

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

Order Instituting Rulemaking to Establish  
Policies, Processes, and Rules to Ensure  
Reliable Electric Service in California in  
the Event of an Extreme Weather Event in  
2021.

**R.20-11-003**  
(Filed November 20, 2020)

**OPENING BRIEF OF CALIFORNIANS FOR GREEN NUCLEAR  
POWER, INC.**

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**I. Introduction**

In this Brief, Party Californians for Green Nuclear Power, Inc. (CGNP) will review the large-scale dispatchable energy sources available to California (nuclear, hydroelectricity, coal, and natural gas) and briefly discuss the advantages and California-specific disadvantages of each. Then CGNP will show why intermittent solar and wind power, even assisted by an envisioned massive buildout of lithium-ion battery storage, cannot possibly offer a practical or cost-effective alternative to the reliable supply of electricity provided by the sources listed above. Finally, CGNP will discuss the challenges inherent in aspirational legislation such as California

A.B. 32 - and challenges summarized in a recently - released policy paper, "Harmonizing States' Energy Utility Regulation Frameworks and Climate Laws," <sup>1</sup>

## II. Dispatchable Nuclear Power

Nuclear power has many advantages relative to other California large-scale dispatchable energy sources. Both dispatchable and emission-free, it complies with numerous California statutes and executive orders focused on eliminating California air pollution. Using 2018 FERC Form 1 data submitted by Pacific Gas and Electric Company (PG&E), CGNP has discovered the company's Diablo Canyon Power Plant (DCPP) generated electricity at a cost that was consistently lower than that of fossil-fired energy from its three large thermal power plants. <sup>2</sup>

With a capacity factor in excess of 90%, DCPP generates electricity more reliably than any other large-scale California source, a topic of direct relevance to this proceeding. DCPP is California's largest generator by far, typically generating about 18 billion kilowatt-hours annually - the equivalent of about five Hoover Dams.

Despite public perceptions to the contrary, U.S. nuclear energy is the safest method of generating grid electricity, claiming one life for every 4,400 claimed by rooftop solar, and one for every 40,000 attributed to gas-fired electricity. Diablo Canyon, operating independently of California's aging and vulnerable natural gas transmission pipeline and storage system, is no exception. Diablo Canyon Power Plant continued to operate when the region was struck by the 2003 San Simeon Earthquake, which killed two in Paso Robles, was unsurprising, given it has been designed to withstand forces far

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<sup>1</sup> <https://policyintegrity.org/publications/detail/harmonizing-states-energy-utility-regulation-frameworks-and-climate-laws>  
January 29, 2021 Webinar with two slide decks:  
<https://policyintegrity.org/news/event/when-old-laws-threaten-new-climate-ambitions-a-new-york-case-study>

<sup>2</sup> DCPP expenses per net kwh:	\$0.0291	Annual generation, kwh:	18,265,519,000
Colusa expenses per net kwh:	\$0.0340	Annual generation, kwh:	2,991,759,812
Gateway expenses per net kwh:	\$0.0386	Annual generation, kwh:	2,939,850,866
Humboldt expenses per net kwh:	\$0.0714	Annual generation, kwh:	384,780,571

in excess of any projected seismic events in the area. As CGNP has previously noted, the U.S. Nuclear Regulatory Commission reaffirmed DCP's seismic safety in 2016.

One of the most highly-regarded "Generation II" plants in the country (with a Generation III five-million gallon supply of gravity-fed cooling water). Diablo Canyon serves as a torchbearer for a new generation of nuclear plants on the horizon. Victor H. Reis, Ph.D., a retired Dept. of Energy official, announced in a 2020 online presentation<sup>3</sup> that NuScale's Small Modular Reactor (SMR) received NRC design approval on September 2, 2020.<sup>4</sup> As Dr. Reis noted,, SMRs are particularly adept at accommodating the hour-to-hour variations typical - of demand in California,-suggesting the possibility of meeting all of our state's future electric power needs with a fleet of emission-free nuclear power plants.

### **III. Dispatchable Hydroelectricity**

As a consequence of its low generation cost and its emission-free characteristic, hydroelectricity plays a significant role in California's clean energy portfolio. However, as a consequence of climate change, the year-to-year trend for California annual hydroelectric generation is declining annual production. Given the lack of sites suitable for new California large-scale hydroelectric dams, new capacity additions are unlikely. Permitting time scales are now measured in decades. However, the risk profile for California hydroelectric generation includes possible dam failure as a consequence of design flaws or earthquake damage. One recent example was the over 180,000 Californians subject to emergency evacuation orders when Oroville Dam suffered damage as a consequence of an "Atmospheric River Event."<sup>5</sup>

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<sup>3</sup> "A Strategy for U.S. Nuclear Power: Mitigating Climate Change" with Dr. Victor Reis, September 24, 2020 <https://www.youtube.com/watch?v=KTm7irP0lxc>

<sup>4</sup> <https://www.energy.gov/ne/articles/nrc-approves-first-us-small-modular-reactor-design>

<sup>5</sup> "No word when evacuation order for 188,000 will be lifted as Oroville threat remains," By Ryan Sabalow and Sam Stanton, February 12, 2017, *The Sacramento Bee*.

#### **IV. Dispatchable Coal**

While California prides itself regarding effectively shutting down in-state coal-fired generation, its strategy has been to make significant use of out-of-state coal-fired generation which outsources the air pollution, harming residents near those coal plants. One example is the 1,900 MW Intermountain Power Plant in Delta, Utah <sup>6</sup> that provides a significant fraction of the power for Los Angeles and several Los Angeles suburbs. Furthermore, the use of imported "Unspecified Sources of Power" increased in California following SCE's shutdown of the 2,254 MW San Onofre Nuclear Generating Station in January, 2012 after a minor steam generator system leak that posed no public health risk<sup>7</sup> As CGNP has previously noted, Berkshire Hathaway Energy subsidiary PacifiCorp (in conjunction with subsidiary NV Energy) is preparing to link its approximately 6,000 MW of coal-fired generation, mostly in Wyoming, and 3,000 MW of natural-gas-fired generation to California's load centers via PacifiCorp's Energy Gateway - and two large NV Energy power corridors spanning the width of Nevada. <sup>8</sup> CGNP previously cited Hansen and Kharecha's paper showing the significant mortality per TWH associated with coal-fired generation. Coal's mortality rate is about ten times the mortality rate of natural gas fired generation. <sup>9</sup>

#### **V. Dispatchable natural gas**

About 60% of California's in-state dispatchable generation is gas-fired, making natural gas the dominant energy source for in-state dispatchable generation. Furthermore,

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<http://www.sacbee.com/news/state/california/water-and-drought/article132332499.html>

<sup>6</sup> [https://en.wikipedia.org/wiki/Intermountain\\_Power\\_Plant](https://en.wikipedia.org/wiki/Intermountain_Power_Plant) and <https://www.ipautah.com/>

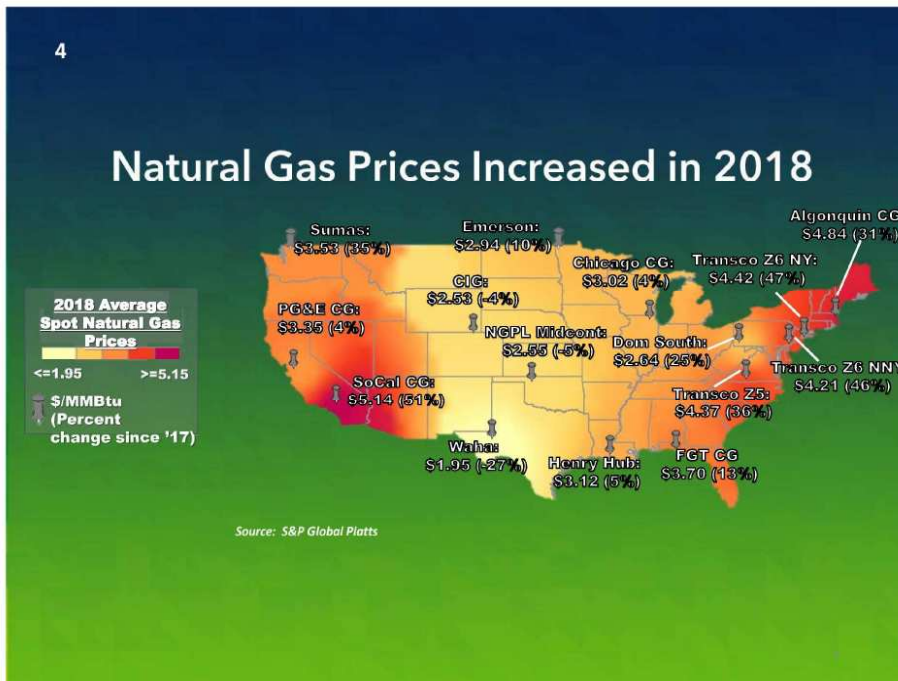
<sup>7</sup> "Is California Meeting Climate Goals By Exporting CO2 Emissions to Its Neighbors?" October 20, 2020 CGNP Press Release. See Appendix 1.

<sup>8</sup> "Who will profit from the grid of the future?" By Sammy Roth, February 2, 2017, *The Desert Sun* See Appendix 2

<sup>9</sup> "Prevented Mortality and Greenhouse Gas Emissions from Historical and Projected Nuclear Power" Pushker A. Kharecha\* and James E. Hansen, *Environmental Science and Technology*, March 15, 2013, <http://pubs.acs.org/doi/pdfplus/10.1021/>

95% of California's natural gas is imported via an aging system of vulnerable transmission pipelines. Because gas is a fuel of low volumetric energy density, it is impractical to store large quantities of natural gas at a power generator, making it a "just in time" energy source. Moreover, the transmission speed of natural gas through a pipeline on California's transmission network is a modest 15 miles per hour<sup>10</sup> While the combustion of natural gas has a lower carbon footprint than coal, estimates of methane leakage, or "fugitive" methane, are as high as 3% of consumption. Since natural gas is primarily methane, a potent greenhouse gas (GHG) with 80 times the heat-trapping properties of carbon dioxide, the result is a higher GHG heat trapping than coal.

CGNP has previously raised seismic vulnerability concerns regarding California's



natural gas transmission lines, particularly where they cross the San Andreas Fault on their way to southern California. There have been significant delays in repairing

<sup>10</sup> <http://www.esdevelop.com/about/faqs/natural-gas-faqs/>

SoCalGas's Line 235-2 since the line exploded near an active earthquake fault on October 1, 2017.<sup>11</sup> FERC observes the ongoing pipeline delivery impairments have imposed significant burdens on California ratepayers.<sup>12</sup>

Natural gas fired generation plays an essential role in integrating nondispatchable solar and nondispatchable wind into the California power grid, but is dispatched inefficiently and intermittently to compensate for the 80% intermittency of both solar and wind in the state.<sup>13</sup> These inefficiencies, and the added emissions for which they are responsible for, call into question the net environmental benefit of solar and wind. In this proceeding, CGNP notes the complete dependence of solar and wind on natural gas – for backup power, supply balancing, and both frequency and voltage regulation. Thus, California natural gas delivery impairments have, and will always have, a direct and deleterious effect on grid stability.

One of the narratives favored by "environmental" non-profit organizations suggests energy efficiency, battery storage, and renewables might one day be capable of replacing natural gas on California's grid. Mark Brownstein, a Senior Vice President of Environmental Defense Fund (EDF), claims: ***"We share the community's concern that we not lose sight of the importance of energy efficiency and renewables, and are working hard to see that these options become preferred alternatives to natural gas over time."***<sup>14</sup> <sup>15</sup> Notwithstanding such emotional appeals, there is no evidence energy

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<sup>11</sup> "After Aliso Canyon, a gas pipeline exploded — costing Californians \$1 billion" by Sammy Roth, July 11, 2019, *The Los Angeles Times*, <https://tinyurl.com/Sempra-Gas-Pipeline-Explosion>

<sup>12</sup> "FERC OE Energy Market Snapshot - National Data Through April, 2019" May, 2019 <https://www.ferc.gov/sites/default/files/2020-05/May2019NationalVersion.pdf>

This Page 4 of 58 map shows SoCalGas citygate 2018 average spot natural gas price of \$5.14/MMBTu ( the highest price shown on the map ) relative to PG&E citygate at \$3.36 / MMBTu

<sup>13</sup> "Diablo Canyon Retirement," by Gene Nelson, Ph.D., January 11, 2018, Nuclear Economics Consulting Group. <https://nuclear-economics.com/wp-content/uploads/2018/01/2018-01-11-DCPP-1.pdf>

<sup>14</sup> "Why EDF Is Working On Natural Gas," By Attorney Mark Brownstein, Published: September 10, 2012 <http://blogs.edf.org/energyexchange/2012/09/10/why-edf-is-working-on-natural-gas/>

efficiency and-intermittent renewables might ever serve as an *alternative*, i.e., become capable of replacing the flexible and reliable contribution made by natural gas to California's grid. Lacking other carbon-free sources, Diablo Canyon - together with new nuclear technologies in advanced development - pave the only viable path forward to reliably and cost-effectively meeting our state's goal of 100% clean electricity.

## **VI. Nondispatchable solar and wind**

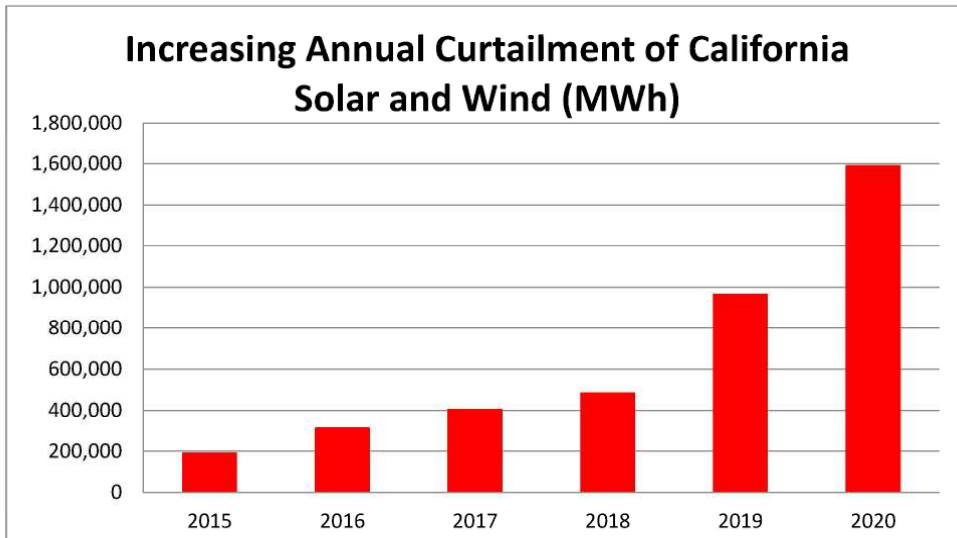
Reliance on solar and wind energy, and even batteries charged by them, put California business and residents at the mercy of weather and time of day – an unacceptable trade for emissions-free energy. Furthermore, when solar and wind farms generate too much electricity their operators must be paid to turn off (curtail) their generation. These "decremental" payments, together with payments to other states to take our excess electricity ("negative pricing"), result in an additional cost to California electricity customers estimated at \$1 billion annually – for which they receive nothing of value in return.

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<sup>15</sup> "How the Sierra Club Took Millions From the Natural Gas Industry — and Why They Stopped [UPDATE]," By Bryan Walsh, February 2, 2012, *Time Magazine*  
<http://science.time.com/2012/02/02/exclusive-how-the-sierra-club-took-millions-from-the-natural-gas-industry-and-why-they-stopped/>

...Gas has a much smaller carbon footprint than coal — according to most scientists — and produces far fewer air pollutants. That was enough for many major green groups to give support to gas as a “bridge fuel” to a cleaner energy future — the next best domestic alternative to coal as an electricity source while alternatives like wind and solar scaled up....TIME has learned that between 2007 and 2010 the Sierra Club accepted over \$25 million in donations from the gas industry, mostly from Aubrey McClendon, CEO of Chesapeake Energy—one of the biggest gas drilling companies in the U.S. and a firm heavily involved in fracking — to help fund the Club’s Beyond Coal campaign....





Such large and increasing annual curtailments are wasteful and represent an unfair burden to California ratepayers.<sup>16</sup>

Solar and wind power advocates have proposed using energy storage to compensate for their inherent intermittency. Using the example of the 1,212 MW Helms Pumped Storage facility, CGNP notes that pumped hydroelectric storage is mainly used for ancillary service to provide voltage and frequency stability - and is rarely being used for bulk energy storage. Exorbitantly-expensive lithium-ion batteries make no economic sense for bulk energy storage.<sup>17</sup>

<sup>16</sup> <http://www.caiso.com/Style%20Library/caiso/csv/curtailmentsMonthly.csv> ( For each year, monthly curtailment values in MWh are summed to determine the annual curtailment total. )

<sup>17</sup> Per <https://business.directenergy.com/understanding-energy/energy-tools/conversion-calculator>  
 1 Bcf = 292.997363 GWH therefore, 6he 86 BCF ACSF stores the equivalent of 25,197.77 GWH ( 25.198 TWH )  
 The 32 MWH ( 8 MW for 4 hours ) Tehachapi Battery Demonstration Project cost \$50 million in 2014. Thus, the cost was \$1.5625 million per MWH ( 1,000 MWH = 1 GWH )

A recent article <sup>18</sup> documents the large and growing environmental burden associated with solar cells, rechargeable batteries, and wind turbine blades. It describes how planned recycling programs seldom materialize, and why we can expect the toxic materials within them to remain environmental hazards essentially forever.

"Aspirational" legislation such as California A.B. 32, which lacks significant sanctions for noncompliance, presents challenges to reducing California air pollution. This 2010 paper describes how non-profit organizations have been forced to turn to lawsuits as a means to advance the cause of clean air envisioned by such legislation. <sup>19</sup>

Another challenge to air pollution reduction is the tension between legislation guaranteeing access to reliable supplies of natural gas to homes and businesses and legislation such as California A.B. 32. <sup>20</sup> In its clean air advocacy, CGNP argues that the social justice aspects of laws and policies should be given more than lip-service. Furthermore, before large-scale electrification is undertaken, there should be a strong fact base supporting these policies. The facts must take into account the inherent thermodynamic efficiency of about 30% for power plants. That means that if electricity

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Therefore, **1 GWH of batteries (0.25 GW for 4 hours) costs \$1.5625 billion.**  
To store the energy in **1 Bcf of natural gas in batteries would cost almost \$ 1/2 trillion ( \$457.808 billion.) To store the energy in ACSF in batteries would cost 86 times this or \$39.371 trillion.** (The current federal budget is slightly more than \$4 trillion.)

<sup>18</sup> "The dark side of 'green energy' and its threat to the nation's environment  
What happens to old solar panels, windmills and high tech batteries?"  
By Amy Joi O'Donoghue@Amyjoi16 Jan 30, 2021, 10:00pm MST *Deseret News*  
<https://www.deseret.com/utah/2021/1/30/22249311/why-green-energy-isnt-so-green-and-poses-harm-to-the-environment-hazardous-waste-utah-china-solar>

<sup>19</sup> "Addressing Climate Change at the State and Local Level: Using Land Use Controls to Reduce Automobile Emissions," Rachel Medina and A. Dan Tarlock, *Sustainability* 2010, 2, 1742-1764;  
<https://www.mdpi.com/2071-1050/2/6/1742/htm>

<sup>20</sup> <https://policyintegrity.org/publications/detail/harmonizing-states-energy-utility-regulation-frameworks-and-climate-laws>  
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replaces gas, the efficiency of the end-user replacement with electricity must be over three times that currently obtained with gas. Otherwise, the result is merely moving the combustion point, but using more gas at a gas-fired power plant.

## **VII. Conclusion**

CGNP has made a compelling case for using reliable nuclear power to cost-effectively decarbonize California's power supply, and for allowing Diablo Canyon Power Plant to continue to be a source residents and businesses can trust for carbon-free electricity.

Sincerely,

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