BUILDING A SUSTAINABLE ENERGY FUTURE:

A CALL TO ACTION

"Saving our planet, lifting people out of poverty, advancing economic growth…these are one and the same fight. We must connect the dots between climate change, water scarcity, energy shortages, global health, food security, and women's empowerment. Solutions to one problem must be solutions for all."

— **Ban Ki-moon**, Former United Nations Secretary-General

Dear friends,

In the past year, California has passed climate legislation of global importance while operating an electricity grid that weathered an unprecedented heat wave intensified by climate change. These are truly incredible accomplishments worth celebrating. But for all of our hard work and progress, there is so much more to do and very little time to do it.

Electricity in California must be reliable but it must also be affordable and sustainable. The affordability of energy, and the technologies that help conserve it, is essential for building a state that is equitable in deeds as well as in words. In an unfortunate convergence, the low-income communities and communities of color that are bearing the brunt of extreme heat events and other disasters brought on by climate change are also the most impacted by higher electricity and gas costs brought on by our policies attempting to respond to this crisis. And they are the ones for whom new energy conservation technologies are currently most out of reach.

To redress the equity issue brought on by our rising energy costs, sustainable energy must be abundant. To reliably power our homes, our modes of transportation and our businesses, sustainable energy must be abundant. To make the necessary evolution toward a decarbonized economy, **sustainable energy must be abundant**.

Energy policy is truly a triple-bottom-line issue that includes equity and the economy, in addition to the environment. It is for this reason that California Forward (CA FWD) is putting forth this call to action to do substantially more as a state to build new sources of sustainable power. It is also a call to action to be careful about how we proceed with this energy evolution so that we do not destroy people's livelihoods while becoming dependent on energy production from around the world that is not produced in ways consistent with our standards and values.

To do this, California needs to make much bigger plans around new energy production and demand reduction, as we improve our ability to execute quickly on these plans given the rapidly unfolding climate crisis. If we leave in place our dense thicket of regulations and our balkanized bureaucratic structures, we will not move with the speed required to combat the crisis we face. Climate policy is energy policy, and energy policy is climate policy. Full stop. If we are unwilling to reform our systems to tackle these policy challenges assertively and equitably, we will fail the people of California, especially those with the fewest resources to adapt.

The following report builds on decades of research, organizing and action to chart a path forward. CA FWD knows we can achieve the state's goals by working together, taking bold action, navigating the difficult tradeoffs and investing heavily in our communities as we make the transition ahead of us.

Ever forward,

Micah Weinberg

Micah Weinberg
CEO, California Forward

EXECUTIVE SUMMARY

How does California meet the urgency of the climate crisis we face, while planning for and building an energy system that works for all Californians? This is the critical question the state's governments, industries, and residents have been grappling with for decades. However, today we are faced with a shrinking timeline for action and a growing imperative to make some challenging decisions. These choices will determine if California can build a truly sustainable energy system that generates abundant and affordable electricity, while distributing the benefits and costs of this environmental and economic transition equally among the state's diverse regions and communities.

This call to action provides context on the current state of this energy landscape. It aims to provide perspective on the high stakes of the climate and energy crises California faces, alongside context on the evolving energy market catalyzed by economic decarbonization. It will detail how key state agencies oversee various aspects of energy policymaking and bring necessary awareness of the transition's impact on regional labor markets and local economies.

The speed and scale required to meet California's climate and energy goals cannot be overstated. The state has taken ambitious action toward these goals, but the scope of this challenge still vastly exceeds the reach of our recent climate change and energy policy efforts. Achieving our environmental and economic goals will require unprecedented action from our policymakers and regulators. This call to action provides a framework for California to move forward with an urgency befitting the reality before us, and the awareness that we must question the siloed frameworks of the past if we are to bring all Californians forward with us into a healthier, more prosperous future.

OUR RECOMMENDATION: CHOOSE "AND," NOT "OR"

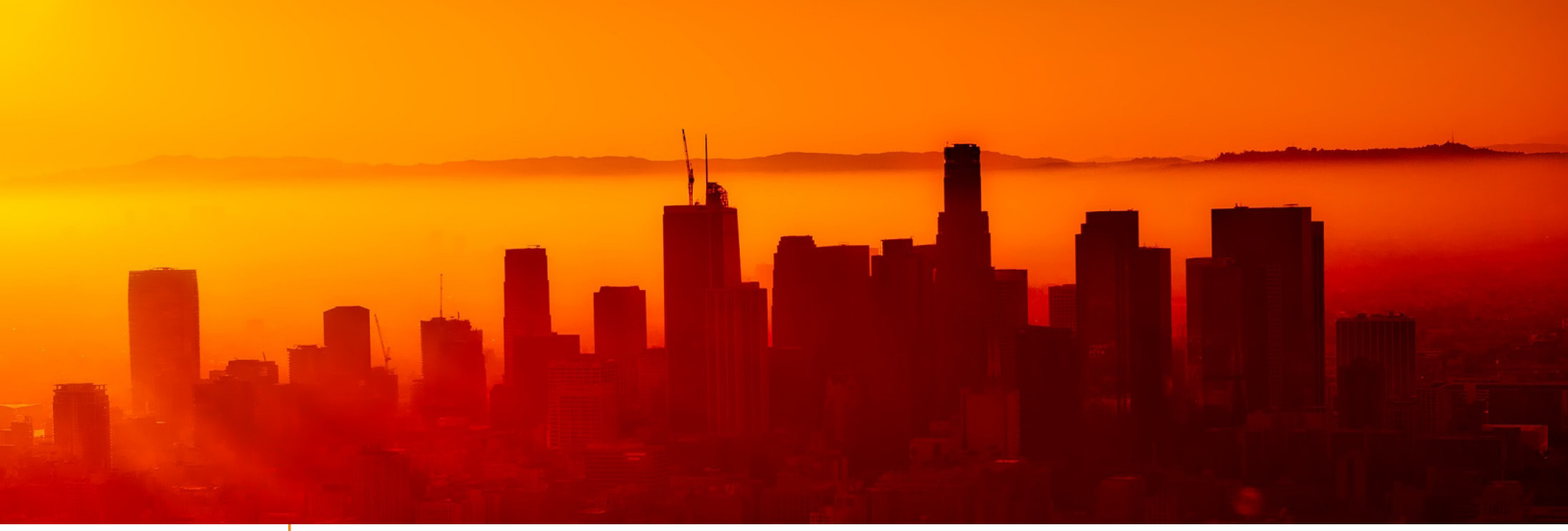
We Must Act Urgently & Carefully. California needs to act with crisis-like urgency and break through the bureaucratic boxes that slow down how new energy generation and transmission projects are planned, permitted and built. But it must strategically calibrate its actions to ensure the energy system it creates is sustainable, reliable, affordable and equitable.

We Must Increase Renewable Energy Production & Be Technology Agnostic. California needs an energy approach that embraces the full range of carbon-free sources of energy and reinvests in our domestic manufacturing sector to support their deployment.

We Must Address Baseload Energy Today & For the Future: California needs a reliable grid, which will require a combination of dramatically increasing battery storage, accelerating the deployment of geothermal power, reconsidering nuclear energy and/or a robust regional transmission grid.

We Must Invest in CCS & Non-Carbon Energies: An array of carbon capture technologies will help us mitigate emissions from the imperfect but necessary energies/industries we still need today as we work to develop a diverse portfolio of zero-carbon energy sources for the future.

We Must Show Leadership & Share the Decision-Making. State policymakers and regulators have to make some hard choices and trade-offs and must engage regional collaboratives to equitably drive this change.



THE CRISES WE FACE

In 1862, a statewide flood emergency broke river levees and submerged the city of Sacramento. Two-story houses were picked up and carried downriver. At least 4,000 people — roughly 1% of the state's population — lost their lives. The U.S. Army Corps of Engineers previously estimated that this type of storm was a once-a-century to once-a-millennium event. With climate change increasing the probability of extreme weather, researchers at UCLA now estimate an extreme weather event like the 1862 floods is more than twice as likely, with a 50-50 chance of such an event occurring in the next half century.[1]

This past summer, California and much of the Western United States saw a heat-dome event that lasted 10 straight days. Temperatures peaked at 125 degrees and areas of the state that largely lack air conditioning saw temperatures in the triple digits. Across the country, the annual "heat wave season" has expanded to a shocking 70 days in the 2010s, compared to 22 days in the 1960s.[2] California saw more than 3,900 heat-related deaths in the last decade.[3]

Climate change presents California with complex, interrelated challenges, including heat waves breaking temperature records, large and destructive wildfires, unprecedented flooding and shrinking water supplies.

> What does it mean to meet the urgency of California's climate reality, while planning for and building a future energy system that is sustainable, reliable, affordable, and equitable?

California's last two decades are the driest in the past 800 years. This water scarcity not only impacts our state's ability to grow crops, it also impacts the availability of hydropower and the sustainability of thermoelectric power in California and across the American West.[4]

Meanwhile, in 2020, California experienced its worst fire season on record, with more than 9,900 blazes taking 33 lives and burning 4.3 million acres–more than 4% of the state.[5] The cost of fighting the fires alone approached $2.1 billion, with total economic losses totalling more than $19 billion.

1 Climate change makes catastrophic flood twice as likely, study shows, UCLA, August 2022, https://newsroom.ucla.edu/releases/climate-change-makes-catastrophic-flood-twice-as-likely

2 Humans may not be able to handle as much heat as scientists thought, ScienceNews, July 2022, https://www.sciencenews.org/article/heat-humans-stress-extreme-climate-change-physiology

3 California extreme heat deaths show climate change risks, LA Times, October 2021, https://www.latimes.com/projects/california-extreme-heat-deaths-show-climate-change-risks/

4 California drought could reduce hydroelectric generation to half of normal levels, U.S. Energy Information Administration, June 2022 https://www.eia.gov/todayinenergy/detail.php?id=52578

5 California's 2020 Wildfire Season, UC Davis, May 2022, https://www.ucdavis.edu/climate/news/californias-2020-wildfire-season-numbers

All of these factors increase the urgency of addressing climate change by addressing the greenhouse gasses (GHGs) that are the root causes of these extreme weather phenomena. California policymakers have set unprecedented goals to move our energy sector away from GHG-emitting fossil fuels by pushing to electrify transportation, reduce the use of carbon-emitting fuels by industry and increase the share of renewables on the grid.

By its very nature, energy policy is intimately related to not only the state's environmental landscape, but its economic future as well. Reliable, affordable energy is a key driver of the modern economy. Energy generation and clean energy innovation produce jobs and contribute tax revenue. Pushing for a sustainable energy system cannot be discussed without consideration for how we ensure enough energy is generated to keep our grid reliable and our energy prices affordable enough for all Californians.

What does it mean to meet the urgency of California's climate reality, while planning for and building a future energy system that is sustainable, reliable, affordable, and equitable? Critical decisions are currently being made that will determine our ability to transform our energy system to meet this very challenge.

Nowhere is this being felt more than in Kern County, the heart of California's energy industry, as pressure mounts to transition rapidly away from fossil fuels. Our state's success is dependent on including all stakeholders at the table to protect the integrity of the energy system, the balance of our rapidly changing climate and the lives of those who stand to be left behind without careful consideration.

Through this call to action and a working session at the 2022 California Economic Summit in Kern County, CA FWD will provide context on key factors driving the state's action on energy and present a series of recommendations designed to promote a dialogue on how California can best position energy stakeholders to meet its goals as it looks toward the next two decades of challenging energy and climate work.

CALIFORNIA'S CURRENT CLIMATE AND ENERGY ACTIONS

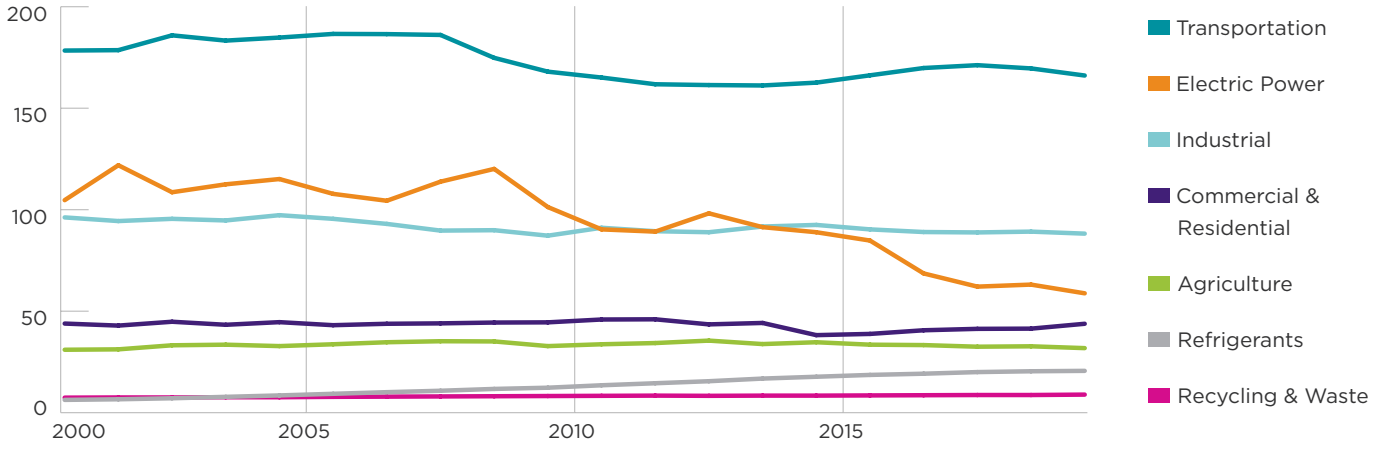
California enacted the country's first binding emissions reductions legislation via AB 32, the Global Warming Solutions Act of 2006. Per capita emissions have dropped by more than a quarter in the two decades since their peak of 14 metric tons per person in 2001. The typical Californian emits less than half the CO_2 equivalent of the average American.[6]

Despite this progress, Californians on average still emit almost 3.5 times the CO_2 equivalent of the typical Swede.[7] Today, a growing chorus of state leaders have noted that California is no longer the indisputable world leader it once was. At the recent Conference of the Parties (COP26) Summit in Glasgow, Speaker Anthony Rendon stated, "I don't at all feel that we are leading the world anymore."

This is not a lone sentiment. In 2019, the American Society of Civil Engineers gave California a "D" grade on its energy sector because of the high risk of emergencies and its fluctuating capacity.[8] Despite its leadership at the forefront of energy and climate policy, California still has work to do on the ground.

CA electricity generation GHG emissions have declined 44%

Change in California's GHG emissions over the past two decades



Source: California Air Resources Board

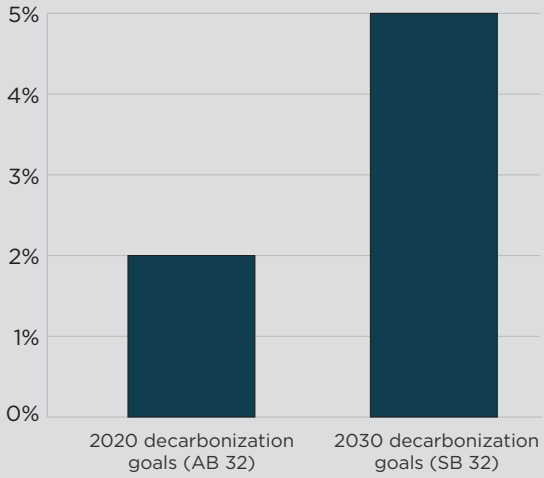
6 California Greenhouse Gas Emission Inventory Program, CARB, https://ww2.arb.ca.gov/our-work/programs/ghg-inventory-program#:~:text=Per%20capita%20GHG%20emissions%20in,average%20for%20per%20capita%20emissions

7 CO_2 emissions (metric tons per capita), The World Bank, https://data.worldbank.org/indicator/EN.ATM.CO2E.PC

8 2019 Report Card for California's Infrastructure, Report Card for America's Infrastructure, https://infrastructurereportcard.org/state-item/california/

California 2030 decarbonization goals require increased ambition

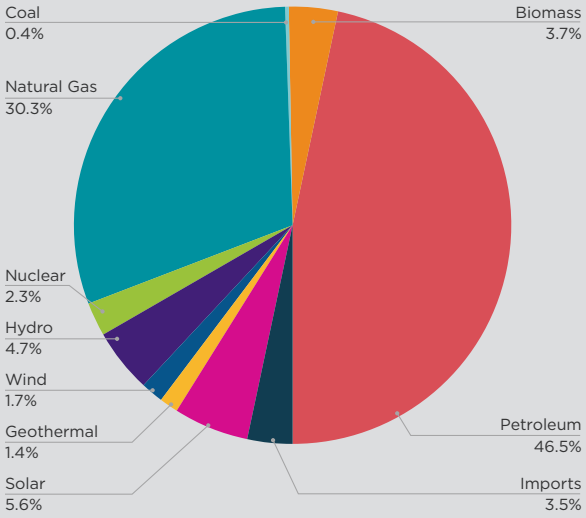
Annualized carbon emissions reductions to meet state legislative goals



Source: Beacon Economics

Fossil fuels still makes up the vast majority of California's energy supply

California energy supply by source (2019)



In meeting the state's AB 32 objectives, California reduced its emissions an average of 2% per year. To meet the state's updated 2030 carbon goals set out in AB 32's 2016 follow-up legislation, SB 32, the state will need to achieve five percent average annual reductions in harder to abate sectors such as transportation, industrial processes and land use.[9]

California's SB 100, the California 100% Clean Energy Act of 2018, builds on those goals, mandating 60% renewable provision of retail electricity in the state by 2030 and 100% zero carbon power by 2045.

Because of California's ambitious energy policies, the state's solar industry has seen explosive growth, increasing more than 10 times in the last 10 years. Yet in 2020, solar still only made up 5.5% of the state's total energy supply.[10] Renewable Portfolio Standard (RPS) eligible generation makes up 39.5% of the state's electricity. Adding in both large dams and nuclear increases that number to around 59%.[11] Assuming stable electricity demand, California's goal of 60% renewable energy generation by 2030 may be considered relatively modest, less than three-quarters of the scale of the growth in renewable energy that we saw in the 2010s.

California's renewable energy goals do not exist in a vacuum, however. The state has set ambitious demand-side goals for electric vehicle adoption by codifying the transition to 100% zero-emission new vehicle sales by 2035.[12] There is also a national market transformation underway to convert heating and home appliances from natural gas to electricity.

Yet as a percentage of California's total energy demand, including energy used for moving internal combustion engine cars and other non-electric uses, all zero carbon energy sources currently make up 15.5% of supply.

As of 2019, the latest year comprehensive data is available from Lawrence Livermore National Labs, electricity generation only made up 22% of

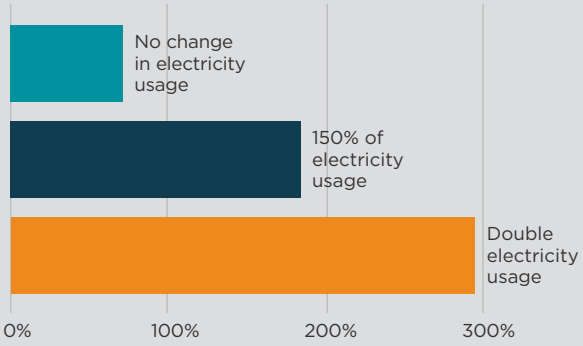
9 Congrats California! We've Met Climate Change Goals Early But Can We Rise To The Challenges Ahead?, February 2021, https://beaconecon.com/blog/environment/congrats-california-climate-change-goals-met-early-but-challenges-ahead/

10 Lawrence Livermore National Labs, https://flowcharts.llnl.gov/commodities/energy. The percentage of solar as a share of electricity production is higher, yet as more and more Californians switch to EV's the demand on the grid will increase. Thus total energy demand rather than simply electricity is the more valid denominator.

11 New Data Indicates California Remains Ahead of Clean Electricity Goals, CEC, February 2022, https://www.energy.ca.gov/news/2022-02/new-data-indicates-california-remains-ahead-clean-electricity-goals

12 Gavin Newsom Ordered The End Of Gas-Powered Car Sales In California & President Biden Is Under Pressure To Do Same For Entire Nation, Forbes, May 2022, https://www.forbes.com/sites/patrickgleason/2022/05/04/governor-gavin-newsom-ordered-an-end-gas-powered-cars-sales-in-california--president-biden-is-under-pressure-to-do-same-for-entire-nation/?sh=72cf92373eab

California's 2030 renewable energy goals require increased ambition with increased electrification



California's energy use. Increased electrification dramatically expands the scale of California's renewable energy goals. The following chart shows the renewable energy growth needed to meet California's 2030 goal relative to renewable energy growth from 2010-19 under various electrification expansion scenarios.[13]

‹ The scale of renewable energy generation expansion is shown relative to renewable energy growth from 2010-19 to meet California's 60% renewable energy generation by 2030 goal. Data comes from the Lawrence Livermore National Laboratory. The latest available data is from 2019 so is scaled linearly to provide a decade to decade comparison.

Leveraging Public Opinion to Support Climate and Energy Policy

Policy action on climate change and clean energy is frequently stymied by the political polarization of the issue. In place of strong federal policies, states such as California have taken the initiative to lead the way. The impacts of climate change, however, are not distributed depending on the actions of any individual state. Significant action across the globe will be required to reduce GHG emissions and extreme climate events.

In 2021, CA FWD partnered with the Stanford Center for Deliberative Democracy to address the seemingly intractable political polarization on this issue. The "America in One Room: Climate and Energy" deliberative polling project reinforced the importance of substantive, engaged discussions with members of the public to drive meaningful action. This program brought together a representative sample of Americans to engage in thoughtful, moderated discussions on the country's climate and energy future.

Polling before and after the event showed that when Americans have an opportunity to learn about these issues through thoughtful deliberation with access to factually verifiable information, support for a wide range of GHG-reduction policies tends to increase, often by substantial margins (10-20 percentage points). At the same time, results indicate large majorities across all groups are highly price sensitive and concerned about job impacts, and as such are likely to insist that any way forward regarding climate policy be affordable, broadly accessible and reliable.

Additionally, the study found that even among people who are supportive of immediate and substantial action, they still have important questions about how new sol utions work and their impact on people's daily lives and budgets. For example, during sessions with experts, there were significant questions about carbon capture and storage: *"Where exactly does the carbon go? Why does it stay there? Won't it seep back out eventually? How do we know?"*

The study found that experts must explain these technologies — carbon sequestration, hydrogen, solar, electric vehicles, "new" nuclear vs. "old" nuclear, etc. — clearly and factually if we hope to achieve greater popular enthusiasm for the broad array of climate change solutions we need. To learn more about this study, visit America in One Room: Climate & Energy.

13 Lawrence Livermore National Labs, https://flowcharts.llnl.gov/commodities/energy

PRINCIPLES OF A NET-ZERO ENERGY SYSTEM

California announced its intentions to achieve a net-zero energy system[14] no later than 2045, meaning any carbon that is emitted can be removed from the atmosphere through natural and technological processes. Reaching this goal in that timeline will require the build-out of the critical infrastructure required to support this transition and acceleration of policies that will directly guide industries, businesses, households and individuals.

Currently, California is pushing forward with these ambitious plans even though policymakers do not yet have all the answers about the technologies the state will use in place of fossil fuels. Most crucially, our society is undertaking this transition to a new energy system on a faster timeline than ever before in human history. Such an urgent and necessary system evolution requires that we think very intentionally about the components of the new system we are building.

CA FWD firmly believes the state's energy policies should be evaluated against the following criteria:

Sustainable & Clean: Are there limitations, either on the energy resource itself or component parts (e.g., batteries) that affect the state's ability to sustainably scale supply? How does the utilization of this energy source impact the health and well-being of the local community and environment?

Reliable: How will this impact the risk of residents and businesses experiencing power losses? What backup solutions are in place?

Affordable: How will this affect the price California residents and businesses pay for electricity and other fuel sources?

Equitable: Will certain populations incur greater costs (financial, health or environmental)? How do we remove barriers to access if cost is a hurdle or redress other externalities?

Barriers to achieving these components within the existing energy system are many. We must move urgently to build the sustainable system we need, while acknowledging the ongoing role of existing fuel sources and infrastructure to ensure reliability, affordability and equity throughout the transition.

14 The term "carbon neutrality" generally means an entity can offset the balance of its emissions in part through financed projects beyond its own operations (e.g.carbon credits), without actually reducing its own emissions. "Net-zero," on the other hand, does not permit financed emissions, which compels companies to more meaningfully reduce the emissions created by their value chain.

Explaining Intermittency, Baseload & Peaking

The modern electric grid requires a steady supply of power generated to meet demand in real time. The minimum level of demand on the grid is called **baseload energy**, and is traditionally supplied by stable energy sources such as fossil fuels, nuclear power, and battery storage. The fluctuating energy demand above the minimum is called **peaking energy**, which is electricity supplied to match real-time shifting demand.

In California, renewable sources of energy such as wind and solar make up a considerable portion of the energy we generate, however their supplies fluctuate based on the time of day, weather and seasons. This feature of renewable energy is known as **intermittency** and requires careful planning to integrate with utility scale grid infrastructure. Times of high power demand, such as during extreme heat events, can strain the grid, particularly during evening hours when solar generation starts to decline. Ensuring a reliable power supply will require using a wide array of tools and technologies, alongside investment in the electric grid, to ensure its stability as electrification ramps up and electricity demand increases.

Guidance issued by the California Independent System Operator (CAISO) on reducing energy consumption when periods of high demand put strain on the grid.

WHO MAKES ENERGY POLICY IN CALIFORNIA

California has three main governing bodies that oversee energy production and distribution: the California Energy Commission (CEC), the California Public Utilities Commission (CPUC) and the California Independent System Operator (CAISO). Despite shared goals, each agency has a distinct purview, structure and role. Although these three bodies oversee all energy policy matters in the state, they do so in collaboration with the California Air Resources Board (CARB) which oversees policy responses to air pollution and climate change-related issues. All of these agencies operate under the legislative directives set by the Governor and the California legislature, though each agency operates independently and follows the mandates of their own leadership.

The complex jurisdictions of these five bodies (outlined below), which are at various times both overlapping and siloed, often contribute to what is seen as a fractured statewide energy policy landscape in California.

The California Energy Commission (CEC)

The CEC was created in the midst of the 1970s energy crisis to certify new electricity generation facilities. Today, the CEC develops the state's energy demand forecasts and is responsible for programs designed to meet the state's emissions reduction goals.[15]

The CEC publishes an annual Integrated Energy Policy Report that forecasts energy demand for the purposes of infrastructure planning.[16] This document is an integral part of the CPUC's Integrated Resource Plan, CAISO's Transmission Plan and CARB's Scoping Plan that sets the state's GHG target range.

The California Public Utilities Commission (CPUC)

The CPUC regulates essential services in the state such as electricity generation, natural gas, water and telecommunications. Its energy purview covers rates, reliability and development of the state's six investor-owned utilities (IOUs), 25 community choice aggregators (CCAs) and 18 registered electric service providers (ESPs).

Each year, the CPUC publishes its Integrated Resource Plan (IRP), with input from the CEC and CARB, that establishes its own greenhouse gas targets for the entities under its jurisdiction and orders energy procurement from the California Independent System Operator (CAISO). The IRP evaluates all of the CPUC's electric procurement policies with a focus on reducing the cost of GHG reductions by looking holistically at all energy utilities to identify integrated solutions that increase the safety and reliability of our grid while ensuring our energy supply is affordable.

The California Independent System Operator (CAISO)

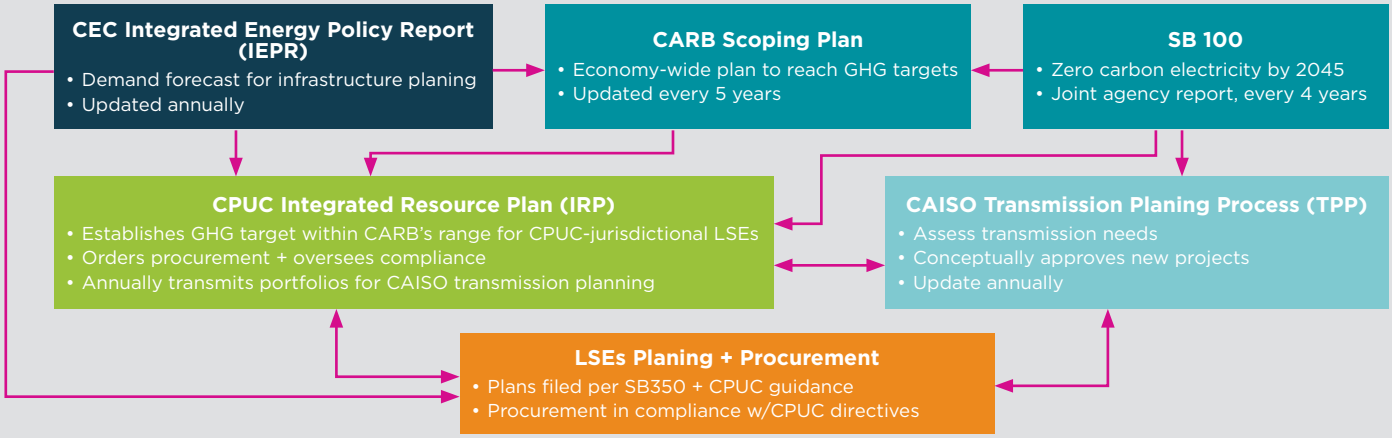
CAISO is an independent entity responsible for managing the state's electricity marketplace and transmission grid and oversees 80% of the state's energy delivery. It is the state's "air traffic controller" for electricity delivery and oversees grid reliability issues by continually balancing conditions that drive energy supply/demand to ensure the state neither produces too much nor too little energy. The intermittency of solar and wind energy is a particular focus of CAISO's work. It has the ability to leverage natural gas generation to alleviate potential shortages when renewable generation falls or when demand rises.

15 In June 2022, California passed AB 205, which significantly expanded the CEC's jurisdiction to expedite the development of new clean energy projects. The law opened avenues to a streamlined environmental review and authorization process for certain solar, wind, energy storage, and thermal generating facilities.

16 The CEC's infrastructure planning process provides details about the resources that the state needs to build to ensure it can adequately and flexibly meet the state's energy demand.

California's Electricity Planning Ecosystem

This diagram shows a simplified version of the relationships among California's main electricity and grid



Source: California Public Utilities Commission

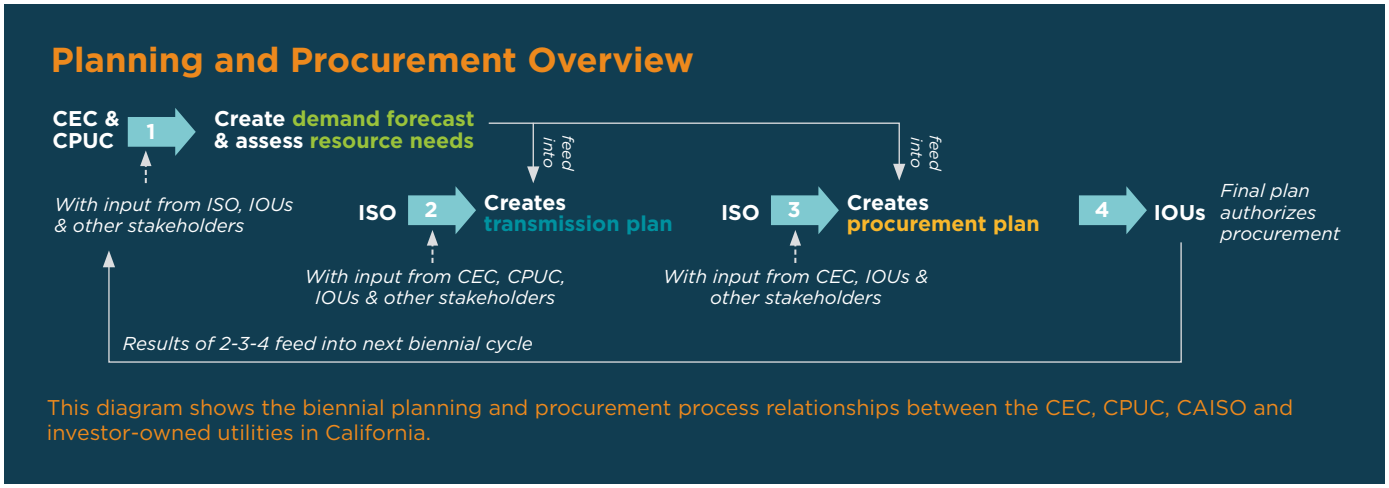
Each year, CAISO conducts a Transmission Planning Process[17] that assesses the transmission needs for the CPUC's procurement orders and approves new transmission projects.

The California Air Resources Board (CARB)

CARB was created to protect California residents from exposure to air pollution and today is the lead agency for statewide climate change programs. CARB sets statewide emission standards for pollution sources ranging from auto emissions, industrial GHGs and consumer product off-gassing. Among other responsibilities, CARB sets the GHG target range for California's electricity sector, thus setting outer boundaries for the emission targets in the CPUC Integrated Resource Plan.

The California Legislature

California's legislature creates the laws under which these agencies exist and operate. It enacted the first version of the Renewables Portfolio Standard (RPS) in 2002, which required some utilities to supply 20% renewable energy by 2017. The legislature then passed SB 100 in 2018 which updated the state's RPS to ensure that at least 60% of California's electricity is renewable by 2030, increasing to 100% by 2045. It required the CEC, CPUC and CARB to prepare a joint agency report every four years to evaluate the challenges and opportunities in implementing SB 100's energy goals and assess the additional energy resources, expansion rates and expenditures needed to meet the 2045 deadline.



Source: California Independent System Operator

17 Transmission Planning for a Reliable, Economic and Open Grid, California ISO, http://www.caiso.com/planning/Pages/TransmissionPlanning/Default.aspx

OUR ENERGY REGULATORS CAN WORK MORE CLOSELY

There have been times when our energy regulators have worked much more closely. California faced a wake-up call in August 2020 when devastating heat waves roiled most of the state.

After rolling outages impacted hundreds of thousands of Californians, Governor Newsom spoke to the state's residents and addressed the state's energy planning agencies: "[We're] basically putting all our energy to create more energy, all the tools in the tool kit to meet the needs of customers...But even with all of that, we are likely to fall short."

The 2020 power crisis further highlighted the importance of grid reliability as the state worked to transition from fossil fuels to renewables and prompted the Governor to sign an emergency proclamation. Announcing this declaration, Newsom highlighted the problem, saying, "We've always maintained that, a golden oldie, you can't control the weather, but you can prepare for the weather events. And let me just make this crystal clear: We failed to predict and plan [for] these shortages, and that's simply unacceptable...We cannot sacrifice reliability as we move forward in this transition."18

In response to this emergency directive, the CEC, CPUC and CAISO worked closely to expedite their regulatory and procurement processes to develop additional generation and storage resources that were online by summer 2021. A portion of this generation leveraged natural gas as a flexible, though GHG-emitting, means to fill gaps when renewable energy generation could not be brought online fast enough. However, in many ways, this joint response was seen as a short-lived reactive remedy to the 2020 crisis. Many energy stakeholders wished to see this close interagency dynamism and all-of-the-above thinking continue in all of California's energy planning.

> The speed and scale required to meet California's climate and energy goals cannot be overstated. The state has taken ambitious action toward these goals, but the scope of this challenge still vastly exceeds the reach of our recent climate change and energy policy efforts.

18 California Blackouts Feared, LA Times, August 2020, https://www.latimes.com/california/story/2020-08-17/california-blackouts-feared-extreme-weatherv

THE RISKS OF AN "EITHER/OR" APPROACH TO ENERGY

As Governor Newsom stated, in times of dire emergency, California needs to use "all the tools in the tool kit." But the state has at times retired tools that may prove useful on our path toward decarbonization. Such tools often provide added reliability to our energy composition during periods of high demand or deliver multiple values beyond energy production, however imperfectly. Two such case studies — biomass and nuclear — can show the risks associated with an intentional or inadvertent "either/or" approach to energy generation.

Case Study: Nuclear Energy

In 1976, California passed what in effect became a moratorium on all new nuclear energy reactors in the state. The law only allowed the permitting of new nuclear power plants when "there exists a demonstrated technology for the permanent disposal of spent fuel," a condition that has never been met in the 46 years since. This left California with only two nuclear power generating sites, the San Onofre Nuclear Generating Station which closed in 2013 and Diablo Canyon Power Plant, which was slated to close in 2025 until a legislative reprieve in August 2022.

But nuclear energy is also a GHG-free way of generating energy. With the ambitious renewable and zero-carbon energy goals the state passed with SB 100, it is confusing to many that California is considering closing its last remaining in-state nuclear energy source.

Diablo Canyon still provides roughly 9% of the state's energy, supplying a consistent 24/7 baseload that serves the equivalent of nearly three million residents. California energy agencies are moving ahead to total decarbonization by 2045, but have still not fully identified reliable and climate-friendly replacements to offset the loss of Diablo's baseload energy. This is why, on the last night of California's 2021-22 legislative session, California lawmakers voted to delay the closure of the Diablo Canyon facility, after Governor Newsom warned that the state could face rolling power outages if the reactors were retired without first planning for the renewable energy sources and the necessary storage to replace them.[26]

At this time, Diablo Canyon has an extension until 2030 (pending federal approval), however its reprieve was implemented last-minute by the state's legislative branch, not by the agencies the state empowers to make strategic energy decisions. Without a coordinated effort by California's energy regulators, it is unclear if the stay of one plant's closure will broaden the debate about the role of nuclear energy or the quickly expanding need for reliable baseload energy and storage as California moves toward cleaner sources of energy.

Above is an excerpt of CA FWD's case study on nuclear energy. Read the whole case study here.

26 Lawmakers approve $1.4-billion loan for PG&E to keep Diablo Canyon nuclear plant open, LA Times, September 2022, https://www.latimes.com/california/story/2022-09-01/lawmakers-approve-1-4-billion-loan-for-pg-e-to-keep-diablo-canyon-nuclear-plant-open

Case Study: Biomass Energy

Biomass is made up of organic byproducts from harvesting agricultural, forestry and landfill wastes and processing them to be used as fuels for producing energy.[19] Biomass energy is an acknowledged component of the scoping, planning and procurement plans conducted by the CEC, CPUC, CAISO and CARB, but is additionally under the regulatory purview of the California Natural Resources Agency and California Department of Food and Agriculture.

Biomass energy, though renewable, can create emissions about which regulators are rightfully concerned. However there are now technologies — pyrolysis, hydrotreating, and gasification, among others — that can more easily capture and sequester the emissions from biomass energy.[20] For many energy and climate scientists, the use of these technologies to further enable the integration of biomass into our energy portfolio adds a significant additional value – the reduction of wildfires by channeling kindling waste away from fire-prone areas and into energy supply chains. In the summer of 2021 alone, California wildfires released 75 million metric tons of carbon dioxide,[21] nearly 75% of the state's 2019 industrial sector emissions.[22]

In the wake of the 1970s energy crisis, government subsidies helped create more than 65 biomass plants in California, turning 10 million tons of wood waste into electricity.[23] But the same alternative-energy zeal that supported the early biomass industry has been the cause of its decline. As price supports expired in the 1990s, they were almost wholly shifted to support the fledgling solar energy sector, leading to the closure of more than half of the state's biomass plants.[24]

There is no doubt that California needed to support the nascent solar energy industry. But an unintended externality arose from the "either/or" subsidy shift. The closure of biomass plants drastically constricted a waste-to-energy industry that funneled wood wastes away from fire-prone areas and into renewable energy production facilities.[25]

It is decisions like these that California's energy regulators need to grapple with strategically. Solar power is clean, renewable and cheap – and a technology we need to incentivize into the future. But biomass advocates offer that regulators should consider the totality of benefits from biomass and its new technologies, including reduction in wildfire risk and open-burn waste disposal, while simultaneously resulting in renewable sources of energy that California needs as it works to transition from fossil fuels to alternatives.

Above is an excerpt of CA FWD's case study on biomass energy. Read the whole case study here.

19 Biomass Energy in California, California Energy Commission, https://www.energy.ca.gov/data-reports/california-power-generation-and-power-sources/biomass/biomass-energy-california

20 To ensure emissions are less than the combined emission that would have been made by the same energetic amount of fossil fuels and those created by the decomposition of the biomass in nature.

21 Wildfire Emissions, NY Times, September 2021, https://www.nytimes.com/2021/09/21/climate/wildfire-emissions-climate-change.html

22 GHG Inventory Data, CARB, https://ww2.arb.ca.gov/ghg-inventory-data

23 Solar is in, biomass energy is out, LA Times, December 2015 https://www.latimes.com/business/la-fi-biomass-closing-20160101-story.html

24 Biomass Energy in California, California Energy Commission, https://www.energy.ca.gov/data-reports/california-power-generation-and-power-sources/biomass/biomass-energy-california

25 Solar is in, biomass energy is out, LA Times, December 2015 https://www.latimes.com/business/la-fi-biomass-closing-20160101-story.html

CALIFORNIA'S FRACTURED ENERGY POLICY

There are valid concerns with nuclear energy that needed and still need to be addressed. The risk to waterways, the threat posed by earthquakes and the disposal of waste present serious environmental and equity concerns that need to be mitigated. However, the California legislature's moratorium on any new nuclear facilities created unintended consequences for the state's baseload energy supply with which the state's other regulators have been left to deal.

With no new nuclear plants, the state was forced to rely on its existing and ever more diminished facilities. San Onofre was decommissioned in 2013 after replacement steam generators failed and caused a toxic water leak. CAISO worked to replace the plant's generation capacity and was able to make up 260 megawatts with renewable energy storage projects, but between 1200-1800 megawatts was replaced by the easiest, most cost-effective tool at the time – GHG-emitting natural gas.[27]

Diablo Canyon required such significant upgrades it made more sense for PG&E to request to shut it down. And when the company designed its own proposal to shift the load generation to, in part, sustainable sources, the CPUC rejected their plan in favor of its own Integrated Resource Planning process. Unfortunately, as the planned sunset date for Diablo Canyon approached, the CPUC had not found sufficient renewable energy sources to offset the energy lost by the potential shutdown, necessitating the legislative extension for Diablo Canyon. These fractures in the energy decision-making process have put tangible roadblocks to keeping the lights on as the state moves toward a carbon-free energy sector.

Looking back at biomass, the state's energy agencies and the fragmented way they design air quality targets and energy plans do not seem to properly account for the multiple returns on investment that certain power sources provide. When price support for biomass, which utilized carbon-emitting combustion technology at the time, shifted almost entirely to clean solar energy, California experienced unintended externalities alongside the growth of an important new clean energy source. As the biomass industry dwindled, the cost of clearing land of residual wood and plant debris increased dramatically. This has,

27 AES to provide 1,284 MW of gas power to replace San Onofre, Utility Dive, November 2014, https://www.utilitydive.com/news/aes-to-provide-1284-mw-of-gas-power-to-replace-san-onofre/330391/

in some cases, led to municipalities allowing harvested biomass caches to be burned in open on-site bonfires, increasing pollutants in the air and impacting already vulnerable communities, like those in the San Joaquin Valley which has some of the nation's worst air quality.[28]

Worse yet, by financially disincentivizing the clearing of land, California has left itself increasingly helpless to calamitous wildfires that compound their disastrous pollutant effects with the loss of life, property and emergency resources. The 2007 Moonlight Fire alone created the annual CO_2 equivalent of 750,000 gasoline-power cars. The 2018 Camp Fire cost the state more than 150,000 acres, nearly 19,000 structures and, most horrifying, 85 lives.[29] In regions faced with the best-case scenario — no megafires or open bonfires — the residual biomass that is not channeled into a waste-to-energy pipeline decomposes or burns naturally, putting carbon into the air without reducing our use of fossil fuels.

With new non-combustion technologies available today like pyrolysis, hydrotreating, and gasification, California may need to reevaluate biomass' priority in our energy plans and consider putting significant investment into supporting the new technologies that can allow this sector to once again grow, this time cleaner than before. Beyond the benefits to our climate, reinvigorated biomass-to-energy pipelines create a more diverse energy pool that levels electricity prices when renewable production is low, while creating vital jobs in often-overlooked rural parts of California.

These are two substantive examples of a divided energy policy space that can lead to fractured and inefficient outcomes. There is no doubt California's energy regulators have a sincere belief in the shared goals of decarbonization. However, without more formal coordination and strategic planning among the state's energy principals, focused with a crisis-like urgency on grid reliability and phasing out coal and natural gas, it is unlikely California will achieve its climate or energy goals on time.

Without more formal coordination and strategic planning among the state's energy principals...it is unlikely California will achieve its climate or energy goals on time.

28 San Joaquin Valley Air Pollution Control District, https://www.valleyair.org/Home.htm

29 Top 20 Deadliest California Wildfires, CalFire, October 2021, https://www.fire.ca.gov/media/lbfd0m2f/top20_deadliest.pdf

ECONOMIC TRANSITION, JOBS & DIVERSIFICATION

The oil and gas industry is a significant driver of economic activity in the state and is heavily concentrated in Kern County and the San Joaquin Valley region. Refining also has a large presence, primarily in Los Angeles County and the Bay Area. Refining crude oil produces a wide variety of goods, including gasoline, diesel and petrochemicals, which are part of supply chains for products ranging from pharmaceuticals to clothing.

This activity generates regional economic benefits from taxes and fees, leases and royalty payments, employment and other direct impacts from industry spending. Specific job numbers from the oil, gas and renewables industries vary widely depending on data sources and other considerations (e.g., direct vs. indirect employment). As of 2019, it is estimated that the oil and gas industry directly employed approximately 112,000 workers in the state.[30] A 2017 report estimated that the industry generated $152.3 billion in total economic output and $21.5 billion in state and local taxes.[31] At the local level, these taxes support city and county services, school districts and special districts such as park, water and conservation districts. In Kern County, where production is concentrated, the oil and gas industry contributed close to $200 million in property tax revenues alone for the 2018-2019 fiscal year.[32]

Employment impacts of the energy transition needs to be a significant area of policy focus. Jobs supported by the oil and gas industry have traditionally provided higher wage opportunities for individuals across the education spectrum; individuals do not necessarily need to have a post-secondary four-year degree to earn a competitive salary and good benefits. Renewable energy production, in comparison, typically requires less

Employment impacts of the energy transition needs to be a significant area of policy focus. Jobs supported by the oil and gas industry have traditionally provided higher wage opportunities for individuals across the education spectrum.

30 Relief Programs for Displaced Oil & Gas Workers, CA Climate Jobs Plan, 2021, https://static1.squarespace.com/static/60b43a18079fdd42c6d01286/t/60bdc5bf6a007c14509e0887/1623049663256/LNS_Pollin+Fact+Sheets_Displaced+Worker_v2.pdf

31 Oil and Gas Industry in California, LAEDC, August 2019, https://laedc.org/2019/08/27/oil-and-gas-industry-in-california-2019-report/

32 Kern County Oil and Gas Tax Revenue, Kern County California, July 2020, https://psbweb.co.kern.ca.us/planning/pdfs/kc_oil_gas_prop_tax_revenue_report.pdf

labor from ongoing operations and maintenance, with most of the jobs coming from the initial construction phases. Of particular note is the outsized potential impact on regions where oil and gas production and refining activity is concentrated (e.g., Kern County) and on industries without an immediate clear pathway to decarbonization, due to technological or economic constraints (e.g., significant investments in heavy industry).

There are economic opportunities in this transition, however, not only risks. Demand for clean energy is projected to increase dramatically as we work to achieve net zero emissions no later than 2045. The sheer scale of raw materials, products and technology needed to support this energy transition will increase correspondingly over the next decades. California can either source these products from other states and countries or expand its own manufacturing sector and domestic supply chains to capitalize on the national and global market evolution it is leading. From the lithium in electric vehicle and energy storage batteries,[33] to the silicon in solar panels and the steel in wind turbines, the next 20 years have tremendous potential to truly establish in-state supply chains *and* manufacturing for renewable technologies.

By reinvesting in its manufacturing base with a focus on clean energy inputs, California would retain and create tens to hundreds of thousands of higher wage jobs, strengthen energy supply chains, and increase economic opportunity through the state. This work is especially critical as evidence shows that the manufacturing sector produces more jobs

California can either source these products from other states and countries or expand its own manufacturing sector and domestic supply chains to capitalize on the national and global market evolution it is leading.

and outsized regional economic benefits than its direct footprint would indicate by spurring demand in related industries and supporting local economies and supply chains.[34] All of which contributes to an economy that can more easily weather or recover from severe economic shocks such as the current COVID-19 downturn.[35]

A strategic and equitable transition away from oil and gas is tremendously complicated and requires strategic planning and the ability to adjust quickly. This is a challenge that requires urgent and ambitious action, and the ability to evaluate and realign quickly. The energy challenges before us require multifaceted and complex solutions, which only underscores the need for a highly organized and tightly coordinated transition to a more sustainable economy.

33 Currently, the US controls less than 10% of the global market share for battery components, compared to China's 75%. Building Resilient Supply Chains, The White House, June 2021, https://www.whitehouse.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf

34 Delivering the US manufacturing renaissance, McKinsey & Company, August 2022, https://www.mckinsey.com/capabilities/operations/our-insights/delivering-the-us-manufacturing-renaissance

35 Did someone say manufacturing downturn?, Deloitte, https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/resilience-in-manufacturing-downturn.html

Case Study: Kern County and the Energy Evolution

Krystal Raynes was born and raised in California's oil capital, Bakersfield. There she served in multiple leadership roles, including her term as a governor-appointed California State University Student Trustee, where she crafted advocacy strategies to divest the system from fossil fuel investments. She is a member of CA FWD's Young Leaders Advisory Council and will begin her career in public policy working as a Jesse M. Unruh Assembly Fellow in 2022. In the case study that follows, Krystal examines the impact of the energy evolution on her home region.

Oil and gas have long been at the heart of Kern County's economy. For more than a century, residents have relied on the industry for higher-wage jobs and millions in property taxes to fund schools and other local services. In 2021, oil and gas brought in more than $1 billion in wages to the region. But as the world grapples with the devastating effects of climate change, states such as California have been looking toward transitioning away from oil and gas into renewable energy. What does this transition look like in a place like Kern County where residents rely on oil and gas industry jobs?

While oil and gas and the associated workforce remain critical to the local economy, Kern County is blazing a path forward in biodiesel, solar and wind in accordance with California's goal to shift to 100% clean energy by 2045, creating new opportunities for workers. Opportunity flourishes from several significant investments:

- Bakersfield College has partnered with local businesses to create the Valley Strong Energy Institute to expand the energy sector in Kern County to include more renewable sources by supporting job training, research and critical community discussion.
- In 2022, Governor Newsom approved $83 million for California State University, Bakersfield to develop their Energy Innovation Center to research zero-emission technologies and open new doors of opportunity to workers in the region's energy sector.
- In March 2022, the U.S. Department of Energy pledged to work with Kern County to develop a new clean energy and carbon-management business park to store CO_2; this project would bring more than 10,000 construction jobs and 4,000 permanent jobs to the county.

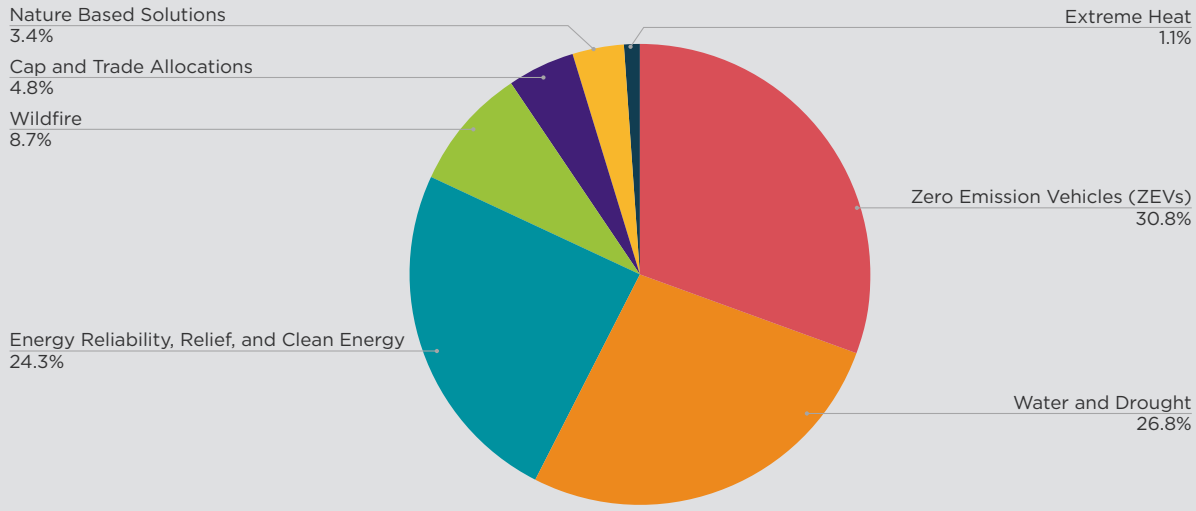
However, more work and investment need to be allocated. To make the transition more equitable for the existing workforce, unionized oil and gas workers have demanded relief and support in the form of pension guarantees, wage insurance, retraining and healthcare coverage, which has yet to be fully funded by state and federal leaders.

In total, CalMatters reported that there are 112,000 oil and gas workers in California. In 2022, Governor Newsom pledged $50 million to support displaced oil and gas workers, but further investment is needed from other key stakeholders. In 2016, The American Prospect estimated that a national "just transition" plan for the totality of 263,000 American fossil fuel workers would cost the federal government a modest $500 million per year. Working together to support and fund such a just transition plan for displaced workers would mean security for thousands of Californian families while critically moving the state closer to mitigating the devastating effects of climate change.

WHERE IS THE CAPITAL FLOWING?

The state and federal governments have committed billions of dollars in outlays over the next few years to enhance climate resiliency and accelerate the transition to net zero. An overview of recent state climate investments, depicted below, provides some insight into where public funds are flowing. More information on spending allocations in these categories can be found here.

Budget categories as percentages of the total amount the state has recently invested in climate and energy[36]



Source: California Department of Finance, 2022 Budget Addendum

36 The chart provides a point-in-time overview of state budget actions on climate and energy investments and is not intended to be comprehensive.

ENSURING AN EQUITABLE TRANSITION

How do we handle concerns, transparently and cohesively, around the burden of energy externalities and affordability as we work to make the state's decarbonization goal a reality?

A successful transition to a clean energy future will require large, ongoing investments from both the public and private sectors. This raises the question of who will bear the direct and indirect costs.

Nationwide, communities of color have long borne the externalities of energy production and the modern reliance on fossil fuels.[37] Those impacts extend beyond financial costs to include the health effects of living near energy production sites, manufacturing facilities and alongside congested transportation hubs, a legacy of historic and modern redlining.[38] Advocates and community-based organizations have rallied to empower these fenceline communities,[39] striving to ensure that those who have suffered the harms of a fossil fuel-based system receive the environmental and economic benefits of cleaner power.

Recent state and federal action represent positive steps in addressing inequities that have been embedded in our built environment and which have disproportionately impacted communities of color. These include funding to support the plugging of orphan wells and new requirements that increase the distance between wells and communities. More action is needed, however, to ensure vulnerable populations are not left behind.

> As many as 25% of Americans spend more than 6% of their household incomes on energy costs, while 13% of Americans spend more than 10%.

37 Life at the Fenceline, Environmental Justice Health Alliance for Chemical Policy Reform, 2018, https://ej4all.org/assets/media/documents/Life%20at%20the%20Fenceline%20-%20English%20-%20Public.pdf

38 Historic redlining and the siting of oil and gas wells in the United States, Journal of Exposure Science & Environmental Epidemiology, April 2022, https://www.nature.com/articles/s41370-022-00434-9

39 Fenceline Monitoring Plans, Bay Area Air Quality Management District, 2020, https://www.baaqmd.gov/plans-and-climate/emission-tracking-and-monitoring/fenceline-monitoring-plans

How can we empower local communities to participate in these processes?

As the state pursues new technologies and industries to facilitate the energy transition, it must proactively ensure that any potential harms are mitigated and benefits are directed to local communities, particularly those that have been victimized by past energy policies.

Ensuring the jobs that are created as these evolving industries take shape are high-road jobs is key to ensuring the majority of these benefits stay within local communities. The Community Economic Resilience Fund and the High Road Training Partnerships are two programs designed to support the state's diverse regions as they seek to reimagine their economies to be more inclusive and sustainable. Such work can be complemented by targeted efforts to develop education, apprenticeship and other workforce training programs to ensure local residents have equitable access to the jobs created by the environmental and economic transition. These regional models can help California promote sustainability, equity and job quality to support economically and environmentally resilient communities across the state.

To proceed equitably, the state must strike a balance between actively remediating the harms of earlier decisions, directly engaging communities in charting a path to a new energy/economic future, and quickly moving to prevent the worst climate outcomes.

The affordability of and access to reliable energy should be a significant component of any equity discussion. The unfortunate reality of the state's current environmental schema is that the very people who have felt the greatest negative impacts of climate change could also experience the greatest negative impacts from climate policies in the form of rising energy costs. Studies have shown that communities of color and low-income families spend a considerably higher percentage of their income on energy.[40] As many as 25% of Americans spend more than 6% of their household incomes on energy costs, while 13% of Americans spend more than 10%.[41]

California must acknowledge the impact increasing energy costs could have on its most vulnerable populations and take steps to mitigate that impact, such as direct financial assistance for low-income families' energy bills. Creating a financial crisis for potentially 25% of residents is antithetical to a just energy transition.

40 Low-Income Energy Affordability Data (LEAD) Tool, US Department of Energy, 2022, https://www.energy.gov/eere/slsc/low-income-energy-affordability-data-lead-tool
41 How High Are Household Energy Burdens?, American Council for an Energy-Efficient Economy, September 2020, https://www.aceee.org/sites/default/files/pdfs/u2006.pdf

RECOMMENDATIONS FOR ACTION: CHOOSE "AND," NOT "OR"

We Must Act Urgently & Carefully:

California needs to act with crisis-like urgency and break through the bureaucratic boxes that slow down how new energy generation and transmission projects are planned, permitted and built. But it must strategically calibrate its actions to ensure the energy system it creates is sustainable, reliable, affordable and equitable.

After surveying the fire-ravaged Oroville State Recreation Area in September 2020, Governor Newsom announced, "this is a climate damn emergency." In the two years since, he has acted with an urgency befitting the dire climate change consequences he witnessed. To accelerate the drastic shifts needed to combat the ongoing impacts of climate change, California has codified the state's goal of carbon neutrality by 2045, set a 2035 deadline for the end of new gas car sales and significantly increased setbacks between oil wells and communities.

However, the scope of the climate crisis is too great to allow us to rest on these policy accomplishments. They are steps in the right direction, but not nearly enough.

Two years after Oroville and the rolling blackouts of August 2020, the state cannot ignore that extreme heat events have become an annual threat both to residents and the reliability of the power grid. No one government entity or regulator can fix this alone. California needs a systemic tightening of its regulatory framework to get the expedited coordination and streamlining needed to hasten new sustainable energy generation and procurement.

With or without an imminent threat that sparks an emergency declaration, California must act on the climate emergency in front of us by bringing regulators dramatically closer together to plan for worst case scenarios and expedite approvals for necessary energy generation projects. California did this in 2020 as part of the Governor's emergency declaration, in which he clearly stated: "I find that strict compliance with various statutes and regulations specified in this Order would prevent, hinder, or delay appropriate actions to prevent and mitigate the effects of the Extreme Heat Event."[42] Nothing short of a similar emergency response posture will get the state to its climate goals while generating enough energy to keep the grid secure and energy prices affordable.

In the wake of the Oroville dam crisis, California brought the broken spillway back into working condition in 165 days and built a 1.2 million square foot spillway in only 18 months.[43] This state can still build, when it needs to. The climate crisis and increasing energy demands emphatically underline that need today. California must summon the same crisis-like urgency that it activated in the past and make that the new normal for planning, permitting and building the abundant renewable energy generation and transmission the state needs. The state must acknowledge the most successful moments from its energy history to recognize the need to reform the state's fragmented energy regulatory landscape. Without this critical but extremely challenging undertaking, California will resign itself to short-lived reactive change, in a time when proactive long-term strategies are vitally necessary.

42 Proclamation of A State of Emergency, Office of California Governor, August 2020, https://www.gov.ca.gov/wp-content/uploads/2020/08/8.16.20-Extreme-Heat-Event-proclamation.pdf

43 Why America Can't Build, Palladium magazine, June 2022, https://www.palladiummag.com/2022/06/09/why-america-cant-build/

Each additional recommendation that follows is meant to spur the state and its climate and energy stakeholders to redouble efforts and do so strategically so that the state acts with speed and at scale. It is only through highly-coordinated, moon-shot efforts to eliminate carbon emissions that California will stem the tide of extreme climate phenomena. While this work needs to be conducted with all due haste, it cannot be done indiscriminately. We can no longer push for statewide improvements that systematically benefit some Californians at the expense of people of color, native peoples and low-income communities. All policy actions toward a sustainable energy future must be strictly evaluated against the core criteria of sustainability, reliability, affordability *and* equity.

We Must Increase Renewable Energy Production & Be Technology Agnostic:

California needs an energy approach that embraces the full range of carbon-free sources of energy and reinvests in our domestic manufacturing sector to support their deployment.

Governments at every level can provide important market signals about where private dollars should be invested, which in turn can help accelerate the deployment of low- or zero-carbon technologies.

In the case of California's energy transition, defining a binding goal for emissions reductions is the important driver, or market signal. Not all signals, however, are understood the same way by all parties. As California pushes forward with ambitious energy policies, policymakers, industries and residents must grapple honestly about what these policies actually achieve. The state must be clear-eyed about policies that will result in merely replacing emissions made domestically with those made in other states and countries, and must be transparent with California communities that are economically dependent on gas and oil or vulnerable to the hazards of energy infrastructure.

To ensure the state does not meet one criteria at the expense of all the others, flexibility in how energy goals are met is key. To be successful, the state must create space for, and adequately invest in, emerging technologies, while ensuring that it can still leverage the least hazardous resources available today to ensure a system that is reliable and affordable.

This involves funding new technologies that need government support to reach scale, while allowing desirable low- or zero-carbon technologies to be deployed in ways that fully leverage their potential. Government support for the development of carbon capture, utilization and storage technologies is a key example of the former and is discussed in greater detail below. An example of the latter is creating an environment where the promotion of zero emission vehicles for the transportation sector does not exclusively focus on electric vehicles, but could also include fuel cell technology. Hydrogen fuel cell vehicles are often discussed as a pathway to decarbonizing medium to heavy duty transportation which could also be deployed to meet Californians' everyday transportation needs.

This strategy may also include the sustained use of technologies with political or economic baggage that remain viable when it comes to zero- or low-carbon electricity generation–especially when new carbon-mitigation technologies are considered. Nuclear and biomass are just two case studies in this category. Helping these options remain on the table allows for a degree of certainty while creating new markets for technological innovation that can enhance the overall generation mix and address underlying safety or emissions concerns.

As the state expands these new markets, it is imperative that California reinvest in its manufacturing base through grants, loans and loan guarantees to support the growth of domestic companies and the supply chains they require. Lithium mining, rare earth element refining and domestic battery materials processing are just a few examples of sectors that will grow because of our climate policies, and should be encouraged to do so within California. Putting significant investment into growing the manufacturing sector for clean energy inputs will help retain and create hundreds of thousands of jobs, increase regional tax bases and dramatically secure the state's energy interests.

In their own siloes, it is easy to look at California's energy landscape as a choice of choosing one technology over another toward a greener grid. A more holistic view shows that this either/or mentality sacrifices reliability and impedes larger

We can no longer push for statewide improvements that systematically benefit some Californians at the expense of people of color, native peoples and low-income communities.

decarbonization goals. Efforts to decrease fossil fuel use, like the movement toward zero emission vehicles and electric appliances, will not be adopted en masse with a grid that is unreliable when Californians need it most.

Instead, a coordinated all-of-the-above approach focused on emissions reductions and domestic renewable energy generation is required to bridge the gap to the state's goals for 2045. The energy diversity that comes from expanding the portfolio with a broad array of locally sourced technologies helps to maintain a reliable supply of inputs for electricity generation and protects Californians from devastating shortages, price spikes and economic disruptions.

We Must Address Baseload Energy Today & For the Future:

California needs a reliable grid, which will require a combination of dramatically increasing battery storage, accelerating the deployment of geothermal power, reconsidering nuclear energy and/or a robust regional transmission grid.

Renewable energy sources such as solar and wind are intermittent and California needs a stable electricity grid. Though the battery storage sector has grown, there are still significant unmet needs for baseload energy generation.[44] The state needs to increase its baseload or dramatically accelerate grid scale storage to increase renewable reliability. That reality only compounds with increased demands from additional electric vehicles and use of electricity for heating and cooking at home.

Supplying enough baseload electricity to meet today's demand may require some difficult political choices, such as reconsidering nuclear energy. The recent decision to extend the life of Diablo Canyon should not end the conversation; instead, it should start a discussion about the role of nuclear energy to provide consistent baseload energy that is deployable today. New modular reactor designs and fuel types have evolved nuclear energy far beyond the existing facilities in California which were designed more than half a century ago. As California and the West face severe water shortages, with massive impacts to hydroelectric power, the state needs to keep every option on the table to meet its baseload electricity needs.

For the needs of tomorrow, California must also acknowledge existing resources that have not yet been adequately tapped. Geothermal energy has the potential to meet a substantial amount of the state's baseload needs if properly utilized. California already hosts the largest geothermal power complex in the world: the Geysers, on the border of Sonoma and Lake counties, is home to 13 geothermal power plants totaling 725 MW.[45] The proposed 50 MW Hell's Kitchen geothermal energy project in the Salton Sea region will not only generate consistent baseload power, but includes plans to extract lithium from geothermal brine for use in battery storage. Additional studies have found the Imperial Valley to have growing unrealized potential for geothermal energy and lithium extraction.[46] These are domestic opportunities for extra baseload capacity that California must tap to ensure grid stability for the future.

Additionally, as the state leverages the resources within its borders, California should continue to embrace regional opportunities. The creation of an official regional transmission operator (RTO) covering multiple western states would be a possible means of ensuring reliable baseload and peaking supply. Formal coordination allowing

44 Not Enough Energy Storage, Sarah Constantin, May 2022, https://sarahconstantin.substack.com/p/not-enough-energy-storage

45 About Geothermal Energy, The Geysers, 2022, https://geysers.com/geothermal

46 The Salton Sea Geothermal Field In California — Quantifying California's Lithium Valley: Can It Power Our EV Revolution?, US Department of Energy, February 2022, https://cleantechnica.com/2022/02/18/the-salton-sea-geothermal-field-in-california-quantifying-californias-lithium-valley-can-it-power-our-ev-revolution/

utilities across multiple states to share energy would allow California to balance supply and demand fluctuations by automatically finding the lowest-cost energy from a broad set of providers to meet real-time needs. Additionally, such markets make excess hydroelectric, solar or wind power in one state available to other states at a low cost and prevents unmet energy demands from being served by less clean energy resources. RTOs in other parts of the nation have proven their ability to enhance reliability and bring down costs for the states that participate. Embracing a regional approach may be the key complement to increasing California's own domestic energy supply while strengthening future reliability.

We Must Invest in CCS & Non-Carbon Energies:

An array of carbon capture technologies will help mitigate emissions from the imperfect but necessary energies/industries we still need today as we work to develop a diverse portfolio of zero-carbon energy sources for the future.

Confronting climate change requires making difficult choices in the face of great uncertainty. California is in a position to be a national leader in carbon capture technologies[47] due to its position as a leader in clean energy innovation and the geological characteristics of the Central Valley that make it a prime location for carbon capture and sequestration (CCS). Developing a framework to advance the state's CCS capabilities in a way that allows for meaningful demonstration projects to move forward will be key to ensuring the state can leverage this tool to meet long-term emissions reductions and decarbonizations goals.

However, the state must also ensure it addresses the vulnerabilities of certain applications of carbon capture to prevent its use as a springboard for continued pollution. Critics of CCS believe the technology could further fuel climate change because of the potential to use carbon capture for enhanced oil recovery. Supporters, on the other hand, highlight that the various carbon capture technologies can mitigate carbon emissions not just from the energy sector, but from the many industries our economy relies upon whose collaboration is needed to meet climate goals.

There is an urgent need for these technologies, and legitimate concerns for their use, which is why it was critical that recently passed SB 905

> Pacing this transition in a way that keeps equity at the forefront likely means a long-term commitment of state funds to support access to cleaner technologies and the necessary regions-up infrastructure for inclusive economic growth and prosperity.

and SB 1314 codified California's push to advance carbon capture, while setting limits on how the technologies can be operationalized. But this policy discussion cannot end there. These actions must be a starting point for iterative evaluation of CCS policy that could be the bridge between the environmental and economic challenges we face.

Carbon capture processes have not been perfected yet, and does not remove all carbon from fossil fuel production processes. We recommend their use despite this fact because we acknowledge we are participating in an energy evolution, not an energy disruption. Even if it were physically possible, California could not eliminate fossil fuels immediately without economically displacing hundreds of thousands of California workers and leaving the energy grid floundering.

Carbon capture technologies can, however, be used to help transition to a more diverse array of renewable energies that include solar, wind, hydro, tidal, geothermal and biomass. In the case of biomass, carbon capture can play a direct role in reducing the carbon footprint of this process as the use of the renewable resources that are a product of necessary agricultural and forest-clearing increases. Additionally, each of the other five sectors will still require significant energy inputs to build and successfully expand, and fossil fuels will likely comprise a portion of their energy needs. Capturing and storing the carbon from these processes is an important way to reduce emissions from industries the state cannot do without.

47 A variety of technologies can be used to capture CO_2: post-combustion carbon capture, (currently the main method utilized by power plants), pre-combustion capture (used in industrial processes), and oxy-combustion based systems. All of these technologies are often lumped under the term CCS.

We Must Show Leadership & Share the Decision-Making:

State policymakers and regulators have to make some hard choices and trade-offs, and must engage regional collaboratives to equitably drive this change.

Truly grappling with the impact of the energy transition on low-income residents and communities of color means confronting the reality of the modern economy's reliance on fossil fuels and the economically precarious position in which the state's residents increasingly find themselves. Moving too quickly threatens severe economic damage; delayed action leads to a series of consequences including health and environmental impacts that threaten to further exacerbate harms experienced by the state's most vulnerable residents. California must work to quantify the scale of each of these risks to understand the negative impact trade-offs and the residents most affected by a faster vs. slower transition. Pacing this transition in a way that keeps equity at the forefront likely means a long-term commitment of state funds to support access to cleaner technologies and the necessary regions-up infrastructure for inclusive economic growth and prosperity.

Consumer adoption of clean technologies often includes cost savings and other benefits that help offset steep upfront costs. Solar panels and other distributed resources can lower electricity bills and provide access to reliable power if the grid goes offline and electric vehicles have lower long-term maintenance costs than cars with internal combustion engines. Early adopters of these technologies have benefited from government support and subsidies meant to encourage scale, which in turn has helped drive down costs.

The cost of these technologies, and the infrastructure required to support them, however, are still out of reach for most Californians. Ongoing commitments of state funding to help economically vulnerable residents and impacted communities transition to low- or zero-carbon technologies are essential and should include both residents and small businesses. There are models from around the country, such as the Connecticut Green Bank, that point to how California can leverage public funding to attract private investment to scale this support and create sustainable long-term funding models.

Long-term state support is also needed to help regional economies lead in the development of low-carbon industries and support existing industries as they adapt to state regulations. This will ensure sustainable funding for local governments and access to higher wage jobs for residents. This work is underway in California through the Community Economic Resilience Fund (CERF), High Road Training Partnerships and other programs, but by its nature will require difficult tradeoffs that differ from region to region. The state can do its part to ensure an equitable energy future through consistent and sustained funding of the mechanisms that underpin this work, including education and workforce development and support for local organizations doing the difficult work of engaging diverse regional stakeholder groups for inclusive economic development planning in the face of a future in transition.