No. 19-70340

IN THE UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

CENTER FOR BIOLOGICAL DIVERSITY, DESERT CITIZENS AGAINST POLLUTION, CALIFORNIA COMMUNITIES AGAINST TOXICS, AND SIERRA CLUB,

Petitioners

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, AND ANDREW WHEELER, ACTING ADMINISTRATOR, UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,

Respondents

Petition for Review from the United States Environmental Protection Agency
Environmental Appeals Board
PSD Appeal No. 18-01

VOTE SOLAR AND CALIFORNIA ENERGY STORAGE ALLIANCE'S *AMICI CURIAE* BRIEF SUPPORTING PETITIONERS AND SUPPORTING REVERSAL

Charles Carter Hall
Earthjustice
1625 Massachusetts Avenue, NW,
Suite 702
Washington, DC 20036
(202) 797-4304
chall@earthjustice.org

Attorney for Vote Solar and
California Energy Storage Alliance

CORPORATE DISCLOSURE STATEMENT

Pursuant to Federal Rule of Appellate Procedure 26.1, counsel for Amici Curiae Vote Solar and California Energy Storage Alliance certifies that Amici, respectively, are not publicly held corporations, that Amici, respectively, do not have parent corporations, and that no publicly held corporation owns 10 percent or more of Amici's respective stock.

Dated July 5, 2019

By: */s/ Charles Carter Hall*
Charles Carter Hall

Attorney for Amici Vote Solar and California Energy Storage Alliance

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FED. R. APP. P. 29(A) STATEMENTS OF CONSENT TO FILE AND AUTHORSHIP

All parties consent to filing this brief pursuant to Fed. R. App. P. 29(a)(2). No party or party's counsel authored or contributed money intended to fund the preparation or submission of this brief. No person, other than Amici Curiae, their members, or their counsel contributed money that was intended to fund the preparation or submission of this brief.

INTRODUCTION AND STATEMENT OF INTEREST OF AMICI CURIAE

This case is about recognizing the full potential of energy storage as the grid transitions to a new paradigm that relies on non-polluting, renewable resources like sunshine and wind to generate most of our electricity. Energy storage is an essential technology for meeting the technical challenges of a clean grid—among other things, it can ensure that electricity is available when the sun does not shine or the wind does not blow without resorting to burning fossil fuels. Fortunately, deployment of utility-scale battery storage is skyrocketing in light of ongoing advances in batteries' technical capabilities and rapid declines in their cost. As the Court considers the legality of the Environmental Protection Agency's ("EPA") rejection of batteries as "best available control technology" ("BACT") in this case, Amici submit this brief to provide context on the well-established and growing role

of storage, and battery technology in particular, in the clean energy transition.[1] Battery storage is a proven, cost-effective technology employed by utilities around the country to meet the needs of a grid in transition. This real-world industry experience belies any suggestion that batteries are not a technically feasible alternative to peaking gas generation.

Both Amici advocate to advance clean energy technologies. Vote Solar is a not-for profit membership organization founded in 2002 that works to make solar affordable and accessible to all Americans. Vote Solar works on behalf of its members at the state level across the United States to support policies and programs to repower the electric grid with clean, renewable energy. That work includes significant focus on the states in this Circuit.

The California Energy Storage Alliance ("CESA") is a 501(c)(6) membership-based advocacy group committed to advancing the role of energy storage in the electric power sector through policy development, education, outreach, and research. CESA members are the leaders of the energy storage industry, including technology manufacturers, project developers, systems

[1] *See* Federal Rule of Evidence 201(b) ("The court may judicially notice a fact that is not subject to reasonable dispute because it: (1) is generally known within the trial court's territorial jurisdiction; or (2) can be accurately and readily determined from sources whose accuracy cannot reasonably be questioned."); *Jamul Action Comm. v. Stevens*, No. 2:13-cv-01920, 2014 WL 3853148, at *7 (E.D. Cal. Aug. 5, 2014) (recognizing that judicial notice may be taken of information presented in an amicus brief).

integrators, electrical contractors, software developers, professional services firms, and other clean tech industry leaders. The mission of CESA is to make energy storage a mainstream resource to advance a more affordable, efficient, reliable, safe, and sustainable electric power system for all Californians.

SUMMARY OF ARGUMENT

Pollution-free renewable resources are rapidly replacing fossil fuel-burning power plants as the mainstay of this country's electric grid. Energy storage, including utility-scale battery storage, is a mainstream, cost-effective technology that plays an essential and growing role in this transition. EPA's conclusion that batteries are not a technically viable alternative to duct burners flies in the face of the experience of utilities throughout the country, which use battery storage (as well as other forms of energy storage) in a variety of technical configurations to meet peak demand and provide load-following energy. Finally, battery and other forms of energy storage can reduce emissions of harmful air pollutants in several ways, making it an important potential control technology for polluting gas-fired power plants.

ARGUMENT

I. BACKGROUND ON ENERGY STORAGE AND THE CLEAN ENERGY TRANSITION

A. The Grid is Moving Towards 100 Percent Clean Energy, and the Pace of Change is Accelerating.

The transition to an electric grid based on 100 percent clean energy forms the backdrop to this case. As noted by the EPA, the purpose of the Palmdale gas power plant is to "be able to respond to changes in demand from the electric grid" due to increasing levels of solar generation in California.[2] Clean, renewable resources like solar and wind are rapidly becoming mainstays of the electric grid in the United States—their share of power generation in this country has doubled since 2008 to 17.6 percent of total generation in 2018, with solar and wind accounting for nearly all of this increase.[3] Thirty-four percent of California's electricity came from renewable resources in 2018, with solar generation accounting for 31 percent of that total.[4] Higher penetrations of renewable energy in many parts of the country are a certainty, and periods of grid operations often

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[2] U.S. EPA Region 9, *Fact Sheet for Palmdale Energy Project, PSD Permit SE 17-01* § 2, at 26 (Aug. 2017) (A.R. 2.2) (footnotes omitted). Specifically, "[t]his type of facility primarily operates to meet the energy market's ramping and peak load requirements in the morning and late afternoon, helping to integrate the ramp up and ramp down of solar generation." *Id.*

[3] U.S. Energy Information Administration, *Today in Energy: U.S. renewable electricity generation has doubled since 2008* (Mar. 19, 2019), https://www.eia.gov/todayinenergy/detail.php?id=38752.

[4] California Energy Commission, *Tracking Progress: Highlights* (June 2019), https://www.energy.ca.gov/sites/default/files/2019-06/renewable_highlights.pdf.

show extremely high levels of renewable penetrations, such as when the sun is shining brightly but electric system loads are lower. In the spring of 2019, the California Independent System Operator ("CAISO") had 49.95 percent of its demand served by solar.[5]

Advances in technology, rapidly declining costs, and state climate policies indicate that the clean energy transition will continue to gain momentum. Between 2009 and 2018, the cost of energy from solar photovoltaic wind facilities dropped 88 percent and 69 percent, respectively.[6] The National Renewable Energy Laboratory ("NREL") predicts this trend will continue: assuming continued advances in technology, NREL forecasts that the cost of new utility-sale solar facilities could drop by as much as 80 percent by 2050, with the cost of wind facilities falling by as much as 64 percent over the same period.[7] Meanwhile, eight

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[5] Julia Pyper, *California Sets Two New Solar Records*, Greentech Media (Mar. 6, 2018), https://www.greentechmedia.com/articles/read/california-sets-two-new-solar-records#gs.n7u1gr.

[6] Lazard, *Lazard's Levelized Cost of Energy Analysis—Version 12.0*, at 7 (Nov. 2018), https://www.lazard.com/media/450784/lazards-levelized-cost-of-energy-version-120-vfinal.pdf.

[7] Megan Mahajan, *Plunging Prices Mean Building New Renewable Energy Is Cheaper Than Running Existing Coal*, Forbes (Dec. 3, 2018), https://www.forbes.com/sites/energyinnovation/2018/12/03/plunging-prices-mean-building-new-renewable-energy-is-cheaper-than-running-existing-coal/#24f7be1231f3 (citing National Renewable Energy Laboratory Annual Technology Baseline Data, https://data.nrel.gov/files/89/2018-ATB-data-interim-geo.xlsm).

states, including California,[8] as well as the District of Columbia and Puerto Rico have passed legislation or taken executive action mandating a transition to 100 percent renewable or net-zero greenhouse gas emissions electricity.[9]

The majority of existing grid infrastructure was built at a time when large coal- or gas-fired power plants supplied most of our electricity, and transitioning to a grid that relies primarily on renewable resources like solar and wind presents technical challenges. Energy storage is an essential piece of this puzzle.

B. Energy Storage is a Proven, Cost-Effective Technology that Plays an Integral Part of the Clean Energy Transition.

Energy storage, as relevant to this case, refers to the process of converting electrical energy into a stored form that can later be converted back into electrical energy when needed.[10] At the most basic level, energy storage is essential to a

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[8] Cal. Pub. Util. Code § 454.53(a).

[9] David Roberts, *New York just passed the most ambitious climate target in the country*, Vox (June 20, 2019), https://www.vox.com/energy-and-environment/2019/6/20/18691058/new-york-green-new-deal-climate-change-cuomo (listing California, Hawaii, Nevada, New Jersey, New Mexico, New York, Washington, the District of Columbia, and Puerto Rico as states and territories that have passed legislation or taken executive action); Office of Governor Janet T. Mills, *Governor Mills Signs Major Renewable Energy and Climate Change Bills Into Law* (June 26, 2019), https://www.maine.gov/governor/mills/news/governor-mills-signs-major-renewable-energy-and-climate-change-bills-law-2019-06-26 (adding Maine to the list of states to pass 100 percent renewable energy legislation).

[10] *See* University of Michigan Center for Sustainable Systems, *U.S. Grid Energy Storage Factsheet* (Aug. 2018), http://css.umich.edu/factsheets/us-grid-energy-storage-factsheet.

clean grid because it can deliver electricity when the sun does not shine or the wind does not blow without resorting to burning fossil fuels. The United States had over 25.2 gigawatts of rated power in grid-connected energy storage as of June 2018, compared to 1,082 gigawatts of total installed generation capacity.[11] While there are several energy storage technologies with uses in various settings, this brief focuses on batteries,[12] which are at issue in this case and have a proven capability to control air pollution at gas-fired power plants like the proposed Palmdale project.

The cost of battery storage has fallen dramatically in recent years, alongside similar drops in the price of solar and wind power. The cost of electricity from lithium-ion batteries, a predominant battery technology, has declined by 76 percent since 2012.[13] According to industry-standard Lazard's Levelized Cost of Storage Analysis, the cost of lithium-ion batteries is projected to fall an average of eight percent per year through 2022.[14] Combined solar generation and battery storage can now serve many of the same grid functions as gas plants at significantly lower

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[11] *Id.*

[12] A battery stores electrical energy in the form of chemical energy, which is then converted back into electricity when needed. *Id.*

[13] HJ Mai, *Electricity costs from battery storage down 76% since 2012: BNEF*, Utility Dive (March 26, 2019), https://www.utilitydive.com/news/electricity-costs-from-battery-storage-down-76-since-2012-bnef/551337/.

[14] Lazard, *Lazard's Levelized Costs of Storage Analysis Version—4.0*, at 14 (Nov. 2018), https://www.lazard.com/media/450774/lazards-levelized-cost-of-storage-version-40-vfinal.pdf.

cost. For example, Los Angeles' municipal utility recently announced a contract with the developer of what will be the world's largest combined solar and battery storage project, which will supply seven percent of the city's electricity demand for twenty-five years at prices that are approximately half the cost of energy from a gas plant.[15]

In addition to storing energy, batteries allow utilities to manage the precise level of power on the grid and maintain system reliability.[16] In the words of the U.S. Energy Information Administration, such versatility allows batteries to "uniquely capture a range of value streams."[17]

Due to technical advances and steeply declining costs, utility-scale batteries have become a mainstream and cost-effective technology for electric utilities around the country. By the end of 2017, there were more than 700 megawatts of grid-connected batteries deployed in the United States.[18] Battery installations for

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[15] Jeff McMahon, *New Solar + Battery Price Crushes Fossil Fuels, Buries Nuclear*, Forbes (July 1, 2019), https://www.forbes.com/sites/jeffmcmahon/2019/07/01/new-solar--battery-price-crushes-fossil-fuels-buries-nuclear/#31b335f45971.

[16] *See* U.S. Energy Information Administration, *Today in Energy: The design and application of utility-scale battery storage varies by region* (Feb. 28, 2018), https://www.eia.gov/todayinenergy/detail.php?id=35132.

[17] U.S. Energy Information Administration, *Today in Energy: Batteries perform many different functions on the power grid* (Jan. 8, 2018), https://www.eia.gov/todayinenergy/detail.php?id=34432.

[18] *Id.*

2018 alone totaled 311 megawatts;[19] industry experts have projected annual battery storage deployment to approximately double in 2019 and triple in 2020, reaching a level of over 4,500 megawatts deployed in 2024.[20]

The Federal Energy Regulatory Commission ("FERC") recognized energy storage's important and growing role in today's grid in February 2018, when it issued the landmark Order No. 841.[21] Recognizing improvements in energy storage's capabilities and ongoing declines in cost,[22] FERC ordered grid operators to change their rules to ensure that energy storage resources could provide all services they are technically capable of providing in wholesale markets.[23] Notably, FERC is a technology and fuel-neutral regulator without an explicit environmental mandate, and four out of five of the Commissioners who signed Order No. 841 were nominated by President Trump.

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[19] Julian Spector, *US Energy Storage Broke Records in 2018, but the Best Is Yet to Come*, Greentech Media (March 5, 2019), https://www.greentechmedia.com/articles/read/us-energy-storage-broke-records-in-2018-but-the-best-is-yet-to-come#gs.m84w75.

[20] Wood Mackenzie Power & Renewables/Energy Storage Association, *U.S. energy storage monitor: Q2 2019 executive summary*, at 10 (June 2019). For the convenience of the Court, this executive summary is included with this amicus brief as Exhibit A.

[21] *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, 162 FERC ¶ 61,127 (Feb. 15, 2018) ("Order No. 841").

[22] *Id.* at P 8.

[23] *Id.* at P 68.

Several states have also recognized energy storage's potential to contribute to their ambitious clean energy targets. The California Public Utilities Commission ("CPUC") has approved a target requiring the state's three largest investor-owned utilities and other energy service providers to procure 1.3 gigawatts of energy storage by 2020.[24] Similarly, New York's executive branch has announced target of 1.5 gigawatts of energy storage by 2025, and 3 gigawatts by 2030.[25]

In short, battery storage is a mature technology that plays important and growing part in ensuring reliable delivery of electricity as the grid relies more and more on renewable energy. As shown below, electric utilities are already deploying batteries in a variety of settings to reduce emissions and meet the technical challenges of a clean grid.

II. UTILITY-SCALE BATTERIES ARE A PROVEN AND EFFECTIVE TECHNOLOGY FOR A VARIETY OF USES.

EPA rejected batteries as BACT for the Palmdale facility's duct burners, and the Environmental Appeals Board ("EAB") affirmed that decision, based on EPA's determination that using battery storage in lieu of duct burners "has not been

[24] CPUC Decision 13-10-040, *Decision Adopting Energy Storage Procurement Framework and Design Program*, Rulemaking 10-12-007, (Oct. 17, 2013), http://docs.cpuc.ca.gov/publisheddocs/published/g000/m079/k533/79533378.docx.
[25] New York State Energy Research and Development Authority, *Energy Storage in New York*, https://www.nyserda.ny.gov/All-Programs/Programs/Energy-Storage/Energy-Storage-in-NYS.

demonstrated to be technically feasible."[26] Respectfully, this is incorrect. Utilities currently rely on batteries to serve the exact same needs as duct burners—meeting peak demand and following load—in a variety of technical configurations.

A. Existing Plants Effectively Pair Battery Storage with Gas Generation.

California utilities are already combining battery storage with existing plants to reduce emissions and increase efficiency. Southern California Edison completed two "Hybrid Gas Turbine" projects in 2017, each of which installed a battery energy storage system and an upgraded emissions control system at an existing gas peaker plant.[27] These plants perform a function similar to the duct burners at issue in this case, providing high-flexibility generation that can rapidly respond to changes in demand from the electric grid.[28] However, gas peakers are more expensive to operate and emit higher amounts of air pollution for every unit of electricity produced compared to other types of gas power plants.[29] In Southern

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[26] *In re: Palmdale Energy LLC*, 17 EAD 620, 48 ELR 41402, at 12 (EPA EAB, Oct. 23, 2018) (hereinafter, *In re: Palmdale Energy LLC*).

[27] Southern California Edison, Hybrid Enhanced Gas Turbine Technology Fact Sheet at 1. For the convenience of the Court, this fact sheet is included with this amicus brief as Exhibit B.

[28] N.W. Miller *et al.*, *Hybridizing Gas Turbine with Battery Energy Storage: Performance and Economics*, CIGRE, at 1-2 (2018). For the convenience of the Court, this whitepaper is included with this amicus brief as Exhibit C.

[29] Elena M. Krieger *et al.*, *A framework for siting and dispatch of emerging energy resources to realize environmental and health benefits: Case study on peaker power plant displacement*, Energy Policy 96, at 310 (2016). For the convenience of the Court, this article is included with this amicus brief as Exhibit D.

California Edison's Hybrid Gas Turbine projects, a 50 megawatt gas peaker plant is combined with a 10 megawatt/4.3 megawatt-hour[30] lithium-ion battery system that enables the facility to operate with greater flexibility and higher capacity value while significantly reducing the number of starts and run hours for the gas turbine.[31] As a result, the hybrid facilities have reduced their emissions of greenhouse gases by 60 percent and their emissions of particulate matter by 78 percent.[32]

In addition to reducing air pollution, pairing a gas peaker with battery storage enables the plant to sell valuable ancillary services to the grid without burning fuel or creating emissions, providing greater revenue for plant operators than gas-only facilities.[33] Thus, the economic calculus for a gas plant owner considering battery installation includes not just the cost of the battery, but new revenue streams as well. In light of the success of the Hybrid Gas Turbine

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[30] A battery's power rating (measured in megawatts here) indicates how much power can flow into or out of the battery in any given instant, while a battery's energy rating (measured in megawatt-hours here) indicates the total amount of energy that can be stored. *See* Joyce McLaren, *Batteries 101 Series: How to Talk About Batteries and Power-To-Energy Ratios*, NREL (Apr. 13, 2016), https://www.nrel.gov/state-local-tribal/blog/posts/batteries-101-series-how-to-talk-about-batteries-and-power-to-energy-ratios.html.

[31] Southern California Edison, Hybrid Enhanced Gas Turbine Technology Fact Sheet at 1 (Exhibit B).

[32] *Id.*

[33] *Id.*

projects, Southern California Edison is considering similar upgrades to five additional gas peaker facilities.[34]

The Southern California Edison Hybrid Gas Turbine projects demonstrate that batteries can be paired with gas generation to meet the same needs as the Palmdale duct burners. Notably, providing a relatively small 10 megawatt/4.3 megawatt-hour battery system to an existing 50 megawatt gas peaker plant enabled dramatic reductions in the facility's emissions. This success demonstrates that a battery storage system representing only a fraction of a gas facility's capacity can deliver significant air quality benefits.

B. California Utilities Have Used Battery Storage to Replace Entire Gas Power Plants.

Beyond improving performance and reducing emissions at existing facilities, battery storage systems can be used to displace pollution-emitting gas power plants or replace them in their entirety. For example, in early 2019, the electric utility on the Hawaiian island of Kauai completed a 20 megawatt/100 megawatt-hour battery system to provide 40 percent of the system's peak power.[35] The batteries are charged with solar energy; because the island previously relied on diesel oil

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[34] *Id.*

[35] Julian Spector, *AES Completes Record-Breaking Solar and Battery Plant on Kauai*, Greentech Media (Jan. 8, 2019), https://www.greentechmedia.com/articles/read/aes-completes-its-record-breaking-solar-and-battery-plant-on-kauai#gs.n5ieb7.

generation to meet peak demand, the battery system will offset the burning of 3.7 million gallons of diesel fuel each year.[36] Similarly, Arizona's largest investor-owned electric utility announced in February 2019 that it will add 850 megawatts of battery storage along with at least 100 megawatts of solar generation by 2025.[37] The new facility will serve as a peaker plant, and the utility chose storage over potential new gas generation based on technical and economic factors. In the words of a utility official, "[i]t was a straight-up selection, comparing the virtues of batteries and gas resources — and we selected batteries."[38]

In California, energy storage has stepped in to replace a planned new gas power plant in a community already overburdened with industrial air pollution. The California Public Utilities Commission approved a long-term contract in 2016 for Southern California Edison to purchase capacity from the Puente Power Project, a new 262-megawatt gas peaker plant in Oxnard, California. While the California Energy Commission conducted an environmental review of the

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[36] *Id.*
[37] Julia Pyper, *APS Plans to Add Nearly 1GW of New Battery Storage and Solar Resources by 2025*, Greentech Media (Feb. 21, 2019), https://www.greentechmedia.com/articles/read/aps-battery-storage-solar-2025#gs.n5tc92.
[38] *Id.*

proposal, CAISO[39] published a study concluding that a combination of energy storage and incremental additions of distributed energy resources[40] could obviate the need for the proposed plant.[41] The developer ultimately withdrew the Puente Power Project in the face of hundreds of written protests as well as oral testimony from community members opposing the pollution-emitting facility.[42] Southern California Edison subsequently conducted a solicitation for cost-effective alternatives to the Puente plant and, in April 2019, it submitted an application for a 100 megawatt/400 megawatt-hour battery storage project to meet the reliability needs identified in the CAISO study.[43]

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[39] The California Independent System Operator oversees the operation of California's bulk electric power system, transmission lines, and electricity market generated and transmitted by its member utilities. *See* www.caiso.com.

[40] Distributed energy resources are resources located across the distribution grid near where energy is consumed, in contrast to centrally-located power plants whose power is delivered to a wide area over transmission lines. *See* Tanuj Deora *et al.*, *Distributed Energy Resources 101: Required Reading for a Modern Grid*, Advanced Energy Economy (Feb. 13, 2017), https://blog.aee.net/distributed-energy-resources-101-required-reading-for-a-modern-grid.

[41] CAISO, *Moorpark Sub-Area Local Capacity Alternative Study*, at 30 (Aug. 16, 2017), https://www.caiso.com/Documents/Aug16_2017_MoorparkSub-AreaLocalCapacityRequirementStudy-PuentePowerProject_15-AFC-01.pdf.

[42] Ivan Penn, *Power plant developer pulls the plug on its natural gas project in Oxnard*, Los Angeles Times (Oct. 16, 2017), https://www.latimes.com/business/la-fi-puente-gas-plant-20171016-story.html.

[43] Testimony of Southern California Edison Company (U-388-E) In Support of Its Application for Approval of the Results of Its 2018 Local Capacity Requirements Request for Proposals (LCR RFP), Application No. 19-04-016, at 1-2 (Apr. 22, 2019), http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/11D80C3CF6F46FEF882583E5000118BE/%24FILE/A1904XXX-

Battery storage can also fill the role of retiring gas power plants. In November 2018, CAISO determined that a 580-megawatt combined cycle gas plant in Moss Landing, California was needed for local reliability, prompting the plant's owner to file at CAISO for a "reliability must-run" designation.[44] Reliability must-run status conveys an administratively set price for the plant's capacity, which is significantly higher than market prices.[45] To avoid burdening ratepayers with this cost, the California Public Utilities Commission directed Pacific Gas & Electric Company ("PG&E") to procure energy storage and clean energy resources to replace the Moss Landing plant as well as two other plants with reliability must-run designation.[46] PG&E ultimately requested approval of four energy storage contracts for a total of 567.5 megawatts of capacity to replace the Moss Landing plant.[47] PG&E calculated that the energy storage contracts would save ratepayers a total of $233 million over 10 years.[48] On October 25,

PUBLIC%20SCE%20Testimony%20in%20Support%20of%20Appl%20for%20App%20of%20Results%20of%202018%20LCR%20RFP%20SCE-01.pdf.

[44] CPUC Energy Division, Resolution E-4909 at 2-3 (Jan. 11, 2018), http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M200/K602/200602742.PDF.

[45] *Id.* at 4.

[46] *Id.* at 4-6.

[47] PG&E, Advice Letter 5322-E at 1 (June 29, 2018), https://www.pge.com/tariffs/assets/pdf/adviceletter/ELEC_5322-E.pdf.

[48] CPUC Energy Division, Resolution E-4949 at 31 (Oct. 25, 2018), http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M229/K550/229550723.PDF.

2018, the California Public Utilities Commission approved the energy storage contracts, finding that storage provided "superior environmental solution over natural gas fired resources to supplying locational capacity."[49]

The EAB relied on EPA's conclusion that using battery storage to meet the "load-following needs of the grid" has "not been demonstrated in practice."[50] The Moss Landing example shows otherwise. Like the Palmdale facility,[51] the Moss Landing facility is a load-following combined cycle gas-fired electrical generation plant, and the two plants are similar in size—Palmdale's 645 megawatts compared to Moss Landing's 580 megawatts. The planned battery even has a four-hour dispatch duration,[52] which EPA noted is the length of the regional peak demand that would be served by the Palmdale facility.[53] In short, Moss Landing demonstrates that batteries can meet the very same load-following needs as a facility of Palmdale's type.

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[49] *Id.* at 32.
[50] *In re: Palmdale Energy LLC*, at 14-15.
[51] *In re: Palmdale Energy LLC*, at 2-3.
[52] CPUC Energy Division, Resolution E-4949 at 27-28 (Oct. 25, 2018), http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M229/K550/229550723.PDF.
[53] *In re: Palmdale Energy LLC*, at 13.

III. ENERGY STORAGE CAN SIGNIFICANTLY REDUCE AIR POLLUTION.

Energy storage can reduce air pollution in several ways. First, the greatest potential for improving air quality lies in charging energy storage with electricity from renewable sources. Given that solar photovoltaic panels generate electricity when the sun is shining, for example, a grid with large amounts of solar generation such as California's will generally have large amounts of virtually free, emissions-free electricity at midday. After sunset, the system must rely on other sources to step in for the inactive solar panels, which are often fossil fuel-fired generators like gas plants. However, if a battery is charged using solar energy and discharged at time when the grid would otherwise rely on fossil fuel generation—as in Kauai, where a solar-charged battery system serves 40 percent of peak demand needs—it effectively replaces a polluting generator with an air emissions-free energy source.[54]

Second, integrating batteries with existing gas generators can dramatically lower emissions. As described above, Southern California Edison's Hybrid Gas Turbine projects employ batteries to reduce the number of starts and run hours for

[54] Julian Spector, *AES Completes Record-Breaking Solar and Battery Plant on Kauai*, Greentech Media (Jan. 8, 2019), https://www.greentechmedia.com/articles/read/aes-completes-its-record-breaking-solar-and-battery-plant-on-kauai#gs.n5ieb7.

the gas turbine, reducing greenhouse gas emissions by 60 percent and emissions of particulate matter by 78 percent.[55]

Third, stand-alone batteries connected to the grid can improve air quality by displacing generation from gas peaker plants. Peakers are generally among the highest-polluting generators in a system, but they are only called upon when demand for electricity is highest. If a battery charges at a time of low demand (when peaker plants are not operating), and then discharges at times of high demand (when peakers might otherwise run), it can obviate the need for the peaker. A 2016 study showed that meeting peak demand with energy storage instead of peaker plants leads to significant reductions in carbon dioxide and nitrogen oxide emissions even if the system is charged using energy from a combined cycle gas power plant.[56] The air quality benefits are even greater if the energy storage system is charged using a mix of renewables and combined cycle gas generation.[57]

Similarly, Strategen Consulting modeled the effects on summer nitrogen oxide emissions from an aging gas peaker plant in New York City if batteries with

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[55] Southern California Edison, Hybrid Enhanced Gas Turbine Technology Fact Sheet at 1 (Exhibit B).
[56] Elena M. Krieger *et al.*, *A framework for siting and dispatch of emerging energy resources to realize environmental and health benefits: Case study on peaker power plant displacement*, Energy Policy 96, at 310 (2016) (Exhibit D).
[57] *Id.*

the same power rating (in megawatts) were added nearby.[58] A battery with a two-hour duration reduced nitrogen oxide emissions from 56 tons to 37 tons (a 34 percent reduction); a battery with a four-hour duration reduced nitrogen oxide emission to 21 tons (a 62 percent reduction); and a battery with an eight-hour duration reduced nitrogen oxide emissions to 5 tons (a 90 percent reduction).[59] Stratagen noted that charging energy storage at night is unlikely to substantially increase nitrogen oxide emissions in this example because the units providing power at that time are likely to be either zero-emission resources such as renewables, or relatively efficient combined cycle gas units with pollution controls.[60]

CONCLUSION

Battery storage is a mainstream, cost-effective technology employed by utilities to meet the very same grid needs as duct burners. Moreover, batteries can reduce emission of harmful air pollution in a variety of applications, making them an important potential control technology for pollutive gas power plants. EPA's

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[58] Strategen Consulting, *New York City's Aging Power Plants: Risks, Replacement Options, and the Role of Energy Storage*, at 26-27 (Sept. 20, 2017), https://static1.squarespace.com/static/571a88e12fe1312111f1f6e6/t/59c3d46ae9bfdf16412f8b7e/1506006147665/Strategen+-+NYC+Power+Plants+and+Energy+Storage+9.20.2017.pdf.

[59] *Id.* at 27-30.

[60] *Id.* at 30.

rejection of batteries as a control technology for duct burners flies in the face of this real-world industry experience.

Respectfully submitted this 5th day of July, 2019.

/s/ Charles Carter Hall
Charles Carter Hall
Earthjustice
1625 Massachusetts Avenue, NW,
Suite 702
Washington, DC 20036
(202) 797-4304
chall@earthjustice.org

Attorney for Vote Solar and
California Energy Storage Alliance

CERTIFICATE OF COMPLIANCE

Pursuant to Federal Rule of Appellate Procedure 32(g) counsel for Amici Curiae certifies that this brief contains 4,361 words, based on the "Word Count" feature of Microsoft Word 2016, compiling with the length requirement of Federal Rule of Appellate Procedure 29(a)(5). Pursuant to Federal Rule of Appellate Procedure 32(f) this word count does not include the words contained in the Corporate Disclosure Statement, Table of Contents, Table of Authorities, and Certificates of Counsel, signature block, or Certificate of Service. Counsel also certifies that this document was prepared in proportionally spaced type using 14-point Times New Roman in Microsoft Word 2016, compiling with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and (6).

Dated: July 5, 2019

By: */s/ Charles Carter Hall*
Charles Carter Hall

Attorney for Amici Vote Solar and California Energy Storage Alliance

CERTIFICATE OF SERVICE

I hereby certify that on July 5, 2019, I electronically filed the foregoing with the Clerk of the Court for the United States Court of Appeals for the Ninth Circuit by using the appellate CM/ECF system.

I certify that all participants in the case who are registered CM/ECF users and that service will be accomplished by the appellate CM/ECF system.

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