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CGNP's Opening Brief in CPUC Application A.16-08-006

Attached find a copy of Californians for Green Nuclear Power, Inc;'s (CGNP's) accepted Opening Brief in CPUC Application A.16-08-006 by Pacific Gas and Electric (PG&E) to abandon the safe, efficient, cost-effective and reliable Diablo Canyon Power Plant (DCPP) in 2025. CGNP, as a CPUC Intervenor requests proper notice by the California Energy Commission (CEC) of CGNP's Opening Brief. In summary, CGNP supports the continued safe operation of DCPP far beyond PG&E's proposed abandonment date of 2025. CGNP further requests that any CEC requests for information or clarification be sent to the contact email address shown in the document. CGNP expects substantial revision of the upcoming CEC IEPR to reflect CGNP's fact-based perspectives.

Additional submitted attachment is included below.

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

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Application of Pacific Gas and Electric Company for Approval of the Retirement of Diablo Canyon Power Plant, Implementation of the Joint Proposal, and Recovery of Associated Costs Through Proposed Ratemaking Mechanisms (U 39 E)	Application: No. 16-08-006 (Filed: 08/11/2016)

OPENING BRIEF OF
CALIFORNIANS FOR GREEN NUCLEAR POWER

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I. INTRODUCTION AND SUMMARY OF RECOMMENDATIONS

The California Public Utilities Commission is charged with a sacrosanct duty: regulating the entities to which the state has granted monopoly power. To that end, the original basis for the Commission, its *raison d'etre*, was primarily economic. In exchange for certain benefits (captive customers and guaranteed revenue) granted to utilities, the state and its ratepayers needed a guarantor of fair and reasonable rates. In the twenty-first century however, the regulation of electric utilities has taken on additional dimensions. Electric power is a much more critical part of life than when the Commission was born. Today, it's a rare worker or student who can function without reliable electric power. And the realization that our atmosphere is warming faster than ever has made the consequences of Commission decisions even more profound, causing California policymakers to require the Commission take steps to preserve our planet.

If the Commission takes its tri-functional role seriously, then the continued operation of Diablo Canyon Power Plant ("Diablo") is the only possible outcome here. And lest the three principles in this introduction be considered merely aspirational, Californians for Green Nuclear Power, Inc. ("CGNP") reminds the Commission of the statutes that must govern its decision. First and foremost, ratemaking must be just and reasonable. *See Cal. Pub. Util. Code*§ 451. In the same vein, the Commission must consider the economic consequences of its actions. *See id*. § 321.1(a). No party in Commission proceedings may make a false representation of cost or value. *See id.* § 459(a). Moreover, the Commission must ensure reliable, low-cost power. *See id.* § 454.51(a)-(b). It must choose for California ratepayers a "***diverse and balanced portfolio*** of resources." *Id.* (emphasis added). And last but not least, the "costs and benefits to the environment, including air quality" must be part of the Commission's calculus. *See id.* § 701(c).

With those statutes in mind, it becomes clear that the Commission must reject PG&E's application. CGNP makes that recommendation on six grounds:

1. PG&E has not met its burden of proof.
2. As a threshold matter, PG&E's actions to essentially re-scope this proceeding midway through violate Rules 1.7, 1.12, and 7.3 of the Commission's *Rules of Practice & Procedure* as well as Due Process principles, prejudicing the other parties.
3. As a second threshold matter, this proceeding is *void ab initio* unless and until PG&E obtains a Coastal Development Permit.
4. Approving this application would result in unjust and unreasonable rates. Simply put, it is unreasonable to shutter a cost-effective resource in favor of more expensive, less-certain alternatives.
5. Approving this application would diminish power reliability.
6. Approving this application would make it impossible for California to meet its clean-air goals, causing irreparable harm to the environment.

As PG&E Senior Vice President Ed Halpin stated in September 2015, Diablo "**is a vital resource for California. It is a safe, clean, reliable and affordable energy resource for PG&E's customers statewide**."[1] Nothing in that statement has changed, except the political winds. Legal principles, not politics, must govern the Commission's decision.

II. ARGUMENT

The consequences of the proposed retirement of Diablo are many. They include the livelihoods of the plant employees, the economic wellbeing of the surrounding areas, the cost of electricity to ratepayers, grid reliability, and the ability of California to meet its objectives regarding GHG-emissions and climate change. CGNP will focus on the latter three, but first must raise three important procedural

[1] CGNP Prepared Testimony p.34, lines 18--22.

defects.

A. PG&E Has Not Met Its Burden of Proof.

Under well-established legal principles, PG&E, as the applicant, bears the burden of proving that its requested alterations to the status quo are necessary, and that any rates it seeks would be just and reasonable. Here, unfortunately, the opposite is true. PG&E has failed to provide sufficient credible information to support its request to retire Diablo and has not demonstrated need for a decision at this time. This legal proceeding must stand on its own, and this decision, standing alone, is subject to a writ petition. With withdrawal of Tranches 2 & 3 from Application, PG&E has provided no basis whatsoever for its contention that replacement sources of electricity would be equally or more safe, reliable, efficient, or cost-effective. There is nothing in the record to meet the evidentiary standard that the applicant and Commission must follow.

Furthermore, no party presented evidence that supported the assumption that Diablo could only operate in "baseload" mode. PG&E withheld from this proceeding its own studies of flexible operation, which might have illustrated the full range of possible operational scenarios and costs typical of similar reactors worldwide.[2]

PG&E did not meet its burden on another highly disputed issue, projected cost. Those opposing Diablo cite potential higher costs, while CGNP cites current Diablo-specific and industry trends. Of particular note are those associated with once-through-cooling mitigation and plant modifications necessary to accommodate potential flexible operation. In its rebuttal testimony, PG&E categorically rejects claims of higher operating costs for current and future licensing periods made by WEM,[3] and A4NR/Mothers for Peace[4]. Except for alleged once-

[2] CGNP Prepared Testimony, Page 14, line 16, et. seq.
[3] PG&E-5 Rebuttal Testimony, page 1-19, line 15, et. seq.

through-cooling mitigation costs, which CGNP disposes of in Section D, *infra*, PG&E has identified no factor that would significantly affect cost in a relicensed operation.

The *Commission's Rules of Practice & Procedure* 12.1(d) require that settlements be in the public interest. Since PG&E has not proved that this one is, the Commission must reject it. The "Joint Proposal" embedded within this application is a settlement negotiated privately between PG&E and other self-interested parties without public input, and it entirely disregards the interests of millions of PG&E ratepayers with a stake in the outcome. PG&E has not showed its proposal is in the public interest, and therefore has not met the burden of proof that applies to the "Joint Proposal" either.

Lastly, subsumed in a burden-of-proof analysis is also whether an applicant has submitted factually accurate, credible testimony. Here, PG&E claims that future operating costs for Diablo will escalate dramatically,[5] in contradiction to its own cost analysis from 2010.[6] PG&E estimates of future operating costs here are far higher than its previous estimate primarily because it assumes a 25% probability that cooling towers will be required for once-through-cooling mitigation, with estimated costs of up to $13.3 billion.[7] As CGNP demonstrated in section D, *infra*, the problems with PG&E's cost estimate can be solved by resorting to calculations submitted in this proceeding and other judicially noticeable, public proceedings. Resolving PG&E's cost estimates demonstrates continued operation is economical, and raises questions regarding the credibility of PG&E's recent statements.[8]

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4 PG&E-5 Rebuttal Testimony, page 5-7, line 14, et. seq.

5 PG&E WP 2-16

6 Ex. CGNP 3, pp. 5-3

7 PG&E WP 2-20

8 As another example, PG&E alleges that Diablo's clean, reliable power can be partly replaced by Energy Efficiency, at a level of 2,000 GWh yearly – barely 1/9 of Diablo's output. A PG&E analyst testified that improved energy efficiency would be gained by examining expenditures and actions of other states, in search of the desired 2,000 GWh of annual savings. When asked: "Did you evaluate the specific

B. PG&E Violated the Commission's Rules When It Unilaterally Re-Scoped This Proceeding, Midway Through.

In its rebuttal testimony served 17 March 2017, PG&E substantively altered the focus of this proceeding. Its witnesses, three PG&E executives, proclaimed: that PG&E was withdrawing certain aspects of its application; that as far as PG&E was concerned those aspects would be considered in another proceeding; and that PG&E would not be spending any more time on those subjects and considered the matter closed.[9] PG&E also issued a press release, announcing to the world that it had changed the focus of this proceeding.[10] In the press release, PG&E stated that it (*i.e.*, as opposed to the Administrative Law Judge, or the Commission) had made "[p]rocedural [m]odifications" to this matter. In response to the general confusion PG&E's machinations caused, ALJ Peter V. Allen e-mailed the service list, claiming that the tranches PG&E lopped off this proceeding are still within the scope, that PG&E would not be required to amend its application, and that the schedule for the proceeding would remain the same.

None of the above was procedurally proper. PG&E's actions violate Rules 1.7, 1.12, and 7.3. Unless the Commission itself re-scopes this proceeding, it would be allowing PG&E to get away with a patently late amendment to its application and a clear change in the scope, both which prejudice the other parties. Rule 1.12(a) is clear. "An amendment is a document that makes a substantive change to a previously filed document." Deep into its 882-page rebuttal

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measures that were used by those other states that have not already been used in California?" she said, "No, I didn't" *See* Cross Examination Transcript, Vol 5, p. 802, line 21. Earlier, another PG&E witness had indicated that energy efficiency might achieve a per-capita demand reduction of 1 divided by "1.5" Cross Examination Transcript Vol 3, p. 471 lines 20-24.. That's less than 34% improvement, achieved via methods and technologies that PG&E couldn't list. This is simply not credible. The Commission cannot give it any weight. Thus, another pillar of PG&E's application collapses.

[9] See PG&E Rebuttal Testimony 6-2, lines 1-27 [page 863 of 882].

[10] Available at https://www.pge.com/en_US/safety/how-the-system-works/diablo-canyon-power-plant/news-and-articles/pge-makes-procedural-modifications-to-diablo-canyon-joint-proposal.page

testimony served on 17 March 2017, PG&E attempted to bury such an amendment to its initial application. Its witnesses, three PG&E executives, "testified:"

> On February 27, 2017, PG&E notified the service list in this proceeding that: ...after careful review of the important feedback provided by parties in their January 27, 2017 opening testimony on the Diablo Canyon replacement proposal, PG&E is withdrawing the Diablo Canyon Tranches #2 and #3 replacement proposals, as well as the proposal to implement the Clean Energy Charge to recover the costs associated with Tranches #2 and #3. The Joint Parties believe that these aspects of the Diablo Canyon replacement proposal are better addressed in the Commission's Integrated Resource Plan ("IRP") proceeding (Rulemaking 16-02-007). Consistent with the Joint Proposal, PG&E is requesting the Commission adopt a policy directive in this proceeding (A.16-08-006) that the output of Diablo Canyon be replaced with greenhouse gas ("GHG") free resources, and that the responsibility for, definition of, and cost of these resources be addressed as a part of the IRP proceeding.[11]

PG&E's actions are unusual and improper. Whether the Commission focuses on the fact that PG&E placed this text in its rebuttal testimony, or the fact that it allegedly e-mailed these concepts to the service list – both were equivalent to a legal motion in disguise, and one that clearly sought to "make[] a substantive change to a previously filed document", under Rule 1.12(a).

Motions must be made properly, with papers styled as such and formally submitted to the ALJ for approval. Here, it is clear why PG&E did not do so. The time for filing an amendment to its application had long since passed. Again, Rule 1.12(a) is clear. "An amendment to an application . . . must be filed prior to the issuance of the scoping memo." The Scoping Memo in this proceeding issued in November 2016. PG&E's actions were three-months late.

Further, PG&E's actions improperly usurped the Commission's authority. Rule 7.3(a) states plainly that "the assigned Commissioner . . . shall determine the . . . issues addressed." A party can request to amend its application (or a change in scope), but only the Commission has authority to act on such a motion. By attempting to alter the scope of this proceeding with an e-

[11] PG&E Rebuttal Testimony 6-2, lines 1-27 [page 863 of 882].

mail, a press release, and then rebuttal testimony, PG&E has usurped the role of the Commission. Allowing a regulated utility, without a timely filed amendment or motion, to unilaterally re-focus a proceeding midway through would make a mockery of this proceeding, the Commission's own rules, and the Commission's mission to act in the public interest.

Whether the proposal PG&E submitted is acceptable to the Commission or not, the Commission must formally re-scope this proceeding. The Scoping Memo sets the parameters of a matter and is critical for the parties involved and for the public record. The requirement of Scoping Memos is statutory. *See Cal. Pub. Util. Code § 1701 et seq*. Straying from a scoping memo (whether technically, or substantively) can cause a proceeding to be fatally flawed from a due-process standpoint, and subject to a due-process attack at a later date. In 2006, this concept of late alterations to the substance of a proceeding was tested in a writ petition, and the Court of Appeal agreed very clearly such changes were improper. *See Southern California Edison Co. v. Public Utilities Com'n* 140 Cal.App.4th 1085, 1106 (2006).

PG&E's actions were prejudicial and violated the other parties' due-process rights as well as fundamental fairness. The parties have directed extensive time and resources focusing on all of the requisite topics in the initial application and scoping memo. The parties with no foreknowledge of PG&E's actions were substantially harmed, because resources could have been re-allocated to the new foci, had they known they wouldn't need to work on the now-withdrawn tranches present in the initial application. Second, PG&E has effectively announced it will not respond to several of the issues it initially raised, so ALJ Allen's e-mail and the docket do not reflect the actual circumstances of the proceeding.

And respectfully, ALJ Allen's e-mail, essentially informing the parties he was inclined to let PG&E get away with its actions, resulted in more confusion than clarity. First, there was no

motion before the ALJ, and thus his e-mail wasn't a ruling. Second, pretending that the other parties can simply continue responding to non-existent proposals, when the applicant has stated it would not, and when PG&E's actions clearly constitute an amendment to its application, would make for a curious process at best.[12] It must be emphasized that the very point of this proceeding is for the Commission to collect testimony and argumentation as to whether credible alternative sources of emissions-free power exist to replace the power lost, should PG&E be permitted to be reimbursed for its abandonment of Diablo Canyon. *See PG&E Application*, p. 8-9.[13] PG&E has stated plainly that it is deviating from its own application, making a re-scoping necessary, at a minimum.

C. The Commission Must Dismiss or Stay the Proceeding Until PG&E Obtains a Coastal Development Permit.

[12] Furthermore, on 29 March 2017, PG&E cited its unilateral action as one of the rationales for denying CGNP's Data Request Number 9, regarding PG&E's very modest use of Helms Pumped Storage (with annual capacity factors ranging between 0.84% and 4.69% between 2003-2016).

[13] The Commission has fundamental responsibilities to consider the effect of this proposed action upon reliability, cost, and greenhouse-gas emissions. Indeed the scoping memo explicitly requests that all of these issues be addressed in any proposals regarding replacement procurement. Yet PG&E's amendment attempts to defer consideration of these essential issues to a separate (IRP) proceeding, after a decision on Diablo Canyon is already made. The Public Utilities Code directs the commission to "Identify a diverse and balanced portfolio of resources needed to ensure a reliable electricity supply that provides optimal integration of renewable energy in a cost-effective manner" and further requires that "[t]he portfolio shall rely upon zero carbon-emitting resources to the maximum extent reasonable and be designed to achieve any state wide greenhouse gas emissions limit." See *Cal. Pub. Util. Code* § 454.51(a). Significantly, the code also requires the Commission to "[d]irect each electrical corporation to include, as part of its proposed procurement plan, a strategy for procuring best-fit and least-cost resources to satisfy the portfolio needs identified by the commission." See id. § 454.51(b).

PG&E's amendment to defer consideration of these critical issues to a separate proceeding (after a decision on Diablo Canyon is made) contravenes those requirements. It would preclude the Commission from developing an optimal, minimum-cost portfolio, which maximizes use of zero carbon-emitting resources, as required by law. If the IRP determines available replacements are more costly, would actually increase overall emissions, degrade reliability, or deliver inadequate firm generation capacity – it would be too late to correct the error. These considerations are especially vital given that Diablo Canyon is established as California's largest, reliable, zero-carbon-emitting energy source. If the PUC moves those critical considerations to the IRP proceeding, it must move its decision on the fate of Diablo Canyon to the same.

Recent precedent implies that a coastal-development permit is needed before the PUC can act on this application, because the specific change of use proposed here (decommissioning) will require a coastal-development permit anyway. Furthermore – no matter what – the PUC acting first will violate the spirit of the Coastal Act by setting in motion a change that is more appropriately first considered under the principles of that Act.

PG&E needs a coastal-development permit. The general process for land-use changes near California's coasts is as follows. *Cal. Pub. Res. Code* § 30600 states that parties "wishing to perform or undertake any development in the coastal zone . . . shall obtain a coastal development permit." This clause is construed very broadly, encompassing almost any **change** of use in coastal zones. *See La Fe, Inc. v. Cnty. of Los Angeles*, 73 Cal. App. 4th 231 (1999). In counties that have adopted a local development program approved by the Coastal Commission, parties seeking to change a coastal use must first apply to the appropriate local government for a permit, and that decision is then appealable to the Coastal Commission. *See Cal. Pub. Res. Code* § 30600 (d).

Recent Supreme Court decisions indicate that a coastal-development permit must be issued first, before an undertaking like the one contemplated here. In *Pacific Palisades Bowl Mobile Estates, LLC v. City of Los Angeles*, 55 Cal.4th 783 (2012), the Court ruled that a city properly halted a similarly extensive, multi-stage permit process because the applicant there had not first obtained a coastal-development permit. Thus, it is appropriate for the PUC to dismiss or stay this proceeding unless and until the applicant obtains the necessary coastal-development permits, here, from San Luis Obispo County and/or the Coastal Commission.

Beyond the procedural and timing issues, there is also a substantive reason why a coastal-development permit is necessary before the PUC can act here. While it is true that the PUC can

approve the utility-related aspects of decommissioning Diablo, the actual substantive change in use almost certainly requires a coastal-development permit. Thus, while some may argue that PG&E or its successor in interest will in due course seek such a permit for a proposed new use, **it is almost certain that the mere act of decommissioning the power plant – turning the operations off, and how that would affect the coast, including water temperature – is <u>also</u> a change of use subject to Coastal Act, and one that requires a coastal-development permit.** Therefore, the PUC cannot grant permission for this act, the decommissioning, unless and until the county and the Coastal Commission give their approval. This proceeding should be dismissed or stayed unless and until those approvals are granted.

Lastly, there is a fundamental common-sense reason why the PUC should defer, and stay or dismiss this proceeding. Assuming arguendo PG&E obtains all necessary approvals from the PUC for the act of decommissioning, PG&E or its successors will still need approval for any subsequent uses of the site. Whether a coastal-development permit will be granted for those uses is very uncertain. Therefore, if the PUC approves the decommissioning of the power plant – shutting off of this tremendous asset for the state's power needs – but then the next use is not approved – the PUC would have allowed the fallowing of Diablo for nothing.

That scenario is problematic for two reasons. First, it would be immensely wasteful to take Diablo offline and idle the land without an equally useful alternative already proposed and approved. The law abhors waste, and such an act would be wasteful. Moreover, such an act by the PUC could pre-determine the final outcome. Here, if it sets Diablo down the path of decommissioning, that act could force the hand of other decisionmakers, so that they feel the need to continue down this already time-consuming and potentially non-productive path that has been pre-ordained. In other words, to avoid the decommissioning being for naught, the county

and Coastal Commission are more likely to approve future uses that they might not otherwise permit.

Such outcome-determining near the coast by the PUC – forcing the issue, in effect – would violate the spirit of the Coastal Act, which grants exclusive authority for significant decisions affecting the coast to the Coastal Commission and certain local agencies. This line of argument is consistent with prior PUC precedent, which scrupulously demarcates the boundaries of jurisdiction between the PUC and the Coastal Commission. *See, e.g., Re Southern California Edison Company*, D. 87-07-097, 25 Commission 2d 91. "Time does not confirm a void act." *Cal. Civ. Code* § 3539. And yet by starting the state down this process without the other necessary approvals in place, the PUC could eventually force such a confirmation upon the people of California, in violation of established legal principles.

D. Approving this Application Would Result in Unjust and Unreasonable Rates.

1. The Employee Retention Program is unnecessary.

PG&E requests approval of a $352.1 million Employee Retention Program.[14] It justifies this program by postulated "precipitous levels of employee attrition" and "high levels of attrition"[15] that might result from the announcement of the plant closure, and which would negatively affect the safe and reliable operation of Diablo. PG&E provided no testimony to establish that these levels of attrition would be likely to occur. CGNP raised serious doubts about the need for this program.[16][17] Information provided by PG&E confirmed it is unneeded.

PG&E witness Welsch correctly stated "the plant cannot operate under its NRC licenses and applicable regulations if we experience shortages of certain personnel. For example, the

[14] PG&E-5 Prepared Testimony, page 7-11, lines 5-6
[15] PG&E-5 Rebuttal Testimony, page 3-13, lines 13 and 16.
[16] CGNP Prepared Testimony, pages 85-87
[17] CGNP Rebuttal Testimony, pages 39-40

plant cannot operate without adequately trained on-shift operations crews (including licensed operators, shift management, and non-licensed operators), security personnel, emergency response teams, and fire brigades."[18] However, PG&E's response to Data Request Commission_001-Q11[19] reveals that of the identified 1639 employees, 101 were associated with the job title "operator", 17 associated with the job title "fire brigade" and 230 associated with the job title "security." Thus it would be reasonable to conclude that there were less than 400 positions of the 1639 total whose attrition might put the plant operation in jeopardy. Of these, it is also reasonable to conclude that the 101 operator positions would require the most training and qualification and so would be the most difficult to fill, while the others might be filled more readily. This does not justify a 25% salary bonus for all 1500 Diablo employees for up to nine years. There is also some degree of operational flexibility from having multiple shifts including a training shift that could address some increased attrition should it actually occur. Or the retention bonus could be limited to these hard-to-fill positions.

The issue then shifts to the likelihood of high levels of employee attrition and the availability of potential replacements. In response to Commission_001-Q15, PG&E witness King stated that there are 442 employees eligible for full retirement and 471 eligible for retirement with partial benefits before 2024.[20] These employees constitute 63% of the 1458 regular Diablo employees, and it is highly unlikely they would be eager to leave when they could continue to work towards retirement. Older workers face well-known difficulties in finding new employment, thus given the choice of transferring within PG&E vs. a severance package if their job was eliminated, there would be little incentive for employees to leave voluntarily.

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[18] PG&E-5 Rebuttal Testimony, page 3-14, lines 1-6
[19] Exhibit PGE 6 ,pages 1-11
[20] Exhibit PGE 6, page 25

In response to Commission_001-Q16, the table[21] shows that there are currently 81 Diablo employees over the age of 65. Retiring workers offer a potential source of already trained replacements for other employees who may leave Diablo. The PG&E response to Commission_001-Q13[22] shows that on 31 March 2017, there were 1,207 temporary and contract workers on site, many of whom were preparing for the April 2017 outage. These workers routinely receive the security checks and training needed to perform their tasks. Their job titles are similar to those of many the permanent staff, but there are some positions primarily in management they do not perform. These numbers of workers have been regularly augmenting the permanent Diablo staff since it started operation. They are another source of potential replacements should Diablo experience an unusual level of attrition. Beyond the non-permanent workers at Diablo, there are qualified individuals who do similar work at the 97 other nuclear power plants across the United States. Of those, about sixty undergo refueling outages each year. Workers at those plants make up a trained labor pool, numbering in the thousands, who could conceivably fill-in at Diablo. Additionally, some jobs can readily be filled from the local labor pool. To put these numbers in perspective, the 2015 Diablo attrition rate was 5%[23], which would be in the range of 75 to 80 employees. The availability of thousands of potential replacement workers, many of whom would have prior experience at Diablo or other nuclear plants, would indicate that some significant increase in Diablo attrition would be manageable without a retention program.

The high levels of attrition suggested by PG&E are unlikely, and there exists an ample supply of qualified potential replacement personnel. Thus, the $352.1 million Employee Retention Program is an unnecessary and wasteful expense to be borne by ratepayers, and not in

[21] Exhibit PGE 6, page 26
[22] Exhibit PGE 6, page 15
[23] PG&E-5 Rebuttal Testimony, page 3-16, lines 12

the public interest. CUE correctly states the single greatest concern of Diablo employees for the past five years was their job security in light of the pressures to close the plant.[24] However, it is disturbing that Mr. Dalzell elected to address their concern by agreeing to the Joint Proposal, which would eliminate their jobs in return for a 25% retention bonus, without polling his membership. The interests of the employees would be best served if the PG&E Application was rejected and Diablo continued to operate, simultaneously resolving PG&E's concern about precipitous and high levels of attrition. Conclusively, ORA witness S. Logan testified that "**there is no policy or legal precedent which compels the Commission to authorize ratepayer funding of *retention bonuses* to employees of a power plant that is scheduled to retire.**"[25]

2. The Community Impacts Mitigation Program is unjustified.

In its Application PG&E originally also requested approval of a $49.5 million Community Impacts Mitigation Program (CIMP).[26] This amount was later increased in a proposed settlement between parties to the Joint Proposal and the jurisdictions in the vicinity of Diablo to a $75 million Essential Services Mitigation Fund (ESMF) and a $10 million regional Economic Development Fund (EDF).[27]

There is no conceivable justification for ratepayers, who have had no say in the matter, to be held liable for additional costs of the PG&E voluntary abandonment of Diablo. CGNP agrees with the ORA recommendation and supporting rationale[28] that the CIMP should be funded by PG&E's shareholders. Green Power Institute echoed this: "It is not clear why all ratepayers should pay the full amount of the CIMP when the Commission has denied similar costs in many

[24] CUE-Exhibit-2, page 1, Response to DR 1.
[25] Ex. ORA-7, page 4, line 5.
[26] PG&E-5 Prepared Testimony, page 8-8, lines 6-7.
[27] PG&E Proposal Plea, 12/28/2016, page 2, last 7 lines
[28] EX. ORA-1, p. 4

comparable circumstances, and for far less expensive sources of electricity."[29] Furthermore, an $85 million settlement might be questioned when compared to the economic effect of the Diablo closure. Diablo created a total 2011 economic benefit for San Luis Obispo and Northern Santa Barbara counties of $919.8 million[30], which would dwarf this one-time $85 million settlement. Because it has not been demonstrated that approval of the PG&E Application including the CIMP is in the public interest, the commission must reject the Application in its entirety.

3. There is no cost effectiveness of shuttering Diablo.

This Application also raised myriad issues on cost effectiveness. To offer PG&E ratepayers the opportunity to receive their electricity in the most cost-effective manner required by section 399.2, CGNP recommends that the Commission approve future reimbursement of incurred license-renewal costs, together with future costs required to obtain NRC approval of license renewal, and with other necessary consultations and certifications by state and federal agencies.31 It may be noted that the $352.1 million cost of the proposed Employee Retention Program is substantially greater than the $52.7 million incurred to obtain NRC resolution of issues relating to the Safety Evaluation Report of the Diablo license renewal application.

Further, PG&E projects it will sell some of the electricity generated by Diablo on the wholesale market in future years. This portion is in excess of its projected demand of its bundled customers. Diablo Canyon's total unit revenue requirement will be competitive with the unit electricity prices PG&E estimates it would obtain from wholesale market sales in those years.

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[29] GPI Opening comments on the Joint Motion for Partial Settlement ("Joint Motion"), submitted December 28, 2016.

[30] PG&E-5 Prepared Testimony, Chapter 8 Atch. A, Economic Benefits of Diablo Canyon Power Plant, June 2013, page 4, second paragraph.

[31] As explained throughout this brief, the Commission cannot approve this application without violating the Public Utilities Code and its own Rules of Practice and Procedure. At a bare minimum, however, the Commission must require PG&E to complete activities to the point where uncertainties as to the cost of future operations of Diablo in a mix of evolving renewable sources of electricity are reduced so that PG&E and the Commission and can make an informed decision about its future operation.

Employing Helms pumped storage to delay the sale of this electricity to hours of higher prices will enable revenues to exceed requirements by a substantial margin.

Diablo Canyon generates electricity at a lower cost than does PG&E's gas-fueled plants. These gas plants will have higher unit costs in the future, resulting from lower utilization rates imposed upon them by increased amounts of intermittent RPS sources required by SB 350 (De Leon, 2016). Estimates of the future costs of electricity from those gas plants substantially exceed future costs of electricity from Diablo Canyon. This is true even if one optimistically assumes that gas prices continue their record low values adjusted for inflation. Sales of "excess" electricity from Diablo Canyon will be profitable, more so than sales from the gas plants. A substantial increase in real gas prices, such as predicted by the US EIA by 2025, would cause wholesale market sales of Diablo electricity to generate substantial excess revenues. Some of these could be applied to reduce rates for PG&E's bundled customers.

Several other parties have embraced cost models that greatly overestimate Diablo future operating costs. These violate essential engineering facts regarding the expected service lives of major plant components. These models are wholly inconsistent with trends in costs averaged across industry data, including plants that are operating well into their relicensing periods.

4. There are significant issues with PG&E's proposed cost allocation.

Because this issue is so important, CGNP provides the following detailed analysis. Performance statistics for 2016 show Diablo Canyon continues to be highly reliable and productive. Unit 1 generation exceeded the nameplate capacity factor at 101.15%.[32] The average capacity factor of the two units was 96% generating 18.9 TWh.[33] The unit operating expenditures, including fuel, O&M costs and capital expenditures, was $708.8 million and total

[32] ERRA-2016-PGE-Compliance_test, pp. 4-7.
[33] ERRA-2016-PGE-Compliance_test, pp. 4-7.

revenue requirement was $932.8 million, as itemized in Table 1a in the appendix. The unit operating cost was $37.5 / MWh and the unit revenue requirement was $49.3 / MWh, itemized in Table 1b of the appendix. At $37.5 / MWh Diablo Canyon's unit operating cost is very competitive, and similar to the industry average of $35.5 / MWh for 2015.[34]

In 2010, PG&E requested Commission approval to apply to the NRC for twenty-year extensions to Diablo Canyon's operating licenses. In preparation for this filing PG&E performed a detailed cost-effectiveness study which included estimated costs for continued operation of Diablo versus 18 alternatives.[35] For each case costs were estimated every year through 2045 and the total expenses over the license extension period were compared. PG&E concluded

> In order to fully inform its decision whether to file an application with the Nuclear Regulatory Commission (NRC) to renew the Diablo Canyon operating licenses, PG&E also completed an economic analysis to determine whether operating Diablo Canyon an additional 20 years is cost effective and in the best interest of ratepayers and concluded that, even using conservative assumptions, extending Diablo Canyon operations is significantly less expensive than the next cheapest alternative generation resource.[36]

It also asserted:

> During the past three years, PG&E completed the safety, technical, environmental, and economic analyses required to inform the Company's decision whether to pursue license renewal. The results of those analyses strongly support pursuing license renewal.[37]

Since PG&E has reached an astonishingly different conclusion regarding future Diablo Canyon costs in just a matter of years, understanding the difference between their cost projections is highly relevant and important here.

PG&E's assumptions regarding costs for once-through-cooling mitigation are the largest single reason for the substantially increased costs in the new estimates. It lists a single cost per

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[34] CGNP Prepared Testimony, pp. 103, table 1.
[35] Ex. CGNP-3, pp. 5-1, line 17.
[36] Ex. CGNP-3, pp. 1-1, line 20.
[37] Ex. CGNP-3, pp. 2-6, line 20.

year for mitigation, of $471 million for 2025, almost 30% of the projected cost.[38][39] This single result actually averages several very different approaches to once-through-cooling mitigation that span a factor 100x in cost. It includes an estimated 25% probability of that cooling towers will be required in the future, with an estimated cost as high as $13.3 billion.[40] Although the Regional Water Quality Board has not made any decision that cooling towers will be required, PG&E had stated that it believes the cost of installing them would be an unreasonable burden, and that if they were to be required it would close the plant in 2025[41] Thus, the actual probability PG&E ratepayers would pay for the cost of cooling towers is zero. Therefore, it is inappropriate for PG&E to include this huge cost in the estimate of actual costs since PG&E would never actually pay it. It is intended to inflate artificially the operating costs for the purpose of speciously minimizing Diablo's competitiveness and justifying shutdown.

A framework for once-through-cooling mitigation was also discussed between PG&E consultant, John Steinbeck, and members of the Regional Water Board.[42] An economical solution in form of a barrier reef was discussed. San Onofre Nuclear Generating Station (SONGS) provided precedent: a compensatory reef was built and is still operating.[43] They also discussed a different option for PG&E to pay $4 million per year to support and implement marine-protected areas.[44] This option is currently implemented through the end of its current operating license, and allows Diablo to operate exactly as it has for the last 32 years. No determination has been made that cooling towers will be required for mitigation. And the law specifically indicates alternative approaches if the cooling towers are not feasible, or would be

38 PG&E WP 2-20
39 PG&E-5 Rebuttal Testimony, page 1-19, lines 17-19
40 PG&E WP 2-16
41 TURN_20170127_400997, pp. 51, answer 6..
42 CGNP Prepared Testimony, pp. 104, line 12, et. Seq.
43 CGNP Prepared Testimony, pp. 105, line 5
44 Commission proceeding A1608006, conf #101848, pp. 13.

impractical.[45] All of the parties in the framework discussion concluded that adding cooling towers at Diablo would not be feasible.[46] It is the Regional Water Board, not the State Water Board that decides if cooling towers are required.[47]

Steinbeck explained

> There's a large misconception of what the State did with [the Federal Clean Water Act's] once-through cooling [once-through-cooling] requirement. I keep seeing wrong stuff in print. The State did not make once-through-cooling illegal or stop the use of once-through-cooling. Plants can still use once-through-cooling, they just have to initiate some kind of useful measures, operational or technological, to reduce the effects of once-through-cooling.[48]

and

> PG&E may make the decision to shut Diablo Canyon down but under existing state regulation they can continue to operate without building cooling towers. PG&E just needs the Board to make decision that we're going to do this or that and then come up with a proposal and then they're going to move forward with that. I don't understand why PG&E is so concerned.[49]

In the application, PG&E assumes a two-month refueling outage as part of the once-through-cooling mitigation costs. But the longer outage was never included in mitigation framework proposed to the Regional Water Quality Board.[50] Meaningful estimates for once-through-cooling mitigation costs address the specific practical options that were discussed as part of the mitigation framework.

Estimates of future O&M expenses is the second area where there are significant, yet much smaller differences between PG&E's 2010 and 2016 cost estimates. The O&M cost estimates in the application are significantly higher than the estimates from the 2010 model. Evidence provided by PG&E witness Jearl Strickland shows a downward trend in actual O&M

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45 Transcript, PG&E, Strickland, pp. 870, line 14.
46 Commission proceeding A1608006, conf #101848, pp. 22
47 Commission proceeding A1608006, conf #101848, pp. 13
48 Commission proceeding A1608006, conf #101848, pp. 27
49 Commission proceeding A1608006, conf #101848, pp. 14
50 CGNP Prepared Testimony, pp. 106, line 2

expenses. Responding to a question about O&M cost estimates in the current business plan, listed as $370 million for 2017, he described decreases being observed in these costs relative to recent PG&E models:

> But what I could tell you is that based on the numbers that I have for what our current expense budget is for 2017, it is 341.6 million. So, it is less than both of those numbers and for 2018 it drops to 335 million.[51]

He later asserted that the current trend in capital expenditures and O&M costs shows they are trending lower than predicted in PG&E's 2010 model

> I believe that based on the five-year forecast that we're currently working to that you see a negative trend now when it comes to capital investments and expense cost for the plant going forward. So that it's less than the 1.8 percent that was assumed here.[52]

Mr. Strickland also makes a similar point in PG&E rebuttal testimony:

> Clearly, Diablo Canyon continues to manage its operating costs to below inflationary levels despite labor escalation approximating 3 percent per year.[53]

All of this indicates the rate of increase in O&M costs is presently lower than predicted in the most recent model in the application. The 2010 model has predicted costs reported later for the years 2010 through 2016 generally to within a few percent, as is evident in Table 2. The sum of costs for all years from 2010 through 2016 agrees between the model and data to within 1.5%. For the years 2025 through 2045 O&M costs in PG&E's 2010 model increase at a rate very similar to what is observed in industry data, approximately 2%.[54][55] Given the efficiencies gained by exchanging information with other nuclear plant operators through the STARS consortium, it is reasonable to expect PG&E will be able to keep future increases in O&M costs in line with

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51 Transcript, PG&E, Strickland, pp. 905, line 13.
52 Transcript, PG&E, Strickland, pp. 986, line 28.
53 PG&E rebuttal testimony A1608006, pp. 1-11, line 14.
54 A. 10-01-022, PG&E Testimony, Volume 1, pp. 3-8
55 CGNP Prepared Testimony, pp. 106, line 6

industry averages over the long term.[56] Therefore (unsurprisingly) the 2010 model is a better fit than the model in the application. Forecasts given by Mr. Strickland, shown in Table 2, imply the 2010 model might overestimate future O&M costs.

5. Costs of extended operation are vastly more economical than PG&E now indicates.

Based upon what has been learned through discovery and the evidentiary hearings, PG&E's future cost estimates can be corrected first by applying only itemized costs of the individual once-through-cooling mitigation measures discussed as part of the mitigation framework. PG&E witness Frazier-Hampton agreed that one could itemize costs of the individual approaches to once-through-cooling mitigation.[57] As described above, PG&E's 2010 model for future O&M costs is the more appropriate one to use. The overall costs for operation in 2025 and 2030 are assembled in Table 3a.[58] Once-through-cooling mitigation costs represent the currently approved method, an annual payment to support and implement marine-protected areas. Table 3b expresses the costs as unit operating costs and revenue requirements. A 93% capacity factor is assumed since this is the average value Diablo Canyon has achieved over the years since 2010.[59] Fuel costs from the application[60] are scaled up by the factor 0.93 / 0.833 to account for increased fuel usage at the higher capacity factor. The unit operating costs are $48.3 / MWh and $57.6 / MWh for 2025 and 2030 respectively. The total unit revenue requirements are $63.8 / MWh and $70.8 / MWh for 2025 and 2030 respectively.

The unit-revenue requirements for the different practical once-through-cooling mitigation approaches that were discussed within the mitigation framework are shown in Table 3d. The

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56 Ex. CGNP-3, pp. 1-2, lines 3-7.
57 Transcript, PG&E, Frazier-Hampton, pp. 925, line 20.
58 All tables appear in the appendix.
59 https://www.ferc.gov/docs-filing/forms/form-1/data.asp, FERC Form 1, line 12
60 TURN_20170426_409277, pp. 9; scaled for 93% CF

options listed in Table 3d include construction of a barrier reef, conservatively estimated at a one-time cost of $200 million.[61] The yearly revenue requirements for the barrier reef are calculated using the RRQ factors from PG&E WP 2-22.

PG&E's 2010 model gives O&M cost estimates for every year through 2045.[62] Estimates of yearly capital equipment expenditures used in this application were provided by PG&E extending through 2044.[63] Nuclear fuel costs are especially predictable.[64] Together these substantiate the economical operating costs for Diablo Canyon in 2025 and 2030 will remain representative of real operating costs throughout the extended license period.

6. PG&E's estimates of revenue from sales on the wholesale market is comparable.

PG&E proposes to sell "excess" Diablo electricity, beyond its future projections of needs of their bundled customers, on the wholesale market. PG&E refused CGNP's request for information about the electricity-price model it used to calculate revenues obtained from the wholesale market, stating that it was proprietary information. However, in WP 2-21, PG&E lists its projected monthly totals of energy sold and revenues obtained from sales to the wholesale market, for 2025 and 2030. By simply summing the total market sales for all months of the year and dividing by the sum of the total market sales we can deduce its average price for each year.[65] The total unit revenue requirements for continued operation of Diablo given earlier are competitive with these average unit sales prices for the wholesale market. **This is in stark**

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[61] Commission proceeding A1608006, conf #101848

[62] Ex. CGNP-3, pp. 5-3; Commission 10-01-022, PG&E Testimony, Volume I, pp. 3-8

[63] TURN Prepared Testimony of William Perea Marcus, Volume 1, pp. 26.

[64] CGNP Prepared Testimony, pp. 106, Table 1.

[65] Average price = Σ Total sales / (Σ Diablo output – Σ Diablo net need) Using the numbers from the low load case we obtain the average sales price in 2025 of $ 668,045,956 / (16,289,280 – 4,713,437) = **$57.7 / Mwh.** And in 2030: $ 798,009,117 / (16,289,280 – 4,312,222) = **$66.6 / MWh**

contrast to PG&E testimony, where inflated revenue requirements exceeding $100 / MWh resulted in selling power at a large loss on the wholesale market.

PG&E WP 2-12 shows the percent of Diablo generation they project will be needed by their bundled customers on an hourly basis for the four seasons in 2030. The lowest hourly need, corresponding to the highest fraction sold directly to the wholesale, market generally occurs during the hours extending from 10 AM to 5 – 7 PM. Clearly this time of reduced net need corresponds to overgeneration caused during peak daylight hours by photovoltaic sources. Thus a large fraction of these sales to the wholesale market in their model occur during periods of photovoltaic overgeneration, when it is well known that CAISO day-ahead market prices are strongly depressed.

7. DCPP revenues are increased by employing Helms for energy arbitrage.

PG&E built the Helms pumped storage plant to store Diablo Canyon energy generated at times of low power demand, and recover it at times of high demand, using arbitrage to maximize the value of Diablo Canyon's electricity. Helms' 1212 MW generation capacity can handle a large fraction of Diablo Canyon's 2240 MW capacity. This has been explained in publications[66] going back to a *San Luis Obispo Tribune* article from August 27, 1980,[67] entitled "Diablo Canyon's odd cousin in the mountains" The article explains that 75% of the energy stored is recoverable due to losses in the system:

> Helms will use four units of electricity to make three units — a setup that company officials say would make no sense if it were not for the cheap nuclear power they expect to get from Diablo. But because Helms will be like a huge storage battery for Diablo's

[66] CGNP Opening Testimony Workpaper, pp. 41.

[67] http://www.sanluisobispo.com/news/local/news-columns-blogs/photos-from-the-vault/article39098913.html

> slack-time power, it will be worth its $400 million cost, company representatives told about 25 reporters last week

PG&E witness Janice Frazier-Hampton indicated she worked on the needs determination for Diablo Canyon.[68] When asked, "In your analysis of the hourly need for Diablo Canyon presented in your testimony, was PG&E's Helms Pumped Storage Project utilized to the maximum extent practical to minimize overgeneration?" she responded[69]

> The analysis was not performed to assess a specific minimization of overgeneration. The analysis was performed to assess how much of Diablo Canyon's generation would be needed from our – by our bundled customers.

Ms. Frazier-Hampton confirms that PG&E's hourly needs analysis **did not make aggressive use of Helms for arbitrage to store Diablo Canyon output during periods of overgeneration**. Thus, PG&E's hourly needs analysis does not represent a meaningful constraint on how Helms and Diablo Canyon together would sell electricity on an hourly basis in the wholesale market. The total revenue that is obtained with arbitrage is simple to calculate[70]. One can estimate the revenues noting that prices are often in the range of $20 – 25 / MWh during an 8-hour period centered around noon.[71] Approaching 2030, as more photovoltaic is added to the grid in response to the RPS, one can expect the depression in the day-ahead market price for several midday hours will become more pronounced. For 2025, one can conservatively assume that the price during the depressed period averages $20 / MWh for 9 hours per day. One can assume the price remains near the average value at $48 / MWh for 6 hours. The average price for the

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[68] Transcript, PG&E, Frazier-Hampton, pp. 937, line 7.

[69] Transcript, PG&E, Frazier-Hampton, pp. 943, line 23.

[70] https://www.osti.gov/scitech/biblio/1088080 - Estimating the Maximum Potential Revenue for Grid Connected Electricity Storage: Arbitrage and Regulation, Sandia Report SAND2012-3863, Raymond H. Byrne and C´esar A. Silva-Monroy, December 2012. It is Revenue = (Energy generated * average sales price) + (power purchased for storage) * time * (η_c * sales price – purchase price) where η_c is the fraction of energy recoverable from the storage system.

[71] http://www.energyonline.com/Data/GenericData.aspx?DataId=22&CAISO___Day-Ahead_Price

remaining nine hours is determined by the mean-value theorem.[72] For 2025 an average high price is **$102 / MWh** is required to obtain PG&E's average price of $57.7 / MWh. Similar assumptions yield an average high price of **$125 / MWh** for 2030. Such price swings are already observed on certain days in the CAISO market.[73]

PG&E's estimated DCPP need of 8,778 gigawatt hours (GWh) for their bundled customers in their 2025 reference case[74] implies an average of approximately 1,200 MW of Diablo power sold on the wholesale market when it operates. The increased revenue from arbitrage is estimated assuming that Helms stores energy at capacity six hours per day during the low-price period and generates at capacity six hours during the period of high price. Using the representative values for 2025, the total revenue from sales on the wholesale market during one day is $2,068,560.[75]

The corresponding unit price from this wholesale revenue is **$71.8 / MWh.** Table 4 lists the unit price of electricity obtained from sales on the wholesale market employing Helms for arbitrage for different years and scenarios. Values in Table 4 illustrate that purposefully employing Helms, in a manner well within its stated performance characteristics, will substantially increase revenues from wholesale market sales well in excess of the revenue requirement for Diablo.

8. Natural-gas plants strongly influence the price of electricity on the wholesale market.

When assessing the ability of Diablo Canyon to sell "excess" electricity profitably on the

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[72] 57.7 * 24h = 9h * 20 + 6h * 48 + 9h * average high price

[73] http://www.energyonline.com/Data/GenericData.aspx?DataId=22&CAISO___Day-Ahead_Price - see prices from CAISO hourly market for May 1-4, 2017

[74] PG&E WP 2-16

[75] Wholesale revenue = 1200 MW * 24 hours * $57.7 / MWh + 1200 MW * 6 hours * (0.75 * $102 / MWh – $20 / MWh.

wholesale market one needs to consider the costs of other sources that sell electricity there. For example PG&E, which buys excess electricity from the Palo Verde Nuclear Plant in Arizona, apparently considers its electricity to be cost effective. Natural-gas-fired plants generated 61.3% of California's electricity in 2014.[76] Given the large fraction of electricity they generate, and the crucial role they play in adjusting output to match supply and demand, they have a strong influence on market prices. Therefore, consideration of their generation costs is essential when considering future wholesale electricity prices. PG&E owns and operates three major gas-fired plants. Colusa and Gateway are combined-cycle plants. Humboldt is a reciprocating-engine plant. The costs of production and total electricity generation are listed in Tables 5a and 5b for 2014 and 2015 respectively. The total revenue requirement for all three of PG&E's gas plants is shown in Table 5c. These are shown in Table 5d as unit costs. Fuel expenses were higher in 2014 due to higher gas prices for that year. The total unit-revenue requirement averaged over the two years was $58.3 / MWh. **Diablo Canyon produces electricity at a lower unit-revenue requirement than does PG&E's gas plants**, even in the present situation of gas prices near the record low in inflation-adjusted terms. PG&E sells electricity from these gas plants every day in the CAISO day ahead market. It makes a profit from the wholesale sales of their electricity. Since Diablo Canyon produces electricity at a lower unit cost than does PG&E's gas plants, Diablo Canyon could sell "excess" electricity profitably on the wholesale market as well.

9. The implementation of SB 350 will result in lower utilization of gas plants leading to higher unit costs.

SB 350 mandates that 50% of CAISO generation come from RPS-eligible sources by 2030. In 2014 the fraction of RPS-eligible in-state generation from the hydro, wind, geothermal,

[76] CGNP Prepared Testimony, pp. 89, line 1.

solar, biomass sources summed to 29.6%.[78] Increasing this to 50% year-round by 2030 will require very large expansions of wind and solar generation. No major hydro projects could be developed by 2025. The realistic expectation for expansion of geothermal and biomass is relatively limited. The addition of new intermittent wind and solar plants would not allow retirement of any of the gas generation capacity, as the federally mandated capacity-reserve margin must be maintained.[79] If electricity from solar and wind sources did increase their fraction of total generation by 20.4% to 50%, the gas units would back down part of the time and run at a lower average-capacity factor (GCF), dropping from 61.3% to 40.9% of total generation for the case of continued operation of Diablo. Because the fixed portion of the gas plant costs will be distributed over a smaller amount of electricity generated, it is elementary that the fixed costs per unit energy will increase by the ratio (2014 GCF / 2030 GCF).[80] So the net increase is fixed cost per unit energy is 2014 fixed cost * ((2014 GCF / 2030 GCF) – 1). The fixed portion of costs for PG&E's gas plants can be considered representative for the state's fleet. Averaged over 2014/2015 from Table 5d this is $31 / MWh. So the increase in fixed portion of unit electricity cost will be $31 / MWh (61.3 / (61.3 – 20.4) – 1) = $15.5 / MWh.

This is the cost imposed upon dispatchable generators by the intermittent wind and solar sources, expressed per MWh of gas generation. In CGNP testimony, this imposed cost was properly expressed per MWh of solar or wind generation, as they are the sources of these increased costs.[81] Since the MWh generated by solar or wind is smaller, that unit incremental cost per MWh of solar or wind generated is higher. This increase in fixed unit costs would increase the overall cost of gas generation from $58.3/MWh to $73.8/MWh in $2015. If we

[78] CGNP Prepared Testimony, pp. 89, line 1.
[79] CGNP Prepared Testimony, pp. 97, line 24.
[80] CGNP Prepared Testimony, pp. 100, line 1.
[81] CGNP Prepared Testimony, pp. 97, line 24, et. seq.

optimistically assume that today's near record low real gas prices continue into the future, include the above increase in fixed costs for 2030 also for 2025, and apply a 2% inflation rate, we obtain the costs shown in the top row of Table 6 for 2025 and 2030.

PG&E estimates of wholesale electricity prices cited earlier appear to have missed these essential increased costs resulting from underutilization of gas plants caused by intermittent RPS sources. PG&E's original testimony in this application completely missed these imposed costs in calculating the cost of electricity of proposed wind and solar replacements. Also the comparatively low values of the PG&E estimates for unit wholesale market revenue are plausible only when the imposed costs are ignored.

The US EIA forecasts that gas prices will nearly double in inflation adjusted terms to approximately $6/MMTBtu by 2025, 2030.[82] The lower row in Table 6 shows the projected revenue requirements with the EIA forecasted gas price. **Wholesale natural gas prices have climbed as high as $15/MMBtu (in $2013) during the past 20 years.**[83] Given the historical volatility of natural gas prices,[84] assuming that today's record low gas prices will continue through 2045 would be unrealistic and extremely short sighted. It is necessary to consider a range of plausible gas prices over the period through 2045. If we go back to PG&E's 2010 detailed cost analysis, we find such foresight. Their cost effectiveness study considered a range of plausible gas prices over the period 2025 – 2045 that went **as high as $202 / MWh in $2010**.[85] Their analysis concluded that gas generation could be the *lowest* **or** the *highest* cost alternative to Diablo. **But it concluded that continued operation of Diablo was cheaper in every case.**

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82 CGNP Prepared Testimony, Fig. 4, pp. 109, line 1.
83 CGNP Prepared Testimony, Fig. 3, pp. 107, line 3.
84 CGNP Prepared Testimony, Fig. 3, pp. 107, line 3.
85 A. 10-01-022, PG&E 2010 Prepared Testimony, Volume I, pp. 4-30.

The gas plants are the principal dispatchable sources on the CAISO grid, and are responsible for a large fraction of total electricity generation. Therefore the day-ahead wholesale-market clearing price must rise to a time-averaged value at least as high as necessary to recover their total cost of operation. Even assuming optimistically that current record-low inflation-adjusted gas prices continue, Table 6 shows revenue requirements for these gas plants rise to $90 / MWh in 2025 and $99.3 / MWh in 2030. In comparison the corresponding revenue requirements for Diablo Canyon are $63.8 / MWh in 2025 and $70.8 / MWh in 2030. Since the higher cost gas plants must operate profitably in the day-ahead wholesale market, Diablo Canyon will be able to sell electricity even more profitably, especially if using Helms. Any substantial increases in future gas prices, such as predicted by the US EIA[86] or beyond, will cause sales of "excess" Diablo electricity on the wholesale market to generate large excess revenues, some of which could be used to reduce rates for bundled customers.

10. Cost models embraced by other parties greatly overestimate Diablo's future operating costs.

Several other parties have testified that future operating costs of Diablo Canyon will rise dramatically, making continued operation uneconomical. TURN, CEERT and FOE have all embraced a common model as the basis of cost estimates in their testimony or rebuttal testimony.[87] It is "A Cost Effective and Reliable Zero Carbon Replacement Strategy for Diablo Canyon Power Plant " – "the FOE Report", **no author, nor anyone who has testified in support of it, is a nuclear engineer, an electrical engineer, or a physicist.** Throughout the FOE report there are **arbitrary, unsupported assumptions** about cost inflation of various

[86] CGNP Prepared Testimony, Fig. 4, pp. 109, line 1.

[87] TURN Prepared Testimony of William Perea Marcus, Volume 1, pp. 1;, CEERT Prepared Testimony, pp. 18;, FOE Rebuttal Testimony, pp. 5, line 16

expenses for Diablo operations going forward.[88] It does not justify these assumptions, other than to postulate unexpected projects will arise, and even admit "we do not know the size and number of specific projects on which PG&E would need to spend money in the period of time from 2025-2044."[89] It then asserts, "These (capital) costs are assumed to escalate at 2% above inflation over the relicensing period to reflect that PG&E's labor costs are likely to escalate faster than inflation and that that (sic) many parts of the plant have limited life spans and may need replacement in the 20-year period."[90] Because of their nature, **nuclear plants are always "over"-engineered to last well beyond sixty years.** Data being collected as part of Idaho National Engineering Laboratory's Light Water Reactor Sustainability Program supports the ability of specific plant components to last over one-hundred years.[91] The FOE report's assertion that "many parts of the plant … may need replacement" is **inconsistent** with scientific and engineering fact.

A fairly significant effort has been expended in the last several years to prepare Diablo Canyon for operation through 2045, in anticipation of license extension. Significant preventative maintenance and upgrades have included replacement of the steam generators, the reactor vessel heads and the steam turbine cradles. Therefore, this period has shown an increase in capital expenditures and O&M expenses relative to the inflation adjusted historical norm for Diablo Canyon, as would be expected. Dr. Marinak testified that "…there has been an uptick in costs in the past five years."[92] The authors of this report have seized upon the increase in capital expenditures and O&M costs associated with that effort and make the false argument that these costs are spiraling out of control. This contradicts the downward trend in costs described by

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88 CGNP Rebuttal Testimony, pp. 43, line 15.
89 CEERT Prepared Testimony, pp. 47
90 CEERT Prepared Testimony, pp. 48
91 CGNP Rebuttal Testimony, pp. 44, line 2
92 Transcript, CGNP, Marinak, pp. 1317, line 13,

PG&E witness Strickland referenced above.

Previous PG&E rebuttal testimony has already addressed the risk of major increases in future capital expenditures for Diablo during the license extension period[93]

> PG&E has already replaced the large age-limited components at Diablo Canyon, e.g., steam generators, turbines, main generator Unit 1, and reactor vessel heads. The replacement components were engineered for a 50-year life. PG&E's knowledge and experience with the aging mechanisms of the original components along with improved materials and engineering of replacement components adequately address the risk of major equipment failure or degradation. Additionally, PG&E will monitor structures and buildings for deterioration and repair them as necessary. These facilities (containment, auxiliary building, fuel-handling building, turbine building and intake structure) can last indefinitely with a reasonable monitoring and repair program.

Mr. Strickland was asked in this proceeding if he believed the above is an accurate statement? He responded[94]

> I believe it is for the most part, that under the plant betterment study there still would be additional projects that would need to be implemented such as potential for condenser replacements that we had noted, that the transformers have been replaced…

In addition to the definitive statement above, further information is available in PG&E's FERC Form 1 submission in which all of the components of Diablo Canyon have been assigned a value and categorized according to estimated average service life.[95] There are five categories, listed in accounts 321 through 325, corresponding to estimated average service lives of 40, 40, 60, 75 and 100 years. It shows that $5,277 million of the total $7,497 million depreciable base, or 70%, has an estimated average service life of at least 60 years. So this 70% would not be expected to require replacement before the end of the license extension period in 2045. Given the estimated remaining lives given for the two forty-year categories, we should expect only a limited fraction of that depreciable base to require replacement by 2045, well under $2.2 billion in 2015 dollars.

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93 Ex. CGNP 4, pp. 10, line 25.
94 Transcript, PG&E, Strickland, pp. 990, line 22.
95 CGNP Prepared Testimony Workpaper , pp. 5.

TURN's model for Diablo Canyon future costs[96] has capital additions skyrocketing from $160 Million in 2026 to $580 Million in 2041 in inflation-adjusted real dollars. Summing all their capital additions costs for the years 2025 through 2044 yields **$7.901 billion in inflation-adjusted dollars. This sum actually exceeds the entire depreciable basis of the plant.** Given that 70% of the plant depreciable basis has an estimated average useful life of at least 60 years, the FOE report, upon which they base their estimate of capital additions expenditures, must be rejected. **It cannot be considered credible.**

The sum of TURN's estimates of costs for capital additions, refueling O&M and base O&M climb from $572 million in 2026 to $1,138 million in 2041.[97] These correspond to a portion of operating costs, excluding fuel. Assuming a 90% CF these correspond to unit costs for O&M and capital additions of $32 / MWh and $64 / MWh in 2026 and 2041 respectively in real dollars. Their model corresponds to a rate of increase of $43 / MWh over a 20 year period. Industry data reported on FERC Form 1 shows operating costs, excluding fuel, increasing with plant age by $5 / MWh over 20 years.[98] The TURN model increases at an absolute rate approximately nine times as fast as does the industry data. Such a large, sustained rate of increase in real costs is wholly inconsistent with trends in costs averaged across industry data.

11. Continued operation of Diablo Canyon is more economical than the proposed alternatives.

Cost escalation has been alleged in PG&E's Application and Joint Proposal as a reason to close Diablo. CGNP Testimony and PG&E's own data discredit this. On April 25, PG&E VP

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[96] TURN_20170215_402801Atch07_402808 – A1608006_TURN_Marcus_workpapers; Diablo Canyon Model for TURN Testimony, Column O.

[97] TURN_20170215_402801Atch07_402808 – A1608006_TURN_Marcus_workpapers; Diablo Canyon Model for TURN Testimony, Columns F, G and O.

[98] CGNP Prepared Testimony, fig 2, pp. 104, line 1.

Strickland stated under cross examination that Diablo operating costs "show a negative trend."[99] Furthermore, as CGNP pointed out, the Application doesn't account for cost of reliable replacement eventually needed if Diablo Canyon's 2,240 MW firm generating capacity is lost.[100] **Because they can never be counted on to produce energy at a particular time it is needed, adding *any* number of new solar or wind sources, as was proposed in Tranches 2 and 3, does not allow one to retire a *single* power plant from the grid.** Abandoning Diablo, PG&E's largest and most reliable power source, could well turn an abundant electricity resource into a scarce one, resulting in higher prices, not unlike what occurred to San Diego Gas and Electric customers when San Onofre was closed.[101]

Independent of whether the proposed wind and solar sources were actually constructed, new fossil-fueled units would have to be constructed to meet the federally imposed capacity reserve margin.[102] The sources of capacity must be cost recovered, as they are the primary sources. Wind and solar are tag-along energy sources. They allow the capacity sources to back down their output part of the time, but without replacing the need for them. So the cost of replacing the lost firm capacity is higher with wind and solar than without. As mentioned above, the wind and solar **resources impose costs on the dispatchable sources** by causing them to run at a lower capacity factor, increasing their levelized fixed costs per unit energy.[103]

At CAISO's current six-percent market share of PV this imposed cost amounts to $35.8 / MWh of PV energy generated, increasing the EIA LCOE 2020 estimate for PV to a total estimated cost of $146.9 / MWh.[104] Properly accounting for the imposed costs resulting from

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99 Transcript, PG&E, Strickland, pp. 986, line 28.
100 CGNP Prepared Testimony, pp. 93, line 20.
101 CGNP Prepared Testimony, pp. 94, line 22.
102 CGNP Prepared Testimony, pp. 97, line 24.
103 CGNP Prepared Testimony, pp. 100, line 1.
104 CGNP Prepared Testimony, pp. 100, line 12.

utilizing a combination of CC and CT gas plants as backup, the overall cost of new wind turbines increases from $78.16 / MWh to $107.93 / MWh of wind energy generated.[105] Using the actual utility scale intermittent energy mix of wind and solar PV in California results in an **estimated cost of replacement power of $131 / MWh**.[106] As noted ,this doesn't include many additional costs such as lost fuel efficiency due to ramping and cycling the dispatchable sources, or the higher maintenance costs associated with those more demanding operating dynamics, or the cost of transmission lines to remote sites of PV's and wind turbines, or the shorter life spans of the PV and wind turbine systems.[107] All of these will significantly increase actual costs to the ratepayers further, beyond the estimated value. **In comparison, Diablo Canyon's estimated operating costs of $48.3 / MWh in 2025 would be far cheaper than the $131 / MWh cost of the proposed alternatives.**

CGNP observed that nations having the highest dependencies upon wind and solar sources have among the highest electricity prices. This includes **$390 / MWh** in Germany where "energy poverty" is becoming a serious problem *as more than 800,000 households have disconnected their electrical service completely* because they can no longer afford to pay their electricity bills.[108] The well-being of California ratepayers depends upon considering up front the full costs associated with the proposed replacements in this case.

Over its useful lifetime, the continued operation of Diablo will save billions of dollars for California ratepayers. Diablo provides about 18,000,000 megaWatt-hours (MWh) per year for approximately $40/MWh. In comparison, a so-called "renewable" concentrating-solar plant that burns large amounts of natural gas annually, Ivanpah is contracted to supply PG&E electricity at

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105 CGNP Prepared Testimony, pp. 101, line 16.
106 CGNP Prepared Testimony, pp. 102, line 1.
107 CGNP Prepared Testimony, pp. 102, line 2.
108 CGNP Prepared Testimony, pp. 110, line 2, et. seq.

$200.00/MWh.[109] (This is also a representative cost for the actual cost, less taxpayer-funded subsidies for other California solar and wind projects.) Thus, the Ivanpah premium over Diablo is $160.00/MWh. **Multiplying the Ivanpah premium by Diablo's annual production yields $2.88 billion/year in avoided costs for California ratepayers.** Multiplying $2.88 billion/year by 68 years, extending Diablo's lifetime to 2085, yields cumulative avoided costs to California ratepayers of **$195.8 billion.**

Furthermore, the difficult-to-justify estimated expenditure of an estimated $73.6 billion[110] dollars and the utilization of a total of more than 200 square miles of precious California land in order to create a dispatchable solar-powered generation system, energy transmission lines, and a complex energy storage system of historically-unprecedented size just to equal Diablo's dispatchable annual production of about 18,000 GWh should **not** be made.[111]

It will be harmful to the interests of California's ratepayers to scrap the highly-performing conservatively-designed Diablo in 2025, as PG&E proposes in A.16-08-006. At a minimum, Diablo should be operated for at least another two decades because more than 70% of Diablo's basis is comprised of components with estimated average service lives (EASL) of sixty or more years - and ratepayers have already paid for a large portion of Diablo's basis via PG&E's use of the Capital Cost Recovery (CCR) process.[112] A compensatory artificial reef to remediate any alleged once-through-cooling harms to larvae was constructed for SONGS for approximately 50 million dollars, by one estimate. This alternative compliance approach that is available under existing applicable statutes should be utilized for Diablo's once-through-cooling mitigation. [113]

E. Shuttering Diablo Would Be Detrimental to Grid Reliability.

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109 CGNP's Prepared Testimony Pages 47 - 49 of 140
110 CGNP Prepared Testimony, pp. 96, line 18.
111 CGNP's Prepared Testimony, Pages 119 - 124 of 140
112 CGNP's Prepared Testimony Workpaper. Spreadsheet, page 5 of 172
113 CGNP's Prepared Testimony, Pages 105 - 107 of 140

Approving this application would violate the Commission's duty to provide ratepayers with a diverse and balanced, reliable portfolio of power. Any evaluation of Diablo retirement must consider reliability effect on the grid. In prepared testimony, CGNP witness Weitzberg testified "not only is Diablo license renewal for twenty years a reality, but that license renewal beyond twenty years is believed to be possible by the NRC and the industry."[114] This conclusion was supported in the PG&E Prepared Testimony of L. Jearl Strickland.[115] CGNP witness Weitzberg also testified "that Diablo can operate flexibly in an evolving mix of increasing solar and wind-powered generation" and "the venue for such safety discussions is more appropriate to the NRC review of Diablo's license application rather than in a Commission rate-setting Proceeding."[116] CGNP agrees with Strickland's rebuttal caution[117] that consultations and certifications by state and federal agencies would also be required in addition to NRC license renewal in order to permit continued operation of Diablo. However, despite persistent opposition to the construction and operation of Diablo for decades, PG&E has successfully obtained the necessary approvals, and no evidence has been presented to prove this would not occur going forward.

In its testimony, ORA agrees with PG&E's conclusions[118] that retiring Diablo Canyon would affect reliability for the CAISO system, there is significant uncertainty as to whether incremental resources will be needed before 2030 to provide system-resource availability, and there is ample time to address these and other related issues regarding the closure of the Diablo at the expiration of the current license in 2024 and 2025 in the Commission's IRP proceeding.

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114 CGNP Prepared Testimony, Page 8, line 14
115 PG&E Prepared Testimony, Page 9-1, lines 25-30
116 CGNP Prepared Testimony, Page 15, lines 13-16.
117 PG&E Rebuttal Testimony. PG&E-5, page 1-4, line 26, et. seq.
118 EX. ORA-2, p. 4, line 3 et. seq.

Laird Dyer, on behalf of Shell Energy,[119] testified any decisions made regarding PG&E's electric resource planning and procurement need for its bundled sales customers, including the future need for Diablo Canyon and possible replacement procurements, should be addressed within the Integrated Resource Planning ("IRP") process. Furthermore, he stated the future of Diablo Canyon should not be left to PG&E's discretion in a limited application proceeding. CGNP agrees fully with these statements which support the CGNP position that the PG&E application be rejected.

Flexible operation of Diablo is certainly possible and any limitations would have to be defined during NRC relicensing of Diablo.[120] PG&E has investigated the flexible operation of Diablo, but has chosen to withhold the information as proprietary and confidential. All issues relating to future Diablo operations, including costs such as once-through-cooling mitigation, can only be determined if relicensing were to be resumed and completed. The manufacturer's stated power up/down ramp rates of about 100MW/minute exceed what CAISO reports daily as the fastest post-solar day-demand increases. [121] PG&E studies on this should be revealed in the public interest. On April 24 2017, under cross examination, PG&E VP Todd Strauss was asked if he knew about such studies and answered: "At some high level."[122] He was asked if Diablo would be only "baseload", if such studies supported Westinghouse's flexibility statements. He answered: "…it [Diablo] would be a dispatchable unit."[123] Diablo thus might directly help mitigate overgeneration. For the public interest, grid-operation standards require the most reliable sources to remain in operation, despite failures and inadequacies of other sources. Reliable, clean sources, like Diablo should be turned off **last**.

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119 Prepared Testimony of Laird Dyer on Behalf of Shell Energy North America, p. 3, et.seq.
120 CGNP Prepared Testimony, p. 9
121 CGNP Prepared Testimony, see figures on pp58-60
122 Cross Examination Transcript, Vol. 4, Page 620, lines 1-5
123 Cross Examination Transcript, Vol. 4, Page 621, lines 11-24.

A CAISO load graphic from January 2017[124] plus all daily load graphs from then on, show Diablo is indeed ***not*** capable of creating an "overgeneration" condition -- Diablo's 24/7 output is about 2.2GW. CAISO's minimum, workday demand is 8 or 9 times higher. Even on weekends, minimum CAISO Net Load amounts to about 9GW (over four Diablos). It's simply false to claim Diablo contributes to "overgeneration." Even if SONGS were restarted, Diablo and it together could not cause "overgeneration."

F. Shuttering Diablo Would Make It Impossible to Meet the State's GHG Goals.

Until there is an assured supply of true GHG-free electricity, any shortfalls from shuttering Diablo will be covered by the burning of natural gas, contrary to the policies of the state. CGNP witness Weitzberg concluded his rebuttal testimony on this issue as follows:

> "Considering the facts that there are large uncertainties in the PG&E estimates which do not include the cost of replacing the 2240 MW of needed reliable generating capacity that would be lost if Diablo were closed, and no apparent urgency to replace the power to be lost by Diablo closure, the absence of any evidence to support the need to make the Diablo closure decision at this time in this proceeding is notable. CGNP reiterates that replacement for lost Diablo electricity will most likely be by burning natural gas and it is therefore prudent to delay the shutdown decision as long as possible by rejecting PG&E's application. To retain continued operation as an option, relicensing Diablo should be continued, authorized by Commission, and reimbursed by the ratepayers as being in the public interest. This will preserve the value of Diablo as a large capital

[124] CGNP Prepared Testimony, p. 60, including the graphic

investment capable of producing GHG-free electricity."[125]

PG&E acknowledged this. "I reference Colusa and Gateway," said PG&E's Frazier-Hampton, answering CLECA cross examination [126] on how Diablo replacement will be partly accomplished via "renewables integration". Colusa and Gateway are gas-fired plants. Such "renewables integration" increases GHG emissions, as the California Air Resources Board documented, considering the SONGS shutdown.[127] PG&E provided no evidence of competent planning for GHG-free energy to replace Diablo, foisting plans off onto their IRP.

If Diablo is abandoned, eliminating about 18,000 GWh, per year of reasonably priced emission-free electricity, California will likely be required to import large amounts of fossil-fired emission-laden electricity from PacifiCorp, an out-of-state entity that generates much coal-fired power. Instead, Diablo should be operated for its design lifetime, likely until 2085.[128] California's emissions and clean-power concerns, mean Diablo is essential, even if demand will fall, as PG&E alleges. California's external coal power amounts to about 95% of Diablo's annual energy production (17,735 GWh,)[129] That harmful coal dependence can thus be eliminated by Diablo, as soon as the state wishes. If demand doesn't drop, perhaps because of electric-vehicle usage, all California coal dependence could be erased by repairing and restarting SONGS. Either would save the cost of planned re-powering of Intermountain to burn gas. All that would be in the public interest, here and around the world.

III. CONCLUSION

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125 CGNP Rebuttal Testimony, Page 6, line 10, et. seq.

126 Cross Examination Transcript, Vol. 3, p. 417, lines 1-13; Frazier-Hampton, repeatedly (in her testimony in the 4/20 & 4/26 Transcripts) brushes away such inconsistencies by saying they will be elucidated "in the IRP". *See id.,* p. 404, line 3.

127 CGNP Prepared Testimony, p31 of 140

128 CGNP's Prepared Testimony, Pages 129 - 137 of 140

129 CGNP's Prepared Testimony, Lower right corner of Table 1, page 33

This proceeding suffers from serious defects. The procedure has been rushed and improper. The testimony from many of the Applicant's witnesses has been demonstrably unreliable. The facts show approving this application would be inconsistent with the Commission's statutory mandates.

If the Commission wishes to take action, it should authorize recovery of incurred costs by PG&E, contingent on approval, of NRC license renewal together with other necessary consultations and certifications by state and federal agencies. *See Cal. Pub. Util. Code*§ 454.51(a)- (b). Additionally, the Commission should require PG&E to examine the viability of flexible operation of Diablo together with intermittent RPS generation, the company's Helms Pumped Storage Plant, and other potential storage technologies. *See Cal. Pub. Util. Code*§ 399.2 and 701.11(c).

Diablo constitutes California's largest source of reliable clean energy, and buttresses CAISO's ability to maintain grid voltage, phase and frequency stability, thus reliable state power deliveries. It provides unmatched clean-energy flexibility.[130] If PG&E no longer wishes to own and operate Diablo, let PG&E sell it, perhaps continuing to operate it under contract with the new owner. Such sale would retain all the benefits Diablo currently provides Californians.

[130] "Planned Maintenance at Diablo Canyon Unit 2 Delayed to Meet State Energy Needs During Heat Wave" [CAISO] "Requests Both Units Operate at Full Power" CAISO , 9 Sep. 2015, CGNP Direct Testimony, Reference 9, p74-75, lines 21.

APPENDIX - Tables 1-6

Costs reported for 2016	($M)
O&M[131]	351.7
Capital expenditures[132]	223.5
Fuel[133]	133.6
A&G[134]	48
Return book value[135]	176
Total (O&M + Cap ex + Fuel)	708.8
Total	932.8

Table 1a. Total costs associated with Diablo Canyon operations in 2016.

2016 COE	($ / MWh)
Production (O&M + Fuel)	25.7
Operating (O&M + Fuel + CapEx)	37.5
Total RRQ	49.3

Table 1b. Cost of electricity generated by Diablo Canyon in 2016.

O&M costs ($M)	2010	2011	2012	2013	2014	2015	2016	2017 forecast	2018 forecast
data/forecast[136]	296	326	367	363	382	404	352	341	335
2010 study[137]	297	334	348	353	398	363	359	370	377
Diff ($M)	-1	-8	+19	+10	-16	+41	-7	-29	-42
Diff %	-0.3%	-2.4%	+5.5%	+2.8%	-4.0%	+11%	-1.9%	-7.8%	-11%

Table 2. O&M costs versus year. The top row shows actual expenses reported through 2016 and updated estimates provided by Jearl Strickland in testimony for 2017 and 2018. The second row shows predictions of the 2010 study.

Total cost ($M)	2025	2030
O&M[139]	427	467
2016 Fuel[140]	235.5	256.2
CapEx RRQ[141]	216.2	324.2
A&G[142]	69.8	77
Return on book value[143]	211.7	163.1

131 Ex. TURN 4, pp. A-3.
132 Ex. TURN 4, pp. A-4.
133 A 14-02-008, PG&E Prepared Testimony, pp. 7-11, line 9, and p. 7-12, line 23.
134 TURN workpaper_20170127_400996, pp. 8.
135 PG&E-10 2017 GRC A-24
136 Ex. PG&E 5, WP 3-103 for 2010 – 2015, Ex. TURN 4, pp. A-3 for 2016, Transcript PG&E, Strickland, pp. 905, line 13.
137 A 10-01-022, PG&E Prepared Testimony, Volume I, pp. 3-8
139 A 10-01-022, PG&E Prepared Testimony, Volume I, pp. 3-8
140 TURN_20170426_409277, pp. 9; scaled for 93% CF
141 PG&E WP 2-18
142 TURN_20170426_409277, pp. 9

once-through-cooling mitigation	4	4
Total O&M, fuel, CapEx, once-through-cooling mitigation	882.7	1051.4
Total RRQ	1,164.2	1,291.5

Table 3a. Total costs of extended operation for the years 2025, 2030.

RRQ nominal ($/MWh)	2025	2030
Unit operating expense	48.3	57.6
Total unit RRQ	63.8	70.8

Table 3b: Total unit revenue requirement for the year 2025, 2030.

Revenue requirement ($M)	2025	2030
Fund preserve	4	4
Barrier reef	36.2	28.2

Table 3c: Itemized annual revenue requirements for different once-through-cooling mitigation approaches

Unit RRQ ($/MWh)	2025	2030
Fund preserve	63.8	70.6
Barrier reef	65.6	72.1

Table 3d: Total unit revenue requirement for the years 2025, 2030 for different once-through-cooling mitigation approaches.

Unit wholesale revenue ($/MWh)	2025	2030
6 hours / day	71.8	85.0
9 hours / day	78.9	94.3

Table 4. Effective unit sales price of Diablo electricity on wholesale market employing Helms at capacity for the specified number of hours per day.

	Production cost ($/MWh)	Fuel ($)	Generation (MWh)	Total production cost ($Million)
Colusa	50.8	86,665,465	2,484,637	126.2
Gateway	46.8	112,757,401	3,241,592	151.6
Humboldt	93.7	14,951,435	350,052	32.8
Total	51.1	214,374,301	6,076,281	310.6

Table 5a. Production costs and electricity generation from PG&E's gas plants in 2014.[144]

	Production cost ($/MWh)	Fuel ($)	Generation (MWh)	Total production cost ($Million)

[143] PG&E WP 2-19

[144] ERRA-2014-PGE-Compliance_Test A.15-02-023, pp. 4-14; https://www.ferc.gov/docs-filing/forms/form-1/data.asp - FERC Form 1, PG&E, 2014 Q4, pp. 402-403, lines 20, 34 and 35.

Colusa	38.6	66,083,754	3,571,840	137.87
Gateway	31.6	60,910,318	3,315,168	104.76
Humboldt	83.8	13,948,664	406,338	34.05
Total		140,942,736	7,293,346	276.6

Table 5b. Production costs and electricity generation from PG&E's gas plants in 2015.[145]

	2014 ($M)	2015 ($M)
O&M + misc. prod[146]	96.2	135.7
Fuel[147]	214.4	140.9
Capital Exp[148]	9.9	21.6
A & G[149]	11.7	11.7
Return on book value[150]	64.4	64.4
Total Revenue Requirement	396.6	374.3

Table 5c. Total revenue requirement for PG&E's gas plants for 2014 and 2015.

	2014 ($/MWh)	2015 ($/MWh)
Fuel expense	35.3	19.3
Operating expense	52.7	40.9
RRQ	65.3	51.3

Table 5d. Unit costs and revenue requirements for PG&E's gas plants in 2014 and 2015

	2025 ($/MWh)	2030 ($/MWh)
Continued low gas price $3.8/MMBtu in $2015	90.0	99.3
Gas price of $6/MMBtu in $2015	112	123

Table 6. Projected revenue requirement for PG&E's gas plants in 2025 and 2030 for different gas prices

/s/ Gene A. Nelson, Ph.D. Central Coast Government Liaison 26 May 2017

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[145] ERRA- 2015- PGE-Compliance_Test A. 16-02-019, pp. 3-15 ; https://www.ferc.gov/docs-filing/forms/form-1/data.asp - FERC Form 1, PG&E, 2014 Q4, pp. 402-403, lines 20, 34 and 35.

[146] https://www.ferc.gov/docs-filing/forms/form-1/data.asp; FERC Form 1, PG&E, 2014 Q4, pp. 402-403, PG&E, 2015 Q4, pp. 402-403 equals total production costs (line 34) minus fuel cost (line 20)

[147] https://www.ferc.gov/docs-filing/forms/form-1/data.asp , FERC Form 1, PG&E, 2014 Q4, pp. 402-403, PG&E, 2015 Q4, pp. 402-403, line 20.

[148] GRC-2017_Phl_Test_PGE_20150901_346363, PG&E-5, pp. 5-60

[149] GRC-2017_Phl_Test_PGE_20150901_346372, PG&E-10, A-24.

[150] GRC-2017_Phl_Test_PGE_20150901_346372, PG&E-10, A-24.