BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

FILED
10/14/22
01:40 PM
A1608006

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 (U39E).	Application 16-08-006 (Filed August 11, 2016)

REPLY COMMENTS OF CALIFORNIANS FOR GREEN NUCLEAR POWER, INC. (CGNP) TO PG&E'S OPENING COMMENTS DATED OCTOBER 7, 2022

1. INTRODUCTION

Californians for Green Nuclear Power (CGNP) is an organization dedicated to caring for the environment and halting harmful climate change. The board and members of CGNP include dedicated scientists considered to be elite specialists in our fields, with decades of experience on issues of power generation, grid safety, and emissions reduction. CGNP has deeply immersed itself in issues that affect power generation, climate change, and environmental justice, and has sparked notable policy changes at the federal and state levels. At the outset of this Proceeding, CGNP opined that it would be impossible to meet California's clean-air goals and keep supplying steady power if Diablo Canyon Power Plant (DCPP) was retired. We are pleased that the Governor and Legislature have analyzed the evidence and come to the same conclusions.

CGNP has analyzed the Revised Scoping Memo in this Proceeding and the opening comments by Pacific Gas and Electric (PG&E) and hereby submits these Reply Comments for consideration.

In the first part of these reply comments, CGNP will focus on a pair of recent informative articles. The first article explores the reasons for the escalating cost trends for solar and wind generation which continue to be proffered by DCPP opponents as replacements for DCPP. [1] The second article critically examines how a DCPP opponent, the Center for Energy Efficiency and Renewable Technology (CEERT) significantly inflated estimates of DCPP's cost of operation beyond 2025 within a report developed in 2016. [2] CGNP previously raised that those DCPP cost inflations were likely influenced by a conflict of interest, namely the CEERT Chairman of the Board for a substantial period of time, including during the development of the 2016 report, was Attorney Jonathan Weisgall, who serves as Berkshire Hathaway Energy's (BHE's) Vice President of Legislative and Regulatory Affairs. BHE stands to increase its sales of electricity (likely by billions of dollars each year) to California from its mostly Wyoming coal-fired generation fleet in the event that DCPP's operations cease. [3]

Finally, CGNP will show using PG&E's FERC filings that since DCPP will no longer be eligible for rate recovery in large part after 2025, DCPP's cost of electricity will likely diminish. Furthermore, the impact of recently enacted federal legislation analogous to the significant current federal subsidies for solar and wind generation will further diminish DCPP's costs relative to CEERT's 2016 cost projections. CGNP applauds California Governor Gavin Newsom for his courageous political leadership in pressing for DCPP operation extension at least until 2030. [4] Governor Newsom

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[1] "High Energy Cost Hurts Wind & Solar," Goehring & Rozencwajg, October 14, 2022. **https://blog.gorozen.com/blog/high-energy-cost-hurts-wind-and-solar**

[2] "The Faulty Diablo Canyon Study that Started it All - How Friends of the Earth and a Prominent Renewable Energy Lobbyist Hoodwinked California Policy-Makers," Jonah Messinger, et. al., August 30, 2022, The Breakthrough Institute. **https://thebreakthrough.org/issues/energy/the-faulty-diablo-canyon-study-that-started-it-all**

[3] "Closing Diablo Canyon Spurs Fears Over Replacement Power," Gene Nelson, Ph.D., April 5, 2022; *Capitol Weekly*. **https://tinyurl.com/DCPP-Versus-Coal**

[4] Eytan Wallace CA Capital correspondent for @KTLA, @KRON4news, @KSEE24, @CBS47, @KGETnews, @fox40, @fox5sandiego | Formerly: @KGETnews, @NBCLA, @USC, @AnnenbergMedia
https://tinyurl.com/Newsom-on-DCPP
3:34 PM · Sep 12, 2022 Gov. @GavinNewsom 42,400 Views, 108 retweets, 47 quote tweets, 436 likes
Without the power supply from the Diablo Canyon Nuclear Power Plant during the record heatwave last week, we "full stop" would have had rolling outages during that period.

Eytan: What do you think could have happened last week if we did not have Diablo Canyon?

signed SB 846 on September 2, 2022. In making his decisions, the Governor's staff likely had access to information similar to that contained in these reply comments.

Per the above CEERT criticism, "The alternative has always been obvious, despite the false claims of Friends of the Earth, CEERT, and the state environmental community. Keep Diablo open until such time as the state has demonstrated that it can do without its continuing heavy reliance on natural gas to keep the lights on. Neither the state PUC nor Diablo opponents have ever demonstrated that this outcome is possible. Until they do, California ratepayers, and its environment, will be best served by keeping Diablo open and ignoring the imaginary solutions that Diablo opponents continually promote to suggest that the plant can be closed without substantial economic and environmental costs."

2. HIGH ENERGY COST (AND COST OF CAPITAL) HURTS WIND AND SOLAR

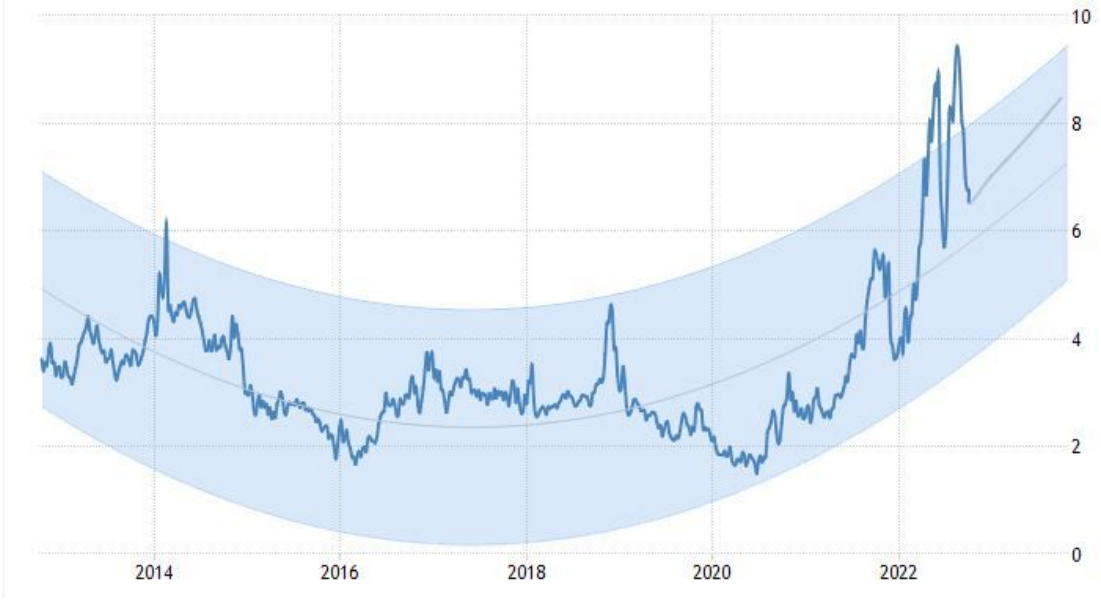
Advocates for solar and wind generation often apply a rule, "Moore's Law" (which is appropriate for diminishing semiconductor prices at a given performance level) to the cost of wind generation, solar generation, and grid-scale batteries. Since large amounts of energy are required for the inputs for these above three items, as the price of energy increases, the cost of those items will increase. Moore's Law is inappropriate in these cases. (The first article neglects the substantial grid integration costs of inherently intermittent wind and solar generation. In almost all cases, these generation means are grid integrated via fast-acting natural-gas fired generation. [5])

As a consequence of increasing worldwide energy demand, and as a consequence of the geopolitical concerns escalated by Russia's invasion of Ukraine on February 24, 2022, U.S. natural gas prices have continued to rise from the low of less than $2.00 / MMBTu during the COVID-19 pandemic lockdowns. Here is a natural gas futures price chart showing recent historical data and a projection to 2023 archived on October 14, 2022 from

https://tradingeconomics.com/commodity/natural-gas

Governor Newsom: We would have I mean, if we didn't have that 9 % base load its about 9% of the base load of electricity in the state of California, there's no doubt we would have blown past, we would have absolutely triggered into what we call load reduction, otherwise referred to as blackouts, unquestionably, if we did not have Diablo Canyon period, full stop. That's not even in debate or dispute.

[5] "Turns out wind and solar have a secret friend: Natural gas," by Chris Mooney, August 11, 2016, *The Washington Post*. **http://tinyurl.com/Natural-Gas-Secret**



The scale on the right side of the chart is U.S. dollars per MMBTu of natural gas and the blue tint shows the general natural gas price trend. Other energy inputs show similar behavior.

The first article discusses the significant amounts of energy-intensive steel, concrete, and other materials that are inputs for a completed wind or solar generator. Quoting from the article,

> " Wind and solar are extremely energy intensive forms of power. The ubiquitous (albeit now modest) 1.5 MW GE wind turbine contains 40 tonnes of steel and 600 tonnes of concrete in the foundation alone. The tower adds another 150 tonnes of steel while the generator requires 9 tonnes of copper. All these materials require huge amounts of energy to mine, process and refine. Between 2010 and 2020, the cost of every form of energy – whether it be oil, natural gas, coal or uranium – fell by 90% from peak to trough. It stands to reason that much of the reduction in the cost of renewables can be attributed to lower energy prices. Furthermore, renewables are very capital intensive. Over the past decade, we have experienced the lowest cost of capital in human history.
>
> Again, it is likely this too contributed to falling renewable energy cost. As simple as these insights were, no one else seemed to be talking about them. Instead, the industry and Wall Street analysts were convinced that renewable energy costs would continue to move ever lower – oftentimes contradicting the very laws of physics.
>
> We built a renewable energy cost model that explicitly incorporated energy and capital costs. We concluded these two factors alone were responsible for most of the dramatic cost reduction in

wind and solar costs between 2010 and 2020. As the era of cheap energy and cheaper capital came to an end, we argued the costs of renewable energy would stop declining and might actually begin to rise.

Since then, our models appear to have been proven correct. According to Bloomberg New Energy Finance, the cost of wind rose by 10% between the first quarters of 2021 and 2022 while solar rose 12% and lithium-ion batteries rose 15%. The culprit in all cases was a combination of rising material prices (themselves a function of higher energy costs) and higher capital costs. Earlier this year, LG announced it would shutter its solar panel division amid higher input costs. Our models suggest this is merely the first company to announce such a move.

While we have mainly focused our analysis on costs, there is now a more acute problem with renewables. The world finds itself in the midst of an immediate energy crisis. After years of underinvestment, the cost of every energy source has gone from record lows to record highs (in real terms) in only two years. The past ten years of abundant reliable energy now seem to be over. If energy continues to be scarce and dear, we simply cannot afford the high energy cost of renewable power.

In our past letters, we have detailed the concept of energy return on energy invested, or EROEI. Every source of useable energy consumes some of that energy in its own generation. The ratio energy-out to energy-in is known as the EROEI. For example, hydrocarbons generate 30 units of usable energy for every unit of energy consumed while the best unbuffered windmill might generate 10 units of energy for every unit of energy consumed. In other words, wind power is 65% less efficient than hydrocarbons on an EROEI basis.

However, looking at EROEI alone does fully capture the current situation. In the case of hydrocarbons, nearly all the usable energy is generated within the first five years. We can naively assume that an oil or gas well will generate six times the energy expended for five years before falling to basically zero (6:1 for 5 years gets you 30:1). Every unit of energy expended in such a system will have an immediate positive impact on total energy availability effective immediately.

Renewables on the other hand are entirely different. Our ideal windmill that enjoys and EROEI of 10:1 will produce power (mostly) evenly over its 25-year life. Therefore, in any given year of

operation, the windmill will only return 40% of the energy necessary for its manufacture and installation.

In a world of abundant energy, society can energetically afford to invest in windmills and solar farms. However, when faced with an immediate energy crisis like we have today, every incremental unit of renewable energy will only make the problem worse."

The article concludes with the sentence, " Policy makers would be advised to understand these limitations before enacting major renewable subsidies that will only make the current energy shortage that much worse."

3. INFLATED POST-2025 DCPP COST PROJECTIONS IN THE 2016 CEERT - TURN - FoE STUDY

The introduction to the key article states, " Since PG&E negotiated an agreement with anti-nuclear environmental groups in 2016 to shutter the Diablo Canyon Nuclear Power Plant, proponents of closing the plant have consistently asserted a preposterous claim, one that until recently has been broadly accepted by California legislators and regulators with little dissent. They claim that it will be cheaper to close the Diablo Canyon plant, which has already been paid for by ratepayers and provides 10 percent of California's electricity, and replace it with new sources of renewable energy and energy efficiency investments, instead of continuing to operate it.

The claim is based upon a single study, [6] commissioned by Friends of the Earth, a group that has openly stated it wishes to eliminate nuclear power.

This article concludes, "The resulting analysis projected future Diablo operating costs at roughly double those projected by independent analyses conducted by Stanford/MIT and Roth and Jaramillo. By contrast, present operations of Diablo cost a bit over $40/MWh. CEERT pushed every input into their analysis that they conceivably could in order to claim that over the next two decades it would rise to over $140/MWh."

The next section is:

How Did The FoE/CEERT Analysis Come To Be Adopted By the California PUC and State Legislature?

[6] A1608006 OPENING PREPARED TESTIMONY OF THE CENTER FOR ENERGY EFFICIENCY AND RENEWABLE TECHNOLOGIES; January 27, 2017. https://s3.us-east-2.amazonaws.com/uploads.thebreakthrough.org/2017-01-27-CEERT-Opening-Testimony-w-Plan-B-Study-Report-Appended-1-27-17.pdf

That section includes this passage:

> " In 2014, Friends of the Earth retained CEERT, White's non-profit consulting firm, to model the costs of closing Diablo Canyon. As noted above, White and his team at CEERT duly delivered the analysis that FOE was looking for, purporting to show that PG&E could shutdown Diablo, replace it with new renewable energy generation, energy efficiency investments, and pumped electricity storage, without increasing carbon emissions and at less cost than continuing to operate Diablo.
>
> . . . .
>
> In addition to the State Water Board's verdict, the state legislature had refused to value Diablo's clean energy production under the renewable portfolio standard established in 2015, had put in place policies that encouraged community aggregation, which was eroding PG&E's rate base, and was heavily subsidizing rooftop solar generation, which was eroding the value of Diablo's baseload generation. This, together with then cheap natural gas generation, which could serve to balance wind and solar generation but was entirely inconsistent with the state's climate commitments, made relicensing Diablo Canyon a risky bet for PG&E.
>
> In short, there was little real basis, at the time or since, to think that closure of DCPP wouldn't cost ratepayers and increase emissions.

The next section is titled, "Who will pay for Friends of the Earth and CEERT's Modeled Falsehoods?" Here is a relevant passage:

> "Whether or not those investments are wise, it should be clear at this point that additional investments in renewable energy generation, energy storage, energy efficiency, and new transmission lines are far better directed towards displacing natural gas, which still produces 38% of the state's electricity than replacing DCPP, California's largest source of clean power.
>
> In the event that opponents succeed in thwarting the governor's Diablo proposal, it is almost certain that the costs will fall heavily on California ratepayers. Over the six years since the negotiated settlement to replace Diablo was unveiled in 2016, claims about how Diablo's firm low carbon electricity generation would be replaced have continually shifted. In the original CEERT study, the plan was to predominantly replace it with pumped storage. That source of firm capability has never materialized because it was clear from virtually the start that it didn't actually exist and what effort has been made to develop new pumped storage in the state has predictably been opposed by the state's environmental community.

. . . .

Now, many Diablo opponents propose to replace the plant through massive development of offshore wind along California's central coast. Offshore wind typically has higher capacity factors than onshore. But it is still variable and cannot provide the firm, 90 percent capacity factor generation that Diablo presently provides. Under the best case, offshore wind development in California will not begin to come online until later this decade. That assumes, of course, that the state can expedite permitting and construction, which would require substantial changes or exemptions from the California Environmental Quality Act, the California Coastal Act, and a range of other laws that neither the state's environmental community nor its Democratic leadership has thus far been willing to consider.

Absent legislation to extend Diablo operations, the likely outcome is continuing dependence on natural gas power plants to firm variable renewable generation, at a time that gas prices have hit record levels, thereby increasing grid instability, raising electricity prices, and limiting progress toward the state's climate goals."

All of these well-researched and well-documented assertions are relevant to the task before the Commission in this re-scoped proceeding.

4. DCPP'S ELECTRICITY COST WILL LIKELY DECREASE AFTER 2025 FOR TWO REASONS.

4A. AFTER 2025, DCPP WILL NO LONGER BE ELEGIBLE FOR COST RECOVERY

First and foremost, it must be remembered that the societal and actual costs of air-pollution are dire, and go beyond the dollars and cents factored into things like utility cost recovery. The Commission is required, under a variety of legislative mandates, to consider the effects of air pollution and climate change. on disadvantaged communities and the state as a whole. Those statutes apply to this proceeding, and they cannot be ignored

The costs of having unreliable power are also manifest, particularly in the post-pandemic era. Many Californians perform work or attend school remotely, and reliable power is critical. Therefore, CGNP urges the Commission to keep these principles in mind when considering, "cost."

As for the specific issue: DCPP's multi-billion-dollar construction and upgrade costs will be fully paid off after 2025. DCPP will have a book value of zero, despite being a modern, well-maintained nuclear power plant with a design life of a century, as CGNP previously established in its testimony.

From the bottom of page 5 of PG&E's October 7, 2022 Comments on the September 23, 2022 Amended Scoping Memorandum,

> II B. DCPP EXTENDED OPERATIONS BALANCING ACCOUNT
>
> For the tracking and recovery of extended operations costs (i.e., beyond the current federal license period for Unit 1 and Unit 2 **and not eligible for cost recovery** under the executed loan agreements with the Department of Water Resources pursuant to SB 846 and AB 180),.... (emphasis added).

The table below documents these substantial cost recovery amounts, more than $13.5 billion, between 2015 and 2021.

From 2015 - 2021 PG&E FERC Form 1 Data

Year	Asset Retirement Costs
2015	$780,875,161.00
2016	$1,646,806,164.00
2017	$1,646,806,164.00
2018	$2,701,010,462.00
2019	$2,701,010,462.00
2020	$2,701,010,462.00
2021	$1,406,235,833.00

PG&E's cost of capital is the product of the allowable rate of return on equity and annual permissible depreciation. In Decision 18-01-022, CPUC granted PG&E's request for accelerated depreciation so that the plant's book value would be reduced to zero after its planned retirement date in 2025.

4B. COMPARISON OF COST / kWh FOR DCPP AND COLUSA

On several occasions in recent years, managers of California's CAISO grid have learned the importance of baseload electricity resources for maintaining grid reliability. Without Diablo Canyon, it's a role only natural gas can play – thus, a cost comparison between what Diablo Canyon and what would necessarily replace it is appropriate. Comparing average costs per kilowatt-hour (kWh) between PG&E's modern, natural-gas fired Colusa plant and DCPP shows that the cost of electricity from

DCPP often undercuts that from Colusa by a wide margin. DCPP costs approximately mirror the annual cost recovery amounts discussed in the previous section.

2015 - 2021 PG&E Electricity Cost of Generation

Year	Colusa (Natural Gas)	Diablo Canyon (Nuclear)	Cost Differential
2015	$0.0386	$0.0270	-30.0%
2016	$21.50	$0.0269	-79,800 %
2017	$0.0326	$0.0278	-14.8%
2018	$0.0384	$0.0291	-24.3%
2019	$0.0345	$0.0379	9.9%
2020	$0.0356	$0.0321	-9.9%
2021	$0.0714	$0.0356	-50.2%

Source: FERC Form 1. Costs shown in $/kWh.

II. B. 2 DCPP PERFORMANCE AND MANAGEMENT SUB-ACCOUNT

Below is a tabulation showing the projected total for the performance and management sub-account, assuming DCPP's typical annual production of 18 terawatt hours (TWh), or 18 billion kilowatt-hours (kWh).

PERFORMANCE AND MANAGEMENT SUB-ACCOUNT		
Annual Management Fee	$100,000,000.00	Total for 18 TWh / year
All-LSE Volumetric Fee per MWh	$6.50	$117,000,000.00
PG&E Volumetric Fee adder per MWh	$6.50	$117,000,000.00
Grand Total for 18 TWh / year	$334,000,000.00	

When $334 million is distributed over 18 TWh, the management fee is comes to $0.0055/kWh for all Commission-jurisdictional customers. The California-wide volumetric fee is $0.0065/kWh, and for PG&E customers $0.0130/kWh. Together, both fees have California customers paying $0.01205 / kWh and PG&E Customers paying $0.01855 / kWh. These performance and management costs are comparable to the cost of power from the least-expensive power generation source for Californians: large hydropower.

II. B. 3 EXTENDED OPERATIONS PERIOD SUB-ACCOUNT

From page 8 of PG&E's October 7, 2022 Comments on the September 23, 2022 Amended Scoping Memorandum,

"While PG&E does not have a complete and detailed accounting of the expected types of costs that will be recovered through this subaccount, PG&E expects that the costs will, at a minimum, include:
(1) operations and maintenance costs,
(2) plant and equipment improvement and investment costs,
(3) future spent fuel storage capacity,
(4) fuel purchasing for post-2026 cycles,
(5) pension, taxes, benefits and all standard PG&E overheads,
(6) costs associated with the employee retention agreement, and
(7) regulatory compliance items."

These amounts contribute to the post-2025 DCPP rate uncertainty previously discussed. However, the 2018 - 2020 annual cost recovery is likely greater than the most costly of the seven annual entries above.

4C. HOW RECENT FEDERAL PROGRAMS FURTHER REDUCE DCPP'S ELECTRICITY COST

The bipartisan federal Inflation Reduction Act (IRA) of 2021 provides up to $1.4 billion in federal funds from 2025-2030 for an average annual benefit of $280 million to reduce the cost of DCPP's electricity to California ratepayers. The 2021 IRA recognizes the national benefit of the clean firm generation from nuclear power. Nuclear power also contributes to U.S. energy security. PG&E timely filed its Civil Nuclear Credit program application with the U.S. Department of Energy on September 2, 2022. The results of PG&E's application to this program are likely to be announced soon.

An analysis published on October 13, 2022 further states:

" Nuclear is already the largest source of clean energy in the U.S., having provided 50 percent of America's clean energy and 19 percent of America's total energy in 2021. Nuclear energy produces energy the most reliably too: nuclear plants in the U.S. operate at full capacity 93 percent of the time, more than natural gas (54 percent), wind (35 percent) and solar (25 percent). The inclusion of nuclear energy as a recipient of the $369 billion allocated for clean energy in the IRA is an example of the all-of-the-above approach we must take to tackle climate change.

To aid existing nuclear power plants in producing reliable clean electricity, the IRA provides a credit of $15 per megawatt-hour, with the potential to move up to $25 should electricity prices increase. That seemingly small credit will provide an estimated $30 billion for aging nuclear plants nearing retirement, like Diablo Canyon in California, or the Palisades plant in Michigan that recently closed. [8] "

5. CONCLUSION

Since it is so relevant, CGNP quotes for a second time the conclusion to the August 31, 2022 criticism of the 2016 CEERT DCPP cost study,

> **The alternative has always been obvious, despite the false claims . . . Keep Diablo open until such time as the state has demonstrated that it can do without its continuing heavy reliance on natural gas to keep the lights on. . . . California ratepayers, and its environment, will be best served by keeping Diablo open and ignoring the imaginary solutions that Diablo opponents continually promote to suggest that the plant can be closed without substantial economic and environmental costs.**

Respectfully submitted on October 14, 2022.

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[8] "The IRA and CHIPS Act were great for nuclear energy — here's what we should do next,"
By Theodore "Ted" J. Garrish, October 13, 2022, *The Hill*.
https://thehill.com/opinion/energy-environment/3686639-the-ira-and-chips-act-were-great-for-nuclear-energy-heres-what-we-should-do-next/