and the overall economy. Finally, reducing demand for energy can make the transition to emerging renewable generation technologies more feasible. Energy efficiency can slow the growth of energy demand overall and allow clean sources to meet most – if not all – of demand. Otherwise, without energy efficiency, renewable energy development will chase a receding target of ever-increasing consumption.[107]

There are several ways in which regional coordination and collaboration can assist in improving the building stock in Los Angeles. Collaborations between researchers, governments, and property owners to pilot technologies can help determine the best applications and spur the business innovation and incubation that can move products to market. Partnerships to determine the highest-value building types and locations for retrofits can ensure that investors maximize returns, and, therefore, attract new investment. Coordinated peer learning can leverage educational resources to build the capacity of the workforce, such as contractors, building inspectors, and energy managers. These workers are at the frontlines of energy efficiency and central to its success but are often under-resourced.

The actions listed below can help improve existing building performance and the associated benefits.

Action 2.2.1 — Develop and implement solutions to increase compliance with, and enforcement of, California's Building Energy Efficiency Standards for alterations to existing buildings.

Action 2.2.2 — Require energy audits and/or retrofits at time of sale or renovation for commercial and residential properties.

Action 2.2.3 — Establish multi-scaled utility billing tiers to incentivize energy efficiency in residential and commercial buildings to the extent permitted by law.

Action 2.2.4 — Establish peer learning and training capacity for building inspectors.

Action 2.2.5 — Develop region-wide incentive and training programs for contractors to improve code compliance.

Action 2.2.6 — Focus energy retrofits in a way that will prioritize and maximize their health benefits.

Action 2.2.7 — Include public health outreach and education, particularly around heat, during the energy audit and retrofit process.

Action 2.2.8 — Develop a cross-jurisdictional campaign to retrofit existing buildings and to leverage resources from multiple partners to build overall capacity in the field.

Action 2.2.9 — Develop collaborative purchasing partnerships among governments to reduce the costs of retrofitting municipal buildings, such as neighborhood-level retrofits through cooperatives or neighborhood councils, via a regionally supported revolving fund.

Action 2.2.10 — Develop Measured Performance Compliance Pathways for the upcoming Building Energy Efficiency Standards rulemaking at the California Energy Commission.

Action 2.2.11 — Develop a standardized approach and tool for collecting and electronically tracking building permits in an analogous way to the oversight of Title 24 compliance through specialized software programs.

Action 2.2.12 — Implement a "square foot tariff" for buildings using over a certain threshold of energy per square foot.

Strategy 2.3 — Strengthen energy efficiency for new buildings to ensure building size does not undermine conservation efforts

While most energy consumption occurs in existing buildings, new buildings provide important opportunities to implement innovative energy efficiency measures. Including energy efficiency measures at the time of construction is often easier and more cost effective than retrofitting existing buildings. As a result, new buildings can be designed to be much more efficient than older counterparts. However, the efficiency per square foot does not necessarily lead to energy reductions. Average home size nationwide has increased over the last several decades, which can erase energy savings from improved efficiency per square foot.[108] The trend in increasing home size is occurring mostly in new construction and to a lesser extent from increasing the size of existing homes.[109] Smaller lot sizes and zoning ordinances in the urban areas of Los Angeles County, however, have limited this trend locally compared to other parts of the country. Energy conservation, and not just improved performance per square foot, is, therefore, the most important overall metric for achieving greenhouse gas reductions and should be the focus of efforts and prioritization of funding.

Action 2.3.1 — Promote adoption of California Green Building (CalGreen) Tier 2 standards or equivalent or better throughout Los Angeles.

Action 2.3.2 — Promote the adoption of "cool roof ordinances" for new buildings across the county, following on the models of Los Angeles and Pasadena.

Action 2.3.3 — Evaluate the potential for net zero energy requirements for new construction and support implementation of such requirements where feasible, at potentially a faster timetable than what the California Energy Commission envisions.

Strategy 2.4 — Create a comprehensive regional strategy for targeting energy reliability programs

Energy providers face a key challenge in maintaining a consistent and reliable supply of energy amid constantly changing conditions. Suppliers do not want to provide either too much or too little energy to meet demand. But at the same time, the demand profile for electricity changes nearly almost every minute, making the task difficult. When particularly high surges in demand occur, such as during heatwaves or when certain supply sources are unavailable, utilities must fire up backup systems. These systems tend to be high emitters of both greenhouse gases and other air pollutants. In addition, when the utility system fails and causes blackouts, entities such as hospitals and other industries will shift to back-up generators, usually fueled by high-polluting diesel fuel, to provide power. These units can, therefore, create significantly more air pollution per unit of energy than standard grid electricity.

Sustainable energy projects can address this challenge by increasing both grid reliability and regional resilience. Smaller-scale energy storage projects can be installed at critical facilities, particularly in vulnerable and pollution-burdened areas, to replace or supplement diesel backup generators. Collaboration between community-based organizations, local governments, researchers, and technology companies can help identify the most viable locations for community-based solar and storage.

A regional or city-scale approach to energy master planning can help optimize energy infrastructure investments. Combining a data-driven decision making process with a master planning process can enable market actors and local governments to set goals and develop informed implementation strategies to deploy distributed energy systems where they bring the most benefit.

Action 2.4.1 — Conduct a vulnerability assessment to determine areas and critical facilities at risk of energy disruptions due to climate change-related events (e.g. sea level rise; more frequent and intense storms; more frequent, longer, and intense heatwaves; more frequent, longer, and intense droughts, etc.).

Action 2.4.2 — Identify areas or facilities where energy storage, voltage regulations, and microgrids can improve energy management or ensure functionality during climate events, and develop programs and policies to support deployment.

Action 2.4.3 — Conduct energy master planning efforts by local governments in order to make data-driven decisions for optimal investment in energy infrastructure.

Strategy 2.5 — Combine transportation electrification and renewable energy planning efforts

Vehicle electrification provides a critical means of reducing greenhouse gas emissions. California has a goal of 1.5 million electric vehicles on the road by 2025 (see above discussion in the transportation section). Cities and regional entities across Los Angeles are also taking steps to transition to electric vehicles. Electric vehicles can also reduce in-basin air pollution and the urban heat island. Improved air quality means improved health for all Angelenos, particularly the poorest and most vulnerable who tend to live in the communities most affected by air pollution. But increasing electric vehicle deployment will also increase electricity demand. Electric vehicle planning should, therefore, be coordinated with renewable energy planning in order to maximize climate benefits.

The actions below will coordinate electric vehicle (EV) charging with renewable generation:

Action 2.5.1 — Develop programs to enable solar-powered EV charging in multifamily units.

Action 2.5.2 — Assess whether, how, and to what extent EVs can help provide energy storage to support the electric grid.

Strategy 2.6 — Reduce urban heat islands to minimize energy consumption and improve building resilience to extreme heat

Urban areas are hotter than rural areas because the roof, pavement, and other surfaces in cities increase heat, whereas vegetation in rural areas has a cooling effect. For example, temperatures in downtown Los Angeles increased .5°C per decade as the area urbanized between 1900 and 1990. Every increase in degree entails approximately 500 additional megawatts of air conditioning load in the region.[110] Increased heat also means more air pollution. In Los Angeles, every 1°C in temperature rise above 22°C, the incident of smog increases by 5%. Nationwide, urban heat islands are responsible for 10% of urban peak-energy consumption and as much as 20% of urban smog.[111] Reducing the heat island effect is essential for improving energy conservation, air quality, and public health.

> *Resurfacing about two-third of the pavements and rooftops with reflective surfaces and planting three trees per house can cool down LA by an average of 2–3K. This reduction in air temperature will reduce urban smog exposure in the LA basin by roughly the same amount as removing the entire basin of on road vehicle exhaust. Heat island mitigation is an effective air pollution control strategy, more than paying for itself in cooling energy cost savings [although water use, maintenance, and trapped heat can offset the vegetation's energy savings].*[112]
>
> —Hashem Akbari, "Energy Saving Potentials and Air Quality Benefits of Urban Heat Island Mitigation"

Action 2.6.1 — Implement smart or living streets to reduce the urban heat island effect (and which can also help capture stormwater for groundwater recharge).

Action 2.6.2 — Develop new and/or expand existing programs to increase the urban forest or shade structures to reduce the urban heat island effect.

Action 2.6.3 — Implement cool roof and cool surfaces programs across the region, particularly in the most impacted communities, while balancing the potential harmful effects of potentially more daytime heat in the immediate areas from these reflective surfaces.

Action 2.6.4 — Identify priority urban heat island retrofit areas, where the negative impacts are greatest and the potential benefits of cool surfaces are most needed.

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