CONSULTANT REPORT

STATE OF CALIFORNIA
ENERGY ASSURANCE PLAN

Prepared for: California Energy Commission
Prepared by: Aanko Technologies Inc.

Aanko Technologies, Inc.
Safety & Security Solutions
"Lead the Journey..."™

JUNE 2014

CEC-600-2014-006

Prepared by:

Primary Author(s)
Steve Longoria
Dan Voreyer
Dave Pucci
Rick Cruz
Mohammad Khan
Gerald Williams

Aanko Technologies, Inc.
607 Elmira Road, Ste 191
Vacaville, CA 95687
866-968-7478
www.aanko.com

Contract Number: 600-10-003

Prepared for:

California Energy Commission

Elizabeth Keller
Contract Manager

Tim Olson
Project Manager

Tim Olson
Office Manager
Transportation Energy Office

Randy Roesser
Deputy Director
Fuels and Transportation Division

Robert P. Oglesby
Executive Director

ACKNOWLEDGEMENTS

California Energy Commission staff contributed to development of this report, including:

Ivin Rhyne

Ruben Tavares

Robert Kennedy

Elizabeth Keller

Gary Yowell

Gordon Schremp

Alan Mattes

Sharon Purewal

David Michael

Yelena Kirsanova

PREFACE

California depends highly upon its energy resources. An energy emergency or shortage could bring substantial injury to commercial and industrial activity and to the personal health, safety, and welfare of California's residents.

The authors developed this report, the *State of California Energy Assurance Plan,* in accordance with the contract specifications identified in Contract Number 600-10-003. The *State Energy Assurance Guidelines,* developed by the National Association of State Energy Officials (NASEO), served as a model for developing this *Energy Assurance Plan*. This *Energy Assurance Plan* is based on a substantial revision of the 2006 Energy Emergency Response Plan that was originally published in response to legislative requirements specified in Public Resource Code Sections 25216.5(b) and 25700. The statute directs the California Energy Commission to prepare and submit to the Governor and Legislature a plan to deal with shortages of electrical energy or fuel supplies to protect public health, safety, and welfare.

The *2006 Energy Emergency Response Plan* described the state's strategy for responding to an energy emergency. It has been substantially updated and made part of this *Energy Assurance Plan* as Chapter 1. The material in this *Energy Assurance Plan* is also drawn from several existing state documents, including the *State of California Emergency Plan*. This *Energy Assurance Plan* reflects the state's priorities for a response to an energy disruption or emergency. To implement this plan, several state agencies, entities, and others will work together to successfully minimize energy disruptions through conservation and other means. The goals and objectives outlined in this plan and within its appendices support this effort. Accomplishments can be realized only by joint efforts, dedication, and commitment to energy shortage mitigation. Clear recognition is made that energy producers and suppliers have emergency response plans of their own, which will be used in emergencies.

The Energy Commission encourages companies, institutions, and communities to develop and exercise plans to address energy disruptions and respond and recover from energy emergencies.

ABSTRACT

This *State of California Energy Assurance Plan* has been developed to identify successful energy emergency mitigation, preparedness, response, and recovery actions to ensure California's energy needs.

This plan supports the mission and goals of the California Energy Commission to assess, advocate, and act through public/private partnerships to improve energy systems that promote a strong economy and a healthy environment.

This *Energy Assurance Plan* provides an overview of the state energy infrastructure and identifies the role state government plays in preventing and mitigating energy disruptions. This plan also outlines the energy emergency preparedness and energy emergency response activities in California. It identifies the role state government plays in response to an energy emergency, relevant legal authorities, and team roles and responsibilities at the California Energy Commission. It also identifies other state and federal government agencies that are responsible for energy emergency preparedness and response.

This *Energy Assurance Plan* summarizes several state plans that provide contingency plans for electric and natural gas utilities and provides strategies for responding to petroleum shortages. It incorporates energy emergency response actions for critical energy infrastructure and addresses new energy portfolios, smart grid applications and vulnerabilities, critical infrastructure interdependencies, cyber security, energy supply systems, energy data analysis, and communications as they relate to the energy assurance needs of California.

Keywords: Air Resources Board, biodiesel, bioenergy, biofuels, building efficiency standards, California Energy Commission, California Independent System Operator, California Public Utilities Commission, California's Clean Energy Future, clean energy economy, demand response, electric vehicles, electricity, electricity demand, energy efficiency, ethanol, gas-fired generation, gasoline, greenhouse gas, jet fuel, job creation, Low Carbon Fuel Standard, natural gas demand, natural gas pipelines, nuclear power plants, once-through cooling, petroleum reduction, power plant licensing, renewable, Renewables Portfolio Standard, resource adequacy, transmission, transportation fuel demand

Please use the following citation for this report:

Longoria, Steve, Dan Voreyer, Dave Pucci, Rick Cruz, Mohammad Khan, and Gerald Williams. (Aanko Technologies Inc.). 2014. ***Energy Assurance Plan.*** California Energy Commission Publication Number: CEC-600-2014-006.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

To assure the state's energy needs, the California Energy Commission is responsible for developing a California Energy Assurance Plan (CEAP). This plan provides the Governor, the Legislature, state agencies and departments, the energy industry, and the public a clear, concise, and comprehensive plan to reduce critical energy infrastructure risk and vulnerability, while improving planning across public and private sector agencies and entities charged with the state's energy infrastructure resiliency.

Energy assurance is the state's ability to meet its energy needs in the event of a potential or actual energy disruption or emergency caused by natural hazards (earthquake, severe storm, and so forth), technological events (such as a market fluctuation or a power outage), or human-caused situations (infrastructure accident or criminal/terrorist act). This plan presents information to identify and lessen energy risks associated with energy disruptions and energy emergencies and describes the planning authority roles and responsibilities of state agencies at various stages of energy emergencies.

California's energy infrastructure is the backbone of commerce, transportation, communications, government, health care, and home life for the eighth largest economy in the world.

California depends on robust, secure, and reliable energy systems to power its economy and provide for the well-being of its residents, as any energy interruption could be devastating to the state and its residents. Because energy is a vital part of an interdependent network of critical physical and information infrastructures, it must be protected from deliberate, natural, accidental, and systemic attacks or threats.

When identifying the state's energy needs, this plan focuses on the electric, natural gas, and transportation fuels energy sectors. This plan also provides an overview of other energy resources, including nuclear power, biomass, wind, and solar, within the state, befitting of California's role as the national leader in energy efficiency and renewable energy. California's energy systems and their associated infrastructures provide the foundation for stability of the state economy and promote economic growth and life safety. They also provide the basic ability to mobilize resources during emergencies. The importance of California's energy sector to the state and the nation has led to the designation by the federal government as "critical infrastructure."

This plan relies on a strategy to respond to varying degrees of an energy disruption or emergency. Most energy disruption incidents tend to have minor impacts and are evaluated and monitored as emergency response and private entities take appropriate levels of action to resolve problems. The State of California intervention occurs to the extent necessary to protect public health, safety and welfare. The strategy builds on multiple capabilities within the state energy system to address these varying degrees of energy emergencies.

The scope of the plan extends from establishing procedures for energy emergency response to identifying and minimizing risks to energy resources. The plan is designed to augment, not to supplant or redefine, existing planning measures, risk analyses or recovery/restoration processes.

In addition to developing this plan, the Energy Commission is also charged with monitoring impacts to major energy systems within the state. This monitoring includes electric, natural gas (including liquefied natural gas), and transportation fuels, (including petroleum and diesel). This monitoring also includes renewable energy sources such as biomass, solar, wind, hydroelectric, and nuclear. This monitoring leads the Energy Commission to:

- Identify and assess the impacts of energy disruptions.
- Identify mitigation measures to improve the energy transmission and distribution system and enhance supply reliability.
- Promote energy technology development and emergency response tools.
- Elevate public awareness in energy assurance by promoting energy education and training.
- Improve the robustness of the state's energy systems.
- Enhance energy resiliency and improve response to energy disruptions.
- Coordinate state government energy emergency preparedness and energy critical infrastructure protection efforts.

Along with identifying the state's energy resources and infrastructure, this plan identifies several ongoing energy investments that reduce the risk of energy disruptions or emergencies. These measures include conservation, increased reliance on renewable energy, and infrastructure improvements that increase resiliency. California produces roughly 70 percent of the electricity it uses, while natural gas is the main source for electricity generation at 45 percent of the total in-state electric generation system. California produces less than 5 percent of the in-state natural gas it consumes and is the nation's fourth largest producer of crude oil, but requires more than 60 percent of its petroleum from imports. These critical facts drive the need for a cohesive energy assurance strategy.

California faces multiple challenges to ensure adequate energy supplies and fulfill several policy goals, including a reduction of greenhouse gas emissions across every sector. In addition, the Renewables Portfolio Standard requires utilities to produce 33 percent of the state's electricity consumption from renewable electricity sources by 2020. Since 2003, California has established an electricity "loading order" as the preferred strategy to reduce electricity demand and add new resources for growth. The loading order lists energy efficiency and demand response first, renewable resources second, and clean and efficient natural gas-fired power plants third.

California's power plants rely on imported natural gas, leaving the state vulnerable to price shocks and supply disruptions. However, additional pipeline capacity and open access in recent years have contributed to long-term supply availability and gas-on-gas competition for the California market. California's in-state renewable generation consists of biomass, geothermal, small hydro, wind, and solar generation sites that make up about 18 percent of the total in-state generational output, and these successful efficiency programs and reliance on renewable sources of electricity should slow the demand for natural gas relative to demand in other parts of the nation.

California has reduced its reliance on petroleum by 6 percent since 2006 through more efficient vehicles and the use of alternative fuels. In 2012 petroleum-based fuels accounted for roughly 93 percent of the state's transportation fuel consumption. California's transportation sector generates nearly 40 percent of the state's greenhouse gas emissions, and several laws, regulations, and executive orders have been enacted to reduce emissions from petroleum sources. These government initiatives include Assembly Bill (AB) 32 (Global Warming Solutions Act – Núñez, Chapter 488, Statutes of 2006), the Alternative and Renewable Fuels and Vehicle Technology incentive fund, and Low Carbon Fuel Standard and Zero-Emission Vehicle regulations.

The *State of California Energy Assurance Plan* highlights planning documents (regulations, polices, plans, reports, and so forth) to gain a greater understanding of the state's energy assurance planning processes or initiate energy assurance activities.

California's *Energy Assurance Plan* outlines the roles and responsibilities of state agencies in response to and recovery from energy disruptions and emergencies, including integration with the *State Emergency Plan's* Emergency Function #12-Utilities (EF-12). The EF-12 plan responds to federal requirements and identifies the critical public and private sector partners that form the state's holistic energy assurance system (supply and infrastructure), are directly responsible for producing and overseeing the transmission and distribution of the state energy system, and are the primary response and recovery entities that respond and restore utilities from energy emergencies.

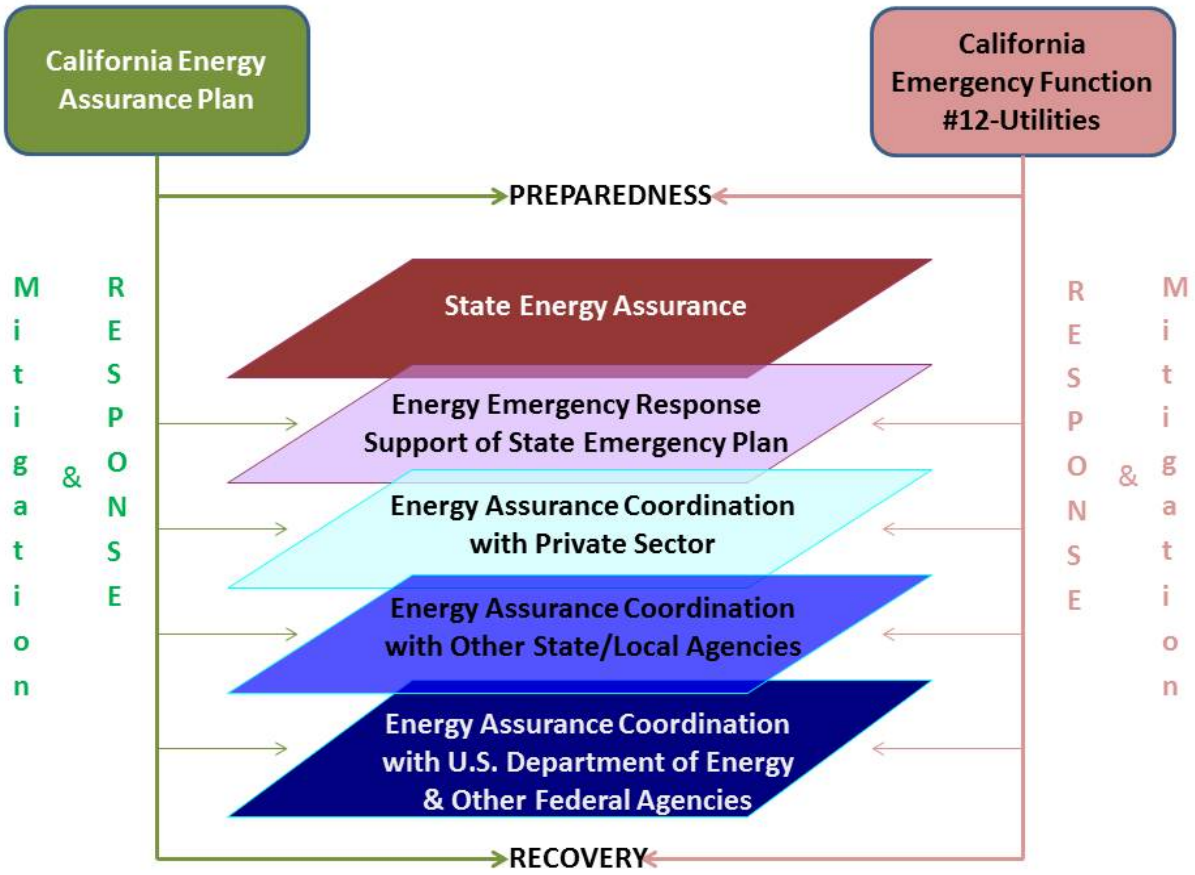
This plan connects multiple energy assurance activities within the four energy assurance areas of mitigation, preparedness, response, and recovery. Figure 1 provides an overview of this high-level *California Energy Assurance Plan* and Emergency Function #12 interrelationship.

This *Energy Assurance Plan* contains four increasing phases of activity depending on the severity of the energy disruption or emergency. These phases describe how California will:

- Identify energy assurance risks (risk identification level).
- Attempt to address identified energy assurance risks (risk minimization level).
- Direct response to perceived or identified energy assurance disruptions or emergencies (energy emergency response level).

- Initiate actions to recover from energy assurance disruptions or emergencies (energy supply/infrastructure recovery/restoration level).

Figure 1: High-Level *Energy Assurance Plan* and Emergency Function #12 Interrelationships.



Source: Aanko Technologies Inc.

This plan is divided into six chapters and 12 appendices.

Chapter 1 provides the *State Energy Emergency Response Plan* that works in conjunction with the State Emergency Plan's Emergency Function 12 – Utilities.

Chapter 2 provides an introduction to energy assurance planning, including the legislative mandate for energy assurance planning at the California Energy Commission.

Chapter 3 provides an overview of the energy infrastructure risks and vulnerabilities.

Chapter 4 provides an introduction to electric resources within the state, including information on renewable energy resources, the smart grid and cybersecurity issues, and

outlines its strategies for risk identification, risk minimization, emergency response, and supply/infrastructure recovery/restoration.

Chapter 5 provides an introduction to natural gas resources within the state and outlines the state's strategies for risk identification, risk minimization emergency response, and supply/infrastructure recovery/restoration.

Chapter 6 provides an introduction to petroleum and transportation fuels within the state and outlines strategies for risk identification, risk minimization, emergency response, and supply/infrastructure recovery/restoration.

Appendix A is the *Energy Assurance Plan* operating guidelines used by the Energy Emergency Management Center during energy assurance emergencies.

Appendix B provides the integration between the *California Energy Assurance Plan* and Emergency Function #12-Utlities of the *State Emergency Plan*.

Appendix C identifies the state energy emergency response programs.

Appendix D is the State Energy Profile (*Integrated Energy Policy Report*), provided under a separate cover.

Appendix E is the glossary.

Appendix F is the references.

Appendix G identifies a sample situation report used in the event of an energy emergency.

Appendix H provides an Energy Disruption After-Action Report format.

Appendix I identifies an Energy Disruption History Report.

Appendix J is the Energy Risk Assessment Matrix.

Appendix K is the Energy Workforce Development Plan.

Appendix L is the Energy Supply Disruption Tracking Process.

The state is making great strides in implementing adequate, affordable, technologically advanced, and environmentally sound energy, while ensuring the safety and effectiveness of its energy delivery systems. The overarching goal for California's energy assurance is for the state's energy to be reliable–provided when and where needed and with minimal environmental risks and impacts. The strategy is to provide affordable energy that is environmentally responsible, optimizes economic growth, increases efficiency, reduces dependency on foreign oil and fossil fuels, increases energy diversity, and empowers Californians with the knowledge to assist in addressing energy disruptions or emergencies.

The California Energy Commission expects to revise and update the *Energy Assurance Plan* as necessary.

CHAPTER 1:
Energy Emergency Response Plan

Energy Emergency Response Plan Introduction

The *California Energy Emergency Response Plan* (*EERP*) is the state's strategy for responding to an energy emergency and works in conjunction with the *State Emergency Plan* (SEP). The EERP is a component of the overall *CEAP*.

An "energy emergency" is an actual or impending shortage or curtailment of usable, necessary energy resources that affects public health, safety, and welfare, or critical infrastructure of the state. An energy emergency can be caused by natural disasters (such as earthquake, fire, or flood) or geopolitical events (such as war, terrorism, civil disturbance, or embargo).

Since each energy emergency is unique, it is impossible to envision every potential event or combination of events that might contribute to, or result in, an energy emergency. The *EERP* is based on an "all hazards" approach that provides the flexibility to adapt to every energy emergency situation, regardless of the origin. The *EERP* provides both a management and operational structure that identifies the functional relationships that must exist to ensure effective identification, response, and recovery from an energy emergency.

The State of California organizes its emergency response resources and capabilities, as well as those of certain private-sector and nongovernmental organizations, under the *SEP* and its 18 associated emergency functions (EFs). EFs are coordinated through the California Office of Emergency Services (OES) as part of its lead role in response to emergencies and disasters affecting or disrupting essential services, including energy.

EFs provide the structure for coordinating state interagency support in response to an incident. EFs are mechanisms for grouping functions most frequently used to provide state support to other state agencies and local governments, both for declared disasters and emergencies under the California Emergency Services Act[1] and the federal Robert T. Stafford Act[2] and for nondeclared incidents. In California, EF #12 is designated as energy industry utilities' coordination for energy infrastructure assessment, repair, and restoration in response to an energy emergency and works in conjunction with this *EERP* and the overall *CEAP*. Appendix B identifies the integration of this plan and EF#12-Utilities.

---

1 http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/CAlifornia%20Emergency%20Services%20Act/$file/ESA-all8-06-final.pdf.

2 http://uscode.house.gov/download/pls/42C68.txt.

Energy Assurance Partner Integration

Depending upon the level emergency (as defined in the California *SEP*), various local, regional, state, and federal resources and entities would be activated. At the federal level, the U.S. Department of Energy (DOE) Office of Electricity Delivery and Energy Reliability's (OE), Office of Infrastructure Security and Energy Restoration (ISER), maintains a password-protected Energy Emergency Assurance Coordinators (EEAC) website, through which authorized state energy emergency coordinators may access valuable energy security information, including daily news summaries, emergency situation reports, lessons learned from other states, links to outage and curtailment information, and the ability to email messages to colleagues in other jurisdictions.

The EEAC is a cooperative effort among several federal and private sector (nonprofit) agencies:

- National Association of State Energy Officials (NASEO).
- National Association of Regulatory Utility Commissioners (NARUC).
- National Conference of State Legislatures (NCSL).
- National Governor's Association (NGA)—Center for Best Practices.
- Public Technology Institute (PTI).
- DOE OE's ISER Division.

Data Information Acquisition and Dissemination

The EEAC establishes a secure cooperative data information acquisition and dissemination environment for state and local government personnel with access to information on energy supply, demand, pricing, and infrastructure. Designated members have expertise in electricity, petroleum, and natural gas. The current membership of nearly 200 people is made up of representatives from state energy offices, public utility organizations, state legislatures, emergency management agencies, homeland security offices, local governments, and governors' offices. In a major energy emergency, all of these resources would be called upon.[3]

California has designated several primary and secondary designees per energy source (electricity, natural gas, and petroleum) for inclusion in the EEAC. In the event of an energy supply disruption or emergency, DOE OE relies upon the EEAC contacts to provide an up-to-date assessment of energy markets in the affected states. During these emergencies, as well as other nonemergency situations in which the list may be used, the EEAC serves as the link between the state, industry, and DOE OE.

---

3 *NASEO State Energy Assurance Guidelines*, V3.1, 2009, p39.

In an energy emergency, DOE OE may need to disclose sensitive and privileged information and, in these situations, may contact only the primary coordinator. From that point, it is the designated primary coordinator's responsibility to follow California's plan for disclosure of information. In most other nonemergency or less sensitive emergency or disruption situations, both the primary and secondary coordinators may be contacted. Communications can be sent directly to the DOE OE via email, and an EEAC can use listservs to send information to different regions. In addition, the EEAC bulletin board provides a great way for coordinators to share information and best practices.

California's EEAC coordinators and designees must keep in touch with the state's key energy sector contacts, including key players in the state's primary energy supply and energy-consuming sectors, as well as key emergency or energy-related personnel in other state and local government agencies. Moreover, it is important to keep in contact with other EEACs in the state. If a responder's first contact with other EEACs is during an emergency, it is already too late. The types of events that warrant communication with the EEAC network include:

- Large-scale events, such as an attack on the power grid, international oil disruption, catastrophic storm damage, and similar events.
- Emerging problems, such as the spring gasoline change in nonattainment air quality areas that cause a significant increase in the number of terminals without a supply, price spikes, and other indicators of stress on ability of the supply/distribution system to supply fuel (oil, gas, gasoline, and so forth).
- Routine summer and winter energy assessments.
- Simulations and exercises.

The types of nonproprietary information that should be shared include:

- Information that quantifies the size, scope, and potential duration of the problem.
- Geographic area affected.
- Effects upstream and downstream in the energy supply/distribution system.
- Public statements by state officials.
- Specific actions taken by state or local governments to mitigate impacts.
- Requests from industry for assistance and response.
- In-state media reports that accurately describe the problem.

The California EEAC coordinator should consider sending information to the EEAC list when market indicators suggest the potential for supply problems and monitoring will be increased. In addition, information should be sent when an event occurs that affects

energy supply, demand, or price or when an energy emergency or state of disaster is declared that affects energy supply.

In the case of an international event that affects energy supply, DOE OE will likely communicate its analysis to the EEAC list and/or California. EEACs may request such information from DOE OE. The EEAC list may also be used by DOE OE to request information if there are reports of energy problems. California EEAC should also use this list to communicate regionally to counterparts because problems are often not limited to a single jurisdiction. Too much information is often better than little or no information—if in doubt, use the list. A brief message can go a long way, and communication is key.

Communications and Interagency Coordination

During an energy emergency, the state will establish and maintain information networks and operational relationships with all levels of government, as described below.

Federal Government

The *Energy Emergency Response Plan* is designed to be compatible with the National Response Framework (NRF), specifically Emergency Support Function (ESF) #12. The U.S. DOE is the lead federal agency for ESF #12 and is the point of contact during an incident of national significance requiring the activation of the NRF. In the event the federal government is mobilized in support of the state, the *California Catastrophic Incident Base Plan*[4] will be activated.

During this type of emergency, the Energy Commission will provide both DOE and the Federal Emergency Management Agency (FEMA) with situation reports. Requests for federal energy assistance, such as withdrawals from the Strategic Petroleum Reserve, will be coordinated between the Energy Commission and DOE.

Federal Energy Regulatory Commission (FERC): FERC is an independent regulatory agency within the DOE that regulates the transmission and sale for resale of natural gas in interstate commerce; regulates the transmission of oil by pipeline in interstate commerce; regulates the transmission and wholesale sales of electricity in interstate commerce; licenses and inspects private, municipal, and state hydroelectric projects; oversees related environmental matters; and administers accounting and financial reporting regulations and conducts of jurisdictional companies.

Other State Governments

The United States is divided into Petroleum Administration Defense Districts (PADDs). California is in PADD V (5), with Alaska, Arizona, Hawaii, Nevada, Oregon, and Washington. The states in PADD V are closely linked by their dependency on an oil

4 http://www.calema.ca.gov/planningandpreparedness/pages/catastrophic-planning.aspx

supply system that is essentially self-contained. Because PADD V is somewhat isolated from the other PADDs, a continuum of cooperation and coordination is needed during a supply disruption. The Energy Commission Energy Emergency Planning staff will keep all PADD V states informed of potential supply impacts, as appropriate.

Other Out-of-State Entities

North American Electric Reliability Council (NERC): The council is a voluntary organization that develops, promotes, and enforces standards for a reliable North American bulk electric system. Coordination will be through the Western Electricity Coordinating Council or the FERC.

Western Electricity Coordinating Council (WECC): The WECC is responsible for coordinating and promoting electric system reliability in the Western Interconnection, one of the two major alternating current power grids in North America. [5] WECC supports efficient competitive power markets, assures open and nondiscriminatory transmission access among members, and provides a forum for resolving transmission access disputes. The WECC is geographically the largest and most diverse of the eight regional entities that have delegation agreements with the NERC. Delegation agreements are established to develop and enforce the nation's bulk-power system reliability standards under Section 215(c) of the Federal Power Act.[6]

California State Entities

Various state entities have key roles in the energy supply disruption management structure, including preparedness, response, and recovery from emergencies and disasters. Within the state, OES is charged with coordinating these activities. Therefore, OES is the key point of contact for the Governor's Office in the event of any emergency or significant situation. This notification process is not intended to dilute the statutory authority of agencies that have emergency operational responsibilities, but rather to ensure that consistent procedures are followed in providing factual information to the Governor and his staff in a timely manner. Communication links shall be established and maintained throughout all levels of the incident to support efficient emergency operations, internal information needs, and the delivery of regular status updates to the public, external agencies, and the media. These reporting requirements include OES, the Energy Commission, the California Public Utilities Commission (CPUC), the California

---

5 North American Electric Reliability Corporation (NERC) is an institution that oversees and regulates the reliability of the North American electrical grids. It is the federally recognized Electric Reliability Organization (ERO) which means that it is responsible for developing and enforcing reliability standards, creating annual and 10-year assessments for winter and summer forecasts, monitoring the bulk power system and educating, training and certifying industry personnel.

6 Federal Power Act http://www.law.cornell.edu/uscode/16/usc_sup_01_16_10_12.html.

Independent System Operator (California ISO), the California Department of Water Resources (DWR), and all utilities within the state as the situation dictates. Local governments in California use the Standardized Emergency Management System (SEMS) when requesting assistance during a disaster or other emergency.

The following state entities play active roles in California's energy assurance:

- Governor
- Governor's Office of Emergency Services
- California Assembly Committee on Natural Resources
- California Assembly Committee on Utilities and Commerce
- California Department of Water Resources
- California Energy Commission
- California Independent System Operator
- California Natural Resources Agency
- California Public Utilities Commission
- California Senate Committee on Energy, Utilities and Communications
- California Senate Committee on Natural Resources and Water
- California State Lands Commission
- California Utilities Emergency Association
- Department of Conservation − Division of Oil, Gas, and Geothermal Resources
- Major investor-owned utilities
- Major publicly owned utilities

Governor

The Governor is ultimately responsible for assuring the energy needs of the state and in preparing for and responding to energy emergencies affecting California. The Governor relies upon state, public-, and private-sector entities to assist in this assurance. This is due to the energy sector being largely privately owned, which limits the Governor's regulatory and statutory authority.

Governor's Office of Emergency Services (OES)

During a disaster, the Governor's Office of Emergency Services (OES) is the lead agency, and other state agencies, including the Energy Commission, provide support relative to their mission assignment and capability. The Energy Commission's responsibilities include information gathering, energy infrastructure impact analysis, response coordination, and supporting the OES with fuel distribution to ensure that emergency and essential services can adequately respond to a disaster.

OES is divided into three administrative regions throughout California. The regions and their headquarter locations are:

- Inland Region (Sacramento/Mather).
- Coastal Region (Oakland).
- Southern Region (Los Alamitos Armed Forces Reserve Center).

If the disaster is localized within a single region, the Regional Emergency Operations Center (REOC) is activated, and all requested state agency representatives respond to that REOC.

If the disaster affects multiple regions, however, the State Operations Center (SOC) becomes the primary coordination center for state agency representatives. Agency representatives respond to the SOC in lieu of assigning multiple regional representatives.

Although OES is the lead state agency during a disaster, the Energy Commission assumes the lead agency role in situations where the energy emergency is the result of nondisaster-related event, such as an embargo. In nondisaster energy emergencies, OES will assist the Energy Commission in coordinating the statewide distribution of fuel supplies and ensuring that the Governor and Legislature are kept informed.

California Assembly Committee on Natural Resources

The Committee on Natural Resources has the primary jurisdiction for reviewing energy efficiency and renewable energy bills and reviewing the bills favorably or unfavorably to the full California Assembly.

California Assembly Committee on Utilities and Commerce

The Committee on Utilities and Commerce has the primary jurisdiction for reviewing public utilities, the CPUC, the Energy Commission, California ISO, energy companies, common carriers, electricity, alternative energy development and conservation, natural gas, and wireless, wireline, and cable communications bills. It reviews these bills favorably or unfavorably to the full California Assembly.

California Department of Water Resources

The Department of Water Resources (DWR) operates the California State Water Project. The State Water Project is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the State Water Project is to store water and distribute it to 29 urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California.

In addition to water, the State Water Project is one of the largest power systems in the world. Power plants and pumping facilities are critically important to the generation and consumption of power in California. Large hydroelectric projects account for about

11 percent of overall energy generation in the state. Generating capacity and, therefore, energy supply are influenced by water supply, environmental requirements, and flood management policies and regulations. Hydroelectric and coal-fired facilities, along with contractual arrangements, are the major power sources for power operations. The DWR uses its power resources primarily to run the pumps that move water to California farmlands and cities, but also to provide peak power to utilities.

Because the DWR has the flexibility to regulate pumping on an hourly basis, maximum pumping is generally scheduled when power costs are low. By scheduling as much off-peak pumping as possible, the DWR is able to take advantage of less expensive surplus electrical generation. Conversely, the DWR maximizes its power generation for the benefit of the interconnected electrical grid during the on-peak hours when electric demand is highest. In this manner, the DWR is able to manage a comprehensive power resources program that helps minimize the cost of water deliveries to water supply contractors while maximizing the benefits to the statewide electric grid. DWR participates in the California Independent System Operator (California ISO) supplemental electric energy market and ancillary services markets. In case of system emergencies, DWR can drop pump loads to help California ISO maintain reliable electric power for California.

The DWR's power planning process begins with a review of all projected loads and resources, including pump load, generation from the DWR's facilities, generation from joint facilities, sales, purchases, and exchanges. The net of these loads and resources yields a power portfolio in which the DWR often has a net deficit during the off-peak hours and a net surplus in the on-peak hours. DWR then procures the deficit and markets the surplus in stages, baseline amounts are transacted in advance, and the remaining deficit and surplus quantities are transacted as the year progresses and more information becomes available regarding hydrology, water demands, and so forth.

During emergency response, DWR will mobilize incident command teams to assess DWR-controlled hydroelectric and dam infrastructure and report the initial assessment information back to OES in accordance with established emergency action plans as required by the Federal Emergency Management Agency (FEMA).[7] DWR will also direct private sector dam owners to initiate their EAPs and report their assessments through established reporting channels to provide the state with a clear common operating picture of the incident extent.

---

7 National Dam Safety Program Act of 1996, Public Law 104-303, *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners*. http://www.fema.gov/media-library/assets/documents/3357.

California Energy Commission

Officially known as the California Energy Resources Conservation and Development Commission, but better known as the Energy Commission, it was formed in 1975 to assess energy needs, license power plants, promote energy conservation, and develop alternative energy resources. Furthermore, the original statute[8] directed the Energy Commission to prepare an integrated plan specifying actions to be taken in the event of an impending or serious shortage of energy, or a clear threat to public health, safety, or welfare. In 1996, the legislation directed the Energy Commission to develop the state's first energy emergency response plan and develop an energy assurance plan. While there is no lead state agency to plan for and direct the state response to energy emergencies, the Energy Commission takes an active role in identifying strategies for energy assurance alongside the energy assurance partners noted in this plan.

California Independent System Operator

The California Independent System Operator (California ISO) is an impartial link between the electrical generating power plants and the utility companies that provide electricity to more than 38 million consumers. When the demand for electricity exceeds the generating capacity of power plants, the California ISO must determine the manner in which limited electrical supply will be distributed through the transmission and distribution network. Electrical energy shortages are classified in emergency "stages" as follows:

- Stage One: Operating reserves are between 6 and 7 percent.
    - Operating reserves are below the requirement (generally 7 percent or greater).
    - California ISO initiates its Voluntary Load Reduction Program.
    - California ISO and utilities make public appeals for conservation.
- Stage Two: Operating reserves are less than 5 percent.
    - California ISO requests utilities to initiate their interruptible rate tariff programs (billing rate reduction offered to customers for their reduced energy consumption).
    - Communication and coordination are ongoing among California ISO, utilities, market participants, and state regulatory and oversight agencies.
- Stage Three: Operating reserves are less than required (Between 1.5 and 3 percent).

---

8 Warren-Alquist State Energy Resources Conservation and Development Act. http://www.energy.ca.gov/2014publications/CEC-140-2014-001/CEC-140-2014-001.pdf

- The California ISO must request that the utilities implement involuntary service interruptions to their customers to maintain the reliability and integrity of the interconnected transmission grid.
- Involuntary interruption to utility customer service begins. The California ISO requests that utilities initiate rotating outages with advance notification (if possible) to utility companies.
- Utility companies must notify customers of impending outages.

The California ISO is not required to move through the stages sequentially. System conditions are dynamic, and, therefore, it may be necessary to skip a stage to respond to the emergency.

The Energy Commission coordinates with the California ISO in the following areas:

- Shares information and participates in reports of the electricity grid status during times of peak energy use.
- If needed, uses the informal fuels set-aside program to ensure sufficient fuel supplies for essential utility support services. If required during a declared emergency, the Energy Commission implements the formal petroleum fuels set-aside program to ensure a continuum of power generating capability.
- Assists with conservation announcements to the public, as needed.

The California ISO also works closely with the Western Electric Coordinating Council-WECC, which handles transmission and grid stability for the entire western United States. The California ISO must operate the electrical power system in accordance with North American Electric Reliability Corporation (NERC) standards and regional coordinating council standards. The California ISO also provides market pricing structures developed for such services as day-ahead forecasts, hourly forecasts, and near real-time operations. The California ISO possesses near real-time knowledge (generally 4 sec and subcycle, in some cases) of the status of the electric system within its operating area and adjacent operating areas.

Below are steps that California ISO operators may take before and during system emergencies:

- Continually monitor system operations and conditions
- Discontinue outside sales of power/increase power imports
- Modify operation of generating units for emergency relief
- Request selected customers to reduce load
- Request all customers to voluntarily reduce load
- Reduce voltage

- Implement controlled rotating interruptions (rolling blackouts)

California Natural Resources Agency

The agency is tasked as the lead agency in developing Emergency Function #12-Utilities, (EF-#12) in support of the *State Emergency Plan.* EF #12 addresses utilities-related aspects of disasters and emergencies. It establishes policies and procedures for response to and recovery from shortages and disruptions in the supply and delivery of electricity, natural gas, and other forms of energy and fuels that impact or threaten to impact large numbers of the state's residents and visitors.

California Public Utilities Commission

The California Public Utilities Commission (CPUC) continually ensures that jurisdictional electric utilities are prepared for emergencies and disasters to minimize damage and inconvenience to the public that may occur as a result of electric system failures, major outages, or hazards posed by damage to electric distribution facilities under General Order 166.[9] Furthermore, the CPUC establishes safety and service requirements (General Order 95) for overhead transmission line design, construction, maintenance and operations; and reliability standards (General Order 167) for maintenance and operation of power plants.

The CPUC also has an agreement with the United State Department of Transportation Pipeline and Hazardous Materials Safety Administration to enforce minimum gas pipeline safety standards codified in 49 Code of Federal Regulations (CFR), Part 192. The CPUC's General Order 112-E references and adopts 49 CFR, Part 192, in its entirety. GO 112-E and General Orders 58-A and 58-B identify the minimum safety requirements for the operation and maintenance of natural gas transportation systems.

The CPUC oversees the safety and reliability aspects of operator pipeline safety programs through audits, inspections, and investigations of incidents reported by operators. Engineers from the Utilities Safety and Reliability Branch (USRB) of the CPUC's Consumer Protection and Safety Division (CPSD) participate on national and state committees that develop and update pipeline safety standards. The CPUC supports campaigns that raise awareness of excavation damage prevention. Excavation damage is the most common threat to pipeline safety. CPSD has also created a risk-assessment unit to provide additional expertise in risk identification, risk analysis, and risk management to further reduce the risks presented by utility infrastructure.

The CPUC's USRB audits gas pipeline operator safety programs to assure that they comply with GO 112-E. The USRB audits review operator operations, maintenance, and emergency (OM&E) manuals, as well as operator qualification plans, integrity

9 http://www.cpuc.ca.gov/PUC/energy/ElectricSR/Reliability/emer_stand.htm.

management plans, public awareness plans, and drug and alcohol testing programs. The reviews confirm if the operator has created adequate procedures to address safety requirements. Audits at the division, district, or region level include records review specific to that area, as well as field inspections of certain pipeline facilities.

During division, district, or region audits, USRB staff inspects, on a sampling basis, regulator/limiting stations, valves, pipeline safety, corrosion, repairs, emergency contact information, emergency materials, operator's review of an emergency response or mock drill, and other activity reflected on compliance records. USRB inspects new construction when resources permit and performs field inspections related to investigations of incidents reported by operators to the CPUC or customer complaints related to gas pipeline facilities.

California Senate Committee on Energy, Utilities and Communications

The Committee on Energy, Utilities and Communications has the primary jurisdiction for reviewing utilities, energy companies, alternative energy development and conservation, and communications development and technology bills, and reviewing these bills favorably or unfavorably to the full California Senate.

California Senate Committee on Natural Resources and Water

The Committee on Natural Resources and Water has the primary jurisdiction for reviewing conservation and management of public resources, and regulation of oil, mining, and geothermal development, and reviewing these bills favorably or unfavorably to the full California Senate.

California State Lands Commission

In 1921, the Legislature authorized the issuance of prospecting permits and leases for oil and gas development of the state's tide and submerged lands by the Surveyor General, the predecessor of the California State Lands Commission. In 1938, the Legislature gave exclusive jurisdiction over all oil and gas development on the state-owned property to the Commission.

The state now administers more than 100 sites on which oil companies have developed some 1,000 wells that take oil and gas from state lands. A royalty is paid on each barrel of oil that is removed. In addition, more than 1,000 wells produce oil from granted tidelands in Long Beach. The revenues received from oil and gas are deposited in the state's General Fund and allocated to be used for the Commission's budget, support of the State Water Project, capital outlay for higher education, and many other important projects. The State Lands Commission authorizes, through leases and permits, geothermal or mineral prospecting permits, and oil and gas leases.

California Utilities Emergency Association

The California Utilities Emergency Association (CUEA) is a nonprofit organization. Its mission is to provide emergency operations support for gas, electric, water, wastewater, telecommunications (including wireless), and petroleum pipeline utilities necessary for

the preservation of lives and property. CUEA also provides for the coordination of joint planning, training, exercising, and partnering to further collaborative efforts with utilities and governmental agencies within the emergency management environment. This support enhances the overall protection of California's economic infrastructure.

The CUEA Energy Operations Center (EOC) serves as a coordination and facilitation point for communication between utilities and state OES. The CUEA EOC consists of volunteers from the utility sector who bring critical industry expertise to assist in the information flow into the State Operations Center (SOC) through the Utilities Liaison. The CUEA EOC may operate as an element of the state OES Private Sector EOC.

The CUEA EOC can activate under multiple scenarios and whenever the State Operations Center is activated for an event that may involve or affect California's utilities, including activation of the OES SOC Utilities branch, with operations relating to significant utility response and recovery operations. The CUEA coordinates resources and technical assistance among utility organizations during the response, restoration, and recovery efforts under a memorandum of agreement (MOU) between the CUEA and the State OES.

The CUEA is the lead for gaining assistance from the private sector utilities operating within California and for utilities' mutual aid under EF # 12 of the *California State Emergency Plan*, which works in coordination with this plan.

Department of Conservation – Division of Oil, Gas, and Geothermal Resources (DOGGR)

The division oversees the drilling, operation, maintenance, plugging, and abandonment of oil, natural gas, and geothermal wells. Regulatory programs emphasize development of oil, natural gas, and geothermal resources through sound engineering practices that protect the environment, prevent pollution, and ensure public safety.

Major Investor-Owned Utilities (IOUs)

IOUs are utilities organized as tax-paying businesses usually financed by the sale of securities in the free market, and whose properties are managed by representatives regularly elected by their shareholders. IOUs, which may be owned by an individual proprietor or a small group of people, are usually corporations owned by the public. In California, the CPUC regulates the IOUs.

Major Publicly Owned Utilities (POUs)

POUs are organizations that maintain the energy infrastructure for a public service. POUs are subject to forms of public control and regulation ranging from local

community-based groups to the Energy Commission (such as the statutory requirement for under the Power Source Disclosure Program under AB 162).[10]

Concept of Operations

The state's energy assurance partners work together in all of the following four phases of increasing energy emergency activity.

- Alert-Readiness Phase
- Verification Phase
- Pre-Emergency Phase
- Emergency Phase

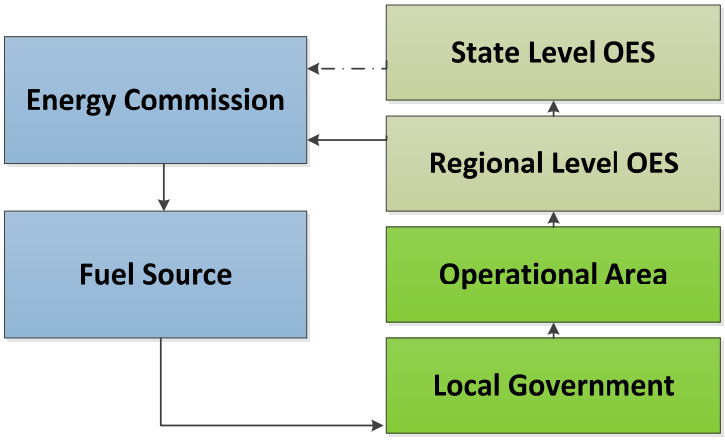
The nature and severity of the event determine in which phase the response begins. During an energy emergency, the activities prescribed in each phase intensify depending on the severity of the emergency. The point of transition from one phase to the next is not an absolute. To a large degree, it is qualitative, and the decision to implement each phase requires expert judgment, recognizing public perception of the seriousness of the energy emergency. It is not mandatory to advance sequentially through each phase. If appropriate, it is possible to implement any phase without going through intervening phases.

In accordance with SEMS, the State of California provides for the orderly submittal of resource requests from the Emergency Operations Centers (EOCs) of county operational areas to one of three regional EOCs and potentially to the SOC, or through discipline-specific mutual aid system channels, including direct coordination with the Energy Commission.

Local governments may request any needed supplies, including energy, through their operational areas. (Each of California's 58 counties is considered an operational area.). If the operational area is unable to supply what is needed, the request goes to the regional level OES and, if necessary, the state level OES at the SOC. At this point, the Energy Commission could be asked for assistance if supplies of transportation fuel are still needed for emergency or essential services. Direct contact between the Energy Commission and local governments may occur when the requests have been approved by OES to better coordinate quantities, types of fuel, and delivery locations. Electricity and natural gas utility coordination and emergency response are handled through the CUEA who coordinates with the OES and the utilities. Figure 2 illustrates how these requests could occur.

10.http://www.energy.ca.gov/power_source_disclosure/documents/ab_162_bill_20091011_chaptered.pdf.

Figure 2: Coordination With Local Government



Source: California Energy Commission

Energy Emergency Response

In the event of an energy emergency, all local and state-level response entities will operate under the California Standardized Emergency Management System (SEMS) using the Incident Command System (ICS).

Alert-Readiness Phase

The Energy Commission's Energy Emergency Planning staff remains in the Readiness Phase under normal operating conditions on an ongoing basis. In the Alert-Readiness Phase, the staff:

- Monitors international and domestic events.
- Attends periodic exercises to establish and test emergency protocols.
- Trains appropriate Energy Commission staff.
- Updates and maintains a network of public and private sector contacts.
- Prepares internal advisory reports, as needed.

Verification Phase

The Verification Phase may be activated if the Energy Commission determines that an energy emergency has occurred or may shortly occur. During this phase, the Energy Emergency Planning staff will:

- Rapidly determine the nature, extent, and duration of a potential, impending, or actual energy emergency.

- Coordinate energy emergency response activities with the OES, other appropriate state agencies, the U.S. Department of Energy, other state governments, local government agencies, and private industry.
- Provide a detailed situation report that assesses the potential or actual impacts of the emergency on energy prices and supplies.
- If required, use the informal fuels set-aside program to ensure that emergency and essential services receive adequate supplies of fuel.
- Recommend further actions (if any) to the Energy Commission's Chairman.

Pre-Emergency Phase

If the Energy Commission determines the existence of a protracted or growing energy problem, the Pre-Emergency Phase may be activated. This phase is characterized by an increased level of government activity as the energy problem worsens.

During this phase, the Energy Emergency Planning staff will:

- Continue to coordinate energy emergency response activities with the OES, other appropriate state agencies, the U.S. Department of Energy, other state governments, local government agencies, and private industry.
- Continue to provide periodic situation reports that describe the nature of the energy emergency, the potential or actual impacts on energy prices and supplies, and the expected duration of the event.
- If required, continue to use the informal fuels set-aside program to ensure that emergency and essential services receive adequate supplies of fuel.
- Recommend to the Chairman appropriate voluntary demand reduction measures that may be used to mitigate the impacts of the energy emergency.

Emergency Phase

If the problem becomes more severe, the Chairman may activate the Emergency Phase, based upon the recommendations of the energy emergency manager and the California Energy Emergency Management Center (EEMC) staff. The Chairman will confer with the state OES on this decision and notify the Natural Resources Agency and the Governor. This phase involves all activities initiated during the Pre-Emergency Phase, along with additional voluntary or mandatory programs.

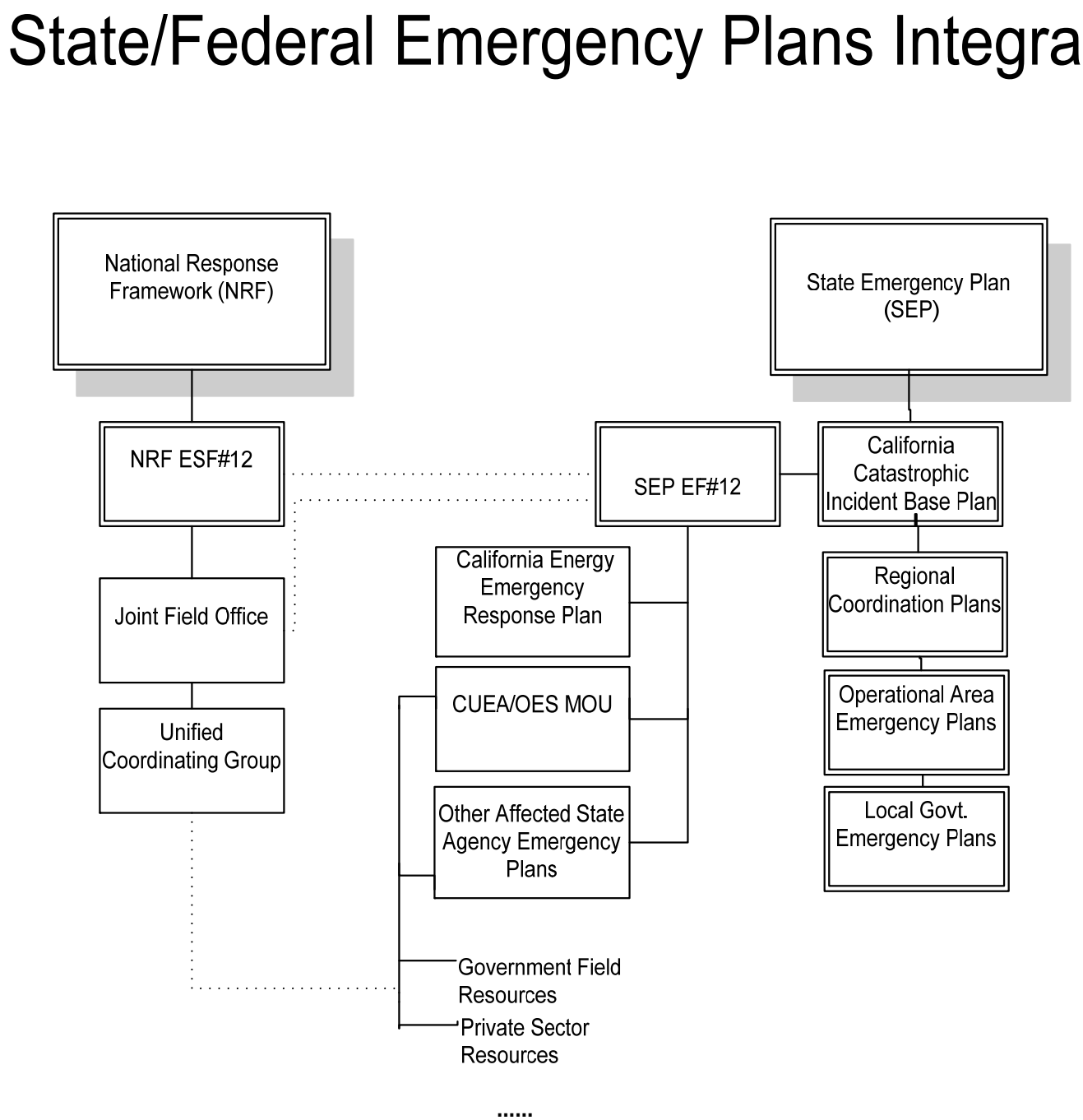
To impose mandatory programs, the Governor must first issue the Proclamation of a State of Emergency and file an Emergency Order specific to the Fuels Set-Aside Program with the Office of the Secretary of State. The Emergency Order takes effect immediately upon being filed. All mandatory programs automatically terminate when the Governor rescinds the emergency proclamation.

During this phase, the Energy Emergency Planning staff continues to coordinate response activities, prepare situation reports, and use the informal fuels set-aside program as described in the Pre-Emergency Phase. In addition, the staff will:

- If directed by management, activate the Energy Emergency Management Center.
- If required, implement the activation of the Petroleum Fuels Set-Aside Program. Implementation of this program requires that the Governor sign Emergency Order #6. This order empowers the Energy Commission to *"hold control of petroleum stocks needed to ensure the health, safety and welfare of the public."*
- Recommend to the Chairman appropriate mandatory demand reduction measures that may be used to reduce the impacts of the energy emergency.

In the event the Emergency Phase is activated, EF#12 will automatically go into effect in conjunction with this *CEAP*. In addition, the state OES, under the Governor's direction, may request mutual aid from the federal government. In this instance, in addition to EF#12 being activated, the California Catastrophic Incident Base Plan and other state emergency plans will be activated. Figure 3 shows the interrelationship of emergency plans involved during the Emergency Phase.

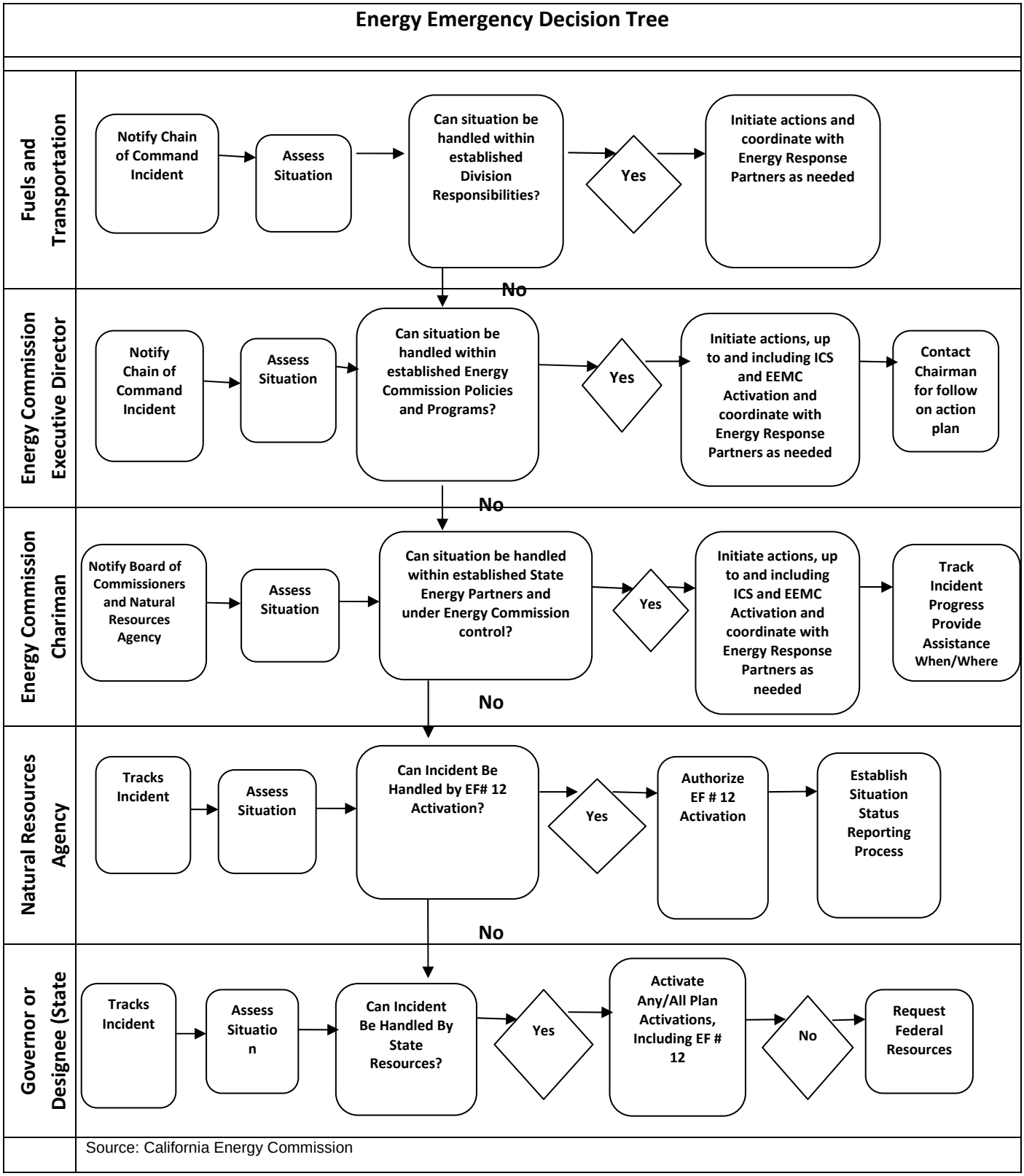
Figure 3: State/Federal Emergency Plans Integration



Source: Aanko Technologies Inc.

The decision to activate energy emergency plans is based on the "all-hazards" approach and is typically handled at the lowest level of command and control. For activations of energy emergencies, these may begin at the local government level. When instances involve situations that begin at the state level, the following energy emergency decision tree will be followed, as noted in Figure 4.

Figure 4: Energy Emergency Decision Tree



Source: California Energy Commission

California Energy Emergency Management Center (EEMC)

During an energy emergency or disaster, the California Energy Emergency Management Center (EEMC) may be activated. Activation of the EEMC can be authorized by the Energy Commission's Chairman or Executive Director. The EEMC may be activated when any of the following actions occur:

- The Emergency Phase of this EERP is activated.
- Governor proclaims a State of Emergency or Energy Emergency.
- Governor invokes Emergency Order #6.

Figure 5 shows the EEMC activation protocol.

The EEMC provides a centralized management location for the coordination of fuel set-aside activities not related to the needs of emergency responders. This allows a more efficient structure to:

- Provide timely reports, analyses, and action recommendations.
- Coordinate more effectively with OES, the CUEA, and the California Independent System Operator during proclaimed emergencies.
- Ensure that the Energy Commission can respond quickly to nonemergency fuel distribution missions at the request of Fuel Set-Aside Program applicants.
- Ensure effective operation of the Fuels Set-Aside Program activities not related to the needs of emergency responders.
- Ensure that a separate accounting of emergency response and recovery activity is documented for reimbursement purposes.
- Coordinate staff resources.

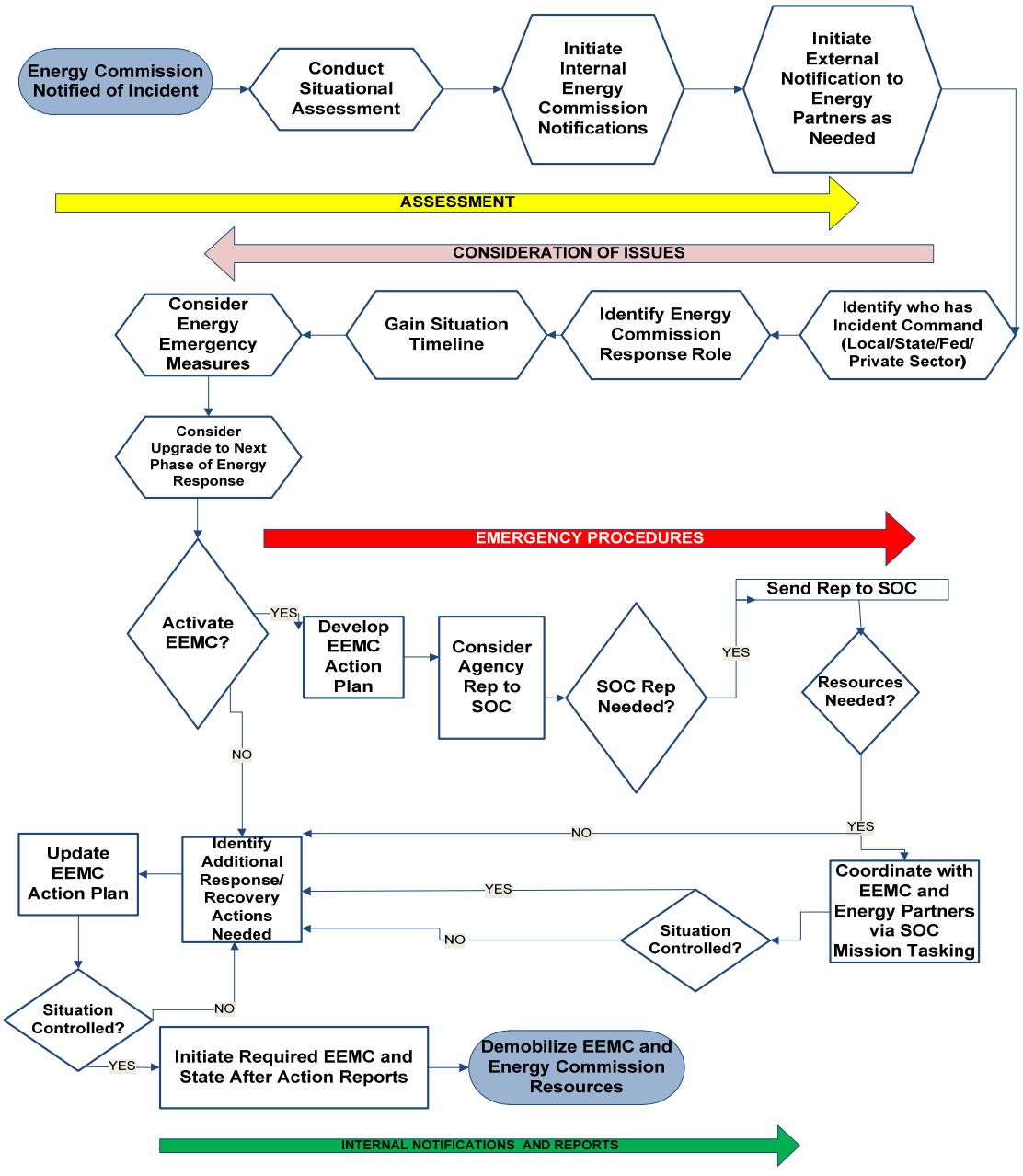
All Fuel Set-Aside Program activities directly related to the needs of emergency responders will be coordinated through OES by Energy Commission personnel stationed at the SOC. These personnel will also be responsible for providing periodic situation reports on the status of the transportation fuel supply system and adequacy of fuel supplies to help meet the needs of emergency responders.

The functions performed in the EEMC must be consistent with the Standardized Emergency Management System (SEMS). The activation and positioning of the five SEMS functions can be determined by the nature of the event. The operations, planning, and logistics functions will most likely be co-located in the EEMC. The management and finance administration functions, however, may be decentralized in adjacent offices, as appropriate.

During a proclaimed energy emergency, it is essential that the finance administration function ensures that all personnel and procurement costs associated with the

emergency are documented and tracked separately from normal Energy Commission business operations. It is also imperative that the energy emergency manager conducts periodic coordination meetings for all personnel assigned to the EEMC to ensure mission objectives are being accomplished.

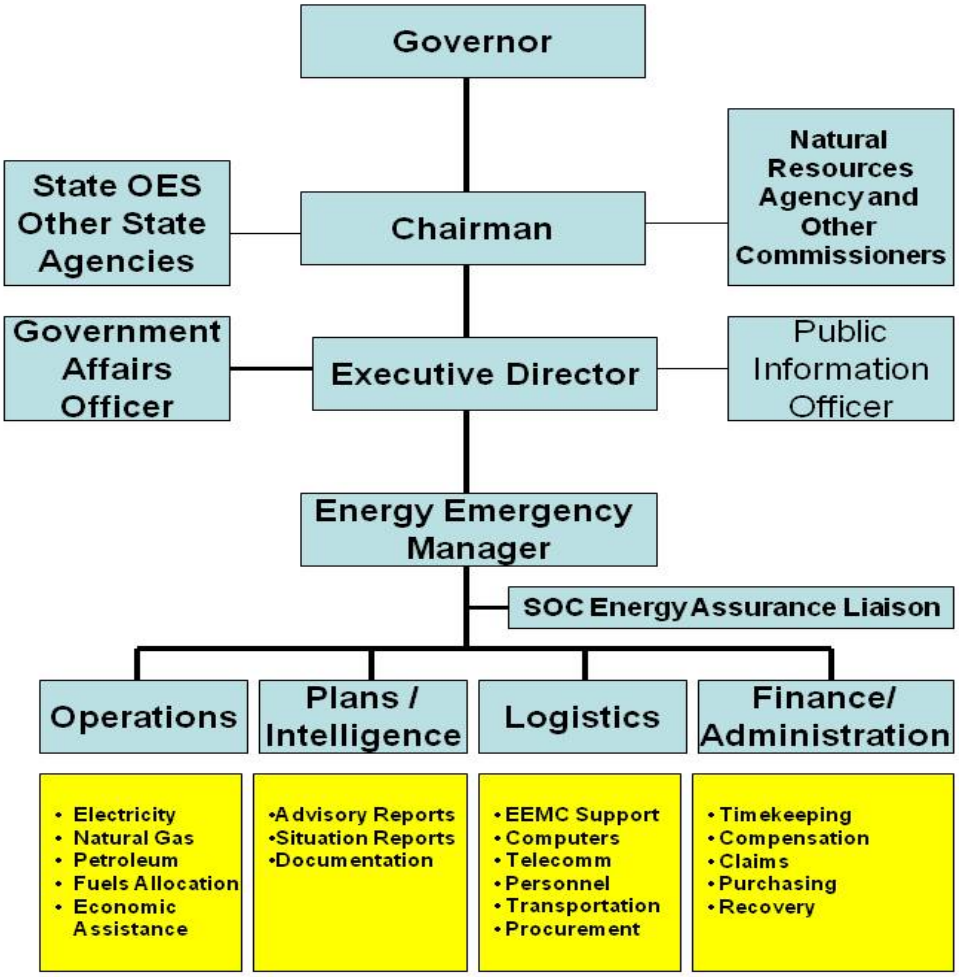
Figure 5: EEMC Activation Protocol



Source: California Energy Commission

Figure 6 illustrates the SEMS functions as applied to the Energy Commission organization and functions. During an emergency, the EEMC could be located in a designated conference room at the Energy Commission headquarters. The EEMC should have adequate computer network and Internet access, as well as telephone and conference call capability. If appropriate, staff working to respond to Fuel Set-Aside Program applicant fuel requests and order tracking may instead operate from their normal work stations or even remotely.

Figure 6: Energy Emergency Management Center Organization



Source: California Energy Commission

Operating Guidelines

The operating guidelines in Appendix A of this *CEAP* describe the general responsibilities of each position in the EEMC, as well as recommended actions for each position within each phase of an energy emergency.

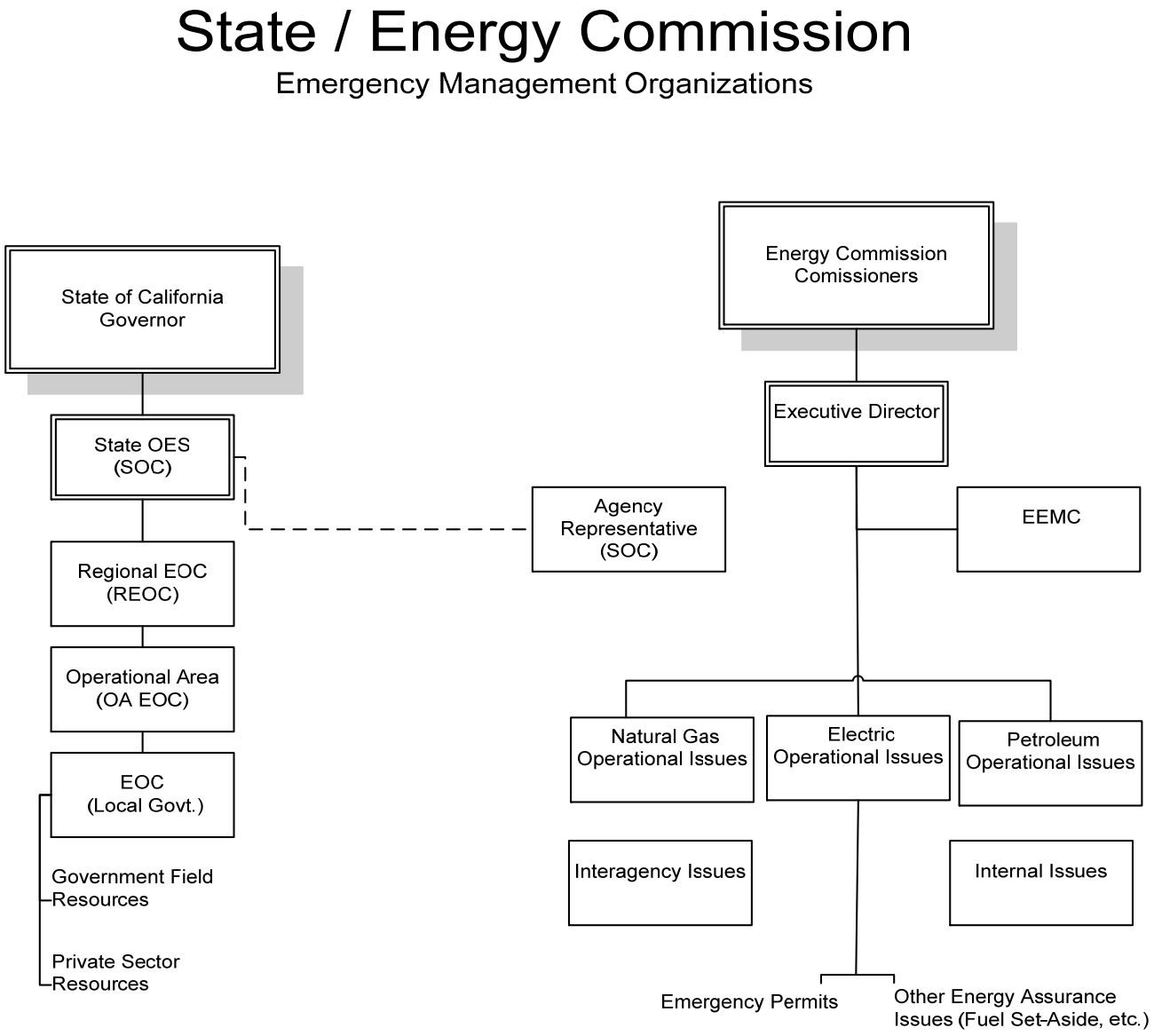
EEMC Integration With the State Operations Center (SOC)

During activations of the SOC that involve energy emergencies, State OES has invited the Energy Commission to provide an energy assurance liaison at the SOC. The liaison coordinates with the SOC on matters pertaining to energy emergencies that involve the EEMC. In this role the liaison does not speak for the EEMC autonomously. The liaison obtains information from the SOC and passes the information on to the EEMC, who works with federal, state, and local energy assurance partners on energy assurance strategies related to fuel needs of nonemergency responders.

The liaison's focus is to maintain active listening of the evolving energy emergency information and pass information back and forth between the SOC and EEMC. When requested by the energy emergency manager, the liaison may also attend SOC operational period briefings on behalf of the EEMC. In no case may the liaison speak on behalf of the EEMC unless specifically directed by the energy emergency manager, in coordination with the Energy Commission Executive Director. Figure 7 shows the Energy Commission relationship with the SOC.

Excluding the liaison, other Energy Commission personnel assigned to OES will have the responsibility to coordinate fuel supplies for the needs of all emergency responder requests that arrive at the SOC as funneled through SEMS. These Energy Commission personnel will also be responsible for providing periodic situation reports to the OES on the status of the transportation fuel supply system and adequacy of fuel supplies to help meet the needs of emergency responders. The Energy Commission liaison will be responsible for passing along these situation reports to the EEMC.

Figure 7: Energy Commission/SOC Integration



Source: Aanko Technologies Inc.

Reports and Reporting Procedures

Depending on the nature and urgency of the energy emergency, Energy Commission staff will prepare written reports on its analysis of the nature, extent, and duration of the event. In addition, administrative reports may be required if the EEMC is activated. The energy emergency manager may direct use of six types of reports.

- Internal advisory report
- Situation report
- Governor's memo
- Press release
- Internal status report
- After-action report

Internal Advisory Report

The internal advisory report is used under normal operating conditions (Readiness Phase) for minor events with no energy impact for informational purposes only. This report is generally distributed via email to an internal distribution list.

Situation Report

The situation report is an in-depth, categorical analysis of the energy emergency, along with analyses of possible future impacts based on the current situation. The situation report should include:

- Date and period covered by the report.
- Description of the event.
- Current status of petroleum fuels, natural gas, and electricity, if appropriate.
- Staff analysis of how the event is likely to affect energy supplies, prices, or distribution.
- Other information, as appropriate.

Depending on the nature of the problem and level of the situation, the distribution list may include the Office of Emergency Services, U.S. Department of Energy, Governor, Legislature, and appropriate PADD V states.

A sample situation report is located in Appendix G of this *Energy Assurance Plan.*

Governor's Memo

The Governor's memo is intended to include information relative to supply shortages and industry status and analyses, some of which may be sensitive or proprietary. This *Energy Assurance Plan* must be hand-delivered to the Governor's Office.

Press Release

Media releases are strategically used for conveying information to the public regarding the energy emergency. Media releases may be used for:

- Announcing voluntary or mandatory demand reduction programs.
- Outlining procedures for economic assistance programs.
- Directing the public to Web locations and other resources where they can get additional information on recommended actions they can take to assist them during the emergency.
- General information regarding the energy emergency, as appropriate.

These releases may be distributed through normal media sources using standard protocols, as appropriate.

Internal Status Report

During activation of the EEMC, an internal status report will be prepared by the energy emergency manager. This report is a routine, periodic summary of Energy Commission activity during the energy emergency. The status report should contain:

- Date and period covered by the report.
- Activation status of Energy Commission personnel.
- Summary of hours worked by Energy Commission personnel related to the energy emergency.
- Summary of costs incurred as of the date of the report (personnel time and any procurement expenses) related to the energy emergency.
- Key issues or objectives being addressed by the EEMC or other Energy Commission personnel following the energy emergency.

This report may be distributed via email to EEMC personnel, Executive Director, Chairman, Committee Chairs, and other appropriate staff.

After-Action Report

This report is mandatory for all state agencies activating an emergency management center during a proclaimed emergency and is a requirement under the SEMS. Key information areas are:

- Type and level of activation.
- Overall summary of the performance of the five SEMS functions.
- List of deficiencies relative to each function.
- Determination if deficiencies were related to insufficient planning guidance or training.

- Remedial action plan to ensure that deficiencies are corrected.

This report is sent to an internal distribution list, the Governor, and the Office of Emergency Services (OES). A report format is located in Appendix H of this *Energy Assurance Plan*.

Additional Recording Requirements

Implementation Status

The energy emergency manager is responsible for keeping a record of the events the energy emergency response team participates in. This documentation consists of:

- Response history.
- Activity log.
- Lessons learned report.
- Archive.

Historical Record: Energy Emergency Response History

Every event that one or more members of the team respond to is tracked on monthly and recorded in the Energy Emergency Response History spreadsheet (Appendix I). The spreadsheet contains the date of the event (month/year) column, whether the energy emergency response plan was formally activated, the name of the event column, and the type of action taken:

- Internal Only/Preliminary Analysis (in other words, no further action taken once the event was investigated)
- Situation Report (list how many reports were developed for this event)
- Other Actions (such as coordination with another state agency to resolve issues, informal fuel allocation, staffing of emergency operations centers, and so forth)

Events will also be categorized by energy sector (oil, natural gas, electricity, or combination) and type (natural, technical, human).

Activity Log

For those events that require more than just a preliminary analysis, team members should keep an activity log of actions taken during the event. These logs document the date and time of phone calls, who was included in the call, and a brief summary of the subject of the call. The activity log should also include any meetings that the team member participated in and any actions taken in response to the event. Once the event has ended, team members should send their individual activity log, along with copies of all emails sent or received during the event, to the energy emergency manager. The energy emergency manager will use the individual activity logs, situation reports,

news articles, and other related material to create a schedule of events that summarizes the major milestones chronologically that occurred during the event.

Lessons Learned Report

Most events do not necessitate a lessons learned report. However, this report can be useful under certain circumstances. The primary reasons for preparing a lessons learned report include the following:

- While responding to the emergency, team members or management identify issues that need to be resolved at a later date (that is, during nonemergency conditions). An after-action report could help document any unresolved issues or new information uncovered during the emergency. This report would be especially important if there are possible actions identified that could be taken to prevent or address a similar emergency in the future.
- An event is complex, has transpired over a long period, or has received unusual media attention. In this case, a lessons learned report (in addition to the schedule of events) might help management understand what actions were taken and why.

The lessons learned report should consist of a basic description of the event (date, name of event, summary of the emergency); background information, if appropriate; a summary of what went well; a description of what could be improved, including lessons learned; a list of recommendations; and next steps.

Archive

The archive is a collection of files (electronic and physical) relating to all the energy supply disruption events in which the energy emergency response team has been involved. The files include all internal advisory reports, situation reports, activity logs, response history, after-action reports, and any other related information. The physical file is a set of binders with print-outs of what is kept in the electronic file. Files are in chronological order (month/year) and identified by the name of the event.

Public Information

The public information system provides guidance and procedures for coordinating emergency public information efforts in support of California's response during disasters and emergencies. It provides for the effective collection, monitoring, management, and dissemination of accurate, useful, and timely public information to the media and for the public during disasters and emergencies. It also provides long-term public education efforts related to hazard awareness, family protection planning, and emergency self-help. Providing factual, authoritative, and considerate information to the public about an energy emergency is the management tool that the Governor's Office, state agencies, local governments, energy providers, local business, state Legislature, and the federal government use during an energy emergency. Adequate

understanding and awareness of an energy emergency prevent counterproductive reactions that may exacerbate the situation.

Timely, accurate information on the energy situation can help prevent confusion and uncertainty, as well as enlist the support and cooperation of the various sectors of the economy. Public information may include situation analyses, response plans with regular updates, and other media options such as staff reports, memoranda, presentations, press releases, public service announcements, fact and tip sheets, Web pages, public meetings, and workshops.

EEMC staff, in coordination with OES, will work closely with media outlets and trade associations to ensure that a consistent, concise, and well-informed message is distributed by all parties. Providing these stakeholders with information about the nature, severity, and possible duration of the energy emergency is essential.

It is also vital that the public clearly understands exactly what the energy emergency situation is and what needs to be done to successfully address the energy shortage crisis. Caution should be exercised to comply with state information protocols when receiving direct requests from the media.

A lack of adequate information on the energy emergency situation and the actions that are being taken to address it can lead to reactions by the public that may worsen the situation. Poor communication may result in an inadvertent release of contradictory information or in use of inconsistent technical terms by multiple authorities.

Barring a statewide set of multiple nearly simultaneous disasters in the mold of the Japan earthquake, tsunami and nuclear reactor triple disasters of 2011, information flows that are critical to managing during a disaster and critical to rapid recovery should still be available over much of California, and their use will be essential for use in response and recovery, as well as for use in continuous public information.

CHAPTER 2:
California's Energy Assurance Authority

State Energy Profile

A reference to California's energy profile is provided in Appendix D of this document.

Plan Development and Maintenance

The development and maintenance of this CEAP rest with the California Energy Commission. While there is no requirement as to what must be in an energy assurance plan, the National Association of State Energy Officials (NASEO) has published a set of recommended guidelines.[11] The plan is considered a "living document" and must be reviewed annually by the Energy Commission. The Energy Commission should request a review of this *Energy Assurance Plan* by all energy assurance partners at least every three years, or after a serious "All Hazards" disaster, to determine if any improvements or lessons learned must be incorporated in this plan.

Energy Assurance Planning Legislative Mandate

Sufficient supplies of cost-effective and environmentally sound energy, and the infrastructure to process and deliver reliable supplies to citizens and businesses, are crucial to the continued growth and development of the California economy. The supply of and demand for energy affects, or is affected by, several public interests, including the economy, public health and safety, and the environment. To ensure the ability to identify and minimize risks to the energy supply, the Energy Commission has been given a legislative mandate for energy assurance planning.

The Warren-Alquist Act[12] (formally called the State Energy Resources Conservation and Development Act), Public Resources Code Section 25000, established the Energy Commission, in part, to address California's growing reliance on petroleum fuels, natural gas, and electricity. The Energy Commission is mandated to monitor the state's energy infrastructure, develop programs that promote the diversification of energy resource types used in-state, and direct state response to energy emergencies and disruptions.

---

11 http://www.naseo.org/eaguidelines/State_Energy_Assurance_Guidelines_Version_3.1.pdf.

12 *Warren-Alquist State Energy Resources Conservation and Development Act* http://www.energy.ca.gov/2009publications/CEC-140-2009-001/CEC-140-2009-001-REV1.PDF.

Under California Public Resources Code (PRC) 25216.5b,[13] the Energy Commission is required to prepare an integrated plan with actions to identify and address energy threats or shortages that affect the public health, safety, or welfare. In addition, under PRC 25216.5, the Energy Commission has the authority to serve as the California government's central repository for collection, storage, retrieval, and dissemination of data and information on all forms of energy supply, demand, conservation, public safety, research, and related subjects.

In addition to PRC 25216.5, energy assurance is also mandated under the following regulatory standards that are part of the state regulatory framework:

- Section 25700 directs the Energy Commission to "develop contingency plans to deal with possible shortages of electrical energy or fuel supplies to protect public health, safety, and welfare."
- Section 25702 directs the Energy Commission to review utility emergency load curtailment plans. These plans shall "provide for the provision of essential services, the protection of public health, safety, and welfare, and the maintenance of a sound basic state economy."
- Section 25704 directs the Energy Commission to "determine if potential serious shortages of electrical, natural gas, or other sources of energy are likely to occur and shall make recommendations to the Governor and the Legislature concerning administrative and legislative actions required to avert possible energy supply emergencies or serious fuel shortages, including, but not limited to, energy conservation and energy development measures, to grant authority to specific governmental agencies or officers to take actions in the event of a sudden energy shortage, and to clarify and coordinate existing responsibilities for energy emergency actions."
- EMERGENCY ORDER NUMBER 6 − A provision under the California Emergency Services Act permits the Governor to establish, by Executive Order Number 6, a state Petroleum Fuels Set-Aside Program after proclamation of an energy emergency.
- EXECUTIVE ORDER W-9-91 directs all branches of state government to be prepared and ready to serve if called upon in an emergency.

This *Energy Assurance Plan* is consistent with California Government Code Section 8596, which states, "Each department, division, bureau, board, commission, officer, and employee of this state shall render all possible assistance to the Governor and to the

13 http://www.leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001-26000&file=25200-25227.

Director of the Office of Emergency Services in carrying out the provisions of this chapter."

It is also consistent with California Government Code Section 8607,[14] which mandates the use of the Standardized Emergency Management Systems (SEMS) for all state agencies during a proclaimed disaster or emergency. This *Energy Assurance Plan* is also consistent with the National Incident Management System (NIMS), which mandates response to "All Hazards" emergencies using the Incident Command System (ICS). The ICS management structure is the same as the SEMS.

Energy Assurance Process

Energy assurance at the state level provides for California's ability to reduce the risk and vulnerability of critical energy infrastructure, to improve planning across public and private sector agencies and entities charged with the resiliency of the energy infrastructure, and develop and carry out strategies to respond quickly and effectively to energy disruptions and energy emergencies.

Any prolonged interruption of the supply of basic energy − be it electrical, natural gas, or oil products − would be devastating. The state and its residents increasingly depend on robust, secure, and reliable energy systems to power the state and private sector economies, maintain personal and community security, and provide for the well-being of Californians.

The California Energy Commission is the state's primary energy policy and planning agency. Created by the Legislature in 1974 and located in Sacramento, six basic responsibilities guide the Energy Commission as it sets state energy policy:

- Forecasting future energy needs
- Promoting energy efficiency and conservation by setting the state's appliance and building efficiency standards
- Supporting public interest energy research that advances energy science and technology through research, development, and demonstration programs
- Developing renewable energy resources and alternative and renewable energy technologies for buildings, industry, and transportation
- Licensing thermal power plants 50 megawatts or larger
- Planning for and directing state response to energy emergencies.

---

14 *California Government Code Section 8607-8607.2*
http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/State%20Gov.%20Code/$file/StateGovtCode8607.pdf.

Energy Assurance Overview

California is as diverse in its energy profile as it is in its geography, economy, and people. With more than 38 million people and a civilian workforce of more than 18 million, California is the country's most populous state. California's $1.8 trillion gross domestic product makes it one of the world's largest economic powers.

In 1996, California approved AB 1890 (Brulte, Chapter 854), which led to deregulation of the electricity market in California and created the California Independent System Operator. The California energy crisis of 2000-2001 was the result of energy providers manipulating the market through loopholes caused by this partial electric deregulation. To correct deficiencies within deregulation, California has taken multiple steps to eliminate those loopholes, protect consumers from fraudulent activity, and strengthen its energy supply and infrastructure to assure reliable energy sources. Some of these involve regulatory standards, such as the following:

- Assembly Bill 1X 1 (AB1X 1)[15] in 2001 authorized the Department of Water Resources to enter into long-term contracts to buy electricity for resale to retail end-use customers and with exceptions to municipal utilities. (The suffix "X" denotes it builds upon previous legislation.)
- California's Renewables Portfolio Standard (established by Senate Bill 1078 [Sher, Chapter 516, Statutes of 2002] and updated by Senate Bill 107 [Simitian, Chapter 464, Statutes of 2006]) requires electricity sellers to increase procurement of electricity from renewable energy sources to at least 20 percent, with 2010 as the deadline for reaching this threshold.
- Assembly Bill 380 (Núñez, Chapter 367, Statutes of 2005) requires the CPUC, in consultation with the California ISO, to establish resource adequacy requirements for most load-serving entities. *Resource adequacy* means the entities must provide sufficient resources to the California ISO to ensure the safe and reliable operation of the grid in real time. It also provides appropriate incentives for the siting and construction of new resources needed for future reliability.
- Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006) enacted the landmark Global Warming Solutions Act, led by the ARB. One of the main requirements within the law was to adopt improved appliance efficiency standards and other electricity and energy efficiency measures aimed at a goal of 33 percent of energy statewide to come from renewable sources by 2020.

15 http://www.leginfo.ca.gov/pub/01-02/bill/asm/ab_0001-0050/abx1_1_bill_20010201_chaptered.pdf.

- Senate Bill 695 (Kehoe, Chapter 337, Statutes of 2009), the Ratepayer Protection Act, allowed phase-in for nonresidential end-use customers to purchase electricity directly from nonutility sources.

CHAPTER 3:
Energy Assurance Risks and Vulnerabilities

Introduction

There are inherent and potential induced risks to the energy assurance needs of the state. The shape of energy assurance within California relies on a mixed strategy to respond to fluctuations in energy demand or supply, which can lead to an energy disruption or emergency. Ongoing energy supply monitoring (electric, gas, and petroleum products) is crucial in all ways. There are a variety of strategies used to monitor the energy needs of the state and to assist in anticipating potential disruptions or emergencies affecting energy supply or infrastructure. This provides resource adequacy to meet the state's energy demands. These monitoring strategies include, but are not limited to:

- Established working relationships among state agencies and private sector and nongovernment organization industry, including the Energy Commission, CUEA, CPUC, OES, and energy producers and distributors.
- Energy Commission staff's continuous assessment of investor-owned utilities' (IOU) resource adequacy.
- Energy Commission staff's continuous assessment of publicly owned utilities' (POU) resource adequacy.
- Energy Commission staff's analysis of state transportation fuels infrastructure and potential impacts on transportation fuels supply and prices from infrastructure problems and supply shortages, to determine resource adequacy.
- Energy Commission staff's continuous assessment of energy developments pertaining to the state, its regions, and the nation through industry contacts, trade publications, and statistical reports.
- Energy Commission staff work with regulatory agencies, such as the CPUC, to validate IOU and POU regulatory framework for electricity and natural gas.
- California ISO's assessment of key market and physical constraints of the system to include continuous pricing and congestion management and to include short-term electricity peak demand forecasts.

Much of the monitoring of state energy needs relies upon monitoring interdependent systems the state's energy infrastructure is built upon, including telecommunications, financial markets, and integrated energy sources such as oil, natural gas, renewables, and water.

Risk and Vulnerability Overview

California's energy infrastructure spans one of the most diverse geographic areas in the nation, including large river systems, accompanying water delivery systems, coastlines and major ports, a huge agricultural region, large population, and industrial centers, extensive borders with other states and Mexico, and a highly diverse population approaching 40 million in California.[16]

California's energy infrastructure − power plants, refineries, and transmission and distribution networks − share the risk of natural and man-made disasters and threats with other state critical infrastructure, such as water and telecommunications systems. Managing these risks is necessary to the state's overall security, economic well-being, and environmental protection. The fact that 32 percent of the state's electric energy, 85 percent of the state's natural gas, and 60 percent of the state's petroleum are imported through pipelines and other transportation systems that traverse the state indicates a potential key vulnerability to the state's overall energy health.[17] Based on the level of risk, measures are taken to detect, prevent, control, and manage the consequences of natural and man-made risk directed toward the energy infrastructure.

During California's development of its *2010 State Multi-Hazard Mitigation Plan*, a multitude of hazards were identified that impact the energy sector. As expected, earthquakes were noted as a hazard of highest concern for both the public and private sectors, including the risk of more than 200 known major earthquake faults. Observations of damage from California earthquakes have also shown that ground shaking may be locally attenuated but then be amplified farther away due to differential soil conditions and structural response. This amplification can lead to multiple power generation and distribution infrastructure disruptions far away from the actual earthquake epicenter. The next most concerning hazards were both urban and rural wildfires and flood, with more than 5 million Californians subject to federal flood insurance zoning adjacent to 1,400 dams and 13,000 miles of earthen levees. Overlaid on this foundation is the risk of several active volcanic regions. On average, the private sector respondents expressed a somewhat higher level of concern than the local governments for energy shortage.[18]

Secondary impacts of energy shortages are most often felt by vulnerable populations. For example, those who rely on electric power for life-saving medical equipment, such as respirators, are extremely vulnerable to power outages. Also, during periods of extreme heat emergencies, the elderly and the very young are more vulnerable to the

---

16 *State of California Emergency Plan* 2009, p30.

17 California Energy Commission, *2011 Integrated Energy Policy Report (IEPR).*

18 *2010 State of California Multi-Hazard Mitigation Plan*, p14.

loss of cooling systems requiring power sources. Predicted increases in heat waves, as well as increasingly severe winter storms, continue to put ever greater strain on California's energy systems.

Historical Natural Disasters

The following natural disaster events took place in California and are briefly described here for both background purposes and for illustration:

Earthquakes

San Francisco, 1906: Estimated as a 7.8 quake, this temblor killed more than 3,000 people and destroyed $8 billion (2012 $) in property between direct destruction by the quake and the fire that followed. It left more than half the city's 400,000 population homeless and completely destroyed the city's energy and utility infrastructure.

Crescent City Tsunami: 1964 − originating from the great Alaska earthquake; and **Crescent City/Santa Cruz Tsunami**, 2011 – triggered by Japan's mega-earthquake. These tsunamis killed several people, and the recent event left $5 million in total property damage to the harbors of both towns.

Loma Prieta, 1989: Originated as a relatively small 6.9 quake in the Santa Cruz Mountains, it resulted in 63 deaths and more than $11 billion (2012 $) in property damage, including the collapse of the Cypress freeway and closure of the San Francisco-Oakland Bay Bridge for one month.

Northridge, 1994: Originated as a "relatively" small 6.7 quake near Reseda, this quake provided some of the highest ground accelerations ever recorded in an urban setting (1.7g's), killed 33 people, and resulted in $20 billion in property damage − one of the most expensive natural disasters in U.S. history.

Wildfires

Oakland Hills Fire, 1991: This fire was one of the most devastating residential fires in the last century of U.S. history. Twenty-five people were killed, 3,900 homes were destroyed, and more than $2 billion in property damage occurred.

San Diego Fires 2003 and 2007: San Diego experienced extremely high winds blowing from the east for an extended number of days and produced firestorms of unprecedented proportions. When firestorms occur in San Diego, there will always be multiple fires burning throughout Southern California, if not the entire state, stretching the state's well-developed mutual aid system to the limit. The October 2007 San Diego Wildfires, consisting of seven fires within San Diego County, began on October 21, 2007, during a major Santa Ana wind event that lasted for three days. These winds are characterized by warm temperatures, low relative humidity, and high wind speeds. As the Santa Ana winds are channeled through the mountain passes, they can approach hurricane force. The combination of wind, heat, and dryness turns the chaparral vegetation into explosive fuel and impacts energy infrastructure that traverses the area.

Weather

November 2011 Southern California Wind Storm. Gale force winds knocked down power lines and left 300,000 people without power, affecting Los Angeles Department of Water and Power, the nation's largest public utility, and Southern California Edison.

July 2006 Heat Storm. The July 2006 heat storm (also known as a "heat wave") affected the entire state as well as most of the West, producing record energy demand levels in California. The state was able to avoid rotating outages due to a combination of favorable factors that included no major transmission outages, lower-than-typical generator outages, significant customer response to pleas for energy conservation, high imports from the Pacific Northwest despite unusually high loads, outstanding cooperation among western control area operators, and prompt response to fires that potentially threatened major interties. However, the event brought to light the vulnerability of the electric distribution system, as more than 3,500 distribution transformers failed, leaving more than 2 million customers without power at various times over the 10-day event, many for several hours and a small minority for up to three days.

Human-Caused Energy Disruptions

San Diego Blackout, 2011: The blackout was a widespread power outage that affected large areas of Southern California as a result of human error. More than 1.4 million Californians were affected, resulting in the largest power outage in state history.

San Bruno Natural Gas Pipeline Explosion, 2010: A high-pressure (400 psi) 30" gas transmission line running underground through a residential neighborhood exploded, killing 11 people, destroying 38 homes, and causing roughly $300 million in damage. This disaster has initiated a major overhaul of how the entire nation's gas pipeline infrastructure is sited, designed, tested, and rated.

LADWP, 2005: Originating as an upgrade to a substations supervisory control and data acquisition (SCADA) system (early smart grid), installation and labeling errors cascaded into a blackout that affected about 3 million people.

California Energy Crisis (Enron/Market Manipulation), 2000-01: The deregulated California electric energy markets were "gamed" with manipulated off-line generators to drive spot energy prices up by more than 20 times the average price. This resulted in a large number of power disruptions throughout the state, the bankruptcy of Pacific Gas and Electric Company, and about $45 billion in economic losses.

The 2000-2001 California electricity crisis identified many critical issues surrounding the state's power generation system, including postderegulation market manipulation and California's dependency on out-of-state resources coupled with in-state transmission bottlenecks. Although the state has taken effective measures to address market manipulation, built more transmission to reduce bottlenecks, and implemented effective energy conservation programs, California continues to experience both population growth and weather cycles that contribute to a heavy demand for power. Climate

change may also increase California's vulnerability to energy shortage hazards, and the state has taken proactive steps in this area with the implementation of a *Climate Adaptation Strategy*.[19]

The energy shortage hit critical stage when, on January 17, 2001, the California ISO, the entity that coordinates statewide flow of electrical supply, declared a Stage 3 Emergency and notified OES that PG&E was dropping firm load of 500 MW in Northern California (rolling blackouts). OES, in turn, issued an electrical emergency message to all emergency services agencies to prepare for rolling blackouts. This scenario was repeated the following day. On March 19, 2001, OES again issued an electrical emergency message to emergency services agencies that the California ISO declared a Stage 3 Emergency and would be conducting statewide rolling blackouts.

Northern California DC Intertie With Oregon's BPA Failure, 1996: Due to inadequate clearing of underlying vegetation, this primary electrical artery "shorted" to trees when it was heavy loaded (and predictably "sags" when heated) on a peak summer AC cooling day, blacking-out more than 7.5 million customers.

One point that is important to understand about each of these events is that each is considered an independent event that most engineering systems are designed to accommodate (meaning that equipment may be destroyed, but it shouldn't bring the system down). It is much more difficult to design, respond, and recover from multiple disasters such as Japan's twin disasters of both a destructive earthquake and nearly simultaneous tsunami, or the added catastrophic nuclear incident that struck Japan at the same time. This same consideration is especially true for a well-planned terrorist attack, which preemptively accounts for expected emergency and disaster responses.

Terrorism Potential

Energy security is and will be among the most serious security and economic challenges. The state's energy infrastructure is highly vulnerable to coordinated and nearly simultaneous terrorist attacks on both the electrical and gas infrastructures. Since California produces less than 15 percent of its gas needs in-state, imports of gas through interstate pipelines and the associated ripple effects must be thoroughly understood.

For instance, California may have enough "on paper" reserve capacity (estimated at 33 percent) for meeting projected peak demands, but if other nearby sourcing states have their own gas extreme peak days or experience supply interruptions in coincidence with California, there may not be enough reserves in the event of a terrorist attack. Though not a terrorist event, this curtailment occurred as recently as 2007 when severe gas demand in neighboring states led to actual curtailment orders in California.

---

19 *2009 California Climate Adaptation Strategy: A Report in Response to Executive Order* S-13-2008.

Energy resources beyond America's shores are increasingly being targeted by terrorists for political and media gain. Short-term supply shortages, tight production characteristics (little spare capacity for oil production) and the lack of growth in production, accelerated speculation, a weaker U.S. dollar, and increased commodity prices result in higher energy costs. The huge price swings of 2012 have been the result of market fears that rising demand will eventually outgrow available supply, even as developed countries stagger from the weight of increasing debt.

Though these debt concerns tend to lower crude oil prices, the economic fear emboldens terrorists to strike at other vulnerable energy interdependent sectors, such as electricity, water, and natural gas, to gain additional fear in the general population and disrupt geopolitical and military power. While market-related factors, such as tighter supply chains and changes in demand, are the primary areas that dictate global energy costs, other events such as geopolitical turbulence and threats of any kind to the oil infrastructure create uncertainty and affect prices

Hence, in the long term, the energy markets will continue to be sensitive to the risk of disruptions from perceived or real terrorist threats.

Energy infrastructure disruption may take the form of terrorist attacks targeting power plants, and in particular, the state's nuclear power plants. Over the past 10 years, the U.S. Nuclear Regulatory Commission (NRC) has instituted several measures to improve the security of U.S. reactors. The agency struggles to balance the concerns of plant operators that additional security requirements are excessive and too costly with critics' concerns that the same requirements are inadequate. In addition, the NRC's process for determining which concerns need to be addressed and how they should be addressed has not always been transparent, even to governmental or quasigovernmental organizations such as the U.S. Government Accountability Office and the National Academies.

For example, the NRC has not explained why it rejected some of its staff's proposals for requiring reactors to be secured against certain types of attacks. Similarly, the NRC has not explained why the agency is confident that the current fleet of U.S. reactors would stand up to aircraft attacks with a very low probability of radiation release, while some professional studies appear to have come to very different conclusions. For instance, a 1982 report by Argonne National Lab concluded that aircraft crashes might subject nuclear power plants to numerous multiple failures that could lead to "total meltdown," even without damaging the containment structure. Former U.S. Representative Bart Gordon (D-Tennessee) noted that while this report did not address plant design changes, it clearly showed that design changes could help reduce the potential impact of aircraft hazards at nuclear power plants. [20]

---

20 *Global Nuclear Energy Partnership Strategic Plan*, U.S. DOE, January 2007.

This secrecy, particularly with regard to the U.S. Government Accountability Office and the National Academies, has made it difficult for the NRC to instill public confidence in its actions regarding plant security. Critics and members of the public continue to question the adequacy of the U.S. Nuclear Regulatory Commission's security regulations.

Cyberattack Potential Disruption

Cybersecurity for the electric sector is a national concern. As late as 2010, *The Wall Street Journal* reported cyber spies from China, Russia, and other countries may have penetrated the U.S. electrical grid and implanted software programs that could be used to disrupt the system.[21] Thus far, efforts to better secure the grid have understandably focused on the existing network.

The concern is growing as the power system becomes increasingly complex and reliant on information technology and communications infrastructures. This reliance has seen a corresponding increase in the vulnerability of the power system to cyberattacks. Cybersecurity includes preventing damage to, unauthorized use of, or exploitation of electronic information and communications systems and the information contained therein to ensure confidentiality, integrity, and availability. Cybersecurity also includes restoring electronic information and communications systems in the event of a terrorist attack or natural disaster.

Security is best applied in layers and at different levels. The term "layers" implies multiple security barriers between the attacker and the target, while the term "levels" refers to the different levels in the communications infrastructure underlying any cyber system. This concept is referred to as "defense in depth," such as the physical lock on a door in conjunction with the use of a password delaying or preventing an attack.

An assessment of California's energy risks and mitigations relating to cybersecurity is increasingly important, given some of the statistics below as examples of everyday cybersecurity breaches (as reported by *InformationWeek*):[22]

- Seventy-six percent of energy utilities experienced a data breach in the last 12 months.
- Sixty-nine percent of utilities believe they will be breached again.
- Sixty-seven percent aren't using state-of-the-art techniques against SCADA attacks.

---

21 Electricity Grid in US Penetrated by Spies, Siobhan Gorman, April 8, 2009, http://online.wsj.com/news/articles/SB123914805204099085.

22 http://www.informationweek.com/.

- The number one threat is insiders, with 43 percent of utilities stating insiders cause most breaches.
- Only 21 percent feel existing controls protect against smart grid attacks.

The following examples are known cybersecurity-related energy vulnerabilities, which are being addressed by experts but are highlighted here for illustration:

- Smart meters – hardware, software, and firmware[23] design and implementations, and communications protocols
- Data concentrators – physical protection, hardware interfaces, software of embedded devices, encryption algorithms, and keys
- Head end (utility network systems) – software that was evaluated from the security perspective accessibility to the system from outside the company, internal threats, the construction and implementation of Web interfaces, application programming interface (APIs), and database connectivity.
- All field hardware − disassembled, programs and memory were retrieved and reviewed for security holes, looking for encryptions keys and weaknesses that could compromise the system. A common cybersecurity issue unique to utilities that should be more fully addressed is the use of typically only 10 or so private encryption keys for large deployments of smart meters. The breaking of just one encryption key could thus compromise hundreds of thousands of meters at any of the larger California IOUs or POUs.

As the electric and natural gas energy systems become "smarter" with more capable, automatic, and autonomous controls and communications, cyber-attacks can be very effective and must be accounted for at all levels. California has routinely led the nation in cybersecurity and energy advancements; the integration of cybersecurity mitigation strategies is no different.

California Senate Bill 1476 (Padilla, Chapter 497, Statutes of 2010) established new privacy protections for consumers' energy use data. It addresses disclosure and protection — two key issues for many consumers and consumer groups who have voiced concern about potential uses (or misuses) of their detailed energy use data.

---

23 *Firmware* is programming that's written to the read-only memory (ROM) of a computing device. Firmware, which is added at the time of manufacturing, is used to run user programs on the device.

On July 29, 2011, the CPUC officially issued Rulemaking 08-12-009, adopting rules to protect the privacy and security of customer electricity usage data of the three IOUs – PG&E, SCE, and SDG&E.

Intentional Disruptions

There are four types of intentional disruptions:

1. Planned: Some disruptions are intentional and can be scheduled. For example, a disruption may be necessary when power system components are taken out of service for maintenance or upgrading. Scheduled intentional disruptions can last from several minutes to several hours, and customers are usually notified in advance.

2. Unscheduled: Some intentional disruptions must be done "on the spot." As a result, advance notice cannot be provided. For example, a fire department or a police department may request a disruption in service during a fire or an accident.

3. Demand-Side Management: Some customers (that is, on the demand side) have entered into an agreement with their utility provider to curtail their demand for electricity during periods of peak system loads. In return for agreeing to these disruptions, these customers receive a lower electric rate and/or rebate.

4. Load Shedding: When the power system is under extreme stress due to heavy demand and/or failure of critical components, it is sometimes necessary to intentionally interrupt the service to selected customers to prevent the entire system from collapsing. In such cases, customer service (or load) is cut, sometimes with little or no warning. One form of load shedding called a "rotating blackout" involves cutting service to selected customers for a predetermined period (usually not more than two hours). As power is restored to one block of customers, power to another block of customers is interrupted to reduce the overall load on the system.

Unintentional or unplanned disruptions are outages that come with essentially no advance notice. This type of disruption is the most problematic. The following are categories of unplanned disruptions:

- Accident by the utility, utility contractor, or others
- Malfunction or equipment failure due, for example, to age, improper operation, excessive operation, or manufacturing defect; special subcategories cover broken fuse links and underground cable, joint, or termination failures
- Equipment overload (utility company or customer)
- Reduced capability (equipment that cannot operate within its design criteria)
- Tree contact other than from storms
- Vandalism or intentional damage
- Weather, including ice/snow, lightning, wind, earthquake, flood, and broken tree limbs taking down power lines

- Wildfire that damages transmission lines.

The California ISO is tasked with managing the power distribution grid that supplies most of California, except in areas served by municipal utilities. California ISO uses a series of stage alerts to the media based on system conditions. The alerts are:

- Stage 1 − reserve margin falls below 7 percent.
- Stage 2 − reserve margin falls below 5 percent.
- Stage 3 − reserve margin falls below 1.5 percent.

Rotating blackouts become a possibility when Stage 3 is reached.

Electric Energy Resource Risks and Vulnerabilities

In 2000 and 2001, California suffered an energy crisis characterized by electricity price instability and four major blackouts and caused by a supply-and-demand imbalance. Multiple factors contributed to this imbalance, including a heavy dependence on out-of-state electricity providers, drought conditions in the Northwest that reduced hydroelectric power generation, a rupture on a major natural gas pipeline supplying California power plants, strong economic growth leading to increased electricity demand in western states, an increase in unplanned power plant outages, and unusually high temperatures that increased electricity demand for air conditioning and other cooling uses.

Following the energy crisis, California state government created an *Energy Action Plan*,[24] designed to eliminate outages and excessive price spikes. To achieve these goals, the plan calls for optimizing energy conservation, building sufficient new generation facilities, upgrading and expanding the electricity transmission and distribution infrastructure, and ensuring that generation facilities can quickly come on-line when needed. Although California statewide electricity consumption appears to be growing rapidly, it actually represents a modest 1 percent/year compounded growth rate and reflects the fact that the state is projected to continue growing its population considerably over the next decade. In fact, energy conservation, efficiency, and renewables efforts by the CPUC and Energy Commission have had dramatic effects on California's energy requirements compared to most other states, regardless of which metric is used to measure (for example, kWh/capita, energy $/capita, and so forth).

To maintain the ability to identify risks within the electric sector, monitoring of the supply and infrastructure is crucial. For electricity-related information, daily reports are available on electric flows from California ISO in great detail. Utilities are also required

---

24 http://www.energy.ca.gov/2008publications/CEC-100-2008-001/CEC-100-2008-001.PDF.

to report to the DOE EOC (and should also report to California ISO) any of the following events:

- Loss of firm system loads
- Voltage reductions
- Requests to the public to reduce usage (whether regional or along a distribution feeder)
- Vulnerabilities that could impact system adequacy or reliability
- Fuel supply emergencies

In addition, electricity sales are published by state, month, and sector by the U.S. Energy Information Administration (EIA) in the *Electric Power Monthly*.[25] Similarly, electricity production by fuel source is also published in the *Electric Power Monthly.* Information regarding generation capacity and power plant availability can be obtained from the *Inventory of Power Plants in the United States* and combined heat and power information from EIA.[26] Regional system reliability forecasts are available through NERC, which publishes annual reports of regional system reliability.[27] These reports assess regional reserve margins by comparing net system availability with peak-load projections and system-pool reserve availability. Cooling and heating degree-day data are available from the National Weather Service (NWS) and National Oceanic and Atmospheric Administration (NOAA). These data may be used to describe extreme weather conditions that create peak loads on the electrical generation system, which could more likely result in a compounded staged emergency (such as severe weather in conjunction with a transmission line trip or power plants going offline.)[28]

Added to these areas of research, the Energy Commission Electricity Analysis Office of the Electricity Supply Analysis Division researches and analyzes central station generation technologies, transmission analysis to support new generation resources, cost analysis of central station generation, and electricity procurement-related policy development. Division staff uses this information to compile data on the electrical market for the following reports:

- *Summer Outlook* – annually
- SB 1389 POU Report – every two years

---

25 http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html.

26 http://www.eia.doe.gov/cneaf/electricity/epa/epat2p2.html.

27 http://www.nerc.com/.

28 http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/.

- *Electricity Infrastructure Analysis* (every two years)
- *Cost of Generation Report* (every two)
- *Transmission Planning Process*
- *Local Capacity Area Report*
- *Demand Forecast Plan*
- Long Term Procurement Plan (LTPP)
- *Resource Adequacy Report*

Overall, California has a robust electric delivery system with widespread transmission and distribution capabilities. However, due to expense and politics, there exists relatively tight redundancy capacity in the state's high-voltage transmission lines, so attacks or disasters that destroy towers or substations can be potentially devastating, especially at chokepoints. Even more so, the state's distribution grid (which emanates radially from substations) has even fewer opportunities for redundancy.

The electric power industry does not have a universal agreement for classifying disruptions. Nevertheless, it is important to recognize that different types of outages are possible, so plans may be made to handle them effectively. Electric power disruptions can be generally grouped into two categories: intentional and unintentional.

Several risk issues will continue to challenge the state in reference to potential conflict between state policy goals and electric system reliability. As noted previously in this *Energy Assurance Plan*, California's drive to clean energy and its RPS efforts targets its own policy goals and the supply reliability requirements mandated by state and federal requirements. Another source of uncertainty emanates from state energy efficiency and other demand-side goals. While the state, in its historic push for energy alternatives, has permitted older power plants to expire given several studies that determined capacity was not needed at previous levels, the Legislature did not reauthorize the Public Goods Charge that historically has funded a substantial portion of IOU infrastructure investments; therefore, it is unknown if future capacity can indeed keep up with demand in the southern part of the state.[29] This is a critical risk.

New transmission developments and investments have lagged load and population growth due to regulatory uncertainty, local opposition, industry restructuring, long development lead times, uncertain and changing approval processes, concerns about inadequate returns on investment, and other factors.

As an example of some of the challenges that exist in reliably supplying electric power throughout the state, through an elaborate interplay among legislation, regulatory

---

29 *2011 IEPR*, p 116.

policy, and the courts, the repowering of aging power plants with more efficient designs in Southern California has come to a standstill due to lack of sufficient air emission credits (as part of the South Coast Air Quality Management District rule). The net result is that Energy Commission staff projections indicate that the electric reserve margins in the SCE territory could drop to less than 7 percent in 2014. (The normal minimum electrical reserve margin is 15 percent.) Reserve margins this low make the electric grid much less reliable, less stable, and, therefore, more prone to unexpected blackouts and other disruptions.[30]

Although Californians have demonstrated nearly flat per capita energy consumption for the last 10 years, California ISO projections for total electricity demand show a steady decline in both total electric consumption and peak growth demand due to the state of the economy. However, because of the issues arising from the imminent shutdown of power plants that affect primarily the Southern California LSEs, the California ISO studies show that the northwestern portion of the San Diego area will need substantial capacity for replacement. This capacity need will have a crucial impact on replacement infrastructure than previously identified.[31]

Electric Energy Resource Risk Minimization

There are several risk minimization strategies in place or underway to promote the integrity, stability, and availability of electric energy resources. These include:

- Increasing use of renewable or more efficient electricity sources.
- California ISO transmission planning assessments.
- Requirements on IOUs and energy service providers to ensure that they have procured enough resources to meet their loads (resource adequacy).
- Coordination with municipal utilities to ensure their resource adequacy is being addressed by their elected governing boards.
- Coordination with other energy partners, including California ISO, DWR, CPUC, and OES on preincident strategies to reduce demand.
- Implementation of energy efficiency standards to provide additional supply, especially during peak demand.
- Infrastructure upgrades in generation, transmission, and distribution by IOUs.
- Implementation of an aggressive statewide renewable energy program.
- Energy Commission authority under PRC 25216.5 to evaluate electrical power rates and rates for other energy sources and make recommendations for changes in power pricing and rate schedules.

---

30 *2009 IEPR*.

31 *2011 IEPR*, p 116.

In addition, in 2008, California passed sweeping building energy efficiency standards. Plans are underway by the Energy Commission to open a public process and rulemaking proceeding to adopt changes to the *Building Energy Efficiency Standards* contained in the California Code of Regulations (CCR), Title 24, Part 6 (also known as the California Energy Code), and associated administrative regulations in Part 1 (collectively referred to here as the standards). The proposed amended standards will be adopted in 2014 to update the 2008 standards. The 2008 standards were designed:

- To provide California with an adequate, reasonably priced, and environmentally sound supply of energy.
- To respond to AB 32, the Global Warming Solutions Act of 2006, which mandates that California must reduce its greenhouse gas emissions to 1990 levels by 2020.
- To pursue California energy policy such that energy efficiency is the resource of first choice for meeting California's energy needs.
- To act on the findings of the *Integrated Energy Policy Report (IEPR)* that standards are the most cost-effective means to achieve energy efficiency, to expect the *Building Energy Efficiency Standards* to continue to be upgraded over time to reduce electricity and peak demand, and to recognize the role of the standards in reducing energy related to meeting California's water needs and in reducing greenhouse gas emissions.
- To meet the West Coast Governors' Global Warming Initiative commitment to include aggressive energy efficiency measures into updates of state building codes.
- To meet the executive order in the Green Building Initiative to improve the energy efficiency of nonresidential buildings through aggressive standards.
- To acknowledge that the Renewables Portfolio Standard (RPS) requires utilities to supply 33 percent of their electricity from renewable electricity sources, and that water regulations will compel the replacement of aging natural gas power plants to use dry cooling. New natural gas plants will also be designed for greater flexibility and efficiency.

The use of various alternatives to conventional electricity, petroleum, and natural gas has the potential to enhance energy security by increasing distributed generation to 12,000 megawatts, primarily in small-scale applications in urban areas, and to diversify supply among various locations. This can reduce, but not eliminate, the risk of relying on the concentrated power production or energy acquisition from relatively few locations such as power plants, pipelines, and grids.

Several other major initiatives are underway with California to lead the nation is energy assurance. This includes the *Bioenergy Action Plan for California.* The first *Bioenergy Action*

Plan for California was passed in 2006. The updated *2011 Bioenergy Action Plan for California* will evaluate and consider the following strategies to overcome the remaining challenges to meeting the Governor's targets for bioenergy in California:

- Address siting, permitting, and regulatory barriers to increased bioenergy and biofuels production.
- Facilitate the ability of project developers to obtain project financing and identify funding opportunities.
- Continue research and development of low-emission bioenergy technologies and develop policy mechanisms that accurately account for GHG benefits associated with each technology.
- Increase the availability of affordable biomass products collected through sustainable practices.
- Develop new and revised policies necessary for meeting bioenergy and biofuel goals.

Natural Gas Resource Risks and Vulnerabilities

California's energy supply relies on natural gas playing a crucial ongoing role in electricity generation and in meeting the goals set by the state to achieve its clean energy and environmental objectives.

PG&E and Southern California Gas Company (SoCalGas) own and operate several natural gas storage fields located in Northern and Southern California. These storage fields and two independently owned storage utilities – Lodi Gas Storage and Wild Goose Storage – help meet peak seasonal natural gas demand and allow California natural gas customers to secure natural gas supplies more efficiently.

California's regulated utilities do not own any natural gas production facilities. All of the natural gas sold by these utilities must be purchased from suppliers and/or marketers. The price of natural gas sold by suppliers and marketers was deregulated by the Federal Energy Regulatory Commission (FERC) in the mid-1980s and is determined by "market forces." However, the CPUC decides whether California's utilities have taken reasonable steps to minimize the cost of natural gas purchased on behalf of their core customers.[32]

Although most of California's core customers purchase natural gas directly from the regulated utilities, core customers have the option to purchase natural gas from independent, unregulated natural gas marketers. Most of California's noncore

32 The vast majority of California's natural gas customers are residential and small commercial customers, referred to as "core" customers. Large consumers, like electric generators and industrial customers, are referred to as "noncore" customers.

customers, on the other hand, make natural gas supply arrangements directly with producers or purchase natural gas from marketers. Contact information for independent natural gas marketers can be found on the utilities' websites.

Before the late 1980s, California's regulated utilities provided virtually all natural gas services to natural gas customers. In a 1997 decision, the CPUC adopted PG&E's "Gas Accord,"[33] which unbundled backbone transmission costs from noncore transportation rates and gave customers and marketers the opportunity to obtain pipeline capacity rights on PG&E's backbone pipeline system. The Gas Accord also required PG&E to set aside a certain amount of pipeline capacity to deliver natural gas to its core customers. Subsequent CPUC decisions modified and extended the initial terms of the Gas Accord. The Gas Accord framework is still in place today for PG&E's backbone and storage rates and services.

In a December 2006 decision, the CPUC adopted a similar gas transmission framework for Southern California called the "firm access rights" system. SoCalGas and SDG&E implemented the firm access rights (FAR) system in October 2008. Under the FAR system, customers may obtain firm receipt point capacity rights for delivery on the integrated SoCalGas/SDG&E gas transmission system.

Since then, the CPUC has gradually restructured the natural gas industry to give customers more options while assuring regulatory protections for those customers that wish to continue receiving utility-provided services. The option to purchase natural gas from independent suppliers, as noted above, is one of the results of this restructuring.

Although California has more than 33 percent reserve capacity in its entire gas transmission system (15.5 Bcf/11.7 Bcf peak with poor hydro condition, projected for 2025), when more regional analyses are reviewed, it is apparent that under some conditions the system cannot handle demand. Both PG&E and SoCalGas have indicated that they are concerned about “real” gas capacity under some set of conditions, especially on a smaller resolution regional basis. These issues will be further exacerbated by higher renewables penetration and relocation of power generation sites. Since California produces less than 15 percent of its gas needs in-state, imports of gas through interstate pipelines and their associated ripple effects must be thoroughly understood.

Due to long-standing FERC rules, about 90 percent of U.S. storage has migrated to now being “open access” to other third parties under the same terms and conditions. Given strong interdependencies between natural gas demand and peaking electrical generation, the natural gas infrastructure is more constrained on a regional basis.

---

33 https://www.pge.com/regulation/SanBrunoExplosion-FireOII/Hearing-Exhibits/PGE/2012/SanBrunoExplosion-FireOII_Exh_PGE_20120925_ExhPGE-013_250540.pdf.

California may have to retire, repower, replace, and/or mitigate more than 13,000 MW of natural gas-fired generation to comply with the State Water Resources Control Board's once-through cooling (OTC) policy by 2020. A major challenge with this transition is that these older power plants are typically located in transmission-constrained areas that require local generation. Remotely located renewable resources can provide some of the needed replacement capacity, but a portion of these will require new or upgraded transmission lines to deliver electricity to the load centers. The advantage is that the new (or repowered) facilities (for example, solar thermal power plants) are more efficient than those they replace, which will help reduce GHG emissions.[34]

Another issue is market price fluctuations. Natural gas is a heavily traded commodity in a market characterized historically by price volatility. However, hydraulic fracturing[35] used in natural gas extraction has created substantial new natural gas supplies in North America and lowered the price. Most experts believe this trend will dampen price volatility for 7-10 years. There are several risks that must be recognized:

- Fuel Price Risk: the risk that the price of the fuel used to generate electricity will exhibit variability, resulting in an uncertain cost to generate electricity.
- Fuel Supply Risk: the risk that the fuel supply to a power plant will be unreliable, resulting in the inability to generate electricity predictably and dependably.
- Performance Risk: the risk that the seller may not be willing or able to deliver gas or electricity according to the contractually prescribed requirements in terms of time and quantity.
- Demand Risk: the risk that the energy that has been contracted for will not be needed as anticipated, or that there will not be enough to support electricity generation to meet fluctuating demand.
- Environmental Risk: the financial risk to which parties to an energy contract are exposed, stemming from both existing environmental regulations and the uncertainty over possible future regulations.
- Regulatory Risk: the risk that future laws or regulations, or regulatory review or renegotiation of a contract, will alter the benefits or burdens of an energy contract to either party.

---

34 *2011 IEPR*.

35 *Hydraulic fracturing* is the use of fluid and chemicals to create or restore small fractures in a formation to stimulate production from new and existing oil and gas wells. This creates paths that increase the rate at which natural gas and crude oil can be produced from the reservoir formations.

The "reported prices," that is, the price indexes reported by major natural gas industry publications, are only for daily or monthly transactions. No major gas industry publication develops any reported indices for transactions with terms longer than a month. There is no law or regulation that requires market participants to report their deals to gas industry publications, so the price indices are based only on the prices voluntarily provided by market participants. The state agencies are not aware of any source of data that indicates the total amount of natural gas bought and sold at index prices or under long-term deals.

The major gas industry publications that establish the price indices do report the number of deals, the volume, and the range of prices upon which they base their price indices. So, the state agencies do not know how much natural gas is bought and sold in the market at the various price indices, but they do know the number of deals, the volume, and the range of prices upon which the daily and monthly price indices are based.

The price of the natural gas commodity is unregulated. The market establishes natural gas prices at the time a trade of the physical commodity or a futures contract is executed. Buyers and sellers trade natural gas through private transactions, through over-the-counter transactions, and through trading forums or exchanges. The price for each transaction is established at the culmination of each trade and is the amount a willing buyer pays a willing seller for the commodity or futures contract.

Details of natural gas physical trades may be reported to the trade press by the executing parties. Details of natural gas futures contracts must be reported to the New York Mercantile Exchange (NYMEX). These entities collect data on the trades, compile them, and publish the results in indices that are central to the functioning of both the wholesale and futures markets.

The Energy Commission; the DWR, who handles the majority of preset energy contracts; the California ISO; the CPUC; and private sector energy assurance partners are aware of these volatile risks and take prudent steps to assurance energy availability.

Finally, another area for review is the potential implications to transmission infrastructure that would result from future increasingly stringent pipeline integrity requirements that could limit natural gas throughput on certain pipeline segments (such as post-San Bruno natural gas disaster requirements and derating [36] on existing natural gas lines). As natural gas transmission lines are reassessed, especially as critical infrastructure running through dense urban areas, a more detailed review will have to occur for energy disruption and disaster preparedness. In addition to deratings that

---

36 *Derating* is the technique employed in power electrical and electronic devices wherein the devises are operated at less than their rated maximum power dissipation.

might be possible in reviewing California's gas lines, additional demands will be likely placed on natural gas as penetration of variable renewable generation increases, especially with respect to regional and local natural gas demand and pressure fluctuations.

To maintain risk identification, monitoring of natural gas supply and infrastructure is key. For natural gas information, California's major gas IOUs (PG&E, San Diego Gas & Electric [SDG&E], and SoCalGas) provide monthly data on:

- Their respective gas injection/takeout for gas storage in the state (totaling roughly 313 Bcf—180 Bcf in Northern California and 133 Bcf in Southern California).
- California-based production purchases and imported natural gas inputs (87 percent of the state's natural gas is imported from other states, and in the case of liquefied natural gas (LNG) from a Sempra-owned 1Bcf/day LNG facility in Baja California, Mexico).
- Spot market and contract prices.
- Curtailment notices.
- Heating/cooling degree days.

Moreover, natural gas deliveries by sector and through which local distribution company (LDC), as well as gas inventories and storage injection rates, are shown in the EIA *Natural Gas Monthly*.[37]

Further, natural gas demand and supply projections are provided by the LDC as part of its annual GCR filings. These projections include storage field inventory balances and ramp rates. Potential shortages can be identified when long-term supply is inadequate to meet projected demand. The EIA *Natural Gas Monthly* also publishes average city gate prices (price to the LDC as gas is received), and prices by sector used to determine if supply is short or in excess of demand and how critical.

In addition to these areas of research, the Energy Commission's Electricity and Natural Gas Office of the Electricity Supply Analysis Division compiles data on the natural gas market, including natural gas procurement and planning for the following reports:

- Natural Gas Working Group quarterly meetings with the utilities and other state agencies.
- Natural Gas Market Assessment – every two years.

37http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/natural_gas_monthly/ngm.html.

Interstate pipelines provide notices of curtailments to FERC. Notices of curtailment are early indicators of reduced supply. The supplementary supply required to offset the reduction in deliveries may need to be calculated and perhaps satisfied from other in-state supplies, depending upon the current levels of storage volumes, natural gas transferred in the system, and intertie exchanges. Again, statewide weather data, regional, and even local data are available for use in predicting extreme winter periods for projecting natural gas demand.

What are more troublesome in relation to pipelines are the risks and vulnerabilities of aging pipelines, or the fact that they are sited in geological hazard areas. For instance, one issue that was raised in the Ruby Pipeline (See Figure 8), which interconnects with PG&E at Malin, Oregon, for gas distribution and storage in California is the potential adverse effect of the pipeline crossing areas of geologic hazards, such as seismicity, landslides, karst topography,[38] and subsidence. The pipeline crosses 110 faults or fault zones and 32 areas where soils are susceptible to liquefaction. About 16 percent of the pipeline route crosses areas of moderate-to-high landslide risk. Ruby has developed site-specific measures to reduce the risk associated with these geologic hazards, including the use of heavier-walled pipe, pipeline realignment to avoid specific faults, and postseismic event field evaluation.

38 When limestone interacts with underground water, the water dissolves the limestone to form karst topography – an amalgamation of caves, underground channels, and a rough and bumpy ground surface.

Figure 8: Ruby Pipeline Map

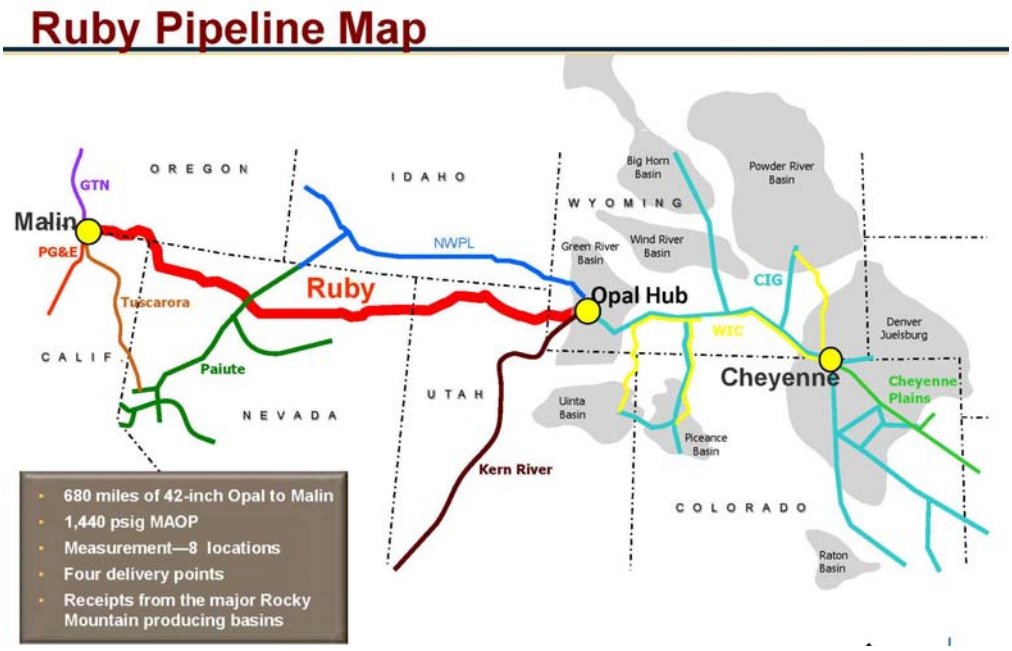


Photo Source: El Paso Western Pipelines

Ruby Pipeline operators have agreed to implement measures such as providing negative buoyancy for the pipe using concrete coating, set-on weights, or screw anchors; and alignment monitoring following the occurrence of significant earthquakes. Ruby also employs measures to control runoff and erosion, thereby minimizing the potential for slope failures. According to the environmental impact statement (EIS) filed with the FERC, Environmental Condition No. 17 requires Ruby to implement additional protective measures in karst terrain to minimize potential subsidence-related impacts along the right-of-way. The EIS concluded that the proposed measures for Ruby and the condition will adequately minimize effects due to geologic hazards.[39]

Natural Gas Resource Risk Minimization

To minimize risk to the natural gas supply and infrastructure, the Energy Commission develops models and assessment scenarios to determine ongoing and future disruption forecasts. They identify current demand, infrastructure, pricing, and supply, and then model these data sets against disruptions such as high-price and low-price demand models. These ongoing assessments provide a basis for continuing engagement of state, federal, and private sector energy partners to address potential issues before they occur.

39 FERC 2011 Summer Market and Reliability Assessment.

One of the ways the Energy Commission minimizes risks is by evaluating gas supply, including pipeline connection to the natural gas main or transmission line for all licensing review of thermal power plants 50 MW or greater. The Energy Commission assesses risk and impacts to public health and safety up to the point of interconnection with the existing transmission pipeline system.

These ongoing efforts help balance financial supply issues with risks to supply and infrastructure as a result of catastrophic disruptions or emergencies. Even though long-term natural gas prices are less volatile, daily spot prices can be affected by constraints such as weather, speculation, high or low demand, availability of pipeline capacity, infield production problems, storage injection or withdrawal, or a major disaster incapacitating infrastructure, such as what occurred in San Bruno in 2009.

The Energy Commission has concluded that single-point forecasts of future natural gas prices are not only inaccurate, but not useful in focusing proper attention on the complexity of the gas market and range of potential outcomes. To offset inaccuracies, the Energy Commission designed a range of explorable underlying conditions to develop some potential price estimates. This approach provides tradeoffs necessary for sensible risk management, given the volatility of future natural gas issues that may or may not occur.

Natural gas is bought and sold in a national market in the United States. Transactions may take place, for example, directly between a consumer and a producer, between a marketer and a producer, or between a consumer and a marketer. Natural gas supply deals may be priced at a fixed price for a day, for a month, or for a longer period. Natural gas prices for supplies are also commonly linked to the price indices reported by major industry publications. For example, a one-year supply deal may specify that the price of the natural gas for each month is at the monthly *Gas Daily* price index for a specific receipt point.

There are two types of natural gas price indices: those created and published by the trade press to disseminate cash price information to the industry, and one developed and published by the NYMEX to disseminate futures price information. These indices are central to the functioning of both the wholesale and futures markets. Natural gas customers and traders rely on these published price indices to make physical purchases and to buy and sell futures contracts and options. Market participants rely on these price indices to help them make informed decisions about trading and to evaluate new investments.

When the organizations publishing the indices receive the raw data on each transaction, it is sorted into pricing locations, given a reasonableness check, and examined for irregular data before being compiled.

The federal Energy Policy Act, enacted in August 2005, increases the amount for criminal and civil penalties that the FERC may impose on companies that participate in anticompetitive behavior, including knowingly misreporting price information to index

developers. It gives the FERC authority to collect additional transaction information if such information is necessary to ensure price transparency. Furthermore, the FERC and the CFTC entered into a memorandum of understanding to share and coordinate requests for information, which will allow FERC to more readily identify and sanction market manipulation.

According to the United States Government Accountability Office (GAO), many industry stakeholders report that they now have greater confidence in most price indices. FERC reports that stakeholders are generally satisfied with current price indices and that the quality of information has improved. In a recent FERC survey, two-thirds of respondents reported their confidence in price indices, on a scale of 1 to 10 (with 10 being most confident), as a 7 or greater. The GAO report indicates that since 2002 the quality of information has improved because more companies are reporting data to publishers and the major publishers are providing more information about the number of transactions and volume of natural gas trades.

The extent of these reforms has been significant, and it appears that the indices reporting natural gas wholesale and futures prices are functioning at a more precise level than previously.

To further strengthen risk minimization, California's ongoing strategies include:

- Working with regulatory agencies and the private sector to deploy cost-effective energy efficiency measures.
- Conducting energy research that may result in developing beneficial technological advances in natural gas use, conversion, production, or transmission.
- Using other renewable energy systems to bridge the gap between demand and supply availability.
- Coordinating between the Energy Commission and the CPUC on the Integrity Management Program, which requires regularly scheduled inspections and design reviews, risk assessment, and mitigation measures of any pipeline that traverses high-consequence areas.
- Upgrading pipeline distribution infrastructure by IOUs.
- Passing Senate Bill 44 (Corbett, Chapter 520, Statutes of 2001), requiring the CPUC to establish emergency response standards for gas corporations that shall contain additional or more stringent standards that are compatible with the minimum standards established by the federal government under CFR 49, Part 192 for pipeline safety.

Petroleum and Transportation Fuels Resource Risks and Vulnerabilities

California is a net importer of oil, producing 37.2 percent of the petroleum it uses. In 2007, California residents spent nearly $50 billion for gasoline and $9.7 billion for diesel.

Petroleum-based fuels account for 92.8 percent of the state's transportation needs. The dependence on a single type of transportation fuel makes Californians vulnerable to petroleum price spikes. Furthermore, transportation sources emit nearly 40 percent of the state's greenhouse gases.

From 1950 to 2006, the demand for gasoline and diesel fuel grew on average 275 million gallons per year, mostly in response to population growth. Also, the locations of jobs and housing continue to grow farther apart, increasing the miles traveled by the workforce. Since 2006, gasoline fuel demand has decreased 6 billion gallons from the 1950-2006 fuel use trajectory, primarily because vehicles have become more efficient under federal corporate average fuel economy (CAFÉ) standards.

The California Air Resources Board's adoption of a unique California gasoline and diesel fuel specification and an absence of petroleum pipeline connections isolate California from other fuel markets. As a consequence, California's motorists and economy are particularly vulnerable to short-term spikes in the price of gasoline. No pipelines connect California to other major U.S. refining centers, and California refineries often operate at near-maximum capacity due to high demand for petroleum products. When an unplanned refinery outage occurs, replacement supplies must be brought in via marine tanker. Locating and transporting this replacement gasoline (which must conform to the state's strict fuel requirements) can take from two to six weeks.

The Energy Commission's Transportation Energy Office staff has the responsibility to monitor and analyze the adequacy of California's transportation fuels infrastructure and potential impacts on petroleum, renewable and alternative fuel supply, and prices from infrastructure constraints and supply shortages. The transportation of crude oil falls under both federal and state jurisdiction. At the federal level, the appropriate regulatory agency for maintaining pipeline safety is the Pipeline and Hazardous Materials Safety Administration (PHMSA) of the Department of Transportation (DOT). At the state level, the appropriate regulatory agency is the Pipeline Safety Division of the California State Fire Marshal (CSFM).

California-based refineries can process more than 1,960,000 barrels of crude oil per day.[40] The supply infrastructure is expensive and diverse in its operation, including use of expensive equipment like pressure vessels, heat exchangers, storage tanks, pipelines and piping systems, petroleum depots, and transport equipment. All are critical to this industry. Disruption within the transportation fuels infrastructure and supply chain can be stimulated by changes in crude oil imports, fluctuating fuel energy prices, and the

40 http://www.eia.gov/state/state-energy-profiles-data.cfm?sid=California#Reserves.

potential for accidental or intentional interruption to production or transport of liquid fuels.

For petroleum markets, detailed information is obtained from both the EIA and the American Petroleum Institute (API), which maintain databases containing information used to determine recent market behavior and anticipate supply disruptions.[41] Since it is relatively easy to obtain aggregate petroleum data but more difficult to learn about individual companies, the Energy Commission requires California's refineries, pipeline operators, terminal operators, importers, and major marketers to provide information regarding inventories, production, imports and exports of transportation fuels, and refinery feedstocks. In addition, these stakeholders periodically provide confidential information related to any significant potential fuel supply issues.

Because petroleum is distributed through a decentralized network and antitrust laws prohibit oil companies from sharing information regarding supply availability and price, there is no single source of information by which to assess or characterize emerging problems. Consequently, the state's role in developing data and assessing supply is more critical for petroleum products than it is for electricity or natural gas.

The total number of taxable gallons of gasoline and diesel fuel used is provided on a monthly and annual basis of motor gasoline sales revenue by the California State Board of Equalization (BOE). Similarly, parties that import into or export from California petroleum and renewable fuels provide monthly data submittals to the Energy Commission. In addition, KinderMorgan provides weekly reports on exports of transportation fuels to neighboring states via petroleum product pipelines that they operate.

Wholesale and retail petroleum prices are available through the EIA under the Refiner, Reseller, and Retail Monthly Prices heading and at the state level on the *Weekly Petroleum Status Report* that provides information on national and international prices and inventory information.

The Energy Commission also purchases pricing information from the Oil Price Information Service (OPIS) for petroleum and renewable fuels on a daily basis. In addition, the Energy Commission subscribes to OPIS daily alerts that provide timely information regarding fuel supply issues.

The authority for monitoring and analysis is granted by the Petroleum Industry Information Reporting Act (PIIRA). The PIIRA data collection program consists of a highly sensitive, confidential data reporting system that requires refiners and distributors to submit proprietary information about transportation fuels product inventories, shipments, production, and prices. The monitoring helps identify:

---

41 http://tonto.eia.doe.gov/dnav/pet/pet_pub_publist.asp; http://www.api.org/statistics/.

- Availability, supply, price, and economic impacts relating to transportation fuels in California.
- Nature, cause, and extent of crude oil or transportation fuel shortages.
- Emerging trends related to supply, demand, and use of crude oil and transportation fuels.
- Present or future constraints in the transportation fuels supply infrastructure and distribution system.
- Potential for improvements to California's infrastructure to better facilitate economically adequate responses to unanticipated supply disruptions.

In addition to PIIRA data, other risk identification methods include the following:

- Analyze information received from other data and research, including retail fuel stations, marine import-export, and refinery production and operations.
- Research technical journals, reports, databases, and other sources to identify and compile the most appropriate data on pipeline movements, fuel terminal operations, refinery operations, and expansion projects to assess California's transportation fuels infrastructure and potential effects on supply and prices from infrastructure problems and supply shortages. These sources include, but are not limited to, other state agencies, including the Board of Equalization and the state Lands Commission, and subscriptions from:
    - OPIS – this includes the sister website service OPISnet, for oil price information, including refining, transport and retail pump prices.
    - PIERS – for import and export trade activity and to conduct market research on transportation fuels.
    - Platt's – for information on maritime vessel activity and, in particular, fuels movements.

California also has critical nodes for petroleum product pipeline distribution infrastructure. Information on critical nodes and potential implications of disruption to specific points within the distribution infrastructure are considered homeland security-sensitive and not included in this *Energy Assurance Plan*. However, Energy Commission staff has all the background information for California's petroleum market and maps showing locations of refineries, primary petroleum pipelines, marine terminals, and distribution terminals and is highly qualified to initiate assistance to first responders and energy assurance partners to enable the continued distribution of transportation fuels in the event that one or more of the "critical" distribution nodes are temporarily disrupted.

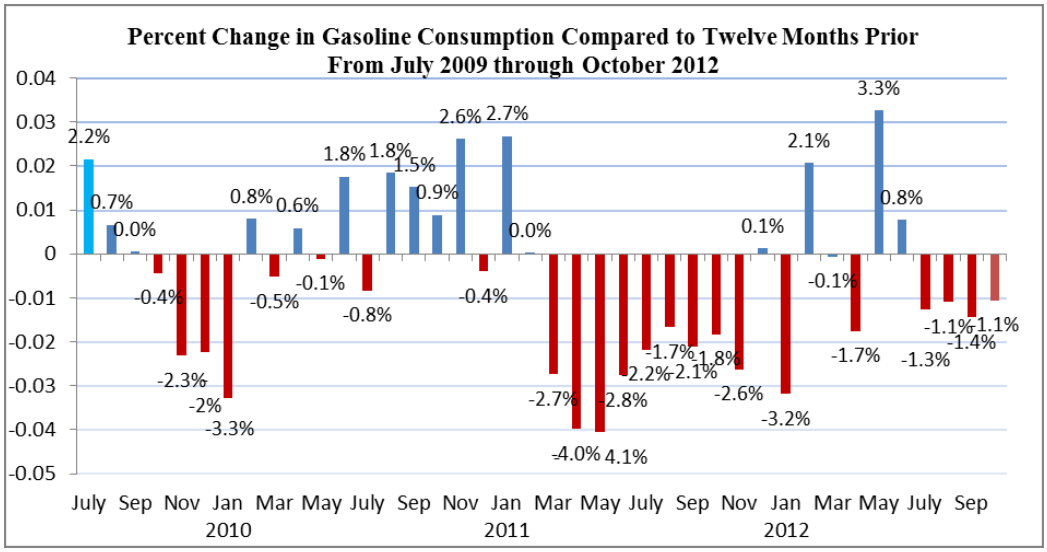
Petroleum and Transportation Fuels Resource Risk Minimization

There are few effective tools state government can use to minimize the risk of transportation fuels energy supply and infrastructure disruptions or emergencies.

Market power and consumer response to higher fuel prices are the dominant methods used to reduce demand. (See Figure 9.) For example, April/May 2011 gasoline prices rose more than a $1.00 per gallon, 34 percent higher than the prior year, and gasoline demand dropped 4.0 percent. This represents a 530,000-gallons-per-day decline in April and May 2011 versus 2010 volumes. This high-price event lasted 10 months, effectively reducing gasoline demand 160 million gallons from the prior year use. In 2012 alternative fuels displaced 153 million gallons over the same period, excluding ethanol, a nondiscretionary fuel substitute.

Government may best serve Californians by collecting and providing timely, accurate, reliable information to help residents and business make informed fuel-use decisions to encourage consumers when to conserve, and to inform Californians of the duration of the emergency. Where possible, the Energy Commission may recommend actions to remove governmental obstacles to minimize the duration of acute supply shortages. For example, the Commission may adjust governmental regulations that may be impeding urgently needed volumes.

Figure 9: 2012 Example of Gasoline Demand Changes in California



Source: http://www.boe.ca.gov/news/2013/16-13-S.pdf

California also leads the nation in reducing petroleum fuel use and using alternatives to petroleum. In 2012 alternative fuels displaced 7.2 percent of the total petroleum fuel for on- and off-road uses.[42] Collectively the federal Renewable Fuels Standard and the California Low Carbon Fuel Standard (LCFS) policies are in place and stand to enhance alternative fuels use in California over the near term.

42 Energy Commission staff analysis.

The California Air Resources Board (ARB) administers the California LCFS. In general, the regulated parties under the LCFS legislation are fuel producers or importers who sell gasoline or diesel fuel in California. The legislation is designed to reduce the carbon intensity of gasoline and diesel fuels sold in California by 10 percent between 2012 and 2020 through the increased sale of alternative low-carbon fuels. Each low-carbon fuel has a specific carbon intensity, based on life-cycle analyses conducted under the guidance of ARB for several approved fuel pathways. The LCFS may result in additional renewable fuels being used in California. To meet the LCFS gasoline mandate, consumption of motor fuel containing up to 85 percent ethanol (E85) is projected to increase by 2020. For diesel, biodiesel or other alternative fuels may be used.

The Energy Commission administers the Alternative and Renewable Fuel and Vehicle Technology Program, which provides financial incentives to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policy objectives. Distributing as much as $100 million annually through competitive grants and other means, the Energy Commission is leveraging federal and private investments to help grow the nation's energy security through fuel diversity, while encouraging long-term economic development and advanced transportation employment opportunities.

The Energy Commission and ARB jointly developed and adopted the *State Alternative Fuels Plan of 2007*,[43] which meets the requirements of Assembly Bill 1007 (Pavley, Chapter 371, Statutes of 2005). In general, the *State Alternative Fuels Plan* recommends the goal to reduce GHG emissions to 1990 levels by 2020 and 80 percent below 1990 levels by 2050. It also sets the goal to reduce petroleum fuel use to 15 percent below 2003 levels by 2020 and to increase the use and production of alternative fuels in the state by 26 percent by 2022 and in-state biofuels production 40 percent by 2020. It also set a 2012 goal that alternative fuels displace 9 percent of fuel use. As of 2012 alternative fuels had reached 7.2 percent of the total petroleum fuels use.

The ARB's California Advanced Clean Car rules[44] combine the control of smog-causing pollutants and greenhouse gas emissions into a single coordinated package of emission requirements for model years 2017 through 2025. This program lowers gasoline- and diesel-powered cars emission standards and requires increasing zero-emission technologies, such as full battery electric cars, plug-in hybrid electric vehicles, and hydrogen fuel cell cars.

---

43 http://www.energy.ca.gov/2007publications/CEC-600-2007-011/CEC-600-2007-011-CMF.PDF.

44 http://www.arb.ca.gov/msprog/consumer_info/advanced_clean_cars/consumer_acc.htm.

Alternative and Renewable Energy Resource Risks and Vulnerabilities

In 2011 alternative energy, including renewables (solar, wind, geothermal, biomass) and hydrogen, provided 18 percent to the overall power supply. As renewable energy sources progress to achieve 33 percent of the state's electricity mix by 2020, more power is expected to be configured in small-scale distributed generation closer to customers in urban areas. Because of the intermittent nature of solar and wind availability, new natural gas power plants have been designed to complement the load profile of renewable sources. In October 2013, the CPUC directed IOUs to provide 1,325 megawatts (MW) of energy storage capacity by 2020 for their electricity, including renewable electricity sources. This initiative is expected to spur innovation in batteries, flywheels, and other storage technologies. As these trends continue, additional work will be required to assess how the available capacity, changing mix, and location of electric generating facilities will be impacted and responsive to acute and small localized emergencies, as well as energy emergencies affecting larger statewide regions. Furthermore, as alternative fuel use increases to meet policy goals, the overall transportation system becomes more diverse and less vulnerable to a supply disruption of one source of fuel.

As California's renewables penetration increases, both the total electric power displacements and concentrations will be important to ascertain what the likely interdependent ripple effects could be for natural gas demand. As an example of this additional level of complexity, historical methods for estimating California's peak-demand involved two primary issues: extreme temperature variability (for example, SoCalGas uses a 1-in-35-year analysis, and PG&E uses a 1-in-90) and hydro conditions (drought superimposed on extremely cold winter days so that additional power generation using gas-fired turbines to compensate for reduced hydroelectric power). Now as renewables penetration increases toward the RPS goal of 33 percent by 2020, many additional network flow changes and characteristics will potentially be introduced within the new, broader "big picture."

The three California IOUs are just now beginning to plan for appropriate distribution characterization and research (with some assistance from Energy Commission funding) to analyze the impacts of high-penetration renewables on distribution feeder circuits. For example, the probabilistic and partially correlated impacts of moving clouds and variable winds and seasonal, daily, hourly, minute changes will definitely affect the electric grid and its responsiveness, such as California ISO dispatches to spinning reserves, but could also require calling on additional electric generation resources to both compensate and fill the power void − such as dispatching one or more gas-fired power plants to pick up for lost power from SCE's Mojave Desert multiple 100 MW photovoltaic farms or a 200 MW fast ramp-down loss out of the Altamont Pass wind farms.

Alternative and Renewable Energy Resource Risk Minimization

An important risk minimization strategy came with the passage of Executive Order S-14-08, mandating development of the Desert Renewable Energy Conservation Plan (DRECP), a major component of California's renewable energy planning efforts. One of the key components of this order was the MOU signed on November 17, 2008, by the Energy Commission and the California Department of Fish and Wildlife (DFW), formalizing development of a Renewable Energy Action Team (REAT) to create a "one-stop" process for permitting renewable energy generation power plants. Instead of filing multiple sequential applications, the DFW and Energy Commission created a concurrent application review process, to be filed directly at the state level. The process streamlined permit processing times by at least 50 percent for projects in renewable energy development areas and included all appropriate federal partners in the expedited permitting process. The order also led to development of a best management practices manual to help RPS project applicants design projects to emphasize siting considerations and minimize environmental impacts for RPS desert projects.[45]

Several studies and projects are underway within the state to determine the best strategies to integrate alternatives and renewables into the state's energy portfolio. This effort would meet or exceed AB 32 requirements and reduce gas emissions by up to 80 percent by 2050. Invariably, the single-risk minimization strategy outlined in all reports and studies is to not limit the future energy efficiencies to one alternative or renewable energy source, but rather to create a viable mix of energy sources to meet future clean energy goals. This process also creates an optimum risk minimization strategy for energy assurance by not relying on a sole source of energy, but by keeping a viable energy "pool" from which to draw upon to meet the state's energy demands of the future.

Energy Interdependency Risks and Vulnerabilities

Numerous interdependencies arise across all aspects of energy infrastructure and economic, cultural, and social activities, as well as government jurisdictions within the state, including:

- State, regional, and local energy financial markets and their interrelationships.
- Interdependencies covering all energy and fuel types, including electricity, natural gas and liquefied natural gas (LNG), gasoline, aviation fuels, propane, heavy industrial fuels, distillates, biodiesel, renewables (including hydro, solar thermal, geothermal, wind, tidal/wave, and so forth), and nuclear power.

Furthermore, these interdependencies cover the following four domains:

---

45 California Office of the Governor Executive Order S-14-08.

- Physical (inputs and outputs of one infrastructure used by another)
- Cyber (electronic, informational linkages)
- Geographic (common corridor or location)
- Logical (dependency through financial markets)

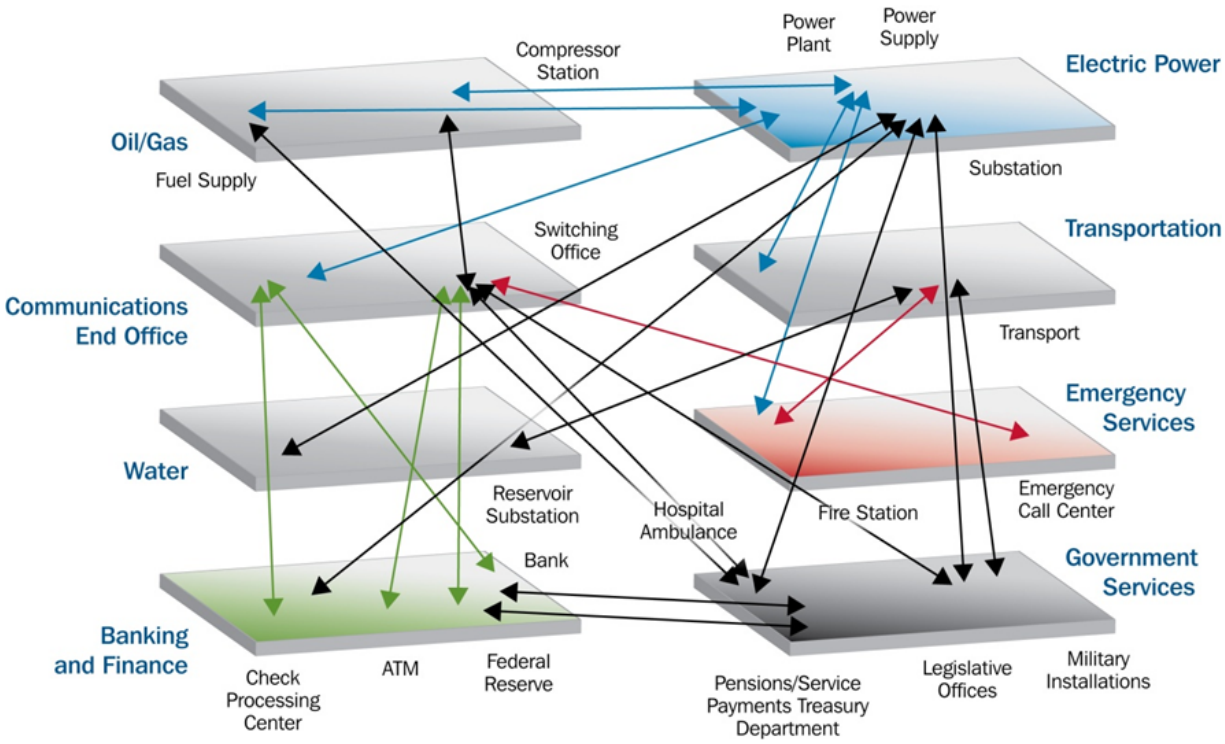
A major example of interdependencies includes how many petroleum refineries, natural gas compressors, fueling stations, drinking water pumping and wastewater treatment plants all rely on electric power to operate. In the event of a power disruption, they may not be able to execute a controlled "soft" shutdown. This inability, in turn, can damage equipment, aggravating a bad situation. In addition, all rely on the state's water system to operate their facilities and operations. Without water, there is no power, and without power to operate public drinking water and wastewater systems, crucial lifelines are adversely affected.

California natural gas peak demands are limited to a handful of underground storage fields (located in depleted oil reservoirs), further taxing the gas infrastructure and interdependencies. Refined analyses may indicate that locating more distributed natural gas storage facilities will not only better handle peak requirements more cost-effectively, but may also result in increasing overall system reliability from depending on only several very large storage sites. Natural gas storage capacity is being increased by almost 30 percent and is further discussed in Chapter 5.

An example of how interdependencies and infrastructure resilience interplay is shown in Figure 10 below.[46]

46. Modified from *Enhancing Resilience*, 2010, p 16.

Figure 10: Infrastructure Interdependencies



Source: Aanko Technologies Inc.

Given these structural interdependencies inherent in the state energy system, along with inherent natural hazards within the state and human-induced hazards (accidental or intentional), there is enough information to form an energy disruption risk and vulnerability assessment. Historical emergencies and disasters are instructive in helping determine “what worked and what didn't work." Although such historical events shouldn't be wholly relied upon, they represent real-world tests of the preparedness, response, and recovery processes and, as such, are highly instructive.

Energy Interdependency Risk and Vulnerability Minimization

Risk can best be understood by examining energy supply and demand at various times. Risk reduction is best accomplished as a result of longer-term investment and changes to the state’s energy infrastructure. In addition, because it is impractical to eliminate all risk, effective short-term responses are also needed to reduce the consequences and allow for more rapid recovery. Efforts to both assure effective emergency response and reduce risks in the long term need to be considered.

There are several interdependent risk mitigation projects underway within the state. The state’s massive state water project is the nation's largest state-built water and power development and conveyance system and has been built with safety redundancies to minimize risk and vulnerabilities. The project includes 34 storage facilities, reservoirs, and lakes; 20 pumping plants; 4 pumping-generating plants; 5 hydroelectric power

plants; and about 701 miles of open canals and pipelines. Flexible water-pumping operations help manage the state's power needs. This flexibility is allowed by reservoirs, which temporarily store water until it is needed to meet the daily and seasonal demands of its contracting agencies (both water and power).

Over time the state's electric grid may become more closely tied to and dependent upon the state's gas grid and the capacity, resiliency, and natural gas supply alternatives with the addition of the influx of the Ruby pipeline of up to 1.5 billion cubic feet per day via the PG&E interconnection at Malin.

The use of various alternatives has the potential to enhance energy security by helping distribute generation and diversify supply among various locations. This can reduce, but not eliminate, the risk of relying on the concentrated power production or energy acquisition from relatively few locations such as power plants, pipelines, and grids. In other cases, when conventional gasoline and diesel fuel are in short supply, replacement volumes of 5-20 percent may be possible to obtain a variety of local and regional alternative fuels such as ethanol or biodiesel to meet short-term energy assurance needs, assuming these local producing facilities are either not operating at full capacity or are able to rapidly obtain additional feedstocks to enable increased output of renewable fuels.

Energy Supply and Infrastructure Risk and Vulnerability Assessment

California's energy assurance and emergency response planning requires a supply risk and vulnerability assessment of the energy systems in the state. The matrix illustrated in Table 9 of Appendix I is designed to quantify and estimate the probability and overall severity of various types of threat events or hazards that may cause an energy emergency. The Energy Commission believes this is a starting point to evaluate and reduce risks and will continue to work on assessment updates in future planning activities.

For each threat event, the probability and impact estimates are factored (Probability x Impact) to quantify the relative risk of each energy supply disruption threat/event. The relative risk provides a basis to identify and evaluate existing mitigation and recovery efforts to determine if a facility has significant vulnerabilities.

The matrix in Appendix I is based on an Excel spreadsheet format using straightforward calculations. For each threat/event, assessors answer one question representing probability of occurrence and then evaluate four impact questions across two categories – facilities impact and socioeconomic impact.

All four estimates for impact are averaged to produce an overall severity score. The assumption is that threats/events that affect two categories would have greater overall impact than threats/events where the impacts are limited to just facilities or people. The overall severity score and the probability are then completed to create a relative risk

score for each threat event. Once all the threats/events have been evaluated, the results are sorted from high to low to produce a relative risk ranking of threat exposures. The highest value suggests the greatest risk. Then the results are discussed with the group to determine reasonableness and validity.

The results of this risk assessment provide a basis to evaluate adequacy of mitigation measures and recovery planning for the most significant energy supply disruption threats. This assessment will review, reevaluate, and note the various threats and past events, including any particular features specific to a local area. These threats and past events fall into four categories:

- Natural
- Technological
- Human-induced
- Terrorism

These quantified results will be used with relevant quality attributes to develop an approach to assess energy supply disruption risk and vulnerability. The final results are used as a critical planning and exercise component.

Based on this completed assessment in Appendix I, the terrorism hazard is identified as the hazard with the greatest severity of impacts coupled with relative risks. In addition to this type of risk assessment, the California Office of Emergency Services develops a statewide hazard mitigation plan. As well, the California ISO develops an annual transmission plan assessment to determine risks to the electrical transmission system. All stakeholder participants within the CPUC-regulated entities have input to the California ISO assessment and conduct internal assessments of their supply and infrastructure, to include financial energy markets, on an ongoing basis.

Energy Supply and Infrastructure Risk Minimization

Minimizing risk is a key factor to energy assurance in California. California's energy supply is continuously monitored by a variety of agencies. When risks to the energy supply or infrastructure are identified through monitoring, the Energy Commission staff and other state energy partners may initiate risk minimization strategies to avert disruptions or emergencies.

Risk minimization can best be understood by examining energy supply and demand at various times and is best accomplished as a result of longer-term investment and changes to California's energy infrastructure. In addition, because it is impractical to eliminate all risk, effective short-term responses are also needed to reduce the consequences and allow for more rapid recovery. Efforts to reduce risks in the long-term provide for a more effective emergency response and subsequent recovery.

Minimization strategies include, but are not limited to, the following:

- Energy Commission staff evaluates natural gas supply, including pipeline connections to the natural gas main or transmission lines, and assesses risk and impacts to public health and safety up to the point of interconnection with the existing transmission pipeline system.
- Energy Commission staff ensures adequate conditions for certification of energy infrastructure to ensure integrity, including power plant and facilities siting and licensing.
- CPUC verifies the ongoing IOU Integrity Management Program that requires regularly scheduled inspections and design reviews, risk assessment, and mitigation measures of any natural gas pipeline that traverses high-consequence areas.

Another way that the state's energy risk is minimized is through the use of the CPUC's Resource Adequacy (RA) Program. The CPUC adopted a RA policy framework (Public Utilities Code Section 380) in 2004 to ensure the reliability of electric service in California. This framework guides resource procurement and promotes infrastructure investment by requiring that load-serving entities (LSEs) procure capacity so that it is available to the California ISO when and where it's needed.

The CPUC's RA program now contains two requirements: system RA filings (effective June 1, 2006) and local RA filings (effective January 1, 2007). System RA filings are required annually and monthly, while local RA filings are required only annually. These filings are designed to demonstrate that LSEs have procured sufficient capacity resources, including reserves needed to serve its aggregate system load on a monthly basis. Each LSE's system requirement is 100 percent of its total forecast load plus a 15 percent reserve, for a total of 115 percent. In addition, each LSE is required to file with the CPUC demonstrating procurement of sufficient local RA resources to meet its RA obligations in transmission-constrained local areas.

As a measure of this operational risk minimization effectiveness, one of the issues affecting the electrical grid is the State Water Resource Control Board's policy decision concerning use of seawater at coastal power plants to comply with Section 316(b) of the federal Clean Water Act.

That decision directed owners of 19 coastal and estuary power plants in the state to greatly reduce their seawater use from previously permitted levels or take some other action to eliminate once-through cooling (OTC) systems, which pump seawater through the plant's condensers and then back into the ocean. This directive will cause the potential retirement of 12,079 MW of once-through-cooled generation units that will impact the grid. Given that California has to comply with a 33 percent Renewables Portfolio Standard (RPS) in addition to this generation loss, a series of misfortunes befell nuclear power plant capacity in Southern California.

To adapt to these conditions, the California ISO is developing solutions, in coordination with energy assurance partners, to continue to meet the needs of California energy users. One of the ways the California ISO is doing this is by proposing to unretire natural gas-fired plants, along with accelerating two transmission projects and promoting more conservation efforts to deal with the potential loss of the 2,150-MW nuclear capacity.

In addition, the California ISO has the ability to trigger other demand response programs when power operating reserves are expected to drop below 7 percent. The California ISO works with the CPUC when the need for flexible capacity resources increases with the level of intermittent resources typically used to meet RPS requirements. The CPUC has the ability to consider modifications to its resource adequacy (RA) program to incorporate these flexible capacity procurement requirements. This allows the California ISO to work with the CPUC and other local regulatory authorities (LRAs) by providing the information required to incorporate flexible capacity needs into their respective resource adequacy and procurement requirements so that LSEs can meet the energy needs of California.

In addition to the risk assessment identified in Appendix I, the OES develops a statewide hazard mitigation plan. As well, the California ISO develops an annual transmission plan assessment to determine the risks to the electrical transmission system. All stakeholder participants within the CPUC-regulated entities have input to the California ISO assessment and conduct internal assessments of their supply and infrastructure to include financial energy markets on an ongoing basis.

The State of California and its local governments are also taking measures to improve their ability to cope with energy disruptions in the longer term. These measures include building codes, zoning ordinances, climate action plans, and growth and development projections.

Building codes are used to ensure that construction in a community meets minimum standards required for public health and safety and for quality workmanship. Building codes are also being used to increase a community's ability to deal with disruptions to the electric power infrastructure by requiring facilities to be adequately prepared for power disruptions. Modification of the use of a building can significantly affect electrical service requirements, which may or may not be readily identified on building permits. Some examples of this type of project include:

- Conversion of conventional commercial or industrial facilities to computer-based company operations with extensive computer equipment and air-conditioning requirements.
- Conversion of a commercial building to residential condominiums.
- Rehabilitation of residential buildings to increase their electrical service.

Local governments are using zoning change requests, permit applications, economic development plans, or other means to identify modification to rehabilitation projects. Communities that adopt building codes as part of their municipal codes, making compliance mandatory, frequently use several codes developed by national organizations. While model codes provide basic guidance, municipalities often amend and modify them to meet specific local requirements.

Another major project underway is the development of local energy assurance plans in communities throughout the state. These plans include detailed reviews of hazard profiles and vulnerability assessments contained in the local hazard mitigation plans, examination of hazards in relation to locations of prioritized critical community facilities, and considerations of using this information to conceptualize the best routing for primary and alternative delivery of emergency fuel supplies. The goal of these plans is to enable local communities to explore alternative energy technology solutions that might be pursued in the future as additional funding and utility partnership opportunities become available. The exploration includes consideration of opportunities to deploy renewable and distributed energy technologies and conceptual frameworks for the application of a dedicated microgrid to serve a central cluster of critical community facilities for continuity of government operations.

CHAPTER 4:
Electric Resources

Introduction

California has more than 32,000 miles of electric transmission lines and up to double that amount for the electric distribution system.[47] According to the California Power Plant Database, California has more than 210 operational power plants, varying in size from 50 megawatts (MW) to more than 2,000 MW and generating a total of nearly 60,000 MW. In addition, California has almost 800 smaller power plants totaling nearly 10,000 MW that range in size from 0.1 to 49.9 MW.[48]

California's massive electricity generation system generates more than 296,000 gigawatt hours (GWh) each year, and the state's transmission lines deliver the power to customers. In 2009, California produced 69 percent of the electricity it uses; the rest is imported from the Pacific Northwest (7 percent) and the U.S. Southwest (24 percent). Hydroelectric generation provides about 20 percent of California's electric power, with the balance coming from fossil fuels, nuclear, and renewable sources. Natural gas is the main source for electricity generation at 56.7 percent of the total in-state system power.[49] The installed capacity of the 1,008 in-state power plants (greater than 0.1 MW) totals 69,709 MW. These plants produced 205,695 GWh of electricity in 2009. Table 2 provides a quick look at California's electric energy generation.

47 http://www.energyalmanac.ca.gov/electricity/.

48 *2011 IEPR*.

49 http://energyalmanac.ca.gov/electricity/index.html.

Table 1: California Electric Energy Generation 2010 Quick Facts

Resource Type	Gigawatts	Resource Type	Gigawatts
Hydroelectric	34,301	Biomass	5,745
Nuclear	32,214	Wind	6,172
In-State Coal	3,406	Solar	908
Oil	52	Direct Coal Imports	13,119
Gas	109,481	Other Imports	72,050
Geothermal	12,740		
Total Generation Plus Net Imports: 290,187(Gigawatts)			

Note: Data is based on corrections and updates as of July 8, 2011.
Source: http://energyalmanac.ca.gov/electricity/electricity_generation.html

Current Electric Resource Availability

California has one of the most diverse energy supply systems in the world. The state provides for more than two-thirds of its own electrical usage and imports one-third. For the electricity California supplies itself, the majority is met through natural gas, while the remainder is distributed over most alternative and renewable generation sources. Reliable electricity at affordable prices is critical to support California's growing population and economy. California's transmission grid and interconnections with other states and regions in the Western Interconnection[50] are critical to meeting reliability, environmental, and economic goals. California's transmission grid is designed to reliably move power within the state and deliver it to consumers. As stated previously in this *Energy Assurance Plan*, due to expiring power plants that used once-through cooling, California's electricity generating industry will require new generating capacity to meet its energy consumption needs, as well as provide adequate reserves.[51]

California's in-state net electric power generation capacity is more than 69 gigawatts, comprising 6.4 percent of the U.S. total. Some of California's primary nonnuclear generating facilities (and ownership) include:

- Dynegy Moss Landing Power Plant (Dynegy-Moss Landing, LLC).
- AES Alamitos LLC (AES Alamitos, LLC)
- Haynes (City of Los Angeles).

50 http://energy.gov/oe/information-center/recovery-act/recovery-act-interconnection-transmission-planning/learn-more.

51 *2011 IEPR*, p 113.

- Ormond Beach (RRI Energy Ormond Bch, LLC).
- Pittsburg Power (Mirant Delta LLC).

California's nuclear generating facilities are:

- Diablo Canyon (Pacific Gas and Electric Co).
- Palo Verde Station near Phoenix, Arizona (out-of-state nuclear facility).

Natural gas-fired power plants typically account for more than one-half of state electricity generation. California is one of the largest hydroelectric power producers in the United States, and with adequate rainfall, hydroelectric power typically accounts for close to one-fifth of state electricity generation. California's two nuclear power plants accounted for about 15 percent of total generation when both were operational. However, Southern California Edison (SCE) recently decided to decommission the San Onofre Nuclear Generating Station.[52] Due to strict emission laws, only a few small coal-fired power plants operate in California.

Due to high electricity demand, California imports more electricity than any other state. States in the Pacific Northwest deliver power to California markets primarily from hydroelectric sources, while states in the Desert Southwest deliver power primarily from coal-fired sources. State law requires combustion power plants to achieve greenhouse gas emission levels that restrict delivery of power from conventional coal-fired power plants, including out-of-state sources, as contracts expire. Hydroelectric power comes to California primarily through the Pacific DC Intertie, which runs from northern Oregon to Southern California.

The Pacific DC Intertie is the largest electricity transmission program in the United States. Although the Pacific Intertie was originally designed to transmit electricity south during California's peak summer demand season, flow is sometimes reversed overnight and has occasionally been reversed during periods of reduced hydroelectric generation in the Northwest.

Electric Energy Suppliers

Investor-Owned Utilities

California's electric system is divided into three parts: generation, transmission, and distribution, with investor-owned utilities (IOU) dominating the state's electricity industry. Investors own the assets of IOUs. The CPUC regulates the IOUs for tariff,

---

52 *Southern California Edison Announces Plans to Retire San Onofre Nuclear Generating Station*, SCE press release, June 7, 2013. http://newsroom.edison.com/releases/southern-california-edison-announces-plans-to-retire-san-onofre-nuclear-generating-station.

reliability, safety, consumer priorities, growth, and emergencies. In California, there are eight IOUs:

- Bear Valley Electric Service
- Mountain Utilities
- NV Energy
- PacifiCorp[53]
- Pacific Gas and Electric (PG&E, largest IOU)
- Southern California Edison (SCE)
- San Diego Gas & Electric (SDG&E)
- Southwestern Electric Power

Together, the IOUs create, transport, and distribute the majority of the state's electricity, with more than two-thirds of the total electricity demand throughout California being provided by PG&E, SCE, SDG&E, and Southern California Gas Company (SoCalGas), collectively.

Publicly Owned Utilities and Load-Serving Entities

Publicly owned utilities (POUs) throughout the state own and operate their utilities, with the majority of these run by municipalities. Load-serving entities (LSEs) are utilities and/or service providers that offer distribution, customer, and energy services for natural gas and electricity customers. There are 39 POUs and 5 LSEs operating in the state. These POUs and LSEs vary greatly from one to another and from the IOUs. While IOUs are investor-owned, POUs are owned by the customers themselves, and the energy rates are controlled by a local governing board versus being regulated by the CPUC, as is the case with IOUs. However, POUs and LSEs are required to comply with a number of regulatory standards issued by the federal government, the state, and the CPUC, just like the IOUs.

Electric Service Providers

Electric service providers (ESPs) are nonutility entities that are not IOUs or POUs. They offer electric service to customers within the service territory of an electric utility. There are 17 ESPs operating in the state. A key requirement of these ESPs is to ensure consumer protection safeguards by setting forth standards for proof of financial viability, as well as proof of technical and operational ability to assure energy reliability. All ESPs must register with the CPUC, which oversees these consumer protection safeguards.

---

53 http://www.pacificorp.com/index.html.

Cooperatives

There are three rural distribution cooperatives, Anza, Plumas-Sierra, and Surprise Valley, plus two electricity aggregation co-ops, California Oil Producers and California Electric Users. They are nonprofit and member-owned and controlled entities that provide wholesale electricity to their local markets. Less than 1 percent of California ratepayers are members of electric co-ops.

The California Independent System Operator

A critical player in the state's electric market supply and marketplace is the California ISO. The three major investor-owned utilities (PG&E, SCE, and SDG&E) and several publicly owned utilities transferred operation of their transmission systems to the California ISO. These utilities continue to operate their own distribution systems but rely on the California ISO to operate the overall transmission network. The California ISO functions as the independent electric transmission operator, balancing authority, and reliability coordinator and works intimately with the state's three major IOUs and works closely with the Western Electric Coordinating Council (WECC, which handles transmission and grid stability for the entire western United States) and the CPUC.

Several publicly owned utilities, including Sacramento Municipal Utility District (SMUD), the Los Angeles Department of Water and Power (LADWP), and the Imperial Irrigation District,[54] still control and operate both their transmission and distribution systems, although the systems are connected to the California ISO-controlled grid. Extensive interconnections to the north and southeast allow imported electricity to flow into California, and they tie California into the Western Interconnection, which includes most western states and British Columbia.

The California ISO must operate the electrical power system in accordance with the North American Electric Reliability Corporation (NERC) standards and regional coordinating council standards. California ISO also provides market pricing structures developed for such services, including day-ahead forecasts, hourly forecasts, and near real-time operations. California ISO possesses near real-time knowledge (generally 4 sec and subcycle, in some cases) of the status of the electric system within its operating area and adjacent operating areas. Such knowledge includes power plant availability and fuel type, as well as predictive models (such as state estimation models) that describe the stability of forecasted and current operations. California ISO has established emergency plans for dealing with conditions where the power system is under stress. Such conditions may exist when there is either an abundance or shortage of power within the immediate control area and may include events ranging from a systemwide reserve shortage to localized voltage problems.

---

54 http://www.iid.com/.

California restricts the use of coal-fired generation within its boundaries. However, the Los Angeles Department of Water and Power (LADWP) operates the coal-fired Intermountain Power Plant in Delta, Utah, which delivers almost all of its output to LADWP and other California municipal utilities. A recent California law forbids utilities from entering into long-term contracts with conventional coal-fired power producers. Intermountain's existing contracts with Southern California cities are set to expire in 2027. The transmission grid is designed to move power reliably within the state and deliver it to consumers. Interconnections to other regions total more than 18,000 MW or roughly one-third of its peak-load requirements. Much of the system was developed in the 1970s and '80s. Figure 11 shows electric transmission lines in California.

Figure 11: California Electric Transmission Lines

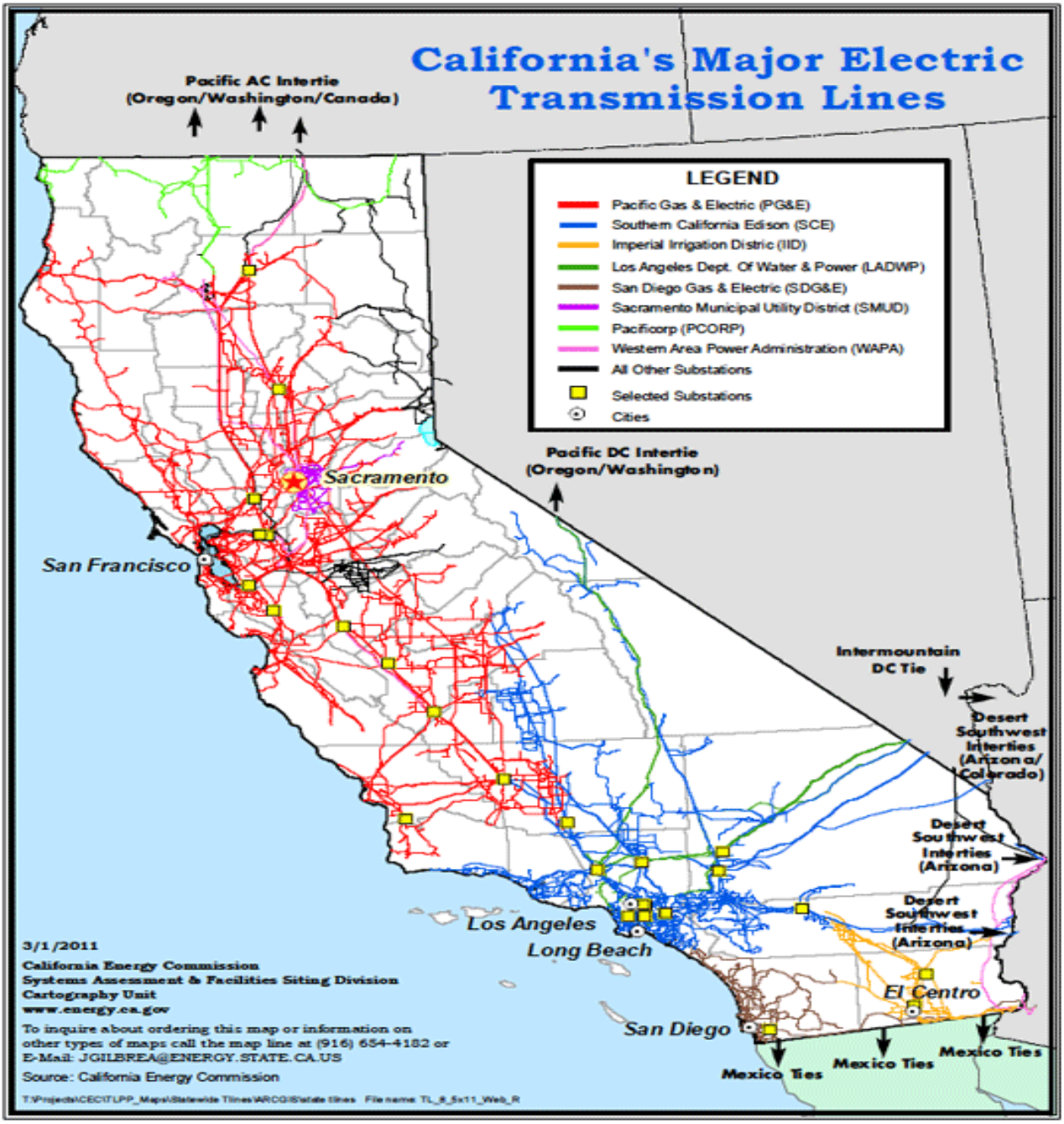


Photo Source: California Energy Commission

Renewable Energy Resources and Other Options

California leads the nation in electricity generation from nonhydroelectric renewable energy sources. Assembly Bill 1890 (Brulte, Chapter 854, Statutes of 1996) and Senate Bill 90 (Sher, Chapter 905, Statutes of 1997) created the Energy Commission's Renewable Energy Program.

In 2006, California passed the landmark AB 32, the California Global Warming Solutions Act, amending its Renewables Portfolio Standard (RPS) to require investor-owned utilities, electric service providers, small and multijurisdictional utilities, and community choice aggregators to provide at least 20 percent of retail sales from renewable sources by the end of 2010 and 33 percent by the end of 2020. In 2009, 11.6 percent of all electricity came from renewable resources such as wind, solar, geothermal, biomass, and small hydroelectric facilities. Large hydro plants generated another 9.2 percent of the state's electricity. As of 2010, the use of renewables for energy generation accounted for 14.6 percent of the California's in-state energy generation, or 30,005 gigawatt hours (GWh). By the end of 2012, renewables accounted for nearly 18 percent of California's electricity.

California has also adopted other policies to promote energy efficiency and renewable energy, including energy standards for public and private buildings (Title 24), power source disclosure requirements for utilities, and net metering. In April 2011, the Governor signed into law Senate Bill X1-2 (Simitian, Chapter 1, Statutes of 2011), which preempted the 33 percent Renewable Electricity Standard (RP) and applies to all electricity retailers in the state, including publicly owned utilities, investor-owned utilities, electricity service providers, and community choice aggregators. All of these entities were required to adopt the new RPS goals of 20 percent of retails sales from renewables by the end of 2013, 25 percent by the end of 2016, and the 33 percent requirement being met by the end of 2020.

In concert with the renewables portfolio objective, California has approved 4 GW of photovoltaic and solar thermal electric capacity to be developed over the next few years in some of its desert regions (subject to environmental and other jurisdictional considerations) and continues to add considerable wind, small hydro, waste gas, geothermal, and biofuels capacities, as well.

Supply-side renewable resources include wind, solar, waste gas, biomass, hydroelectric, and geothermal power. Wind, solar, and biomass have become prominent in recent years. The California RPS further supports the integration, application, and role of these technologies to help address disasters and emergencies. The following table outlines renewable energy alternatives, advantages, disadvantages, and appropriate emergency energy responses.[55]

55 Modified from *NASEO State Energy Assurance Guidelines*, Vol. 3.1, 2009, p. 110.

Table 2: Potential Renewable Areas for Consideration During Energy Emergency Response

SUPPLY SIDE					
RENEWABLE RESOURCES			**SUPPLEMENTAL RESOURCES**		
Wind Energy			**Combined Heat & Power (Cogeneration)**		
Advantages	Disadvantages	Emergency Response	Advantages	Disadvantages	Emergency Response
-Can lower need for building additional conventional electric generation capacity -Can be located to offset more localized loads assisting with grid stability	-In general, wind output is highly variable and averages 25-30% of rated capacity		-Can serve all aspects -Can support "mission critical" facilities during power outage -Black start capability -"Island mode" avail. -Primarily for industrial or institutional use	-May not be coordinated with emergency and assurance agencies and thus, while reducing risk, cannot be readily called upon for assistance	
RENEWABLE RESOURCES			**SUPPLEMENTAL RESOURCES**		
Solar Energy (PV)			**Other Distributed Energy**		
Advantages	Disadvantages	Emergency Response	Advantages	Disadvantages	Emergency Response
-Can mitigate summer peak in some locations -Distributed generation reduces need for transmission lines -Can provide portable back-up generation for critical	-Subject to time-of-day and seasonal sun light variation -In general, PV output is highly variable and averages 20-25% of rated capacity		-Units provide assurance through decentralizatio n of generation capacity -May be able to provide ″black start" capability	-Safety issues for utility restoration teams must be addressed when units are used during restoration	

SUPPLY SIDE					
comm. -PV becoming attractive for "Big Box" commercial roof installation					
RENEWABLE RESOURCES			**SUPPLEMENTAL RESOURCES**		
Biomass-Waste (Landfill Gas) **(Anaerobic Digestion)**			**Natural Gas or Propane** **(Vehicles)**		
Advantages	Disadvantages	Emergency Response	Advantages	Disadvantages	Emergency Response
-Can reduce dependence on conventional fuels -Often located closer to loads so assists grid in balancing	-Not a large presence and production output horizon is uncertain		-Both fuels back up motor gasoline and diesel and thus diversify fuel options -Low fuel cost -Both fuels may be especially beneficial for industrial, commercial, and government operations where centralized fuel capacity is cost effective	-Both require new infrastructure and higher vehicles cost for operators that do not drive significant miles i.e., more than twice the mileage as the average driver.	
RENEWABLE RESOURCES			**SUPPLEMENTAL RESOURCES**		
Biodiesel-Ethanol			**Hybrid Transportation Technology** **Electric Hybrid**		
Advantages	Disadvantages	Emergency Response	Advantages	Disadvantages	Emergency Response
-Can reduce	Higher cost, fuel	OK for use	-Both fuels	-Electric vehicle	Good

SUPPLY SIDE					
dependence on conventional fuels while reducing environmental risk	feedstock assurance	in moderation 10% ethanol blended in gasoline. Up to 20% biodiesel blends may be used.	back up motor gasoline and diesel and thus diversify fuel options	range -Higher vehicle cost	opportunity, some vehicles can serve as a stationary power supply for a residential or construction, or emergency station need.
RENEWABLE RESOURCES			**SUPPLEMENTAL RESOURCES**		
Hydropower			**Fuel Cells** **Hydrogen and Alternate**		
Advantages	Disadvantages	Emergency Response	Advantages	Disadvantages	Emergency Response
-Has extensive track record for reliable alternative power provision -Enhances flood control in certain locations -Provides for considerable power flow control within a season (e.g. peaking summer afternoons)	-Can be subject to seasonal weather impacts affecting snow mass and water flow -Water supply and environmental issues limit expansion		-Can be produced from natural gas, thus reducing dependency on petroleum imports -Can be used to provide peaking and back-up power	-Still significantly more expensive, but improvements being made. -Not a practical vehicle power source	Not likely a reliable emergency response opportunity from a vehicle perspective. OK from a stationary FC
RENEWABLE RESOURCES			**SUPPLEMENTAL RESOURCES**		
Geothermal			**Enhanced Battery Technology**		
Advantages	Disadvantages	Emergency Response	Advantages	Disadvantages	Emergency Response
-Reduces use of conventional	-Issues of long-term		-Has promise of increasing	-Battery technology to	

SUPPLY SIDE					
fossil fuels for both electric generation and space conditioning -Represents diversified generation apart from intermittency of other renewables	maintenance and reliability (corrosion)		dispatchability for both wind- and solar-generated power	enhance large-scale applications suitable for vehicles and large motor operation is still under development (pilots begun) -Limited power supply	

Source: *NASEO State Energy Assurance Guidelines*, Version 3.1, 2009

Although California is expected to have 1.5 million electric vehicles (PEVs) by 2025, the impact of these vehicles on total electricity consumption is not expected to be significant based on electric vehicle projections. From a vulnerability perspective, in 2020 EVs may add 0.03 percent to the total statewide electric load and have an impact on more localized peak effects, especially along distribution feeders that serve neighborhoods with an unusually high percentage of EVs. Although California is proactively providing incentives for its ”nonwire alternatives” (for example, demand response, energy efficiency, distributed generation, and others), California will likely continue to experience steady growth in its total and peak electric requirements for the next 10 years.

Wind

As a result of strong public policy, California was the first state in which large wind energy projects were developed, beginning in the early 1980s. Ninety-five percent of all of California's wind generating capacity and output are located in three primary regions: Altamont Pass (east of San Francisco), Tehachapi (southeast of Bakersfield), and San Gorgonio (near Palm Springs, east of Los Angeles).

Wind energy projects totaling 3,141 MW of capacity were operating in California in 2010, providing enough electricity to power about 829,000 California households. This operating capacity represents a near-doubling of capacity since California's RPS law was adopted in 2002. Wind energy projects comprise most of the development that has occurred under California's renewable energy law as of 2010. In 2010, California wind projects generated 6,172 gigawatt-hours (GWh) of electricity, or 3.0 percent of all power generated within California (more than enough to supply the entire county of San Francisco). In the same year, out-of-state wind projects generated 7,364 GWh of electricity for California, representing 8.6 percent of total power imports. Combined, wind projects supplied 13,536 GWh—4.7 percent of California's total electricity supply, more than enough to serve all load in Alameda, Sacramento, or San Bernardino

Counties. With the expected completion of new transmission facilities, CalWEA expects wind energy to serve 5 percent of California's electricity supply by 2013.[56]

Plans call for the Tehachapi Wind Energy Storage project to evaluate the performance of an 8 MW, 4-hour (32 MWh) lithium-ion battery system to improve grid performance and integration with large-scale, wind-powered electricity generation. Southern California Edison (SCE) will site the system at its Monolith substation on the Antelope-Bailey system. Antelope-Bailey is part of the Tehachapi Wind Resource Area, where up to 4,500 MW of wind resources will come on-line by 2015. The project team will measure performance under 13 specific operational uses: voltage support and grid stabilization, decreased transmission losses, diminished congestion, increased system reliability, deferred transmission investment, optimized size and cost of renewable energy-related transmission, system capacity and resources adequacy, renewable energy integration, wind generation output shifting, frequency regulation, spin/nonspin replacement reserves, ramp rate, and energy price arbitrage. Most of the operations either shift wind and conventional power to meet peak load and other electricity system needs with stored electricity or resolve grid instability and capacity issues that result from the interconnection of wind generation resources.

Solar

California is striving to create 12,000 MW of new solar-generated electricity, moving the state toward a clean energy future through its California Solar Initiative, whereby customers earn cash rebates for every watt of solar energy installed on homes, businesses, farms, schools, and government and nonprofit organizations if they buy electricity from one of California's three major investor-owned utilities. More than 90 schools in California are taking advantage of the California Solar Initiative and installing solar projects.

During 2010, the Energy Commission certified nine solar thermal power plants, accounting for more than 4,100 MW, in addition to an 800 MW wind farm, a 230 MW photovoltaic project, and 1,100 MW of nonthermal capacity on private lands (not state or federal Bureau of Land Management).[57] These projects received ARRA grants, and most qualified for loan guarantees from U.S. DOE.

Many large solar energy projects have been approved in California's deserts on federal Bureau of Land Management (BLM) land. BLM has received right-of-way requests encompassing more than 300,000 acres to develop nearly 34 large solar thermal power plants totaling roughly 24,000 megawatts. Not all of the projects have yet reached the

---

56 California Wind Energy Association. http://www.calwea.org/

57 EIA, 2010, Update Renewables Statistics; http://www.eia.gov/state/state-energy-profiles-print.cfm?sid=California.

stage of an application for certification (AFC) with the California Energy Commission for power plant licensing. Solar thermal projects (above 50 MW) will require approvals from both the BLM and the Energy Commission prior to construction. Therefore, to provide joint National Environmental Protection Act (NEPA) and California Environmental Quality Act (CEQA) review for a more efficient process, the BLM and Energy Commission have entered into a memorandum of understanding (MOU).

Prior to the Renewables Portfolio Standard in 2002, 13 solar thermal power projects were planned in California, with 11 of those filing applications with the Energy Commission. Table 3 below identifies the largest solar projects on-line or approved projects within California.

Table 3: On-Line or Approved Major California Solar Projects.

Project Name	Capacity (MW)	Location (County)	Status
Luz SEGS I (Solar/Nat Gas)	13.8	San Bernardino	Active
Luz SEGS II (Solar/Nat Gas)	30	San Bernardino	Active
Luz SEGS III-VII (Solar/Nat Gas)	150	San Bernardino	Active
Luz SEGS VIII (Solar/Nat Gas)	80	San Bernardino	Active
Luz SEGS IX (Solar/Nat Gas)	80	San Bernardino	Active
Rancho Seco PV (Solar)	3.9	Sacramento	Active
Victorville (513 MW natural gas) (50 MW Solar Trough)	563	San Bernardino	Approved 7/16/08
Beacon Solar Energy (Solar Trough)	250	Kern	Approved 6/25/10
Abengoa Mohave (Solar Trough)	250	San Bernardino	Approved 9/28/10
Solar Millennium Blythe (Solar Trough)	1,000	Riverside	Approved 9/15/10
Ivanpah Solar (Solar Tower)	370	San Bernardino	Approved 9/22/10
Imperial Valley Solar Project (Stirling Engine)	700	Imperial	Approved 9/29/10
Genesis Solar (Solar Trough)	250	Riverside	Approved 9/29/10
Calico Solar (Stirling Engine)	663.5	San Bernardino	Approved 10/28/10
Solar Millennium Palen (Solar Trough)	500	Riverside	Approved 12/15/10
Rice Solar Energy Project (Solar Trough)	150	Riverside	Approved 12/15/10

Project Name	Capacity (MW)	Location (County)	Status
City of Palmdale Hybrid Solar (520 MW Nat Gas) (50 MW Solar Trough)	570	San Bernardino	Approved 08/10/11

Source: California Energy Commission http://www.energy.ca.gov/siting/solar/index.html

In addition to these on-line or approved solar projects, there are three major solar projects under review for an additional 1,500 MW of capacity with applications for certifications on file. The application for certification is the license application filed with the Energy Commission for thermal power plants 50 MW or larger.

Nuclear

Assembly Bill 1632 (Blakeslee, Chapter 722, Statutes of 2006) directed the Energy Commission to assess the vulnerability of the state's operating nuclear power plants to a major disruption due to a major earthquake or plant aging, the potential impacts of such a disruption, potential impacts from the accumulation of nuclear waste at the state's existing nuclear plants, and other key policy and planning issues regarding the future role of California's existing nuclear plants.

As of mid-2012, California had one operating nuclear power plant: the Diablo Canyon Power Plant (2,160 MW), near San Luis Obispo. The San Onofre Nuclear Generating Station, about midway between Los Angeles and San Diego, went offline in January 2012 and was ordered by the Nuclear Regulatory Commission to stay offline while tubing wear issues were investigated. Nuclear units at both plants use ocean water for cooling.

Pacific Gas and Electric Company (PG&E) owns the Diablo Canyon Nuclear Power Plant, which consists of two units. Unit 1 is a 1,073 MW pressurized-water reactor power plant (PWR) that began commercial operation in May 1985, while Unit 2 is a 1,087 MW PWR that began commercial operation in March 1986. Diablo Canyon's operation license expires in 2024, and PG&E must apply to the Nuclear Regulatory Commission for a 20-year license extension.

Southern California Edison Co. and San Diego Gas & Electric own the two operating units at the San Onofre Nuclear Generating Station. Unit 2 is a 1,070 MW PWR that began commercial operation in August 1983, while Unit 3 is a 1,080 MW PWR that began commercial operation in April 1984. SCE announced on June 7, 2013, that it decided to decommission the nuclear reactors and not seek a licensing extension.

Biomass

California is also a leader in biomass electricity. Biomass electricity is drawn from combusting or decomposing organic matter. There are about 132 biomass energy plants in California, with a total capacity of almost 1,000 MW. These plants power California homes and businesses with electricity from agricultural, forest, and urban waste residue

that would have been released into the atmosphere, added fuel to forest fires, and burdened state landfills.

In 2007, 6,236 GWh of electricity in homes and businesses was produced from biomass such as burning forestry, agricultural, and urban biomass; converting methane-rich landfill gas to energy (LFGTE); and processing wastewater and dairy biogas into useful energy. Biomass power plants produced 2.1 percent of the total electricity in California in 2007, or about one-fifth of all the renewable energy.

Using biomass to produce electricity reduces the state's reliance on fossil fuels, the nation's primary energy sources for electricity, and the largest contributors to air pollution and greenhouse gases. Biomass electricity offers alternatives with many benefits:

- Californians create nearly than 2,900 pounds of household garbage and industrial waste each second.[58]
- Electricity produced by biomass reduces the threat of global climate change.
- Using biomass waste eliminates the need to place it in landfills.
- Clearing biomass from wooded areas helps prevent forest fires.
- Using by-product methane gases to produce electricity eliminates odor and reduces air pollution in surrounding areas.

Geothermal

California is the top producer of geothermal energy in the nation with more than 2,500 MW of capacity. A facility known as "The Geysers," located in the Mayacamas Mountains north of San Francisco, is the largest complex of geothermal power plants in the world, with more than 700 MW of installed capacity. The Geysers was first tapped as a geothermal resource to generate electricity in 1960. It is one of only two locations in the world where a high-temperature, dry steam is found that can be directly used to turn turbines and generate electricity (the other being Larderello, Italy). Other major geothermal locations in the state include the Imperial Valley area east of San Diego and the Coso Hot Springs area near Bakersfield. When added together, California's geothermal power plants produce about 4.5 percent of the California's total electricity. It is estimated that the state has a potential of more than 4,000 MW of additional power from geothermal energy, using current technologies.

Forty-six of California's 58 counties have lower-temperature resources for direct-use geothermal. In fact, the City of San Bernardino developed the largest geothermal direct-use projects in North America, heating 37 buildings—including a 15-story high-rise and

58 California Department of Resources Recycling and Recovery

government facilities—with fluids distributed through 15 miles of pipelines. Environmentally benign fluids are discharged to surface water channels after heat is used.

In February 2012, the Energy Commission initiated an order for a rulemaking to expedite streamlining of the application procedure for geothermal energy grants and loans authorized by the Public Resources Code, Sections 3820 et seq. The rulemaking is also to clarify Public Resources Code Section 3822(g) requirements for grants and loans to private entities, as well as update and make other nonsubstantive changes to simplify and clarify the regulations. The full intent is to rapidly expand this source of renewable energy.

The regulations will be developed with public input per procedures in the Administrative Procedure Act (Gov. Code, § 11346 et seq.), the Warren Alquist Act, and Commission rulemaking regulations.

Smart Grid

The smart grid is a network that delivers electricity from supplier to consumer. The process starts with power station generation and begins the process of electricity moving along power lines and power transformers into a transmission substation. From there it channels through a distribution substation, where it is carried to commercial and industrial, business and residential consumers.[59] A transformation toward smart grid is also beginning to occur in the natural gas natural gas system (especially after the recent San Bruno, California, natural gas pipeline disaster), which over time will replicate many of the information and recovery functions present in the electric system.

The potential to maximize existing energy infrastructure and supplies is the basic foundation of the smart grid (SG). The electric SG holds considerable promise in almost all aspects of California statewide emergency planning and disaster recovery. As these systems are implemented over the next 5-10 years, they will be able to contribute to all stages of emergency response, from readiness and monitoring, to immediate and long-term response, and finally to recovery and even after-action reporting.

Working with industry, government, and consumer stakeholders, the National Institute of Standards and Technology (NIST) is expediting the development of standards critical to achieving a reliable and interoperable smart grid (NIST, 2010). The interoperability of the smart grid is extremely important to its performance, given that it enables both integration and two-way communication among the many interconnected elements of the electric power grid. The accelerated development of smart grid technology is one of the primary objectives of the American Recovery and Reinvestment Act (ARRA), of which California has been the recipient. One of primary purposes of ARRA funding is,

---

59 *Smart Grid 101 for Local Governments*, Public Technology Institute, 2011.

in part, to "facilitate recovery from disruptions to the energy supply and enhance reliability and quicker repair of outages.[60] California has already made major investments in smart grid with its smart meter rollout programs and transmission and distribution system upgrades.

As defined by the Energy Independence and Security Act of 2007,[61] the smart grid is:

"A modernization of the electricity infrastructure to maintain a reliable and secure system that can meet future growth. It is important to note that the Smart Grid vision is characterized by a two-way flow of electricity and information that creates an automated, widely distributed electricity network. It will monitor, protect and automatically optimize the operation of its interconnected elements – from both central and distributed generators, through the high-voltage transmission network and the distribution system, to industrial users and commercial building automation systems; to energy storage installations; and to residential consumers with their thermostats, electric vehicles, appliances, and other household devices."

According to Section 1301 of Title XIII, the smart grid contains:

- Digital information and controls.
- Integration of advanced technologies into the electric grid to enable all electric resources and demand response to contribute to an efficient, reliable electricity network and respond to and recover from system security threats.
- Distributed resources and distributed generation, including renewable generation, renewable energy.
- Demand response and energy efficiency.
- Smart technologies for metering, grid communications, and distribution automation.
- Smart appliances and consumer devices.
- Advanced storage and peak-shaving technologies, including plug-in electric hybrid vehicles (PHEVs), thermal storage air conditioning, and hybrid thermal air conditioning.
- Information and control options to consumers.
- Standards for communication and interoperability.
- Identification and lowering of barriers.

---

60 *Smart Grid & Cyber-Security for Energy Assurance*, 2010, p. 2.

61 Energy Independence and Security Act 2007.

A primary objective of the smart grid is to move toward demand-side management (DSM), that is, the assurance of an adequate electric supply to meet demand. The smart grid enables utilities to identify energy use in real time and increase or decrease the available supply as the demand requires, rather than simply building more generation facilities, which may result in lost power due to nonuse or oversupply. A representation of the smart grid is found in Figure 12 below.

The communication capability of the smart grid will allow for integration of an increased number of renewable energy sources with varying output rates, to help balance the demand and supply of electricity. This necessitates the need for increased cybersecurity measures. The smart grid depends highly on computer-based control systems, which are increasingly connected to open networks, such as the Internet. This exposes the systems to cyber risks. Cybersecurity is all about keeping data safe from those who wish to access them. This includes generation, transmission, and distribution data, as well as sensitive and confidential consumer data inherent in smart meters.

In December 2010, the California ISO developed a *Smart Grid Roadmap and Architecture* strategy through 2020 from a technology perspective that includes advanced transmission efficiencies, as well as the anticipated progress of measurement devices and automation.[62]

The smart grid can be a critical component of an energy-resilient infrastructure, if properly designed and implemented, to help ensure electricity supply will continue to be highly reliable and will become increasingly more resilient.

Smart grid characteristics that ensure these factors include the ability to:

- Anticipate and respond to system disturbances.
- Operate with resiliency to attack and natural disaster.
- Accommodate all generation and storage options including renewables.
- Optimize asset use and operate efficiently.
- Address cybersecurity goals for availability, integrity, confidentiality, reliability and accountability.

62 http://www.caiso.com/green/greensmartgrid.html.

Figure 12: Smart Grid Infrastructure

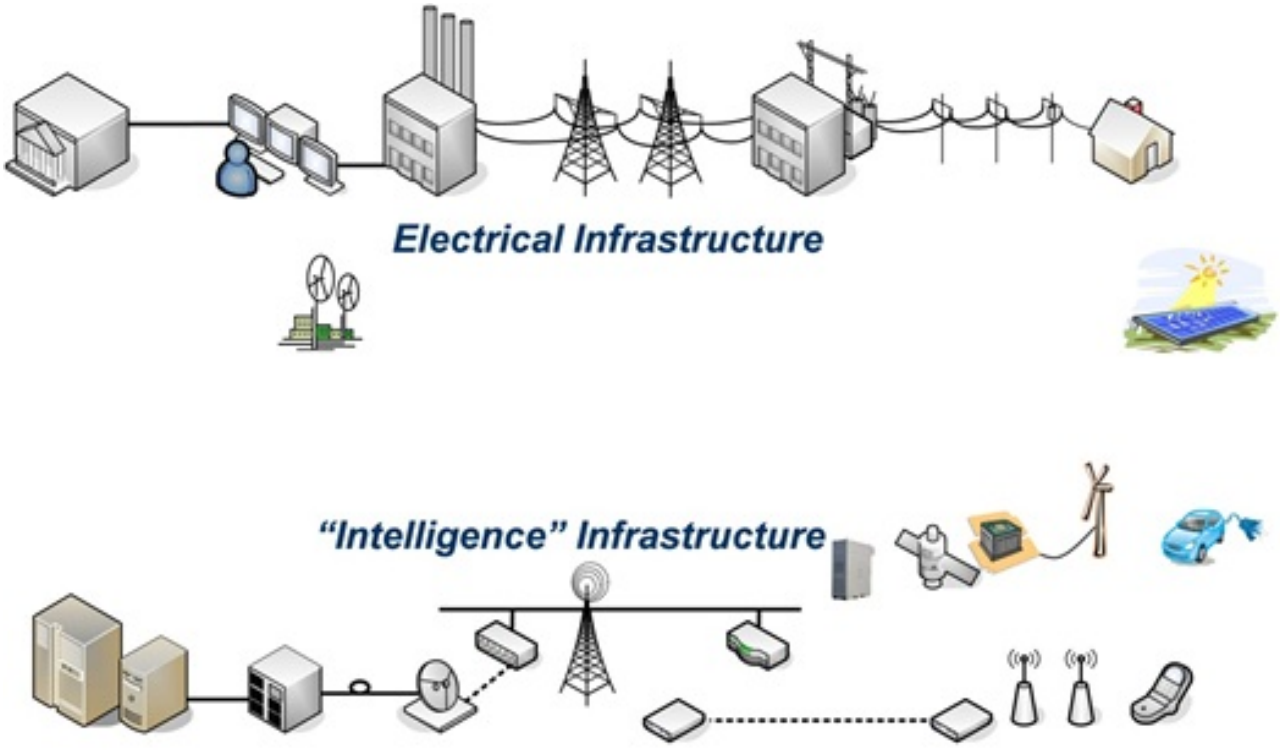


Photo Source: California Energy Commission.

Understanding the need to have congruency in the buildout of the state smart grid, the CPUC, in March 2012, approved rule 08-12-009, Order Instituting Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission's own Motion to Actively Guide Policy in California's Development of a Smart Grid System. The order adopted 19 metrics to measure the smart grid deployments of PG&E, SCE, and SDG&E, including metrics for customers, the environment, and cybersecurity.

The following smart grid projects are a sample of those underway within the state:

SDG&E. SDG&E's Grid Communication System project includes the installation of a fully integrated wireless communication system covering up to 90 percent of the utility's customers. The project aims to enhance reliability and reduce outage durations and operations and maintenance costs.

Sacramento Municipal Utility District's (SMUD). SMUD's Smart Sacramento project involves systemwide deployment of an advanced metering system integrated with existing enterprise and information technology systems, as well as a partial deployment

of advanced distribution grid assets that equip SMUD's distribution circuits with automated control and operation capabilities.

City of Anaheim. The City of Anaheim's smart grid project involves a citywide deployment of advanced metering infrastructure (AMI)[63] and an expansion of distribution automation capabilities to allow Anaheim to manage, measure, and verify targeted demand reductions during peak periods.

Burbank Water and Power. Burbank Water and Power's smart grid project implements two-way communications and metering to enable customers to view their energy consumption at their convenience through systems such as Web portals. The project includes controls for distributed energy resources to manage peak electric demand and integrate renewable resources into grid operations.

63 *Advanced metering infrastructure* (AMI) is an integrated system of smart meters, communications networks, and data management systems that enables two-way communication between utilities and customers.

CHAPTER 5:
Natural Gas Resources

Introduction

The natural gas grid encompasses transmission, distribution, and storage, as well as compressor stations, interconnects, pressure regulators, flow-control valves, redundant delivery mechanisms, and automatic and manual shutoff capabilities, all of which represent potential vulnerabilities in either a natural disaster or terrorist situation.

Natural gas provides almost one-third of the state's total energy requirements and will continue to be a major fuel in California's supply portfolio. California's supplies of natural gas come from four areas: in-state production, Southwestern United States, Canada, and the Rocky Mountain region.

California natural gas production typically accounts for less than 5 percent of California's demand. Production takes place in basins located in Northern and Southern California, as well as offshore in the Pacific Ocean. As with crude oil production, California natural gas production is declining. However, state supply has remained relatively stable due to increases in net receipts from pipelines that supply California.

As a state, California is the second largest natural gas consumer in the United States, representing more than 10 percent of national natural gas consumption.[64]

The state's natural gas transmission system is composed of more than 12,000 miles of lines that bring gas into the state, as well as distributes it throughout California. The largest use of natural gas is electricity generation, using about half of all natural gas in the state. The residential sector uses 22 percent of the natural gas. Of that amount, 88 percent is used by space and water heating.

Current Natural Gas Resource Availability

Natural Gas Suppliers

There are several natural gas distribution utilities in the state, with the four largest serving California under CPUC jurisdiction:

- Pacific Gas and Electric Company (PG&E)
- Southern California Gas Company (SoCalGas)
- San Diego Gas & Electric (SDG&E)
- Southwest Gas (SWG)

---

64 *2011 California Energy Commission Integrated Energy Policy Report*, Publication Number: CEC–100–2011–001-CMF.

The regulated California utilities deliver natural gas to more than 10.5 million customers. Since the early 1990s, the CPUC has offered all customers of these major CPUC-regulated natural gas utilities the option to procure their supply of natural gas from a nonutility gas supplier. California's existing gas supply portfolio is regionally diverse and includes supplies from in-state (onshore and offshore) and out-of-state sources.

Demand for natural gas within the state is expected to grow 0.07 percent per year through 2030. This forecast is due to moderate growth in residential, core commercial, and electric generation markets, with demand lessening in the noncore commercial and industrial markets.[65] The state's ongoing energy efficiency programs will continue to influence the downward trend in natural gas use within all markets.

California markets are served by two key natural gas trading centers, the Golden Gate Center in Northern California and the California Energy Hub in Southern California, and the state has a dozen natural gas storage facilities that help stabilize supply. In part to help meet California's demand for natural gas, an offshore LNG import terminal in Southern California has been proposed to the Maritime Administration and the U.S. Coast Guard. If approved, this terminal could import up to 1.4 billion cubic feet of natural gas per day. Two additional potential Southern Californian LNG import facility sites have been identified by project sponsors.

California has more than 1,600 producing natural gas wells (comprises 0.3 percent of U.S. wells), has roughly 2,800 billion cubic feet (Bcf) of natural gas reserves (comprises 1 percent of supply in the United States), and has the ability to store about 387 Bcf underground in depleted reservoirs. However, additional sources of natural gas have recently been found during exploration in the Kern County area using new, advanced technologies. In the event these new reserves can be tapped into at relatively low cost and without long-term permitting and environmental factors, these natural gas sources could significantly curtail the use of LNG.

The state's natural gas transmission system is composed of more than 12,000 miles of lines that bring gas into the state (87 percent of natural gas is imported), as well as distributes it throughout California (Energy Commission *2009 IEPR*). The newest supply of natural gas comes from the Ruby pipeline. The Ruby pipeline consists of a 675.2-mile-long, 42-inch-diameter mainline commencing in Wyoming, extending westward through Utah and Nevada and terminating at the Malin Hub in Oregon. A 2.6-mile-long, 42-inch-diameter lateral pipeline extending from the Malin Hub to an interconnection with PG&E's system at the Oregon/California border feeds this gas into California.

---

65. *2010 California Gas Report*: http://www.pge.com/pipeline/library/regulatory/cgr_index.shtml

Current in-state production and interstate pipelines provide a total capacity of about 10,230 MMcf/day (MMCF=1million cubic feet); however, the state can reliably count on only 8,300 MMcf/day due to possible upstream demand from pipelines before they reach California. Figure 13 identifies the locations from where natural gas pipelines originate and where they enter California

Figure 13: Natural Gas Resource Area and Pipelines

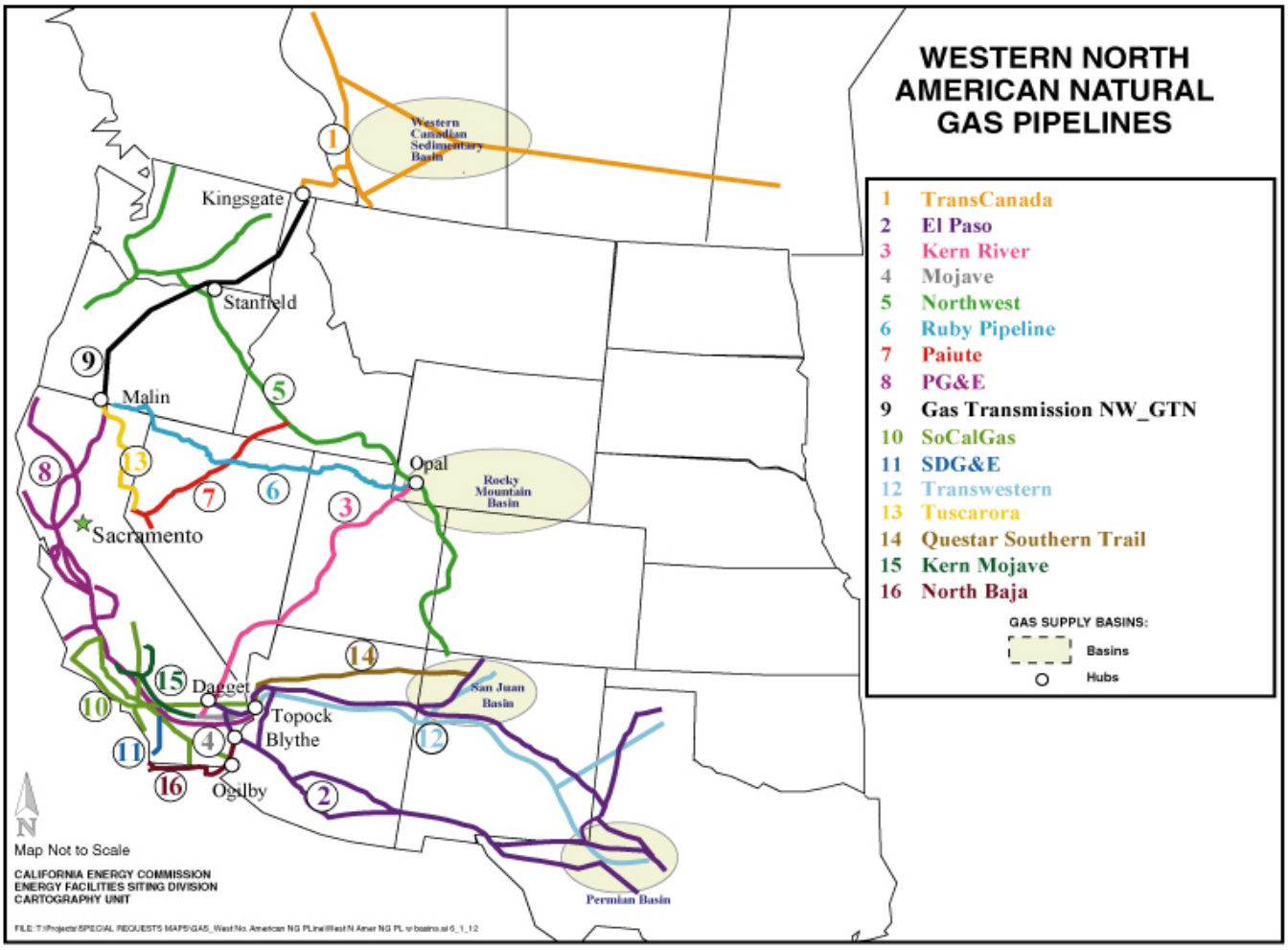


Photo Source: California Energy Commission

Most of the natural gas transported via the interstate pipelines, as well as some of the California-produced natural gas, is delivered into the PG&E and SoCalGas intrastate natural gas transmission pipeline systems (commonly referred to as California's "backbone" natural gas pipeline system). Natural gas on the utilities' backbone pipeline systems is then delivered into the local transmission and distribution pipeline systems, or to natural gas storage fields. Some large noncore customers take natural gas directly off the high-pressure backbone pipeline systems, while core customers and other

noncore customers take natural gas off utilities' distribution pipeline systems. The CPUC has regulatory jurisdiction over 100,000 miles of utility-owned natural gas pipelines.

An interstate natural gas pipeline is a long-distance, large-diameter, open-access pipeline system that transports natural gas supplies from supply sources located in one state to local markets usually located in another state. Generally, the system delivers natural gas to LDCs who, in turn, sell or distribute the natural gas to end users. It also delivers supplies directly to large-volume end users, such as industrial and electric power generation facilities, bypassing LDCs. Interstate natural gas pipelines are subject to the jurisdiction of the Federal Energy Regulatory Commission (FERC).

Natural gas is delivered to end users by several types of business organizations. These local distribution companies (LDC) are organized with the objective of selling and/or transporting natural gas to specific customer groups known as investor-owned, municipal, privately owned, or cooperatives.

Investor-Owned: An LDC whose stock is publicly traded and is generally granted exclusive territorial contracts covering large areas within a state. The CPUC has jurisdiction over all operational aspects of an investor-owned LDC. The CPUC also approves service rates and reviews the quality of service.

Privately Owned: An LDC that is owned by private investors and whose stock is not publicly traded. Like an investor-owned LDC, it is subject to CPUC regulations and ratesetting guidelines.

Municipal: An LDC that is owned and operated by a municipal government. Most municipal LDCs were organized in areas located along the long-distance routes of the large interstate natural gas pipelines that were built during the first half of the 20th century but where the potential rates of returns on investment were not attractive enough for investor-owned or privately owned utilities to build a distribution network. Many municipalities operate their own natural gas distribution system contract with investor- or privately owned utilities, granting an exclusive territorial contract (monopoly franchise arrangement) to the utility while retaining authority over rates, operations, and the type and quality of services provided within its jurisdiction.

Cooperative: An LDC that operates on a cooperative nonprofit basis for the mutual benefit of its members. No interest or dividends are paid out of earnings, although the company is obligated to pay, by credits to a capital account for each member, any excess revenues received beyond annual operating costs and expenses. Anyone, or any firm, may become a member by paying a fee, agreeing to purchase its natural gas needs from the cooperative, and being approved for membership by the board of directors. In addition to the above LDC categories, intrastate and interstate pipeline companies deliver natural gas supplies directly to end users, primarily large-volume users.

The two largest non-LDC natural gas deliverers to end users are intrastate natural gas pipelines and interstate natural gas pipelines. These pipelines may provide open-access

transportation services or purchase natural gas from producers and suppliers for reselling to large-volume customers, such as local natural gas distribution companies, electric utility companies, and industrial customers. They are subject to the CPUC's jurisdiction.

Three gas companies supply natural gas to more than 98 percent of California's customers: PG&E, SoCal Gas, and SDG&E. California's major natural gas pipelines are owned by Kern River Gas Transmission, Mojave Pipeline, Questar Pipeline, Southwest Gas, and Tuscarora Pipeline. The vast majority of California's natural gas customers are residential and small commercial customers, who accounted for roughly 40 percent of the natural gas delivered by California utilities in 2008. Large consumers, like electric generators and industrial customers, referred to as "noncore" customers, accounted for about 60 percent of the natural gas delivered by California utilities in 2008.

The CPUC regulates natural gas utility service for nearly 10.7 million customers that receive natural gas from PG&E, SoCalGas, SDG&E, Southwest Gas, and several smaller natural gas utilities. The CPUC also regulates independent storage operators Lodi Gas Storage and Wild Goose Storage. The CPUC regulates utilities' natural gas rates and natural gas services, including in-state transportation over utilities' transmission and distribution pipeline systems, storage, procurement, metering, and billing.

Other Sources

The integrated SDG&E and SoCalGas natural gas transmission system has the capability to take 3,875 million cubic feet per day (MMcf/d) of supplies on a firm basis from various intrastate and interstate receipt points and deliver those supplies to storage fields and/or end users. This capability of 3,875 MMcf/d is 40 percent greater than the combined SoCalGas/SDG&E average demand during 2008, which was 2,766 MMcf/d. SoCalGas estimates that Southern California demand in 2015 will be about 2624 MMcf/d under average temperature conditions. The total physical capacity of interstate pipelines and California suppliers that interconnect with SDG&E and SoCalGas is 7,275 MMcf/d, based on the FERC Certificated Capacity or SoCalGas estimated physical capacity of upstream pipelines as noted in Table 4.

Table 4: Interstate and Intrastate Pipeline and California Production Capability to SoCalGas/SDG&E

Pipeline and Receipt Point	Upstream Capacity
El Paso@ Blythe	1,410
El Paso@ Topock	540
Transwestern@Needles	1,150
PG&E@Kern River Station	650*
Southern Trails@ Needles	80
Mojave@Hector Road	200
Kern/Mojave@ Wheeler Ridge	885
Kern/Mojave@ Kramer	500
Occidental@Wheeler	150
TGN@Otay Mesa	400
California	310
North Baja@ Blythe	1,200
Total	**7,275**

Table Source: CPUC

More upstream physical capacity is connected to the Southern California gas transmission system than can be fully used to deliver supplies. To provide greater assurance that supplies can be delivered at Southern California transmission receipt points, the CPUC adopted a system of "firm access rights" for Southern California. The firm access rights system was implemented in October 2008. Under the firm access rights framework, end users or marketers can obtain firm receipt point rights within various transmission zones in Southern California. The capacities set forth in Table 5 indicate the physical receipt capacity of receipt points in Southern California and the firm receipt point capacity amounts for certain "zones." The transmission zone capacity indicates the volume of natural gas deliveries that can be received on a firm basis from all receipt points in that zone. Firm receipt point rights assure the holders of firm rights in a particular zone that their supplies can be delivered through that zone, and their supplies will not be prorationed where there is a mismatch with upstream capacity.

Table 5: Current Available Southern California Firm Receipt Point Capacity and Zones

Receipt Point Name	**Physical Capacity at Receipt Point** (MMcf/d)	**Transmission Zone Firm Capacity** (MMcf/d)
Transwestern@North Needles[66]	800	Northern
Questar @ North Needles	120	Northern
El Paso @ Topock[67]	540	Northern
TW @ Topock	190	Northern
Kern River @ Kramer	500	Northern
Northern Zone Subtotal	*{2,150}*	
Northern Zone Firm Capacity		**1,590**
TGN Otay Mesa	400	Southern
North Baja – Blythe	1,200	Southern
El Paso @ Blythe	1,210	Southern
Southern Subtotal	*{2,810}*	
Southern Zone Firm Capacity		**1,210**
Coastal System (Producers)	150	California
L85 System (Producers)	160	California
California Subtotal	*{310}*	
California Firm Capacity[68]		**310**
Kern/Mojave @ Wheeler	765	Wheeler
PG&E @ Kern River Station[69]	520	Wheeler
Oxy@Gosford	150	Wheeler
Wheeler Ridge Zone Subtotal	*{1,435}*	
Wheeler Zone Firm Capacity		**765**
Total Receipt Points	6,705	
Total Firm Receipt Point Capacity		**3,875**

Table Source: CPUC.

SoCalGas' storage fields allow it to meet much greater peak natural gas demand in Southern California than could be met with just its major transmission system. SoCalGas owns and operates four natural gas storage fields: Aliso Canyon, Honor Rancho,

66 Transwestern and Southern Trails at N. Needles cannot exceed 800 MMcf/d.

67 El Paso and TW at Topock cannot exceed 540 MMcf/d.

68 Excludes 20 MMcf/d of "other" producers who deliver directly into distribution, not backbone, system.

69 PG&E and Occidental Supplies cannot exceed 520 MMcf/d in total.

La Goleta, and Playa del Rey. (A fifth field, Montebello, is being decommissioned, and the gas is being withdrawn from that field.) SoCalGas is the only storage provider in Southern California, while Lodi Gas and PG&E, through its Gill Ranch, LLC partnership, operate in Northern California. Furthermore, there are ongoing environmental impact reports to address other requests for storage capacity statewide, with CPUC direct involvement.

The northern backbone facilities of PG&E interconnect with the Gas Transmission Northwest (GTN) interstate pipeline near Malin, Oregon. These facilities receive Canadian natural gas and small amounts of Rocky Mountain gas from GTN. The GTN pipeline capacity at Malin is about 2,190 MMcf/d. The northern system also has another pipeline, the Ruby pipeline, that delivers on average 1.0 bcf/d into Malin, and that amount and the GTN levels are transported to PG&E's load centers.

The receipt capacity of the PG&E southern system, also known as the Baja Path or line 300, is 1,060 MMcf/d. The southern backbone facilities interconnect with El Paso Natural Gas Company and Transwestern Pipeline Company interstate pipelines near Topock, Arizona; with Southern Trails Pipeline Company at Essex, California; with Kern River Pipeline Company at Daggett, California; and with the Kern River High Desert Lateral near Kramer Junction, California. These interstate pipelines deliver gas from U.S. Southwest and Rockies gas production basins to PG&E's southern backbone system, which delivers the gas in turn to PG&E's load centers. The El Paso, Transwestern, and Southern Trails pipelines connect to the San Juan Basin in northern New Mexico and the Permian Basin in west Texas. The Kern River Pipeline connects to the Rocky Mountain producing region in southern Wyoming. The above interstate pipelines have a combined capacity to PG&E's southern system in excess of 2,000 MMcf/d, but PG&E can receive only as much supply as the Baja Path capacity.

Similar to the situation in Southern California, PG&E's storage facilities and those of the independent storage operators in Northern California allow PG&E to meet much higher peak demand than could met with just its transmission system. PG&E owns and operates three underground storage fields: McDonald Island, Los Medanos, and Pleasant Creek. The McDonald Island field, located near Stockton (San Joaquin County), is the largest of PG&E's storage fields. It has a maximum working gas capacity of about 82 Bcf. The Los Medanos field is located near Concord (Contra Costa County) and has about 16 Bcf of working gas capacity. The Pleasant Creek field is located near Winters (Yolo County) and has about 2 Bcf of working gas capacity.

The "firm working inventory" of PG&E's storage fields is substantially lower than the maximum working gas capacity of the fields. Cushion gas, which consists of both "native gas" (that is, natural gas already in the field) and injected gas, creates drive pressure within the underground reservoir and protects the reservoir from damage (for example, damage caused by migrating groundwater). Cushion gas cannot be withdrawn during normal operations. Working gas is the portion of the field that could,

theoretically, given enough injection and withdrawal capacity, be cycled (withdrawn and then reinjected) without damaging the integrity of the underground reservoir.

Working gas is made up of two components: firm inventory and what PG&E refers to as "PG&E Working Gas – Storage." *Firm inventory capacity* is the volume of the capacity of the storage fields for which PG&E has sufficient firm injection and withdrawal capacities to cycle customer-owned gas as specified in PG&E's tariffs. "PG&E Working Gas – Storage" represents gas purchased by PG&E to support the necessary minimum field pressure needed to meet firm withdrawal commitments. Unlike cushion gas, this gas is not needed to preserve the integrity of the fields and can be cycled under certain conditions.

Figure 14: PG&E Natural Gas Pipeline Network

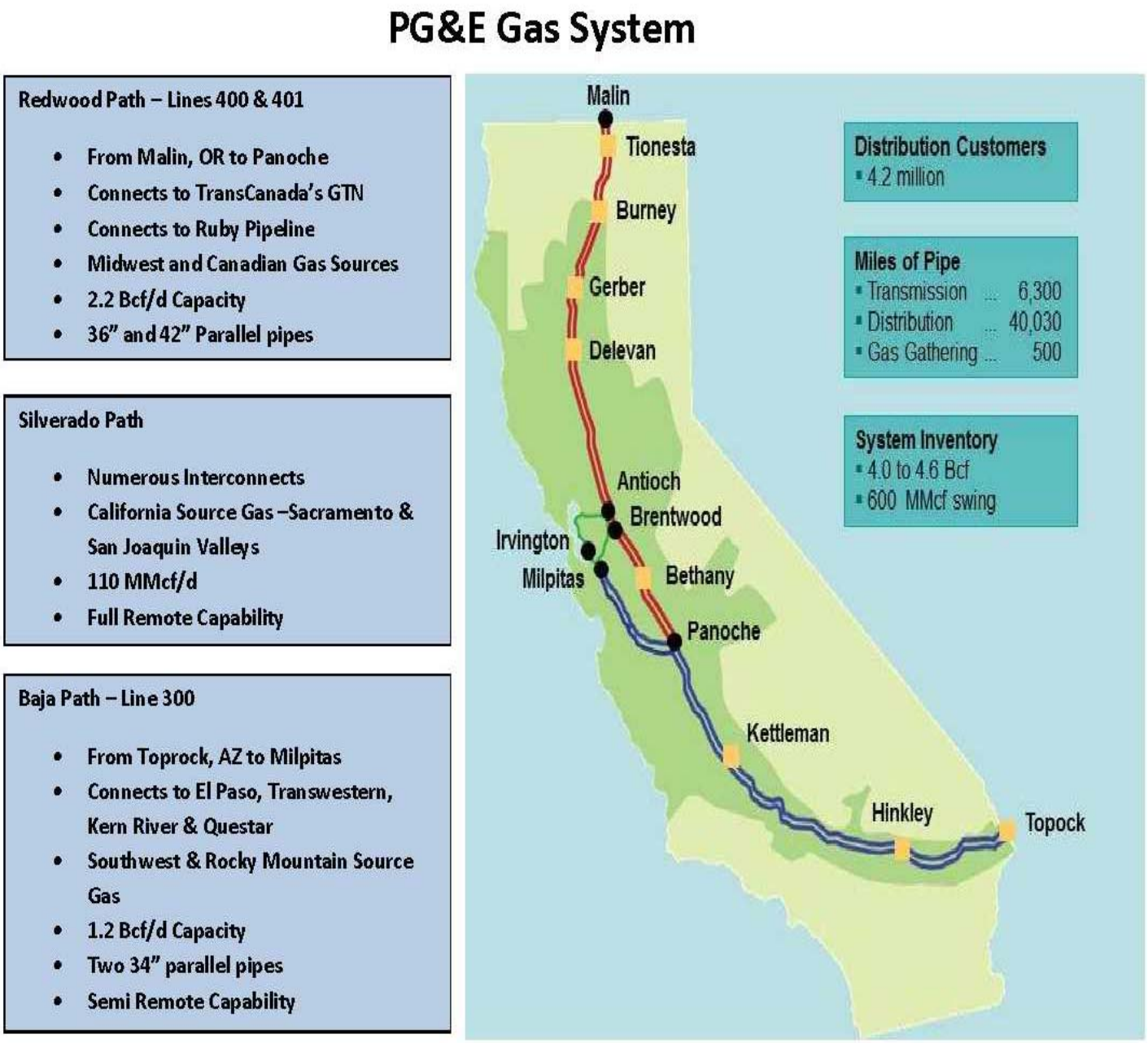


Photo Source: PG&E.

Figure 15: PG&E Storage System

Photo Source: PG&E.

Under any scenario, natural gas will and should play an important role in providing for much of California's future electrical and thermal requirements. These will be especially important in guiding future market-based rate structures that align with California's forecasted needs for 20 years as highlighted in the *Integrated Energy Policy Report (IEPR)* The *IEPR* clearly states this intended policy: "Looking forward, California must actively

encourage infrastructure enhancements such as additional pipeline capacity, incentives for increased operations and use on in-state storage, in-state productive capacity, and nontraditional supply sources such as liquefied natural gas."

Figure 16 below identifies the pipeline and storage complexity of the state.

Figure 16: Statewide Gas Pipeline and Storage Facilities

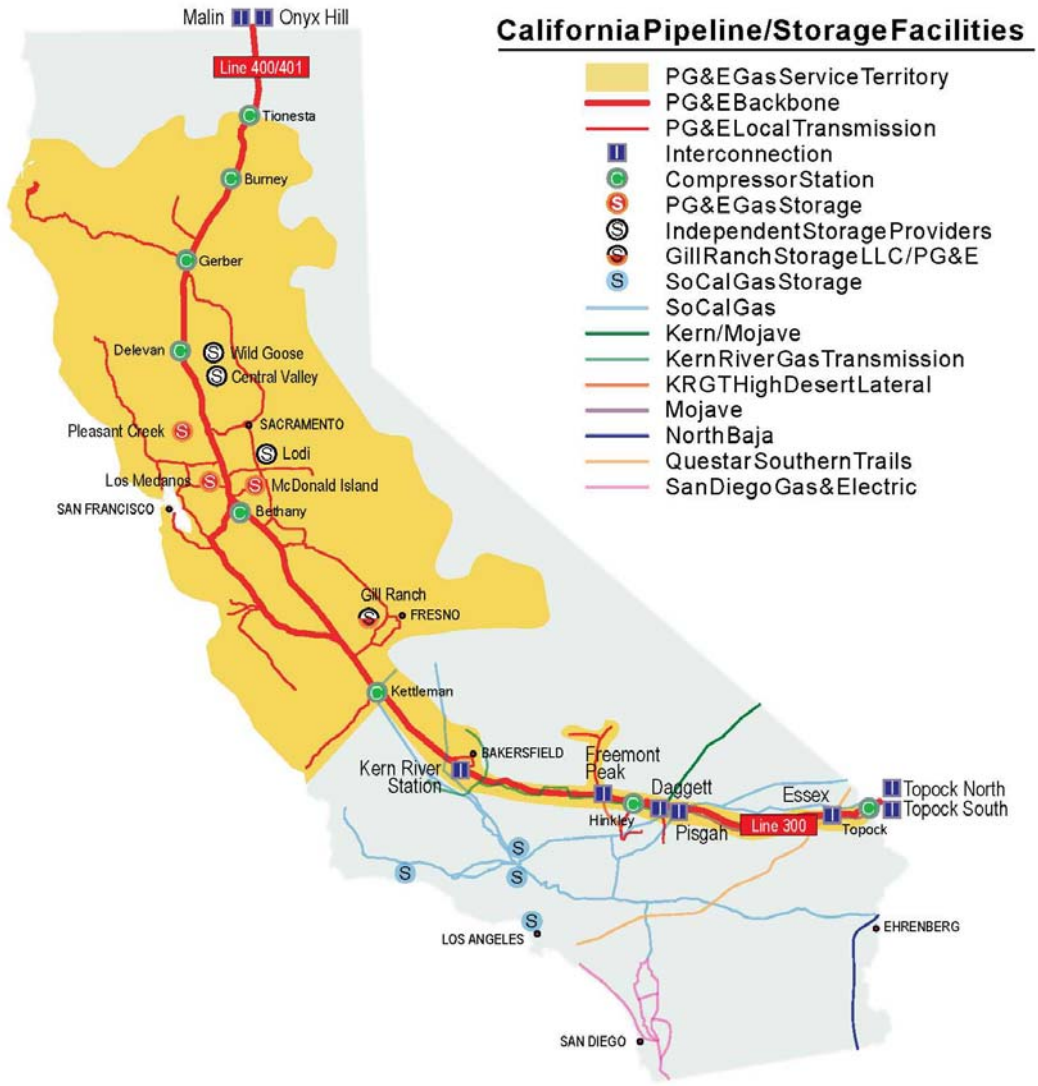


Photo Source: CPUC

CHAPTER 6:
Petroleum and Transportation Fuels Resources

Introduction

California is one of the top producers of crude oil in the nation, with output accounting for more than one-tenth of total U.S. production. Drilling operations are concentrated primarily in Kern County and the Los Angeles basin. Although substantial production also takes place offshore in both California and federal juridictions, there is a permanent moratorium on offshore oil and gas leasing in California waters. Development on existing state leases is not affected.

California's 22 refineries processed more than 1.7 million barrels per day of crude oil in 2010. Most of this crude oil is imported by marine vessel, historically from Alaska and a variety of foreign sources, leaving 38 percent produced from within the state.

California has three subsectors within the petroleum industry:

- The production sector includes infrastructure relating to the exploration for and development and movement (maritime via tanker ships, overland via road or rail, or via pipeline) of crude oil from state and foreign facilities, including ports.
- The refining and storage sector includes marine terminals, refinery operations, pipeline shipments, storage of refined petroleum products and blending components at distribution terminals, and wholesale transfers of petroleum products.
- Retail marketing includes delivery, storage, and marketing of finished products to the consumer (retail fuel stations).

California has about 2.8 billion barrels of crude oil reserves (comprises 13.7 percent of the U.S. total petroleum reserves). California also has more than 51,000 producing oil wells (10 percent of U.S.) and has in-state storage of nearly 203,000 thousand barrels.[70]

The state's petroleum fuels infrastructure and distribution system falls into three main categories:

- Refineries
- Pipelines and distribution terminals
- Marine facilities

---

70 Energy Information Administration, http://www.eia.gov/dnav/pet/pet_crd_pres_dcu_SCA_a.htm.

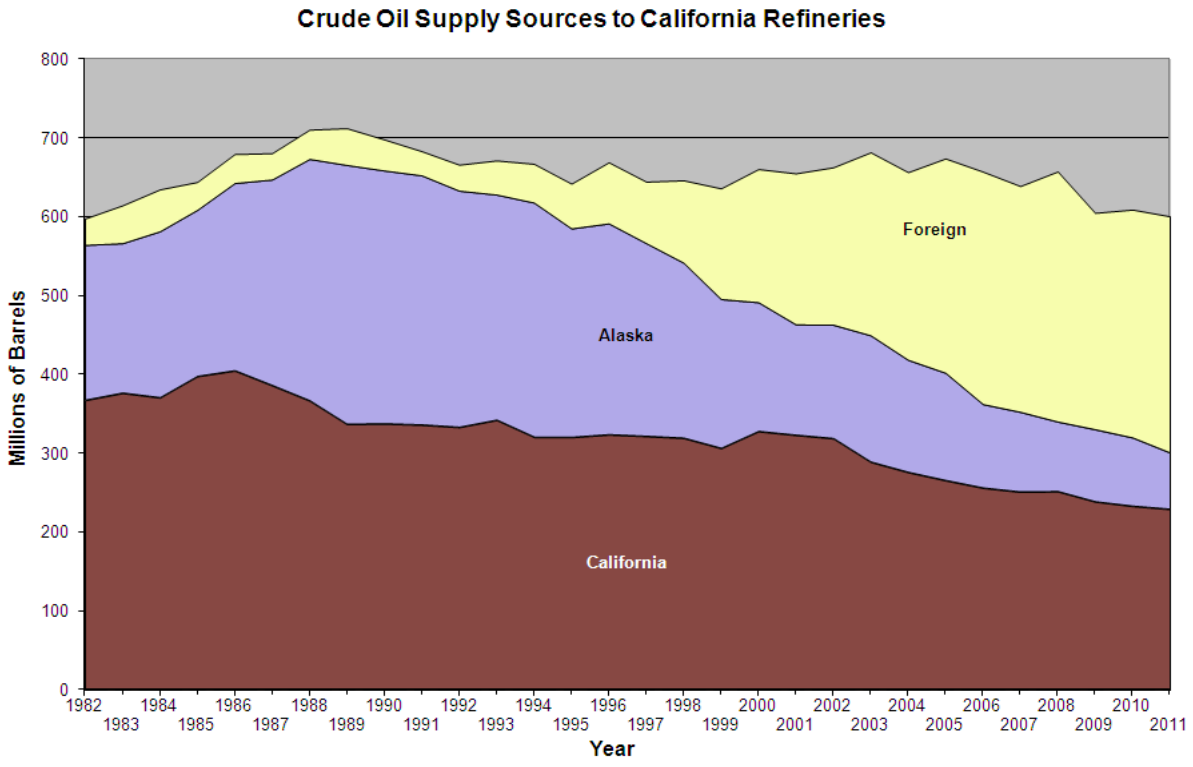
Current Petroleum and Transportation Fuels Resource Availability

Petroleum Supply and Infrastructure

Crude Oil

California refineries rely heavily upon in-state crude oil production. However, over the last 10 years, foreign sources of crude oil have steadily increased as California and Alaska output declined. In 2010, California produced about 38 percent of total crude oil, while foreign imports increased up to nearly 50 percent, and Alaskan crude oil represented nearly 12 percent. This gradual shift of crude oil sources is depicted in Figure 17.

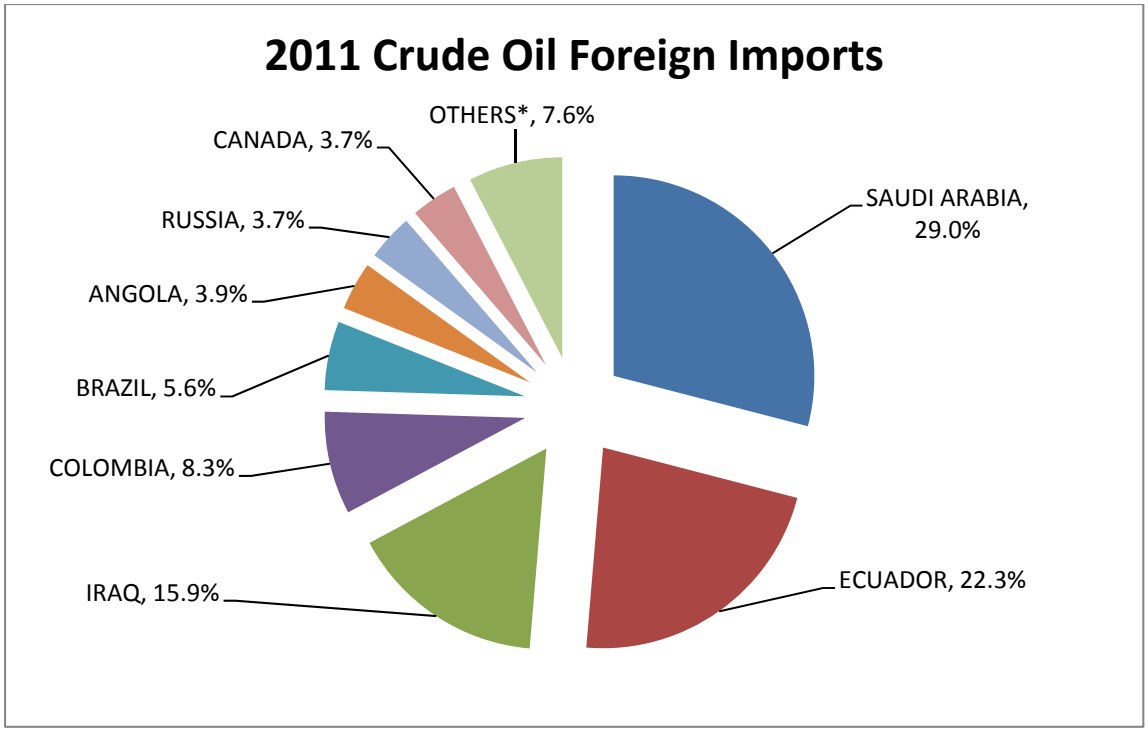
Figure 17: Crude Oil Supply Sources for California Refineries



Source: California Energy Commission

Foreign imports come from Middle Eastern, Latin American, and Asian sources. In 2011, the primary sources of the Middle Eastern crude oil come from Saudi Arabia (29 percent of foreign imports) and Iraq (16 percent of imports). Ecuador is the largest Latin American source of supply, accounting for 22 percent of imports. (See Figure 18 below.)

Figure 18: 2011 Foreign Sources of Crude Oil for California Refineries



Source: California Energy Commission

Refineries

Refineries in California processed 1.7 million barrels per day of crude oil in 2010 at 22 facilities located throughout the state.[71] Most of these refineries (14) produced transportation fuels for use in California, while the remaining facilities produced other types of petroleum products, such as asphalt and lube oils. Most of these facilities are located in two main geographic regions, the San Francisco Bay Area and the Los Angeles Basin. The Central Coast and Bakersfield regions serve as locations for five of these refineries. Refineries consist of several process units that are designed to convert crude oil and other refinery feedstocks (such as gas oils) to higher-value transportation fuels. These facilities serve as main hubs that both receive raw materials and send out finished refined products continuously. The California refineries produce a variety of transportation fuels that are sold in this state, as well as the neighboring states of Arizona, Nevada, and Oregon. Activity at refineries rarely ceases, except during planned maintenance periods. Even then, portions of the refinery not undergoing maintenance are usually operating while work is conducted in other areas of the facility. Table 6 is a list of California's refineries, their locations, and crude oil distillation capacity.

71 Based on 2010 crude oil inputs to California refineries from PIIRA database.

Table 6: California Refineries, Locations, Crude Oil Distillation Capacities, and ARB Fuel Capability

Company Name	California Location	Total Processing Capacity Barrels per Day	2010 CARB Diesel Production	2010 CARB Gasoline Production
ALON USA (formerly Big West)	Bakersfield	66,000	Yes	Yes
Tesoro	Carson	265,000	Yes	Yes
Chevron U.S.A. Inc.	El Segundo	276,000	Yes	Yes
Chevron U.S.A. Inc.	Richmond	245,271	Yes	Yes
Phillips66	Wilmington	139,000	Yes	Yes
Phillips66	Rodeo	120,200	Yes	Yes
ConocoPhillips	Santa Maria	41,800	No	No
ALON USA (formerly Edgington)	Long Beach	31,500	No	No
ExxonMobil	Torrance	155,800	Yes	Yes
Greka Energy	Santa Maria	9,950	No	No
Kern Oil	Bakersfield	26,000	Yes	Yes
Lunday Thagard	South Gate	8,500	No	No
Paramount Petroleum	Paramount	84,000	Yes	Yes
San Joaquin Refining	Oildale	15,000	No	No
Shell Oil	Martinez	165,400	Yes	Yes
Tenby, Incorporated	Oxnard	6,300	No	No
Tesoro	Martinez	166,000	Yes	Yes
Tesoro	Wilmington	103,800	Yes	Yes
Valero	Benicia	144,000	Yes	Yes
Valero	Benicia	14,500	No	No
Valero	Wilmington	80,887	Yes	Yes
Valero Asphalt Refinery	Wilmington	6,300	No	No
State Totals		2,105,458		

Source: California Energy Commission

Petroleum Product Pipelines

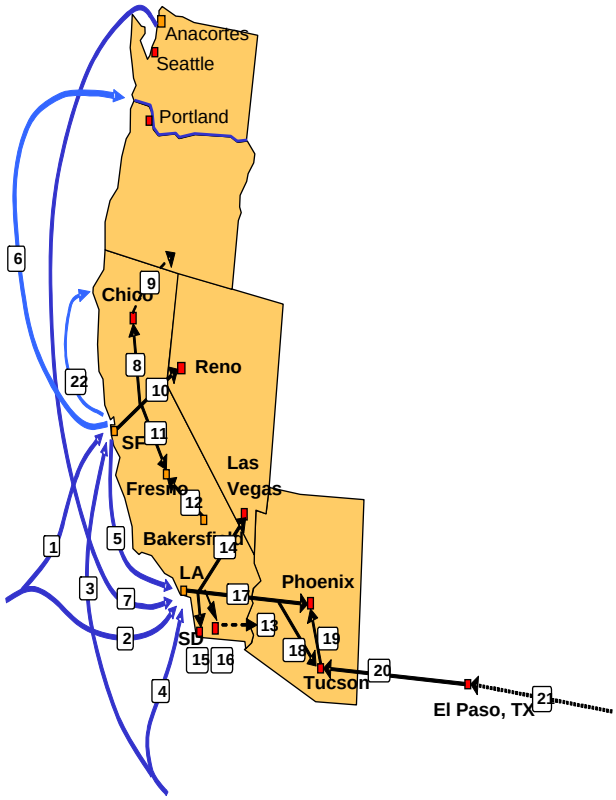
Transportation fuels produced at refineries and imported to California are distributed primarily to more than 60 distribution terminals located throughout the State via a network of petroleum product pipelines. The petroleum product pipelines in Northern California connect the Bay Area refineries to terminals located in Sacramento, Chico, Reno, Stockton, Fresno, San Jose, Oakland and the San Francisco Airport. There is no petroleum product pipeline that connects Northern California with Southern California. Refineries located in Southern California are connected to terminals in Los Angeles, San Diego, Imperial, Barstow, Las Vegas, Phoenix, and Tucson. (See Figure 19.)

- Intrastate pipelines are used to convey petroleum products within California's borders.
- Interstate pipelines are used to export transportation fuels to Arizona (more than 50 percent of supply) and Nevada (nearly 100 percent of supply).

In addition to the pipelines that connect refineries to terminals, there is also a network of pipelines that connect the marine facilities that receive imports to refineries and other storage terminals. During the peak period of gasoline demand (summer months), some of these pipeline segments reach maximum capacity, which results in higher distribution costs associated with additional truck deliveries.

Figure 19: Transportation Fuel Logistics – Western States

1 Foreign Imports into Northern California
2 Foreign Imports into Southern California
3 US Gulf Coast Imports into Northern California
4 US Gulf Coast Imports into Southern California
5 Ship/barge San Francisco to Los Angeles
6 Ship/barge San Francisco to Portland
7 Ship/Barge Washington to Los Angeles
8 Kinder Morgan San Francisco to Chico
9 Truck Chico into Southern Oregon
10 Kinder Morgan San Francisco to Reno
11 Kinder Morgan San Francisco to Fresno
12 Kinder Morgan Bakersfield to Fresno
13 Truck Imperial to Western Arizona
14 Kinder Morgan Los Angeles to Las Vegas
15 Kinder Morgan Los Angeles to San Diego
16 Kinder Morgan Los Angeles to Imperial
17 Kinder Morgan Los Angeles to Phoenix
18 Kinder Morgan Los Angeles to Tucson
19 Kinder Morgan Tucson - Phoenix
20 Kinder Morgan El Paso - Tucson
21 Longhorn Pipeline (nearly complete - on hold)
22 Ship/barge San Francisco to Eureka



Source: California Energy Commission

Crude Oil Pipelines

As is the case with petroleum products, crude oil is also dispensed throughout different regions of the state in a network of pipelines. These pipelines are used to deliver crude oil from areas of the state that have producing oil wells to refineries that will process the crude oil. The main crude oil pipelines in California are those that transport crude oil from the southern San Joaquin Valley to refineries located in the San Francisco Bay Area, the Los Angeles Basin, and Bakersfield. Pipelines are also used to transport crude oil from drilling platforms located off the coast of Central California to various refineries.

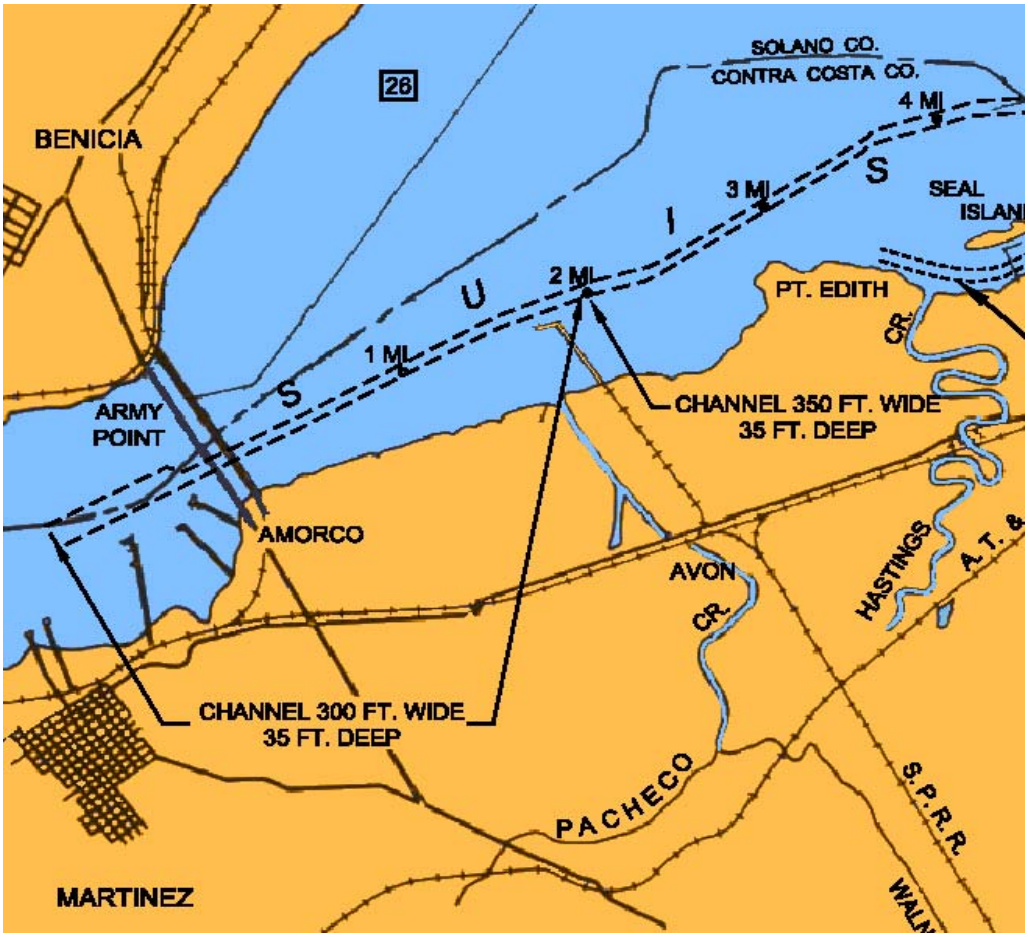
Marine Terminals

Marine terminals consist of berths, onshore storage tanks, and an interconnecting network of pipelines that are used to transfer petroleum products to and from marine

vessels. Almost all of California's refineries have their own proprietary berth or access to a third-party marine terminal. These facilities are used primarily to import crude oil, refinery feedstocks, gasoline blending components, and other finished transportation fuels. These docks are also used to export petroleum products to other states along the West Coast and foreign destinations.

In the San Francisco Bay Area, the marine petroleum infrastructure assets are concentrated in the northeastern parts of the San Francisco Bay, in Richmond, in San Pablo Bay and in the Carquinez Strait. Petroleum cargo deliveries are limited by the depth of the main ship channels in the Bay, which restrict the size and cargo load of the vessels moving through these waters, particularly to marine terminals that are located upriver of the Pinole Shoals. Figure 20 illustrates the shipping channels in the Carquinez Straits that are used to gain access to the Shell (Martinez), Tesoro (Amorco), Valero (Benicia), and Kaneb (Avon) marine terminals.

Figure 20: Carquinez Straits Shipping Channels



Source: California Energy Commission

In Southern California, many refineries and terminals that are part of the marine petroleum infrastructure in the Los Angeles Basin are actually located up to five miles or more inland and connected to the dock by a network of pipelines. Expansion of terminals for handling containers from cargo ships has reduced the amount of space available for marine tankage for petroleum fuels. Generally speaking, the berths in Southern California are not subject to any main ship channel depth limitations such as the Pinole Shoals in San Francisco Bay.

Marine tankers and barges are an important source of transportation capability to bring petroleum products to California. The average volume a vessel carries is 275,000 barrels. Ships from the U.S. Gulf Coast travel to California via the Panama Canal to either Los Angeles or San Francisco Bay. Typical one-way trip times are 21 to 23 days. Fleets loaded at a U.S. port that sail to another U.S. destination must be shipped on a domestic flag vessel in accordance with federal law (Jones Act).

Storage Tanks

Storage tanks are an essential element in the petroleum infrastructure distribution system. Tanks are located alongside marine terminals, at refineries, along pipelines, and

at large holding areas referred to as *tank farms*. Storage tanks in California are used to store crude oil and to store refined petroleum products. The majority of the crude oil and refined products storage tank capacity is located in Southern California. Storage tanks can be classified into three broad use categories:

Operations tanks are those that normally serve a critical function for the day-to-day operations of a refinery, pipeline pump station, or marine terminal. The only exception to this type of storage tank classification would be operational tanks that are used on a seasonal basis, such as those that store inventory of petroleum products in advance of a planned maintenance event.

Strategic storage tanks are used normally to temporarily hold inventory that can be used later when a refinery experiences an unplanned outage. Traders are a class of petroleum marketer who engage in this behavior. Over the last several years, it has been profitable for these companies to store refined products in storage tanks for several months and then sell the products to a refiner that requires additional supplies on a near-term basis. Refiners will also store some refined blending components that are critical to producing California reformulated gasoline as a form of "insurance" against the unexpected loss of an important process unit. An example would be holding additional inventory of alkylate in a storage tank at the refinery in case the alkylation unit experiences operational problems.

Distribution storage tanks are used to hold refined product before it is dispensed into tanker trucks. These types of storage tanks are usually located at refineries and at pipeline distribution terminals. These distribution storage tanks are not used to hold refined products for extended periods. In fact, the storage tank capacities at any pipeline terminal are optimized to accommodate the largest weekly delivery of refined product (gasoline, diesel or jet fuel) that is expected throughout the year.

The storage tanks adjacent to or connected by pipeline with marine berths are used to receive petroleum cargoes discharged from marine vessels (if an import) or are used to temporarily hold petroleum products that are being transferred to a marine vessel for export outside the state. These marine storage tanks can also be used to hold marine fuels that are transferred to vessels in a process referred to as *bunkering*.

Storage tanks at refineries are used for a variety of purposes. One function is to store crude oil prior to processing. Another use is for the temporary storage of intermediate petroleum compounds that are produced by a process unit but still need to undergo further conversion in subsequent refinery units. A third use is to store different types of blending components in segregated tanks that will be used to create finished gasoline. Finally, refiners use storage tanks to temporarily hold refined transportation products that have completed their processing and meet all appropriate state and federal specifications. These tanks will normally be used to feed these refined products into a network of petroleum pipelines and distribution terminals.

Distribution Terminals

Gasoline and diesel fuel dispensed at retail outlets are normally delivered to these locations in tanker trucks that have picked up their cargoes at a facility known as a *terminal*. These types of petroleum infrastructure facilities are supplied either by pipeline or fed directly from storage tanks located at the refinery. Distribution terminals will have several storage tanks and associated piping that feed gasoline, diesel, and jet fuel to a set of valves and hose connections. This arrangement is referred to as a *truck rack*.

Conventional and Renewable Fuel Distribution and Retail Infrastructure

Conventional Fuels

California demand for gasoline and diesel fuel totaled 17.8 billion gallons during 2012. Demand for gasoline has declined in California due to a continued improvement in fuel economy for new vehicles sold and more recently a reduction in vehicle-miles-traveled resulting from a downturn in the state's economy. California is nearly self-sufficient with regard to the gasoline and diesel fuel supply, obtaining nearly all of the supply to meet local demand from the California refineries.

There are roughly 9,700 public retail locations in California where consumers can obtain transportation fuels.[72] It is estimated that diesel fuel is available at about 48 percent of these retail locations. The results of the Energy Commission's 2011 A15 Retail Outlet Survey reveal the following details:

Retail Gasoline:

- The average gasoline sales per stations were 1.57 million gallons or 131,000 gallons per month.
- The top 1 percent of retail gasoline stations sold about 8 percent of the total gasoline. The average gasoline sale per station of the top 1 percent was 11.64 million gallons or 970,000 gallons per month.
- The top 20 percent of retail gasoline stations sold half of the total gasoline. The average gasoline sale per station of the top 20 percent was 3.73 million gallons or 311,000 gallons per month.

72 http://energyalmanac.ca.gov/gasoline/piira_retail_survey.html.

Retail Diesel Fuel:

- The average diesel sales per station were 0.34 million gallons or 28,000 gallons per month.
- Projected total retail diesel sales were 1.45 billion gallons in 2011.
- About 44 percent of the estimated taxable diesel sales and nearly all the gasoline sales in California were at the retail level.
- The top 1 percent of reporting retail diesel stations in California sold about 29 percent of the total retail diesel. The average diesel sale per station of the top 1 percent was 9.98 million gallons or 832,000 gallons per month.
- The top 3.4 percent of reporting diesel stations sold half the retail diesel. The average diesel sale per station of the top 3.4 percent was 4.98 million gallons or 415,000 gallons per month.

Ethanol Infrastructure

California ethanol use is widespread and blended with gasoline at a concentration of 10 percent by volume. The state's infrastructure to receive, distribute, and blend ethanol is robust and adequate to accommodate a continued growth of ethanol use over the next several years. Rail imports have accounted for about 91 percent of California ethanol supply over the last seven years, followed by marine imports (5 percent) and in-state production (4 percent). There were no marine imports of ethanol during 2010 due to unfavorable economics in foreign source countries. However, marine imports have increased in 2012 and 2013 as California transitions to greater use of lower carbon intensity ethanol from Brazil or Caribbean Basin Initiative countries. There are two pathways for foreign ethanol to enter California: marine vessels directly from Brazil and rail shipments from another marine terminal outside California.

Availability of E85 continues to increase throughout California. About 6.5 million gallons of E85 were sold during 2012, with 55 locations offering the fuel for sale to the public by the end of that year.[73]

Biodiesel Infrastructure

Nearly 31 million gallons of biodiesel were used as transportation fuel during 2012. Kinder Morgan accommodated increased biodiesel volumes by converting all ARB diesel tanks at its Colton facility for use in storing and blending diesel with 5 percent biodiesel (B5) in 2012. A limited number of other terminals may follow suit, although the number of such facilities is unknown at this time. In 2012 the majority (70 percent) of biodiesel use in California was produced from within the state.

---

73 Information obtained from Energy Commission staff.

Retail diesel fuel dispensers and underground storage tanks can handle diesel fuel that contains up to 5 percent biodiesel concentrations by volume, but not up to 20 percent. However, the California State Water Resources Control Board (SWRCB) has issued a temporary variance from this restriction. Assuming biodiesel fuel blends in California do not exceed 20 percent, required retail station modifications should be negligible. According to original equipment manufactures' statements on the National Biodiesel Board website, 18 vehicle models sold in the United States accept B5, 15 accept B20, and 4 accept B100. Vehicles switching to B20 blends may experience a period where fuel filters plug – due to the biodiesel cleaning up the fuel tanks and depositing the gunk in the fuel filters. Fleets switching to B20 or higher blends are encouraged to clean fuel tanks and fuel filters frequently upon switching to higher biodiesel blends.

CNG and Propane

Today, the use of natural gas vehicles (NGVs) is limited to largely medium- and heavy-duty vehicles. Ford Motor Company and other manufacturers plan on reentering the light-duty natural gas vehicles market for 2012 and beyond, including vans, wagons, pickups, and utility vehicles. There are 140 public and 424 private CNG fueling stations and 13 public and 19 private LNG sites in the state. By the middle of 2014, eight truck/chassis manufacturers will make natural gas trucks using natural gas engines manufactured by two suppliers for 8.9-liter and 11.9-liter sizes. By 2015, engine manufacturers will supply 15-liter natural gas engines for trucks. As a consequence, a wide variety of natural gas vehicles will be available for long-haul trucks, shuttle buses, transit buses, package delivery vans, refuse trucks, and utility trucks.

California users consumed about 20 million gallons of propane for transportation fuel in 2012.[74] Propane can be a by-product of either natural gas processing or petroleum refining. Propane is attractive in terms of pricing compared to both diesel and gasoline. There are about 228 propane vehicle fueling stations in California. These numbers can be expanded with the addition of fuel capacity, a tank pump, and metering equipment at virtually any propane distributor or station in California for between $37,000 and $52,000 per site. Propane can play an especially significant role in rural communities, where it is already widely available.

74 Energy Commission transportation fuel use analysis, 2013.

Table 7: 2012 California Transportation Fuels Usage
(and Petroleum Reductions, Where Appropriate)

Fuel Type	Volume (million gasoline gallon equivalents)	Percent of Total	Number of Fuel Stations
Gasoline	14,483	75.15%	9,350[2]
On-Road Diesel	2,631	13.65%	4,600[2]
Off-Road Diesel	840	4.36%	N/A
Jet Fuel	125.9	0.65%	?
Ethanol	1,011	5.25%	9,350
Natural Gas[1]	100	0.52%	450
Electricity - Rail & Trolleys[1]	21	0.11%	N/A
Biodiesel	31.5	0.16%	Same as diesel
Propane	19.5	0.10%	228
E85	4.8	0.02%	60
Electricity - Cars & Trucks[1]	4.1	0.02%	7,200
Hydrogen[1]	0.04	0.00%	15
Total	**19,271**	99.99%	

[1] Reported as petroleum reduction accounting for the vehicle energy efficiency.
[2] Retail Station Counts from 2011 A15 Survey (excludes public and private fleet and Card Lock stations)

Source: California Energy Commission

APPENDIX A:
Energy Commission EEMC Operating Guidelines

The operating guidelines in this appendix describe the current general responsibilities of each position in the EEMC, as well as current recommended actions for each phase of an energy emergency.

These guidelines are intended as general direction only and do not contain all actions that may be necessary to perform a specific position's responsibilities. Furthermore, all of these respective responsibilities should be revised, if appropriate, when the *State Energy Emergency Plan* is updated. The positions are:

- Governor.
- Chairman.
- Executive Director.
- Governmental Affairs Officer.
- Public Information Officer.
- Energy Emergency Manager.
- SOC Energy Assurance Liaison.
- Electricity Specialist.
- Natural Gas Specialist.
- Petroleum Specialist.
- Fuels Set-Aside Specialist.
- Economic Assistance Coordinator.
- Operations Coordinator.
- Planning Coordinator.
- Logistics Coordinator.
- Finance Administration Coordinator.

Governor

The Governor provides direction to California residents and for all state government agencies during an energy emergency. He or she may recommend voluntary energy demand reduction measures. The Governor may also proclaim a state of emergency and sign executive orders that implement mandatory demand reduction and other mitigation programs, as deemed necessary.

	Table A-1: Governor Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Receive periodic briefings and reports from the Energy Commission relative to California's energy price, supply, and distribution status. ☐ Alert the Press Secretary of the likely nature of press releases and appropriate responses to media inquiries.
Pre-Emergency	☐ Issue a public appeal for voluntary energy demand reduction (if appropriate). ☐ Meet and confer with the California Emergency Council. ☐ Direct all state government agencies to reduce energy consumption (if appropriate). ☐ If the energy shortage level increases, prepare to proclaim a state of emergency.
Emergency	☐ Review energy emergency response recommendations from the Energy Commission. ☐ Issue public appeals for increased energy demand reduction efforts (if appropriate). ☐ Proclaim a state of emergency (if appropriate). ☐ If needed, sign Emergency Order #6 to implement the Petroleum Fuels Set-Aside Program. ☐ Direct state agencies to implement stringent energy demand reduction programs. ☐ If the emergency is widespread throughout California, request a presidential declaration of emergency. ☐ Request federal assistance and aid, as necessary.

Source: California Energy Commission

Chairman

The Chairman directs Energy Commission staff to implement EERP elements. Based on staff information and analyses, the Chairman may confer with the Natural Resources Agency Secretary and other Commissioners and recommend energy demand reduction measures and other energy emergency impact reduction actions to the Governor.

	Table A-2: Chairman Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Receive updates from the Executive Director regarding information relative to the potential energy emergency. ☐ Notify the Governor the Energy Commission has activated the Energy Emergency Response Plan Verification Phase. ☐ Review media releases with the Executive Director and Public Information Officer. ☐ If it is likely that the situation will continue to worsen, inform the Executive Director to prepare for the Pre-Emergency.
Pre-Emergency	☐ Attend regular briefings with the Executive Director, Energy Emergency Manager, and appropriate staff. ☐ Notify the Governor that the Energy Commission has activated the Pre-Emergency Phase of the Energy Emergency Response Plan. ☐ Ensure that all press releases are coordinated with the Governor's Press Secretary and the OES Public Information Officer. ☐ Review media briefing packets and be prepared to conduct press conferences with the Natural Resources Agency Secretary and other Commissioners. ☐ Confer with the Natural Resources Agency Secretary and other Commissioners on possible voluntary emergency response actions to be recommended to the Governor. ☐ If energy shortage becomes more severe, be prepared to recommend, in conjunction with the Director, Office of Emergency Services, that the Governor proclaim a State of Emergency.

Emergency	☐ Ensure the Energy Emergency Management Center (EEMC) is activated at the level appropriate to respond to the emergency. ☐ Notify the Governor that the Energy Commission has activated Energy Emergency Response Plan Emergency Phase. ☐ Confer with the Natural Resources Agency Secretary and other Commissioners on possible mandatory emergency response actions to be recommended to the Governor. ☐ Ensure that the Governor and his/her staff receives regular reports and recommendations. ☐ If the Petroleum Fuels Set-Aside Program is implemented, ensure that the Executive Director has appointed a Fuels Allocation Officer.

Source: California Energy Commission

Executive Director

The Executive Director is responsible for ensuring that the Chairman and Commissioners are kept informed of all pertinent energy related issues during an energy emergency. The Executive Director works closely with the Energy Emergency Manager to ensure adequate staff and resources to support the EEMC.

	Table A-3: Executive Director Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Upon notification of a potential emergency, provide a briefing for the Chairman and appropriate Commissioners. ☐ Attend regular briefings with the Energy Emergency Manager to ensure coordination of timely information. ☐ Review media releases in conjunction with the Chairman and Public Information Officer. ☐ Review and approve all related reports prepared by staff and ensure they are distributed accordingly to the Chairman and appropriate Commissioners.
Pre-Emergency	☐ Confer with the Energy Emergency Manager on potential activation and staffing of the Energy Emergency Management Center. ☐ Confer with the Energy Emergency Manager regarding staff preparation of recommended voluntary emergency response actions. ☐ If the situation becomes more serious, confer with the Chairman to coordinate activation of the Emergency Phase of the Energy Emergency Response Plan.
Emergency	☐ Ensure that the EEMC is activated and adequate staff and resources are available to support necessary functions. ☐ If the Governor proclaims a "state of emergency," ensure that all emergency-related record-keeping and reporting procedures are maintained separately from the normal business of the Commission. ☐ Confer with the Energy Emergency Manager regarding staff preparation of recommended mandatory emergency response actions. ☐ If the Petroleum Fuels Set-Aside Program is implemented, appoint a Fuels Allocation Officer and a Fuels Set-Aside Review Officer. ☐ Meet regularly with the Governmental Affairs Officer to ensure that the Legislature is kept informed of the situation.

Source: California Energy Commission

Governmental Affairs Officer

The Governmental Affairs Officer delivers and interprets situation reports to state legislators, prepares briefing information for the Chairman to present to both the Legislature and California congressional delegates, and responds to inquiries from local elected officials.

	Table A-4: Governmental Affairs Officer Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Review and monitor any potential situation and keep informed of any new developments. ☐ Confer with the Executive Director and Chairman regarding the timing of notification to the Legislature and California congressional delegates. ☐ Respond accordingly to inquiries from the Legislature or local government. ☐ Keep the Executive Director and Chairman informed of any inquiries or contact with Legislators, California congressional delegates, or local elected officials.
Pre-Emergency	☐ Attend regular briefings with the Chairman, Executive Director, and Public Information Officer, as needed. ☐ Maintain a contact record of all government inquiries and the Commission's response.
Emergency	☐ Prepare regular briefing packages for the Legislature, Congressional delegates in coordination with the Executive Director, Chairman, Public Information Officer, and Energy Emergency Manager. ☐ Coordinate additional staffing needs with the Executive Director, if necessary.

Source: California Energy Commission

Public Information Officer

The Public Information Officer, with the authorization of the Executive Director, schedules media conferences, media releases, and Web updates. The Public Information Officer ensures that the information released to the public is coordinated with the Governor's Office, Office of Emergency Services, and other appropriate state agencies.

	Table A-5: Public Information Officer Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Attend all information briefings and keep informed of the current and potential future situation. ☐ Establish lines of communication with the Governor's Press Secretary and the Public Information Officers from the Office of Emergency Services and the U.S. Department of Energy. ☐ Develop appropriate preliminary media releases for review by the Executive Director and Chairman.
Pre-Emergency	☐ Determine staffing needs and establish the Energy Commission Media Center to monitor and record media coverage. ☐ Attend all situation briefings and obtain and review all formal situation reports. ☐ Ensure consistency with information released by the Governor's Press Secretary and the OES PIO. ☐ Ensure that Energy Commission website is updated to assist the public, including listing appropriate voluntary response actions and updating the Petroleum Fuels Set-Aside database pages.
Emergency	☐ Expand media support staff, as needed. ☐ Intensify coordination of information releases with state and local Public Information Officers. ☐ Assist the Chairman and Commissioners with media conferences.

Source: California Energy Commission

Energy Emergency Manager

The Energy Emergency Manager is appointed by the Executive Director and is responsible for direct supervision and operation of the Energy Emergency Management Center (EEMC), ensuring that all appropriate EEMC functions are effectively staffed. The Energy Emergency Manager also promotes interagency coordination at all levels of government and facilitates management-level coordination and communication with industry groups. This position keeps the Executive Director, Chairman, and appropriate Commissioners, Governmental Affairs Officers, and Public Information Officer informed at all times.

	Table A-6: Energy Emergency Manager Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Ensure that all relevant data is analyzed by the energy emergency planning staff. ☐ Ensure that a preliminary situation report is prepared for review by the Executive Director and Chairman. ☐ If there is a high probability that activation of the Energy Emergency Management Center will occur, notify appropriate staff, including function coordinators (Operations, Planning, Logistics, and Finance). ☐ With the approval of the Executive Director and Chairman, distribute and interpret the preliminary situation report to the Governor and the Office of Emergency Services.
Pre-Emergency	☐ Establish a regular briefing schedule for the Executive Director, Chairman, appropriate Commissioners, Governmental Affairs Officer, and Public Information Officer. ☐ Ensure adequate staff and an appropriate location are available should the activation of the Energy Emergency Management Center become necessary. ☐ In conjunction with appropriate staff, ensure that all media releases and situation reports are technically accurate. ☐ Review recommended voluntary emergency response actions prepared by technical specialists and confer with Executive Director regarding these recommendations.
Emergency	☐ In coordination with the Executive Director and the Chairman, activate the Energy Emergency Management Center and inform appropriate Energy Commission staff and the Office of Emergency Services. ☐ Designate an Energy Commission agency representative to staff the State Operations Center at OES Headquarters, if needed.

	☐ Ensure Operations staff has adequate support for all appropriate programs being implemented. ☐ Ensure that the Planning staff develops all reports promptly. ☐ Ensure that the Logistics staff provides materials, personnel, and procurement support for all staff assigned to the Energy Emergency Management Center. ☐ Ensure that the Finance Administration staff maintains accurate fiscal and compensation records related to the energy emergency. This information must be maintained separately from normal Energy Commission business operations. ☐ Review recommended mandatory emergency response actions prepared by technical specialists and confer with Executive Director regarding these recommendations. ☐ Oversee the preparation of the internal status reports, as appropriate. ☐ When the Governor rescinds the emergency proclamation, de-activate the Energy Emergency Management Center and ensure that staff members return to their normal duties. ☐ Oversee the preparation of the after-action report for the Energy Commission, ensuring distribution to the Governor's Office and Office of Emergency Services.

Source: California Energy Commission

SOC Energy Assurance Liaison

The SOC Energy Assurance Liaison, with the authorization of the Executive Director and in coordination with the Energy Emergency Manager, is located at the State OES SOC and liaises with energy assurance partners to facilitate energy emergency information to and from the SOC and EEMC.

	Table A-7: SOC Energy Assurance Liaison Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Attend all information briefings with the Energy Emergency Manager and keep informed of the current and potential future situation. ☐ Establish lines of communication with the SOC when directed by the Executive Director and the Energy Emergency Manager.
Pre-Emergency	☐ Determine energy assurance liaison staffing needs at the SOC. ☐ Check-in at the SOC to monitor and facilitate energy information to and from the SOC and EEMC. ☐ Attend all SOC energy emergency briefings and pass along all information to the EEMC.
Emergency	☐ Expand SOC liaison staff as needed under direction of the Energy Emergency Manager. ☐ Intensify coordination of energy emergency information between SOC and EEMC.

Source: California Energy Commission

Electricity Specialist

The Electricity Specialist maintains contact and coordinates information with the electricity industry in California. In addition, the Electricity Specialist is responsible for situation monitoring, analysis of impacts, response planning, report preparation, and program implementation for the electricity sector during an energy emergency.

	Table A-8: Electricity Specialist Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Review and monitor the situation and stay informed of any new developments. ☐ Meet regularly with the Operations Coordinator to provide updates and determine the potential for activating the pre-emergency or emergency phase. ☐ Assist Planning Coordinator with preparing preliminary situation reports. ☐ Update and maintain contact list for electric utilities, California Independent System Operator, and other appropriate energy emergency contacts.
Pre-Emergency	☐ Help prepare situation reports and attend briefings, as required. ☐ Continue information collection and analyses, provide periodic updates, and coordinate with the Office of Emergency Services, other government agencies, and private industry, as appropriate. ☐ Work with the Operations Coordinator, Energy Emergency Manager, and other appropriate Energy Commission staff to prepare recommendations for voluntary emergency response actions impacting the electricity industry.
Emergency	☐ Work with the Operations Coordinator and Energy Emergency Manager to prepare recommendations for mandatory emergency response actions impacting the electricity industry. ☐ At the conclusion of the energy emergency, assist the Energy Emergency Manager with response evaluation and preparation of the after-action report.

Source: California Energy Commission

Natural Gas Specialist

The Natural Gas Specialist maintains contact and coordinates information with the natural gas industry in California. In addition, the Natural Gas Specialist is responsible for situation monitoring, analysis of impacts, response planning, report preparation, and program implementation for the natural gas sector during an energy emergency.

	Table A-9: Natural Gas Specialist Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Review and monitor the situation and stay informed of any new developments. ☐ Meet regularly with the Operations Coordinator to provide updates and determine the potential for activating the pre-emergency or emergency phase. ☐ Assist Planning Coordinator with preparing situation reports. ☐ Update and maintain contact list for natural gas utilities and other appropriate energy emergency contacts.
Pre-Emergency	☐ Help prepare situation reports and attend briefings, as required. ☐ Continue information collection and analyses, provide periodic updates, and coordinate with the Office of Emergency Services and other government agencies and private industry, as appropriate. ☐ Work with the Operations Coordinator, Energy Emergency Manager, and other appropriate Energy Commission staff to prepare recommendations for voluntary emergency response actions impacting the natural gas industry.
Emergency	☐ Work with the Operations Coordinator and Energy Emergency Manager to prepare recommendations for mandatory emergency response actions impacting the natural gas industry. ☐ At the conclusion of the energy emergency, assist the Energy Emergency Manager with response evaluation and preparation of the after-action report.

Source: California Energy Commission

Petroleum Specialist

The Petroleum Specialist is responsible for maintaining contact and coordinating information with the petroleum industry in California. The Petroleum Specialist is also responsible for situation monitoring, analysis of impacts, response planning, report preparation, and program implementation for the petroleum sector.

	Table A-10: Petroleum Specialist Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Review/monitor situation and stay aware of new developments. ☐ Meet regularly with the Operations Coordinator to provide updates and determine the potential for activating the pre-emergency or emergency phase. ☐ Assist Planning Coordinator with preparing situation reports. ☐ Meet regularly with the Fuels Set-Aside Specialist to assess the need for informal or formal fuels set-aside. ☐ Update and maintain contact list for petroleum companies and other appropriate energy emergency contacts.
Pre-Emergency	☐ Help prepare situation reports and attend briefings, as required. ☐ Continue information collection and analyses, provide periodic updates, and coordinate with the Office of Emergency Services and other government agencies and private industry, as appropriate. ☐ If a need for the informal fuels set-aside process occurs, assist the Fuels Set-Aside Specialist with analyzing the request for fuel, determining the appropriate response, and coordinating the resulting activities, if any. ☐ Work with the Operations Coordinator, Energy Emergency Manager, and other appropriate Energy Commission staff to prepare recommendations for voluntary emergency response actions impacting the petroleum industry.
Emergency	☐ Work with the Operations Coordinator and Energy Emergency Manager to prepare recommendations for mandatory emergency response actions impacting the petroleum industry. ☐ If the formal Petroleum Fuels Set-Aside Program is implemented, assist the Fuels Allocation Officer and Fuels Set-Aside Specialist with obtaining data from the EIA-782c forms to help determine the volume of fuel to be used in the program. ☐ At energy emergency conclusion, assist Energy Emergency Manager with response evaluation and preparation of after-action reports.

Source: California Energy Commission

Fuels Set-Aside Specialist

The Fuels Set-Aside Specialist is responsible for the distribution of fuel during an emergency. This position will coordinate informal fuel set-aside requests, activate and administer the Fuels Set-Aside Office, if needed, and oversee the processing of requests under the formal Petroleum Fuels Set-Aside Program, if activated.

	Table A-11: Fuels Set-Aside Specialist Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Review and monitor the situation and stay informed of any new developments. ☐ Meet regularly with the Operations Coordinator and Petroleum Specialist to determine the potential for activating fuels set-aside programs. ☐ Ensure that all industry contacts and rosters are current should it become necessary to implement the informal fuels set-aside process. ☐ Review the Fuels Set-Aside Office Operations Manual to ensure the instructions and procedures are up to date.
Pre-Emergency	☐ Work with the Petroleum Specialist and the Office of Emergency Services (if appropriate) to provide fuel to emergency and essential services (informal process). ☐ In conjunction with the Governmental Affairs Officer, ensure Emergency Order #6 is ready to be filed with the Secretary of State should the need arise during the Emergency Phase. ☐ Ensure adequate staff is available and trained to operate the Fuels Set-Aside Office, including Fuels Allocation Officer, Fuels Set-Aside Review Officer, Supervisor, Analysts, and Secretary. ☐ Ensure sufficient equipment and office space is available to operate the Petroleum Fuels Set-Aside Program should the need arise, including computers, phones, fax machines, printers, copiers, lighting, heating, and appropriate reference materials. ☐ Ensure applicant handbooks are available for distribution and the Internet application process is functioning properly.
Emergency	☐ Continue with Pre-Emergency Phase activity, as appropriate. ☐ If needed, activate the Fuels Set-Aside Office following the procedures outlined in the Fuels Set-Aside Office Operations Manual. ☐ If the formal Petroleum Fuels Set-Aside Program is implemented, assist the Fuels Allocation Officer and Petroleum Specialist with determining the volume of fuel to be used in the program. Notify

	the oil companies, as appropriate. ☐ Work with the Public Information Officer to ensure press releases, Internet sites, and media briefing packages contain information on who is eligible to apply for fuel under the Petroleum Fuels Set-Aside Program and how to apply. ☐ Provide information to the Planning Coordinator on a regular basis for use in the situation report. ☐ At the conclusion of the energy emergency, assist the Energy Emergency Manager with response evaluation and preparation of the after-action report.

Source: California Energy Commission

Economic Assistance Coordinator

The Economic Assistance Coordinator is a liaison with the California Department of Community Services and Development (CSD). CSD coordinates all economic assistance programs. The Economic Assistance Coordinator is familiar with the programs available at CSD and refers any requests for assistance to the appropriate contacts at that department. This position also ensures that CSD program staff is provided with current information regarding the energy emergency to project the funding need for economic assistance programs.

	Table A-12: Economic Assistance Coordinator Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Ensure that CSD point of contact information is up to date should the need arise for program referrals. ☐ Review all appropriate program descriptions to ensure knowledge of CSD's processes and eligibility requirements are up to date and accurate. ☐ Provide Situation Reports to CSD as necessary for economic assistance program planning purposes.
Pre-Emergency	☐ Continue with Verification Phase activities, as needed. ☐ Respond to requests received for assistance and make referrals, as appropriate. ☐ Provide regular updates to the Operations Coordinator and Energy Emergency Manager regarding the number of requests received and referrals made. ☐ Provide LIHEAP, ECIP, and weatherization program information and updates to appropriate Energy Commission staff and management as needed to familiarize them with available programs.
Emergency	☐ Continue with Pre-Emergency Phase activity, as appropriate. ☐ Keep the Energy Emergency Manager and Operations Coordinator informed of any significant changes or occurrences. ☐ At the conclusion of the energy emergency, assist the Energy Emergency Manager with response evaluation and preparation of the after-action report.

Source: California Energy Commission

Operations Coordinator

The Operations Coordinator is responsible for coordinating Operations Function activities and programs. The position interacts and coordinates with Planning, Logistics, and Finance Administration Coordinators during Energy Emergency Management Center activation and plays a lead role for the Operations Function of the EEMC.

	Table A-13: Operations Coordinator Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Monitor and review situation and stay abreast of any new issues. ☐ Coordinate with the Energy Emergency Manager to determine likelihood of Energy Emergency Management Center activation.
Pre-Emergency	☐ Review situation reports and attend briefings, as required. ☐ Meet with the Energy Emergency Manager to determine the potential scope of energy emergency operations in the event of an Emergency Phase. ☐ Coordinate program support needs with appropriate staff and personnel responsible for the following program activities: • Electricity • Natural Gas • Petroleum • Fuels Set-Aside • Economic Assistance ☐ Ensure all program areas are prepared for the Emergency Phase.
Emergency	☐ Set up and maintain periodic operations briefings for the Energy Emergency Manager. ☐ If an Energy Commission Agency Representative is assigned to the OES State Operations Center, ensure that a continuum of communication and coordination is maintained with the Energy Emergency Management Center. ☐ Ensure all program specialists provide current information to the Planning Coordinator for internal status reports and situation reports. ☐ Ensure all Energy Emergency expenditures, including time sheets, are submitted to the Finance Administration Coordinator for accounting and reimbursement. ☐ Continually monitor the effectiveness of the Operations Function and ensure adequate staff and support are provided. ☐ Assist Energy Emergency Manager with response evaluation and after-action report preparation at energy emergency conclusion.

Source: California Energy Commission

Planning Coordinator

The Planning Coordinator coordinates energy emergency-related information and the development of internal status reports and situation reports. This position may also help develop the Governor's memo and the after-action report. The Planning Coordinator will work closely with the Operations staff to receive technical data collection, analyses, and forecasts for situation reports and plays a lead role for the Planning function during activation of the Energy Emergency Management Center.

	Table A-14: Planning Coordinator Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Monitor statewide, national, and international events that may potentially impact California's energy prices and supplies. ☐ Coordinate with the Energy Emergency Manager to determine the likelihood of Energy Emergency Management Center activation. ☐ Oversee and participate in the development of situation reports and Governor's memo, if required. ☐ Ensure that all reports are archived for future reference.
Pre-Emergency	☐ Continue to oversee and participate in the development of situation reports and attend briefings, as required. ☐ Establish a publication schedule for the situation report updates. ☐ Be prepared to provide situation briefings to all key staff, as well as Energy Emergency Manager, Executive Director, Chairman, and Commissioners, as needed.
Emergency	☐ Establish and maintain a publication schedule and distribution process for internal status reports and situation reports. ☐ Maintain a briefing schedule for the Energy Emergency Manager, Executive Director, Chairman, and Commissioners. ☐ Continually monitor the effectiveness of the Planning Function and ensure that adequate staff and support are provided. ☐ Assist Energy Emergency Manager with response evaluation and after-action report preparation at energy emergency conclusion.

Source: California Energy Commission

Logistics Coordinator

The Logistics Coordinator provides services and support to all activated functions within the Energy Emergency Management Center. Services and support include, but are not limited to, computer and other information technology support, telecommunications, personnel, transportation, supplies, and procurement. This position must interact with the Energy Emergency Manager, Operations Coordinator, Planning Coordinator, and Finance Administration Coordinator to determine and assist with logistical needs.

	Table A-15: Logistics Coordinator Responsibilities
PHASE	**RECOMMENDED ACTIONS**
Verification	☐ Coordinate with the Energy Emergency Manager to determine the likelihood of an activation of the Energy Emergency Management Center. ☐ Determine the anticipated support needs for EEMC functions and personnel should activation occur. ☐ Ensure that the list of vendors and contractors used by the Energy Commission is updated and that contact numbers are current.
Pre-Emergency	☐ Arrange for additional staff to support the Logistics Function upon activation of the EEMC. ☐ Work with the Energy Emergency Manager to choose a location for the EEMC should activation occur. Ensure that the chosen location has appropriate communications outlets, phone connection jacks, and other equipment are in place and operational. ☐ Ensure system maintenance and repairs are completed, as needed. ☐ Coordinate with Finance Administration Coordinator to determine the process for ensuring that fiscal records and expenditures are maintained separately from normal Energy Commission procedures, for claim and reimbursement.
Emergency	☐ Attend EEMC operations and situation briefings, as needed. ☐ Arrange EEMC personnel transportation and lodging, as needed. ☐ Arrange for food, supplies, equipment, heating, lighting, and other similar needs for EEMC personnel. ☐ Ensure that all receipts, invoices, and other financial records are submitted to Finance Administration. ☐ Ensure current information is provided to the Planning Coordinator for internal status reports. ☐ Assist Energy Emergency Manager with response evaluation and after-action report preparation at energy emergency conclusion.

Source: California Energy Commission

Finance Administration Coordinator

The primary responsibility of the Finance Administration Coordinator is to ensure that all fiscal records are maintained accurately and are indexed separately from normal Energy Commission activity. This is particularly critical during federally declared disasters. This position is also responsible for timekeeping, compensation and claims, purchasing, and assisting with the fiscal recovery process.

Table A-16: Finance Administration Coordinator Responsibilities

PHASE	RECOMMENDED ACTIONS
Verification	☐ Coordinate with the Energy Emergency Manager to determine likelihood of an Energy Emergency Management Center activation. ☐ Coordinate with the Energy Emergency Manager and Executive Director to ensure that a system is in place to index all energy emergency-related expenses. ☐ Alert appropriate financial support staff that may be required upon activation of the EEMC.
Pre-Emergency	☐ Ensure adequate workspace is available in accounting or business services to support the EEMC when activated. ☐ Review the list of contractors and vendors and ensure that it is current. Provide a copy to the Logistics Coordinator. ☐ Establish procedures to implement emergency contracts or agreements as needed to respond to the energy emergency.
Emergency	☐ Inform all EEMC personnel as to appropriate processing of timesheets and other fiscal records and expenditures. ☐ Brief all supervisors and managers regarding compensation and claims procedures. Time frames for submittal of claim forms are usually not waived for an energy emergency. ☐ Ensure that current information is provided to the Planning Coordinator for internal status reports. ☐ At the conclusion of the emergency, publish a comprehensive fiscal recovery report in coordination with OES. ☐ Assist Energy Emergency Manager with response evaluation and after-action report preparation at energy emergency conclusion.

Source: California Energy Commission

APPENDIX B:
Energy Assurance Plan – Emergency Function #12 Integration

The intended scope of Emergency Function #12 (EF #12) of the *State Emergency Plan* and this *CEAP* is to address significant disruptions in energy supplies for any reason, whether caused by physical disruption of energy transmission and distribution systems, unexpected operational failure of such systems, and unusual economic or international political events.

An aspect of energy emergencies that influences state response is whether there is a service interruption or an actual shortage of energy supply. Sometimes energy service is interrupted, and demand cannot be met at any price. This is mostly true with electricity and natural gas service when infrastructure is destroyed or damaged, especially at the local distribution level. Customers are connected directly to electricity grids and natural gas pipelines. If the grid or pipelines are damaged, service can be lost. If damage to infrastructure is the cause, the state response is limited because energy companies are responsible for repairing their own systems. The state does what it can to help, but direct assistance to energy companies is rare.

Occasionally an energy emergency takes the form of a shortage. Petroleum product shortages characterize this kind of emergency. Whether caused by infrastructure damage (tanker grounding, pipeline explosion) or by market factors (labor strike, economic upswing increasing consumption), energy supply shortages occur when supply becomes insufficient to meet demand.

Increased energy prices signify an energy supply shortage. The market impact of higher prices (both dampening demand and drawing new supplies to the state) is an expected outcome to help resolve emergencies. However, if prices increase quickly and maintain high levels for sustained periods, they can have debilitating effects on residents and businesses. The state may need to take steps to address high prices and their negative economic consequences. The Office of the Attorney General maintains an automated website to receive consumer complaints about potential unlawful pricing practices.[75]

EF #12 will expand and supplement the operational concepts and assignment of responsibilities established in this *CEAP* that define roles and responsibilities of energy assurance partners in managing energy supply shortages due to unexpected operational failures or unusual economic or international political events. Disruptions to energy supply, transmission, and distribution due to physical or operational failures caused by external disasters are addressed through other operational concepts contained within EF

75 http://ag.ca.gov/antitrust/gasoline/index.php

#12. As such, EF #12 provides additional procedures for managing energy emergencies that occur or could occur in the absence of the physical impacts of a disaster, such as an earthquake or flood, or are unrelated to the physical impacts of such a disaster.

The State of California's response to an incident affecting its energy supply and/or infrastructure corresponds to the federal energy emergency policy. The federal energy emergency policy is to ensure the nation has an adequate supply of energy at a reasonable cost. In support of this policy, California has developed a set of emergency response protocols to respond to energy disruptions, including energy market fluctuations, transportation fuels shortages, or disaster-level power and petroleum emergencies potentially caused by faulty infrastructure, natural hazards, or criminal events such as terrorism. Those protocols are included or referred to in this *EERP.*

Energy emergencies occur in various forms, from blackouts to pipeline explosions to petroleum shortages. The nature of state response depends on what is needed to avoid, or end, the emergency. The way in which the state organizes itself to respond to an emergency can vary with the emergency. When an emergency occurs, the Energy Commission and other state agencies determine the best way to organize their response. Small "emergencies" happen frequently, and energy companies respond without government assistance. The more severe an emergency, the more likely it is that local, state, or federal government action will be required.

When an energy supply service disruption is caused by infrastructure damage as part of a larger disaster like an earthquake, disaster response efforts are coordinated through the state OES' State Operations Center (SOC). Under most scenarios OES directs and coordinates state response. State response is then implemented under the SEP. The Energy Commission responds along with other state agencies in support of the SEP, including providing an energy policy coordinator to respond to the State Operations Center. If there is a disaster-associated energy shortage, Energy Commission-designated staff assists OES by liaising with affected energy companies. Disaster assistance by the Energy Commission typically amounts to monitoring and sharing information. Each emergency is different, and energy problems are identified, prioritized, and resolved.

This effort will include emergency response and restoration support, as well as mutual assistance in both statewide and interstate utility agreements. The OES, in coordination with the CUEA, has established partnerships with the private sector. These partnerships include memoranda of understanding (MOUs) and task forces (TFs), but each is established to ensure that local, state, and, if necessary, federal efforts ease the repair efforts of the private sector and ensure a coordinated effort that leads to the rapid and effective restoration of utility services.

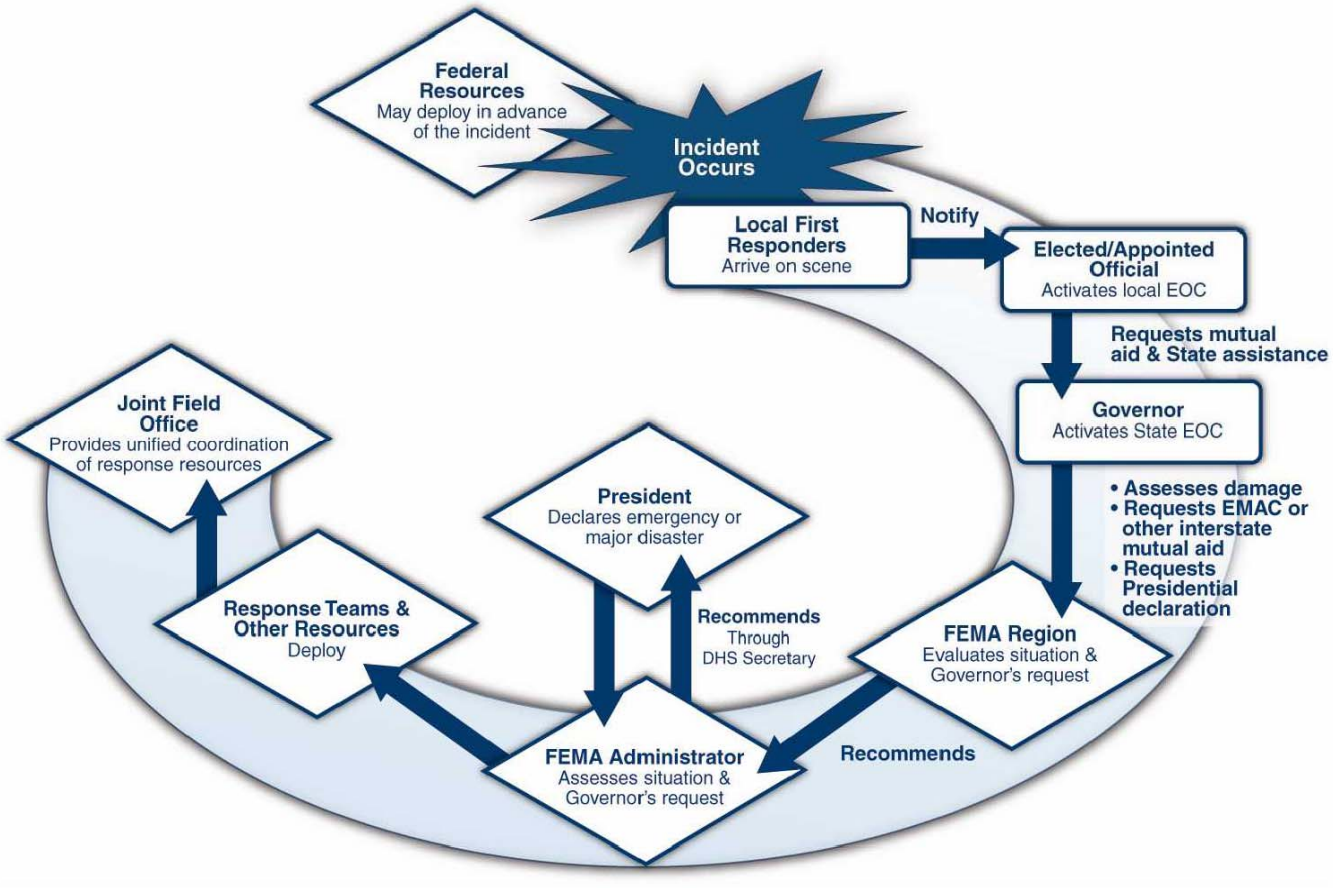
Key to the successful execution of incident response is the establishment of task forces to carry out missions to repair and restore critical systems that support emergency restoration operations and services. The task forces identify critical infrastructure nodes and potential points of failure based on analysis and modeling, as well as private sector

utility shortfalls and requirements and state (and if necessary, federal government) organizations and assets that can fill private sector shortfalls. Private sector utility companies immediately execute emergency action plans and mutual aid in accordance with their operating procedures as the task forces immediately stand up and coordinate staging of preidentified resources.

The task forces will work with state and, if necessary, federal support assets at designated staging areas and establish base camps before conducting repair operations. Operations are sustained throughout the entire response phase via these staging areas and established base camps until they can be relieved by normal commercial logistic contractors or vendors.

Should disruption of production, transportation, or distribution of energy supplies cause a nationwide energy shortage through war, civil unrest, acts of terrorism, or political decisions that may be of long duration, they will be considered as incidents of national significance, and the state will integrate its activities, as required, with Federal Essential Support Function (ESF) #12 – Energy Annex of the National Response Framework (NRF). Figure 22 shows how the federal integration will occur.

Figure 21: Federal Emergency Response Integration



Source: Aanko Technologies Inc.

In the most severe disasters, the federal government steps in to assist the state and OES liaisons with the Federal Emergency Management Agency (FEMA), while the Energy Commission liaisons with the U.S. Department of Energy (DOE). It is possible that a disaster can lead to a serious energy supply emergency. In situations where an energy emergency is a component of a disaster, the Natural Resources Agency is the lead with Energy Commission support. All operations are conducted in compliance with the State of California's Standardized Emergency Management System (SEMS) and the National Incident Management System (NIMS).

When necessary, DOE also may deploy response staff to disaster sites. DOE is the lead agency directing the Federal Emergency Support Function-12 (ESF-12, Energy Sector Specific), which helps restore energy systems and provides an initial point-of-contact for the activation and deployment of DOE resources. These activities are performed pursuant to the Stafford Act and Homeland Security Presidential Directive HSPD-5 (Management of Domestic Incidents) and the NRF.

APPENDIX C:
Energy Emergency Response Programs

In addition to the coordination, management, and reporting functions described in the four phases of energy emergencies in Chapter 1 of this plan, three other emergency response programs may be implemented during an emergency fuel disruption:

- Petroleum Fuels Set-Aside
- Demand Reduction
- Economic Assistance

A fuel disruption is the result of an imbalance between the amount of fuel available and the demand for that fuel at the prevailing price. It may be the result of either 1) a rapid drop in fuel supply due to international disturbances, natural disasters, refining or pipeline problems, terrorist activity, or even labor disputes; or, 2) a sudden increase in demand caused by, for example, unseasonable weather conditions. The disturbance can be a short-term occurrence caused by transitory events, or, it can be of longer term, demanding changes in fuel use priorities.

The increase in the price of fuel that usually accompanies a disruption tends to establish new supply/demand equilibrium at the higher price. History has demonstrated that people adjust their behavior and reduce fuel consumption during fuel shortages, whether because of price increases or the difficulty and inconvenience of obtaining fuel. Thus, a fuel shortage is essentially a transition from one stable state to another.

While the fundamental objective is to provide specific authority and procedures to appropriate personnel during a fuel disruption to protect the interests and safety of California, a corollary purpose is to make the transition to a stable market as quickly as possible and to eliminate additional emergencies that could occur during the transition.

Information is needed to estimate the extent to which refiners may need to shift supplies if any given source of crude oil is disrupted. A visual representation of average unleaded fuel prices by county can be found on the Web.[76] This information is very useful in the event the state petroleum set-aside program is implemented. Use of set-aside fuel and allocation processes are established in the *California Emergency Plan* and further delineated in the Energy Commission report *Petroleum Fuels Set-Aside Program*.[77]

---

76 http://www.gasbuddy.com/gb_gastemperaturemap.aspx

77 http://www.energy.ca.gov/2007publications/CEC-600-2007-010/CEC-600-2007-010.PDF

If the formal Petroleum Fuels Set-Aside Program is implemented, data will be obtained from petroleum refiners, terminal operators, and major marketers to better determine the availability of transportation fuels for use in this program. The specific management of the Fuels Set-Aside Program is located in the Energy Commission's Fuels and Transportation Division and is the responsibility of the Fuels Allocation Officer. The program is designed to work in conjunction with the *State of California Emergency Plan,* as developed and implemented by OES.

Petroleum Fuels Set-Aside Program

California's petroleum fuels set-aside program assists emergency and essential service personnel who are unable to acquire sufficient volumes of fuel at any price during an emergency. The state's set-aside program is designed to interfere minimally with the market, using volumes of fuel sufficient to satisfy only emergency and essential services. All fuel delivered through the program will be purchased at the market price and, whenever possible, through the usual fuel supplier. Additional details on this program as well as instructions and forms are available in the *California Petroleum Fuels Set-Aside Program Applicant Handbook*.[78]

There are two components to this program: informal and formal.

Informal Set-Aside Process

The informal fuel set-aside process is used generally during a localized event when fuel needs to be redirected immediately to one or two areas for a particular use, normally directly related to an emergency support function. The informal process does not require a declaration of emergency and is based on the voluntary cooperation of the oil companies to meet short-term fuel needs of emergency responders or essential services.

In summary, the objectives of this program are:

- To provide a quick, unified, and consistent statewide response to each fuel disruption.
- To provide specific authority and procedures to appropriate personnel to protect the interests and safety of California residents.
- To provide direction and assistance to the Energy Commission during any fuel disruption.
- To provide direction and assistance to state agencies during any fuel disruption.
- To foster clear communication relating to fuel disruptions between state and local government, industry, and residents before and/or during a fuel disruption.
- To encourage and facilitate changes in travel patterns and conservation of resources before, during, or as a result of a fuel disruption.

78 http://www.energy.ca.gov/emergencies/setaside.html.

- To minimize adverse impacts on public health, safety, mobility, commerce, and the state's economy.

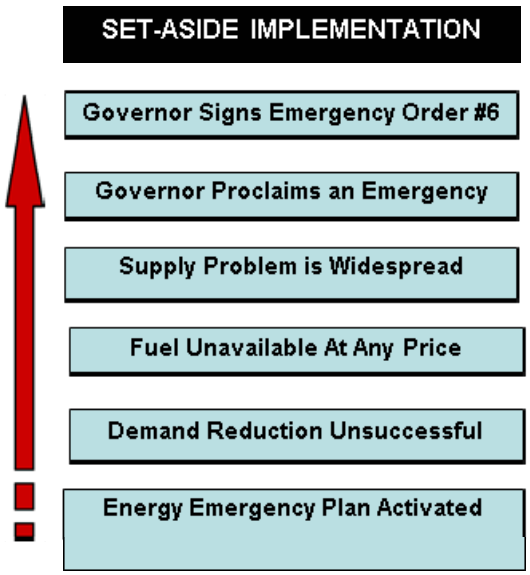
Once a request is received and analyzed, an informal phone call request from the Energy Commission to the appropriate fuel supplier will set the delivery process in motion. This program can also be very effective during nondisaster-related events because action can be taken quickly to help prevent a more widespread problem and thereby help prevent the public from overreacting to a perceived fuel shortage.

Formal Set-Aside Process

During a more prolonged and widespread shortage, such as an embargo or catastrophic earthquake, the informal program may not be sufficient to respond to the number of requests for fuel.

If market forces and voluntary demand reduction are unable to provide for adequate and equitable fuel distribution, the Governor may proclaim a state of emergency and sign Emergency Order #6 to implement the Petroleum Fuels Set-Aside Program. (See Figure 22.)

Figure 22: Set-Aside Implementation Process



Source: California Energy Commission

Emergency Order #6 is one in a set of preexisting orders prepared by the California Emergency Council. The council advises the Governor in times of emergency and recommends specific orders and regulations relative to emergency response for the state.

In a moderate shortage situation, the need for a method to alleviate the long lines at retail service stations may arise. To avoid the hardship and inconvenience to the motoring public, and to assure the equitable distribution of gasoline to all potential users, the

Governor, through an emergency declaration, may authorize other specific, short-term measures. Other strategies for petroleum fuels response may include:

- Incident petroleum supply enhancement strategies.
- Plans for resupply of gas stations on evacuation routes.
- Statewide liquid fuels status assessment.
- Fuel allocation to distributors.
- Fuel contingency planning staff operations.
- Transportation fuel needs assessment of emergency responders during a major energy disruption event, including consideration of designating a petroleum refinery as an emergency supply location, facility fueling equipment requirements (pumps, backup power generation, tanker truck fleet, and other infrastructure) and security services.
- Waiver of driver hours and load restrictions measure.

Demand Reduction Program

As described in Chapter 1, the state uses a phased approach to managing energy emergencies. During the early stages, government's role is monitoring and exchanging information, rather than direct intervention. If an emergency worsens, however, it may be necessary to recommend a set of voluntary and mandatory demand-reduction programs to the Governor.

Technical specialists for the appropriate energy sector (electricity, natural gas, petroleum) will determine the most appropriate mitigation and demand-reduction strategies to be recommended. All program recommendations must be coordinated with other appropriate state and local agencies.

For example, possible measures that may be recommended during a transportation fuel emergency include increased use of rideshare programs, public transit services, and bicycles, as well as encouraging flexible work schedules and telecommuting.

Economic Assistance Program

While it is hoped that market forces will help balance supply and demand, this strategy generally results in higher energy costs. Escalating energy prices, in turn, result in a disproportionate economic impact on lower-income households.

The Energy Commission does not manage or coordinate economic assistance programs. During an energy emergency, the Energy Commission provides:

- Public information about economic assistance programs.
- Referrals to the California Department of Community Services and Development [www.csd.ca.gov].

Federal funding for these and other economic assistance programs comes through annual budget appropriations, such as the Community Development Block Grant program. These appropriations may fluctuate annually and affect the availability of a particular economic assistance program accordingly. The Department of Community Services and Development coordinates:

Low-Income Home Energy Assistance Program (LIHEAP)

- Assists low-income households with payments of home energy bills.
- Discourages the use of unsafe heating methods, such as fireplaces, stoves, poorly vented portable heaters, and barbecues.
- Reduces the risk of carbon monoxide poisoning.

Energy Crisis Intervention Program (ECIP)

Provides assistance to low-income households in the following crisis situations:

- Household has received a 24-48 hour disconnect notice.
- Household has received a service termination notice by its utility company.
- An energy-related crisis or life-threatening situation exists within the applicant's household.

Energy Low-Income Weatherization Assistance Program

- The goal of this program is to provide installation of weatherization measures that increase the energy efficiency of low-income housing.
- It provides funding for weather stripping, insulation, caulking, water heater blankets, refrigerator replacement, heating/cooling system repairs, and compact fluorescent lamps.

APPENDIX D:
State Energy Profile

To maintain this energy assurance plan as a "living document," California's energy profile is provided in a separate report, the *Integrated Energy Policy Report.* Public Resources Code Section 25302 requires the Energy Commission to prepare an integrated energy policy report every two years (starting in November 2003) that provides an overview of major energy issues and trends facing California.

The report makes energy policy recommendations based on Energy Commission assessments and forecasts that are intended to conserve resources, protect the environment, provide reliable energy, enhance the state's economy, and protect public health and safety. The Energy Commission prepares an update in alternate years that may include updates on analyses conducted in support of the biennial *IEPR* or discuss new energy issues that may have arisen. The current report is the *2013 Integrated Energy Policy Report*, Publication Number: CEC-100-2013-001-LCF.[79]

79 http://www.energy.ca.gov/2013_energypolicy/index.html.

APPENDIX E:
Glossary

List of Acronyms

Acronym/Abbreviation	Original Term
ARB	California Air Resources Board
California ISO	California Independent System Operator
Cal/EPA	California Environmental Protection Agency
CPUC	California Public Utilities Commission
CUEA	California Utilities Emergency Association
DFG	California Department of Fish and Game
DOE	Department of Energy (United States)
DWR	California Department of Water Resources
EEMC	Energy Emergency Management Center
EIS	Environmental impact statement
Energy Commission	California Energy Commission
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GHGs	Greenhouse gases
GW/GWh	Gigawatt/gigawatt-hour
IEPR	*Integrated Energy Policy Report*
IS	Independent study
LNG	Liquefied natural gas, liquefied petroleum gas
LADWP	Los Angeles Department of Water and Power
MW/MWh	Megawatt/megawatt-hour
NRC	Nuclear Regulatory Commission
NASEO	National Association of State Energy Officials
NARUC	National Association of Regulatory Utility Commissioners
OES	California Office of Emergency Services
OPEC	Organization of Petroleum Exporting Countries
PG&E	Pacific Gas and Electric Company
RPS	Renewable Portfolio Standard
SCE	Southern California Edison Company
SDG&E	San Diego Gas & Electric Company
SEP	*State Emergency Plan*
SMUD	Sacramento Municipal Utility District
SOC	State Operations Center
SoCal Gas	Southern California Gas Company
WECC	Western Electric Coordinating Council

Definitions

Actual peak reduction: The actual reduction in annual peak load (measured in kilowatts) achieved by customers that participate in a utility demand-side management (DSM) program. It reflects the changes in the demand for electricity resulting from a utility DSM program that is in effect at the same time the utility experiences its annual peak load, as opposed to the installed peak load reduction capability (that is, potential peak reduction). It should account for the regular cycling of energy-efficient units during the period of annual peak load.

Adjusted electricity: A measurement of electricity that includes the approximate amount of energy used to generate electricity. To approximate the adjusted amount of electricity, the site value of the electricity is multiplied by a factor of 3. This conversion factor of 3 is a rough approximation of the Btu value of raw fuels used to generate electricity in a steam-generation power plant.

Alternative fuel: Alternative fuels, for transportation applications, include:

- Methanol.
- Denatured ethanol, and other alcohols.
- Fuel mixtures containing 85 percent or more by volume of methanol, denatured ethanol, and other alcohols with gasoline or other fuels − natural gas.
- Liquefied petroleum gas (propane).
- Hydrogen.
- Coal-derived transportation fuels.
- Fuels (other than alcohol) derived from biological materials (biofuels such as soy diesel fuel).
- Electricity (including electricity from solar energy).

The term "alternative fuel" does not include alcohol or other blended portions of primarily petroleum-based fuels used as oxygenates or extenders, that is, MTBE, ETBE, other ethers, and the 10-percent-ethanol portion of gasohol.

Alternative-fuel vehicle (AFV): A vehicle designed to operate on an alternative fuel (for example, compressed natural gas, methane blend, electricity). The vehicle could be either a dedicated vehicle designed to operate exclusively on alternative fuel or a nondedicated vehicle designed to operate on alternative fuel and/or a traditional fuel.

Alternative fuel vehicle converter: An organization (including companies, government agencies, and utilities) or individual that performs conversions involving alternative fuel vehicles. An AFV converter can convert (1) conventionally fueled vehicles to AFVs, (2) AFVs to conventionally fueled vehicles, or (3) AFVs to use another alternative fuel.

Aviation gasoline (finished): A complex mixture of relatively volatile hydrocarbons, with or without small quantities of additives, blended to form a fuel suitable for use in aviation reciprocating engines. Fuel specifications are provided in ASTM Specification D 910 and Military Specification MIL-G-5572. *Note:* Data on blending components are not counted in data on finished aviation gasoline.

Aviation gasoline blending components: Components that will be used for blending or compounding into finished aviation gasoline (for example, straight run gasoline, alkylate, reformate, benzene, toluene, and xylene). Excludes oxygenates (alcohols, ethers), butane, and pentanes plus. Oxygenates are reported as other hydrocarbons, hydrogen, and oxygenates.

Backup fuel: In a central heat pump system, the fuel used in the furnace that takes over the space heating when the outdoor temperature drops below the temperature that is feasible to operate a heat pump.

Backup generator: A generator that is used only for test purposes, or in the event of an emergency, such as a shortage of power needed to meet customer load requirements.

Backup power: Electric energy supplied by a utility to replace power and energy lost during an unscheduled equipment outage.

Barrel: A unit of volume equal to 42 U.S. gallons.

Base load: The minimum amount of electric power delivered or required over a given period at a steady rate.

Baseload capacity: The generating equipment normally operated to serve loads on an around-the-clock basis.

Baseload plant: A plant, usually housing high-efficiency steam-electric units, that is normally operated to take all or part of the minimum load of a system, and that consequently produces electricity at an essentially constant rate and runs continuously. These units are operated to maximize system mechanical and thermal efficiency and minimize system operating costs.

Base period: The period for which data used as the base of an index number, or other ratio, have been collected. This period is frequently one of a year, but it may be as short as one day or as long as the average of a group of years. The length of the base period is governed by the nature of the material under review, the purpose for which the index number (or ratio) is being compiled, and the desire to use a period as free as possible from abnormal influences to avoid bias.

Base rate: A fixed kilowatt hour charge for electricity consumed that is independent of other charges and/or adjustments.

Biodiesel: Any liquid biofuel suitable as a diesel fuel substitute or diesel fuel additive or extender. Biodiesel fuels are typically made from oils such as soybeans, rapeseed, or sunflowers, or from animal tallow. Biodiesel can also be made from hydrocarbons

derived from agricultural products such as rice hulls.

Biofuels: Liquid fuels and blending components produced from biomass (plant) feedstocks, used primarily for transportation.

Biomass: Organic nonfossil material of biological origin constituting a renewable energy source.

Biomass gas: A medium Btu gas containing methane and carbon dioxide, resulting from the action of microorganisms on organic materials, such as a landfill.

Bitumen: A naturally occurring viscous mixture, mainly of hydrocarbons heavier than pentane, that may contain sulfur compounds and that, in a natural occurring viscous state, is not recoverable at a commercial rate through a well.

Bituminous coal: A dense coal, usually black, sometimes dark brown, often with well-defined bands of bright and dull material, used primarily as fuel in steam-electric power generation, with substantial quantities also used for heat and power applications in manufacturing and to make coke. Bituminous coal is the most abundant coal in active U.S. mining regions. The moisture content usually is less than 20 percent. The heat content of bituminous coal ranges from 21 million to 30 million Btu per ton on a moist, mineral-matter-free basis. The heat content of bituminous coal consumed in the United States averages 24 million Btu per ton, on the as-received basis (in other words, containing both inherent moisture and mineral matter).

Blending plant: A facility that has no refining capability but is capable of either producing finished motor gasoline through mechanical blending or blending oxygenates with motor gasoline.

Bonded petroleum imports: Petroleum imported and entered into Customs bonded storage. These imports are not included in the import statistics until they are (1) withdrawn from storage free of duty for use as fuel for vessels and aircraft engaged in international trade; or (2) withdrawn from storage with duty paid for domestic use.

Borderline customer: A customer located in the service area of one utility but supplied by a neighboring utility through an arrangement between the utilities.

Bottled gas, LPG, or propane: Any fuel gas supplied to a building in liquid form, such as liquefied petroleum gas, propane, or butane. It is usually delivered by tank truck and stored near the building in a tank or cylinder until used.

Branded product: A refined petroleum product sold by a refiner with the understanding that the purchaser has the right to resell the product under a trademark, trade name, service mark, or other identifying symbol or names owned by such refiner.

British thermal unit (Btu): The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water has its greatest density (about 39 degrees Fahrenheit).

Btu conversion factors: Btu conversion factors for site energy are as follows:

- Electricity 3,412 Btu/kilowatt hour
- Natural Gas 1,031 Btu/cubic foot
- Fuel Oil No.1 135,000 Btu/gallon
- Kerosene 135,000 Btu/gallon
- Fuel Oil No.2 138,690 Btu/gallon
- LPG (Propane) 91,330 Btu/gallon
- Wood 20 million Btu/cord

Btu per cubic foot: A measure of the heat available or released when one cubic foot of gas is burned. (Sometimes called gross heating value or total heating value.)

Bunker fuels: Fuel supplied to ships and aircraft, both domestic and foreign, consisting primarily of residual and distillate fuel oil for ships and kerosene-based jet fuel for aircraft. The term "international bunker fuels" is used to denote the consumption of fuel for international transport activities. Note: For greenhouse gas emissions inventories, data on emissions from combustion of international bunker fuels are subtracted from national emissions totals. Historically, bunker fuels have meant only ship fuel.

Coal: A readily combustible black or brownish-black rock whose composition, including inherent moisture, consists of more than 50 percent by weight and more than 70 percent by volume of carbonaceous material. It is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time.

Compact fluorescent bulbs: These are also known as "screw-in fluorescent replacements for incandescent" or "screw-ins." Compact fluorescent bulbs combine the efficiency of fluorescent lighting with the convenience of a standard incandescent bulb. There are many styles of compact fluorescent, including exit light fixtures and floodlights (lamps containing reflectors). Many screw into a standard light socket, and most produce a similar color of light as a standard incandescent bulb. Compact fluorescent bulbs come with ballasts that are electronic (lightweight, instant, no-flicker starting, and 10 to 15 percent more efficient) or magnetic (much heavier and slower starting). Other types of compact fluorescent bulbs include adaptive circulation and PL and SL lamps and ballasts. Compact fluorescent bulbs are designed for home uses they are also used in table lamps, wall sconces, and hall and ceiling fixtures of hotels, motels, hospitals, and other types of commercial buildings with residential-type applications.

Cooling degree-days: A measure of how warm a location is over a time frame relative to a base temperature, most commonly specified as 65 degrees Fahrenheit. The measure is computed for each day by subtracting the base temperature (65 degrees) from the average of the day's high and low temperatures, with negative values set equal to zero. Each day's cooling degree-days are summed to create a cooling degree-day measure for a specified reference period. Cooling degree-days are used in energy analysis as an indicator of air conditioning energy requirements or use.

Crude oil: A mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Depending upon the characteristics of the crude stream, it may also include:

- Small amounts of hydrocarbons that exist in gaseous phase in natural underground reservoirs but are liquid at atmospheric pressure after being recovered from oil well (casing head) gas in lease separators and are subsequently commingled with the crude stream without being separately measured. Lease condensate recovered as a liquid from natural gas wells in lease or field separation facilities and later mixed into the crude stream is also included; small amounts of nonhydrocarbons produced with the oil, such as sulfur and various metals.
- Drip gases and liquid hydrocarbons produced from tar sands, oil sands, gilsonite, and oil shale.

Liquids produced at natural gas processing plants are excluded. Crude oil is refined to produce a wide array of petroleum products, including heating oils; gasoline, diesel and jet fuels; lubricants; asphalt; ethane, propane, and butane; and many other products used for their energy or chemical content.

Crude oil production: The volume of crude oil produced from oil reservoirs during given periods. The amount of such production for a given period is measured as volumes delivered from lease storage tanks (that is, the point of custody transfer) to pipelines, trucks, or other media for transport to refineries or terminals with adjustments for (1) net differences between opening and closing lease inventories, and (2) basic sediment and water (BS&W).

Dedicated reserves: The volume of recoverable, salable gas reserves committed to, controlled by, or possessed by the reporting pipeline company and used for acts and services for which both the seller and the company have received certificate authorization from the Federal Energy Regulatory Commission (FERC). Reserves include both company-owned reserves (including owned gas in underground storage), reserves under contract from independent producers, and short-term and emergency supplies from the intrastate market. Gas volumes under contract from other interstate pipelines are not included as reserves but may constitute part or all of a company's gas supply.

Deliverability: Represents the number of future years during which a pipeline company can meet its annual requirements for its presently certificated delivery capacity from presently committed sources of supply. The availability of gas from these sources of supply shall be governed by the physical capabilities of these sources to deliver gas by the terms of existing gas-purchase contracts, and by limitations imposed by state or federal regulatory agencies.

Delivered cost: The cost of fuel, including the invoice price of fuel, transportation

charges, taxes, commissions, insurance, and expenses associated with leased or owned equipment used to transport the fuel.

Delivered energy: The amount of energy delivered to the site (building); no adjustment is made for the fuels consumed to produce electricity or district sources. This is also referred to as *net energy*.

Delivered (gas): The physical transfer of natural, synthetic, and/or supplemental gas from facilities operated by the responding company to facilities operated by others or to consumers.

Deliveries (electric): Energy generated by one system and delivered to another system through one or more transmission lines.

Demonstrated resources: Same qualifications as identified resources but include measured and indicated degrees of geologic assurance and excludes the inferred.

Diesel-electric plant: A generating station that uses diesel engines to drive its electric generators.

Diesel fuel: A fuel composed of distillates obtained in petroleum refining operation or blends of such distillates with residual oil used in motor vehicles. The boiling point and specific gravity are higher for diesel fuels than for gasoline.

EIA: The Energy Information Administration. An independent agency within the U.S. Department of Energy that develops surveys, collects energy data, and analyzes and models energy issues. The agency must meet the requests of Congress, other elements within the Department of Energy, Federal Energy Regulatory Commission, the Executive Branch, and its own independent needs and assist the public or other interest groups without taking a policy position. See more information about EIA at http://www.eia.doe.gov/neic/aboutEIA

Electric generation industry: Stationary and mobile generating units that are connected to the electric power grid and can generate electricity. The electric generation industry includes the "electric power sector" (utility generators and independent power producers) and industrial and commercial power generators, including combined-heat-and power producers, but excludes units at single-family homes.

Electric generator: A facility that produces only electricity, commonly expressed in kilowatt hours (kWh) or megawatt hours (MWh). Electric generators include electric utilities and independent power producers.

Electric hybrid vehicle: An electric vehicle that either (1) operates solely on electricity, but contains an internal combustion motor that generates additional electricity (series hybrid); or (2) contains an electric system and an internal combustion system and is capable of operating on either system (parallel hybrid).

Electric industry reregulation: The design and implementation of regulatory practices to be applied to the remaining traditional utilities after the electric power industry has been restructured. Reregulation applies to those entities that continue to exhibit characteristics

of a natural monopoly. Reregulation could employ the same or different regulatory practices as those used before restructuring.

Electric industry restructuring: The process of replacing a monopolistic system of electric utility suppliers with competing sellers, allowing retail customers to choose their supplier but still receive delivery over the power lines of the local utility. It includes the reconfiguration of vertically integrated electric utilities.

Electric motor vehicle: A motor vehicle powered by an electric motor that draws current from rechargeable storage batteries, fuel cells, photovoltaic arrays, or other sources of electric current.

Electric power: The rate at which electric energy is transferred. Electric power is measured by capacity and is commonly expressed in megawatts (MW).

Electric power grid: A system of synchronized power providers and consumers connected by transmission and distribution lines and operated by one or more control centers. In the continental United States, the electric power grid consists of three systems: the Eastern Interconnect, the Western Interconnect, and the Texas Interconnect. In Alaska and Hawaii, several systems encompass areas smaller than the state (for example, the interconnect serving Anchorage, Fairbanks, and the Kenai Peninsula; individual islands).

Electric power plant: A station containing prime movers, electric generators, and auxiliary equipment for converting mechanical, chemical, and/or fission energy into electric energy.

Electric power sector: An energy-consuming sector that consists of electricity only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public, for example, North American Industry Classification System 22 plants.

Electric power system: An electric power entity − a company; an electric cooperative; a public electric supply corporation as the Tennessee Valley Authority; a similar federal department or agency such as the Bonneville Power Administration; the Bureau of Reclamation or the Corps of Engineers; a municipally owned electric department offering service to the public; or an electric public utility district (a "PUD"); also a jointly owned electric supply project such as the Keystone.

Emergency: The failure of an electric power system to generate or deliver electric power as normally intended, resulting in the cutoff or curtailment of service.

Emergency backup generation: The use of electric generators only during interruptions of normal power supply.

Emergency energy: Electric energy provided for a limited duration, intended for use only during emergency conditions.

Energy reserves: Estimated quantities of energy sources that are demonstrated to exist with reasonable certainty on the basis of geologic and engineering data (proved reserves) or that can reasonably be expected to exist on the basis of geologic evidence that supports

projections from proved reserves (probable/indicated reserves). Knowledge of the location, quantity, and grade of probable/indicated reserves is generally incomplete or much less certain than it is for proved energy reserves. *Note:* This term is equivalent to "Demonstrated Reserves" as defined in the resource/reserve classification contained in the U.S. Geological Survey Circular 831, 1980. Demonstrated reserves include measured and indicated reserves but exclude inferred reserves.

Energy service provider: An energy entity that provides service to a retail or end-use customer.

Energy source: Any substance or natural phenomenon that can be consumed or transformed to supply heat or power. Examples include petroleum, coal, natural gas, nuclear, biomass, electricity, wind, sunlight, geothermal, water movement, and hydrogen in fuel cells.

Energy supply: Energy made available for future disposition. Supply can be considered and measured from the point of view of the energy provider or the receiver.

Energy supplier: Fuel companies supplying electricity, natural gas, fuel oil, kerosene, or LPG (liquefied petroleum gas) to the household.

Federal Energy Regulatory Commission (FERC): The federal agency with jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas pricing, oil pipeline rates, and gas pipeline certification. FERC is an independent regulatory agency within the U.S. Department of Energy and is the successor to the Federal Power Commission.

Fluorescent lamp: A glass enclosure in which light is produced when electricity is passed through mercury vapor inside the enclosure. The electricity creates a radiation discharge that strikes a coating on the inside surface of the enclosure, causing the coating to glow. *Note:* Traditional fluorescent lamps are usually straight or circular white glass tubes used in fixtures specially designed for them. A newer type of fluorescent lamp, the compact fluorescent lamp, and takes up much less room, comes in many different-shaped configurations, and is designed to be used in some fixtures originally intended to house incandescent lamps.

Fluorescent light bulbs: These are usually long, narrow, white tubes made of glass coated on the inside with fluorescent material, which is connected to a fixture at both ends of the light bulb; some are circular tubes. The light bulb produces light by passing electricity through mercury vapor, which causes the fluorescent coating to glow or fluoresce.

Fossil fuel: An energy source formed in the earth's crust from decayed organic material. The common fossil fuels are petroleum, coal, and natural gas.

Fuel: Any material substance that can be consumed to supply heat or power. Included are petroleum, coal, and natural gas (the fossil fuels), and other consumable materials, such as uranium, biomass, and hydrogen.

Fuel cell: A device capable of generating an electrical current by converting the chemical energy of a fuel directly into electrical energy. Fuel cells differ from conventional electrical cells in that the active materials such as fuel and oxygen are not contained within the cell but are supplied from outside. It does not contain an intermediate heat cycle, as do most other electrical generation techniques.

Fuel cycle: The entire set of sequential processes or stages involved in the use of fuel, including extraction, transformation, transportation, and combustion. Emissions generally occur at each stage of the fuel cycle.

Fuel emergencies: An emergency that exists when supplies of fuels or hydroelectric storage for generation are at a level or estimated to be at a level that would threaten the reliability or adequacy of bulk electric power supply. The following factors should be taken into account to determine that a fuel emergency exists: Fuel stock or hydroelectric project water storage levels are 50 percent or less of normal for that particular time of the year, and a continued downward trend in fuel stock or hydroelectric project water storage level is estimated; or unscheduled dispatch of emergency generation is causing an abnormal use of a particular fuel type, such that the future supply of stocks of that fuel could reach a level that threatens the reliability or adequacy of bulk electric power supply.

Fuel switching capability: The short-term capability of a manufacturing establishment to have used substitute energy sources in place of those actually consumed. Capability to use substitute energy sources means that the establishment's combustors (for example, boilers, furnaces, ovens, and blast furnaces) had the machinery or equipment either in place or available for installation so that substitutions could actually have been introduced within 30 days without extensive modifications. Fuel-switching capability does not depend on the relative prices of energy sources; it depends only on the characteristics of the equipment and certain legal constraints.

Gas plant operator: Any firm, including a gas plant owner, that operates a gas plant and keeps the gas plant records. A gas plant is a facility in which natural gas liquids are separated from natural gas or in which natural gas liquids are divided into natural gas liquid products or both.

Gas processing unit: A facility designed to recover natural gas liquids from a stream of natural gas that may or may not have passed through lease separators and/or field separation facilities. Another function of natural gas processing plants is to control the quality of the processed natural gas stream. Cycling plants are considered natural gas processing plants.

Gate station: Location where the pressure of natural gas being transferred from the transmission system to the distribution system is lowered for transport through small-diameter, low-pressure pipelines.

Generating facility: An existing or planned location or site at which electricity is or will be produced.

Generating station: A station that consists of electric generators and auxiliary equipment for converting mechanical, chemical, or nuclear energy into electric energy.

Generating unit: Any combination of physically connected generators, reactors, boilers, combustion turbines, and other prime movers operated together to produce electric power.

Generation: The process of producing electric energy by transforming other forms of energy; also, the amount of electric energy produced, expressed in kilowatt hours.

Generation company: An entity that owns or operates generating plants. The generation company may own the generation plants or interact with the short-term market on behalf of plant owners.

Generator capacity: The maximum output, commonly expressed in megawatts (MW), that generating equipment can supply to system load, adjusted for ambient conditions.

Geothermal energy: Hot water or steam extracted from geothermal reservoirs in the earth's crust. Water or steam extracted from geothermal reservoirs can be used for geothermal heat pumps, water heating, or electricity generation.

Geothermal plant: A plant in which the prime mover is a steam turbine. The turbine is driven either by steam produced from hot water or by natural steam that derives its energy from heat found in rock

Independent power producer: A corporation, person, agency, authority, or other legal entity or instrumentality that owns or operates facilities for the generation of electricity for use primarily by the public, and that is not an **electric utility**.

Independent system operator (ISO): An independent, federally regulated entity established to coordinate regional transmission in a nondiscriminatory manner and ensure the safety and reliability of the electric system.

Interruptible load: This demand-side management category represents the consumer load that, in accordance with contractual arrangements, can be interrupted at the time of annual peak load by the action of the consumer at the direct request of the system operator. This type of control usually involves large-volume commercial and industrial consumers. Interruptible load does not include direct load control.

Interruptible or curtailable rate: A special electricity or natural gas arrangement under which, in return for lower rates, the customer must either reduce energy demand on short notice or allow the electric or natural gas utility to temporarily cut off the energy supply for the utility to maintain service for higher priority users. This interruption or reduction in demand typically occurs during periods of high demand for the energy (summer for electricity and winter for natural gas).

Interruptible power: Power and usually the associated energy made available by one utility to another. This transaction is subject to curtailment or cessation of delivery by the supplier in accordance with a prior agreement with the other party or under specified conditions.

Interstate companies: Natural gas pipeline companies subject to Federal Energy Regulatory Commission (FERC) jurisdiction.

Interstate pipeline: Any pipeline engaged in natural gas transportation subject to the jurisdiction of Federal Energy Regulatory Commission (FERC) under the Natural Gas Act.

Islanding: Refers to the condition of a distributed generation (DG) generator continuing to power a location even though power from the electric utility is no longer present.

Jet fuel: A refined petroleum product used in jet aircraft engines. It includes kerosene-type jet fuel and naphtha-type jet fuel.

Kilovolt-ampere (kVa): A unit of apparent power, equal to 1,000 volt-amperes; the mathematical product of the volts and amperes in an electrical circuit.

Kilowatt (kW): One thousand watts.

Kilowatt hour (kWh): A measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu.

Load (electric): The amount of electric power delivered or required at any specific point or points on a system. The requirement originates at the energy-consuming equipment of the consumers.

Load control program: A program in which the utility company offers a lower rate in return for having permission to turn off the air conditioner or water heater for short periods by remote control. This control allows the utility to reduce peak demand.

Local distribution company (LDC): A legal entity engaged primarily in the retail sale and/or delivery of natural gas through a distribution system that includes mainlines (that is, pipelines designed to carry large volumes of gas, usually located under roads or other major rights-of-way) and laterals (that is, pipelines of smaller diameter that connect the end user to the mainline). Since the restructuring of the gas industry, the sale of gas and/or delivery arrangements may be handled by other agents, such as producers, brokers, and marketers that are referred to as "non-LDC."

Mains: A system of pipes for transporting gas within a distributing gas utility's retail service area to points of connection with consumer service pipes.

Megawatt (MW): One million watts of electricity.

Megawatt electric (MWe): One million watts of electric capacity.

Megawatt hour (MWh): One thousand kilowatt-hours or 1 million watt-hours.

National Association of Regulatory Utility Commissioners (NARUC): An affiliation of the public service commissioners to promote the uniform treatment of members of the railroad, public utilities, and public service commissions of the 50 states, the District of Columbia, the Commonwealth of Puerto Rico, and the territory of the Virgin Islands.

Natural gas: A gaseous mixture of hydrocarbon compounds.

Natural gas field facility: A field facility designed to process natural gas produced from more than one lease for recovering condensate from a stream of natural gas; however, some field facilities are designed to recover propane, normal butane, pentanes plus, and other gases, and to control the quality of natural gas to be marketed.

Natural gas liquids (NGL): Those hydrocarbons in natural gas that are separated from the gas as liquids through absorption, condensation, adsorption, or other methods in gas processing or cycling plants. Generally such liquids consist of propane and heavier hydrocarbons and are commonly referred to as *lease condensate, natural gasoline*, and *liquefied petroleum gases.*

Natural gas liquids production: The volume of natural gas liquids removed from natural gas in lease separators, field facilities, gas processing plants, or cycling plants during the report year.

Natural gas marketed production: Gross withdrawals of natural gas from production reservoirs, less gas used for reservoir repressuring, nonhydrocarbon gases removed in treating and processing operations, and quantities vented and flared.

Natural gas utility demand-side management (DSM) program sponsor: A DSM (demand-side management) program sponsored by a natural gas utility that suggests ways to increase the energy efficiency of buildings, to reduce energy costs, to change usage patterns, or to promote the use of a different energy source.

Net generation: The amount of gross generation less the electrical energy consumed at the generating station(s) for station service or auxiliaries. *Note*: Electricity required for pumping at pumped-storage plants is regarded as electricity for station service and is deducted from gross generation.

Nonattainment area: Any area that does not meet the national primary or secondary ambient air quality standard established by the U.S. Environmental Protection Agency for designated pollutants, such as carbon monoxide and ozone.

North American Electric Reliability Council (NERC): A council formed in 1968 by the electric utility industry to promote the reliability and adequacy of bulk power supply in the electric utility systems of North America. NERC consists of regional reliability councils and encompasses essentially all the power regions of the contiguous United States, Canada, and Mexico. See the various NERC Regional Reliability Councils here: http://www.nerc.com/regional/

Nuclear electric power (nuclear power): Electricity generated by the use of the thermal energy released from the fission of nuclear fuel in a reactor.

Nuclear fuel: Fissionable materials that have been enriched to such a composition that, when placed in a nuclear reactor, will support a self-sustaining fission chain reaction, producing heat in a controlled manner for process use.

Nuclear reactor: An apparatus in which a nuclear fission chain reaction can be initiated,

controlled, and sustained at a specific rate. A reactor includes fuel (fissionable material), moderating material to control the rate of fission, a heavy-walled pressure vessel to house reactor components, shielding to protect personnel, a system to conduct heat away from the reactor, and instrumentation for monitoring and controlling the systems of the reactor.

OEM: Original equipment manufacturer.

Operable capacity: The amount of capacity that, at the beginning of the period, is in operation; not in operation and not under active repair, but capable of being placed in operation within 30 days; or not in operation but under active repair that can be completed within 90 days. Operable capacity is the sum of the operating and idle capacity and is measured in barrels per calendar day or barrels per stream day.

Operable generators/units: Electric generators or generating units that are available to provide power to the grid or generating units that have been providing power to the grid but are temporarily shut down.

Operating capacity: The component of operable capacity that is in operation at the beginning of the period.

Operating day: A normal business day. Days when a company conducts business due to emergencies or other unexpected events are not included.

Operator, gas plant: The person responsible for the management and day-to-day operation of one or more natural gas processing plants as of December 31 of the report year. The operator is generally a working-interest owner or a company under contract to the working-interest owner(s). Plants shut down during the report year are also to be considered "operated" as of December 31.

Operator, oil and/or gas well: The person responsible for the management and day-to-day operation of one or more crude oil and/or natural gas wells as of December 31 of the report year. The operator is generally a working-interest owner or a company under contract to the working-interest owner(s). Wells included are those that have proved reserves of crude oil, natural gas, and/or lease condensate in the reservoirs associated with them, whether or not they are producing. Wells abandoned during the report year are also to be considered "operated" as of December 31.

Ozone: A molecule made up of three atoms of oxygen. Occurs naturally in the stratosphere and provides a protective layer shielding the Earth from harmful ultraviolet radiation. In the troposphere, it is a chemical oxidant, a greenhouse gas, and a major component of photochemical smog.

Peak day withdrawal: The maximum daily withdrawal rate (Mcf/d) experienced during the reporting period.

Peak demand: The maximum load during a specified period.

Peak kilowatt: One thousand peak watts.

Peak load: The maximum load during a specified period.

Peak load month: The month of greatest plant electrical generation during the winter heating season (October-March) and summer cooling season (April-September), respectively.

Peak load plant: A plant usually housing old, low-efficiency steam units, gas turbines, diesels, or pumped-storage hydroelectric equipment used normally during the peak-load periods.

Peak megawatt: One million peak watts.

Peak watt: A manufacturer's unit indicating the amount of power a photovoltaic cell or module will produce at standard test conditions (normally 1,000 watts per square meter and 25 degrees Celsius).

Peaking capacity: Capacity of generating equipment normally reserved for operation during the hours of highest daily, weekly, or seasonal loads. Some generating equipment may be operated at certain times as peaking capacity and at other times to serve loads around the clock.

Petroleum: A broadly defined class of liquid hydrocarbon mixtures. This class includes crude oil, lease condensate, unfinished oils, refined products obtained from the processing of crude oil, and natural gas plant liquids. *Note:* Volumes of finished petroleum products include nonhydrocarbon compounds, such as additives and detergents, after they have been blended into the products.

Petroleum Administration for Defense District (PADD): A geographic aggregation of the 50 states and the District of Columbia into five districts, with PADD I further split into three subdistricts. The PADDs include the states listed below:

PADD I (East Coast):

PADD IA (New England): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. PADD IB (Central Atlantic): Delaware, District of Columbia, Maryland, New Jersey, New York, and Pennsylvania. PADD IC (Lower Atlantic): Florida, Georgia, North Carolina, South Carolina, Virginia, and West Virginia. PADD II (Midwest): Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, and Wisconsin. PADD III (Gulf Coast): Alabama, Arkansas, Louisiana, Mississippi, New Mexico, and Texas. PADD IV (Rocky Mountain): Colorado, Idaho, Montana, Utah, and Wyoming. PADD V (West Coast): Alaska, Arizona, California, Hawaii, Nevada, Oregon, and Washington

Petroleum imports: Imports of petroleum into the 50 states and the District of Columbia from foreign countries and from Puerto Rico, the Virgin Islands, and other U.S. territories and possessions. Included are imports for the Strategic Petroleum Reserve and withdrawals from bonded warehouses for onshore consumption, offshore bunker use, and military use. Excluded are receipts of foreign petroleum into bonded warehouses

and into U.S. territories and U.S. Foreign Trade Zones.

Petroleum products: Petroleum products are obtained from the processing of crude oil (including lease condensate), natural gas, and other hydrocarbon compounds. Petroleum products include unfinished oils, liquefied petroleum gases, pentanes plus, aviation gasoline, motor gasoline, naphtha-type jet fuel, kerosene-type jet fuel, kerosene, distillate fuel oil, residual fuel oil, petrochemical feedstocks, special naphthas, lubricants, waxes, petroleum coke, asphalt, road oil, still gas, and miscellaneous products.

Petroleum refinery: An installation that manufactures finished petroleum products from crude oil, unfinished oils, natural gas liquids, other hydrocarbons, and alcohol.

Pipeline, distribution: A pipeline that conveys gas from a transmission pipeline to its ultimate consumer.

Pipeline freight: Refers to freight carried through pipelines, including natural gas, crude oil, and petroleum products (excluding water). Energy is consumed by various electrical components of the pipeline, including, valves, other, appurtenances attaches to the pipe, compressor units, metering stations, regulator stations, delivery stations, holders and fabricated assemblies.

Pipeline fuel: Gas consumed in the operation of pipelines, primarily in compressors.

Pipeline, gathering: A pipeline that conveys gas from a production well/field to a gas processing plant or transmission pipeline for eventual delivery to end-use consumers.

Pipeline (natural gas): A continuous pipe conduit, complete with such equipment as valves, compressor stations, communications systems, and meters for transporting natural and/or supplemental gas from one point to another, usually from a point in or beyond the producing field or processing plant to another pipeline or to points of use. Also refers to a company operating such facilities.

Pipeline (petroleum): Crude oil and product pipelines used to transport crude oil and petroleum products, respectively (including interstate, intrastate, and intracompany pipelines), within the 50 states and the District of Columbia.

Pipeline purchases: Gas supply contracted from and volumes purchased from other natural gas companies as defined by the Natural Gas Act, as amended (52 Stat. 821), excluding independent producers, as defined in Paragraph 154.91(a), Chapter I, Title 18 of the Code of Federal Regulations.

Pipeline-quality natural gas: A mixture of hydrocarbon compounds existing in the gaseous phase with sufficient energy content, generally above 900 British thermal units, and a small enough share of impurities for transport through commercial gas pipelines and sale to end users.

Pipeline, transmission: A pipeline that conveys gas from a region where it is produced to a region where it is to be distributed.

Pipelines, rate regulated: FRS (Financial Reporting System Survey) establishes three

pipeline segments: crude/liquid (raw materials), natural gas, and refined products. The pipelines included in these segments are all federally or state rate-regulated pipeline operations, which are included in the reporting company's consolidated financial statements. However, at the reporting company's option, intrastate pipeline operations may be included in the U.S. Refining/Marketing Segment if they would comprise less than 5 percent of U.S. Refining/Marketing Segment net PP&E, revenues, and earnings in the aggregate; and if the inclusion of such pipelines in the consolidated financial statements adds less than $100 million to the net PP&E reported for the U.S. Refining/Marketing Segment.

Potential peak reduction: The potential annual peak load reduction (measured in kilowatts) that can be deployed from direct load control, interruptible load, other load management, and other DSM program activities. (Energy efficiency and load building are not included in potential peak reduction.) It represents the load that can be reduced either by the direct control of the utility system operator or by the consumer in response to a utility request to curtail load. It reflects the installed load reduction capability, as opposed to the actual peak reduction achieved by participants during the time of annual system peak load.

Power (electrical): An electric measurement unit of power called a volt-ampere is equal to the product of 1 volt and 1 ampere. This is equivalent to 1 watt for a direct current system, and a unit of apparent power is separated into real and reactive power. Real power is the work-producing part of apparent power that measures the rate of supply of energy and is denoted as kilowatts (kW). Reactive power is the portion of apparent power that does not work and is referred to as kilovars. This type of power must be supplied to most types of magnetic equipment, such as motors, and is supplied by generator or by electrostatic equipment. Volt-amperes are usually divided by 1,000 and called kilovolt amperes (kVA). Energy is denoted by the product of real power and the length of time used; this product is expressed as *kilowatt hours*.

Propane: A normally gaseous straight-chain hydrocarbon. It is a colorless paraffinic gas that boils at a temperature of -43.67 degrees Fahrenheit. It is extracted from natural gas or refinery gas streams. It includes all products designated in ASTM Specification D1835 and Gas Processors Association Specifications for commercial propane and HD-5 propane.

Public utility: Enterprise providing essential public services, such as electric, gas, telephone, water, and sewer under legally established monopoly conditions.

Public utility district: Municipal corporations organized to provide electric service to both incorporated cities and towns and unincorporated rural areas.

Public Utility Regulatory Policies Act (PURPA) of 1978: One part of the National Energy Act, PURPA contains measures designed to encourage the conservation of energy, more efficient use of resources, and equitable rates. Principal among these were suggested retail rate reforms and new incentives for production of electricity by cogenerators and users of renewable resources. The Federal Energy Regulatory Commission has primary

authority for implementing several key PURPA programs.

Publicly owned electric utility: A class of ownership found in the electric power industry. This group includes those utilities operated by municipalities and state and federal power agencies.

Reserves, net: Includes all proved reserves associated with the company's net working interests.

Reserves changes: Positive and negative revisions, extensions, new reservoir discoveries in old fields, and new field discoveries that occurred during the report year.

Fuel price risk: The risk that the price of the fuel used to generate electricity will exhibit variability, resulting in an uncertain cost to generate electricity.

Fuel supply risk: The risk that the fuel supply to a power plant will be unreliable, resulting in the inability to generate electricity predictably and dependably.

Performance risk: The risk that the seller may not be willing or able to deliver electricity according to the contractually prescribed requirements in terms of time and quantity.

Demand risk: The risk that the electricity that has been contracted for will not be needed as anticipated, or that there will not be enough electricity to meet fluctuating demand.

Environmental risk: The financial risk to which parties to an electricity contract are exposed, stemming from both existing environmental regulations and the uncertainty over possible future regulations.

Regulatory risk: The risk that future laws or regulations, or regulatory review or renegotiation of a contract, will alter the benefits or burdens of an electricity contract to either party.

Scheduled outage: The shutdown of a generating unit, transmission line, or other facility for inspection or maintenance, in accordance with an advance schedule.

Smart grid: A smarter grid applies technologies, tools, and techniques capable of making the grid work far more efficiently. One technology in use is delivering electricity from suppliers to consumers using two-way digital communications.

Spot market (natural gas): A market in which natural gas is bought and sold for immediate or very near-term delivery, usually for a period of 30 days or less. The transaction does not imply a continuing arrangement between the buyer and the seller. A spot market is more likely to develop at a location with numerous pipeline interconnections, thus allowing for a large number of buyers and sellers. The Henry Hub in southern Louisiana is the best known spot market for natural gas.

Stand-alone generator: A power source/generator that operates independently of or is not connected to an electric transmission and distribution network; used to meet a load(s) physically close to the generator.

Standby electricity generation: Involves use of generators during times of high demand on utilities to avoid extra "peak-demand" charges.

Transformer: An electrical device for changing the voltage of alternating current.

Transmission and distribution loss: Electric energy lost due to the transmission and distribution of electricity. Much of the loss is thermal.

Transmission (electric) (noun): The movement or transfer of electric energy over an interconnected group of lines and associated equipment between points of supply and points at which it is transformed for delivery to consumers or is delivered to other electric systems. Transmission is considered to end when the energy is transformed for distribution to the consumer.

Transmission line: A set of conductors, insulators, supporting structures, and associated equipment used to move large quantities of power at high voltage, usually over long distances between a generating or receiving point and major substations or delivery points.

Transmission network: A system of transmission or distribution lines so cross-connected and operated as to permit multiple power supplies to any principal point.

Transmission system (electric): An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers or is delivered to other electric systems.

Transmitting utility: A regulated entity that owns and may construct and maintain wires used to transmit wholesale power. It may or may not handle the power dispatch and coordination functions. It is regulated to provide nondiscriminatory connections, comparable service, and cost recovery. According to the Energy Policy Act of 1992, it includes any electric utility, qualifying cogeneration facility, qualifying small power production facility, or federal power marketing agency that owns or operates electric power transmission facilities that are used for the sale of electric energy at wholesale.

Underground storage: The storage of natural gas in underground reservoirs at a different location from which it was produced.

Vehicle fuel consumption: Vehicle fuel consumption is computed as the vehicle miles traveled divided by the fuel efficiency reported in miles per gallon (MPG). Vehicle fuel consumption is derived from the actual vehicle mileage collected and the assigned MPGs obtained from EPA certification files adjusted for on-road driving.

APPENDIX F:
References

American Petroleum Institute. Industry Statistics. 2010. http://www.api.org/statistics/

Boyd, James, Jeffrey Byron (California Energy Commission). 2009. *Committee Final 2009 Integrated Energy Policy Report*. California Energy Commission. CEC-100-2009-003-CTD.

California Energy Commission. 2004. *Local Government Emergency Planning Handbook.* California Energy Commission. Retrieved from http://www.energy.ca.gov/emergencies/documents/2004-03-11_GOV_EMRGNCY_HNDB.PDF

California Energy Commission. *2009. Warren-Alquist State Energy Resources Conservation and Development Act*. California Public Resources Code Section 25000 et seq. Retrieved from: http://.energy.ca.gov/2009publications/CEC-140-2009-001/CEC-140-2009-001-REV1.PDF

California Energy Commission. Integrated Energy Policy Report Committee Workshop. 2010. Smart Grid Research Road Mapping Projects. California Energy Commission. Docket No. 11-IEP-1N.

California Energy Commission. 2011. Organizational Chart for the California Energy Commission. Retrieved from http://www.energy.ca.gov/commission/orgchart.html

California Energy Commission, Staff Workshop. 2011. Natural Gas Market Assessment, Reference Case, Proposed Scenarios and San Bruno Incident Safety and Reliability Implications. California Energy Commission.

California Government Code Section 8607-8607.2 http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/State%20Gov.%20Code/$file/StateGovtCode8607.pdf

California Water Plan. California Department of Water Resources. 2009.

Edelstein, Ron. (Gas Technology Institute). 2008. *Report: A Lower-Cost Option for Substantial Carbon Dioxide Emission Reductions in the United States*. Gas Technology Institute.

Edelstein, Ron, Andrew Hammerschmidt, Lou Lautman, Iraj Salehi, David Zuckerman. (Gas Technology Institute). 2008. *California Natural Gas Storage Utilization and Economic Analysis*. California Institute for Energy and Environment.

Electric Power Research Institute (EPRI). 2011. IntelliGrid Website. http://intelligrid.epri.com/default.asp

Eller, Bob, Jairam Gopal, Robert Kennedy, Yvonne Nelson, Pat Perez, Gordon Schremp, Rosella Shapiro, Sherry Stoner (California Energy Commission), Tony Ferrara (California Specialized Training Institute). 2006. *Energy Emergency Response Plan, 2006*. California Energy Commission. CEC-600-2006-014.

Garcia-Cerrutti, Miguel, Tom Gorin, Chris Kavalec, Lynn Marshall. (California Energy Commission). 2011. Revised Short–Term (2011-2012) Peak Demand Forecast, Committee Final Report. California Energy Commission. CEC 200-2011-002-CTF.

Gas Technology Institute. 2005. Technology Needs for U.S. Unconventional Gas Development. Research Partnership to Secure Energy for America, Gas Technology Institute.

GridWise Architecture Council. 2011. Website: http://www.gridwiseac.org/

Kennedy, Robert (California Energy Commission). 2007. *Petroleum Fuels Set-Aside Program, Application for Emergency Fuels Allocation, Applicant Handbook*. California Energy Commission. CEC-600-2007-010.

Kleissl, Jan, Matthew Lave. 2011. *Photovoltaic Output Study*. University of California at San Diego.

Leslie, N. (Gas Technology Institute). 2009. *Report: Validation of Direct Natural Gas Use to Reduce Carbon Dioxide Emissions*. Gas Technology Institute.

National Association of State Energy Officials. 2010. *Smart Grid & Cyber Security for Energy Assurance*. Retrieved from http://www.naseo.org/energyassurance/Smart_Grid_and_Cyber_Security_for_Energy_Assurance-NASEO_December_2010.pdf

National Association of State Energy Officials. 2010. *State Energy Assurance Planning Framework*. Retrieved from http://www.naseo.org/eaguidelines/framework/Energy_Assurance_Planning_Framework.pdf

National Association of State Energy Officials. 2011. *State Energy Assurance Guidelines,* V3.1.

National Energy Technology Laboratory. 2011. The Department of Energy Smart Grid Implementation Strategy. Retrieved from http://www.netl.doe.gov/smartgrid/

National Governor's Association. 2006. *A Governor's Guide to Energy Assurance.* Retrieved from http://www.nga.org/Files/pdf/0612GOVGUIDEENERGY.PDF

National Institute of Standards and Technology (NIST). 2010. *NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0*. Office of the National Coordinator for Smart Grid Interoperability. NIST Special Publication 1108.

National Institute of Standards and Technology. The Cyber Security Coordination Task Group. 2010. Advanced Security Acceleration Project Smart Grid. 2010. *NISTIR 7628 Guidelines for Smart Grid Cyber Security*, Introduction and Volumes 1-3. Retrieved from http://csrc.nist.gov/publications/PubsNISTIRs.html

New York State, Energy Coordinating Working Group. 2009. *New York State Energy Plan*. Retrieved from http://www.nysenergyplan.com/2009stateenergyplan.html

North American Electric Reliability Corporation. 2009. Retrieved from http://www.nerc.com/page.php?cid-2/20

North American Electric Reliability Corporation. 2010. *High Impact, Low-Frequency Event Risk to the North American Bulk Power System, a Jointly-Commissioned Summary Report of the North American Electric Reliability Corporation and the U.S. Department of Energy's November 2009 Workshop*. Retrieved from http://www.nerc.com/files/HILF.pdf

Oregon Department of Energy. 2011. *Oregon State Energy Assurance Plan*. Retrieved from http://www.oregon.gov/ENERGY/docs/OregonStateEnergyAssurancePlan.pdf?ga=t

Public Technology Institute. 2010. *Smart Grid & Cyber-Security for Energy Assurance.* Public Technology Institute: The Resource for Technology Executives in Local Government.

Public Technology Institute. 2011. *Local Government Energy Assurance Guidelines.* Public Technology Institute: The Resource for Technology Executives in Local Government. Retrieved from http://www.pti.org/index.php/ptiee1/more/410/

Smart Grid Information Clearing House. 2011. Website: http://www.sgiclearinghouse.org

State of California Office of Emergency Services. 2009. *State of California Emergency Plan*.

Thompson, M. 2011. Electrical Emergency Communications. California Independent System Operator. Retrieved from http://www.caiso.com/docs/2005/08/03/2005080315474812227.pdf

United States Congress. 2007. *Energy Independence and Security Act of 2007*. Retrieved from http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:h6enr.txt.pdf

United States Department of Energy. 2010. *Energy Sector-Specific Plan*. United States Department of Energy. Retrieved from http://www.oe.energy.gov/DocumentsandMedia/Energy_SSP_2010.pdf

United States Department of Energy. 2011. *Roadmap to Secure Energy Delivery Systems* (Draft). Energy Sector Control Systems Working Group, United States Department of Energy. Retrieved from http://www.oe.energy.gov/DocumentsandMedia/2011_EDS_Roadmap_DRAFT_11111.pdf

United States Department of Energy. 2011. *The Smart Grid: An Introduction*. Retrieved from http://www.oe.energy.gov/SmartGridIntroduction.htm

United States Department of Energy. 2011. United States Energy Information Administration Crude Reserves and Production. Retrieved from http://tonto.eia.doe.gov/dnav/pet/pet_crd_top.asp

United States Department of Energy. 2011. United States Energy Information Administration Natural Gas Monthly. Retrieved from http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/natural_gas_monthly/ngm.html

United States Department of Energy. 2011. United States Energy Information Administration Petroleum and Other Liquids. Retrieved from http://tonto.eia.doe.gov/dnav/pet/pet_cons_prim_dcu_nus_m.htm

United States Department of Energy. 2011. United States Energy Information Administration Petroleum Supply Monthly. Retrieved fromhttp://www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_supply_monthly/psm.html.

United States Department of Energy. 2011. United States Energy Information Administration Weekly Petroleum Status Report. Retrieved from http://www.eia.doe.gov/oil_gas/petroleum/data_publications/weekly_petroleum_status_report/wpsr.html

United States Department of Homeland Security. 2009. *National Infrastructure Protection Plan*. Retrieved from http://www.dhs.gov/xlibrary/assets/NIPP_Plan.pdf

United States Department of Homeland Security. 2009. United States Energy Information Administration Electric Power Monthly. Retrieved from http://www.dhs.gov/files/programs/editorial_0827.shtm#0, 2009, http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html

United States Department of Homeland Security. 2010. Enhancing Resilience and Protecting the Nation's Critical Infrastructure. Power Point Presentation for Society of American Military Engineers of North Virginia. Retrieved from www.novasame.org/presentations/RHSS-2010-DHSIP.ppt

United States Department of Homeland Security, Federal Emergency Management Agency. 2007. *Comprehensive Preparedness Guideline (CPG 101): History, Highlights and Analysis*. Suburban Emergency Management Program. Retrieved from http://www.semp.us/publications/biot_reader.php?BiotID=612

United States Department of Transportation, Federal Highway Administration. 2011. http://www.fhwa.dot.gov/policy/ohpi/qffuel.cfm

Williams, Jennifer (California Energy Commission). 2011. *2010 Integrated Energy Policy Report Update – Commission Final Report*. California Energy Commission. CEC 100-2010-001-CMF.CEC Current Trends Natural Gas Demand, 2010

APPENDIX G:
Situation Report

Situation Report

State of California **Natural Resources Agency**

Memorandum

To: Cabinet Secretary **Date:** Current Date Current Time
Copies to: Deputy Cabinet Secretary
Secretary for Natural Resources Agency
Undersecretary for Natural Resources Agency

From: California Energy Commission – Executive Director
1516 Ninth Street
Sacramento CA
95814 5512

Subject: SITUATION REPORT
TITLE (brief and clear – for example: "Refinery Fire May Impact Gasoline Supplies")

CONFIDENTIAL INFORMATION INCLUDED IN THIS REPORT
PLEASE DO NOT QUOTE OR RELEASE SPECIFIC INFORMATION

Recommended Action

Identify any Gubernatorial Action that may be recommended to address or alleviate the situation. If none, say "No action is recommended at this time."

Overview

Situation Reports should be clear, brief, and checked for grammar and accuracy. Provide a succinct explanation of the developing situation. This information should offer a clear perspective of what, why, when and where the situation has, or could, manifest itself as a concern or problem. Describe the potential statewide impact of this emerging situation.

Current Actions

Describe actions are being taken the Energy Commission and by other entities.

Background

If situation is complicated enough or there is additional detail the Governor's Office and other decision makers may need or be interested in, include it here. For example,

identify events that precipitated or can explain the current situation, provide general statistics in context of the emergency (i.e., refinery is X amount of current production), etc. Try to keep additional information to a few paragraphs. The entire Situation Report should be no more than two pages.

APPENDIX H:
Energy Supply Disruption After-Action Report Format

EVENT TITLE

(example: LOMA PRIETA EARTHQUAKE)

Date of Report:	Current Date
Reporting Agency:	California Energy Commission
Date of Event:	Event Date
EOC Activated:	Dates of Operation (example: October 17 through 30, 2011)
EOC Location:	California Energy Commission 1516 Ninth Street Sacramento, CA 95814 [or list alternate location if any]
Location of Event:	City or County (list if more than one) where event took place.
RESPONSE ACTIVITIES:	Provide a brief description of initial notification, situation reports issued, and other activities by the staff in response to the event.
RECOVERY ACTIVITIES:	The California Energy Commission served no role in the recovery phase of the state's response to this event.
LESSONS LEARNED:	Provide a brief description of any deficiencies relative to each SEMS function (if applicable).
	Determine if deficiencies were related to insufficient planning guidance or training and provide an overview of plans to ensure that deficiencies are corrected. Include any recommendations for actions that could be taken to improve emergency response.

APPENDIX I:
Energy Emergency Response History Report

Energy Emergency Response History

#	Date (mm/year)	Plan Activation (YES/NO)	Name of the Event	Actions Taken

Total Count:

Response Stats				Energy Sector				Type		
Internal Only	Situation Reports	Action	Plan Activation	Oil	Natural Gas	Electricity	Combo	Natural	Technical	Human

Natural = weather/animal related
Technical = mechanical breakdown
Human = political/regulatory/result of human negligence or sabotage

APPENDIX J:
Energy Risk Assessment

Method

Select and rate the events that are present and enter them in the Excel spreadsheet. Any event on the list that is not relevant should be left blank, and new relevant hazards may be added to produce a customized list.

For each identified risk, impacts and frequencies are listed to assist in the subsequent planning, training, and exercises for the facility. Risks, past events, vulnerabilities, and the likely effect of these will emerge from this assessment.

This crucial examination of the effect of past events and risks identified will serve as the foundation for the *CEAP*. The severity of consequences to property, infrastructure, and the environment are part of this evaluation. The likelihood of occurrence should also be considered, and the resulting impact recorded will influence preparedness planning.

Severity

The type or nature of effect of each event should be considered, including socioenvironmental effect, such as disruption and environmental impact on the physical area; economic impact in terms of costs of property and infrastructure damage, as well as recovery costs or loss of revenue streams.

It is also important to consider the likelihood for escalation of an event or the "domino effect" when combined with other events. A simple approach to assessing likelihood is proposed, expressed in terms of the probability of an event occurring that reflects the judgment of people involved in this field, rather than being a strict mathematical probability.

The spreadsheet provides a means of recording information about the risks and past events and their potential impact and likelihood, intended to develop a relative ranking on the risk matrix. The prevention, control and mitigation measures, already in place or planned, will help reduce and manage these risks.

The following questions can be used to help determine the likelihood and severity of events:

Probability

A. Considering the number of occurrences over the past 25 years, the number of similar events at neighboring areas, and any changes or trends that could affect the frequency of this event, estimate the likelihood this event will occur in next 25 years.

0 = not applicable (will not occur)
1 = doubtful (not likely)
2 = possible (could occur)
3 = probable (very likely to occur)
4 = inevitable (will occur)

Facilities Impact

A. Considering the facility vulnerability relative to each event, estimate the damage extent.

0 = little or no damage
1 = mild damage to several facilities
2 = moderate damage to multiple facilities
3 = severe damage to multiple facilities
4 = extensive damage to most facilities

B. Considering the extent of facility damage, estimate the total cost to respond to the event and repair or replace all damaged facilities.

0 = less than $100,000
1 = between $100,000 and $1 million
2 = between $1 million and $100 million
3 = between $100 million and $1 billion
4 = more than $1 billion

Socioeconomic Effect

A. If this event occurred, estimate the duration of interruption to facilitywide business operations.

0 = duration estimated between 0 and 8 hours
1 = duration estimated in days
2 = duration estimated in weeks
3 = duration estimated in months
4 = duration estimated in years

B. To what extent would this event negatively impact the reputation or public image over the long term?

0 = none 1 = minor 2 = moderate 3 = significant 4 = severe

The average score is the sum of each area divided by the four areas (Natural, Technological, Human-Induced, and Terrorism). Table 8 shows the completed energy supply disruption risk and vulnerability assessment.

Table 8: Completed Energy Supply Disruption Risk and Vulnerability Assessment Matrix

ENERGY SUPPLY DISRUPTION THREAT/EVENT	PROBABILITY	SEVERITY = MAGNITUDE of IMPACTS				SEVERITY IMPACTS	RELATIVE RISK
		FACILITIES IMPACT		SOCIO-ECONOMIC IMPACT *Interruption of Normal Operations* *Impact on Reputation/Image*		Overall Impact (Average)	Probability x Impact Severity
		Physical Damage and Costs					
TYPES: Natural, Technological, Human-Induced, Terrorism	*Q: Relative likelihood this will occur*	*Q: Considering facility vulnerability relative to each event, estimate the extent of damage.*	*Q: Considering the extent of facilities damage, estimate the total cost to respond to the event and repair or replace all damaged facilities.*	*Q: If the event occurred, estimate the duration of interruption to facility- wide business operations.*	*Q: To what extent would this event negatively impact the reputation or public image over the long term?*		
	0 = not applicable	*0 = little/no damage*	*0 = less than $100,000*	*0 = estimated between 0 and 8 hours*	*0 = none*		
	1 = doubtful	*1 = mild damage to several facilities*	*1 = between $100,000 and $1 million*	*1 = estimated in days*	*1 = minor*		
	2 = possible	*2 = moderate damage to multiple facilities*	*2 = $1 million and $100 million*	*2 = estimated in weeks*	*2 = moderate*		
	3 = probable	*3 = severe damage to multiple facilities*	*3 = between $100 million and $1 billion*	*3 = estimated in months*	*3 = significant*		
	4 = inevitable	*4 = extensive damage to most facilities*	*4 = more than $1 billion*	*4 = estimated in years*	*4 = severe*	*0 = no impact 4 = highest*	*0 = no risk 16 = highest*
Natural							
Avalanche	1	0	0	0	0	**0.2**	**0.2**
Drought	3	0	0	0	0	**0.6**	**1.8**

Dust/Sand Storms	1	0	0	0	0	**0.2**	**0.2**
Earthquake	4	4	4	4	4	**4**	**16**
Erosion	2	1	2	2	1	**1.6**	**3.2**
Extreme Cold	1	0	0	0	0	**0.2**	**0.2**
Fire	3	3	3	2	2	**2.6**	**7.8**
Flood/Flashflood	2	2	2	1	2	**1.8**	**3.6**
Heat Wave	3	0	0	0	0	**0.6**	**1.8**
High Winds over 58 mph	3	1	2	1	1	**1.6**	**4.8**
Hurricane/Storm Surge	2	1	1	1	0	**1**	**2**
Landslides/Earth Shift	3	2	2	2	1	**2**	**6**
Lightning	3	2	2	1	1	**1.8**	**5.4**
Sinkholes	1	0	0	0	0	**0.2**	**0.2**
Snowstorm	2	1	1	1	0	**1**	**2**
Severe Wind Storm	2	1	2	1	1	**1.4**	**2.8**
Tornado	1	0	0	0	0	**0.2**	**0.2**
Tsunamis/Tidal wave	2	2	3	3	4	**2.8**	**5.6**
Volcanic Eruption	1	0	0	0	0	**0.2**	**0.2**
Natural Hazard Average Score	**2.10526316**	**1.052631579**	**1.263157895**	**1**	**1**	**1.263158**	**3.368421**
Technological							
Biological Hazard Release	2	2	3	3	4	**2.8**	**5.6**
Building Structure Collapse	2	4	3	3	2	**2.8**	**5.6**
Chemical Release	2	1	2	2	3	**2**	**4**
Dam/Levee Failure	3	4	4	4	4	**3.8**	**11.4**
Extreme Air Pollution (Smog)	4	1	1	0	1	**1.4**	**5.6**
Fire/Explosion	3	3	2	1	2	**2.2**	**6.6**
Fuel Shortage	2	1	1	1	2	**1.4**	**2.8**
Gas Leak	2	2	1	1	1	**1.4**	**2.8**
Hazardous Materials Accident	3	2	1	1	1	**1.6**	**4.8**
Transportation or Storage	3	1	2	1	1	**1.6**	**4.8**
Nuclear Hazard Release	1	4	4	4	4	**3.4**	**3.4**
Pipeline Break/Damage	4	4	4	3	4	**3.8**	**15.2**

Power Outage	4	1	1	1	1	**1.6**	**6.4**
Power/Utility Failure	4	1	2	1	2	**2**	**8**
Radioactive Accident	1	2	2	2	3	**2**	**2**
Transportation Accident	4	1	2	1	1	**1.8**	**7.2**
Technological Hazard Average Score	**2.75**	**2.125**	**2.1875**	**1.8125**	**2.25**	**2.225**	**6.0125**
Human-induced							
Arson	2	2	1	0	0	**1**	**2**
Biological Warfare	2	3	3	3	4	**3**	**6**
Bombing	2	3	2	1	4	**2.4**	**4.8**
Chemical Warfare	1	2	2	2	4	**2.2**	**2.2**
Economic Emergency	3	2	2	4	4	**3**	**9**
Enemy Attack	2	2	2	2	4	**2.4**	**4.8**
Hostage Incident	2	0	0	0	2	**0.8**	**1.6**
Active Shooter	2	1	0	0	2	**1**	**2**
Large-scale Strike	3	1	0	1	3	**1.6**	**4.8**
Nuclear Warfare	1	4	4	4	4	**3.4**	**3.4**
Demonstration	3	0	0	0	1	**0.8**	**2.4**
Riot/Civil Disturbance	3	1	1	1	1	**1.4**	**4.2**
Sabotage in Private Sector	2	1	1	1	2	**1.4**	**2.8**
Events (Inaugurals, Parades, Olympic Games, etc.)	4	0	0	0	0	**0**	**0**
Human-induced Hazard Average Score	**2.28571429**	**1.571428571**	**1.285714286**	**1.357142857**	**2.5**	**1.742857**	**3.571429**
Terrorism							
Terrorist Act	3	2	2	2	3	**2.4**	**7.2**
Biological	2	3	3	3	4	**3**	**6**
Chemical	2	2	2	2	3	**2.2**	**4.4**
Nuclear	2	4	4	4	4	**3.6**	**7.2**
Explosion	3	3	2	3	3	**2.8**	**8.4**
Terrorism Hazard Average Score	**2.4**	**2.8**	**2.6**	**2.8**	**3.4**	**2.8**	**6.64**

Source: California Energy Commission

APPENDIX K:
Energy Workforce Development Plan

Summary

The Energy Workforce Development Plan (WDP) identifies the State of California's overall energy assurance workforce development strategy. This workforce development plan (WDP) report will guide the State of California's energy assurance hiring and training as specified by the U.S. Department of Energy (DOE) through funding provided from the American Reinvestment and Recovery Act (ARRA).

As the need for energy and how it is generated, transmitted, stored, and distributed expand further into the technological realm to include the smart grid, future technologies will require the California Energy Commission staff to maintain a high level of experience, judgment, and training. Energy Commission staff members will need to be able to understand pricing information, equipment connection to the grid, and data management to ensure they understand the information they are receiving and how best to use that information to provide service to California residents.

This WDP addresses the Energy Commission's current workforce and hiring plan and internal and external energy assurance training strategies. The WDP is designed to provide a framework for accomplishing the following specific goals:

1. Hire consultants who will work with the California Energy Commission for energy assurance planning.
2. Identify hiring and retention patterns for energy assurance personnel.
3. Provide energy assurance training to Energy Commission personnel.
4. Identify joint energy assurance planning and training for individuals and organizations involved in energy assurance from other state agencies.

The goals of these objectives are to:

1. Increase level of experience, judgment and training among energy assurance personnel in support of energy emergencies.
2. Identify and provide training and exercise to validate energy assurance expertise.
3. Maintain an energy assurance plan as a "living document" that is continually updated and validated by external contactor and internal energy assurance staff to ensure statewide energy resilience and continuity.

Background

In 2009, the DOE released funds to each state and territory with the goal of reinvigorating the update (or initiating the development) of *Energy Assurance Emergency Plans*. As part of this planning, the State of California has prepared this workforce development plan (WDP).

The mission of this WDP is to ensure energy assurance in the state by identifying sustainable hiring, retention, and training strategies of Energy Commission personnel tasked to perform energy assurance activities. It is also designed to identify training strategies for other state-level personnel tasked to perform energy assurance activities within the state.

The California Energy Commission is the state agency tasked with energy policy and planning.[80] As part of this effort, the Energy Commission works with several state agencies for energy assurance throughout the state. The California Emergency Management Agency (CalEMA) is responsible for coordinating overall state agency response to major disasters – natural, man-made, war-caused emergencies and disasters – and for assisting all state agencies and local governments in their emergency preparedness, response, recovery, and hazard mitigation efforts, including energy assurance.[81]

During energy emergencies, CalEMA, as the lead state emergency response agency, works with a number of other state agencies that include:

- California Emergency Council.
- California Natural Resources Agency.
- California Energy Commission.
- California Independent System Operator (California ISO).
- California Utilities Emergency Association (CUEA).
- Energy Emergency Management Center (EEMC).

Regulatory agencies such as the Public Utilities Commission (CPUC) or the California Air Resources Board (ARB) may be engaged, as emergency circumstances dictate. Other agencies throughout the state may also be involved as the nature and impact of the energy emergency unfolds.

---

80 http://www.energy.ca.gov/.

81 http://www.calema.ca.gov/California State Energy Emergency Response Plan http://www.energy.ca.gov/emergencies/plan.html. California State Emergency Plan http://cms.calema.ca.gov/prep_sep.aspx.

The California Natural Resources Agency is the lead state agency for implementing California Emergency Function #12, Utilities (Energy) within the *State Emergency Plan.* The California Energy Commission is part of the Natural Resources Agency and implements Emergency Orders issued by the Governor in support of energy emergencies.

The California ISO is a nonprofit, independent organization that manages the flow of electricity across the high-voltage, long-distance power lines that make up 80 percent of California's power grid.

The CUEA is a nonprofit association of more than 90 utilities that provides integrated public and private partnerships between member CUEA utilities and with government agencies in preparing for, responding to, and recovering from energy emergencies or other potentially serious events that affect the energy assurance within the state.

While all state-level emergencies are centrally controlled from the State Operations Center (SOC), the Energy Commission operates the EEMC to provide a centralized management location for the Energy Commission's coordination of energy emergencies with these entities and a myriad of other state agencies that may be tasked in support as the energy emergency dictates.

Hiring

As part of the DOE's ARRA funding, the Energy Commission hired a consulting company with expertise in energy assurance planning. Five consultants were hired for a period of 15 months to provide the following energy assurance activities:

- Workforce development planning
- Intrastate and interstate energy emergency exercise facilitation
- Energy disruption tracking process planning
- Energy assurance planning

Retention

To retain staff at the Energy Commission, it must ensure that adequate processes are in place to ensure staff has a voice in ongoing and transformative changes that are ongoing with the Energy Commission.

All of the energy assurance staff at the Energy Commission is involved in a variety of energy-related tasks outside of energy emergency planning, but all of these positions are considered critical. The energy assurance staff is set up within five functional emergency organizational areas as required by state and federal law. Staffing of the Energy Emergency Response/Energy Assurance Team is organized into these areas:

- Management
- Operations
- Planning
- Logistics
- Finance administration.

This management system, called SEMS (Standardized Emergency Management System) at the state level and NIMS (National Incident Management System) at the federal level, is designed so that only those functions that are needed for a particular emergency are activated. It is not necessary to involve all five functions in every event, and only those staff needed is expected to respond to any particular event. Staff position assignments for each of the functions established at the Energy Commission are listed in the table below.

Energy Commission

Energy Assurance/Emergency Response Staff Position Assignments

Function
Management
Chairman
Executive Director
Governmental Affairs
Public Information
Energy Emergency Manager
Operations
Operations Coordinator
Petroleum
Natural Gas
Electricity
Planning
Planning Coordinator
Reporting/Documentation
Logistics
Logistics Coordinator
Finance Administration
Finance Admin. Coordinator

One of the strategies the Energy Commission is identifying to meet the need for retention of this critical staff is to validate the organization's unique history, current practices, and strategic objectives through precise succession planning. This succession planning leverages effective performance management of its high-rising performers to raise staff productivity. Our efforts with provide a framework for real-time and ongoing staff goals and performance communication that to ensure staff goals remain relevant and aligned with the Energy Commission's needs. The Energy Commission is working with the State

Department of Personnel Administration and the State Personnel Board as they conduct a comprehensive statewide hiring and retention strategy that involves all state departments and agencies.

Other internal retention strategies will include:

- Involving those responsible for implementing change in actually creating the change, ensuring input and improved shared understanding and support of all energy assurance initiatives.
- Integrating hands-on, action-oriented approaches that enable the Energy Commission staff to have input to move forward quickly and effectively with new initiatives in energy assurance, such as smart grid.
- Developing "no-cost strategies" for recognizing staff loyalty and commitment in its critical role in statewide energy assurance, such as recognition at staff meetings and other staff development forums.
- Training of staff on energy assurance.

Training

Training methods involve all adult learner methods (audio, visual and tactile), and include classroom facilitation, web-based, and tabletop and operational field exercises. The resources used for the training include internal staff expertise, external contractor and private sector public, private, and nonprofit partners, the DOE, the Federal Emergency Management Agency (FEMA), and State of California sister agencies.

Training opportunities in energy assurance will focus on internal Energy Commission staff and external energy assurance partners.

Internal Training

Staff who may be tasked in any phase of emergency management (including all emergency responders and support personnel), both in the field and in an Emergency Operations Center (EOC), must receive training on national incident response systems.

Some Energy Commission emergency team staff may be asked to respond to an EOC at the local, regional, or state level, depending on the emergency.

Staff assigned to the Energy Assurance/Emergency Response Team need to take the following introductory classes:

- IS-100: Introduction to Incident Command System (pre-requisite for IS-200).
- IS-200: Single Resource and Initial Action Incidents.
- IS-700: National Incident Management System (NIMS), An Introduction.
- IS-800A: National Response Plan (NRP), An Introduction.

Each of the four required courses can be taken in interactive Web-based sessions online for free through the Emergency Management Institute. Course completion times vary from 2 to 14 hours, depending on the course and the student's background. Students must score 75 percent or better on a final exam to be issued a certificate of achievement.

Other aspects of the Energy Commission's energy assurance training will be to develop a cross-training plan with internal staff to stop the loss of institutional knowledge as it relates to energy assurance. This plan will include:

- Written desk procedures/standard operating procedures of energy assurance activities.
- Creation of process flow charts.
- Development of an operations manual.

Staff also participates in ongoing National Association of State Energy Officials (NASEO) webinars and podcasts relating to energy assurance. Furthermore, the Energy Commission provides and/or has the ability to create internal training to staff in the following areas:

- *State Energy Assurance Plan.*
- Smart grid use and vulnerabilities.
- Cybersecurity.
- *State Emergency Plan*.
- State Emergency Function #12 – Utilities (Energy).

Additional training courses are provided by the State of California's Standardized Training Institute, under the California Office of Emergency Services,[82] and made available to the Energy Commission. These include:

- Crisis Communication and the Media.
- Introduction to Emergency Management.
- Terrorism and Weapons of Mass Destruction.

The CSTI also has the ability to develop specialized courses for the Energy Commission as they relate to energy assurance.

---

82 http://www.calema.ca.gov/CSTI/Pages/CSTI.aspx.

In addition to formal training, primary team members participate in a variety of exercises at the local, state and national levels. The Energy Commission is an active participant in the state's Golden Guardian statewide exercise, the largest and most comprehensive state-level operational exercise in the United States held annually in May.

External Joint Training

To ensure that external agencies tasked with energy assurance and emergency response are congruently integrated with Energy Commission energy assurance activities, they are also required to complete the following training from the Federal Emergency Management Agency (FEMA) training site's Independent Study (IS):

- IS-100: Introduction to Incident Command System (pre-requisite for IS-200).
- IS-200: Single Resource and Initial Action Incidents.
- IS-700: National Incident Management System (NIMS), An Introduction.
- IS-800A: National Response Plan (NRP), An Introduction.

In addition, the state-level agencies and departments are also required to complete CSTI course on emergency management. They will also be offered to participate in training and exercise on the *State Energy Assurance Plan* and State Emergency Function #12. External partner agencies have also been invited to participate and will continue to be active participants in inter- and intrastate energy assurance exercises.

APPENDIX L:
Energy Supply Disruption Tracking Process California State Energy Assurance Plan Enhancement

Summary

The purpose of this energy disruption tracking process report is (1) to provide guidance for gathering real-time energy availability to address and prepare for energy shortages or increased energy demand, and (2) to collect, evaluate, and use lessons learned from energy disruption emergency events that affect the State of California's energy reliability in response to and recovery from such events.

This energy disruption tracking process report will integrate with the updated *Energy Assurance Plan* as specified in the Statement of Project Objectives of the United States Department of Energy's Office of Electricity Delivery Assistance Agreement and funded by the American Recovery and Reinvestment Act of 2009.

This energy disruption tracking process report addresses the California Energy Commission's current internal energy disruption tracking strategies and processes. It also provides recommendations of what types of other resources, specifically commercial technology systems, can be integrated with current energy disruption processes and used to track energy shortages and outages. The objectives of this report are to:

- Provide the purpose and description of California Energy Supply Disruption Tracking Process.
- Identify data types/sources and information acquisition and dissemination.
- Provide recommendations for enhancements, expansion, and revision of the current process.

The California Energy Commission can use this information to advise energy stakeholders on the nature, extent, and probable duration of problems with energy supply. This energy disruption tracking process, once finalized, shall be incorporated into the state *Energy Assurance Plan* to complement and integrate with other planning, response and recovery strategies for assured energy reliability within the California.

Background

Overview

On August 14, 2009, the U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability (DOE) awarded California $3,572,526 for energy assurance planning. Funded through ARRA, the State Energy Assurance Initiative provides money to state governments to improve emergency preparedness plans and ensure quick recovery and restoration from any energy supply disruptions.

The California Energy Commission is the state's primary energy policy and planning agency. Created by the California Legislature in 1974 and located in Sacramento, the Energy Commission has five major responsibilities:

- Forecasting future energy needs and keeping historical energy data
- Licensing thermal power plants 50 megawatts or larger
- Promoting energy efficiency through appliance and building standards
- Developing energy technologies and supporting renewable energy
- Planning for and directing state response to energy emergency.[83]

As part of this effort, the Energy Commission provides advice, technical assistance, and public outreach to respond to energy shortages. The California Emergency Management Agency (CalEMA) is responsible for coordinating overall state agency response to major disasters – natural, man-made, war-caused emergencies and disasters – and for assisting all state agencies and local governments in their emergency preparedness, response, recovery, and hazard mitigation efforts, including emergencies arising from energy disruption.[84] The Energy Commission provides CalEMA the location of critical infrastructure and develops specific state actions in the event of a serious energy disruption, including energy shortages.

An energy disruption event would be any event that may reasonably lead to a shortage of energy. This shortage can be an actual or potential loss of supply that significantly impacts the state's energy systems, including rapid increases in energy prices. A shortage can be caused by system failure due to aging systems; poor maintenance or accidents; natural disasters such as earthquake, fire, or flood; or geopolitical events such as war, terrorism, civil disturbance, or embargo. Since each energy supply disruption event is unique, it is impossible to envision every event or combination of events which might qualify as, or lead to, an energy disruption event within the state.

---

83 http://www.energy.ca.gov/.

84 http://www.calema.ca.gov/.

During an energy disruption, CalEMA coordinates the state emergency response and works closely with a number of state agencies and other entities including:

- California Emergency Council.
- California Natural Resources Agency.
- California Energy Commission.
- California Independent System Operator (California ISO).
- California Utilities Emergency Association (CUEA).

Regulatory agencies such as the California Public Utilities Commission (CPUC) or the California Air Resources Board (ARB) may be engaged as energy disruption circumstances dictate. Other agencies throughout the state may also be involved as the nature and impact of the energy disruption unfolds.

The California Natural Resources Agency is the lead state agency for implementing California Emergency Function #12, Utilities (Energy) within the *State Emergency Plan*.[85] The California Energy Commission is part of the Natural Resources Agency and implements executive and Emergency Orders issued by the Governor to address, prepare for, respond to, and recover from energy disruptions.

The California ISO is a nonprofit independent organization that manages the flow of electricity across the high-voltage, long-distance power lines that make up 80 percent of California's power grid.

The CUEA is a nonprofit association of more than 90 utilities that provides integrated public and private partnerships between member CUEA utilities and with government agencies in preparing for, responding to, and recovering from energy emergencies or other potentially serious events that affect the energy assurance within the state.

While the state response to emergencies is centrally controlled from the State Operations Center (SOC), the Energy Commission operates the Energy Emergency Management Center (EEMC) to provide a centralized management location for the Energy Commission's coordination with state agencies and other entities that may be tasked in support as the energy disruption dictates.

The state-level energy supply disruption tracking process provides a framework of rules and responsibilities that identifies the existing functional relationships among various state agencies and ensures effective identification, response, and recovery time from an energy supply disruption event. The process includes identifying energy supply disruption response phases, reporting, record keeping, and analysis of an actual or

---

85 *California State Emergency Plan* http://cms.calema.ca.gov/prep_sep.aspx.

potential impact of an energy supply disruption. During the early stages of an energy supply disruption, the primary role of the state government is fact finding, monitoring, and exchanging information; government intervention occurs only to the extent necessary to protect the interests of public health, safety, and welfare, along with critical community services and business operations.

Authority and Statutes

The following statutes authorize the energy emergency response team to assume the primary responsibility for housing the energy supply disruption tracking information.

Public Resource Code Section 25216.5 (b)

Authorizes the Energy Commission to "Prepare an integrated plan specifying actions to be taken in the event of an impending serious shortage of energy, or a clear threat to public health, safety, or welfare."[86]

Public Resource Code Section 25700

The Energy Commission shall, in accordance with the provisions of this chapter; "develop contingency plans to deal with possible shortages of electrical energy or fuel supplies to protect public health, safety, and welfare." [87]

Government Code 8596

"Each department, division, bureau, board, commission, officer, and employee of this state shall render all possible assistance to the Governor and to the Director of the Office of Emergency Services in carrying out the provisions of this chapter." (Emergency fuel for disaster response)

Emergency Order #6

Empowers the Energy Commission to "hold control of petroleum stocks needed to ensure the health, safety and welfare of the public."

---

86 *Public Resources Code Section 25200-25226* http://www.leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001-26000&file=25200-25226.

87 *Public Resources Code Section 25700-25705* http://www.leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001-26000&file=25700-25705.

Profiling California Energy Supply Disruptions

The Energy Commission assesses electricity and natural gas systems and trends within the state that result in balancing the need for adequate resources with economic, public health, safety, and environmental goals. As part of this assessment, the Energy Commission identifies and tracks energy supply disruptions that affect the state's energy reliability.

California's energy infrastructure − power plants, refineries, and transmission and distribution networks − share the vulnerability of all types of critical infrastructures to disruptions associated with natural and man-made disasters and threats. Addressing energy disruptions is a necessary to state's overall security, economic well-being, and environmental protection.

Electricity

California leads the nation in electricity generation from nonhydroelectric renewable energy sources, including geothermal power, wind power, wood, landfill gas, and solar power. California is also a leading generator of hydroelectric power.[88] The following historical disruptions have led to critical energy shortages within the state.

NorCal DC Intertie with Oregon's BPA failure, 1996: Due to inadequate clearing of underlying vegetation, this primary electrical artery "shorted" to trees when it was heavy loaded (and predictably "sags" when heated) on a peak summer air-conditioning cooling day, blacking out more than 7.5 million people.

The 2000-2001 California electricity crisis: The crisis brought to light many critical issues surrounding the state's power generation system, including postderegulation market manipulation and the state's dependency on out-of-state resources, coupled with in-state transmission bottlenecks. Although California has taken effective measures to reduce market manipulation, built more transmission capacity to reduce bottlenecks, and implemented effective energy conservation programs, the state continues to experience both population growth and weather cycles that contribute to a heavy energy demand.[89]

On January 17, 2001, California ISO, the entity that coordinates statewide flow of electrical supply, declared a Stage 3 Emergency and notified the former Governor's Office of Emergency Services that Pacific Gas and Electric Company was dropping firm load of 500 megawatts in Northern California (rolling blackouts). CalEMA, in turn, issued an emergency message to all emergency services agencies to prepare for rolling blackouts.

---

88 United States Energy Information Administration California Energy Fact Sheet http://www.eia.gov/.

89 *State of California Multi-Hazard Mitigation Plan*, October 2007 http://hazardmitigation.calema.ca.gov/docs/SHMP Final 2007.pdf.

This scenario was repeated the following day, January 18, 2001. On March 19, 2001, CalEMA again issued an emergency message to emergency services agencies that the California ISO declared a Stage 3 Emergency and would be conducting statewide rolling blackouts.

Los Angeles Water and Power, 2005: Originating as an upgrade to a substation's Supervisory Control and Data Acquisition (SCADA) system (early smart grid), installation and labeling errors cascaded into a blackout that affected nearly 3 million people.

The Statewide July 2006 Heat Storm: The event affected the entire state as well as most of the West, producing record demand levels in California. The state was able to avoid rotating outages due to a combination of favorable factors, including no major transmission outages, lower-than-typical generator outages, significant customer response to pleas for energy conservation, high imports from the Pacific Northwest despite unusually high loads there, outstanding cooperation among western control area operators, and prompt response to fires that potentially threatened major power lines. However, the event brought to light the vulnerability of the electric distribution system, as more than 3,500 distribution transformers failed, leaving more than 2 million customers without power at various times over the 10-day event, many for several hours and a small minority for up to three days.

As experienced in 2000 and 2001, rotating outages and/or blackouts can occur due to losses in transmission or generation and/or extremely severe temperatures that lead to heavy electric power consumption. The electric power industry does not have a universal agreement for classifying disruptions. Nevertheless, it is important to recognize different types of outages are possible so that plans may be made to handle them effectively. Electric power and other energy supply disruptions can be generally grouped into two categories: intentional and unintentional.

Natural Gas

The following historical disruptions have led to critical energy issues within the state.

Southern California Summer Peaking Natural Gas Curtailment, 2007: With only a 1-in-10 year extreme weather day occurring, gas curtailment orders had to go out to 86 noncore entities, including peaking gas-turbine plants, forcing San Diego Gas & Electric to purchase more than 1,400 MW of compensating power.

San Bruno Natural Gas Explosion, 2010: A high-pressure (400 psi) 30" gas transmission line running underground through a residential neighborhood exploded, killing 11 people, destroying 38 homes, and causing about $300 million in damage. This disaster initiated a major overhaul of how the entire nation's gas pipeline infrastructure is sited, designed, tested, and rated.

Petroleum

California ranks third in the nation in refining capacity, and its refineries are among the most sophisticated in the world.[90]

California's energy production, storage, and distribution systems are vulnerable to physical disruptions caused by earthquakes, floods, fires, or landslides, as well as shortages caused by market forces or operating conditions.

California Energy Commission staff is providing technical assistance to the Critical Infrastructure section of CalEMA regarding the state's petroleum infrastructure. In particular, CalEMA's Division of Homeland Security has received a confidential briefing regarding California's critical nodes for petroleum product pipeline distribution infrastructure. Information included importance of critical nodes and potential implications of disruption to specific points within the distribution infrastructure. Staff has also provided CalEMA with background information for California's petroleum market and maps showing locations of refineries, primary petroleum pipelines, marine terminals, and distribution terminals.

Future collaborative work is anticipated as CalEMA continues to examine potential petroleum infrastructure vulnerabilities. One example is an assessment of current redundancy capabilities of the existing petroleum distribution infrastructure and what types of projects would need to be undertaken to enable the continued distribution of transportation fuels in the event that one or more of the "critical" distribution nodes are temporarily disrupted.

Nuclear

The state has one commercial nuclear power plant at Diablo Canyon that contributes to the state's overall electric supply. Because this plant is important to the state's energy supply, mitigation strategies are necessary to reduce the chance of major disruptions.

The plant has achieved a very high average annual capacity factor in recent years and is a reliable source of power for the state. With the state's projected population expected to rise to more than 44 million by 2020 from the current 38 million, the nuclear energy infrastructure will be strained to meet California's increasing demand for electricity, as these systems are also susceptible to physical disruptions caused by earthquakes, floods, fires, or landslides, as well as shortages caused by market forces or operating conditions.

While no significant event has caused a nuclear infrastructure disruption in California, the events that led to the 2011 crisis in Japan from the 9.0 earthquake and subsequent tsunami, leading to a major nuclear infrastructure collapse, prompted a comprehensive review of nuclear power plants has occurred across the United States.

---

90 United States Energy Information Administration California Energy Fact Sheet http://www.eia.gov/.

Intentional Energy Supply Disruptions Types

Planned/scheduled: Some disruptions are intentional and can be scheduled. For example, a disruption may be necessary when components of the power system are taken out of service for maintenance or upgrading. Scheduled intentional disruptions can last from several minutes to several hours, and customers are usually notified in advance.

Unscheduled: Some intentional disruptions must be done on the spot. As a result, advance notice cannot be provided. For example, a fire department or a police department may request a disruption in service during a fire or an accident.

Demand-Side Management: Some customers (that is, on the demand side) have entered into an agreement with their utility provider to curtail their demand for electricity during periods of peak system loads. In return for agreeing to these disruptions, these customers receive a lower electric rate and/or a rebate.

Load Shedding: When the power system is under extreme stress due to heavy demand and/or failure of critical components, it is sometimes necessary to intentionally interrupt the service to selected customers to prevent the entire system from collapsing. In such cases, customer service (or load) is cut, sometimes with little or no warning. One form of load shedding − called a "rotating blackout" – involves cutting service to selected customers for a predetermined period (usually not more than two hours). As power is restored to one block of customers, power to another block of customers is interrupted to reduce the overall load on the system.

Unintentional or unplanned disruptions are outages that come with essentially no advance notice. This type of disruption is the most problematic. The following are categories to classify unplanned disruptions:

- Accident by the utility or utility contractor, or others.
- Malfunction, or equipment failure, due to, for example, age, improper operation, excessive operation, or manufacturing defect. Special subcategories cover broken fuse links and underground cable, joint, or termination failures.
- Overload on either the utility's equipment or a customer's equipment.
- Reduced capability, that is, equipment that cannot operate within its design criteria.
- Tree contact other than from storms.
- Vandalism or intentional damage.
- Weather, including ice/snow, lightning, wind, earthquake, flood, and broken tree limbs taking down power lines.
- Wildfire that damages transmission lines.

Current Energy Disruption Tracking Process

Energy Supply Disruption Response Phases

There are four energy supply disruption response phases described below, and often they are not sequential. If appropriate, it is possible to implement any phase without going through intervening phases. The nature and severity of the event determine which phase the response begins with.

In addition, the state's response to an energy supply disruption will vary depending on the situation. For example, a response to a significant electricity shortage may involve an appeal to the public to reduce consumer's electricity use. However, an appeal to the public to reduce consumer's liquid fuel use will likely escalate the situation if drivers top off their fuel tanks.

Alert-Readiness Phase

The Energy Commission's energy emergency response team remains in the Alert-Readiness Phase under normal operating conditions on an ongoing basis. In the Readiness Phase, the staff:

- Monitors international and domestic events.
- Attends periodic exercises to establish and test emergency protocols.
- Trains appropriate Energy Commission staff.
- Updates and maintains a network of public and private sector contacts.
- Prepares internal advisory reports, as needed.

Verification Phase

The Verification Phase is activated if the Energy Commission determines that an energy emergency defined as an actual or potential loss of energy supply that significantly impacts the state has occurred or may shortly occur. During this phase, the energy emergency response team will:

- Rapidly determine the nature, extent, and duration of a potential, impending, or actual energy emergency.
- Coordinate energy emergency response activities with the California Office of Emergency Services (CalOES), other appropriate state agencies, the U.S. Department of Energy, other state governments, local government agencies, and private industry.
- Provide a detailed situation report to Cabinet Secretary that assesses the potential or actual impacts of the emergency on energy prices and supplies.
- If required, use the informal fuels set-aside program to ensure that emergency and essential services receive adequate supplies of fuel.

- Recommend further actions (if any) to the Energy Commission's Chairman (Chairman).

Pre-Emergency Phase

If the Energy Commission determines the existence of a protracted or growing energy problem, the Pre-Emergency Phase may be activated. This phase is characterized by an increased level of government activity as the energy problem worsens.

During this phase, the energy emergency response team will:

- Continue to coordinate energy emergency response activities with the CalEMA, other appropriate state agencies, the U.S. Department of Energy, other state governments, local government agencies, and private industry.
- Continue to provide periodic situation reports that describe the nature of the energy emergency, the potential or actual impacts on energy prices and supplies, and the expected duration of the event.
- If required, continue to use the informal fuels set-aside program to ensure that emergency and essential services receive adequate supplies of fuel.
- Recommend to the Chairman appropriate voluntary demand reduction measures that may be used to address the impacts of the energy emergency.

Emergency Phase

If the problem becomes more severe, the Chairman may activate the Emergency Phase. This phase involves all activities initiated during the Pre-Emergency Phase, along with additional voluntary or mandatory programs that may be required.

To impose mandatory programs, the Governor must first issue the Proclamation of a State of Emergency and file an Emergency Order with the Office of the Secretary of State. The Emergency Order takes effect immediately upon being filed. All mandatory programs automatically terminate when the Governor rescinds the emergency proclamation.

During this phase, the energy emergency response team continues to coordinate response activities, prepare situation reports, and use the informal fuels set-aside program as described in the Pre-Emergency Phase. In addition, the energy emergency response team will:

- If directed by management, activate the Energy Emergency Management Center.
- If required, notify major transportation fuel storers that the formal Petroleum Fuels Set-Aside Program has been activated. Activation of this program requires that the Governor sign Emergency Order #6, authorizing the Energy Commission to redirect fuel to emergency and essential services.

- Recommend to the Chairman appropriate mandatory demand reduction measures that may be used to reduce the impacts of the energy emergency.

Energy Emergency Management Center (EEMC)

The EEMC provides a centralized management location for the coordination of Fuel Set-Aside activities not related to the needs of emergency responders. This allows a more efficient structure to:

- Provide timely reports, analyses, and action recommendations.
- Coordinate more effectively with OES, the CUEA and the California Independent System Operator during proclaimed emergencies.
- Ensure that the Energy Commission can respond quickly to nonemergency fuel distribution missions at the request of Fuel Set-Aside Program applicants.
- Ensure effective operation of the Fuels Set-Aside Program activities not related to the needs of emergency responders.
- Ensure that a separate accounting of emergency response and recovery activity is documented for reimbursement purposes.
- The mission of the Energy Commission consists primarily of administrative activity and resource coordination. As such, it may not be necessary to provide continuous staffing on a 24-hour basis. The EEMC may be staffed with an on-call duty officer after hours.

Activation of the EEMC can be authorized by the Energy Commission's Executive Director or Chairman. The EEMC may be activated when any of the following actions occur:

- Activation of the Emergency Phase of the Energy Assurance Plan or Emergency Function #12 of the State Emergency Plan.
- Governor proclaims a State of Emergency or Energy Emergency.
- Governor invokes Emergency Order #6.

During an emergency phase of energy supply disruption, the EEMC will be located in a designated conference room at the Energy Commission headquarters. The EEMC should have adequate computer network and Internet access as well as telephone and conference call capability.

Energy Emergency Response Team Roles and Responsibilities

Depending on the nature and urgency of the energy supply disruption, staff assigned to the energy emergency response team will prepare written reports on the energy impacts of the event. This section documents the steps to be taken from the time an event occurs to the distribution of these reports.

Staff may receive initial notification of an event from a variety of sources, including other Energy Commission staff, industry contacts, state or federal agency staff, and media. An "event" can be anything which has the potential to result in the loss of energy that significantly impacts the state. The event could be a natural disaster (earthquake, fire, flood, and so forth.) or man-made (war, terrorism, civil disturbance, market manipulation, and others).

Once a team member learns about an event, he or she will immediately contact the rest of the team with what information is known at that time. This initial notification could be a phone call or email, depending on the situation. This allows all team members to become aware that something has happened and begin to take the appropriate steps to investigate the situation as it pertains to their area of expertise. This early notification also ensures that everyone involved is fully informed so they may respond appropriately to any inquiries from division management, the Executive Office, Commissioners, and so forth.

The project manager will confer with the team members and decide whether to forward the information to others within the Energy Commission (appropriate to the type and extent of the energy supply disruption). Others to be notified could include the Manager of the Transportation Energy Office, Deputy Director of the Fuels and Transportation Division, the Executive Office, Commissioners, or the Media and Communications Office.

The team members will gather information to determine if the notification is valid and if there is a possible or probable impact on energy supplies and availability. Staff uses the established primary liaisons for both industry and government and these sources must be reliable and verifiable.

The staff will determine the nature, extent and duration of the event, including whether it is likely to impact energy supply, price, or distribution. Once this preliminary assessment is complete, the appropriate staff person will inform the other members of the team (by phone or email) of the results.

Once the preliminary assessment is complete, it can be determined whether the event is affecting energy in California. If not, no action is necessary and staff can return to their normal monitoring activities. If it is, a decision is needed whether the Energy Commission needs to notify the Governor directly about these impacts. This decision will be based on a number of factors, including:

- Probable significance of the energy impacts of the event (if any).
- Information cannot be transmitted through the normal CalEMA emergency reporting procedures due to the confidentiality of the information (usually related to petroleum issues).
- Political climate (cry wolf syndrome, level of media interest).
- Request by management (Executive Office, Commissioners, Resources Agency, and Governor).

If the event is significant, the Emergency Planning Project Manager will coordinate information with CalEMA.

Interagency Coordination

Various state agencies have key roles in the energy supply disruption management structure, including preparedness, response, and recovery from emergencies and disasters. Under the Emergency Services Act,[91] CalOES is charged with coordinating these activities. CalEMA, therefore, is the key point of contact for the Governor's Office in the event of any emergency or significant situation. This notification process is not intended to dilute the statutory authority of agencies that have emergency operational responsibilities, but rather to ensure that consistent procedures are followed in providing factual information to the Governor and his staff quickly.

Reports From the California State Warning Center (CSWC)

The CSWC is located at CalOES headquarters. The CSWC has the primary responsibility for notifying key state agency personnel of emergency events throughout the state. This notification is accomplished in three ways:

- Verbal: If the event involves immediate action or the activation of the State Operations Center, appropriate state agency personnel will receive a phone call from the Warning Center.
- Daily Report: Each day at 10:00 a.m., the CSWC distributes the CalOES Daily Situation Report. This report includes an executive summary of significant events from the prior 24 hours and individual agency reports of significant activity during the same period.
- Flash Incident Report: If a significant event occurs after the daily report has already been distributed, the CSWC will distribute a flash incident report that lists the event name, date and time of the event, location, description of the impact and situation, and a point of contact at CalOES.

These reports are distributed to agency secretaries, agency undersecretaries, department directors, and designated emergency response staff (for example, duty officers).

Notifications to the CSWC

Any state agency that becomes aware of an emergency or significant event must notify CalOES immediately. The CSWC is open 24 hours a day and can be reached by calling or

---

91 *California Emergency Service Act 2006 Edition*
http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/CAlifornia%20Emergency%20Services%20Act/$file/ESAall8-06-final.pdf.

emailing. The contact information is classified as "Confidential" and as such is not for public disclosure. A significant event is defined by CalOES as:

- Serious threat to life.
- Threat to significant amount of property.
- Threat to natural resources.
- Threat to disruption to "lifeline" systems.
- Major media event.
- Major hazardous spill.

Updates to previously reported situations or emergencies should be provided before 9 a.m. so the information can be included in the CalOES Daily Situation Report.

Coordination With California Independent System Operator (CAISO)

Due to special conditions during the summer months in California, the energy emergency response team participates in activities associated with peak electricity use. The California ISO notifies the Energy Emergency Manager whenever the California ISO declares any of the following:

- Warning
- Alert
- Stage 1, 2, or 3 emergency
- Transmission emergency
- Other critical event (fire threatening an energy facility, loss of major generation, and so forth)

Routine communications from the California ISO are generally through email to an address at the Energy Commission called "California ISO Updates." This email is automatically forwarded to an internal distribution list at the Energy Commission.

Moreover, the Energy Emergency Manager participates in the peak day call hosted by the California ISO. These daily conference calls provide real-time information on the status of the transmission grid during imminent emergencies. Much of this information is not available from any other source, since it's based on reports from the operators of the transmission grid.

The Energy Emergency Manager prepares a summary of the information received from the California ISO and distributes it by email to the energy emergency response team, as well as a variety of other Energy Commission staff members who have expressed an interest in being kept informed of the electricity grid status during the summer.

The California ISO peak day call is primarily a discussion on the emergency or pending emergency among the ISO operators and those from the major utilities in the state, including Pacific Gas and Electric, Southern California Edison, San Diego Gas & Electric, Sacramento Municipal Utility District, and Los Angeles Department of Water and Power. Other participants on the calls include small municipal utilities, utilities from outside the state (such as Bonneville Power Authority), the Energy Commission, CalOES, Department of General Services, the Governor's Office, and the California Public Utilities Commission. The information provided is for official use only.

The peak day call usually begins with a summary of the previous day and a brief discussion on the reason for the call. Each utility reports loads, resources, weather, and facility problems or outages in their area.

The California ISO operators then quickly adjust their forecasts based on the most current information and review generation outages, temperatures in various parts of the state, the transmission situation, imports and exports, and other pertinent information. They then form an action plan to address the situation, including steps taken and proposed actions.

They usually provide an adjusted load forecast and plans for reducing load, as well as a schedule for more drastic measures that may be needed. For example, they may review when interruptible customers will be taken off line, when state pump load will be turned off, when a Stage 1 or Stage 2 emergency may be issued, and when and where rotating outages may occur. This is followed by a brief question-and-answer period.

Reports and Reporting Procedures

Depending on the nature and urgency of the energy supply disruption, Energy Commission staff will prepare written reports including an analysis of the nature, extent, duration, response, restoration, and recovery time of the event. [92] In addition, administrative reports may be required if the Energy Emergency Management Center (EEMC) is activated. The Energy Emergency Manager may direct use of six types of reports.

Internal Advisory Report

The internal advisory report is used under normal operating conditions (Alert-Readiness Phase) for minor events with no energy impact for informational purposes only. This report is generally distributed via email to an internal distribution list. The report is a brief (one or two paragraphs) summary of the event and describes what energy impacts may be related to the event.

---

92 *Energy Emergency Response Plan*, October 2006, http://www.energy.ca.gov/2006publications/CEC-600-2006-014/CEC-600-2006-014-F.PDF.

Situation Report

The situation report (Appendix G) is an in-depth, categorical analysis of the energy emergency along with analyses of possible future impacts based on the current situation. The situation report includes:

- Date and time period covered by the report.
- Description of the event.
- Current status of petroleum fuels, natural gas, and electricity, if appropriate.
- Staff analysis of how the event is likely to impact energy supplies, prices, or distribution.
- Other information, as appropriate.

Depending on the nature of the problem and level of the situation, the distribution list may include CalOES, U.S. Department of Energy, Governor, Legislature, and appropriate PADD V states.

Governor's Memo

The Governor's memo is intended to include information pertinent to supply shortages and industry status and analyses, some of which may be sensitive or proprietary. This document must be hand-delivered to the Governor's Office.

Press Release

Media releases are strategically used for conveying information to the public regarding the energy emergency. Media releases may be used for:

- Announcing voluntary or mandatory demand reduction programs.
- Procedures for economic assistance programs.
- Directing the public to Web locations and other resources where they can get additional information on recommended actions they can take to assist them during the emergency.
- General information regarding the energy emergency, as appropriate.

These releases may be distributed through normal media sources using standard protocols, as appropriate.

Internal Status Report

During activation of the EEMC, an internal status report will be prepared by the Energy Emergency Manager. This report is a routine, periodic summary of Energy Commission activity during the energy emergency. The status report contains:

- Date and period covered by the report.
- Activation status of Energy Commission personnel.

- Summary of hours worked by Energy Commission personnel related to the energy emergency.
- Summary of costs incurred as of the date of the report (personnel time and any procurement expenses) related to the energy emergency.
- Key issues or objectives being addressed by the EEMC or other Energy Commission personnel regarding the energy emergency.

This report may be distributed via email to EEMC personnel, Executive Director, Chairman, Committee Chairs, and other appropriate staff.

After-Action Report

This report (Appendix H) is mandatory for all state agencies activating an emergency management center during a proclaimed emergency and is a requirement of the Standardized Emergency Management System (SEMS). Key information areas are:

- Type and level of activation.
- Overall summary of the performance of the five SEMS functions.
- List of deficiencies relative to each function.
- Determination if deficiencies were related to insufficient planning guidance or training.
- Remedial action plan to ensure that deficiencies are corrected.

This report is sent to an internal distribution list, the Governor, and CalEMA.

Implementation Status

The Energy Emergency Manager is responsible for keeping a record of the events the energy emergency response team participates in. This documentation consists of:

- Response history.
- Activity log.
- Lessons learned report.
- Archive.
- Historical record: energy emergency history.

Every event that one or more members of the team respond to is tracked on a monthly basis and recorded in the energy emergency response history spreadsheet. The spreadsheet contains date of the event (month/year) column, whether the energy emergency response plan was formally activated, the name of the event column, and the type of action taken:

- Internal only/preliminary analysis (that is, no further action taken once the event was investigated)
- Situation report (list how many reports were developed for this event)
- Other actions (such as coordination with another state agency to resolve issues, informal fuel allocation, staffing of emergency operations centers, and so forth.)

Events will also be categorized by energy sector (oil, natural gas, electricity, or combination) and type (natural, technical, human).

Activity Log

For those events that require more than just a preliminary analysis, team members should keep an activity log of actions taken during the event. These logs document the date and time of phone calls, who was included in the call, and a brief summary of the subject of the call. The activity log should also include any meetings that the team member participated in and any actions taken in response to the event. Once the event has ended, team members should send their individual activity log, along with copies of all emails sent or received during the event, to the Energy Emergency Manager. The Energy Emergency Manager will use the individual activity logs, situation reports, news articles, and other related material to create a schedule of events that summarizes the major milestones chronologically that occurred during the event.

Lessons Learned Report

Most events do not need a lessons learned report. However, this report can be useful under certain circumstances. The primary reasons for preparing a lessons learned report include the following:

- While responding to the emergency, team members or management identify issues that need to be resolved at a later date (that is, during nonemergency conditions). An after-action report could be helpful in this situation to help document any unresolved issues or new information uncovered during the course of the emergency. This would be especially important if there are possible actions identified that could be taken to prevent or address a similar emergency in the future.
- An event is complex, has transpired over a long period, or has received unusual media attention. In this case, a lessons learned report (in addition to the schedule of events) might be helpful to management in understanding what actions were taken and why.

The lessons learned report should consist of a basic description of the event (date, name of event, summary of the emergency), background information if appropriate, a summary of what went well, a description of what could be improved and lessons learned, and a list of recommendations and next steps.

Archive

The archive is a collection of files (electronic and physical) relating to all the energy supply disruption events in which the energy emergency response team has been involved. The files include all internal advisory reports, situation reports, activity logs, response history, after-action reports, and any other related information. The physical file is a set of binders with print-outs of what is kept in the electronic file. Files are in chronological order (month/year) and identified by the name of the event.

Recommendations for Planned Enhancement, Expansion, and Revision of Energy Disruption Tracking Process

Overview

The current energy supply disruption tracking process does not have the ability to quickly identify, in real time or without time-consuming human intervention, emerging energy infrastructure vulnerabilities or provide analysis to address vulnerabilities before further or future disruptions occur. The manual system in place today relies on reactive, postincident identification, and reporting of issues and lessons learned from incidents often may take a week or more to identify and additional time for resulting improvement actions to take place. The current tracking process archival system is a Microsoft Excel® Worksheet that, again, relies on human interaction to filter, sort, and compile data for further action. The ability to examine past natural disasters and major attacks can provide valuable insight into addressing new ones, and it is at the heart of the recommendation to revise the current energy disruption tracking process.

As part of this grant, there is a need to identify potential enhancements, expansions, or revisions to the current energy disruption tracking process. This chapter identifies and analyzes options for the acquisition/development and maintenance of energy supply disruption tracking processes and tools to enhance energy disruption tracking, analysis, and reporting capabilities of the Energy Commission through the use of new, spatially focused computer and communications technologies.

When looking at systems that can assist the Energy Commission in this endeavor, it was noted that there is no universally accepted system commercially off-the-shelf (COTS) or customized that allows for a "one-size-fits-all-states" approach.

The state of Georgia is implementing a customized system called the Georgia Online Disaster Awareness Geospatial System (GoDAWGS). GoDAWGS is a geospatial visualization tool and disruption tracking system that integrates unconnected data sources for easier analysis, organization, and sharing of information. Its main forms of communication will be through maps and its Web visualization interface. The energy

assurance team in the state has actively partnered with its emergency management agency to integrate this process with other emergency functions within the state.[93]

In Washington State, officials have elected to go with a COTS, selecting iMapData Inc., in June 2011, through a competitive RFQ process. The state focused on the resiliency of the energy sector by incorporating the entire energy supply system, including refining, storage, and distribution of fossil and renewable fuels. The COTS tracking services will help track statewide electric utility power outages and oil and natural gas shortages, allowing the Energy Commission to make better decisions and recommendations concerning state response to energy emergencies.

In California these is a need for both pathways. There is a need to focus on a holistic approach to the entire energy infrastructure due to the volatility of the known natural hazards within the state, as well as the affect market fluctuations drive critical financial spikes or shortages, resulting in disruption in other interdependent systems such as public drinking water, wastewater, healthcare, transportation, and other lifelines. As well, there is a need to integrate these processes with the entire SEMS protocol for the state to ensure mitigation, preparedness, response, and recovery of all interdependent systems that reply on the energy infrastructure are taken into consideration. The integrated and interdependent network of energy and communications utilities is the lifeline of the state's communities. Maintaining these networks and recovering quickly from disruptions is critical to ensure California residents' safety and security.

Regardless of the solution chosen, if any, by the state, the enhanced energy disruption tracking process must have it its core the following abilities:

- The data (for example, weather, electric utility outage data, and road closure) are integrated and can be analyzed, mapped, and shared for interagency planning, supply disruption response, and recovery.
- Integrate existing resources to provide real-time situational awareness with data from multiple sources and jurisdictions/regions. This concept is also known as a common operating picture (COP) and is the foundation of all emergency preparedness, response, and recovery activities in the United States under the National Response Framework.[94]

---

93 http://www.naseo.org/energyassurance/updates/.

94 http://www.fema.gov/emergency/nrf/glossary.htm#C. A *common operating picture* (COP) is a continuously updated overview of an incident compiled throughout an incident's life cycle from data shared between integrated systems for communication, information management, and intelligence and information sharing. The COP allows incident managers at all levels to make effective, consistent, and timely decisions. The COP also helps ensure consistency at all levels of incident management across jurisdictions, as well as between various engaged governmental jurisdictions and private-sector and nongovernmental entities.

While the Energy Commission has tried to better anticipate and respond to energy supply disruptions, it has also recognized a need to better prepare for all hazards and emergencies along with its energy partners within the state. The revised energy disruption tracking process must be a tool for tracking the duration, response, restoration, and recovery time of energy supply disruption events. The Energy Commission conceives this process as part of a common operating picture (COP) that provides situational awareness for state and local agencies in preparedness of, and response to, incidents or emergencies that affect the energy infrastructure. One of the primary benefits of the COP should be that all participants in an energy disruption event have access to the same data, tools, and reports.

Energy data "owners" must and should maintain control over the data and can dictate which other entities have permission to view it, including the Energy Commission, and therefore it is a crucial need to ensure cybersecurity protocols are part of any solution identified.

Regardless of the solution implemented, there will be a need for the Energy Commission to coordinate data requests, data storage, and data use from requested organizations in the public and private sector, including utilities (for utility power outage data) to populate the new tracking process to enable analysis and ongoing monitoring. Existing verbal agreements may have to be strengthened and existing memoranda of understanding, memoranda of agreements, and regulatory notifications may need to be updated to ensure accuracy and timeliness of shared information. In addition, any technology solution will have to ensure the Energy Commission IT Unit is brought on board early in the process as an integral process stakeholder. All the utilities and energy companies in the state provide the Energy Commission with the necessary data now, albeit at different levels of detail and consistency. In any revised process, they will have to be on board as integral stakeholders to provide more consistent and detailed data and through different means. The resulting revised tracking process as a tool for energy emergency planning, response, and recovery will be included in the *Energy Assurance Plan*.

The Energy Commission and CalOES, at the minimum, should have access to all data and can be considered the "receivers and users" of the information. Utilities should provide the data to populate the process in their own service territories and not have access to the data provided by other utilities. They will not see the disruption information unless they have staff inside the State Operations Center as part of the CUEA Emergency Function 12 (Utilities) within the framework of the *State Emergency Plan*. Data security is important, and any vendorized solution must make recommendations and assist with the development of information protocols during the testing and implementation phases should the Energy Commission go forward with this type of energy disruption tracking process.

The recommended COTS and custom solutions represented in this chapter are viable option solutions for the State of California. The consultants writing this report, Aanko Technologies Inc., do not have a vested interest in any of the options or companies presented herein.

Potential Technology Solutions

DHS Solutions (Energy Commission Assumes All Risks)

Integrated Common Analytic Viewer (iCAV) and Automated Critical Asset Management System (ACAMS) are open–source, Web-based mapping tools provided by Department of Homeland Security Office of Infrastructure Protection (IP). The Office of Infrastructure Protection (IP) is a component within the National Programs and Protection Directorate. IP leads the coordinated national program to reduce risks to the nation's Critical Infrastructure and Key Resources (CIKR) posed by acts of terrorism, and to strengthen national preparedness, timely response, and rapid recovery in the event of an attack, natural disaster, or other emergency.

iCAV allows users to see critical infrastructure information in a dynamic map form and provides access to numerous data sources in one central location. Through iCAV, the department connects previously stove-piped information sources providing consistent, mission-specific common operating pictures (COPs) across organizational boundaries, thereby fostering information sharing.

ACAMS is a secure, online database and database management platform that allows for collection and management of CIKR asset data; cataloguing, screening, and sorting of these data; production of tailored infrastructure reports; and development of a variety of pre- and post-incident response plans useful to strategic and operational planners and incident commanders.

iCAV Benefits

iCAV provides a single access point to multiple data sources, which saves time and provides greater situational awareness essential for planning, responding, and recovering from disasters, such as hurricanes or real-time events. Geospatial information links systems and homeland security-specific missions, and iCAV delivers a geospatial context to engage partners. Moreover, iCAV is provided at no cost to state and local users. iCAV can be accessed from any Web-enabled system, so it can be used in an office via a desktop computer or in a mobile-command unit on a laptop or hand-held device.

ACAMS Benefits

- Programmable, role-based access
- Comprehensive CIKR asset inventory, inventory management and assessment tools
- Sector-specific protective measure recommendations for each Homeland Security Advisory system (HSAS) level
- Automatically generated standard and customized reports

- Built-in asset manager questionnaires
- Built-in buffer zone plan development tools
- Department-approved CIKR asset taxonomy classification tool
- Access to live and historical law enforcement and counter-terrorism news feeds
- Integrated robust mapping and geospatial functionality using iCAV

MapInfo Stratus (Pitney Bowes Business Insight)

MapInfo Stratus is a service-based Web-mapping application provided by Pitney Bowes Business Insight. This application allows users to publish their maps (in other words, from MapInfo Professional or the map creation/editing module) and spatial analysis across the enterprise (internally) or externally in a Web application. Stratus is a live product and supports thousands of users worldwide.

Benefits

The following are the benefits of using MapInfo.

- Common metadata for submitted outages and base maps (power, oil, gas) can be developed to insure consistency of information.
- Map printing and PDF exporting are included.
- Each utility will have a secure login into the system to input outage areas.
- The simple and recognizable interface is easy to work with.
- The Web 2.0 application runs in on a Cloud infrastructure. Current implementations have scaled to user bases in excess of 100,000.
- It is highly configurable.
- As a leader in mapping technology, this offering is compatible with most major GIS file formats.

ESRI

ESRI implements a map-based reporting and monitoring system based on the ArcGIS Server platform. This industry leading technology enables capabilities that provide a foundation to extend functionality in the future. Using ArcGIS Server, ESRI would provide a powerful Web application that would allow display of relevant base maps and energy utility stakeholder specific operational layers, and ensure authorized viewing entities have access to incident status and supporting information while conducting operations.

Benefits

- Experience: ESRI has local experience in developing simple, as well as complex, Web applications using the technologies required to meet the likely requirements of the Energy Commission.

- Low-risk solution: Most of the requirements are available –out-of-the-box– based on standard software and application templates that are configured. Custom code will be kept to a minimum, which will decrease risk and delivery time.
- Future–proof:–ESRI brings proven and industry leading software that ensures the platform adapts and scales to meet future Energy Commission needs.
- Flexible deployment options: The final solution can be deployed as a cloud-hosted application, or on infrastructure maintained by the Energy Commission.

IVAULT

IVAULT is a Web-GIS solution that provides an advanced, configurable suite of tools for data integration and analysis available through Pacific Alliance Technologies. Easy access to current data provides the context required for monitoring electrical outages, the length, and responsible party. Querying, reporting, and analysis of the Energy Commission's data in context with other base mapping and stakeholder's data will help provide an integrated service offering to energy customers within the state.

In addition to a user-friendly and powerful browser-based GIS interface for all stakeholder staff, the IVAULT Administrator Console empowers the staff to maintain and expand the Web GIS portal quickly, without coding. With this point-and-click interface, authorized staff can easily add and revise various aspects of their GIS portal, such as users and user groups, data access permissions, search queries, reports, exposed tools and tasks, map types, data sources, and layers.

Benefits

- VAULT can provide a self-sufficient operation and maintenance system or, if preferred, to provide a straightforward interface to configure the system as the Energy Commission would like. This is applicable to data maintenance as well as the ongoing enhancement and extension of the Web application.
- The IVAULT GIS Web user interface provides access to the spatial and nonspatial data through an intuitive interface. The interface is designed to use with collapsible tabs for searching and reporting on tabular data. The application does not require any plug-ins and is accessible with regular Web browsers (for example, Internet Explorer, Chrome, Safari, and Firefox).
- It supports the use of Autodesk's Design Web Format (DWF) technology, which enables downloading of intelligent maps for off-line use in the field or during power outages, if desired.

WebEOC Incident Manager (by SunGard)

WebEOC Incident Manager is delivered by SunGard. It is a full-featured incident management and mapping services solution that can be configured to meet the initial requirements of the Energy Commission and subsequently grow with functionality and

scale requirements. Incident Manager combines the power of SunGard's business continuity and crisis management experience with the functionality and ease of use of WebEOC product. As an integral part of SunGard's complete suite of business continuity solutions, it enables remote incident communications, tracking, and monitoring of events online.

Agencies who do not have access to or support from a GIS department and need the capability to create map layers locally to add to the WebEOC must also have a desktop product (ArcView, ArcEditor, or ArcInfo) in order to author the data. ArcGIS Server 9.3 must be installed on a separate server. This requires that the WebEOC server have direct access to the ArcGIS server. ArcGIS Server system requirements are based on the customer's platform and Web server configuration.

Benefits

WebEOC Incident Manager enables users to respond to incidents in real time by providing:

- Coordination –The best way to beat a disaster is to keep control of the situation. At a glance, Incident Manager gives a broad scope of the situation and makes it possible to track the progress.
- Communication –Features like chat, email, and incident escalation ensures a more efficient and effective recovery.
- Intelligent Methodology – Incident Manager follows best practices developed by using Incident Command System principles that are recognized incident planning standards, yet remains flexible enough to suit any emergency operations center (EOC) or incident response center method.
- Scalability – The virtual command center means Incident Manager can be just as efficient running from a laptop in an ad hoc meeting place as from a large EOC.
- Web Based Application –During the incident response operation, relevant information is available to anyone logged into the secure application, no matter where the person is located at the time.
- Data Combination – It can combine WebEOC data with other geographic information system (GIS) data or services on a single map and dynamically push and pull data in and out of WebEOC and configure the map with data from local and remote services on the fly.

Google Earth Enterprise

Google Earth Enterprise enables the Energy Commission to create custom Google Earth Globes. The system includes two Google Earth Enterprise Appliances consisting of Google Earth Enterprise Fusion Server and Google Earth Enterprise Earth Server. It will require additional hardware servers and Google Earth Enterprise Licenses.

Benefits

The Google Earth Globes consist of many "base" data layers, such as roads, hydrography, schools, and other critical infrastructure. In addition it can be populated with energy specific layers including:

- Electric utility outage data, supplied when reporting thresholds are reached and periodically during an event. Utilities are the data source, and the outage data can be managed by state energy stakeholders.
- Petroleum delivery and storage data, provided by the petroleum companies pursuant to state requirements.
- Fuel storage facility location and capacity.
- Location of wind, solar and other renewable energy installations.
- Future tracking of smart grid implementations.