

**BEFORE THE PUBLIC UTILITIES COMMISSION  
OF THE STATE OF CALIFORNIA**

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

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

**DIRECT TESTIMONY OF ROBERT FREEHLING  
FOR WOMEN'S ENERGY MATTERS  
WITH SECTIONS 2, 6 AND 8  
CO-SPONSORED BY SAN LUIS OBISPO MOTHERS FOR PEACE**

January 27, 2017

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**Prepared Testimony for Women's Energy Matters**  
**Application 16-08-006**  
**January 27, 2017**

This testimony supports the position that the California Public Utilities Commission (Commission) should consider options for how Diablo Canyon Nuclear Power Plant (Diablo Canyon) could be shut down earlier than the dates proposed by Pacific Gas and Electric Company (PG&E).<sup>1</sup> The Scoping Memo in this proceeding specifically invites testimony regarding an earlier retirement of Diablo Canyon:

Parties may present testimony in support of PG&E's proposed dates, or earlier or later retirement dates, including indefinite dates.<sup>2</sup>

The 2024/2025 retirement dates proposed by PG&E coincide with the expiration of Diablo's current operating licenses. PGE cites factors in support of the 2024/2025 retirement dates including 1) problems with continued operation of the plant, 2) constraints on demand for electricity supplied by PG&E, 3) PG&E's existing sources of electric generation, and 4) public policies in California.

These factors do not suddenly arise in 2024/2025, but rather, are ongoing. There is no particular reason why they must all converge and require retirement in 2024/2025. Rather, the impression of convergence is an artifact of PG&E's model, which only includes data for 2017, 2025, and 2030, and excludes examination of the years in between. This Testimony considers the possibility that the factors cited by PGE in support of its 2024/2025 dates actually support an earlier retirement date for DCP.

## **I. Retirement of Diablo Canyon Power Plant**

Here are three options for how Diablo Canyon might retire:

**1. PG&E's Proposal:** A planned retirement by 2024/2025 coinciding with the end of the licensing period. This option removes the costs and risks arising from continued operation from 2025 to the mid-2040s. However, it does not eliminate the high operating expenses and various market, policy, and safety risks Diablo Canyon will face if it continues to operate for another nine years, between 2017 and 2025.

According to PG&E's corrected data from its testimony, annual operating and capital equipment expenditures for Diablo Canyon exceed an average of \$800 million per year in 2020, and rapidly escalate to over \$900 million by 2024.

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<sup>1</sup> August 11, 2016, proposes retirement of Unit 1 in 2024 and Unit 2 in 2025, which are the years these units would otherwise need relicensing if they were to continue operating beyond those dates.

<sup>2</sup> Scoping Memo and Ruling of Assigned Commissioner and Administrative Law Judge, 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), November 18, 2016.

## Diablo Canyon Revenue Requirement-Annual Operating Expenses<sup>3</sup>

*(\$ millions of dollars)*

Cost Category	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Operations and Maintenance Administrative and											
General Nuclear Fuel Expenses	687.6	699.0	707.2	728.0	785.1	761.7	782.2	801.9	822.1	881.8	863.9
Capital Equipment Expenditures	145.8	121.3	125.0	128.7	152.6	139.0	143.1	172.4	176.8	204.5	186.0
Subtotal	833.4	820.4	832.1	856.7	937.7	900.6	925.4	974.3	998.9	1086.3	1049.9

If the plant were to operate near full capacity, the total cost of energy would be just over \$90 per megawatt-hour. However, as the plant's electricity is displaced by market, regulatory, and policy factors, the cost of energy increases to \$141 per megawatt-hour by 2025 in the Reference Case.

**2. Earlier Retirement Due to Unplanned Occurrence or Crisis.** The plant may face unplanned contingencies, including external events such as a natural disaster similar to Fukushima, or problems internal to the plant such as occurred in the case of San Onofre Nuclear Generating Station (SONGS). Either situation could render the plant either physically impossible or financially imprudent to continue operating.

As MFP notes, continued operation can compound both the known burdens and uncertain risks of the nuclear plant:

MFP thinks that Diablo Canyon can and should be shut down earlier than 2025. What can happen in nine years? We know that over a million additional pounds of highly radioactive waste will be added to the more than six million pounds already stored on site. The marine life in the cove will continue to be assaulted. Also possible are the “Big One,” the earthquake that seismologists all over the nation are warning us about. A tsunami, deemed possible by geologist and seismologist Dr. Robert Sewell, might cause the vital cooling system to fail. The aging Diablo Canyon power plant only gets more dangerous as it operates....<sup>4</sup>

Any plan to continue operating the nuclear plant implies continued exposure to these risks, every day. Some of these are inherent to nuclear power, but some are specific to this particular nuclear plant being located directly on the ocean next to the Hosgri Fault, which has a Maximum Credible Earthquake rating of Magnitude 7.5 according to California's official seismic map for major structures.<sup>5</sup> MFP is submitting separate expert testimony that examines this topic.

The Commission should require an alternative analysis that reveals potential need and plans for resources that could be procured in the event of unplanned loss of power from

<sup>3</sup> Source data from PG&E Spreadsheet: Pacific Gas and Electric Company, Application 16-08-006, Workpaper Supporting Chapter 2, Table 2-6 Errata, "004\_Errata\_to\_Chapter\_2\_Workpapers\_Table 2-6\_License\_Extension\_Annual\_Revenue\_Requirement\_for\_DCPCP (Er"; Supplemented by cost of energy calculations for WEM testimony

<sup>4</sup> 2016-07-05 Mothers for Peace Will Continue to Advocate for Safety, <https://mothersforpeace.org/data/2016/2016-07-05-mothers-for-peace-comments-on-pg-e-proposal-for-shut-down-of-diablo>

<sup>5</sup> California Seismic Hazard Detail Index Map 1996, California Department of Transportation, Office of Earthquake Engineering, by Lalliana Maulchin, Engineering Seismologist.

Diablo Canyon for all years prior to 2025. This analysis would lessen the negative impacts of an *unplanned* early retirement; it would also serve as an inquiry into the viability of *planned* retirement prior to 2025. It is important to keep in mind that the predictable costs that PG&E included in its testimony would likely increase should an unplanned crisis occur.

WEM served a data request inquiring , "Has PG&E considered contingencies such as an accident or other unplanned occurrences that would cause retirement of DCPD prior to 2024/2025? In response, PG&E specifically stated, " PG&E has not considered contingencies such as an accident or other unplanned occurrences that would cause retirement of DCPD prior to 2024/2025." In response to another WEM Data Request, PGE stated "...no analyses were completed that included any assumptions on Diablo Canyon (DCPD) being shutdown prior to the expiration of its licenses."<sup>6</sup> ***The Commission should address this glaring omission, and order contingency studies for the replacement of DCPD power with GHG-free resources, for each year, 2017 to 2024/2025.*** The 2012 unplanned early retirement of SONGS serves as an obvious example of the need for such studies.

**3. Early Obsolescence.** PG&E has already concluded that a combination of factors related to limited growth for electricity demand and California's energy and climate policies will most likely render Diablo Canyon uneconomic to continue operating after 2024/2025. Operating the plant at ever lower fractional capacity, as requirements for clean energy increase, combined with increasing operating costs, directly increase the cost of energy. These factors act independently of the large investments that would be required for relicensing.

The general context of decreasing demand for PG&E's bundled electricity, existing committed resources, and policies requiring increasing amounts of clean energy, may render the plant uneconomic and/or dysfunctional prior to 2024/2025. There are several factors that may tend to make this happen.

The rapid ramp up of Community Choice Aggregation (CCA) programs beyond the level assumed by PG&E is already happening. PG&E in its model assumes 14,437 GWh of retail sales from direct access (DA) and CCA combined.

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<sup>6</sup> PG&E Response to Data Request WEM Set 3-Q1 and PGE Response to WEM Data Request Set 3-Q2.

# PG&E Reference Case

Pacific Gas and Electric Company  
Application 16-08-006

Workpapers Supporting Tables 2-3 to 2-5: EE, DG, CCA and Generation Resource Type in 2017,  
2025 and 2030 (Reference, Low, and High Load Scenarios)  
Errata

Reference Case

		<i>GWh</i>		
		2017	2025	2030
	<b>Generation Requirement</b>			
$a = g - c - e$	<b>Gross Service Territory Sales</b>	96,131	117,665	131,153
$b = a + (h - g) - d - f$	<b>Gross Service Territory Load</b>	105,208	129,408	144,369
$c$	Energy Efficiency	(6,482)	(20,676)	(27,461)
$d = (c / 0.91) - c$	T&D Line Losses	(641)	(2,045)	(2,716)
$e$	Distributed Generation	(7,610)	(18,862)	(23,011)
$f = (e / 0.91) - e$	T&D Line Losses	(753)	(1,865)	(2,276)
$g = k - i$	<b>Service Territory Sales</b>	82,039	78,127	80,681
$h = l - i - j$	<b>Service Territory Load</b>	89,722	85,960	88,905
$i$	CCA / DA Sales	(14,437)	(34,273)	(37,068)
$j = (i / 0.91) - i$	T&D Line Losses	(1,428)	(3,390)	(3,666)
$k$	<b>Utility Bundled Sales</b>	67,602	43,854	43,613
$l = m_1 + \dots + m_7$	<b>Utility Bundled Load</b>	73,857	48,297	48,171
$m_1$	RPS-Eligible	21,761	20,377	23,115
$\cdot$	Large Hydro	11,677	10,232	10,231
$\cdot$	CHP	5,212	3,195	1,809
$\cdot$	Humboldt Local Reliability	420	419	419
$\cdot$	Renewable Integration	3,405	4,794	4,805
$m_7$	DCPP Need	18,492	8,778	8,139
	Other	12,890	503	(348)
			515	(335)

According to the most recent California Energy Commission (CEC) forecast, DA load in PG&E's service territory is projected to remain at a flat 9,520 Gigawatt-hours between 2015 and 2027.<sup>7</sup> PG&E's combined DG/CCA value in 2017 therefore implies CCA retail sales of 4917 GWh in that year within PG&E's service area. This is less than what is projected from Marin Clean Energy (MCE) and Sonoma Clean Power (SCP) alone,

### Select CCA Retail Sales in 2017<sup>8</sup>

CCA	GWh
Marin CCA	2,743
Sonoma CCA	2,321
Subtotal	5,064

In addition to the above, operating CCAs in San Francisco and San Mateo (Peninsula) have begun service and will be ramping up over the next few years. The following table shows potential retail sales by emerging CCAs:

<sup>7</sup> California Energy Demand Update Forecast 2015 - 2027, Mid Demand Baseline Case, Mid AAEE Savings, Form 1c, California Energy Commission, December 2016.

<sup>8</sup> Response to WEM data request from MCE and SCP.

## Projected and Likely CCA Retail Sales by 2020<sup>9</sup>

CCA	GWh
Marin	2,784
Sonoma	2,495
San Francisco*	3,000
Peninsula*	2,300
Silicon Valley*	3,000
Alameda*	9,000
Subtotal CCA	22,579
DA	9,520
CCA + DA	32,099

This is close to PGE's 2025 projection for CCA plus DA demand in its Reference Case for 2025, but it could easily happen 5 years earlier.

PG&E's stated resource mix in 2020 also has higher amounts of renewable energy, large hydro, and CHP than is projected for 2025. Therefore, it seems likely that the situation projected for 2025 that supports retirement of Diablo Canyon will actually emerge years earlier than what is directly presented in PG&E's analysis. This likely situation is obscured because of the omission of data for intervening years.

## II. Proposed Replacement Procurement (includes Net Greenhouse Gas Impacts of DCCP Retirement)

From Scoping Ruling: "All proposals should address how much of Diablo Canyon's output needs to be replaced in light of current and projected levels of electric generation."

The previous section implies that constraints projected for 2025 on operating Diablo Canyon may begin to be realized over the next few years, between 2018 and 2020. The amount of output that would need to be replaced in the event of early retirement is thus likely to be similar to what PG&E proposes for 2025. Since data for these years has not been fully provided to WEM and MFP, these factors will need to be further analyzed later.<sup>10</sup>

One particular data and replacement resource gap is the amount of Combined Heat and Power that should have been procured pursuant to California's Climate Scoping Plan, and implemented through the Commission's CHP Settlement Agreement. The Climate Scoping Plan set "a target of an additional 4,000 MW of installed CHP capacity by 2020, enough to displace approximately 30,000 GWh of demand from other power generation sources." This measure is also assigned a greenhouse gas target of 6.7 million metric tons CO<sub>2</sub>e in 2020.

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<sup>9</sup> Includes MCE and SCP data, Implementation Plans or analysis by San Francisco, Peninsula, and Silicon Valley, and CEC data for Alameda County less an assumed exclusion.

<sup>10</sup> On January 25, 2017 WEM and MFP had a "meet and confer" phone conference with PGE representatives seeking further response to WEM Data Request Set 2. PG&E has stated it will provide updated information and WEM and MFP will supplement this testimony once the requested information has been received.

## California 2008 Climate Scoping Plan Electricity Efficiency Measures<sup>11</sup>

**Table 7: Energy Efficiency Recommendation - Electricity**  
(MMTCO<sub>2</sub>E in 2020)

Measure No.	Measure Description	Reductions
E-1	Energy Efficiency (32,000 GWh of Reduced Demand) <ul style="list-style-type: none"> <li>• Increased Utility Energy Efficiency Programs</li> <li>• More Stringent Building &amp; Appliance Standards</li> <li>• Additional Efficiency and Conservation Programs</li> </ul>	15.2
E-2	Increase Combined Heat and Power Use by 30,000 GWh	6.7
<b>Total</b>		<b>21.9</b>

This agreement assigned 1387 MW of CHP procurement to PG&E by 2015. PG&E partially responded to WEM's data request, indicating "The capacity of CHP projected for years 2017, 2025, and 2030 is 974 MWs, 553 MWs, and 253 MWs."<sup>12</sup> This implies a procurement hundreds of megawatts short of the 1387 MW that would be PG&E's pro-rata share of the Climate Scoping Plan target for 2020. The gap implies that PG&E may not be meeting the target established by the Scoping Plan. Note that if this measure were fully implemented it would avoid emissions similar to the amount claimed to be avoided by Diablo Canyon. Thus, it is important that the Commission insure full implementation of this measure by the IOUs.

PG&E reports that in 2008, when the Climate Scoping Plan was written, the utility had at that time procured a total of 2,511 MW of CHP/Cogeneration.<sup>13</sup> Properly, to meet the climate target, PG&E's procurement should have been additional to this amount. In other words a total of about 4,000 MW. However, PG&E most recent reported that CHP/Cogeneration was down to 1,050 MW in 2016.<sup>14</sup> This shows that PG&E had lost about 1500 MW of CHP, when it should have been increasing CHP by about the same amount in order to meet the state climate policy goal.

***PG&E should be required by the Commission to meet all state climate and energy policy goals, including for CHP.*** While this appears to have been the original intent of the CHP Settlement Agreement, proper implementation seems to be slipping through the regulatory cracks. If this had been done strictly as the Climate Scoping Plan states, then this would be another reason why Diablo Canyon could be retired much sooner than 2025, and would also diminish if not avoid the need to purchase other "replacement" energy, as well as address a large portion of the greenhouse gas reduction needed to fill the gap created by retirement of Diablo Canyon.

### III. Proposed Employee Program

This testimony does not include analysis on this topic, but WEM support the principle of this program and reserve the right to comment at other opportunities.

<sup>11</sup> Climate Change Scoping Plan, California Air Resources Board, December 2008, p. 44.

<sup>12</sup> PG&E Data Response to Request No.: WEM\_002-Q03, A., p.1.

<sup>13</sup> Cogeneration and Small Power Production Semi-Annual Report, Pacific Gas and Electric Company, July 2008.

<sup>14</sup> Cogeneration and Small Power Production Semi-Annual Report, Pacific Gas and Electric Company, July 2016.

#### **IV. Proposed Community Impacts Mitigation Program**

This testimony does not include analysis on this topic, but WEM supports the principle of this program and reserve the right to comment at other opportunities.

#### **V. Recovery of License Renewal Costs**

This testimony does not include analysis on this topic, but WEM reserves the right to comment at other opportunities.

#### **VI. Proposed Ratemaking and Cost Allocation Issues**

Please see sections related to cost allocation issues contained in Attachment 1, which is Robert Freehling's November 2016 report, "Clean Energy Replacement for California's Retiring Nuclear Plants".

#### **VII Land Use, Facilities and Decommissioning Issues**

WEM is providing no testimony on this topic, but reserves the right to comment in future briefs.

#### **VIII. Additional Issues Not Addressed Above**

Attachment 1 to this testimony is a copy of *Clean Energy Replacement for California's Retiring Nuclear Plants*, a November 2016 report authored by Robert Freehling. The sub-section *Climate Effect of Nuclear Retirements*, refutes the claims of pro-nuke parties that DCPP retirement presents a threat to achieving California's climate goals. Please see the report at pp. 15-21. The report in its entirety is incorporated herein by this reference. The report provides factual and policy background on the following topics:

1. General background of the proposed retirement of PG&E's nuclear power plant, including the accumulating challenges that make it increasingly difficult to continue operating the plant in the future.
2. How the claim that retiring nuclear power plants will seriously damage California's climate policies is invalid, because the state's various clean energy policies rapidly replace, and over time far exceed, the amount of electricity provided by the nuclear plants.
3. An overview and analysis of PG&E's proposal to replace a portion of Diablo Canyon with new clean energy resources that are intended to be additional to the state's clean energy policies.
4. How retirement of Diablo Canyon will put PG&E further down the road away from the business of generating electricity, and toward being a utility that primarily provides wires and other support services; this should reduce the competitive role the utility has with other electricity suppliers, such as community choice programs and customers who generate their own electricity.

5. Why Community Choice agencies should not be required to pay "non-bypassable charges" for renewable energy that replaces Diablo Canyon, but is not delivered to Community Choice customers.

### **Statement of Qualifications**

Q. Please state your name, business affiliation and address.

A. I am Robert Freehling. I am working as a consultant to Women's Energy Matters (WEM) in this proceeding. WEM is working cooperatively with San Luis Obispo Mothers for Peace (SLOMFP) on a number of issues and SLOMFP is co-sponsoring my testimony related to proposed replacement procurement, proposed ratemaking and cost allocation issues, and additional issues not address above. My business address is PO Box 606, Fair Oaks, CA 95628.

Q Please provide your qualifications.

A I have 15 years of experience with energy utility issues. I have previously testified or made formal comments before the CPUC, the California Air Resources Board, the California Energy Commission, and the NRC. I have also done work for several non-profit organizations including the Sierra Club, the Cal Environmental Justice Alliance, the Environmental Health Coalition and Climate Protection Campaign. I have done consulting work for the San Francisco Public Utilities Commission, the San Francisco Local Agency Formation Commission, Sacramento Municipal Utility District, the City of Boulder, and contract work for the California Energy Commission.

Q What is the purpose of your testimony?

A Within the scope of the proceeding, I provide analyses and make recommendations related to (I) Timing of Diablo Retirement; (II) Proposed Replacement Procurement; (VI) Proposed Ratemaking and Cost Allocation Issues; and (VIII) Additional Issues Not Addressed Above.

Q Does this conclude your testimony?

A Yes it does.