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CGNP's Concerns Regarding Natural Gas Pipeline Vulnerabilities Reinforced by CEC's 11/28/17 Warnings

On 24 November 2017, CGNP placed into the docket of FERC RM18-1-000 (The Grid Resiliency Rule) the attached file. It was also filed in CPUC Docket A.16-08-006 on November 27, 2017 in CGNP's Motion for Official Notice. Copyright for the "Op-Ed" that is the first document in the Appendix is held by this comment's author (Gene A. Nelson, Ph.D.) As author, he authorizes its reproduction as well as the remainder of the file also as its author.

CGNP was very disappointed to learn that the CEC has filed opposition to FERC RM18-1-000. California has an over-reliance on natural-gas-fired generation, with about 60% of in-state generation supplied by natural gas. With the possible abandonment of DCPP by PG&E in 2025, the percentage of natural-gas-fired generation will likely rise to about 70%, as non-dispatchable solar and wind generation cannot be counted on as Firm Capacity.

When the author wrote the Op-Ed titled "Diablo Canyon, A Lifesaver for California" http://tinyurl.com/CGNP-4-DCPP that was published on October 7, 2017 hypothesizing damage to California's natural gas transmission pipeline system , he was not aware that on October 1, 2017 that two large natural gas pipeline ruptured (Line 235-2 ruptured, also damaging Line 4000 near the Newberry Compressor Station) Both lines are still out of service. The title of Slide 5 of 11 of TN 221862 which was posted on 11/28/17 reads, "Winter Outlook Clouded by Pipeline Outages: Normal Firm Receipt Capacity into Northern Zone of 1590 mmcfd is NOW 550" (That is about 1/3 capacity) To translate this title into plain English, the likelihood of southern California power outages is much higher.

It's only common sense to "not put all of your (energy) eggs in one basket." California, as the world's sixth largest economy should end its overreliance on natural gas by operating Diablo Canyon Power Plant for its design lifetime of about a century to 2085 - and should RE-Commission SONGS. Sadly, the CEC, the CPUC, and the California Independent System Operator appear to behave as "captive agencies" of the fossil-fuel industry instead. This is not common sense. The policies of over-reliance natural gas could harm the lives of Californians if we get a "Polar Vortex" and cause serious damage to our huge economy.

A concern about the Polar Vortex is real. Per https://patch.com/california/marinadelrey/record-low-temperature-set-in-los-angeles, the January 14, 2013 headline read, "Record Low Temperature Set in Los Angeles - Temperatures early Monday morning were just above freezing." Please follow the link to read more about potentially deadly cold weather this winter in southern California.

Additional submitted attachment is included below.

Before the Federal Energy Regulatory Commission (FERC)

Commission Docket RM18-1-000 Grid Resiliency Pricing Rule

Californians for Green Nuclear Power, Inc. (CGNP) a not-for-profit independent educational corporation files these comments in support of FERC Docket RM18-1-000 Grid Resiliency Pricing Rule with specific support for the continued safe operation of the U.S. nuclear power fleet, with an additional focus on the continued safe operation of Pacific Gas and Electric's Diablo Canyon Power Plant. (DCPP.) On August 11, 2106, PG&E filed an Application A.16-08-006 with the California Public Utilities Commission (CPUC) requesting permission to abandon the safe, reliable, highly-functioning, cost-effective, and emission-free DCPP in 2025.

CGNP applied to the CPUC to become a intervenor-compensation-eligible organization in A.16-08-006 and was granted intervenor status. CGNP strongly opposes PG&E's application, filing voluminous written testimony, workpapers, briefs, and participating in the oral cross-examination phase. CGNP also plans to present final oral arguments at CPUC headquarters on Tuesday, November 28, 2017.

The summary of CGNP's arguments before the CPUC is that the premature abandonment of DCPP in 2025 will harm grid reliability and resiliency, significantly increase ratepayer burdens, premature retirement is extremely wasteful, will harm the San Luis Obispo, California regional economy, and will harm the environment as thermal generation (with its attendant emission increases - both in-state and out-of-state) would largely replace the typical 18,000 gigawatt-hour annual DCPP generation. CGNP will also show that utility-scale energy storage is an impractical and expensive means to integrate solar generation and wind generation into the California power grid. These negative externalities were previously seen in southern California after the San Onofre Nuclear Generating Station (SONGS) was shut down in January, 2012 as a consequence of a mismanaged routine service operation by the SONGS plant owners.

For far too long wholesale electricity markets have paid the same amount for all sources of electricity, independent of various essentially important factors, such as the reliability, predictability and resiliency of the source. Intermittent sources, such as wind and solar, regularly undergo unpredictable fluctuations in their output. In order to maintain grid stability other dispatchable sources are forced to respond by ramping their outputs. The intermittent sources impose costs upon the dispatchable sources by forcing them to run at a lower capacity factor, without reducing the fixed portion of their costs. The intermittent sources also cause additional expenses for the dispatchable sources due to increased wear and tear, and higher fuel consumption associated with the more demanding operating dynamics. This increases the unit price of their electricity to the consumer.

Current market rules allow the intermittent generators to shift these substantial costs and difficulties associated with their intermittency to other generating sources on the grid. The failure to account for these costs, along with the large continued subsidies for wind and solar, are artificially driving down the wholesale price of electricity to the point where the economics of both the reliable baseload and dispatchable sources are threatened. As intermittent generators are increasing their market penetration these issues are taking on unprecedented significance.

Failure to provide the necessary revenue to insure the necessary reliable baseload sources continue operating will eventually undermine grid reliability. A first step to correcting this situation should be to compensate baseload sources more for their favorable operating characteristics. These include high reliability, predictable output, and resiliency in the face of extreme weather conditions. Nuclear generation have the added benefits of the highest availability rates, low forced outages, emission-free generation, and many months of secured onsite fuel. This many month supply of fuel onsite enables nuclear plants to operate independent of the supply chain, for example providing a buffer against shortages in natural gas deliveries. Nuclear plants also provide frequency support services as a function of their large spinning generators and governor-control settings, along with reactive support for voltage

control. The ability of baseload sources to help provide voltage and phase stability should also be rewarded via updated FERC policies.

It is time for policy governing wholesale power markets to account for how well electricity provided by each specific source promotes grid stability and satisfies demand around the clock. Reliable and economical operation of the grid, during all seasons is critically important to our economy. So it is essential to ensure that reliable, resilient, round-the-clock sources, such as nuclear, are adequately compensated by wholesale power markets for the essential functions they provide. Ensuring the grid continues to have a diverse, balanced set of sources minimizes the risks of disruption of any specific fuel source. This enhances the security of the grid, to the benefit of all society. CGNP will now examine in greater detail some aspects specific to PG&E's CPUC Application A.16-08-006 to abandon DCPP in 2025.

A. Premature retirement of DCPP will harm grid reliability and resiliency.

As a consequence of California's geography and climate and exacerbated by global warming, large high pressure systems that remain stable for substantial periods of time to the east of California are increasing average California temperatures and exacerbating long-term regional drought conditions. Those changes are already increasing electricity demand in California for air conditioning and pumping and treating water (which, per the California Energy Commission accounts for about 1/3 of California's electricity demand.[1.]) Unfortunately, the long-term reliability of dispatchable California hydropower is diminished by California's persistent drought.

The majority (about 60%) of California's in-state generation is supplied by natural-gas-fired generation, which has the disadvantage of not being able to provide on-site energy storage akin to either nuclear power or coal-fired storage. Coal-fired generation energy storage is in the form of huge piles of coal.

[1.] California Energy Commission Water - Energy Nexus webpage: http://www.energy.ca.gov/research/iaw/water.html

Some photographs of PacifiCorp's Jim Bridger coal-fired power plant coal piles are shown in a recent series of newspaper articles. [2] The consequences of a lack of California energy source diversity are discussed in a blog entry by Rod Adams. The deadly, corrosion-induced failure of a single 30-inch natural gas pipeline near Carlsbad, New Mexico on August 19, 2000 triggered natural gas supply challenges in southern California. [3] The unprecedented 2015-2016 natural gas leak at Sempra's Aliso Canyon Storage Field (ACSF) still reduces California's grid resiliency. [4]

A recent op-ed by this section's author, Gene Nelson, Ph.D. raises the important public safety benefits of the continued safe operation of DCPP in the event of a natural (or human-caused) disruption of California's natural gas supply. [5.] There are already California Independent System Operator (Cal-ISO) administered revenue enhancements for California generators via such mechanisms as the Day Ahead (DA) market. Other Cal-ISO market mechanisms apparently provide revenue for frequency and voltage support.[6.] However, just as California's energy policies counterfactually fail to include nuclear power and large hydro in the state's (emission-free) renewable portfolio Standard [RPS,] there are likely California policy exclusions that fail to grant such economic rewards to nuclear power generators as DCPP. One example of this is a recent disclosure that PG&E will likely need to provide reactive voltage support in

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2. "California is aiming for 100% clean energy. How much of it will come from Wyoming wind?" by Sammy Roth, September 10, 2017, ***The Desert Sun.*** https://amp.desertsun.com/amp/645770001

3 "Logical Basis For Sec. Rick Perry's Resiliency Pricing Rule" by Rod Adams, October 30, 2017, ***Atomic Insights***. https://atomicinsights.com/logical-basis-sec-rick-perrys-resiliency-pricing-rule/

4 "California Grid Emergency Comes Days After Reliability Warning" by Jason Fordney May 8, 2017 ***RTO Insider*** https://www.rtoinsider.com/caiso-grid-emergency-natural-gas-demand-42802/

5. "Diablo Canyon — a lifesaver for California" by Gene Nelson, Oct 6, 2017, ***The Santa Maria Times.*** http://santamariatimes.com/opinion/columnists/gene-nelson-diablo-canyon-a-lifesaver-for-california/article_bb8f71c6-062a-5fcb-bc26-20cc06ba21e3.html (Text included in Appendix.)

6 Electric Program Investment Charge (EPIC) Project 1.01 – Energy Storage End Uses, Mike Della Penna, Manho Yeung, and David Fribush, September 13, 2016, **PG&E EPIC Final Report.** https://www.pge.com/pge_global/common/pdfs/about-pge/environment/what-we-are-doing/electric-program-investment-charge/PGE-EPIC-Project-1.01.pdf [Day Ahead (DA) and Helms Pumped Storage - Page 25 of 71. Other Cal-ISO markets described as well.]

the event that DCPP is abandoned in 2025 - a function currently provided by DCPP (with no mention of any reliability revenue now connected with the plant. [7]). As the percentage of destabilizing wind and solar generation increases, this voltage support becomes more critical. The above increasing stresses on the supply of dispatchable electric power in California provide strong arguments for FERC mandating payments to qualified generation facilities that contribute to grid reliability and resiliency. As a consequence of the essentially complete phase-out of California coal-fired generation**, the state's remaining qualified large California generator is DCPP.**

B. Premature retirement of DCPP will significantly increase ratepayer burdens.

An in-depth economic analysis by the University of California Berkeley Energy Institute at Haas documented ratepayer increases associated with the fossil-fired generation required to make up for the loss of California electricity generation after SONGS was shut down in January, 2012. [8]

[7] **California Independent System Operator 2016-2017 Transmission Plan,** March 8, 2017 Revised Draft. The PG&E Bulk system starts on page 69 of 278. www.caiso.com/Documents/RevisedDraft_2016-2017TransmissionPlan.pdf Page 76: "The studies identified high voltages in the 500 kV system in Central California starting from 2026 when Diablo Canyon Nuclear Power Plant retires. The ISO is considering installing additional reactive devices - preferably dynamic - so that they could both absorb reactive power under normal system conditions and supply reactive power with contingencies as needed. The ISO is working with PG&E on the reactive modeling and will be conducting a detailed assessment to determine reactive needs on the bulk system in the 2017-2018 Transmission Planning Process.

High voltages were identified on the sub-transmission system under off-peak conditions as well. These were due to large amount of renewable generation connecting to this system. If the new renewable generation projects have the ability to absorb reactive power, the voltages in the subtransmission system will be more manageable."

Cal-ISO also reveals that more natural gas fired generation will be required if DCPP is retired on page 210.

[8] "Market Impacts of a Nuclear Power Plant Closure" - Revised May 2015 by Lucas Davis and Catherine Hausman. **Energy Institute at Haas WP248R**. ttps://ei.haas.berkeley.edu/research/papers/WP248.pdf From the conclusion "We found that the SONGS closure increased the private cost of electricity generation in California by about $350 million during the first twelve months. For comparison, the annual fixed costs of keeping the plant open were around $340 million, corroborating anecdotal reports about nuclear power plant profitability. Of the $350 million, $40 million reflects costs not predicted by the preperiod supply curve. This reflects transmission constraints and other physical limitations of the grid that necessitated that a high fraction of lost generation be met by plants located in the Southern part of the state. These constraints also increased the scope for market power, and we found evidence consistent with one company acting non-competitively." For additional details, please see page 37 of 67.

In 2016, CGNP prepared a ratepayer cost analysis comparing SDG&E and PG&E rates between 2008-2016 using as a proxy measure the 130% of baseline tier. The SDG&E % Increase over 2012 rate was 59.21%, reflecting the loss of SONGS in January, 2012. On the other hand, PG&E % decrease over 2012 rate: -18.39%, reflecting the benefit of DCPP operation during the cost analysis period. Please refer to the details shown in the Appendix.

C. Premature retirement of DCPP would be extremely wasteful.

DCPP was conservatively designed by PG&E engineers to last for about a century, comparable to the expected lifetime of a large hydroelectric dam. .PG&E has been an excellent steward of DCPP, with industry-leading programs to update the analog measurement and control systems as an example. Considerable detail regarding these topics is provided in CGNP's written testimony in A.16-08-006. CGNP's written testimony to the CPUC is found via the following website links.

http://www.cgnp.org/CGNP_Direct_Testimony_01-27-17.pdf http://tinyurl.com/CGNP-Direct

http://www.cgnp.org/CGNP_Direct_Testimony_Workpapers_01-28-17.pdf

http://www.cgnp.org/CGNP_Rebuttal_Testimony_03-17-17.pdf

http://tinyurl.com/CGNP-Rebuttal

http://www.cgnp.org/CGNP_Rebuttal_Testimony_Workpapers_03-17-17.zip

http://www.cgnp.org/CGNP-OpeningBrief-A1608006_05-26-17.pdf

http://tinyurl.com/CGNP-Opening-Brief

http://www.cgnp.org/CGNP-Reply-Brief-A1608006.pdf

http://tinyurl.com/CGNP-Reply-Brief

Based on review of PG&E's 2015 FERC Form 1 filing, over 70% of DCPP's approximately $8 billion basis is composed of components with useful lifetimes of 60 years or more. See the one-page spreadsheet

in the Appendix. PG&E began accelerated depreciation of DCPP in the late 1990s. The Application A.16-08-006 proposes to further accelerate depreciation so that the "book value" of DCPP is zero by 2025. However, the accounting construct of accelerated depreciation operates independently of the DCPP engineering analysis showing many decades of useful life remain for the plant. Thus, it would be very wasteful to shut down DCPP, a perfectly good nuclear power plant in 2025.

D. Premature retirement of DCPP would harm the San Luis Obispo, California regional economy.

CGNP's written testimony supports the conclusions of a report commissioned by PG&E in 2013 that the closure of DCPP would mean the loss of about a billion dollars a year in direct and indirect payrolls to the region around San Luis Obispo, CA. PG&E is the region's largest private sector employer. Thus, as a consequence of the relative geographical isolation of the area, the result would be economic devastation. See also this recent AP news story. [9]

E. Abandonment of DCPP would harm the environment as thermal generation (with its attendant emission increases - both in-state and out-of-state) would largely replace the typical 18,000 gigawatt-hour annual DCPP generation.

CGNP provided extensive discussion of the harms associated with the fossil-fired generation that would be substituted in its above written filings in A.16-08-006.. In the event that DCPP is abandoned in 2025, replacement generation from PacifiCorp's huge Jim Bridger coal-fired plant in Wyoming would likely be

[9] "Ripples from US nuclear plant closings overwhelm small towns," by John Seewer, March. 26, 2017, ***The Associated Press Big Story***. https://apnews.com/612d238dffbe47c0a6da47d2b6541439/ripples-us-nuclear-plant-closings-overwhelm-small-towns

required as a partial replacement for DCPP's nominal annual production of 18,000 GWh. (They would also face the economic costs of Capital Cost Recovery for the required transmission facilities to move Jim Bridger's power from Wyoming to California's bulk transmission system.) While Jim Bridger has a lower annual electricity than DCPP, it is immensely dirtier in comparison with DCPP's zero emissions..

Year	Generation, KWh	CO2	SO2	NOx
2013	14,806,574,391	14,697,976	10,338	13,913
2014	14,009,450,022	14,005,149	10,724	12,609
2015	13,428,513,831	13,579,826	9,309	12,425

Emission Units are Millions of Metric Tons (MMTs.)
2013 Source URL: https://www.eia.gov/electricity/data/emissions/emissions2013.xlsx
2014 Source URL: https://www.eia.gov/electricity/data/emissions/emissions2014.xlsx
2015 Source URL: https://www.eia.gov/electricity/data/emissions/emissions2015.xlsx

F. Utility-scale energy storage is an impractical and expensive means to integrate solar generation and wind generation into the California power grid.

The extremely high cost of utility-scale energy storage relative to the modest energy outputs were discussed in CGNP's A.16-08-006 Using data from the U.S. EIA, several charts and graphs utilizing power production data for DCPP, Helms Pumped Storage and Castaic Pumped Storage are provided in the Appendix. The plots of monthly power output from Helms and Castaic document the modest amounts of power produced from 2003-2016. (Please note the units are shown in megawatt-hours.) A longer-running series from 1984-2017 also shows the modest annual power production from these two pumped storage systems, with units in terawatt-hours, where 1 terawatt-hour = 1,000 megawatt-hours. The reliable output from DCPP is shown as the green curve. The power output plots from Helms and Castaic are very tiny in comparison. The small downward changes in the green curve correspond to years in which refueling outages occurred. Once every five or so years, both of the DCPP reactors have refueling outages. Thus, it can be readily seen that pumped hydroelectric storage systems have much smaller annual outputs than DCPP.

However, DCPP is ideally suited to "charge up" these pumped storage facilities, as originally intended. The reason is that a nuclear power plant's output is much more predictable than the quasi-random output from solar and wind generators. In order for a utility to receive a financial reward for operating a pumped-storage facility, an accurate forecast of the energy inputs and outputs is required for the "day ahead" DA market administered by Cal-ISO. The forecasts for wind and solar are apparently not accurate enough. For additional details, please see the relevant Energy Institute at Haas blog post - AND the user notes that were posted. [10]

The graph clearly shows how much more powerful PG&E's Diablo Canyon Power Plant (DCPP) is relative to the two largest **energy storage systems** in California, namely PG&E's gigantic1,212 MW Helms Pumped Storage facility, located about 50 miles east of Fresno in the Sierra foothills and Castaic Pumped Storage, located northeast of Los Angeles Civic Center. (Please also remember that energy storage systems must be charged up prior to use, just like the battery in your fossil-fired or electric vehicle. Helms is only 75% efficient, meaning that 400 energy units are required to "charge up" the facility, which only yields 300 energy units. The remaining 100 energy units become waste heat. - Note also that modern nuclear power plants store between 18-20 months of energy in their reactor cores. After a nuclear power reactor has been refueled, **it just runs and runs and runs 24/7, 365 days a year.**)

The trend of more energy being delivered each year from a nuclear power plant as the nuclear power industry has become more efficient is also seen. DCPP provides 9% of California's power, enough to meet the living and working needs for electricity for 3 million Californians. DCPP's power is safe, abundant, reliable, cost-effective and emission-free. CGNP is advocating for the continued safe operation of DCPP, well beyond PG&E's proposed 2025 abandonment date.

Opponents of nuclear power **claim** that energy storage systems such as Helms a means to integrate

[10] ""Is the Duck Sinking? Posted April 24, 2017 by Catherine Wolfram, **Energy Institute at Haas Blog**. https://energyathaas.wordpress.com/2017/04/24/is-the-duck-sinking/comment-page-2/

inherently intermittent solar and wind power into the California grid while not destabilizing the grid. Comparison of the green annual production plot for Diablo Canyon Power Plant with the red and blue plots for Helms and Castaic clearly shows that California's energy storage systems are inadequate - and the **battery-based demonstration projects in use in California are between 1/1000 to 1/10,000 the capacity of Helms Pumped Storage!**

In conclusion, CGNP has provided ample justification for the proposed reliability and resiliency payments for nuclear power plants such as DCPP. These payments likely will "shift the balance" so that PG&E will choose to continue to operate DCPP beyond 2025.

_____/S/_____

November 24, 2017

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Appendices

SANTA MARIA TIMES

Guest Commentary

Gene Nelson: Diablo Canyon — a lifesaver for California

Oct 6, 2017 6:00 PM PDT This Guest Commentary appeared on page A5 of the Saturday, October 7, 2017 print edition of the ***Santa Maria Times.***

http://santamariatimes.com/opinion/columnists/gene-nelson-diablo-canyon-a-lifesaver-for-california/article_bb8f71c6-062a-5fcb-bc26-20cc06ba21e3.html

http://tinyurl.com/CGNP-4-DCPP

Diablo Canyon Power Plant saves lives. Its safe, prodigious, emission-free power protects the very young and the very old from toxic gas and coal-fired power plants. It saves 50 to 500 lives a year, depending on the fossil fuel displaced.

However, there is another way Diablo could save lives in the future. Since the plant stores the energy it needs to operate for 18-20 months inside the reactor core, its 24/7 always-on power can be counted on after a large-scale disaster such as a big earthquake on the southern part of the San Andreas fault.

Large-diameter southern California natural gas pipelines will be inoperable during their substantial repair and inspection interval. Structures and pipelines in the Los Angeles basin, home to over 13 million, will suffer further damage because they sit on alluvial deposits of broken-up rocks and sand instead of the bedrock that sturdy Diablo is solidly built on.

Because California solar and wind generation are each on for only about a fifth of the time, they can't be counted on for the 24/7 loads such as pumping water into the L.A. basin, operating sewage treatment plants, hospitals, traffic lights, and for myriad other uses supporting post-disaster recovery.

What about rooftop solar panels supplying post-disaster power? They won't work because those installations are designed to shut off during blackouts to protect the workers who are restoring power.

Californians for Green Nuclear Power, Inc. (CGNP) an intervenor opposing PG&E's controversial pending application before the California Public Utilities Commission to abandon Diablo in 2025, learned there are only pitiful amounts of utility-scale energy storage, further hampering disaster recovery.

As the heart-rending photos and videos from Puerto Rico and the U.S. Virgin Islands show, their fragile solar and wind generation systems were destroyed by hurricanes. The Reuters headline, "**Hurricane Maria power outage puts old, vulnerable at risk in Puerto Rico,"** is a good summary of the unfolding humanitarian disaster.

Tornadoes also damage solar power plants, such as California's Desert Sunlight Solar Farm, which lost nearly 170,000 solar panels in late April 2015 from a weak twister. That plant was not completely repaired for eight months.

Hurricane Harvey tested nuclear power plants such as the South Texas Project near Houston. The plant ran at 100-percent output before, during and after Harvey produced torrential downpours over the region.

On the other hand, fossil-fired generation was curtailed. Having the plant's power for Hurricane Harvey disaster response doubtless saved many lives. The Onagawa nuclear plant, closer to the 2011 Japanese earthquake epicenter than Fukushima, suffered negligible damage. In fact, it was shelter for hundreds of local residents displaced by the tsunami. Diablo is similarly rugged and well-sited.

The wasteful, premature retirement of Diablo would allow PG&E to impose on ratepayers substantial construction costs of new, unneeded generation and transmission assets. Diablo should continue to operate for its design lifetime of a century. If California had a zero-carbon credit program like Illinois and New York state, the economics would benefit Diablo further.

The CPUC should deny PG&E's pending application, as it fails the primary test of any CPUC decision, which must be for the public good. The continued operation of Diablo protects ratepayers and the environment.

Diablo provides reliable power-source diversity, which as recent events have illustrated is critical to save lives and speed recovery after large-scale natural disasters.

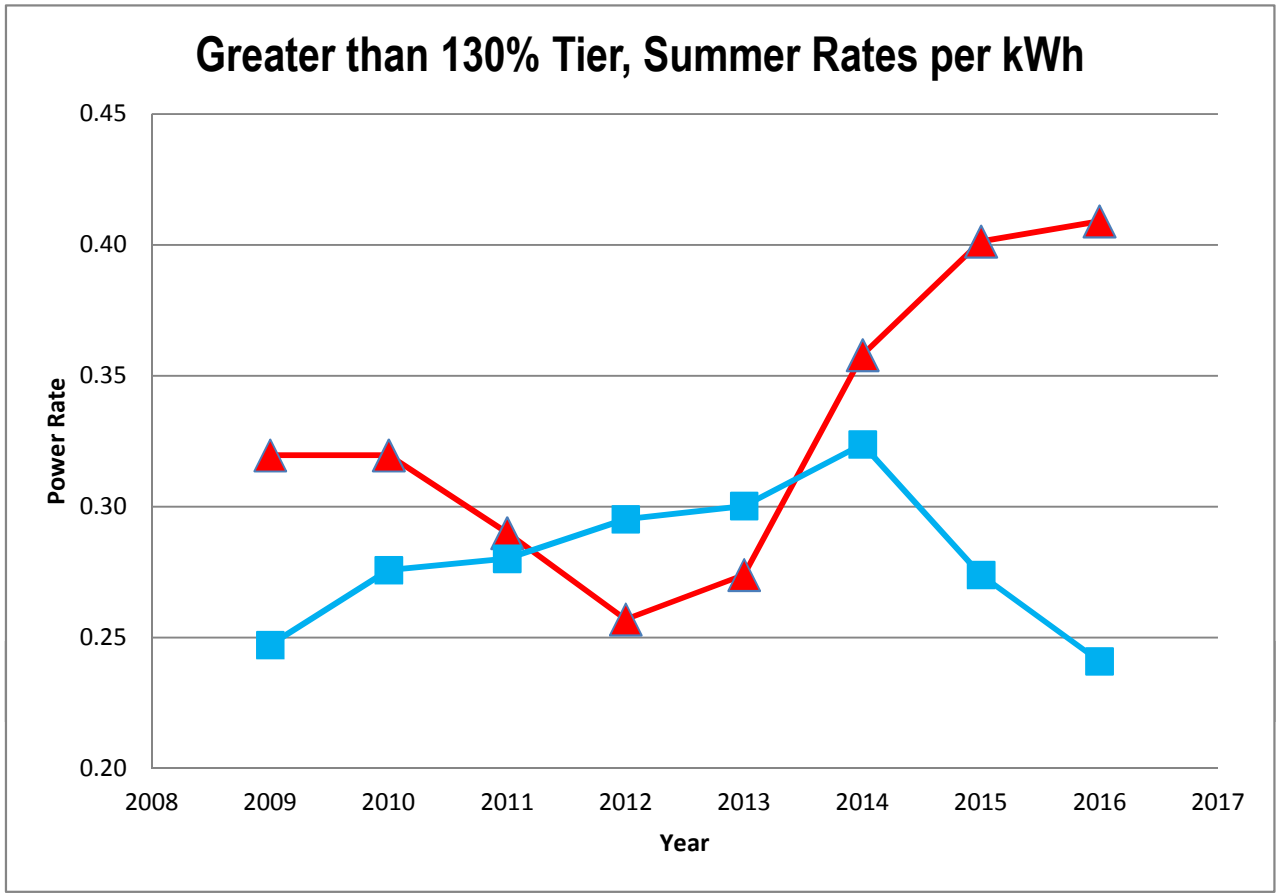
Gene Nelson serves in a volunteer capacity as the CGNP government liaison. CGNP's website is http://CGNP.org. Nelson recently taught engineering courses at Cal Poly and physical science courses at Cuesta College.

SDG&E and PG&E Domestic Power Rates 130 Pct of Baseline by Year 2009-2016.xls 11/24/2017

Year	Greater than 130 % Tier, Summer Rates per kWh	
	SDG&E	PG&E
2009	$0.32	$0.2471
2010	$0.32	$0.2757
2011	$0.29	$0.2801
2012	$0.26	$0.2952
2013	$0.27	$0.3003
2014	$0.36	$0.3238
2015	$0.40	$0.2739
2016	$0.41	$0.2409

SDG&E: Red

PG&E: Teal



2012-2016 increase:	-$0.05428	**PG&E % Decrease over 2012 rate:**	**-18.39%**
2012-2016 increase:	$0.15210	**SDG&E % Increase over 2012 rate:**	**59.21%**

Name of Respondent PACIFIC GAS AND ELECTRIC COMPANY		New	% of plant base column added by Gene Nelson, Ph.D.	Date of Report (Mo, Da, Yr) 02/24/2016	Year/Period End of of Report: 2015/Q4		Undeprec-iated Value (SL) in 2015	Undeprec-iated Value (SL) in 2025
APPENDIX 1 - DEPRECIATION AND AMORTIZATION OF ELECTRIC PLANT (Continued)								
C. Factors Used in Estimating Depreciation Charges							New	New
Line No.	Account No. (a)	Depreciable Plant Base **(Dollars)**	Percent of Plant Base	Estimated Avg. Service Life	Net Salvage (Percent)	Applied Depr. rates (Percent)	Mortality Curve Type	Average Remaining Life
12	Intangible Plant							
13	302	113,750,070		40.00		2.17	SQ	25.00
14	303	2,482,275		3.00			SQ	--14.00
15	Subtotal	116,232,345						
16								
17	Steam Prod - Fossil						0	
18	311	112,125,238		75.00		3.63	L0	69.00
19	312	273,493,692		50.00		3.70	R1	44.00
20	313							
21	314	248,783,088		40.00		3.58	R2.5	34.00
22	315	50,697,111		30.00		3.51	R4	24.00
23	316	28,295,579		40.00		3.76	L0.5	34.00
24	Subtotal	713,394,708						
25								
26	**Hydraulic Production**							
27	331	428,450,107	11.98%	**100.00**	--1.00	0.97	S2.5	76.00
28	332	1,943,104,867	54.34%	**100.00**	--2.00	1.28	S2.5	71.00
29	333	789,278,656	22.07%	**51.00**	--6.00	2.19	R1.5	35.00
30	334	253,646,444	7.09%	**50.00**	--9.00	3.21	R1.5	33.00
31	335	87,261,944	2.44%	40.00	--14.00	3.93	R2	26.00
32	336	73,960,001	2.07%	**65.00**	--3.00	2.52	R1.5	44.00
33	Subtotal	**3,575,702,019**						
34								
35	**Nuclear Prod-Diablo**							
36	321	1,036,743,265	13.83%	**100.00**	--1.00	0.93	R1	73.00
37	322	3,432,483,225	45.79%	**60.00**	--1.00	2.50	R1	39.00
38	323	1,162,811,055	15.51%	40.00	--1.00	1.41	R3	14.00
39	324	808,988,441	10.79%	**75.00**	--1.00	1.14	R1.5	50.00
40	325	1,055,904,489	14.08%	40.00	--2.00	4.47	R4	26.00
41	Subtotal	**7,496,930,475**						
42								
43	Other Production							
44	341	210,375,654		55.00		3.72	R5, R1	50.00
45	342	11,264,118		50.00		3.73	R5,R1	45.00
46	343	223,711,698		40.00		3.59	R5,R2.5	34.00
47	344	353,570,942		27.00		4.27	R5, R2.5,	23.00
48	345	210,675,563		35.00		3.76	R5,R2.5	30.00
49	346	95,867,567		26.00		4.13	R5,S0.5,	20.00
50	Subtotal	1,105,465,542						

		4,620,584,094	**3,546,261,341**
		756,822,583	653,148,257
		2,231,114,096	1,659,033,559
		406,983,869	116,281,106
		539,325,627	431,460,502
		686,337,918	686,337,918

Converted and 3 new columns added by Gene Nelson, Ph.D. 10 30 16. Source: PG&E FERC Form 1 - 2015
https://pgeregulation.blob.core.windows.net/pge-com-regulation-docs/FERCForm1.pdf

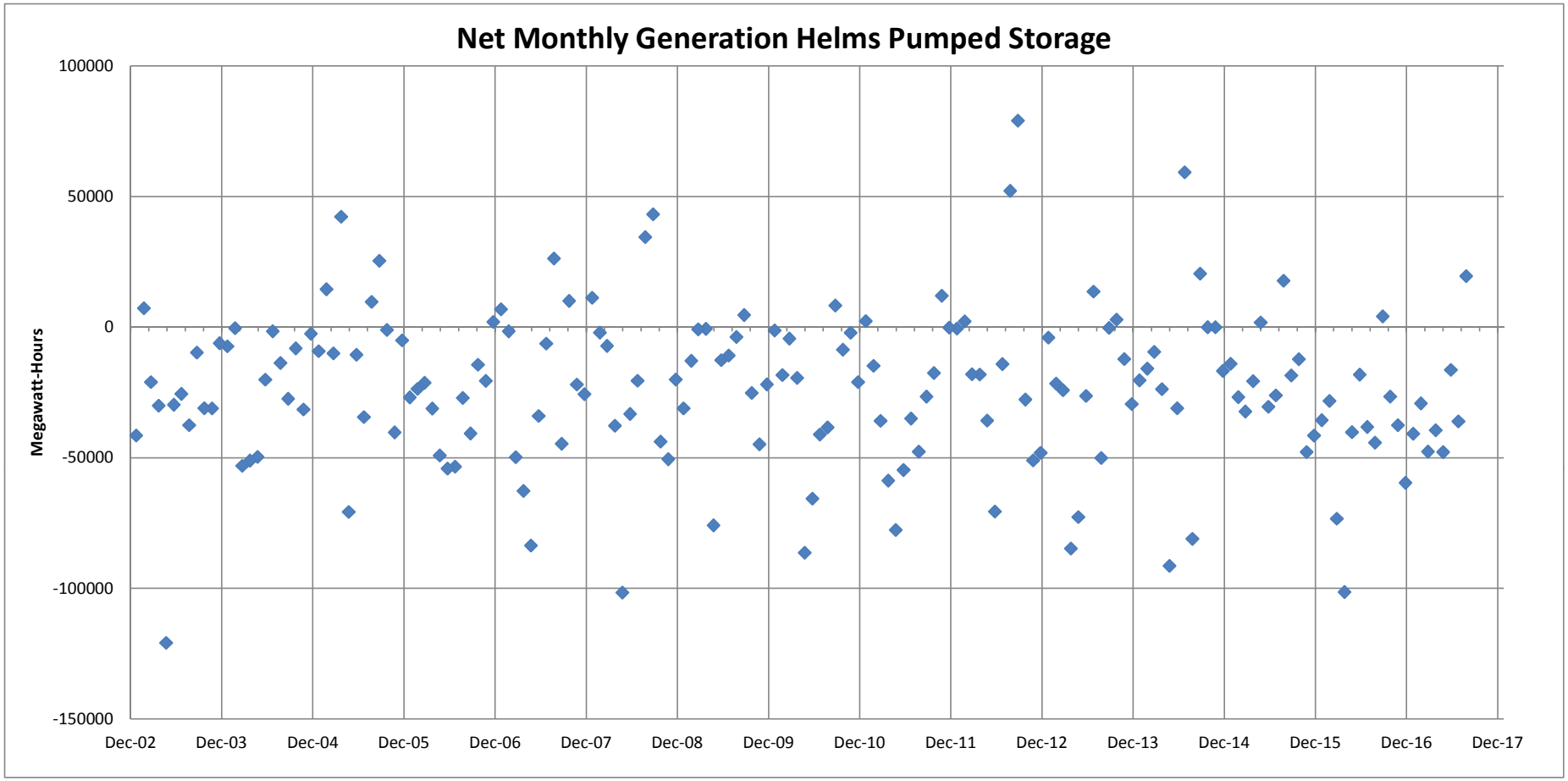
FERC FORM NO. 1 (REV. 12-03) Page 337 Confirmed in "**Uniform System of Accounts for Electric Utilities**"

http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=054f2bfd518f9926aac4b73489f11c67&rgn=div5&view=text&node=18:1.0.1.3.34&idno=18

Account Definitions from http://elibrary.ferc.gov/IDMWS/common/OpenNat.asp?fileID=13021745 Public Service of New Mexico - FERC 1 - 07 03 12

Nuclear Production Plant - Palo Verde	
321	Structures and Improvements
322	Reactor Plant Equipment
323	Turbogenerator Equipment
324	Accessory Electric Equipment
325	Miscellaneous Power Plant Equipment

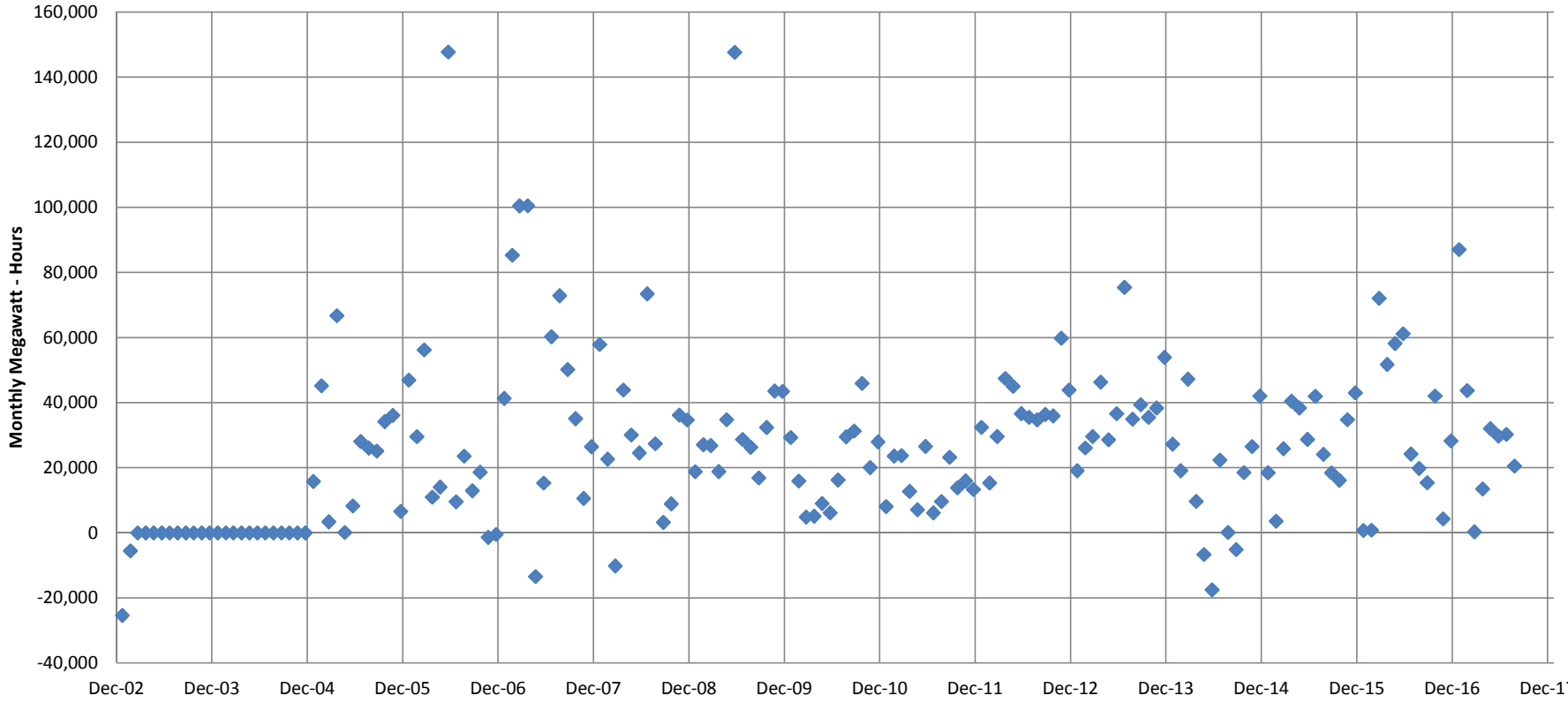
Per PGE's Response to CGNP_001-Q01 dated 10 November 2016, the currency values above are denominated in U.S. dollars, not Thousands of dollars as shown in the 2015 PG&E FERC Form 1



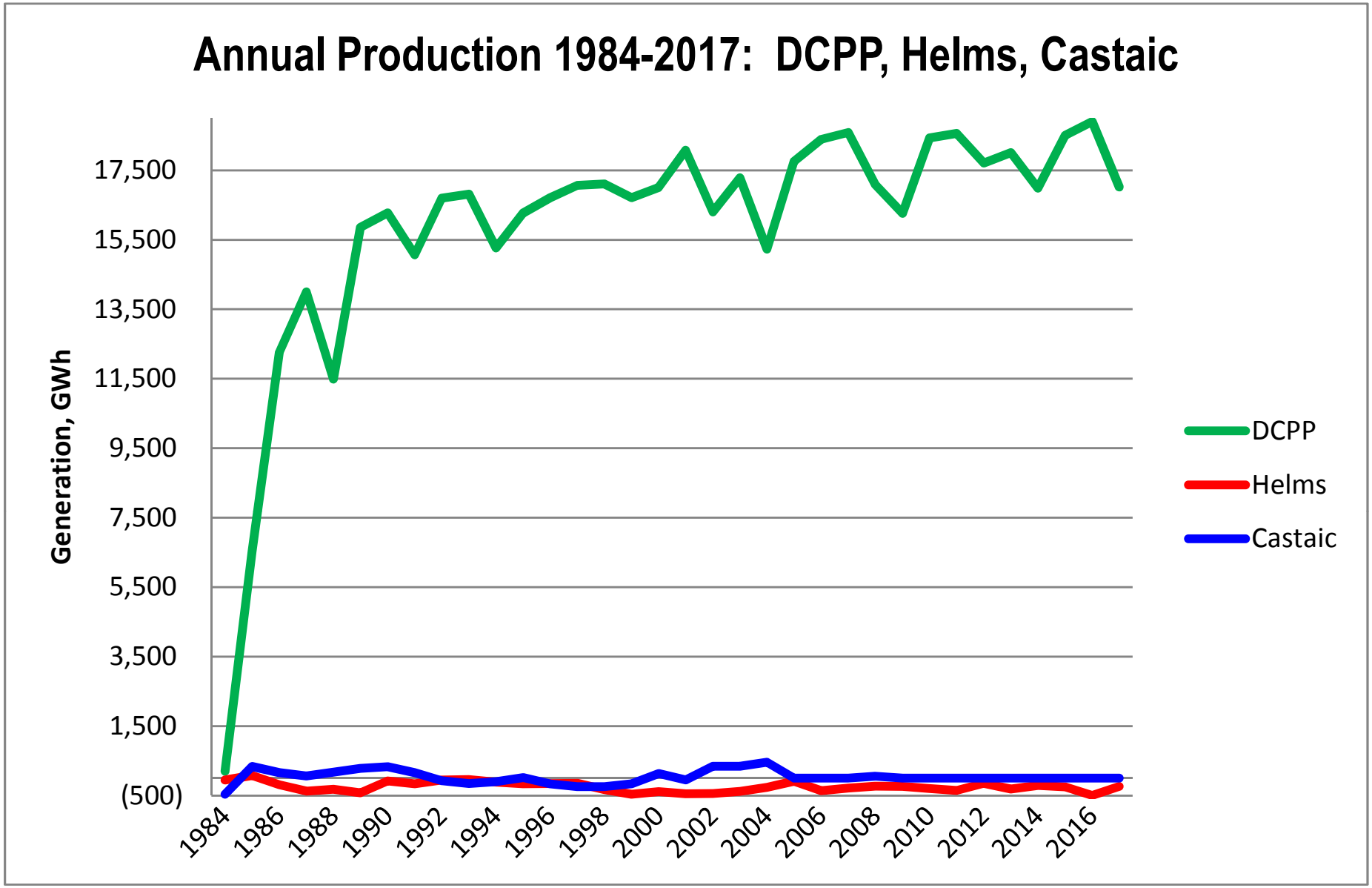
May, 2003 was the month with the highest net generation, -120,846 MW. If the 1,212 MW Helms Pumped Storage were ran 24 hours/day for 30 days, the net generation would be -872,640 MW. The May, 2003 production is 13.85% of this value.
Data URL: https://www.eia.gov/opendata/qb.php?category=3211&sdid=ELEC.PLANT.GEN.6100-WAT-PS.M

Net Monthly Generation - Castaic Pumped Storage

Note Opposite Sign Convention since the water source is the California Water Project



Castaic's Nominal Capacity is 1,247 MW. Thus, if Castaic Power Plant were capable of running at full power, 24 hours a day for a 30-day month, it could produce 897,840 MWh.
Peak production of 147,760 MWh occurred in June, 2006. This would correspond to a monthly capacity factor of 16.46%
Data URL: https://www.eia.gov/opendata/qb.php?category=1279&sdid=ELEC.PLANT.GEN.392-WAT-PS.M


Annual Production 1984-2017: DCPP, Helms, Castaic
Generation, GWh
17,500
15,500
13,500
11,500
9,500
7,500
5,500
3,500
1,500
(500)
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
DCPP
Helms
Castaic

	Total Annual Production, GWh			Total Annual Consumption, GWh	
Year	**DCPP**	**Helms**	**Castaic**	**Helms**	**Castaic**
1984	204	(51)	(458)	NR	NR
1985	6,526	80	340	NR	NR
1986	12,260	(191)	161	NR	NR
1987	14,000	(374)	64	NR	NR
1988	11,491	(315)	173	NR	NR
1989	15,861	(423)	282	NR	NR
1990	16,274	(76)	333	383	804
1991	15,065	(162)	160	613	701
1992	16,698	(54)	(69)	398	815
1993	16,816	(38)	(155)	446	1,003
1994	15,265	(112)	(97)	463	783
1995	16,269	(163)	17	937	400
1996	16,710	(154)	(170)	801	1,179
1997	17,071	(150)	(242)	641	1,570
1998	17,105	(332)	(242)	1,287	1,245
1999	16,716	(459)	(163)	1,271	1,154
2000	17,009	(387)	130	1,446	868
2001	18,078	(451)	(49)	1,453	1,381
2002	16,304	(444)	342	1,199	949
2003	17,285	(377)	346	1,120	NR
2004	15,230	(266)	458	901	NR
2005	17,755	(89)	NR	790	NR
2006	18,391	(360)	NR	1,171	NR
2007	18,588	(287)	NR	882	NR
2008	17,091	(227)	58	712	NR
2009	16,265	(235)	NR	628	NR
2010	18,430	(298)	NR	873	NR
2011	18,566	(354)	NR	994	NR
2012	17,712	(150)	NR	(856)	NR
2013	18,012	(309)	NR	905	NR
2014	16,986	(209)	NR	576	NR
2015	18,505	(250)	NR	720	NR
2016	18,908	(499)	NR	1,359	NR
2017	17,019	(237)	NR	927	NR

1984-1999 Data Source: EIA Form 759 Monthly Data

2000-Present Data Source: EIA Form 923 Monthly Data

NR = Helms and Castaic Data Not Reported on EIA Form 759 or Form 923.

Diablo Canyon Power Plant (DCPP) and Helms Pumped Storage Began Service in 1984

2017 DCPP statistics are projected, based on performance to August 31, 2017.

DCPP Generation: 1984 to August, 2017 = 534,731 GWh.

Document Content(s)

CGNP Commission Docket RM18-1-000.PDF.....1-18