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**Proposed Changes to
Final 2017 Integrated Energy Policy Report**

**For Consideration at the February 21, 2018
California Energy Commission Business Meeting**

Page numbers refer to the report posted on January 26, 2018, that does not show changes in underline-strikeout (docket number 17-IEPR-01, TN# 222377). Added text is shown in underline; ~~deleted text shown in strikeout~~.

Executive Summary, page 1, second paragraph:

California must continue to lower its greenhouse gas emissions to help reduce the risk of the most dangerous impacts of climate change. Because many greenhouse gases remain in circulation for decades, past emissions have already created climate change and more is unavoidable. If emissions continue on the current path, more destructive impacts are anticipated – such as continued large wildfires, additional sea-level rise, reduced snowpack, increased subsidence due to groundwater withdrawal, and more frequent heat waves, major storms, and drought. Californians are already facing the impacts of climate change. For example, about half of the 20 largest wildfires in California burned in the last decade with six ~~seven~~ of the state’s largest, deadliest, and most destructive wildfires in 2017 alone. (See Figure ES-1.)

Executive Summary, page 6:

Advance Transportation Electrification

SB 350 also emphasizes transportation electrification as a key part of California’s low-carbon energy future. This emphasis builds on policies such as Governor Brown’s Executive Order B-16-12, which set a target for California to have 1.5 million ZEVs on the road by 2025. In 2014, Senate Bill 1275 (De León, Chapter 530, Statutes of 2014) established the goal of placing 1 million zero-emission and near-zero-emission vehicles in service by January 1, 2023, while providing increased access to these vehicles for disadvantaged, low-income, and moderate-income communities and consumers. In 2017, CARB’s proposed Climate Change Scoping Plan Update included a goal of 4.2 million ZEVs by 2030.

On January 26, 2018, Governor Brown issued Executive Order B-48-18, setting a new target for 5 million ZEVs on California’s roads by 2030. The new executive order also sets a target of installing 200 hydrogen fueling stations and 250,000 ZEV chargers, including 10,000 direct current fast chargers, by 2025.

Executive Summary, top of page 10:

Through the ~~third~~ fourth quarter of 2017, the Western Energy Imbalance Market has provided gross benefits of \$255 about \$288 million, avoided curtailment of more than 502 520 gigawatt-

hours of renewable energy, and reduced greenhouse gas emissions by ~~almost 215,000~~ more than 222,600 tons of carbon dioxide equivalent emissions.

Executive Summary, page 10 - 11:

In response to Senate Bill 1383 (Lara, Chapter 395, Statutes of 2016), CARB approved and began implementing a comprehensive short-lived climate pollutant (SLCP) strategy in March 2017 that includes strategies to reduce statewide methane emissions 40 percent below 2013 levels by 2030. SB 1383 also requires the Energy Commission, in consultation with CARB and the CPUC, to “develop recommendations for the development and use of renewable gas, including biomethane and biogas as part of its *2017 Integrated Energy Policy Report*.” Renewable gas has been used, or proposed for use, as a substitute for conventional natural gas in a variety of applications ~~and can be used to make hydrogen~~. Consistent with SB 1383, the *2017 IEPR* identifies “cost-effective strategies that are consistent with existing state policies and climate change goals by considering priority end uses of renewable gas.” In this context, cost-effective strategies yield the lowest cost per SLCP reduction benefit in terms of greenhouse gas emissions reduced.

Chapter 1, Primary Policy Drivers, page 37:

Table 1: California Transportation Policy Drivers

Policy Origin	Objectives	Goals and Milestones
Policy Goals		
Executive Order B-16-2012, Senate Bill 1275 (2014), <u>Executive Order B-48-18</u>	Increased Zero-Emission Vehicles	Place 1 million zero-emission vehicles on the road by 2023, and 1.5 million zero-emission vehicles by 2025, <u>and 5 million zero-emission vehicles by 2030 including required infrastructure</u> <u>Install 200 hydrogen refueling stations and 250,000 zero-emission vehicle chargers, including 10,000 direct current fast chargers, by 2025</u>
Executive Order B-32-15, Sustainable Freight Action Plan	Air Quality Improvement GHG Reduction Petroleum Reduction	Improve freight efficiency and transition freight movement to zero-emission technologies
Senate Bill 1383 (2016)	Increase Renewable Gas Use	Adopt policies and incentives to increase the production and use of renewable gas
Regulations and Requirements		
Advanced Clean Cars Regulation (ZEV requirement)	Increased Zero-Emission Vehicles	Require automakers to produce increasing numbers of ZEVs through Model Year 2025
Senate Bill 350 (2015)	Increased Plug-In Electric Vehicles	Require utilities to plan for or invest in electric vehicle charging or both
Federal Clean Air Act of 1970	Air Quality	80 percent reduction in NO _x by 2031
Low-Carbon Fuel Standard	GHG Reduction	Reduce carbon intensity of transportation fuels in California by 10 percent by 2020
Incentives		
Assembly Bill 8 (2013)	GHG Reduction Air Quality Improvement Petroleum Reduction	Transform the state's fuel and vehicle types to attain state climate change goals and improve air quality
Low-Carbon Transportation Investments (from Greenhouse Gas Reduction Fund)	GHG Reduction Air Quality Improvement	Accelerate development and deployment of clean mobile source technologies
Volkswagen Settlement ("Electrify America")	Increased Zero-Emission Vehicles	Support growth of zero-emission vehicles

Chapter 1, Primary Policy Drivers, top of page 38:

Following Executive Order B-16-12, Senate Bill 1275 (De León, Chapter 530, Statutes of 2014) established the Charge Ahead California Initiative, which is administered by CARB in consultation with the Energy Commission and related agencies. This statute establishes a goal of placing 1 million zero-emission and near-zero-emission vehicles in service by January 1, 2023, while providing increased access to these vehicles for disadvantaged, low-income, and

moderate income communities and consumers. Executive Order B-48-18 established a target of 5 million zero-emission vehicles in service by 2030, as well as targets for 200 hydrogen refueling stations and 250,000 zero-emission vehicle chargers (including 10,000 direct current fast chargers) by 2025. (For more information about transportation electrification, see Chapters 2, 3, 4, and 6 and Appendices D and H.) Plug-in electric vehicles are expected to form the majority of these ZEVs, with hydrogen fuel cell electric vehicles accounting for a notable share as well.

Chapter 2, Implementing the Clean Energy and Pollution Reduction Act, Senate Bill 350, page 61- 62:

The CPUC is setting energy efficiency goals for the IOUs based on the most recent IOU potential and goals study that determines market-based savings potential for IOUs under a given set of assumptions.¹ The POU's 2017 report on energy efficiency potential and goals was submitted in March 2017.² Because the most recent studies were not specifically designed to achieve SB 350 targets, additional efforts will be necessary to identify utility program savings beyond the current goal-setting effort. Because CCAs and RENs ~~may will~~ be important in meeting the SB 350 targets, they ~~could should~~ be an important element of future potential and goals studies carried out by the CPUC.

Chapter 3, Increasing the Resiliency of the Electricity Sector, page 108:

Western Energy Imbalance Market

The recent formation and implementation of the Western EIM have proven to be an unprecedented step forward in exploring new and highly effective methods of increased regional coordination. The EIM has been in place since November 2014, has produced substantial savings, and continues to grow through the continual addition of new participants.³ As shown in Table 7, the benefits of avoided renewables curtailment are significant according to California ISO studies, with an estimated ~~502,357~~ 520,417 MWh exported instead of curtailed, which displaced an estimated ~~214,927~~ 222,657 metric tons of carbon dioxide (CO₂) since inception. The total gross benefits for Western EIM participants are ~~\$254.98~~ \$288.44 million as of ~~September 30, 2017~~ December 31, 2017. Table 7 also shows the volume of avoided renewable curtailments, the estimated metric tons of CO₂ displaced, and the total gross benefits for each quarter. The Western EIM delivers significant efficiency enhancements in real-time

¹ CPUC. *Final Public Report: Energy Efficiency Potential and Goals Study for 2018 and Beyond*. August 25, 2017. <http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M194/K614/194614840.PDF>.

² California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector: 11th Edition* – 2017, March 15, 2017, http://www.ncpa.com/wp-content/uploads/2015/02/2017_POU_EE_Reportv2.pdf.

³ Utilities participating in the Western EIM include Oregon-based PacifiCorp; NV Energy of Las Vegas; Puget Sound Energy of Washington state; Arizona Public Service of Phoenix, Arizona; and Portland General Electric. Other utilities that have formally agreed to join the Western EIM include Powerex Corp. of Canada and Idaho Power in April 2018; the Balancing Authority of Northern California/SMUD and the Los Angeles Department of Water and Power (LADWP) in April 2019; and Seattle City Light and Phoenix-based Salt River Project in April 2020.

operations. The expansion of renewable resources in the Western Interconnection (primarily in California) and EIM implementation have encouraged additional assessments of system efficiency and driven operational enhancements.

Chapter 3, Increasing the Resiliency of the Electricity Sector, page 109:

Table 7: Western EIM Reduced Curtailment of Renewable Energy, Associated Reductions in CO₂, and Participant Gross Benefits by Quarter

Year	Quarter	Participants	Avoided Renewable Curtailment (MWh)	Equivalent Metric Tons of CO ₂ Displaced	Total Participant Gross Benefits in Millions USD ⁴
2014	4	California ISO, PacifiCorp	N/A	N/A	\$5.97
2015	1	California ISO, PacifiCorp	8,860	3,792	\$5.26
	2	California ISO, PacifiCorp	3,629	1,553	\$10.18
	3	California ISO, PacifiCorp	828	354	\$12.00
	4	California ISO, PacifiCorp, NV Energy (Dec. 2015)	17,765	7,521	\$12.29
2016	1	California ISO, PacifiCorp, NV Energy	112,948	48,342	\$18.90
	2	California ISO, PacifiCorp, NV Energy	158,806	67,969	\$23.60
	3	California ISO, PacifiCorp, NV Energy	33,094	14,164	\$26.16
	4	California ISO, PacifiCorp, NV Energy, Arizona Public Service (APS, Oct. 2016), Puget Sound Energy (PSE, Oct. 2016)	23,390	10,011	\$28.26
2017	1	California ISO, PacifiCorp, NV Energy, APS, PSE	52,651	22,535	\$31.10
	2	California ISO, PacifiCorp, NV Energy, APS, PSE	67,055	28,700	\$40.71
	3	California ISO, PacifiCorp, NV Energy, APS, PSE	23,331	9,986	\$40.55
	4	California ISO, PacifiCorp, NV Energy, APS, PSE	<u>18,060</u>	<u>7,730</u>	<u>\$33.46</u>
	Total	All	<u>502,357</u><u>520,417</u>	<u>214,927</u><u>222,657</u>	<u>\$254.98</u><u>\$288.44</u>

Source: Adapted from California ISO, Western EIM Benefits Report: Third Quarter 2017, October 18, 2017, available at https://www.westerneim.com/Documents/ISO-EIMBenefitsReportQ3_2017.pdf. Fourth Quarter 2017, available at https://www.westerneim.com/Documents/ISO-EIMBenefitsReportQ4_2017.pdf

Chapter 3, Increasing the Resiliency of the Electricity Sector, page 112:

Currently, Northwest hydro generation is providing a limited amount of within-hour flexibility to the California ISO. The flexibility of Northwest hydro generators is under-utilized by the California ISO due to a combination of physical limitations on dynamic transfer capability (DTC), current market timing and rules, and the resulting inadequate economic incentives. Addressing these limiting factors has the potential to support system operations and provide

⁴ For attribution of gross benefits by participant, see each quarterly Western EIM benefits report, available at <https://www.westerneim.com/Pages/About/QuarterlyBenefits.aspx>.

economic benefits to both California and the Pacific Northwest. One significant source of flexible carbon-free capacity is the extensive hydro system that exists in the Pacific Northwest. In 2018, the California ISO has begun to investigate market design changes that can unlock the flexibility benefits from hydro resources and result in an overall more efficient market for all participants in the long run.

Increasing the transfer of low-carbon supplies to and from the Northwest may also serve as one of several resource options to replace the generation located in Southern California that currently rely on natural gas stored at Aliso Canyon. (See Chapters 8 and 11 for more information on the Aliso Canyon natural gas storage facility and reliability issues in Southern California.) Toward this end, the Energy Commission and CPUC requested a specific sensitivity case be included in the 2018-2019 California ISO transmission planning process (TPP).** It is time-critical that the agencies and California ISO collaborate to evaluate key options to increase transfer ratings of the Pacific AC and DC Interties and assess how it can help mitigate reliability issues in the Greater Los Angeles Area. The insights gained from the sensitivity can be used to inform a broader assessment of Aliso Canyon phase-out options that would include, additional energy efficiency, demand response, storage, as well as overall transmission project additions if any emerge in the 2018-2019 TPP.

**New footnote: Request for Sensitivity Case in the California ISO 2018-2019 Transmission Planning Process - Increased Capabilities for Transfers of Low Carbon Electricity between the Pacific Northwest and California. http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-11/TN222584_20180216T100045_021518_Letter_to_CAISO_Steve_Berberich.pdf, and http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-11/TN222585_20180216T100045_021518_Letter_to_LADWP_Mel_Levine.pdf.

Chapter 3, Increasing the Resiliency of the Electricity Sector, text box, page 118:

Resiliency During Record Heat on September 1, 2017

California experienced record high temperatures and correspondingly high demand for electricity on September 1, 2017. San Francisco had a peak temperature of 106° F, while temperatures in Los Angeles reached 101° F. Electricity demand in the California ISO footprint peaked at 50,116 MW. Based on the Energy Commission's 1-in-2 forecast plus a planning reserve margin of 15 percent, the total Resource Adequacy capacity was 47,000 MW. After credits for demand response and outages, the operational Resource Adequacy capacity was just under 45,000 MW. Nonetheless, a combination of factors allowed the California ISO to maintain reliability. First, the California ISO issued a Flex Alert on September 1, 2017, and the preceding two days, requesting that customers reduce air conditioning use and shift appliance operation to off-peak times. Second, the market responded with 8,700 MW of imports at peak load and the major IOUs activated their various demand response programs both in and out of the California ISO markets. SCE, PG&E, and SDG&E report that approximately 500 MW, 139 MW, and 70 MW of demand response was activated in their service territories, respectively. Additionally,

the Los Angeles Department of Water and Power activated 60 MW of reduction from demand response.

Chapter 3, Increasing the Resiliency of the Electricity Sector, page 130:

Alternatively, the hydrogen produced from excess renewable electricity can be combined with waste or captured carbon dioxide to create renewable methane for the direct displacement of fossil fuel natural gas. This renewable hydrogen or methane can be stored in tanks, used in fuel cell electric vehicles, or directly injected into natural gas pipelines or dedicated hydrogen pipelines. This strategy of transferring electrical energy into gaseous chemical energy for energy storage or other useful purposes is termed *power-to-gas*. Power-to-gas systems can provide long-term energy storage and be deployed in scales similar to pumped hydropower and compressed air, but are modular and flexible in siting. Compared to electric battery storage, while battery costs go up in proportion to the quantity of energy stored, power-to-gas costs are nearly independent of the quantity of energy stored when the existing gas grid is used as the storage medium.

Chapter 5, Strategic Transmission Plan and Landscape-Scale Planning, “Recommendations”, page 183:

- **Continue to explore use of landscape-scale planning tools and techniques.** The Energy Commission should continue to explore and improve the use of landscape scale planning tools and techniques with stakeholders and other agencies ~~to~~ that would:
 - Assess opportunities and constraints for renewable energy across landscapes in concert with local communities and in a public and data-driven process.
 - Interconnect in- and out-of-state transmission pathways identified in RETI 2.0 that would improve import and export of renewable resources.
 - Help alleviate key constraints, such as the Desert Area Constraint identified in RETI 2.0.
 - Connect renewable resource areas.
 - Connect federal Section 368 corridors, subject to limitations in the Corridors of Concern identified in the July 2012 Settlement Agreement between The Wilderness Society, et al., vs. U.S. Department of the Interior. **

** New footnote: The Wilderness Society, et al. v. U.S. Department of the Interior, No. 3:09-cv-03048 JW Joint Motion to Dismiss Case Pursuant to Fed. R. Civ. P. 41(a)(2),
http://corridor.anl.gov/documents/docs/Settlement_Agreement_Package.pdf.

Chapter 6, Electricity and Natural Gas Demand Forecast, Page 184

The California Energy Commission provides full forecasts for electricity and natural gas demand every two years as part of the *Integrated Energy Policy Report (IEPR)* process. The forecasts are used in various proceedings, including the California Public Utilities Commission’s

(CPUC's) ~~Long-term Procurement Planning (LTPP)~~ Integrated Resource Planning (IRP) process and the California Independent System Operator's (California ISO's) Transmission Planning Process (TPP).

Chapter 6, Electricity and Natural Gas Demand Forecast, Page 185

Community choice aggregators (CCAs) are expected to play an increasingly important role in California's energy future. This forecast includes projections for ~~1215~~ 1215 CCAs currently operating or expected to be operating in the next year. More CCAs are expected and a fuller snapshot of these impacts will continue in the next IEPR Update.⁵ (See "Changes in Electricity Market Structure" in Chapter 1 for more information on CCAs.)

Chapter 6, Electricity and Natural Gas Demand Forecast, Page 186

CED 2017 Revised incorporates a new transportation electricity forecast, which includes light-duty vehicles, medium- and heavy-duty vehicles, public transit, and high-speed rail. Predicted light-duty EV purchases, which include battery electric and plug-in hybrid, were discussed and vetted through the Demand Analysis Working Group (DAWG),⁶ a technical stakeholder group, and the Joint Agency Steering Committee (JASC),⁷ and are significantly higher than in previous forecasts, reflecting current trends and more optimistic projections for these vehicles.**

** New footnote: Governor Brown issued Executive Order B-48-18 on January 26, 2018, and therefore it was not incorporated into the 2017 electricity and natural gas demand forecast.

Chapter 6, Electricity and Natural Gas Demand Forecast, Page 186-187

Data and Analytical Needs

Assembly Bill 802 (Williams, Chapter 590, Statutes of 2015) confirmed the Energy Commission's authority to require the submission of individual utility customer usage and billing data. On January 13, 2016, the Energy Commission opened Rulemaking 16-OIR-03⁸ to consider amending the agency's regulations specifying data collection and disclosure for load-serving entities.

⁵ Spencer Olinek, Comments from Pacific Gas and Electric; Danielle Osborn Mills, Comments from the American Wind energy Association.

⁶ The DAWG is a forum for technical discussion and consensus-building on inputs and results for the electricity and natural gas demand forecasts adopted by the Energy Commission. Energy Commission staff convenes DAWG, pulling in forecasting experts at the utilities as well as other stakeholders, to discuss technical details behind the forecast to build consensus. For more information, see <http://www.dawg.info/about-demand-analysis-working-group>.

⁷ The JASC is an interagency team of management from the Energy Commission, CPUC, California ISO, and CARB, responsible for coordinating activities that contribute toward increasing the granularity of the Energy Commission's demand forecast.

⁸ http://www.energy.ca.gov/business_meetings/2016_packets/2016-01-13/Item_05_OIR-Senate_Bill_350/Item%205%20OIR%20Senate_Bill350_final_1-4-16.pdf.

These amendments will help the Energy Commission implement SB 350 and AB 802 provisions and clarify existing provisions in the regulations. The Energy Commission will submit its final proposed regulatory language to the Office of Administrative Law in ~~July 2017~~the second quarter of 2018 and it will become effective in the third quarter of 2018. The rulemaking includes acquisition of high-priority data ~~by January 1~~in August 2018, including:

Chapter 7, Transportation Energy, page 205:

In recognition of these challenges, California has enacted a suite of policies and goals to shift the transportation sector toward cleaner, sustainable fuels and more efficient technology vehicles. These include, but are not limited to:

- Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006) and Senate Bill 32 (Pavley, Chapter 249, Statutes of 2016): These laws respectively established and expanded the Global Warming Solutions Act of 2006. AB 32 set a goal of reverting to 1990 levels of GHG emissions by 2020. SB 32 set a further reduction goal of 40 percent below 1990 levels by 2030. Based on the 2017 Draft Scoping Plan Update required by these laws, the transportation sector will require significant transformation to meet its share of these reductions.
- Senate Bill 1275 (De León, Chapter 530, Statutes of 2014): This law established goals of placing at least 1 million zero-emission vehicles (ZEVs), including plug-in hybrid electric vehicles (PHEVs), battery-electric vehicles (BEVs), and fuel cell electric vehicles (FCEVs), in service by 2023. This reflects the pathway toward 1.5 million ZEVs by 2025 set within the 2016 ZEV Action Plan.
- Executive Order B-48-18: This order set a further, higher target for 5 million ZEVs on California's roads by 2030. The new executive order also sets a target of installing 200 hydrogen fueling stations and 250,000 ZEV chargers, including 10,000 direct current fast chargers, by 2025. **

**New footnote: This Executive Order was issued after completion of the 2017 transportation energy demand forecast described in this chapter.

Chapter 7, Transportation Energy, fourth paragraph, page 233:

For transit buses, the forecast also assumes a significant expansion of zero-emission buses within the forecast period. This expansion is in line with CARB's proposed Innovative Clean Transit goal of transitioning all transit buses to zero-emission technologies by 2040. This assumption is based on CARB staff's analysis that shows that without grants justified on the basis of battery-electric buses are being cost-competitive with conventional buses due to diesel electric buses, capital costs for transit being borne largely by federal grants, and the reduced costs of fuel and maintenance.The initial incremental capital costs for transits can be reduced

with a combination of state grants, programs to support transportation electrification, or leasing options, being borne largely by federal grants, and the reduced costs of fuel and maintenance.

Chapter 7, Transportation Energy, page 237:

The transportation forecast results also offer a similar check on progress toward the state's goal of 1.5 million ZEVs (including BEVs, PHEVs and FCEVs) by 2025 as stated in the *2016 ZEV Action Plan*. The forecast suggests that there may be slightly more than 2.4 million vehicles by 2025 in the high case, about 2.2 million in the mid case, and about 1.56 million in the low case. Taken together, these cases suggest that California could indeed meet its goal of 1.5 million ZEVs.

The Cleaner Technology and Fuels Scenario of CARB's *Mobile Source Strategy* includes a more aggressive assumption of 4.2 million ZEVs deployed by 2030 as a pathway to a longer-term goal of having 100 percent of light-duty sales be zero-emission vehicles. The proposed *2017 Climate Change Scoping Plan Update* includes this interim 2030 target as well. More recently, the Governor's Executive Order B-48-18 set a target of 5 million ZEVs on California's roads by 2030.**

Results from the forecast, however, suggest that California may be on track to reach 4.14 million ZEVs by 2030 in the high case (nearing the scoping plan update's target of 4.2 million) and just over 3.5 million in the mid case.⁹ This forecast is based on projected consumer responses to current regulations and projected market and technological conditions. If the state aims to meet the ~~4.2~~ 5 million vehicle target in 2030, the results from the Energy Commission's forecast suggest that additional measures (such as additional vehicle incentives, regulation, refueling infrastructure development, and increasing consumer awareness) may be needed even under if the more favorable conditions in terms of fuel prices, economic growth, and technological advancements, as assumed in the high case, do not occur.

** New footnote: Governor Brown issued Executive Order B-48-18 on January 26, 2018, after the completion of the 2017 transportation energy demand forecast.

Chapter 8, Natural Gas Trends and Outlook, second paragraph, page 260:

California's existing combination of pipeline capacity and underground gas storage appears adequate to meet forecast natural gas demand and no general increase in capacity is proposed. SoCalGas and SDG&E, ~~however,~~ have an application before the CPUC seeking permission to build a new 47-mile pipeline which will provide several benefits to the San Diego region, including an increase in local system capacity. The proposed pipeline would ~~to~~ transport natural gas from the existing Rainbow ~~Pressure-Limiting Metering~~ Station at the Riverside/San Diego County line, south to the Marine Corps Air Station Miramar in San Diego. The proposed pipeline would replace the existing transmission function of existing Line 1600, which, under

⁹ As stated in the previous footnote, the Energy Commission calculates vehicle population, whereas CARB tabulates cumulative vehicle sales.

this proposal, would be derated, or lowered in pressure, converted to serve as a distribution line. The SoCalGas and SDG&E argue that the new line would allow safety testing and derating of the existing Line 1600 and would provide a measure of redundancy and additional safety and reliability for gas service into San Diego.

Chapter 8, Natural Gas Trends and Outlook, text box on page 262:

Leak at Aliso Canyon

On October 23, 2015, a natural gas leak was detected from one of the wells at the SoCalGas-owned Aliso Canyon natural gas storage facility. SoCalGas stopped the leak on February 11, 2016, and sealed the well permanently on February 18, 2016. As a result of the leak, Senate Bill 380 (Pavley, Chapter, 14, Statutes of 2016) (SB 380) and DOGGR imposed a moratorium on injections at Aliso Canyon until SoCalGas ~~complies~~ complied with regulations and ~~meets~~ met certain conditions. On July 19, 2017, after completing several checks, the CPUC and DOGGR confirmed that SoCalGas had met the requirements of the comprehensive safety review and could resume injections. On July 31, 2017, SoCalGas resumed injection operations at Aliso Canyon, subject to a maximum allowed inventory at the field of 23.6 Bcf. This increased to 24.6 Bcf after the release of the *Aliso Canyon Winter Risk Assessment 2017-18 Supplement* on November 28, 2017, which took into account multiple winter season outages in SoCalGas's pipeline system. However, in In cases of emergency, withdrawals have been authorized to support regional energy reliability. In a letter from Energy Commission Chair Robert B. Weisenmiller to CPUC President Michael Picker dated July 19, 2017, the Chair wrote, "With the state's climate target in mind, Governor Brown has asked me to plan for the permanent closure of the Aliso Canyon natural gas storage facility, and I urge the California Public Utilities Commission to do the same."¹ (See Chapter 11 for more information about energy reliability issues related to Aliso Canyon.)

1 http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-11/TN220299_20170721T134102_July_19_2017_Letter_to_California_Public_Uilities_Commission_P.pdf.

Chapter 9, Renewable Gas, page 278:

In-State Renewable Gas Resource Potential

Renewable gas is gas that is generated from organic waste or from electricity generated by an "eligible renewable energy resource" as defined in Subdivision (e) of Section 399.12 of the California Public Utilities Code or at a "renewable electric generating facility" as defined in Section 25741 of the California Public Resources Code.⁵³³

533 "Gas" means any substance which is in a gaseous state at ambient conditions of temperature and pressure. In the gaseous state of matter at 1 atm (14.696 lb/in²) absolute and 15 °C (60 °F), the reference pressure and temperature for hydrocarbon gas vapor and hydrogen gas measuring devices by the California Department of Food and Agriculture, Division of Measurement Standards. https://www.cdffa.ca.gov/dms/programs/Publications/FRM/2018/3-2018_FRM_Chapter%201_Part_3_3.30-3.40.pdf.

Chapter 9, Renewable Gas, page 294:

Renewable gas has been used, or proposed for use, as a substitute for conventional natural gas in several energy sectors. The most commercial-ready end uses include ~~are~~ electricity generation, natural gas vehicle fuel displacement, and pipeline natural gas displacement.

Chapter 9, Renewable Gas, page 296:

Transportation Fuel

Renewable gas can be used in a variety of ways to power alternative fuel vehicles. For example, with ~~With~~ upgrading, biogas can be used in CNG or LNG vehicles. In 2015, there were 20,963 natural gas vehicles registered in California, 80.6 percent of which belonged to the medium- and heavy-duty vehicle (MHDV) sector.

Chapter 9, Renewable Gas, page 299 - 300:

Other renewable gases may also serve as alternative transportation fuels, such as renewable hydrogen for fuel cell electric vehicles (FCEVs). (See the “Renewable Hydrogen” section later in Chapter 9.) FCEVs play an important role in helping meet multiple policy objectives, including having 1.5 million zero-emission vehicles on California roads by 2025, set forth by Executive Order B-16-2012 and guided by California’s *ZEV Action Plan*. As directed by Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013), the Energy Commission has provided funding (\$20 million per year) for the construction, operation, and maintenance of hydrogen refueling stations and will do so until at least 100 stations are publicly operational. The Energy Commission and CARB annually report on the progress of hydrogen fuel cell vehicle and refueling station development in California and on the time and cost needed to attain 100 hydrogen refueling stations in California.^{10, 11} On January 26, 2018, Governor Brown issued Executive Order B-48-18 ordering all state entities to work with the private sector and all appropriate levels of government to spur the construction and installation of 200 hydrogen fueling stations by 2025.

Alternatively, renewable gases may be used to generate electricity to recharge battery electric vehicles (BEVs). For more discussion of BEVs and FCEVs, see Chapter 7.

On-Site or Grid Connected Electricity Generation

Historically, in general, the most commonly performed beneficial use of biogas ~~is~~ has been for electricity production using reciprocating engines.

¹⁰ CARB, 2017 Annual Evaluation of Fuel Cell Electric Vehicle Deployment and Hydrogen Fuel Station Network Development, August 2017, https://www.arb.ca.gov/msprog/zevprog/ab8/ab8_report_2017.pdf.

¹¹ Baronas, Jean, Gerhard Ahtelik, et al. 2017. Joint Agency Staff Report on Assembly Bill 8: 2017 Annual Assessment of Time and Cost Needed to Attain 100 Hydrogen Refueling Stations in California. California Energy Commission and California Air Resources Board. Publication Number: CEC600-2017-011. <http://www.energy.ca.gov/2017publications/CEC-600-2017-011/CEC-600-2017-011.pdf>.

Chapter 9, Renewable Gas, page 304:

However, power-to-gas is at the initial stages of pilot demonstration in California, with one operational project at the University of California, Irvine, (UC Irvine) that injects 0.24–0.78 percent hydrogen gas by volume into a ~~SoCalGas~~ their natural gas pipeline.¹² Based on utility tariff heating value requirements, mixtures of up to 8.5 percent hydrogen gas by volume may be allowable. However, the effects of hydrogen embrittlement on steel pipes in the natural gas system must also be considered. Research by the University of Illinois at Urbana-Champaign, supported by SoCalGas and in collaboration with UC Irvine, ~~found that~~ simulated mixtures of hydrogen concentration under typical pressure fluctuations. The study conservatively found that after 100 years, cracks with depths less than 40 percent of the pipeline wall thickness will never reach depths of 75 percent of the wall thickness and natural gas with up to 5 percent hydrogen concentration will accelerate fatigue crack growth in steel pipes, conservatively requiring pipelines to be repaired or replaced every 80 years, as opposed to 100 or more years.¹³ This indicates that under existing conditions, hydrogen embrittlement at these low hydrogen concentrations may minimally impact the replacement schedule of steel pipes in the natural gas transmission network. However, further research is needed on how welds are impacted and the added effects of gas impurities. The costs of power-to-gas are further discussed later in this chapter under “Long-Term and Alternative Pathways for Renewable Gas.”

Chapter 9, Renewable Gas, page 306:

Economic Assessment of Renewable Gas End Uses

In addition to fuel production costs, developers (or their customers) may be responsible for covering additional capital costs related to the end uses of the fuel. As discussed, renewable gas ~~biogas~~ end uses include transportation fuel, injection into common carrier natural gas pipelines, and electricity generation. Table 23 presents estimates of the capital expenditures associated with using biogas for these end uses.

The sectors in which natural gas vehicles are used the most (refuse and transit) predominantly operate CNG vehicles, rather than LNG. There has been much recent activity in integrating CNG engines into other medium- and heavy-duty vehicle sectors due to CNG’s economic advantages of lower costs and greater LCFS credit generation compared to LNG. The two main costs of using biomethane as a vehicle fuel are the costs of installing a CNG refueling station(s) and the cost of buying new CNG vehicles or retrofitting diesel vehicles. This is similarly true for using

¹² UCI News. In a national first, UCI injects renewable hydrogen into campus power supply. December 6, 2016. <https://news.uci.edu/2016/12/06/in-a-national-first-uci-injects-renewable-hydrogen-into-campus-power-supply/>.

¹³ M. Dadfarnia and P. Sofronis, Assessment of Resistance of Line Pipe Steels to Hydrogen Embrittlement, November 29, 2016, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0ahUKEwi0gZyggd3YAhWvmuAKHRHhCCAQFgg0MAI&url=http%3A%2F%2Fwww.apep.uci.edu%2Fdownload01%2FPower-to-Gas%2FFinal_Report_SoCalGas_Project_UIUC.doc&usq=AOvVaw1mrQ4W1bu7KFISGedK_qDP.

renewable hydrogen as a transportation fuel. Hydrogen fuel cell electric vehicles (FCEVs) are a more emerging market, with increasing development and initial rollouts of light-duty passenger FCEVs in California, and demonstration of medium- and heavy-duty FCEVs primarily in transit and port operations. Fuel cell technology is typically costlier than their CNG counterparts, but provides superior emission profiles. An analysis by the Union of Concerned Scientists indicates that while biomethane generates lower greenhouse gas and NOx emissions than natural gas when used in CNG vehicles, it can produce even lower emissions when used to make electricity or hydrogen for battery or fuel cell electric vehicles.**

** New footnote: Union of Concerned Scientists, The Promises and Limits of Biomethane as a Transportation Fuel, 2017.

<https://www.ucsusa.org/sites/default/files/attach/2017/05/Promises-and-limits-of-Biomethane-factsheet.pdf>

Chapter 9, Renewable Gas, page 307:

When using renewable gas biomethane for electricity generation, interconnection costs play a similar role. For both gas and electricity interconnection, fees must be paid to the respective utility company. These fees fund applications, studies, and testing to determine whether the existing infrastructure and downstream users are compatible with the existing structure or whether modifications are needed.

Chapter 9, Renewable Gas, page 318:

Power-to-Gas

An emerging use of method of producing renewable hydrogen through electrolysis is ~~as electricity grid storage and balancing mechanism~~ called power-to-gas (P2G). As discussed in Chapter 3, renewable hydrogen produced via electrolysis can provide a load when wind or solar generation may otherwise be curtailed, and be used to provide fuel for hydrogen fuel cell electric vehicles, to displace natural gas, to generate electricity with stationary fuel cells, or to store energy for later use.~~be used later by highly dynamic electrolyzers and fuel cells.~~ Economic analysis was provided from Energy + Environmental Economics (E3) and the National Fuel Cell Research Center.

Chapter 10, Climate Adaptation and Resiliency, page 326:

The energy sector (including transportation) contributes more than 80 percent of the annual greenhouse gas (GHG) emissions in California. This sector is also vulnerable to climate impacts, which have implications for energy reliability, affordability, and safety. For example, high temperatures will increase peak electricity demand for space cooling, decrease the efficiency of

thermal power plants, reduce the performance of transformers and other electrical equipment, and reduce the energy demand for space heating. Sea-level rise will increase the risks of flooding of petroleum, natural gas, and electricity infrastructure in coastal areas. About half of the 20 largest and most destructive wildfires in California burned in the last decade with six ~~seven~~ of the state's largest, deadliest, and most destructive wildfires in 2017 alone. Figure 87 shows the deadliest and most destructive California wildfires since the early 1900s, clearly indicating the increasing toll that wildfires are having on Californians.

Chapter 10, Climate Adaptation and Resiliency, text box, page 329:

California Climate Adaptation Legislation

The *2016 IEPR Update* summarized of the executive orders and legislation pertaining to climate change adaptation.¹ Highlights include the following:

- Senate Bill 379 (Jackson, Chapter 608, Statutes of 2015) requires local hazard mitigation plans to address the impact of climate change, supported by the California Adaptation Planning Guide.¹
- Assembly Bill 1482 (Gordon, Chapter 603, Statutes of 2015) mandated the California Natural Resources Agency (CNRA) to update the state's adaptation plan triennially. An update of this plan, ~~known as the *Safeguarding California Plan*~~ will be finalized in early January 2018 following stakeholder input.
- Assembly Bill 2800 (Quirk, Chapter 580, Statutes of 2016) requires the impacts of climate change to be taken into consideration when planning state infrastructure projects. It also requires creation of a working group to develop a report to the Legislature by July 2018 about the engineering standards that should be updated considering future climatic conditions.
- Assembly Bill 398 (Garcia, Chapter 135, Statutes of 2017) extends the California Cap-and-Trade Program and makes "climate adaptation and resiliency" and "climate and clean energy research" eligible to received cap-and-trade funds.

1 California Energy Commission. 2016. *2016 Integrated Energy Policy Report Update*. California Energy Commission. Publication Number: CEC-100-2016-003-CMF.

2 California Natural Resources Agency, *Safeguarding California Plan: 2018 Update, California's Climate Adaptation Strategy*, January 2018,

<http://resources.ca.gov/docs/climate/safeguarding/update2018/safeguarding-california-plan-2018-update.pdf>.

Chapter 10, Climate Adaptation and Resiliency, text box, page 339:

Impacts of 2017 Wildfires

California suffered a devastating outbreak of wildfires in the final months of 2017. Extreme winds in October drove a number of fires through subdivisions and vineyards in the Sonoma-

Napa wine region. More than 40 people lost their lives in the fast-moving blazes. Figure 89 shows a satellite photo of the fires. The Tubbs Fire in this outbreak destroyed 5,643 structures, nearly doubling the previous record from the 1991 Tunnel Fire in the Oakland Hills. Between October 8 and 18, more than 359,000 PG&E customers lost electricity at various times.¹

Similarly, Santa Ana winds fanned a series of late season fires in Southern California in December, burning more than 1,000 structures and forcing tens of thousands of residents to evacuate. For the first time in its history, the Santa Ana Wildfire Threat Index issued a purple or “Extreme” wind warning. The Thomas Fire in this outbreak became the largest fire in California’s history; at one point, the fire intermittently interrupted transmission lines into the Santa Barbara area, causing outages for more than 85,000 customers.²

The lateness of the fire in the fall did not allow much time for crews to stabilize the burned hillsides before the winter rains ~~began~~. In January, 2018, an intense storm triggered devastating mudslides from the burned areas above Montecito, causing more than 20 deaths and destroying about 100 homes. The mudslides are also suspected of rupturing a natural gas pipeline, which sparked additional fires. At the request of the Santa Barbara County Fire Department, Southern California Gas interrupted gas service to 3,600 customers in support of emergency response efforts and ~~after 15 days they~~ restored service to ~~750~~ all accessible customers over the next three weeks. The ~~recent~~ mudslides ~~in the area~~ also damaged water and sewage pipes. As a result, the more immediate health and safety hazard stems from the lack of water and sewage and ~~has~~ required residents to evacuate their homes.

These tragic events reflect ~~that changes in~~ wildfires have been getting larger and more destructive ~~observed in recent years~~ as a response to climate change. ~~Fires have been getting larger and more destructive.~~ Nine of the 20 largest California wildfires and nine of the 20 most destructive fires (in terms of structures destroyed) have occurred in the last decade, with 2017 being an especially bad year (as discussed at the beginning of the chapter). Fire behavior has also changed – leading to faster moving, more erratic fires.

The increasing risk from wildfires affects all Californians. Besides the heart-wrenching stories of people who have lost loved ones or their homes and possessions, Californians experience these impacts directly and indirectly. Smoke creates health hazards for vulnerable groups. ~~Homeowners in~~ In rural areas ~~have seen~~ homeowners insurance premiums have risen and policies have become more difficult to obtain. Widespread power outages can result from either direct damage to power lines or from lines being de-energized by utilities during a fire for safety reasons. Californians all pay for the rising costs of fire suppression and restoration in the aftermath. The state’s natural and working landscapes, like forests, are often the first to experience the impacts of climate change, and to stabilize the climate, natural and working lands must play a role. These lands can be both a source (as in wildfires) and a sink for GHG emissions. Natural and working lands policies must balance GHG emissions reductions and carbon sequestration with other benefits such as clean air, strong economies, food, fiber, water supply, renewable energy production, and wildlife and pollinator habitat. Recognizing that fire

plays an important role in California forests, the state's goal is to maintain its natural and working lands as a net carbon sink and to minimize the net GHG and black carbon emissions associated with management biomass disposal and wildfire events.³~~In addition, the emissions from these fires threaten the state's GHG reduction goals. For instance, the 2013 Rim Fire burned 257,000 acres and released between 10 and 15 million metric tons, far more than the state was able to reduce from other sectors. In 2013-2015, wildfires on federal lands in California emitted an estimated 20-25 million metric tons of GHGs (carbon dioxide equivalent) per year.² Estimates for the 2017 fires are not currently available.~~

1 http://cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Safety/Oct%209-26%20Unredacted%20Status%20Updates%20from%20PGE%20to%20CPUC.pdf.

<https://www.insideedison.com/stories/sce-crews-work-with-first-responders-to-gain-access-to-fire-damaged-areas>.

2 <http://www.sierranevada.ca.gov/our-board/board-meetings/2016dec/aixiwipattchb.pdf>.

3 https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

Chapter 10, Climate Adaptation and Resiliency, page 362:

In addition, the Energy Commission fully supports SoCalGas's ~~SDG&E's~~ statement in comments on the draft 2017 IEPR: "In order for climate plans to be effective, every region of California must be considered and engaged. Specifically, SoCalGas wants to be involved in establishing a California Partnership for Energy Sector Climate Resilience and convening a joint-agency workshop on climate resilience metrics to help track California's action and successes."**

**New footnote: http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-01/TN221758_20171113T165037_Southern_California_Gas_Company_Comments_SoCalGas_Comments_on_t.pdf.

Chapter 11, Update on Energy Reliability Issues in Southern California, page 364:

- ~~The CPUC issued Draft Resolution G-3536, which was scheduled to be voted on January 11, 2018, but was held until February 8, 2018, pending further review. It orders issued by the CPUC, would order SoCalGas to implement an emergency moratorium on new commercial and industrial natural gas service connections in both incorporated and unincorporated areas of Los Angeles County, but the Draft Resolution is currently undergoing further review.~~⁷⁶¹

Footnote 761: CPUC Draft Resolution G-3536 is available at <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M201/K367/201367863.PDF>.

Chapter 11, Update on Energy Reliability Issues in Southern California, page 370, footnote #736:

The California ISO and LADWP's ability to meet the 1-in-10-year peak summer electric load depends partially on the amount of withdrawal capability from storage facilities other than Aliso Canyon.⁷³⁶

Footnote 736: Chapter 2 of the California Council on Science and Technology study on the long-term viability of underground gas storage in California (referenced previously in Chapter 8) contains a detailed discussion on why California has gas storage and how it is used to meet not only summer peak demand but high demand days in the winter and to remedy hourly gas system imbalances. It focuses not on use of Aliso Canyon *per se* but identifies the role of California's gas storage in general. Any claim that the CCST study demonstrates a need for any particular storage field is false, particularly as California's energy system evolves to reduce reliance on methane.

Chapter 11, Update on Energy Reliability Issues in Southern California, page 372:

Winter 2017-2018 Analysis

The winter 2017-2018 initial analysis showed upcoming winter impacts similar to last winter, but with a little more gas in Aliso Canyon⁷⁴⁶ and a major pipeline outage on Line 3000 (Topock receipt point). On October 1, 2017, SoCalGas suffered a rupture of Line 235-2 near the Newberry compressor station, which also damaged Line 4000 nearby that had been excavated for maintenance.**

Footnote 746: SoCalGas was given the authority to begin injections in July 2017, Joint Division of Oil, Gas, and Geothermal Resources and California Public Utilities Commission letter to SoCalGas regarding Senate Bill 380 findings and concurrence of the safety of the Aliso Canyon Natural Gas Storage Facility, http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/OpenLettertoSoCalGasandPublic.pdf.

** New footnote: See CPUC Resolution G-3535 approving Advice Letter 5213-A and ratifying the Executive Director's letter approving the SoCalGas request to establish the Otay Mesa Pipeline Capacity Memorandum Account, pg. 2. <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M199/K322/199322740.PDF>.

Chapter 11, Update on Energy Reliability Issues in Southern California, pp 378 - 379:

The outlook for winter 2017-2018 depends largely on the weather, even with the mitigation measures in place. Natural gas service is threatened to noncore customers, including electric generators this winter due to unprecedented pipeline outages on the SoCalGas system. This threat exists even though there is more gas in storage than at this time last year. Any actions consumers take to reduce natural gas use in December will help preserve gas in storage for January when the 1-in-35 year peak demand remains possible.**

** New footnote: As mentioned in Chapter 3, the state is beginning to explore expansions of the AC and PDCI Interties among other approaches to help mitigate for a potential long term closure of Aliso Canyon. On February 15, 2018, Chair Weisenmiller and President Picker sent a letter to Stephen Berberich of the California ISO and to Mel Levine of the LADWP requesting they explore this option. <http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR->

11/TN222584_20180216T100045_021518_Letter_to_CAISO_Steve_Berberich.pdf and
[http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-](http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-11/TN222585_20180216T100045_021518_Letter_to_LADWP_Mel_Levine.pdf)
11/TN222585_20180216T100045_021518_Letter_to_LADWP_Mel_Levine.pdf.

Chapter 11, Update on Energy Reliability Issues in Southern California, page 397, end of last paragraph in the text box:

Aliso Canyon continues to be the subject of multiple proceedings (some yet to be opened) - each addressing different aspects of the issue - ranging from a root cause analysis, ~~whether to allow reinjection (and when)~~, to short-term reliability risks evaluation, and to analysis of the long-term future of the facility. Absent Aliso Canyon, the system continues to operate differently than it has historically, creating uncertainty that requires further analyses to maintain energy reliability in the area.