

Name _____

Date _____

Case Study: California Blackouts

Read the case study and underline or note important points as you read.

Geography

California is on the western coast of the United States, bordering the Pacific Ocean. At 401.45 square kilometers (155,779 square miles), California is the third largest state by area in the United States. Over 37.5 million people live in California, making it the United States' most populous state. More than 90% of California's population lives in urban areas, primarily in the coastal regions where most of the state's largest cities are located. Three California counties are among the ten most populous U.S. counties. California's main industries include entertainment, tourism, agriculture, fishing, computers, electronics, aerospace, and food packaging. Most of the industry in the state is centered around the Los Angeles and San Francisco areas.

California has a very diverse geography, including major mountain ranges, a long central valley region, a long coastline, and desert regions. California's climate is diverse as well. Most of the state experiences two seasons—the rainy season and the dry season—although the high mountain regions can experience four distinct seasons. The coastal region has a mild climate, with very little temperature difference throughout the seasons. The mountain regions have colder winters, while the central valley has hotter summers.

Assessment

Over half of electricity consumption in California is fueled by natural gas. About 14% of electricity in the state comes from hydroelectric power, 11% comes from renewable resources other than hydroelectric, and a small percentage is generated using nuclear power. California generates more electricity from non-hydroelectric renewable energy resources than any other state in the country. California also has one of the lowest rates of per capita energy consumption in the nation, largely because of the mild climates and energy efficiency initiatives in the most populous areas. However, because of its large population, California still has the second highest total energy demand in the country. To satisfy its energy needs, California imports more electricity than any other state. Some of this imported electricity originates at hydroelectric dams in the Pacific Northwest. Other imported electricity comes from neighboring Southwestern states. The importation of electricity into California is largely dependent on a few main transmission lines, such as the Pacific Intertie, which runs from the Pacific Northwest to southern California.

The Problem

In 2000 and 2001, California suffered a series of rolling blackouts. Electric utilities in the state had been deregulated in the 1990s. This led to higher wholesale energy costs and serious financial problems for many of the state's electric utilities. By the time of the blackouts, California had

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not significantly invested in new power plants in a decade, and it had been forced to import a significant portion of its electricity from surrounding states. A drought in the Pacific Northwest significantly decreased the amount of electricity available for import from hydroelectric power plants in the region. This drove up the price for electricity in the market, making electric companies in the other states reluctant to sell to California. In addition, a hotter than usual summer led to spikes in demand that California's system could not handle. Rolling blackouts hit the Bay area first, then hit cities throughout northern and central California, and, by March 2001, the entire state. The federal government intervened early to require electric companies to sell to California, but blackouts continued. Factors such as problems with major transmission lines and the rupture of a critical pipeline supplier of natural gas constrained supply during crucial times.

By 2003, emergency measures had reduced the urgency of the situation in California. But the state has experienced other blackouts since that time, including a 2005 blackout caused by a transmission line failure. That blackout left approximately 500,000 customers without power.

In September 2011, a minor short circuit during a repair at a substation in Arizona initiated a cascading effect that resulted in blackouts for around 1.4 million people in the San Diego area. At the time, about a third of San Diego's power was being supplied from Arizona, while another half of the supply was coming from the San Onofre nuclear plant. A surge resulting from the accident in Arizona caused all power to cut off along one of the main transmission lines from Arizona to California, cutting off about a third of the electric supply to the area. Electric load was redirected on to other lines, which eventually tripped off line due to the higher demand. In this surging environment, the San Onofre Nuclear Generation Station (SONGS) was cut off from much of the grid for safety reasons and eventually shut down. A lack of real-time communication along the grid led to poor decision-making. The blackout also raised new questions about the fragility of California's electric grid. A reliance on outside electricity traveling along a limited number of transmission lines leaves California vulnerable to such cascading effects.

Stakeholders

California ISO: The California ISO (Independent System Operator Corporation) is a non-profit public benefit corporation that manages the high-voltage lines that make up 80% of the California electric grid and oversees the market for electricity in the state. The ISO predicts energy needs, and electric companies buy and sell power based on these projections in an open market. The ISO then manages the flow of electricity through their high-voltage, long-distance lines. Because the ISO is impartial and has no financial interest, it keeps the lines open to many providers of electricity. If the available electricity drops too low, the ISO is responsible for notifying electric companies so they can reduce the load on the system, often through blackouts. The ISO is incorporating grid modernization technology into its control centers to help manage the supply and demand of electricity, to make it easier for smaller renewable energy inputs to be

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integrated into the system, and to increase the reliability and efficiency of the system.

Electric Companies: California electric utility companies produce and/or buy electricity from a variety of sources both in state and out of state. This electricity often travels along the high-voltage lines run by the ISO, as well as lower-voltage lines run by the electric companies themselves. The electric companies serve as “middlemen,” producing or buying electricity from wholesalers and reselling it directly to consumers. When demand for electricity exceeds supply, the electric companies make the decision about when and where to interrupt power to reduce the load on the system. They often do this through rolling blackouts, whereby the electricity will be interrupted to one segment of their customers at a time for periods usually ranging from one to two hours. Electric companies have to deal directly with customers upset over any loss of power. Many California electric companies are integrating grid modernization into their systems to give them more control over the flow of electricity and a better ability to react quickly to spikes in demand.

Large Corporations: During unplanned or rolling blackouts, large corporations lose productivity time. This loss of productivity time can be greater than the actual blackout period for some industries, as large machinery takes time to come back online after a loss of power. This can be extremely costly for businesses and industry. Businesses and industry also have a vested interest in keeping overhead costs as low as possible, including the cost of electricity. On one hand, grid modernization technologies can be expensive to install, a cost that electric companies can pass on to their customers. They can also make it possible for the companies to charge higher rates for energy use at peak times. On the other hand, grid modernization technology contributes to system efficiency, which can lower the overall costs of electricity. Grid modernization technology also enables large corporations to work more closely with electric companies to better control what areas lose power and when they lose it in the case of an emergency.

Citizens: Blackouts can cause numerous problems for California citizens. Besides the inconvenience of electrical loss in the home, loss of electricity can also lead to traffic snarls, airport delays, problems with emergency services, and even difficulties with routine tasks such as grocery shopping. Planned, rolling blackouts can lessen the effects of some of these problems, but still cause serious inconveniences for many people. For at-risk populations, such as the elderly, children, and people with special needs, blackouts can be especially dangerous. Blackouts often occur during periods of extreme cold or heat, since extra heating and cooling needs place a higher demand on the system. Electrical loss can knock out heating and cooling systems, leaving at-risk populations vulnerable to extreme temperatures. Most California citizens want solutions that will minimize blackouts and the cost of electricity.

Government: Blackouts disrupt regular government business in much the same way they affect

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private businesses. The need to respond to emergency situations related to the blackouts can place additional burdens on bureaucrats in state and local governments. Significant problems can lead to an increase in legislation and oversight. Large-scale blackouts can also result in negative political fallout for politicians and elected officials, as citizens are upset over loss of services. Many analysts cite the energy crisis in the early 2000s as one of the reasons Californians voted Governor Gray Davis out of office in 2003. California's state government has been studying the implications of grid modernization and awarding grants for research on the best ways to integrate the technology in California. The state government has advised an informed, collaborative approach among all stakeholders to improve the state's electric grid.

Problem Mitigation

Following the 2000–2001 energy crisis in California, the state government created an Energy Action Plan to ensure the security of California's energy future. The plan called for, among other things, measures such as increasing the state electricity output through new facilities, encouraging conservation, and upgrading the grid infrastructure. The state also imposed conservation and efficiency standards for government buildings. In 2006, the state enacted a requirement that 20% of California's electricity come from renewable resources by 2010. In 2009, a new goal of 33% by 2020 was set.

In the wake of the 2011 blackout and subsequent problems with the San Onofre nuclear plant that caused it to shut down, analysts predicted rolling blackouts in the summer of 2012. To help prevent this, electric companies reached deals with the U.S. Navy to voluntarily reduce energy use on its nearby bases if emergency conditions arise. The utilities reached similar deals with large corporations in the area. These deals provide a way to reduce overall energy use in the system in emergency situations without conducting rolling blackouts. Participants receive reduced charges in exchange for their cooperation.

Electric companies, as well as the ISO, are also beginning to introduce grid modernization technologies into their systems. Electric companies are incorporating smart meters, which provide more specific, real-time data than traditional meters. Electric companies can use these data to charge more for energy during peak times and less during non-peak times, to alert customers to those peak times, and to more quickly identify problems. These measures can be costly up front but can save money over the long term by greatly increasing the efficiency of the electrical system. Efficiencies gained by grid modernization can also help California meet its strict environmental requirements by reducing the need for energy resources.