



Diablo Canyon FAQs

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Introduction to Diablo Canyon

What is Diablo Canyon Power Plant?

Diablo Canyon is California's last nuclear power plant, located on the Pacific coast near the city of San Luis Obispo. Nuclear plants like Diablo Canyon use uranium to heat water, making steam which then turns large turbines to make electricity for the California grid. This plant has two reactors and generates around 8% - 10% of California's electricity. The plant provides a steady supply of electricity without carbon emissions to meet the equivalent needs of 3 million people. It is owned and operated by Pacific Gas & Electric (PG&E) Corporation, headquartered in San Francisco.

Why is Diablo Canyon scheduled to close?

Diablo Canyon's original 40-year Nuclear Regulatory Commission licenses expire in 2024 and 2025 for Units 1 and 2, respectively. Similar to almost all other nuclear plants in the country, Diablo Canyon was pursuing its license extension to extend its operation by twenty years to 2044 and 2045. Nuclear plants around the country are now receiving 40-year license extensions, so Diablo with its similar design and operation history would have likely received one also if PG&E had pursued an extension. Diablo is one of the youngest nuclear plants in the country.

PG&E was in the process of relicensing the plant, had completed all required plant upgrades, and was fully expected to receive its license extension from the Nuclear Regulatory Commission. However the plant also needed several permits from California agencies, namely the State Water Board, the State Lands Commission, and the Coastal Commission. These applications had been submitted and were sitting before the relevant commissions in 2015.

Prominent California politicians at the time were opposed to the plant operating, and credibly threatened to prevent Diablo Canyon from progressing through the state's re-permitting processes or even operating a further decade to 2025, unless PG&E's NRC relicensing effort for Diablo Canyon was abandoned.

The prominence of the opposing politicians, and the number of state regulatory levers that could be utilized to oppose the plant's operation, was considered almost

insurmountable by PG&E leadership in 2015 and 2016. PG&E's limited desire to fight these battles was reduced even further by the low revenue allowed from plant operations by the California Public Utilities Commission; PG&E's leadership's desire at that time to encourage natural gas consumption over electricity consumption; and finally, lack of statewide public support for nuclear energy.

PG&E decided to close the plant instead of pursuing relicensing, and in return, agencies granted PG&E state land and water permits to operate Diablo Canyon through the end of its current license. In 2018, the CPUC confirmed the decision by ruling in favor of the [Joint Proposal Agreement](#), the end product of negotiations to close the plant between PG&E, environmental NGOs, and unions.

What was the result of the negotiation to close the plant, and who was involved?

Upon PG&E's decision to close the plant, it entered negotiations with multiple parties to build a consensus around the decision.

Major parties to the Joint Proposal include the Natural Resources Defense Council, Friends of the Earth, Environment California, IBEW Local 1245, the Coalition of California Utility Employees, and the Alliance for Nuclear Responsibility.

Can Diablo Canyon be relicensed?

Nearly all the work to relicense the plant is already complete. Approximately \$800 million was obtained from ratepayers by approval of the California Public Utilities Commission and was used to complete life extension upgrades. The relicensing project remained in full force until just prior to the announcement of the Joint Proposal, and the application for relicensing was withdrawn from the NRC as a condition of the Joint Proposal as approved by the California State Lands Commission. The CPUC approved the withdrawal of the license application effective April 23, 2018.

Relicensing work has not identified the need to undertake any further major refurbishment or replacement actions to maintain the functionality of important systems, structures, or components during the DCCP license renewal period of 2025 to 2045.

The Nuclear Regulatory Commission typically takes 22 months to review completed applications. Review of the DCPD application was partially complete when it was withdrawn. The NRC allows plants that are already in the process of relicensing to continue their operation after their current license has expired as long as progress is being made in the relicensing process. This means that, even up until 2024, it will still be possible to relicense the plant and keep both units operating. For such a late submission, however, the NRC would require a clear plan from the plant owner for the completion of all relicensing activities going forward while maintaining satisfactory operating standards.

Physical Condition and Safety Considerations

How long can Diablo Canyon safely operate?

Essentially indefinitely. The plant's equipment is routinely inspected, well-maintained, and replaceable. When parts show signs of wear, they are fixed, replaced, and/or upgraded. This has already happened at Diablo, with the replacement of major components like the reactor vessel head and steam generators. Diablo Canyon's staff keep the plant operating well, with proactive, capable managers overseeing line workers empowered to question and challenge. This ensures that day-to-day operations are conducted with the utmost attention to details, with special upgrades and inspections occurring during outages every 18 months.

Theoretically, there will be a service limit to the steel of the reactor vessel, the most difficult major component to replace, if possible to replace at all. However, as Diablo is younger than other plants already moving beyond 50 years of service with licenses to 80 years, there will be sufficient advance notice in order to undertake more study or action to keep Diablo Canyon in service.

The licensing activities already completed provide extensive documentation that Diablo is a plant in exemplary condition, especially with respect to environmental responsibilities. Other plants in the U.S. like Turkey Point, which like Diablo Canyon is a Westinghouse PWR design, have received a second license renewal, which the NRC calls "Subsequent License Renewal," to operate for an additional 40 years.

Is Diablo Canyon able to withstand earthquakes?

Nuclear plants like Diablo Canyon are built to withstand strong earthquakes without damage, and to protect staff and the public even during extremely strong earthquakes. Diablo Canyon shuts down automatically if shaking exceeds a certain threshold. The plant is then prepared to manage continued cooling of the reactors even if offsite power is lost because of damage beyond the plant's borders, which can be expected in the strongest earthquakes.

In Japan, there were several nuclear plants close to the epicenter of the 2011 Tohoku Earthquake and all of them shut down automatically. One nuclear site hit by the earthquake even served as an emergency shelter location and provided water and shelter for local residents after the earthquake. Fukushima Daiichi's meltdowns resulted not from the earthquake but later from the resulting tsunami, as discussed below.

Since the discovery of the previously unknown Shoreline fault in 2008, the hazard this fault poses to the nearby Diablo Canyon plant has been thoroughly investigated in numerous state-of-the-art seismic studies. The hazards associated with the new fault are below the original hazards the plant was designed and built to withstand.

Is Diablo Canyon able to withstand tsunamis?

Diablo Canyon sits on a coastal bluff at an elevation of 85 feet above sea level, and the underwater topography just offshore does not support the formation of tsunamis large enough to harm the plant.

For comparison, the Fukushima Daiichi plant sat at an elevation of 30-35 feet above sea level, with offshore topography conducive to the formation of large tsunamis. The Tohoku earthquake, the most powerful in Japan since the start of record keeping, did not significantly damage the plant but did produce a 48 foot wave at the site. The back-up diesel generators at Fukushima were located at the same elevation as the other buildings that flooded and were not placed in waterproof enclosures.

In contrast, at Diablo Canyon, despite the much higher plant elevation and the friendly seafloor shape, precautions have been taken against even cataclysmic tsunamis hitting the California coast. The plant's backup generators are themselves backed up by

portable equipment staged at two other locations onsite, and can be moved into position to provide power and pumping capacity as needed.

Does Diablo need cooling towers?

No. Diablo operates with little impact on the surrounding marine environment. Currently, Diablo Canyon uses ocean water for cooling in a process called Once-Through Cooling (OTC), using carefully designed water intake structures to avoid impacting fish or marine life populations. California's once-through cooling ruling has been based on opposition to the generic principle of once-through cooling systems, rather than the specific case of Diablo Canyon.

Although the California Environmental Protection Agency has ruled generally that once-through cooling should not be used for electricity generation plants, including both fossil fueled and nuclear plants, it grants exceptions on an as-needed basis. Nuclear plants in other U.S. states and around the world continue to use once-through cooling while closely monitoring the continued health of their local marine habitats. Diablo Canyon's excellent ongoing stewardship of its coastal mammal, bird, fish, and invertebrate populations has been observed for decades through extensive surveys, all while the plant remains operating solely with once-through cooling.

Considering the pristine state of Diablo Canyon's immediate environment after four decades of operation, an exception could be permanently granted for Diablo Canyon by the State Water Control Board. Recently, the Board has granted exemptions to many coastal fossil-fueled plants due to electricity supply constraints, as once-through cooling makes coastal plants nearly impervious to cooling limitations during heat waves — and California's grid is already stressed without closing multiple coastal generators, which was scheduled to occur at the end of 2020. As heat waves are expected to worsen, and Diablo operates in heat waves without limitation and without emissions, it would be a simple step for the Water Board to extend its exemption to Diablo Canyon conditional on the continued excellence of its marine sanctuary protection.

What about the waste?

Waste management is actually a positive aspect of nuclear energy generation in general. This is because the volume of nuclear waste is extremely small relative to the waste streams produced by other energy sources and industries, and the high-radioactivity waste (spent fuel rods from the reactor core) is physically robust and

easily shielded from people and the environment as its radioactivity continues to drop with time. Unlike in other industries or other types of power plants where waste products are released to the atmosphere and the environment as unmanaged pollution, nuclear plants like Diablo Canyon contain their waste fuel rods, and do not release them into the environment. As a result, commercial nuclear power's waste stream has never had any impact on public health or the climate. Diablo Canyon is no exception.

Currently there are 49 canisters of used fuel at the facility on site. The used fuel from providing about one-tenth of California's electricity production for the first 40 years will fit in 140 canisters sitting on approximately one acre of Diablo's site. The spent fuel in these canisters could be reprocessed at some point in the future should uranium become more expensive, but for the first century or so of a nuclear plant like Diablo's operation this is not a pressing issue. Some U.S. nuclear plants allow visitors to approach and touch these waste canisters, as they are not hazardous to visitors, workers, or the environment.



Image of Diablo Canyon spent fuel storage in 2018. The red line is 145 meters long.

Does Diablo Canyon produce other types of waste or pollution?

Waste liquids are processed through multiple cleaning systems on site, and then released in accordance with the National Pollutant Discharge Elimination System (NPDES) Permit.

Diablo Canyon also has backup power supplies including six emergency diesel generators, which are used only during tests to ensure their readiness. These generators, like those now being approved for private businesses and facilities around the state after the August 2020 supply blackouts, are not clean ways to generate electricity, so their discharge of regulated pollutants is minimized by use of high-grade ultra-low-sulfur fuel and limits on fuel usage and hours of operation. Diablo Canyon's tests of its generators are in accordance with the San Luis Obispo County Air Pollution Control District (APCD) requirements.

Diablo Canyon workers and facilities produce about 630 cubic feet of what is called Low-Level Radioactive Waste each year, for example used personal protective equipment (PPE), which is packed and transported to designated disposal sites in other states.

What State permits are held for the plant?

State permits are an important part of Diablo's relationship with California's government. As noted previously, these permits provide an opportunity for interested politicians to pressure Diablo Canyon, but also an opportunity for Diablo Canyon's engineers and scientists to demonstrate the plant's strong environmental record.

State and local permits held by Diablo Canyon include, with the relevant granting body included in parentheses:

- Intake and outfall structure permits (State Lands Commission)
- Once-Through Cooling permit (State Water Resources Control Board)
- NPDES water quality permit for Diablo Creek and discharges from the plant (CalEPA / SWRCB)
- NEI groundwater protection initiative (NEI 07-07) - DCCP Radiological Environmental Monitoring Program (REMP)
- Air Quality permit (San Luis Obispo Air Pollution Control District)
- Coastal Development permit (Coastal Commission)

The Loss of Diablo Canyon

How much will it cost to keep Diablo Canyon operating?

Diablo Canyon is currently profitable for its owner. It is not clear if continued increase of solar or wind electricity along with continued decrease of fossil-fueled electricity would interfere with this profitability. But California's heavy focus on building battery storage bodes well for the continued profitability of Diablo Canyon, as the plant's always-on power provides a certain and low-cost way for battery facilities around the state to charge in preparation for times of need. In addition, as California and surrounding states reduce their "baseload" fossil fuel power plants which, like Diablo Canyon, can run all day and night all year, Diablo Canyon's power will be at a premium in California and in neighboring states.

California's legislators have acknowledged the importance of this nuclear power by explicitly including it in the state's landmark energy bill, SB100, as a source of the clean power needed to reach 100% clean by 2045. Therefore Diablo's power will soon become a special supply of stable, non-seasonal clean energy for the state's communities and businesses to purchase. With the goals of electrification of the state's automobiles, homes, and industry, demand for clean electricity, especially in the evening and at night, will ensure that Diablo Canyon has a keystone role to play in the state's electricity system.

In fact, multiple studies of electricity systems around the country (in the Pacific Northwest, in New England, and in the PJM market stretching from New Jersey to Chicago) have found that getting to beyond 80% clean power is much more expensive if nuclear is kept out of the mix.

Because Diablo's current owner, PG&E, a regulated investor-owned utility, is incentivized to invest capital in exchange for regulated returns, it sees little benefit from a coming increase in demand for Diablo's clean energy. This means that PG&E considers Diablo Canyon as only a downside risk, despite its current profitability, life-extendability, and legal admission as clean energy under California law. Because PG&E has already invested the money required to upgrade and life-extend the plant, it sees little further incentive to operate the plant despite its crucial role in securing low-carbon energy supplies in accordance with state climate goals and existing law.

Therefore, the cost of keeping Diablo Canyon running depends mostly on the price assigned by the plant's current or prospective owner to the political risk of operating this type of power plant in the state of California, rather than any need to be subsidized for continued operation.

What are the economic costs of losing Diablo Canyon?

Nuclear plants provide permanent, high-wage, high-skill jobs, for multiple generations of workers at the same location. And for every 100 nuclear power plant jobs, 66 more jobs are created in local communities. As San Luis Obispo county's largest private industrial employer, Diablo Canyon employs nearly 1,500 full-time employees and contributes about \$30 million in taxes annually. These taxes contribute to the budget for local schools, fire, police and other services, along with local tax revenues based on the residency of the plant's workforce. Local employee compensation comprises the majority of the approximately \$350 million in fixed costs to run the plant each year, much of which stays in the local and state economy.

Replacing in-state nuclear generation with out-of-state natural gas production, with that gas combusted in gas turbines both inside and outside of the state, will result in a net tax revenue and job loss for California. California's rapidly escalating electricity prices, rising by around 6% per year despite stable prices on average in the rest of the country, are certainly not being caused by any rise in Diablo's production costs, which are stable or declining. California's electricity costs would be expected to rise even further with the loss of the state's largest power plant and by far its largest clean energy facility. The fact that Diablo's power is accepted by the CAISO market auctions without a subsidy, and the plant is making money, indicates that replacing the power will raise costs for consumers in the state.

Cold snaps in other states can rapidly increase California energy costs, as demonstrated by the record-breaking cold on the central plains and Midwest in February 2021. The presence of Diablo keeps natural gas consumption lower than otherwise, providing a hedge for the state's consumers and businesses.

Wind turbines, solar panels and batteries are almost never manufactured in California, owing to high labor and energy costs, meaning the addition of these power sources will not be accompanied by the establishment of significant, permanent in-state employment.

What are the environmental implications of losing Diablo Canyon?

If Diablo Canyon is allowed to prematurely shut down, California will be losing 2.2 GW of zero-carbon generating capacity. Baseload generation significantly improves electricity system performance by reducing the severity of peaks, while keeping average generation costs down. The replacement of Diablo's output at peak times, even by batteries, means that fossil generation will be running longer hours to fill batteries.

During multiple-day heat wave events, extra peaker plants will be running almost constantly while battery reserves are drained and refilled under grid stress, leading to spiking concentration of local pollutants. The CPUC is now approving inefficient, polluting diesel generators for use by private companies to guard against system-wide limitations in energy supply. This supply risk would be made worse by the loss of the state's highest-output power plant. Diablo, located on the central coast roughly halfway between major Northern and Southern California population centers, is positioned closer to major loads than many new renewable energy projects, further increasing its value to the grid.

Additionally, without Diablo Canyon, the lands and waters currently protected by PG&E's management around the plant facilities are not guaranteed to retain their protected status.

Will Diablo Canyon be replaced by renewables?

No. Although the Joint Proposal Agreement was written to imply that Diablo's closure would be accompanied by sufficient replacement generation under the State's Integrated Resource Planning process, this has not occurred. In fact, the CPUC has acknowledged that the Integrated Resource Planning replacement called for in the Joint Proposal Agreement is not sufficient to replace Diablo.

Instead, a new Integrated Resource Planning effort now in progress is expected to lead to energy storage replacing Diablo's generating capacity, rather than leading to energy generation replacing Diablo's energy production.

The CPUC is now attempting to procure this additional storage capacity in order to replace the plant's output at critical times, to reduce the chance of energy-insufficiency

blackouts like those that occurred in August 2020. This battery storage capacity will be charged with electricity from the grid, primarily generated from natural gas if Diablo is lost. While the CPUC may order the procurement of extra wind and solar along with the extra batteries as part of this Integrated Resource Planning effort, the key point is that any extra batteries and renewables *could be replacing polluting gas-fired generation instead of attempting to replace nuclear*. By pushing for the premature closure of Diablo Canyon, the CPUC is making it harder and more expensive to meet the State's climate goals.

In fact, when California shut down the San Onofre nuclear plant, California's share of gas-fired generation immediately rose from 45 percent to 61 percent. Although this bump has now been reduced back to its starting point, that has been the result of years of investment in renewable energy and progress has slowed down markedly in recent years.

The Integrated Resource Planning (IRP) process "promises" to replace Diablo with renewables only, but recent findings show a significant shortfall in the planning process. The largest in-state source of electricity is currently natural gas, at 43% in 2019 and higher in 2020 by provisional data, and more than a quarter of California's electricity is imported from out of state and is a mixture of natural gas, nuclear, large hydro, wind, and solar.

If Diablo Canyon closes, natural gas will continue to be used for much longer, increasing our carbon emissions and worsening climate change. The Union of Concerned Scientists has recently acknowledged this, calculating that the loss of Diablo means 15.5 million metric tons of CO₂ will be emitted through 2030 alone if the plant is not extended.

Does California consider Diablo Canyon as clean energy?

Yes. The state's groundbreaking clean energy law SB100 classifies nuclear energy as clean for the purpose of meeting the state's 100% clean electricity goals by 2045. Although requirements for clean energy as opposed to just renewable energy only take hold after year 2030, this means Diablo Canyon (if in operation in 2030 and beyond) will become the most important industrial facility in the state for meeting legally-mandated clean energy goals.

Does Diablo Canyon pair well with electric vehicles?

Yes. The vast majority of EV charging — more than 80% — occurs at night. Diablo Canyon's energy output is a very good match to an electric vehicle fleet. Diablo Canyon provides enough energy to charge a fleet of 3.1 million EVs driving the state average distance of 83 kilometers per day while consuming 5 kilowatt-hours per kilometer. This number of vehicles would represent over 10% of California's currently registered cars.

Could Diablo Canyon make carbon-free hydrogen?

Yes. Diablo's steady output is perfectly suited to efficiently running electrolyzers to produce clean hydrogen.

Next Steps

What would need to happen next to keep Diablo open?

- Diablo Canyon's owner would need to resubmit the license renewal application so the NRC can continue to review it, along with a credible plan for completing all needed inspections in a timely manner.
- Perform required inspections and implement license extension programs at the plant.
- Submit a new motion to the CPUC to ask permission to continue operating DCPD past 2025.
- Satisfy various federal and state permits.

What does the CPUC need to do?

The CPUC originally had to approve PG&E's request to not relicense the plant, and issued its decision in 2018 approving the shutdown. The CPUC would need to approve a new motion from Diablo Canyon's owner requesting permission to keep operating the plant beyond 2025.