California Leads:

How to Break Fossil Fuel Dependence in the Golden State

FOOD & WATER WATCH

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Food & Water Watch mobilizes regular people to build political power to move bold and uncompromised solutions to the most pressing food, water, and climate problems of our time. We work to protect people's health, communities, and democracy from the growing destructive power of the most powerful economic interests.

Food & Water Watch has state and regional offices across the country to help engage concerned citizens on the issues they care about. For the most recent field office contact information, visit *foodandwaterwatch.org/about/regional-offices*.

National Office
1616 P Street, NW
Suite 300
Washington, DC 20036
(202) 683-2500

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Executive Director, Food & Water Watch

California speaks to the American imagination. Many see it as the Golden State where natural wonders sit side by side with the farmland that feeds the world. It is viewed as the cradle of 21st-century innovation — its technology and entrepreneurship set the agenda for modern life. And it is known as a place that defines and embraces the progressive values that will deliver a better future for all of us — inclusion, diversity, democratic engagement, social justice and environmental leadership among them. But beneath the surface are buried other, harder truths.

Climate chaos is an existential threat. Reliance on fossil fuels is driving us at breakneck speed toward ecological disaster. As this crisis accelerates, the world looks for the bold leadership and real solutions that will save our future. Many might look to California, understandably believing that the state's leadership on so many fronts means California is also leading the battle for our climate. But, for now, that belief will end in disappointment.

When we look at California with clear eyes, we see fossil fuels everywhere. We see a state leading the nation in fossil fuel emissions, second only to Texas. We see a state overrun with dangerous fossil fuel infrastructure: 80,000 active oil and gas wells; a maze of leaky pipelines; disaster-prone storage facilities like Aliso Canyon. This deadly infrastructure sits on top of homes and schools. It plagues and sickens the most vulnerable Californians. And while fossil fuel corporations have drilled, tapped and fracked California for decades, they tirelessly develop new threats to California's health and safety.

All the while, California is increasingly impacted by climate chaos in the form of deadly wildfires, mudslides and unpredictable, extreme weather.

But Californians aren't fooled. They know what a green future looks like and they know it doesn't include dirty fossil fuels. They know that the popular image of California as a place of innovation and bold leadership isn't a myth, it's an aspiration. Over the past several years, communities across the state have taken on the mantle of leadership — communities we've been proud to stand side by side with have voted directly to ban fracking or moved their elected officials to roll back dirty fossil fuel projects.

Yet statewide leadership is needed to move California off fossil fuels. California is positioned to lead the world on the most pressing climate issues. Governor Gavin Newsom has committed to transition California away from dirty energy. In line with his commitments and vision of a clean energy future for California, this report clearly lays out six commonsense steps the state can take to immediately break California's dangerous dependence on fossil fuels. Californians are ready to stand with him as he takes the bold steps necessary to lead. It's past time to make our image of the Golden State a reality.

Wenonah Hauter, Executive Director

Executive Summary

California pumps out more fossil fuel-related carbon emissions than any state but Texas. The state is helping to lead us to the gravest environmental risks known to humanity. As temperatures increase each year, as wildfires rage and as sea levels rise, California is experiencing unprecedented climate impacts. The state is paying the price for its longstanding dependence on fossil fuels. As oil and gas companies profit, Californians suffer.

From the Sacramento Valley to Los Angeles County, the oil and gas industry has fracked California for years. Other dangerous extraction methods — using acids or heated, pressurized stream — are harming communities across the state. Industry's hazardous byproducts, like toxic wastewater, are pumped deep into California's drinking water aquifers and spread on California's crops. All the while, drilling operations do the most damage to California's most vulnerable communities — drillers operate with impunity in communities of color, in lower-income communities, and near homes, hospitals and schools.

California is riddled with deadly fossil fuel infrastructure. Facilities like the Aliso Canyon storage facility that leaked nearly 100,000 metric tons of methane pose a clear and immediate threat to the people of California. From underground gas storage facilities, to climate-polluting power plants, to leaky pipelines sprawling like tentacles across the state — giant corporations are working tirelessly to cement California into a dirty energy future.

At the same time, they distract and deceive, pushing false solutions to urgent problems. California promotes biogas as a part of its transition to renewable energy as a "renewable natural gas." In reality, it is just a tricky corporate name for a substance made of methane — a potent greenhouse gas — and other pollutants. It comes from landfills and from factory farm manure; it's anything but clean. Corporations are shameless, but Californians aren't helpless.

They know what California's energy leadership looks like: clean, renewable power like solar and wind; energy efficiency; and green energy manufacturing. We have the technology to make a fair and just transition to 100 percent clean, renewable energy backed by storage and transmission — we now need strong political leadership to show the world how California leads on climate.

Candidate Gavin Newsom campaigned on California's need to transition the state away from dirty energy. Californians supported his vision of a clean energy future. Now, as governor, he has the power and authority to take six specific and tangible steps to make his vision a reality.

Key Findings:

- Since January 2019, California has issued 2,383 new oil and gas-related drilling permits. While the head of the Division of Oil, Gas and Geothermal Resources (DOGGR) was fired in July 2019 for recklessly issuing too many fracking permits, the agency continues to fail to carry out its mandate to protect the "life, health, property, and natural resources" of the people of California.
- California routinely injects toxic oil wastewater into aquifers and uses it to irrigate agriculture. From 2017 to 2019, as many as 39 exemptions were granted to allow oil companies to discard wastewater into groundwater. These exemptions rob Californians of the protections of the Safe Drinking Water Act. Companies also use wastewater to irrigate crops, despite the fact that the public health risks of wastewater crops are unknown.
- California is scarred by 298 natural gas-fired power plants, 18 petroleum liquids plants and 1 coal-fired plant. These fossil-fueled facilities hit communities of color and lower-income communities the hardest and unfairly burden California's most vulnerable populations. About half of California's gas-fired power plants are in the most disadvantaged communities; just 9 percent are in the least.
- Corporations are planning seven additional unneeded gas-fired plants for California. For years, California regulators have approved, and utilities have built, unnecessary and expensive gas power plants. Driven by deregulation, these facilities are useless given declining energy demands in California over the past decade.
- Over 100,000 miles of oil and gas pipelines connect California power plants to end users and other dangerous infrastructure. Facilities like Aliso Canyon and California's 11 other natural gas storage facilities rely on a network of unsafe, leaky pipelines rigged to receive, store and deliver gas.
- From 1999 to 2018, Californians suffered 862 pipeline spills, leaks and other incidents; 118 people have been injured, and 29 have been killed. Pipeline construction is disruptive and dangerous, but risks remain once a pipeline is built. In 2015, one of California's worst coastal spills occurred when a burst pipeline

Aliso Canyon gas storage facility in Porter Ranch, California

spewed nearly 140,000 gallons of crude oil into the Pacific. The operator now proposes to build another pipeline in the same place.

- California houses 47 landfill gas power plants and at least 20 dairy digesters, with another 13 digesters under construction. California's 2019-2020 state budget bets on biogas from dairy digesters. In reality, the state is doubling down on dirty energy.

Key Recommendations:

- Stop issuing new fossil fuel permits in California immediately, ban fracking and develop a plan to phase out fossil fuel production; immediately implement measures to protect people and the environment until the phase-out is complete.
- Protect California's water resources and agriculture from toxic wastewater.
- Shut down California's dangerous fossil fuel infrastructure, including immediately and permanently closing the Aliso Canyon gas storage facility.
- Amend California's Renewable Portfolio Standards goal to 100 percent clean, renewable energy and eliminate dirty energy.
- Ban factory farming in California.
- Develop a plan for a fair and just transition to 100 percent clean, renewable energy in California by 2030.

Fossil Fuels Drive Climate Chaos in California

California is in a climate emergency. That emergency requires an aggressive transition away from dirty energy. Oil production, climate-polluting biogas, and the buildout of pipelines, gas-fired power plants and other infrastructure threaten to lock in California's fossil fuel dependence. It's time for California to transition to 100 percent clean, renewable energy to stave off the worst effects of climate change, improve public health and protect our food and water resources.

While the United States is one of the biggest global contributors of climate change-inducing fossil fuel emissions,[1] California pumps out more fossil fuel-related carbon emissions than any other state but Texas.[2] Our continued reliance on fossil fuels means continuing to warm the planet.[3] And if we pass the 1.5 degree Celsius warming threshold, the harm to our climate could be irreversible; parts of our planet could become uninhabitable this century.[4]

Each year, wildfires become larger and more destructive. In 2018, the deadliest wildfire in California history scorched over 153,000 acres and killed 85 people.[5] The threat of higher temperatures and drought make wildfires more intense and frequent. Sea-level rise endangers coastal communities.[6] These dangers are worsening.

It's time for California to transition to 100 percent clean, renewable energy to stave off the worst effects of climate change, improve public health and protect our food and water resources.

Indeed, since January 2019, California has issued 2,383 new oil and gas-related drilling permits, double the previous year's rate.[7] The head of DOGGR was fired in July 2019 for issuing too many new fracking permits.[8] But more is needed. With storage and transmission backing up technology, it is feasible to transition to 100 percent clean, renewable energy at prices that will soon be lower than current energy costs.[9] Political courage is needed to move the Golden State toward that goal.

Candidate Gavin Newsom was right when he promised to "on day one ... issue a directive putting California on a clear path to 100 percent renewable energy."[10] And he was right when he pledged to oppose fracking and other well stimulation operations and to shut down the Aliso Canyon gas storage facility in Los Angeles.[11] Doing this will require taking on the powerful fossil fuel industry, but Californians are ready to support him when he moves to fulfill those promises.

California Oil Production Harms People, Food and Water

Oil drilling drives climate chaos and damages ecosystems across the planet, and it causes real and immediate harm in California. It's no surprise that California has been deeply entrenched in fossil fuel production

for over a century.[12] But it may be surprising to know that for decades, industry-backed decision makers and state agencies have enabled widespread drilling.[13] In fact, during the administration of former governor Jerry Brown, DOGGR issued over 20,000 new injection and production well permits to oil companies; almost 70 percent were drilled by 2018.[14]

While most oil production occurs in the San Joaquin and Los Angeles Basins, the industry also drills throughout California's central coast, from Ventura to Monterey County.[15] In recent years, California has been dominated by dangerous new oil extraction technologies, including hydraulic fracturing ("fracking"), matrix acidizing and steam injection.[16] Today, there are over 80,000 active oil and gas wells in the state.[17] California is the seventh-largest producer of crude oil, and as of 2018 it had the third most oil-refining capacity of any state.[18] Fossil fuels are everywhere.

More troublingly, oil and gas operations harm the most vulnerable Californians, especially lower-income people and people of color.[19] In 2014, nearly 14 percent of Californians, primarily people of color, lived within a mile of at least one well.[20] And the closer people live to drilling, the higher is their potential exposure to hazardous pollutants that increase the risk of respiratory and neurological problems, birth defects and cancer.[21] In Los Angeles, the communities closest to oil development suffer from headaches, asthma and nosebleeds.[22] Drilling in California happens close to homes, hospitals and schools.[23]

Drilling, Fracking and Well Stimulation Techniques Endanger Californians

From the Sacramento Valley to Los Angeles County, the oil and gas industry has been fracking in California for years.[30] Over the last decade, about 20 percent of California's oil and gas came from fracked wells primarily located in the San Joaquin Basin in Kern County,[31] a lower-income region home to many communities of color. The region is plagued by industrial pollution and dangerous environmental conditions.[32]

Fracking is a destructive drilling method linked to public health problems, toxic waste spills, air pollution, earthquakes and drinking water contamination.[33] After drilling down to a rock formation that holds oil or natural gas, millions of gallons of water mixed with chemicals and a solid material (like sand) are injected under extreme pressure to fracture (or "frack") the rock.[34] The sand, keeps the fractures open, letting oil or

The Authority to Ban Drilling and Fracking

Governor Newsom can act now to legally ban fracking.[24] Under California law, the governor has broad authority to declare a state of emergency and "make, amend, and rescind" regulations to address the emergency.[25] This authority can be applied to situations in which "extreme peril to the safety of persons and property within the state caused by conditions such as air pollution, fire, flood, storm, epidemic... drought... or an earthquake" or conditions or situations "by reason of their magnitude, are or are likely to be beyond the control of the services, personnel, equipment, and facilities of any single county, city and county, or city and require the combined forces of a mutual aid region or regions to combat."[26] Former governor Jerry Brown used emergency authority for similar purposes during California's crippling drought.[27]

California has faced drought emergencies; it faces a climate emergency today. The Aliso Canyon blowout; drilling and wells in neighborhoods close to homes, hospitals and schools; the use of scarce water for fossil fuel extraction, processing and generation; and the extreme drought and supercharged wildfires that come with catastrophic climate change all mean that Californians now live in a state of emergency caused by fossil fuel production and consumption, as defined by state law.[28]

Governor Newsom can use his executive authority to recognize this reality by issuing an emergency order to ban fracking, drilling and various forms of well stimulation. He can serve the same goal by issuing an executive order requiring DOGGR to carry out its regulatory mandate to "prevent, as far as possible, damage to life, health, property, and natural resources."[29]

The Cymric oil operation located 35 miles outside of Bakersfield, California spilled nearly 800,000 gallons of oil mixed with water over the course of several weeks, from May through July 2019. / PHOTO COURTESY OF CALIFORNIA DEPT. OF FISH AND WILDLIFE, OFFICE OF SPILL PREVENTION AND RESPONSE

natural gas to flow up.[35] While some injected fluid stays underground, the rest flows back out as either flow-back or produced water,[36] collectively referred to as wastewater (see page 8). In California, most fracking is done less than a mile from the surface. This is shallower than fracking in other states and poses greater risks to groundwater.[37]

Other methods of well stimulation used in California to reach deeper oil include steam injection, acid fracturing and matrix acidizing.[38] Steam injection, an unconventional drilling technique sometimes called "steam fracking," is increasingly used to tap heavy crude oil.[39] It involves injecting highly pressurized heated steam into tar sands wells (among the most climate-polluting fuel sources in the world[40]) to liquefy and separate the thick oil, pumping the resulting mixture to the surface.[41] Toxic solvents or acids can be added to loosen the oil from the sand.[42] State regulations on fracking do not apply to steam injection, and California's oversight is inadequate to safely regulate this method of well stimulation.[43] In a slow-moving disaster from May to July 2019, a steam injection operation run by the oil giant Chevron spilled nearly 800,000 gallons of oil mixed with water approximately 35 miles from Bakersfield.[44]

Despite spills like this, in northern Santa Barbara County, Aera Energy is looking to revive oil production in the East Cat Canyon oil field and drill hundreds of wells using steam injection.[45] In Ventura County, there have been failed attempts to tap crude oil in California's Vaca Tar Sands in Oxnard.[46] A temporary moratorium that lasts until December 2019 has stalled any plans to drill there.[47]

Acid fracturing and matrix acidizing are less used,[48] but are just as dangerous. Acid fracturing pumps acid instead of sand underground at high pressure to fracture rock; matrix acidizing doesn't fracture rock, it dissolves it to make it more permeable for easier access to oil.[49] The latter process can be more dangerous than fracking[50] since the chemicals it uses can corrode casings, pipelines, tubing, tanks and even underground cement well linings.[51]

Toxic wastewater is used in California agriculture, posing potential risks to the food coming from California farmers. / PHOTO BY JON BOWERMASTER

Fossil Fuel Production Threatens California's Food and Water

Oil and gas production threatens Californians' water resources and food supplies. Well stimulation requires huge amounts of water.[52] In addition to the original fluids that are injected underground, drilling and fracking can bring contaminants, brines and radioactive material to the surface in wastewater.[53] Corporations sometimes use wastewater to frack more wells, but they also discharge it into surface waters or store it in pits until it evaporates into the atmosphere or seeps into the ground.[54]

However, when oil and gas corporations want to discard toxic wastewater, underground injection is their most common method.[55] Injecting toxic wastewater into underground wells puts drinking water at risk and is linked to increased earthquake activity.[56] In California, some corporations have routinely injected oil wastewater directly into aquifers.[57] They also use wastewater in California agriculture,[58] posing potential risks to the food California farmers use to feed the world. One San Joaquin Valley farmer was stunned to find that wastewater was being pumped into groundwater aquifers near his orchard.[59] After regulators first tried to dismiss him, they confirmed that the injection well near his property was illegal and shut it down.[60]

Wastewater in California's Aquifers

In 2011, an independent audit of California's underground injection well activity commissioned by the U.S. Environmental Protection Agency (EPA) found that DOGGR was failing to comply with state and federal laws.[61] DOGGR employees were illegally approving permits that let oil companies dispose of toxic wastewater into protected aquifers.[62] (Outrageously, the practice can be deemed legal if the EPA exempts an aquifer from Safe Drinking Water Act protections.[63]) Over 2,500 wells illegally injected wastewater into California's underground drinking water.[64] Many of these wells were in the San Joaquin Valley.[65] Therefore, unknown concentrations of toxic chemicals permeated groundwater in areas already struggling with disproportionately high levels of pollution.

In 2015, DOGGR regulations set a timeframe for stopping all wastewater injection unless companies obtained an exemption.[66] But only a few dozen wells were closed that year; "emergency" rules allowed most wastewater injection to continue until 2017.[67] In January 2017, DOGGR announced that it would shut down 475 wells, but let 1,650 wells continue.[68] As operators who help fund DOGGR waited for their exemptions, they continued injections.[69] In the end, oil and gas trade associations won a lawsuit that kept DOGGR from enforcing regulations[70]; corporations continue to inject wastewater into California's aquifers today.

While DOGGR conceals data on the number of injection wells that actively dispose of wastewater into aquifers, publicly available state data show that 21 aquifer exemptions have been approved between 2017 and 2019.[71] Federal data show even more exemptions — up to 39.[72] But one well is too many. Illegal or legal, the practice endangers California's groundwater.

The Unknown Risks of California's Wastewater Crops

Oil wastewater is being used to irrigate crops across California's Central Valley.[73] In the San Joaquin Valley, it is also used to hydrate livestock and recharge groundwater.[74] Although state law requires the treatment of wastewater to be used in irrigation,[75] treatment practices cannot strip wastewater of all toxic chemicals that could violate agricultural water quality standards.[76]

There is also scant data from just a handful of tests to show whether wastewater crops pose a public health risk. For example, California's Cawelo Water District hired a laboratory to test root crops (like carrots) and citrus irrigated with wastewater for fewer than a dozen petroleum-based chemicals.[77] They also tested nuts and grapes for a wider range of chemicals, but left out many chemical additives used by California oil companies.[78] Given both the high toxicity of wastewater and the scarcity of data on its potential health impacts, it is impossible to quantify the risks that using wastewater for agricultural irrigation might pose to public health.[79]

Indeed, a 2019 study concludes that if we continue to burn fossil fuels at factories and power plants for their effective lifespans, we will surpass the 1.5 degree Celsius tipping point.

California's Dirty Energy Infrastructure Locks in Fossil Fuel Dependence

From underground gas storage facilities to climate-polluting power plants and the labyrinth of pipelines that move oil and gas — fossil fuel infrastructure cements California into a dirty energy future. According to the U.S. Energy Information Administration (EIA), 298 gas-fired power plants (22 of which have generators that also rely on another fuel source), 18 petroleum liquids plants (5 of which also rely on natural gas) and 1 coal-fired plant operate in California.[80] Over 100,000 miles of oil and gas pipelines snake out of these plants across California, connecting to end users and other dangerous infrastructure like California's 12 natural gas storage facilities (see Table 2 on page 11)[81]; 7 new but unneeded gas-fired plants are waiting to be built (see Table 1 on page 10).[82]

Building more dirty energy infrastructure projects in California would lock in a future of climate pollution; these projects have lifespans far longer than the point when experts agree that the world must shed all fossil fuels, meaning that these stranded assets will be wasted economic investments[83] — some U.S. pipelines were built more than 70 years ago, and gas-fired power plants can operate for more than 50 years.[84]

Only a moratorium on fossil fuel infrastructure can stave off the worst effects of climate change and protect Californians. At the same time, Governor Newsom can use his executive authority to institute a moratorium on all new fossil fuel infrastructure and direct the California Public Utility Commission to block the permitting of any such infrastructure (including oil and natural gas pipelines, fossil fuel power plants, petroleum refineries, natural gas compressor stations and oil and liquefied natural gas export facilities).

Power Plants Are Pollution Pitfalls

For years, California regulators have approved, and utilities have built, unneeded and expensive gas power plants,[85] despite the fact that renewable power and storage technology exists to support a low-cost transition from fossil fuels.[86] Driven by deregulation, these facilities are unnecessary since California's electricity demand has declined over the past decade.[87] They serve merely to prop up a faltering fracking industry and lock in climate pollution.[88] Indeed, a 2019 study concludes that if we continue to burn fossil fuels at factories and power plants for their effective lifespans, we will surpass the 1.5 degree Celsius tipping point.[89]

The electric power industry is a major emitter of air pollutants that harm human health and the environment.[90] Power plants release air pollutants such as mercury, particulate matter, sulfur dioxide (SO_2) and nitrogen

Table 1: Proposed California Natural Gas Power Plants, Based on 2018 EIA Data

Plant Name	Utility	Sector	County	Technology	Status	Year Facility Is Scheduled to Start Operation
AES Alamitos Energy Center	AES Alamitos Energy, LLC	Independent Power Producer, Non-Combined Heat and Power	Los Angeles	Natural Gas-Fired Combined Cycle	Under construction, less than or equal to 50 percent complete (based on construction time to date of operation)	2020
AES Huntington Beach Energy Project	AES Huntington Beach Energy, LLC	Independent Power Producer, Non-Combined Heat and Power	Orange	Natural Gas-Fired Combined Cycle	Under construction, less than or equal to 50 percent complete (based on construction time to date of operation)	2020
Biola University	Biola University	Commercial, Combined Heat and Power	Los Angeles	Natural Gas Internal Combustion Engine	Planned for installation, but regulatory approvals not initiated; Not under construction	2019
Bolthouse Farms Fuel Cell	Bakersfield Fuel Cell 1, LLC	Independent Power Producer, Combined Heat and Power	Kern	Other Natural Gas	Planned for installation, but regulatory approvals not initiated; Not under construction	2019
Energy Center	University of Redlands	Commercial, Combined Heat and Power	San Bernardino	Natural Gas Internal Combustion Engine	Construction complete, but not yet in commercial operation	2019
New-Indy Ontario Mill	New-Indy Ontario LLC	Industrial, Combined Heat and Power	San Bernardino	Natural Gas-Fired Combustion Turbine	Under construction, more than 50 percent complete (based on construction time to date of operation)	2019
Stanton Energy Reliability Center	Wellhead Energy, LLC	Independent Power Producer, Non-Combined Heat and Power	Orange	Natural Gas-Fired Combustion Turbine	Planned for installation, but regulatory approvals not initiated; Not under construction	2019

SOURCE: EIA

oxides (NO_x).[91] All fossil fuel plants discharge SO_2 and NO_x, and coal-fired plants are significant mercury emitters.[92] The SO_2, NO_x and particulate matter pollution from power plants contributes to and worsens health problems such as chronic bronchitis, asthma, emphysema and existing heart disease, and also causes labored breathing (especially for people living with asthma) and reduces life expectancy.[93]

Crucially, fossil fuel facilities disproportionately burden California's communities of color and lower-income communities. Researchers found that closing several oil and coal power plants in the state reduced rates of preterm birth in women living nearby, with greater impacts on the reproductive outcomes for African-American and Asian mothers.[94] But the continued reliance on gas-fired power plants burdens frontline communities. For example, a 2017 study found that half of California's gas-fired power plants were located in communities designated as disadvantaged; only 9 percent of the plants were in the least disadvantaged areas.[95]

Natural gas-fired power plants are major NO_x emitters, contribute to ground-level ozone and smog and threaten the environment and human health.[96] Ground-level ozone creates smog when it mixes with particulate matter, which itself has been linked to various cancers.[97] Prolonged exposure to smog has been connected to premature deaths in adults and low birthweight in babies.[98] Natural gas-fired power plants can also release radon,[99] a radioactive material that is the second leading cause of lung cancer in the United States, after smoking.[100]

In Los Angeles, the Haynes and Scattergood gas power plants are located near several predominantly Latino, African-American and lower-income neighborhoods in South Bay and The Harbor that already face increased environmental health risks.[101] In February 2019, Los Angeles Mayor Eric Garcetti announced plans to no longer upgrade the already partially retrofitted Scattergood, Harbor and the Haynes generating stations, but the process will not be immediate and these facilities continue to operate.[102] Shutting down these plants will reduce the pollution and environmental health burden faced by the people in these neighborhoods.

The Gas Storage Disaster

The recent shift from coal to natural gas for electricity generation has driven underground gas storage to record-high levels (see Table 2).[103] But these outdated storage facilities like SoCalGas' Aliso Canyon and Playa del Rey were not designed for high-pressure gas storage, making them inherently unsafe.[104]

For example, in October 2015, a large underground storage well at Aliso Canyon had a massive blowout[105]

Table 2: California's Underground Gas Storage Facilities

Operator	Field	County	Number of Active Wells in Field
Central Valley Gas Storage, LLC	Princeton Gas	Colusa	13
Gill Ranch Storage, LLC	Gill Ranch Gas	Madera	20
Lodi Gas Storage, LLC	Kirby Hill Gas	Solano	25
Lodi Gas Storage, LLC	Lodi Gas	San Joaquin	27
Pacific Gas & Electric Company	Los Medanos Gas	Contra Costa	20
Pacific Gas & Electric Company	McDonald Island Gas	San Joaquin	88
Pacific Gas & Electric Company	Pleasant Creek Gas	Yolo	7
Southern California Gas Company	Aliso Canyon	Los Angeles	161
Southern California Gas Company	Honor Rancho	Los Angeles	43
Southern California Gas Company	La Goleta Gas	Santa Barbara	22
Southern California Gas Company	Playa Del Rey	Los Angeles	54
Wild Goose Storage, LLC	Wild Goose Gas	Butte	21

SOURCE: CDC/DOGGR.

The Playa del Ray gas storage facility sits dangerously close to a large residential area to the south.

that spewed nearly 100,000 metric tons of methane and other pollutants into the air and spread to homes in the nearby Porter Ranch neighborhood and greater San Fernando Valley.[106] Residents suffered headaches, nosebleeds, nausea and rashes.[107] In 2018, SoCalGas paid a $119.5 million settlement for the leak.[108]

Aliso Canyon's blowout, the largest in U.S. history, forced 8,000 families to flee their homes.[109] Even after the blowout, continued leaks led to elevated levels of ambient hazardous air pollutants, as well as natural gas odorants, hydrogen sulfide and an "oily" residue throughout the Porter Ranch community.[110] Years later, effects of this disaster linger. In 2018, approximately 30 firefighters who responded to the disaster claimed SoCalGas withheld information about the toxicity of natural gas and other chemicals and filed a civil lawsuit against the company for health problems including nosebleeds, dizziness, migraines, dermatological problems, respiratory problems and cancer.[111]

Although former governor Jerry Brown declared a state of emergency, he failed to completely shut down the Aliso Canyon facility.[112] The facility still operates, and nearby residents await a shutdown order.[113]

Leaky storage wells have posed hazards elsewhere. In July 2016, PG&E's largest storage facility in the Sacramento-San Joaquin River Delta leaked gas and was temporarily shut down.[114] Playa del Rey's storage facility has also had numerous environmental lapses, including the release of a "fine oil mist" that covered homes; odor emissions; allegations of contaminated drinking water; and a 2013 vent stack explosion visible for miles.[115] The facility regularly emits dangerous air pollutants that contribute to respiratory illnesses, as well as known carcinogenic chemicals.[116]

More Pipelines, More Problems

Facilities like Aliso Canyon rely on a network of pipelines to receive the gas they store and deliver into the grid. But pipeline construction is disruptive and dangerous. Building new and expanding existing pipelines in California threatens human health, wildlife habitats and the environment by compromising soil quality, impacting vegetation, contaminating surface waters and aquifers, and releasing air pollutants.[117]

Risks remain once a pipeline is built. Landowners along their paths are forced to live under the constant threat of accidents and explosions. From 1999 to 2018, California experienced 862 pipeline spills, leaks and other incidents; 118 people were injured, and 29 died.[118] Moreover, pipelines built since 2010 are nearly five times more likely to have problems than those built from 1980 to 2009, possibly because the rush to complete pipelines during the fracking boom encouraged corner-cutting during construction.[119] In 2010, a PG&E pipeline explosion in San Bruno killed 8 people, injured 58, demolished 38 homes and ravaged 70 more.[120]

In 2015, one of California's worst coastal spills occurred when a pipeline burst and spilled nearly 140,000 gallons of crude oil into the Pacific.[121] The pipeline operator, Plains All American Pipeline, was fined almost $3.35 million for the spill that covered beaches for miles, killed wildlife and harmed tourism and fishing.[122] Shamelessly, the company has proposed to construct another pipeline to serve offshore drilling companies; it would slash through three California counties for 124 miles.[123]

Biogas Jeopardizes California's Climate

Compounding these problems, some in California have been misleadingly promoting biogas as a part of a transition to renewable energy. Biogas is a mixture of gases produced after plant and animal material — like manure from factory farms, sewage sludge or food waste — is broken down by microorganisms in a process called anaerobic digestion.[124] Top proponents include natural gas companies like SoCalGas that profit from dirty energy. While they greenwash biogas as "renewable natural gas,"[125] it includes waste methane from landfills, sewage treatment plants and livestock manure.[126] The prefix "bio" does not make it clean — methane is the primary constituent of fracked gas and other pollutants.[127] And methane is nearly 90 times more powerful as a greenhouse gas than carbon dioxide (CO_2) over a 20-year period.[128] Burning biogas also releases CO_2 and other pollutants including NO_x, ammonia and hydrogen sulfide.[129]

Yet California considers this waste gas from landfills, sewage treatment plants and factory farms to be renewable energy under several state programs.[130] The state hosts 47 landfill gas power plants[131] and at least 20 operational dairy digesters, with another 13 under construction.[132] California also holds the dubious distinction of hosting one of the world's largest operating digesters.[133]

The newly proposed Glendale Biogas Renewable Generation Project is a biogas generation project that Glendale Water & Power (GWP) has been plotting to

build at the city-owned Scholl Canyon Landfill near Eagle Rock[134] — a Los Angeles community beset by a history of poor air quality and air pollution-related health problems and casualties.[135]

The Glendale Project is a part of a larger plan to repower and upgrade the city's Grayson Power Plant.[136] This is a lose-lose situation for Angelenos and all Californians. The gas power plant would continue to operate. Together with the dirty biogas plant, they would lock California into more dirty infrastructure and continued fossil fuel reliance. Unsurprisingly, GWP never reached out to community members or stakeholders before their plans were exposed.[137]

The 2019-2020 state budget backs biogas and forces California to invest in more dirty dairy digesters.[138] But Californians have the power to reject false solutions. Governor Newsom has the authority and power to enact a moratorium on new factory farms, eliminate the budget for dairy digesters, decommission existing landfill gas/biogas power plants and support and invest in real renewable energy solutions.

The Biogas / Factory Farm Nexus

Biogas is a product of anaerobic digestion, which presents a number of hazards to nearby communities. For example, residents living near a digester in Monterey County have repeatedly complained about odors.[139] In other places, the stench of digesters has filled the air and reportedly made people sick, causing headaches and dizziness.[140]

Increasingly, digesters are being promoted as a means to reach California's greenhouse gas reduction goals.[141] Proponents also say that "clean" biogas could be pumped into the existing natural gas pipeline network.[142] But gas pipelines, storage facilities and other infrastructure leak tremendous volumes of methane that contribute to climate change.[143]

These digesters also cost millions. Some costs are offset by taxpayer-subsidized handouts; others are simply passed down to utility ratepayers.[144] Before 2002, there were fewer than five digesters operating on dairy farms in California; by 2015, dairy farms were being awarded millions to build biogas digesters on site.[145] Now all of California's dairy digesters have received considerable financial support from state and federal incentives.[146] In 2018, California invested over $70 million toward 42 new dairy biogas digester projects.[147] These grants, coupled with other incentives,[148] encourage the construction of more dairy digesters across the state.

These taxpayer-subsidized digesters produce neither clean nor safe energy because of methane combustion emissions, leaks, accidental manure spills and explosions.

These taxpayer-subsidized digesters produce neither clean nor safe energy because of methane combustion emissions, leaks, accidental manure spills and explosions.[149] They also encourage colossal amounts of pollution from factory farms, which globally produce millions of tons of methane-emitting manure a day.[150] For instance, the nearly 500,000 dairy cows at factory farms in Tulare County, California produce five times as much waste as the New York City metropolitan area.[151]

Although there are claims that biogas technology offers a way to avoid the negative impacts of methane emissions and toxic gases,[152] leakage from "renewable" methane production is similar to that of fossil fuel gas production.[153] Investing in more biogas means more factory farms.[154]

Moreover, most California factory-farmed dairy cows are in the Central Valley, a lower-income region with the state's highest rates of emergency room visits for childhood asthma.[155] The same is true of landfill and sewage facilities. In 2011, a San Jose landfill digester faced an $882,200 fine for a chemical spill that contaminated a nearby creek.[156] Landfill gases can leak into soil and buildings, posing a potential explosion hazard and threatening public health.[157]

SoCalGas Promotes Biogas

Headquartered in Los Angeles, SoCalGas is the nation's largest natural gas distribution utility and a major promoter of the so-called renewable natural gas from biogas — otherwise known as biomethane (processed biogas that can be delivered in pipelines).[158] Renewable natural gas is just a greenwashed, cleaner-sounding name for the same old climate-destroying methane.

The company has been attempting to make biomethane appear climate-friendly and to convince people that biomethane is "clean," with plans to replace one-fifth of its conventional gas supply with biomethane by 2030.[159] It also filed a request with the California Public Utilities Commission to allow customers to buy biomethane for their homes; it hopes this voluntary program will be approved by the end of 2019.[160]

SoCalGas and its parent company, Sempra Energy, benefit from entrenching California's natural gas infrastructure.[161] SoCalGas made roughly $6 billion in upgrades to its natural gas system from 2013 to 2017.[162] In August 2018, the company began accepting biomethane that originated from an anaerobic digestion facility in Perris which is already used to fuel roughly 400 waste hauling trucks.[163] And in February 2019, SoCalGas announced that it had begun to inject biomethane from a dairy digester into its natural gas system.[164] The company also plans to sell it for natural gas vehicles, buses and residential and commercial buildings and to pump it through existing pipelines, further entrenching natural gas.[165]

SoCalGas has also partnered to develop power-to-gas technology that uses clean, renewable energy to create natural gas[166] — a perverse turnabout. Power-to-gas would allegedly store surplus intermittent wind and solar energy to convert water into hydrogen that can be combined with CO_2 to create storable methane for power plants.[167] This technology has only been implemented on a small scale; it faces technical hurdles to become viable.[168] Pursuing this unproven technology to convert zero-emission renewables into climate-destroying gas is nonsensical when renewable power and battery storage are becoming cheaper and more effective.[169]

Further entrenching reliance on biogas, SoCalGas supports biomethane-fueled vehicles.[170] Although gas-powered buses may not belch as much particulate pollution as diesel buses, they still emit dangerous air pollutants and greenhouse gases.[171] Gas buses have high lifecycle emissions for many toxic air pollutants and emit large volumes of carbon monoxide and smog-creating NO_x.[172] California landfill gas buses release 72 percent more NO_x than electric buses.[173]

Overall, burning biomethane spews CO_2 and other pollutants, making it indistinguishable from fracked gas. SoCalGas asserts that biomethane is "carbon neutral" or "carbon negative," purportedly because it comes from organic sources that already absorbed CO_2.[174] But methane combustion releases CO_2 and other air pollutants, while gas pipelines and other infrastructure leak methane, negating any alleged biomethane savings.[175]

The Golden State Can Turn to Real Renewable Energy

California has legislation in place to reach 100 percent "clean" energy for electricity by 2045.[176] But new legislation is needed to amend California's Renewables Portfolio Standard (RPS) to remove currently allowed dirty energy sources like waste methane[177] and to accelerate the deadline to 2030 to avoid runaway climate chaos. To accomplish this, Governor Newsom is empowered to propose a statewide policy to the legislature aimed to create a green public works program, paired with pro-labor policies to ensure that workers share fully in massive clean energy investments.

This program can include competitive grants for large-scale wind, solar and storage projects as well as grid upgrades to support expanded renewables; training programs offered by the California Department of Labor; and the creation of a Climate Action Council with heads from several agencies, workforce organizations, environmental justice leaders and clean energy experts to develop a plan to make California carbon neutral by 2030.[178]

Increased renewable capacity backed by storage is feasible in California. The technology for a large-scale transition to renewables has existed for over 20 years[179] — we now need strong government policies driven by the political will to see them through. These policies and investments to rapidly shift to clean renewables such as solar and wind power should be complemented by upgraded efficiency. Other efforts to upgrade the electric grid, shift to more distributed power generation and enhance transportation and industrial efficiency can further reduce electricity and fossil fuel demand. A fair and just transition to a clean energy future will substantially reduce energy use, save money, create jobs and reduce climate emissions.

The Golden State Can Lead on Clean Energy

The future of energy in California is in clean, renewable power together with energy efficiency manufacturing and installation. By shifting primarily to wind and solar, the United States could also save $4.8 billion in annual global warming damage costs; California could avoid $103 billion annually in air pollution-related health

costs.[180] Energy efficiency programs alone have provided utility customers in the San Joaquin Valley with close to $250 million in net economic benefits from 2010 to 2015.[181] These savings are real, and will be especially felt in the regions of California that are at the crux of these dirty industries.

Already, traditional energy jobs are slowly declining in California. Even without a statewide green public works program, nearly six times more Californians work in the renewable energy electric generation and energy efficiency sectors (over 450,000 jobs) than in fossil fuel production and generation (79,000 jobs) according to Department of Energy data (see Figure 1.)[182] In fact, California has the biggest workforce in the energy efficiency sector in the country.[183]

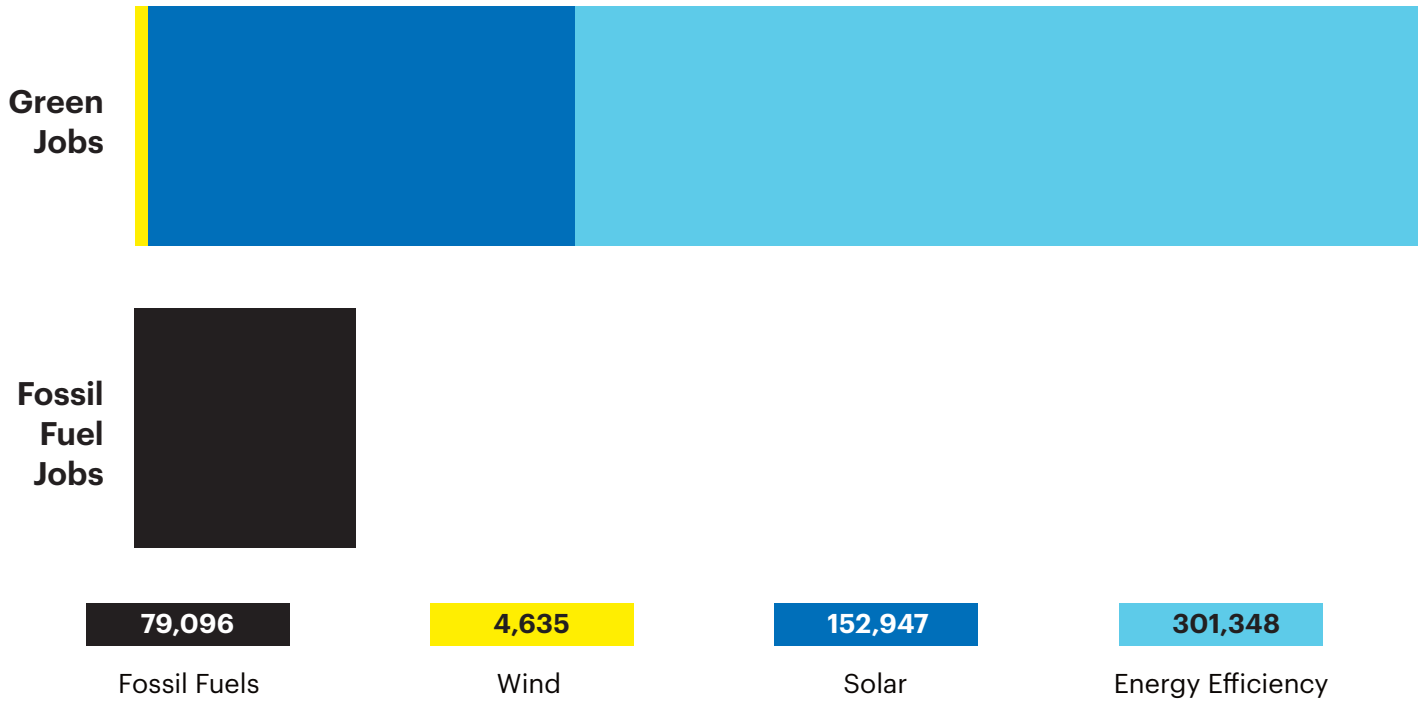
Electrifying the grid through renewables coupled with energy efficiency measures can also reduce the state's power consumption and stabilize energy prices.[184] Currently, solar and wind are the largest renewable energy sources in the state, generating 20 percent and 7 percent of electricity across California.[185]

In California's electric power sector, the solar industry supports the most jobs, employing over 125,000 people.[186] Costs are also expected to drop for utility-scale solar,[187] making it more widely accessible statewide. California's pioneering new 2019 Building Energy Efficiency Standards, effective in early 2020, require rooftop solar to be installed on all new homes.[188] This could double the state's solar generation by 2025.[189] California leads in wind energy development and is home to over 12 wind-related manufacturing facilities.[190] In fact, by 2030, California has the potential to deploy close to 80,000 distributed wind projects.[191]

Green jobs can bolster in-state industries and employment; well-paid workers will manufacture and install California-made solar panels and wind turbines and implement efficiency and clean energy upgrades. A green public works program can also focus on a fair and just transition for fossil fuel workers. Dedicated public funding can support these efforts. A fair and just transition should include guaranteed pensions for fossil fuel workers, training and relocation

In February 2019, Los Angeles Mayor Eric Garcetti announced that the Los Angeles Department of Water and Power would not repower three coastal natural gas power plants. Los Angeles is taking a lead on 100% renewable energy, and the rest of the state should follow.

Figure 1: California Green Jobs Outpace Dirty Energy Jobs



support for laid-off fossil fuel workers and community transition support for regional economies that are centered around fossil fuel activity, to ensure that they receive financial support needed to advance clean energy projects.[192]

A Potential National Climate Leader

Governor Newsom committed to provide the people of California with clean air and water, to protect vulnerable communities and to stave off the impacts of climate change. He campaigned on a pledge to "a long-term transition away from fossil fuels" and to oppose fracking and other dangerous well stimulation operations.[193] He recognized that decisions must be made to protect the environment, address the rising sea level and safeguard drinking water resources that are affected by climate change.[194] Now is the time to deliver on those commitments.

California and the global community cannot afford further delay; a growing grassroots movement is demanding that elected leaders take bold action. In Congress, a joint resolution was introduced in July 2019 declaring a climate emergency — included in it was recognition that we need to move off fossil fuels. In California, the Last Chance Alliance, made up of hundreds of organizations including Food & Water Watch, is waging a dynamic campaign calling on Governor Newsom to stop issuing fossil fuel permits, drop oil production and roll out a 2,500-foot setback. Moving off fossil fuel production and use and investing in 100 percent, clean renewable energy is the only viable path for the Golden State. With the looming climate crisis, compounded by thousands of active oil wells and the continued expansion of fossil fuel infrastructure, real change from strong leadership is more critical than ever. Governor Newsom can rise to national climate leadership and ensure that California leads the world by taking six tangible steps.

California Leads: Food & Water Watch Recommendations

1. Stop issuing new fossil fuel permits in California immediately, ban fracking and develop a plan to phase out fossil fuel production; immediately implement measures to protect people and the environment until the phase-out is complete.
    - Ban all drilling, fracking and well simulation technologies like acidizing and steam injection;

- Institute a moratorium on new drilling permits to stop the expansion of fossil fuels;
- Institute a 2,500-foot setback for all current wells to better protect homes, schools, hospitals and water supplies;
- Develop a plan to phase out oil and gas production in California by 2030 and ensure a fair and just transition for workers and communities impacted by the phase-out.

2. Protect California's water resources and agriculture from toxic wastewater.

- Halt the practice of injecting oil wastewater into aquifers;
- Prohibit the use of wastewater to irrigate crops.

3. Shut down California's dangerous fossil fuel infrastructure, including immediately and permanently closing the Aliso Canyon gas storage facility.

- Institute a moratorium on any new permits for fossil fuel infrastructure, including pipelines, power plants, refineries and export facilities.

4. Amend California's Renewables Portfolio Standard goal to 100 percent clean, renewable energy and eliminate dirty energy.

- Include only real, 100 percent, zero-emission renewable energy (solar, wind, water and geothermal) in the state RPS goal, while removing false solutions like waste methane from landfills, sewage treatment plants and factory farms from its eligible RPS energy sources.

5. Ban factory farming in California.

- Enact a moratorium on new factory farms;
- Eliminate funding in the budget for dairy digesters;
- Support funding to transition from factory farms to sustainable small and mid-sized farms.

6. Develop a plan for a fair and just transition to 100 percent clean, renewable energy in California by 2030.

- Invest in a green energy public works program that fosters a rapid transition to real, zero-emission clean energy like solar and wind, accompanied by widescale deployment of energy efficiency;
- Ensure that clean energy investments are targeted in socially and economically disadvantaged areas and in environmental justice communities with disproportionate pollution burdens;
- Fully fund fair and just transition programs that are needed for fossil fuel workers.

Endnotes

1 Griffin, Paul. Carbon Disclosure Project, Climate Accountability Institute. "The Carbon Majors Database." July 2017 at 8; Ekwurzel, B. et al. "The rise in global atmospheric CO_2, surface temperature, and sea level from emissions traced to major carbon producers." *Climate Change*. Vol. 144, Iss. 4. October 2017 at 578 to 580 and 587 to 588; Olivier, Jos G. J. et al. PBL Netherlands Environmental Assessment Agency and European Commission, Joint Research Centre. "Trends in Global CO_2 Emissions: 2016 Report." 2016 at 5; Boden, Tom et al. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Research Institute for Environment and Energy and Economics, Appalachian State University. "Ranking of the world's countries by 2014 total CO_2 emissions from fossil-fuel burning, cement production, and gas flaring. Emissions (CO_2_TOT) are expressed in thousand metric tons of carbon (not CO_2)." Available at https://cdiac.ess-dive.lbl.gov/trends/emis/top2014.tot. Accessed June 2019.

2 U.S. Energy Information Administration (EIA). "Table 4. 2016 State energy-related carbon dioxide emissions by sector." February 27, 2019. Available at https://www.eia.gov/environment/emissions/state/analysis/. Accessed June 2019.

3 Ebbs, Stephanie. "Scientists: Time running short before climate change effects are 'irreversible'." *ABC News*. October 8, 2018.

4 Intergovernmental Panel on Climate Change (IPCC). "Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty." 2018 at 61 and 447; Schär, Christoph. "The worst heat waves to come." *Nature Climate Change*. Vol. 6. February 2016 at 128 to 129.

5 National Interagency Coordination Center. "Wildland Fire Summary and Statistics Annual Report 2018." 2018 at 6.

6 U.S. Environmental Protection Agency (EPA). "What Climate Change Means for California." EPA 430-F-16-007. August 2016 at 2.

7 Food & Water Watch (FWW) analysis of permit data from January 8, 2019 through July 8, 2019, from the California Department of Conservation (CDC). Division of Oil, Gas, and Geothermal Resources (DOGGR). Available at ftp://ftp.consrv.ca.gov/pub/oil/weekly_summary/2019/. Accessed July 2019. FWW counted any permit for a new, reworked or deepened well in this summation. These drilling permits included: permits for new, reworked or deepened oil and gas, cyclic steam, injection, water disposal, steamflood, water flood, multi-purpose, gas storage and dry gas wells; Willon, Phil. "Gov. Gavin Newsom fires top official over fracking permits — but won't ban the oil wells." *Los Angeles Times*. July 12, 2019.

8 Willon (2019).

9 Diesendorf, Mark and Ben Elliston. "The feasibility of 100% renewable electricity systems: A response to critics." *Renewable and Sustainable Energy Reviews*. Vol. 93. 2018 at 318 and 320 to 323; Brown, T. W. et al. "Response to 'Burden of proof: A comprehensive review of the feasibility of 100% renewable-electricity systems.'" *Renewable and Sustainable Energy Reviews*. Vol. 92. 2018 at 840 and 841; Iaconangelo, David. "Cheap batteries could soon replace gas plants — study." *E&E News*. March 26, 2019; Schmidt, Oliver et al. "Projecting the future levelized cost of electricity storage technologies." *Joule*. Vol. 3. January 16, 2019 at 85 and 86.

10 Newsom, Gavin. "A sustainable world can start in California." Medium. December 5, 2017.

11 Bacher, Dan. "Governor Newsom recommits to closing Aliso Canyon gas facility, but doesn't commit to timeline." *Daily Kos*. June 1, 2019; Newsom, Gavin. Governor. California Budget 2019-20: May Revision 2019-20. May 9, 2019 at 73; Newsom (2017).

12 CDC. "Oil and Gas Production History in California." Accessed May 2019 at 2; Long, Jane C. S. et al. California Council on Science and Technology and Lawrence Berkeley National Laboratory. Prepared for the California Council on Science and Technology. "An Independent Scientific Assessment of Well Stimulation in California: Summary Report." July 2015 at 5.

13 CDC (2005) at 2 and 8; California Department of Finance (CDF). "California Budget 2019-20, Natural Resources Budget." January 2019 at PDF page 53.

14 Trout, Kelly. Oil Change International. "The Sky's Limit California: Why the Paris Climate Goals Demand That California Lead in a Managed Decline of Oil Extraction." May 2018 at 17; CDF (2019) at PDF page 53.

15 EIA. "California state energy profile." November 15, 2018; CDC. DOGGR. "Oil, gas and geothermal fields in California 2001." 2001; Long et al. (2015) at 5; Cooper, Christine and Shannon Sedgwick. Los Angeles County Economic Development Corporation Institute for Applied Economics. Prepared for Western States Petroleum Association. "The Oil and Gas Industry in California: Its Economic Contribution and Workforce in 2013. A California Industry Study." June 2015 at 13 and 16.

16 Long et al. (2015) at 3, 5, 16, 18 and 20; Hanzlik, E. J. et al. "Forty years of steam injection in California — The evolution of heat management." *Society of Petroleum Engineers International*. Vol. 84848. 2003 at 1; CDC. "Analysis of Oil and Gas Well Stimulation Treatments in California — 6. Overview of California's Oil and Gas Resources." June 2015 at 6-1, 6-12, 6-14 and 6-16; CDC (2005) at 7.

17 FWW analysis of CDC. DOGGR well data. "Division of Oil, Gas, and Geothermal Resources – Well search." Available at https://secure.conservation.ca.gov/WellSearch/. Accessed June 2019. FWW counted all active oil and gas-related wells in its analysis, which included wells identified with the code "OG" which indicated oil and gas, but also other codes that indicated well stimulation occurred, such as "SF" for steamflood, "WF" for water flood and so on.

18 EIA (2018); EIA. "Rankings: Crude oil production, March 2019 (thousand barrels.)" Available at https://www.eia.gov/state/rankings/#/series/46. Accessed June 2019.

19 CBD (2017) at 2.

20 Srebotnjak, Tanja and Miriam Rotkin-Ellman. Natural Resources Defense Council (NRDC). "Drilling in California: Who's at risk?" R:14-09-A. October 2014 at 4.

21 *Ibid.*; CBD. Prepared for Californians Against Fracking and Dangerous Drilling. "Fracking and Dangerous Drilling in California: Briefing Book." December 2017 at 9; Long et al. (2015) at 63 to 64.

22 Shamasunder, Bhavna et al. "Community-based health and exposure study around urban oil developments in South Los Angeles." *International Journal of Environmental Research and Public Health*. Vol. 15, Iss. 138. January 2018 at 1 to 3 and 14.

23 CBD (2017) at 2.

24 Willon (2019).

25 California Government Code § 8625; California Government Code §8567(a); Cal. Emergency Services Act, Government Code §§ 8550 et seq.

26 California Government Code § 8558(b).

27 Office of Governor Edmund G. Brown Jr. [Press release]. "Governor Brown declares drought State of Emergency." January 17, 2014.

28 California Government Code § 8558(b).

29 California Public Resources Code § 3106(a).

30 CDC (2015) at 6-1 and 6-14; CDC. DOGGR (2001).

31 Long et al. (2015) at 11.

32 Ferrar, Kyle. FracTracker Alliance. "Hydraulic Fracturing Stimulations and Oil Drilling Near California Schools and Within School Districts Disproportionately Burdens Hispanic and Non-White Students." 2014 at 1 and 8; Brown, Deb et al. American Lung Association. "State of the Air 2019." 2019 at 6 and 9; Billings, Paul G. et

al. American Lung Association. "State of the Air 2018." 2018 at 18; Billings, Paul G. et al. American Lung Association. "State of the Air 2017." 2017 at 15; Billings, Paul G. et al. "State of the Air 2016." 2016 at 14.

33 Concerned Health Professionals of New York, Physicians for Social Responsibility. "Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Gas and Oil Extraction) — Sixth Edition." June 2019 at 46, 68 and 69; Long et al. (2015) at 63 to 64; American Public Health Association (APHA). "The environmental and occupational health impacts of unconventional oil and gas industry." November 13, 2018 at 3.

34 EPA, Office of Research and Development (ORD). "Plan to study the potential impacts of hydraulic fracturing on drinking water resources." November 2011 at 15; American Petroleum Institute. "Freeing Up Energy. Hydraulic Fracturing: Unlocking America's Natural Gas Resources." July 19, 2010 at 1, 2 and 4.

35 EPA ORD (2011) at 15; U.S. Department of Energy (DOE). "Modern Shale Gas Development in the United States: A Primer." April 2009 at 56.

36 EPA. "Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources." EPA/600/R-11/122. November 2011 at 15, 42 and 43.

37 Jackson, Robert B. et al. "The depths of hydraulic fracturing and accompanying water use across the United States." *Environmental Science & Technology.* Vol. 49, Iss. 15. July 21, 2015 at 8971 and 8975.

38 Long et al. (2015) at 1, 3, 5 and 20.

39 Cart, Julie. "What happened to California regulators' vows to make steam injections safer?" *Los Angeles Times*. November 28, 2015; County of Santa Barbara Planning and Development. Energy Division. "Aera East Cat Canyon Oil Field Redevelopment, Draft Environmental Impact Report." November 2018 at 2-10 and 2-62; Dixon Risk Consulting. Prepared for Aera Energy LLC. "East Cat Canyon Oil Field Redevelopment Project. Quantitative Risk Assessment Update." March 2016 at 13 and 29; Cox, John. "State loosens 'fracking' ban near Taft." *Bakersfield Californian*. February 28, 2012.

40 Brandt, Adam. "Oil Depletion and the Energy Efficiency of Oil Production: The Case of California." *Sustainability*. Vol. 3. 2011 at 1833, 1834 and 1848; Gordon, Deborah and Samuel Wojcicki. Carnegie Endowment for International Peace. "Need to Know: The Case for Oil Transparency in California." March 15, 2017; Cooney, Gregory et al. "Updating the U.S. Life Cycle GHG Petroleum Baseline to 2014 With Projections to 2040 Using Open-Source Engineering-Based Models." *Environmental Science & Technology*. Vol. 51. November 22, 2016 at 982 and 983; Lattanzio, Richard K. Congressional Research Service. "Canadian Oil Sands: Life-Cycle Assessments of Greenhouse Gas Emissions." CRS report 7-5700. R42537. March 10, 2014 at Summary.

41 Cox (2012); Mukhametshina, Albina et al. "Asphaltene precipitation during bitumen extraction with expanding-solvent steam-assisted gravity drainage: Effects on pore-scale displacement." *SPE Journal*. April 2016 at 380, 381 and 383.

42 Mukhametshina et al. (2016) at 380, 381 and 383; National Academies of Sciences, Engineering, and Medicine (National Academies). (2016). *Spills of Diluted Bitumen From Pipelines: A Comparative Study of Environmental Fate, Effects and Responses*. Washington, DC: National Academies Press at 60; CDC. DOGGR. "Notice of Intent: Well Program for Lenox Well 4-83 Restarting an Idle Well." Well program for Lenox Well 4-83. Submitted by Vaca Energy LLC. February 6, 2014; U.S. EPA. [Fact sheet]. "Hydrochloric Acid (Hydrogen Chloride)." January 2000 at 1 to 2.

43 Cart (2015); U.S. Government Accountability Office (GAO). "Drinking Water: EPA Needs to Collect Information and Consistently Conduct Activities to Protect Underground Sources of Drinking Water." GAO-16-281. February 2016 at Highlights, 1, 39 and 40.

44 Thompson, Don. "Chevron spills 800k gallons of oil, water near Bakersfield." *Associated Press*. July 15, 2019.

45 County of Santa Barbara Planning and Development (2018) at 2-1; Dixon Risk Consulting (2016) at 13 and 29.

46 Allison, Bruce. "Squeezing more oil out." *McClatchy -Tribune Business News*. June 26, 2010; CDC. DOGGR. "Report of Property and Well Transfer: Oxnard Field, Ventura County." February 15, 2017.

47 Yamamura, Jean." Ventura says no to new cyclic-steam oil drilling." *Santa Barbara Independent*. June 11, 2019; Wilson, Kathleen. "With no answers, drilling moratorium extended six months." *Ventura County Star*. June 6, 2019.

48 Long et al. (2015) at 2 and 11.

49 *Ibid*. at 1, 3 and 4.

50 Mohsin Yousufi, Muhammad et al. "Synthesis and evaluation of Jatropha oil-based emulsified acids for matrix acidizing of carbonate rocks." *Journal of Petroleum Exploration and Production Technology*. 2018 at 1 and 2.

51 Pourabdollah, Kobra. "Matrix acidizing: a fouling mitigation process in oil and gas wells." *Review of Chemical Engineering*. 2018 at 5 and 17; Carvalho, Raissa T. R. et al. "Prospective acid microemulsions development for matrix acidizing petroleum reservoirs." *Fuel*. Vol. 238. 2019.

52 Long et al. (2015) at 17.

53 Adgate, John L. et al. "Potential public health hazards, exposures and health effects from unconventional natural gas development." *Environmental Science & Technology*. Vol. 48, Iss. 15. 2014 at 8313.

54 EPA. "Hydraulic Fracturing for Oil and Gas: Impacts From Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States." EPA-600-R-16-236Fa. December 2016 at ES-10 and 3-24.

55 *Ibid*. at 3-23 and 8-1.

56 Lustgarten, Abrahm. "Injection wells: The poison beneath us." ProPublica. June 21, 2012; Keranen, K. M. et al. "Sharp increase in central Oklahoma seismicity since 2008 induced by massive wastewater injection." *Science*. July 3, 2014 at 1 and 2.

57 Sommer, Lauren. "How much drinking water has California lost to oil industry waste? No one knows." *KQED Science*. August 3, 2017.

58 Shonkoff, Seth B. C. et al. PSE Healthy Energy Inc. University of California, Berkeley. Lawrence Berkeley National Laboratory. University of the Pacific. "Hazard Assessment of Chemical Additives Used in Oil Fields That Reuse Produced Water for Agricultural Irrigation, Livestock Watering, and Groundwater Recharge in the San Joaquin Valley of California: Preliminary Results." September 2016 at 4.

59 Sommer (2017).

60 *Ibid*.

61 GAO (2016) at 29, 39 and 44; Bohlen, Steve and Jonathan Bishop. State Oil and Gas Supervisor, Division of Oil, Gas and Geothermal Resources, Chief Deputy Director, State Water Resources Control Board. Letter to Jane Diamond, Director of Water Division, U.S. EPA Region IX. February 6, 2015 at 2.

62 Shonkoff, Seth B. C. PSE Healthy Energy. University of California Berkeley. Lawrence Berkeley National Lab. "Oil and Gas Wastewater Reuse in California: Considerations and Risks." May 31, 2018 at 4; Sommer (2017).

63 EPA. "EPA oversight of California's underground injection control (UIC) program." Available at https://www.epa.gov/uic/epa-oversight-californias-underground-injection-control-uic-program. Accessed July 2019.

64 Bohlen and Bishop (2015) at 4, 28 and Enclosure B; Williams, Das. Chair. Assembly Committee on Natural Resources. "Oil and gas: groundwater monitoring." April 27, 2015 at 6.

65 Long et al. (2015) at 46 and 47.

66 *Western States Petroleum Association, California Independent Petroleum Association, and Independent Oil Producers Agency v. California Department of Conservation, Division of Oil, Gas and Geothermal Sources*. January 10, 2017 at 2.

67 14 CCR § 1779.1, Deadlines for Obtaining Aquifer Exemption; Harris, Kenneth A. Jr. and Jonathan Bishop. State Oil and Gas Supervisor

& Chief Deputy Director. Department of Conservation, Division of Oil, Gas & Geothermal Resources, State Water Resources Control Board. Letter to Michael Montgomery, U.S. EPA Region IX. January 17, 2017 at 5; Wheeling, Kate and Jim Morris. "Big oil's black mark on California's climate record." *Pacific Standard*. September 12, 2018.

68 Harris and Bishop (2017) at 3, 4 and 5; Wheeling and Morris (2018).

69 Wheeling and Morris (2018); CDF (2019) at PDF page 53.

70 *Western States Petroleum Association, California Independent Petroleum Association, and Independent Oil Producers Agency vs. California Department of Conservation, Division of Oil, Gas and Geothermal Sources*. Case No. BCV-17-100128. January 10, 2017 at 1; *Western States Petroleum Association, California Independent Petroleum Association, and Independent Oil Producers Agency v. California Department of Conservation, Division of Oil, Gas and Geothermal Sources*. Case No. BCV-17-100128. Notice of Entry of Order Granting Plaintiffs' Motion for Preliminary Injunction. March 20, 2017 at 1; 14 CCR § 1779.1, Deadlines for Obtaining Aquifer Exemption.

71 FWW email correspondence with CDC. DOGGR. July 2019. On file with FWW; EPA. "Site-specific Aquifer Exemption Information." April 2019. Available at https://www.epa.gov/uic/aquifer-exemption-data. Accessed July 2019; CDC. DOGGR. Aquifer Exemption Application Status. Last updated July 2, 2019. Available at https://www.conservation.ca.gov/dog/Pages/Aquifer-Exemptions-Status.aspx. Accessed July 2019.

72 EPA (April 2019).

73 California Water Boards. [Fact sheet]. "Frequently Asked Questions About Recycled Oilfield Water for Crop Irrigation." February 15, 2019.

74 Shonkoff (2016) at 13; DiGiulio, Dominic and Seth Shonkoff. "Is reuse of produced water safe? First, let's find out what's in it." *EM*. August 2017 at 4.

75 22 California Code of Regulations §§ 60304(a) and 60304(b).

76 Heberger, Matthew and Kristina Donnelly. Pacific Institute. "Oil, Food and Water: Challenges and Opportunities for California Agriculture." December 2015 at 3; DiGiulio and Shonkoff (2017) at 4; Shariq, Linsey. "Uncertainties associated with the reuse of treated hydraulic fracturing wastewater for crop irrigation." *Environmental Science & Technology*. Vol. 47. February 2013 at 2435.

77 Enviro-Tox Services, Inc. "Root Crop Sampling and Analysis Technical Memorandum." November 2, 2016 at 1 to 2; Enviro-Tox Services, Inc. "Citrus Crop Sampling & Analysis Report." October 11, 2016 at iii to iv.

78 Enviro-Tox Services, Inc. "Irrigation Water Quality Evaluation." April 7, 2016 at iii, iv, 20, and 1/99 to 9/99; Shonkoff (2016) at 8.

79 Heberger and Donnelly (2015) at 3.

80 EIA. "Form EIA-860 Data — Schedule 3, 'Generator Data' (Operator Units Only.)" Available at https://www.eia.gov/electricity/data/eia860/. Accessed September 2019. Note: The fuel source for each power plant was determined by looking at its primary fuel source (column "energy source 1" in the data). Some power plants have multiple generators that do not all use the same fuel. For example, of the 298 natural gas-fired power plants, 22 had generators that also relied on another fuel source for its primary fuel, which included oil, landfill gas, other gases, and solar. The same goes for petroleum-fired power plants, as 5 of them also had one or more generator that relied on natural gas as a fuel.

81 CDC. DOGGR. "Underground Gas Storage Data." Available at https://www.conservation.ca.gov/dog/gas-storage-disclosure/Pages/default.aspx. Accessed July 2019; DOE. "State of California — Energy Sector Risk Profile." 2015 at 4 and 6.

82 EIA (Accessed September 2019).

83 Shalizi, Z. and F. Lecocq. World Bank. Development Economics. "Climate Change and the Economics of Targeted Mitigation in Sectors With Long-Lived Capital Stock." Policy Research Working Paper. No. 5063. September 2009 at 4 to 6; European Systemic Risk Board. "Too Late, Too Sudden: Transition to a Low-Carbon Economy and Systemic Risk." Reports of the Advisory Scientific Committee. No. 6. February 2016 at 11 and 12; Pfeiffer, Alexander et al. "The '2°C Capital Stock' for Electricity Generation: Committed Cumulative Carbon Emissions From the Power Sector and the Transition to a Green Economy." INET Oxford Working Paper No. 2015-09. January 2016 at 1.

84 The Texas Eastern Transmission pipeline was built during World War II and still is a major Gulf Coast to East Coast gas transmission route; Texas Eastern Transmission Corp. "The Big Inch and Little Big Inch Pipelines." 2000 at 1 to 2; Enbridge Inc. U.S. Securities and Exchange (SEC). Filing 10-K. Fiscal year ending December 31, 2017 at 20; FWW analysis of EIA data from EIA-860 2016. The average age of U.S. gas-fired power generators is 26 years, but 743 (13 percent) began operating before 1970, fifty years ago, and the oldest gas plant went online in 1915.

85 Penn, Ivan and Ryan Menezes. "Californians are paying billions for power they don't need." *Los Angeles Times*. February 5, 2017.

86 Brown et al. (2018) at 834 to 835 and 842.

87 Penn and Menezes (2017).

88 See FWW. "Fracking Endgame: Locked into Plastics, Pollution and Climate Chaos." June 2019.

89 Tong, Dan et al. "Committed emissions from existing energy infrastructure jeopardize 1.5 °C climate target." *Nature*. July 2019 at 1 to 2.

90 Schwartz, Lisa et al. "SEE Action Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution and Meet Energy Needs in the Power Sector." DOE. State & Local Energy Efficiency Action Network. February 2016 at 11.

91 Miller, Paul J. and Chris Van Atten. Prepared for the Secretariat of the Commission for Environmental Cooperation of North America. "North American power plant air emissions." 2004 at 1; Massetti, Emanuele et al. Prepared by Oak Ridge National Laboratory for the U.S. DOE. "Environmental quality and the U.S. power sector: Air quality, water quality, land use and environmental justice." January 4, 2017 at vii and 5 to 7.

92 Massetti et al. (2017) at 7, 11 and 12.

93 Kampa, Marilena and Elias Castanas. "Human health effects of air pollution." *Environmental Pollution*. Vol. 151, Iss. 2. January 2008 at 364; EPA. Office of Air Quality, Planning and Standards. "NO_x: How nitrogen oxides affect the way we live and breathe." EPA-456/F-98-005. September 1998 at 2; EPA. "Overview of the human health and environmental effects of power generation: Focus on sulfur dioxide (SO_2), nitrogen oxides (NO_x) and mercury (Hg)." June 2002 at Slides 5 and 6.

94 Casey, Joan A. et al. "Retirements of coal and oil power plants in California: Association with reduced preterm birth among populations nearby." *American Journal of Epidemiology*. Vol. 187, No. 8. May 2018 at 1586, 1590, 1592.

95 Physicians, Scientists, and Engineers for Healthy Energy (PSEHE). [Research brief]. "Natural gas power plants in California's disadvantaged communities." April 2017 at 2.

96 International Energy Agency. "Energy and air pollution: World energy outlook special report." 2016 at 43 and 227; California Environmental Protection Agency (CalEPA). Air Resources Board. Stationary Sources Division. "Report to the legislature: Gas-fired power plant NOx emission controls and related environmental impacts." May 2004 at 6; Massetti et al. (2017) at 7, 11 and 12; EPA. Clean Air Markets Division, Office of Air and Radiation. "Acid rain program. 2005 progress report." EPA-430-R-06-015. October 2006 at 2; EPA (2002) at Slides 5 and 6.

97 Colborn, Theo et al. "Natural gas operations from a public health perspective." *International Journal of Human and Ecological Risk Assessment*. September 2011 at 1042; Wong, Chit Ming et al. "Cancer mortality risks from long-term exposure to ambient fine particle." *Cancer Epidemiology, Biomarkers & Prevention*. May 2016 at 839.

98 Salam, Muhammad T. et al. "Birth outcomes and prenatal exposure to ozone, carbon monoxide, and particulate matter: Results from

the Children's Health Study." *Environmental Health Perspectives*. Vol. 113, No. 11. November 2005 at 1638 and 1643; Bravender, Robin. "Study links smog exposure to premature death." *New York Times*. March 12, 2009.

99 Ericson, J. E. and P. G. Pham. "Radon levels in combustion stream of a natural gas incinerator power plant." *Bulletin of Environmental Contamination and Toxicology*. Vol. 66, Iss. 1. 2001 at 59; Tsyplenkov, V. International Atomic Energy Agency. "Electricity production and waste management: Comparing the options." *International Atomic Energy Agency Bulletin*. 1993 at 29.

100 EPA. "A citizen's guide to radon. The guide to protecting yourself and your family from radon." EPA-402/K-12/002. May 2012 at 3; Khan, M. S. A. "Study of radon gas diffusion and its permeability through some building construction materials by using SSNTD technique." *International Journal of Science and Research*. Vol. 6, Iss. 3. March 2017 at 1599.

101 EPA. Environmental Justice Screening and Mapping Tool. Available at https://ejscreen.epa.gov/mapper/. Accessed April 2017; CalEPA. Office of Environmental Health Hazard Assessment. California Environmental Health Screening Tool: CalEnviroScreen 3.0. Available at https://oehha.maps.arcgis.com/apps/webappviewer/index.html?id=4560cfbce7c745c299b2d0cbb07044f5. Accessed April 2017; Pastor, Manuel et al. Center for Justice, Tolerance & Community. University of California Santa Cruz. Prepared for the Bay Area Environmental Health Collaborative. "Still Toxic After All These Years. Air Quality and Environmental Justice in the San Francisco Bay Area." February 2007 at 6; Wilson, Sacoby M. et al. "Assessment of the distribution of toxic release inventory facilities in metropolitan Charleston: An environmental justice case study." *American Journal of Public Health*. Vol. 102, No. 10. October 2012 at 1976.

102 Office of Eric Garcetti. Mayor of Los Angeles. [Press release]. "Mayor Garcetti: LADWP will phase out natural gas operations at three power plants." February 12, 2019; FWW. [Fact sheet]. "Los Angeles: Stop Investing in Fossil Fuels!" May 2017 at 1 and Table 1 on 2; Cota-Robles, Marc. "Garcetti announces decision to forgo plans to rebuild coastal natural-gas plants." ABC 7. February 12, 2019.

103 Michanowicz, Drew. "The Aliso Canyon gas leak was a disaster. There are 10,000 more storage wells out there just like it." *Los Angeles Times*. May 14, 2018.

104 *Ibid*.; McNary, Sharon. "Like Porter Ranch, neighborhoods in Playa del Rey, Montebello sit near aging gas wells." *Southern California Public Radio. 89.3 KPCC-Southern California*. February 24, 2016.

105 Abram, Susan. "LA doctor sounds alarm over effects of Aliso Canyon gas leak." *Los Angeles Daily News*. February 5, 2017; Garcia-Gonzales, Diane A. et al. "Associations among particulate matter, hazardous air pollutants and methane emissions from the Aliso Canyon natural gas storage facility during the 2015 blowout." *Environment International*. June 26, 2019 at 1 and 2.

106 Khan, Amina. "Porter Ranch leak declared largest methane leak in U.S. history." *Los Angeles Times*. February 25, 2016; Los Angeles Times Editorial Board. "The largest methane leak in U.S. history began one year ago at Aliso Canyon. What have we learned since then?" *Los Angeles Times*. October 22, 2016; California Air Resources Board. "Aliso Canyon Methane Leak Climate Impacts Mitigation Program." March 31, 2016 at 4 and 6; Garcia-Gonzales et al. (2019) at 1.

107 Khan (2016); Los Angeles Times Editorial Board (2016).

108 "SoCalGas announces $119.5 million gas leak settlement." *Environmental Protection Online*. August 8, 2018.

109 "Investigators fault Southern California Gas in Aliso Canyon methane leak." *Associated Press*. May 17, 2019.

110 Garcia-Gonzales et al. (2019) at 1 and 2.

111 *Parris Law Firm, Panish Shea & Boyle, LLP and Morgan & Morgan v. Southern California Gas Company, Sempra Energy and DOES*. Case No. 18STCV00854. (State of California. 2018). at 1 and 5; Grigoryants, Olga. "LA firefighters sue SoCalGas, alleging toxic chemicals from 2015 Aliso Canyon gas leak made them sick." *Los Angeles Daily News*. November 21, 2018.

112 Barboza, Tony. "Brown declares state of emergency at Porter Ranch amid massive gas leak." *Los Angeles Times*. January 6, 2016.

113 Scauzillo, Steve. "3 years since the Aliso Canyon gas leak, almost half the wells in the storage field near Porter Ranch are shut down." *Los Angeles Daily News*. October 22, 2018; Megerian, Chris. "Proposal would close Aliso Canyon — but not for a decade." *Los Angeles Times*. September 14, 2017; Bacher (2019).

114 Baker, David. "PG&E closes gas storage field in delta after finding leaks." *San Francisco Chronicle*. July 7, 2016.

115 McNary (2016).

116 South Coast Air Quality Management District. "Facility information detail: SoCalGas Co Playa del Rey storage facility, 2013-2017." Available at http://www3.aqmd.gov/webappl/fim/prog/search.aspx. Accessed April 2018; EPA. Enforcement and Compliance History Online. "Southern California Gas Company, 8141 Gulana Avenue, Playa del Rey, CA 90293." Available at https://echo.epa.gov. Accessed April 2018.

117 Tomareva, A. et al. "Impact of pipeline construction on air environment." *IOP Conference Series: Materials Science and Engineering*. Vol. 262. 2017 at 5 and 6; Williams, Tim. Library of Parliament of Canada, Industry, Infrastructure and Resources Division, Parliamentary Information and Research Service. "Pipelines: Environmental Considerations." 2012-37-E. July 5, 2012 at 2 and 3.

118 U.S. Department of Transportation (DOT). Pipelines and Hazardous Materials Safety Administration (PHMSA). "Pipeline incident 20 year trend." Available at https://www.phmsa.dot.gov/. Accessed June 17, 2019.

119 Kunkel, Cathy and Tom Sanzillo. Institute for Energy Economics and Financial Analysis. "Risks Associated With Natural Gas Pipeline Expansion in Appalachia. Proposed Atlantic Coast and Mountain Valley Pipelines Need Greater Scrutiny." April 2016 at 14 and 15.

120 Sweet, Cassandra. "PG&E fined $3 million, ending San Bruno explosion case." *Wall Street Journal*. January 26, 2017; Egelko, Bob. "Relatives criticize PG&E for 2010 pipeline blast that killed 8." SFGate. January 23, 2017; Fuller, Thomas. "California utility found guilty of violations in 2010 gas explosion that killed 8." *New York Times*. August 9, 2016.

121 Wagner, Laura. "Pipeline company indicted over 2015 California oil spill." *NPR*. May 17, 2016; "Pipeline firm gets $3.3-million fine for worst California oil spill in 25 years." *Associated Press*. April 25, 2019.

122 "Pipeline firm gets $3.3-million fine for worst California oil spill in 25 years" (2019).

123 Vaughan, Monica. "A new 124-mile oil pipeline is planned on the Central Coast. Here's what you need to know." *San Luis Obispo Tribune*. January 31, 2019.

124 Tanigawa, Sara. Environmental and Energy Study Institute (EESI). "Biogas: Converting Waste to Energy." October 2017 at 1; EPA. "How does AD work?" Available at https://www.epa.gov/anaerobic-digestion/basic-information-about-anaerobic-digestion-ad. Accessed April 2019.

125 SoCalGas. "Biogas and renewable natural gas." Available at https://www. socalgas.com/smart-energy/renewable-gas/biogas-and-renewablenatural-gas. Accessed December 2017.

126 EESI (2017) at 1; EPA (Accessed April 2019).

127 U.S. Department of Agriculture (USDA) et al. "Biogas Opportunities Roadmap." August 2014 at 6; Jørgensen, Peter Jacob. (2009). *Biogas — Green Energy*. Denmark: Faculty of Agricultural Sciences, Aarhus University at 4.

128 Jackson (2015) at 2051.

129 Kuo, Jeff. California State University, Fullerton. "Air Quality Issues Related to Using Biogas From Anaerobic Digestion of Food Waste." February 2015 at 2; Sharvelle, S. and L. Loetscher. Colorado State

University. "Anaerobic Digestion of Animal Wastes in Colorado." May 2011 at 1 and 3; Whiting, Andrew and Adisa Azapagic. "Life cycle environmental impacts of generating electricity and heat from biogas produced by anaerobic digestion." *Energy.* Vol. 70. 2014 at 181, 184, 187 and 191 to 192.

130 Ca. Pub. Res. Code §25741(a)(1) and Ca. Pub. Util. Code §399.12(e); USDA et al. (2014) at 8.

131 EIA (Accessed September 2019).

132 EPA. "AgSTAR livestock anaerobic digester database." January 2019. Available at https://www.epa.gov/agstar/livestock-anaerobic-digester-database. Accessed July 2019.

133 Miller-Coleman, Nicole. "Perris facility to meet state's environmental goals." *San Diego Union-Tribune.* July 29, 2017.

134 Hendrickson, Bill. "Burning of methane at Scholl Canyon raises questions anew." *Boulevard Sentinel.* November 30, 2018; Scauzillo, Steve. "Methane burn-off at Scholl Canyon Landfill angers Pasadena, Glendale and La Cañada Flintridge residents." *Pasadena Star-News.* April 11, 2019.

135 Brown et al. (2019) at 4, 6 to 7 and 19 to 20; Danelski, David. "Los Angeles area's air quality the deadliest in the nation, researchers say." *Press-Enterprise.* August 11, 2016.

136 Stantec Consulting Services Inc. Prepared for City of Glendale Water and Power. "Final Environmental Impact Report, Grayson Repowering Project." March 1, 2018 at 3.1.

137 "Eagle Rock raising a stink over Glendale's biogas plant." *Eastsider.* November 16, 2017.

138 Ashton, Adam and Andrew Sheeler. "Turning poop into power: California dairies appeal for more state climate change money." *Sacramento Bee.* May 29, 2019; Newsom (2019) at 75.

139 Schmalz, David. "An anaerobic digester gets slapped with county permit violations, but operators say it's all hot air." *Monterey County Weekly.* February 21, 2019; Schmalz, David. "Complaints about foul smells in Marina are on the rise. Finding the source is a conundrum." *Monterey County Weekly.* December 27, 2018.

140 Grosh, Brian. "Bio-energy plant's neighbors cry foul." *Courthouse News.* May 11, 2017; Stokley, Sandra. "Eastvale: Homeowners want stinky issue to go away." *Press-Enterprise.* June 21, 2015; Hood, Grace. "Fed up with the smell, neighbors want the Weld County biogas project shut down." *Colorado Public Radio.* December 16, 2016; Marmaduke, Jacy. "Waste-to-energy facility brings smelly complications." *Coloradoan.* January 15, 2017.

141 Ashton and Sheeler (2019); CalEPA. "Facts about: California's climate plan." September 25, 2010 at 2; Lee, Hyunok and Daniel A. Sumner. "Dependence on policy revenue poses risks for investments in dairy digesters." *California Agriculture.* Vol. 72, No. 4. October-December 2018 at 226 to 230.

142 Natural Gas Vehicles for America. [Press release]. "LA Metro awards contract for 195 new natural gas buses." June 22, 2017; Clean Energy Fuels. [Press release]. "LA Metro awards multi-year contract for Clean Energy's Redeem™ renewable natural gas to fuel nation's largest CNG bus fleet." May 26, 2017.

143 Jackson (2015) at 2051.

144 Lucas, Jim. Southern California Gas. Sempra Energy. "Renewable natural gas and interconnecting to the SoCalGas pipeline." PR1118.1 Working Group Meeting. October 24, 2017 at 6, 9, 11 and 14.

145 CalEPA. "History: Anaerobic digesters at dairies in California." Available at https://calepa.ca.gov/digester/history/. Accessed March 2019; "Five new Central Valley dairy digesters to capture methane, generate renewable energy." *Dairy Cares Newsletter.* July 2015; California Department of Food and Agriculture (CDFA). Dairy Digester Research and Development Program. "Report of Funded Projects (2015-18)." January 2019 at 3.

146 Lee and Sumner (2018) at 230.

147 CDFA (2019) at 3.

148 Ashton and Sheeler (2019).

149 Flesch, Thomas K. et al. "Fugitive methane emission from an agricultural biodigester." *Biomass and Bioenergy.* 2011 at 3927; Verburg, Steve. "Blast destroys roof of troubled biodigester near Waunakee." *Wisconsin State Journal.* August 6, 2014.

150 EPA. "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017." 430-R-19-001. April 11, 2019 at 2-18 and 2-19.

151 FWW calculation comparing human and livestock waste production based on EPA (2004) at 9. The average human produces 183 pounds of manure annually compared to 30,000 pounds for 1,000 pounds of live weight dairy cow (which is one dairy cow animal unit). Every dairy cow animal unit produces 163.9 times more manure than an average person. FWW multiplied the number of dairy cow animal units on operations of over 500 cows in each county by 163.9 to come up with a human sewage equivalent. The U.S. EPA reports that "A dairy CAFO with 1,000 animal units is equivalent to a city with 164,000 people," which means that one dairy animal unit is equivalent to 164 people, which matches FWW's calculations. The human sewage equivalent was compared to the U.S. Census Bureau figures for metropolitan area population estimates. U.S. Census Bureau. "Annual Estimates of the Population of Metropolitan and Micropolitan Statistical Areas: April 1, 2000 to July 1, 2012." CBSA-EST2012-01.

152 Mathias, João Felippe Cury Marinho. "Manure as a resource: Livestock waste management from anaerobic digestion, opportunities and challenges for Brazil." *International Food and Agribusiness Management Review.* Vol. 17, Iss. 4. 2014 at 88.

153 Baldino, Chelsea et al. International Council on Clean Transportation. "The Potential for Low-Carbon Renewable Methane in Heating, Power, and Transport in the European Union." Working Paper 2017-26. October 2018 at 9.

154 Smithfield Foods. [Press release]. "Smithfield Foods announces landmark investment to reduce greenhouse gas emissions." October 25, 2018.

155 Kaiser Health News. "ER visits for asthma rising among kids in California." *U.S. News and World Report.* May 30, 2015; EPA. [Press release]. "EPA resolves air violations with thermal energy development partnership in Tracy, California for $145,000." January 28, 2013.

156 Rogers, Paul. "Waste Management faces $882,200 fine in connection with San Jose landfill pollution." *Mercury News* (CA). August 13, 2016.

157 California Department of Resources Recycling and Recovery. "Landfill Gas Investigations at Former Landfills and Disposal Sites." February 2015 at 3 and 6.

158 Sempra Energy. [Press release]. "SoCalGas unveils "Natural Gas Is Clean, Renewable and Affordable" display at World Agricultural Expo in Tulare." February 11, 2019; SoCalGas. [Press release]. "Renewable natural gas now flowing into SoCalGas pipelines from Calgren dairy digestor pipeline cluster." February 14, 2019; Haines, Deanna. SoCalGas/SDG&E. Presentation. "Getting the facts on renewable natural gas." Presented at 2018 Natural Gas STAR and Methane Challenge Renewable Natural Gas Workshop. Fort Worth, Texas. October 23, 2018 at 13.

159 Sempra Energy (2019); SoCalGas (February 14, 2019); SoCalGas. [Press release]. "SoCalGas announces vision to be cleanest natural gas utility in North America." March 6, 2019.

160 SoCalGas (March 6, 2019).

161 Sempra Energy. U.S. Securities and Exchange Commission. Form 10-K. Fiscal year ending December 31, 2017 at 11 and 16 to 17; Sempra Energy. "Investing for the Future: 2017 Annual Report." 2018 at 1 and 4 to 5.

162 Sempra Energy (2019).

163 SoCalGas (February 14, 2019).

164 *Ibid.*

165 Natural Gas Vehicles for America (2017); Clean Energy Fuels (2017).

166 SoCalGas. Sempra Energy. "Power-to-gas technology." Available at https://www.socalgas.com/smart-energy/renewable-gas/power-to-gas. Accessed August 2018.

167 Sempra Energy. [Press release]. "SoCalGas power-to-gas project selected by U.S. Department of Energy's National Renewable Energy Laboratory to receive funding." April 24, 2017.

168 Eveloy, Valerie and Tesfaldet Gebreegziabher. "A review of projected power-to-gas deployment scenarios." *Energies*. Vol. 11, No. 1824. 2018 at 45; Oxford Institute for Energy Studies. "Power-to-Gas: Linking Electricity and Gas in a Decarbonising World." October 2018 at 2 and 10.

169 Abraham, John. "Study: wind and solar can power most of the United States." *The Guardian* (U.K.). March 26, 2018; Berke, Jeremy. "One simple chart shows why an energy revolution is coming — and who is likely to come out on top." *Business Insider*. May 8, 2018.

170 SoCalGas. Sempra Energy. [Press release]. "SoCalGas statement on LA Metro approval of renewable natural gas purchase." May 25, 2017; SoCalGas. Sempra Energy. "Find out why LA Metro is the largest transit property in the U.S. to fully switch to CNG." Available at https://www.socalgas.com/for-your-business/natural-gas-vehicles/Metro. Accessed August 2018; SoCalGas. Sempra Energy. "Learn why Culver City is planning to replace all diesel-fueled city vehicles with CNG." Available at https://www.socalgas.com/for-your-business/natural-gas-vehicles/Culver-City-Bus. Accessed August 2018; SoCalGas. Sempra Energy. [Press release]. "SoCalGas to offer renewable natural gas at its fueling stations for the first time." September 17, 2018.

171 Xu, Yanzhi et al. "Assessment of alternative fuel and powertrain transit bus options using real-world operations data: Life-cycle fuel and emissions modeling." *Applied Energy*. 2015 at 153 and 154.

172 Scott Institute for Energy Innovation. Carnegie Mellon University. "Policymaker Guide: Which Alternative Fuel Technology Is Best for Transit Buses?" January 2017 at Table 4 at 27; EPA. "Technical Bulletin: Nitrogen Oxides (NOx), Why and How They Are Controlled." EPA 456/F-99-006R. November 1999 at 1; Xu et al. (2015) at 146, 153 and 154.

173 Union of Concerned Scientists. "Methodology for Heavy-Duty Vehicle Emissions Analysis." 2017 at Table C-9.

174 SoCalGas. Sempra Energy. "What is renewable natural gas?" Available at https://www.socalgas.com/smart-energy/renewable-gas/what-is-renewable-natural-gas. Accessed August 2018.

175 Howarth, Robert W. et al. "Methane and the greenhouse-gas footprint of natural gas from shale formations." *Climatic Change*. April 2011 at 679, 687 and 688; Howarth, Robert W. "A bridge to nowhere: Methane emissions and the greenhouse gas footprint of natural gas." *Energy Science & Engineering*. 2014 at 1 and 2; Jackson (2015) at 2051; Lavoie, Tegan N. et al. "Assessing the methane emissions from natural gas-fired power plants and oil refineries." *Environmental Science & Technology*. Vol. 52. February 21, 2017 at 3373.

176 Domonoske, Camila. "California sets goal of 100 percent clean electric power by 2045." *NPR*. September 10, 2018.

177 California Energy Commission (CEC). "Commission Guidebook: Renewables Portfolio Standard Eligibility." Ninth edition. CEC-300-2016-006-ED9-CMF. January 2017 at 5 and 79; CEC. "Commission Guidebook: Renewables Portfolio Standard Eligibility." CEC-300-2015-001-ED8-CMF. June 2015 at 6; California Public Resource Code (Ca. Pub. Res. Code) §25741(a)(1) and §40106(a)(2-5); Ca. Pub. Util. Code §399.12(e) and §399.21.

178 Carbon neutral refers to electricity primarily provided by wind, solar and existing hydro.

179 Unruh, Gregory and Javier Carrillo-Hermosilla. "Globalizing carbon lock-in." *Energy Policy*. Vol. 34. 2006 at 1186; Brown et al. (2018) at 834 and 842.

180 Jacobson, Mark Z. et al. "A roadmap for repowering California for all purposes with wind, water, and sunlight." *Energy*. Vol. 73. August 2014 at 883.

181 Jones, Betony et al. University of California, Berkeley. "The Economic Impacts of California's Major Climate Programs on the San Joaquin Valley: Analysis Through 2015 and Projections Through 2030." January 19, 2017 at 10.

182 DOE. "U.S. Energy and Employment Report — State Charts." January 2017 at PDF page 26 to 28.

183 Lehmann, Sarah et al. Environmental Entrepreneurs (E2) and E4TheFuture. "Energy Efficiency Jobs in America." December 2016 at 8 and 14.

184 Jacobson (2014) at Abstract.

185 FWW analysis of EIA data. "Net generation for all sectors — California." Available at https://www.eia.gov/electricity/data/browser/. Accessed June 2019. Jacobson (2014) at 875.

186 National Association of State Energy Officials and Energy Futures Initiative. "Energy and Employment by State — 2019." 2019 at PDF page 33.

187 Jacobson (2014) at 882.

188 CEC. "2019 Building Energy Efficiency Standards." March 2018 at 2; Beitsch, Rebecca. "California warms to solar homes; Other states may give a cold shoulder." *Stateline*. February 4, 2019; Daniels, Jeff. "California clears final hurdle for state's landmark solar panel mandate for new homes." *CNBC*. December 6, 2018.

189 Beitsch (2019).

190 American Wind Energy Association. [Fact sheet]. "California wind energy." Updated July 2019 at 1; Advanced Energy Economy Institute and BW Research Partnership. "Advanced energy jobs in California. Results of the 2016 California Advanced Energy Employment Survey." 2016 at 4.

191 Ramdas, Ashwin et al. National Renewable Energy Laboratory. "California Time-of-Use (TOU) Transition: Effects on Distributed Wind and Solar Economic Potential." NREL/TP-6A20-73147. April 2019 at 6 and 30.

192 Pollin, Robert and Brian Callaci. Political Economy Research Institute, University of Massachusetts Amherst. "The Economics of Just Transition: A Framework for Supporting Fossil Fuel-Dependent Workers and Communities in the United States." October 2016 at Abstract, 21, 22 and 26.

193 Newsom (2019) at 73; Newsom (2017).

194 Office of Governor Gavin Newsom. "Governor Newsom delivers state of the state address." February 12, 2019.

The Fracking Endgame:

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