Environmental & EJ Parties –
Scattergood DEIR Comments
Exhibit 1

Assessment of LADWP's Draft Environmental Impact Report for Scattergood Generating Station Units 1 and 2 Green Hydrogen-Ready Modernization Project

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1. Introduction

Units 1 and 2 of the Scattergood power plant are due for retirement in 2029 to comply with once-through-cooling State Water Board regulations. LADWP is proposing to replace this capacity with thermoelectric generation using a combined-cycle generation system (CCGS) capable of using a hydrogen/gas blend of up to 30% hydrogen, herein referred to as the Project. According to the draft environmental impact report (DEIR), the Project is intended to accomplish the following goals.

> *(1) Provide resilience to maintain the reliability of the LADWP electrical power system to help meet peaks in demand that exceed available renewable generation resources and energy storage capacity as well as demand during infrequent and relatively short-term, but major, interruptions in the primary carbon-free generation and/or transmission system caused by emergency circumstances.*
> *(2) Establish a generation source that is always available, dispatchable, and local relative to the LADWP service area.*
> *(3) Provide generation capacity to support grid stability and energy demand in the Scattergood service area, which includes Los Angeles International Airport, Hyperion Water Reclamation Plant, and the western districts of the City of Los Angeles.*
> *(4) Reduce the emissions of greenhouse gases from power generation consistent with the LADWP transition to a carbon-free electrical power system.*

For this report, we investigated the project's environmental impacts as described in the DEIR and identified additional impacts that were not disclosed in the DEIR. We also investigated alternatives that would meet the above stated goals of the Project while avoiding its negative impacts.

2. Overview

Emissions from the Project will impact air quality in the Los Angeles area and, consequently, the health of Angelenos. Lost Angeles—South Coast Air Basin is already classified as being in extreme nonattainment for $PM_{2.5}$[1] and Ozone.[2] The proposed project's NOx, SOx, and $PM_{2.5}$ emissions will

[1] U.S Environmental Protection Agency. (2024) PM-2.5 (2012) Designated Area/State Information. https://www3.epa.gov/airquality/greenbook/kbtc.html
[2] U.S Environmental Protection Agency. (2024) 8-Hour Ozone (2015) Nonattainment Area Partial County Descriptions. https://www3.epa.gov/airquality/greenbook/jnca.html#Ozone_8-hr.2015

contribute to the formation of secondary $PM_{2.5}$ and ozone, exacerbating and perpetuating the region's already severe air pollution problem. While the health risk assessment presented in the DEIR concluded that emissions from the Project's operations would not exceed established health thresholds, this conclusion depends on the accuracy of the underlying emissions estimates. We were unable to evaluate these estimates because the DEIR does not include details on the methodology or the emissions factors used. In particular, the NOx emissions factors for hydrogen blends are unverified, and the estimates assume the use of NOx emissions controls for which no details are provided. This omission is significant, as existing literature indicates that hydrogen combustion can elevate NOx emissions relative to methane if proper controls are not implemented.

Furthermore, the health risk assessment lacks a cumulative effects analysis as it does not evaluate emissions from the proposed facility in the context of the region's existing air pollution levels. In our analysis, we assessed the $PM_{2.5}$- and ozone-related health impacts associated with emissions from the Project to illustrate the magnitude of the public health issue. Scattergood lies in the second most populated city in the United States, with roughly 390,000 people living within a 5-mile radius of the facility, exacerbating the issue of health impacts from this Project. For an operational capacity factor of 25% (regardless of the fuel composition and vendor), we estimated that the project's emissions are associated with $PM_{2.5}$ pollution linked to approximately 2.5 statistical deaths annually, valued at roughly $35 million. The DEIR did not disclose this information to the public. We also estimated that ozone pollution associated with the Project's emissions could result in approximately 409 asthma exacerbations, 136 ozone-related school loss days due to illness, and 54 PM-related work loss days, among other health impacts. These numbers will increase accordingly if the Project operates at a higher capacity. Notably, our estimates rely on the emissions data provided by the vendors in the DEIR, which, as previously mentioned, we were unable to verify.

We also find that the decision to omit any discussion or analysis of the hydrogen production, delivery, or storage infrastructure required as part of this project compromised our ability to fully and accurately determine its environmental impacts and how these impacts compare to possible project alternatives. The DEIR indicates that there is insufficient data to support this analysis given that "the green hydrogen system that would supply the proposed project is currently in the planning stages." This suggests that there is not currently enough information to produce a comprehensive environmental analysis of the Project and that the Project may not be able to simultaneously meet its reliability and emissions objectives. Additionally, the climate benefits of the 30% hydrogen by volume blend presented in the DEIR are minimal. This blend would only reduce net CO_2 emissions by around 9%, and the DEIR does not account the emissions from hydrogen transport to Scattergood or the warming potential of leaked hydrogen. In short, the DEIR lacks key information and analyses concerning hydrogen and its infrastructure, which are critical to understanding the environmental impact of the project.

We further find that the assessments of project alternatives found in the DEIR and the report contracted by NREL are incomplete and do not sufficiently investigate the viability of alternatives that have significantly lower impacts. Specifically, in NREL's report, a screening tool needlessly eliminated alternatives that are likely more economic, feasible, and market-ready than both the Project and the fuel cell alternative. This was due, in part, to unnecessarily conservative assumptions regarding the parcel size and existing demonstrations. We show here that alternatives with comparable or greater market readiness to hydrogen combustion turbines and fuel cells are able to meet the Project's goals with fewer negative impacts.. Elimination of these alternatives from economic and reliability modeling means that we still do not possess enough information regarding the feasible leading alternatives. More detailed assessments of these alternatives would allow LADWP and the public to better evaluate the Project and identify pathways to avoid most of the environmental impacts of the proposed CCGS while providing additional environmental and resilience benefits.

Finally, we have found inconsistencies between the DEIR and other reports upon which the DEIR relies. First, the DEIR describes a facility with a capacity factor "significantly less than 25%." However, LADWP's 2022 Strategic Long-Term Resource Plan (SLTRP) quotes a capacity factor of approximately 40% in 2030.[3] This higher capacity factor would result in higher negative air quality, public health, greenhouse gas emissions, and other impacts. The FEIR (Final Environmental Impact Report) must clarify the actual projected operational capacity factor because such information is critical to understanding and quantifying LADWP's reliability objectives stated above and to accurately assess the sufficiency of proposed alternatives. Drastically different energy resources are needed to serve different capacity factors and generation intervals. Moreover, LADWP plans to use 100% hydrogen for all in-basin combustion by 2035,[4] which means that either this Project would need to also be able to burn 100% hydrogen, which is not stated in the DEIR, or an upgrade to the Project would be needed within 5 years of coming online. Regardless, the impacts over the lifespan of this Project are not reported for this 100% hydrogen scenario. LADWP should clarify the Project's intended capacity factor and hourly dispatch assumptions and then disclose all environmental impacts resulting from updated project operations estimates in the FEIR.

3. Demographic and Environmental Equity Considerations

The Project is located in a highly populated area with multiple sensitive receptors within a 5-mile radius. Furthermore, various air pollution sources are located in the Scattergood vicinity, including the airport, refineries, and highways—this area of California has been historically burdened with some of the worst air pollution in all of the state. Impacts from the project, then, would perpetuate environmental burdens on the nearby communities.

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[3] California Air Resources Board. (2022). Figure 4-18 of 2022 Scoping Plan for Achieving Carbon Neutrality. https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp.pdf

[4] Los Angeles Department of Water and Power. (2022). 2022 Power Strategic Long-Term Resources Plan. https://www.ladwp.com/sites/default/files/2023-08/2022%20LADWP%20Power%20Strategic%20Long-Term%20Resource%20Plan_0.pdf

a. Methods

We used data from the California Office of Environmental Health Hazard Assessment's (OEHHA) California Communities Environmental Health Screening Tool (CalEnviroScreen)[5] and the U.S. Census to analyze nearby populations and the environmental burdens that they face. CalEnviroScreen provides data for environmental and socioeconomic indicators for every census tract in California. For demographics (i.e. total population, people of color, population under age 5, and population over 64), we used data from the 2020 decennial census. We used the U.S. EPA's EJScreen tool methodology[6] to calculate the population-weighted values for each CalEnviroScreen indicator and the overall CalEnviroScreen score for a 5-mile radius buffer around the Scattergood facility and ranked the value against census tracts in the state. The CalEnviroScreen score combines information about population characteristics and pollution burden into a single score and the percentile rank is used to give insight into the vulnerability of the tract compared to other tracts in the state. Using data from Homeland Infrastructure Foundation-Level Data (HIFLD),[7] we also calculated the number of sensitive facilities (i.e. childcare centers, schools, hospitals, nursing homes, and prisons) within a 5-mile radius buffer.

b. Findings

Approximately 386,000 people live within a 5-mile radius of Scattergood. The area (within 5 miles) is in the top 25% of all CalEnviroScreen scores statewide, meaning the community is already overburdened and highly sensitive to further environmental stressors (**Table 1**, **Figure 1**).

Vulnerable populations, such as children and older adults, may be more susceptible than the average person to adverse health effects from pollution. Over a hundred schools and childcare centers and a few nursing homes are located nearby (**Table 1**). Socioeconomic factors, such as poverty and unemployment, and education, all play a role in communities' well-being and resilience. Near Scattergood, 27% of households were living in poverty and 14% had less than a high school education, both of which are slightly below the state average.

[5] California Office of Environmental Health Hazards Assessment. (2021). CalEnviroScreen 4.0. https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40
[6] U.S Environmental Protection Agency. (2024) Environmental Justice Mapping and Screening Tool. https://www.epa.gov/system/files/documents/2024-07/ejscreen-tech-doc-version-2-3.pdf.
[7] U.S. Department of Homeland Security Geospatial Management Office. (n.d). HIFLD Open. https://hifld-geoplatform.hub.arcgis.com/pages/hifld-open

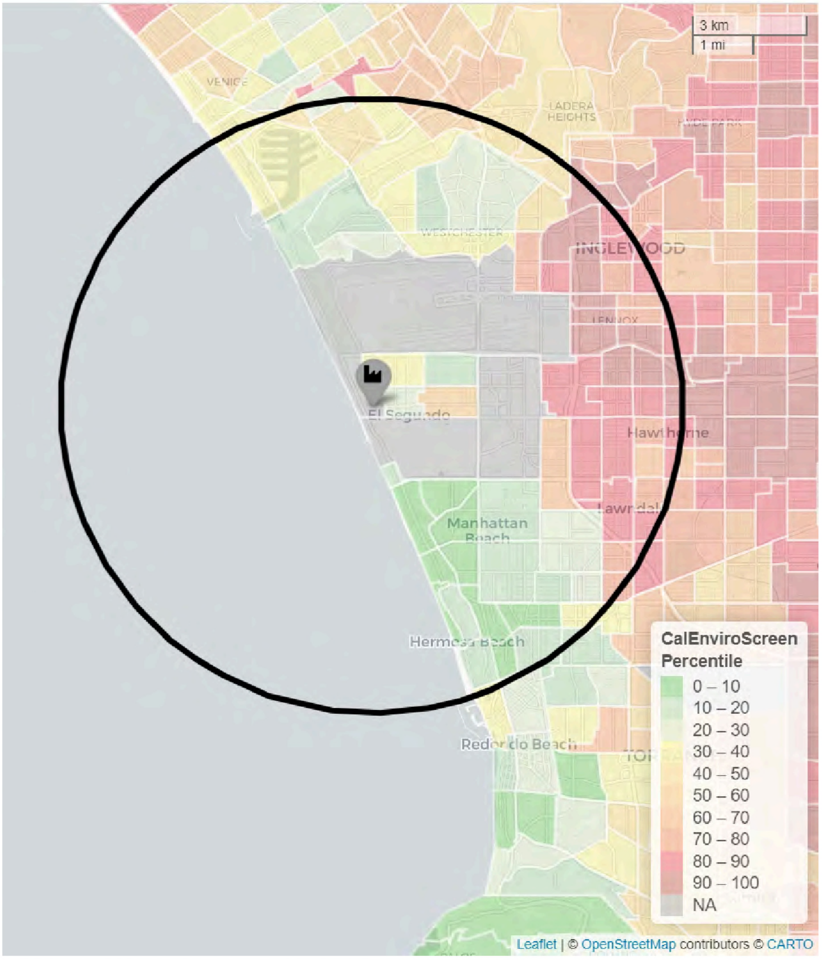

Figure 1. CalEnviroScreen census tract percentiles and the 5-mile radius buffer around Scattergood. A few tracts within the 5-mile buffer do not have a CalEnviroScreen score as a result of low or no population.

Table 1: Demographics within a 5-mile radius of the Scattergood power plant in California.

	5 miles buffer	State Average
CalEnviroScreen Percentile	78	
Total Population	386,236	
% People of Color	62%	62%
% Under Age 5	5%	5%
% Over Age 64	13%	16%
% of Households in Poverty (≤200% of the federal poverty level)	27%	28%
% Unemployment	5%	6%
% Less than High School Education	14%	16%
Number of Childcare Centers	108*	
Number of Schools	94	
Number of Hospitals	5	
Number of Nursing Homes	6	
Number of Prisons	1	

*Includes childcare centers located at schools

The pollution burden is extremely high (>96% of the state) within the 5-mile buffer (Table 2). Most of the individual environmental indicators available in CalEnviroScreen had values greater than 50% of the census tracts in the state. For example, the toxic releases from facilities indicator is the concentration of modeled chemical releases to the air weighted by toxicity. The value of this indicator within the 5-mile buffer was 5,047, which is higher than 93% of the tracts in California. Other environmental indicators related to air pollution such as annual mean $PM_{2.5}$ concentration, diesel PM emissions, toxic releases from facilities, and traffic impacts were also high (>70th percentile). Additionally, parts of Los Angeles County, where Scattergood is located, are designated as a severe nonattainment and extreme nonattainment for the 8-Hour Ozone National Ambient Air Quality

Standard (NAAQS) and serious nonattainment for the annual $PM_{2.5}$ NAAQS.[8],[9] For Scattergood specifically, 48% of the total annual generation occurred on days that exceeded the ozone NAAQs and 6 percent on days that exceeded the $PM_{2.5}$ NAAQS in 2018 when Scattergood operated at a capacity factor of 17 percent.[10]

Communities living nearby are facing multiple sources of pollution in addition to Scattergood, such as the Los Angeles International Airport, the Chevron Oil Refinery, other industrial sites, and highways. They may also face air quality impacts from wildfires in the region. Overall, the pollution burden of the population within the Project's 5-mile radius is higher than 96% of the census tracts in the state (**Table 2**).

[8] U.S Environmental Protection Agency. (2024) 8-Hour Ozone (2015) Nonattainment Area Partial County Descriptions. https://www3.epa.gov/airquality/greenbook/jnca.html#Ozone_8-hr.2015

[9] U.S Environmental Protection Agency. (2024) PM-2.5 (2012) Designated Area/State Information. https://www3.epa.gov/airquality/greenbook/kbtc.html

[10] Krieger, E., Kwoka, B., Lukanov, B. (2024). Green Hydrogen Proposals Across California. PSE Healthy Energy. https://www.psehealthyenergy.org/wp-content/uploads/2024/05/Green-Hydrogen-Proposals-Across-California.pdf

Table 2: Environmental burden within a 5-mile radius of the Scattergood power plant in California.

	Value within 5 miles	Percentile
Overall Pollution Burden		96
Annual Mean Concentration of $PM_{2.5}$ (µg/m3)	11.91	73
Diesel PM Emissions (tons/year)	0.32	78
Pesticide Use (lbs/sq. mi.)	1.24	80
Toxic Release From Facilities (toxicity-weighted concentration)	5,047	93
Traffic Impacts (traffic density)	1,559	79
Cleanup Sites (weighted sites)	8.1	69
Groundwater Threats (weighted sites)	22.60	79
Hazardous Waste Generators and Facilities (weighted sites)	1.44	90
Impaired Water Bodies (number of pollutants)	5.84	71
Solid Waste Sites and Facilities (weighted sites)	1.61	69

4. Public Health Impacts from the Project's Stack Emissions

Given that the location of the Project is in an area of extreme nonattainment for $PM_{2.5}$ and ozone and its 30-year projected timeline of emissions, quantification of the variety of health impacts from $PM_{2.5}$ emissions and emissions of ozone precursors is crucial to accurately capture how the Project will impact public health.

$PM_{2.5}$ exposure is associated with various adverse health outcomes, including increased rates of respiratory and cardiovascular diseases and premature mortality.[11] $PM_{2.5}$ is small enough to penetrate the lungs and enter the bloodstream, triggering inflammation, oxidative stress, and systemic health effects.[12] $PM_{2.5}$ exposure has been associated with health conditions such as asthma, bronchitis, heart attacks, strokes, and lung cancer. Vulnerable populations, such as children, older people, and individuals with pre-existing conditions, are particularly at risk due to their physiology.[13]

Ground-level ozone (commonly known as "smog") is a powerful oxidant; upon contact, ozone can kill the cells lining the airways, damaging respiratory tissue.[14] Exposure to ozone is associated with inflammation and irritation of respiratory airways, reducing the amount of air that lungs breathe, causing symptoms such as coughing and chest tightness, and worsening of asthma symptoms. Higher ozone concentrations are associated with increases in asthma attacks, hospital admissions, and premature mortality, especially in older adults.[15] People with asthma are potentially at increased risk to health impacts as ozone exposure may worsen someone's underlying asthma status, thereby requiring more treatment.

Quantifying the potential $PM_{2.5}$- and ozone- attributable health impacts resulting from the Scattergood project is critical to understanding the project's potential impact on communities.

While the DEIR performs multiple health assessments, we find that gaps remain in order to more completely quantify the Project's health impacts. The Scattergood Modernization Report Appendix B (hereafter referred to as Appendix B) includes a health risk assessment (HRA) evaluating multiple toxic air compounds (TACs) and a comparison of modeled 1-hour, 8-hour, and 24-hour criteria air pollutant concentrations to the NAAQS, California Ambient Air Quality Standards (CAAQS), and South Coast Air

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[11] California Air Resources Board. Inhalable Particulate Matter and Health (PM2.5 and PM10. https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health#:~:text=For%20PM2.,symptoms%2C%20and%20restricted%20activity%20days. Accessed Feb 11, 2025.

[12] Hamanaka, R. B., and Mutlu, G. M. 2018. Particulate Matter Air Pollution: Effects on the Cardiovascular System. *Frontiers in Endocrinology.* 9:680. doi: 10.3389/fendo.2018.00680

[13] California Air Resources Board. Inhalable Particulate Matter and Health (PM2.5 and PM10. https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health#:~:text=For%20PM2.,symptoms%2C%20and%20restricted%20activity%20days. Accessed Feb 11, 2025

[14] California Air Resources Board. Ozone & Health. https://ww2.arb.ca.gov/resources/ozone-and-health#:~:text=Where%20does%20ozone%20come%20from,paints%2C%20and%20many%20other%20sources. Accessed Feb 11, 2025

[15] U.S. EPA. 2024. Health Effects of Ozone in the General Population. https://www.epa.gov/ozone-pollution-and-your-patients-health/health-effects-ozone-general-population. Accessed Feb 11, 2025.

Quality Management District (SCAQMD) Air Quality Significance Thresholds.[16,17,18] The authors concluded that the estimated Maximum Individual Cancer Risk and chronic hazard indices are below established thresholds and that the project operations would not cause an exceedance of the SCAQMD's 24-hour average $PM_{2.5}$ concentration thresholds. However, the evaluation is based on comparing the difference between the Project's emissions and the current emissions from Units 1 and 2 to the thresholds. When the Project's absolute emissions (rather than the difference) are compared to thresholds, volatile organic compounds (VOCs), NOx, CO, and $PM_{2.5}$ are all in exceedance of the SCAQMD's 24-hour significance thresholds regardless of vendor or fuel (DEIR Table 4.2-14). Furthermore, the HRA and modeling analysis does not consider the project's impact on annual $PM_{2.5}$ concentrations in the county to national and federal air quality standards. Additionally, the HRA and modeling analysis do not assess the health impacts from the project's contributions to secondary $PM_{2.5}$ and ozone formation. This is particularly relevant to the community surrounding the Project as it is located in an area of extreme nonattainment for both contaminants.

The DEIR did not evaluate long-term and cumulative health impacts from $PM_{2.5}$ exposure. The DEIR's modeling analysis omitted a comparison to the NAAQS and CAAQS annual average $PM_{2.5}$ standards. While the DEIR's modeling analysis does compare to the SCAQMD significance thresholds for $PM_{2.5}$, these standards only exist for 24-hour averages, meaning the DEIR does not consider long-term exposure (e.g., annual)in its analysis of health impacts. Additionally, the DEIR's comparison to SCAQMD significance thresholds did not include existing background concentration levels of $PM_{2.5}$. Furthermore, the comparisons to thresholds reported in the DEIR are based on the difference between modeled and current Unit 1 and 2 emissions which obscures the true impact the Project will have on air quality. As the Project is located in an area of nonattainment for NAAQS and CAAQS standards, its additional $PM_{2.5}$ burden would be counter to state and federal clean air goals to achieve attainment status. The DEIR must include background $PM_{2.5}$ concentrations for an accurate comparison to the NAAQS and CAAQS 24-hour and annual average $PM_{2.5}$ standards. This inclusion would allow for a more complete assessment of cumulative impacts from the project on an already environmentally overburdened county.

The DEIR did not evaluate health impacts from secondary $PM_{2.5}$ and ozone formation. The DEIR's HRA and modeling analysis also does not account for the harmful effects from secondary $PM_{2.5}$ and ozone formation. While primary particulate matter is directly emitted from sources, secondary particulate matter is formed in the atmosphere from chemical reactions from precursors such SO_2,

[16] U.S EPA. (2024). National Ambient Air Quality Standards (NAAQS) Table. https://www.aqmd.gov/docs/default-source/ceqa/handbook/south-coast-aqmd-air-quality-significance-thresholds.pdf.

[17] California Air Resources Board. California Ambient Air Quality Standards. https://ww2.arb.ca.gov/resources/california-ambient-air-quality-standards. Accessed Feb 11, 2025.

[18] South Coast Air Quality Management District (SCAQMD). (2023). South Coast AQMD Air Quality Significance Thresholds. https://www.aqmd.gov/docs/default-source/ceqa/handbook/south-coast-aqmd-air-quality-significance-thresholds.pdf.

NOx, and VOCs.[19] Similarly, ozone is formed primarily from chemical reactions between NOx and VOCs in the presence of sunlight.[20, 21] This is a particular concern for the Scattergood project due to its potential increase in SO_2 and VOC emissions when compared to baseline, as demonstrated in Table 4.2-14 and Table 4.2-15 of the DEIR. As well as the potential increase in NOx emissions from introducing hydrogen to the fuel blend.[22, 23] Given the South Coast Air Basin's nonattainment of $PM_{2.5}$[24] and ozone[25] air quality standards, no environmental assessment in this area should ignore secondary $PM_{2.5}$ and ozone pollution.

a. The DEIR's Health Impacts Modeling and Analysis Omitted Critical Information

In this analysis, we aimed to fill gaps in the DEIR HRA and modeling analysis by evaluating the potential health impacts of long-term (i.e., annual) exposure to $PM_{2.5}$ (primary and secondary) and ozone associated with the Project's emissions. However, certain limitations are predetermined in our analysis. Since no details on the assumptions and methods used in estimating the Project's emissions for both fuel types are provided, we are required to rely exclusively on emissions estimates as reported in the DEIR, without further evaluation. Outstanding questions remain, such as 1) whether emissions factors were determined using modeling, laboratory or site testing, or a combination of both, 2) whether emissions factors were verified by an independent party, and 3) what uncertainty or confidence intervals exist for reported emissions. Similarly, additional health impacts from increases in traffic demands related to hydrogen transportation are not included in this assessment because these emissions were not provided in the DEIR. This is particularly concerning as truck traffic may rely on diesel fuel, which emits diesel particulate matter, a toxic air contaminant that is a known

[19] California Air Resources Board. Inhalable Particulate Matter and Health (PM2.5 and PM10). https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health#:~:text=For%20PM2.,symptoms%2C%20and%20restricted%20activity%20days. Accessed Feb 11, 2025.
[20] US EPA. (2024). What is Ozone?. https://www.epa.gov/ozone-pollution-and-your-patients-health/what-ozone. Accessed Feb 11, 2025.
[21] California Air Resources Board. Ozone & Health. https://ww2.arb.ca.gov/resources/ozone-and-health#:~:text=Where%20does%20ozone%20come%20from,paints%2C%20and%20many%20other%20sources. Accessed Feb 11, 2025
[22] Cellek, M. S., & Pınarbaşı, A. (2018). Investigations on performance and emission characteristics of an industrial low swirl burner while burning natural gas, methane, hydrogen-enriched natural gas and hydrogen as fuels. *International Journal of Hydrogen Energy*, 43(2), 1194-1207.
[23] Therkelsen, P., Werts, T., McDonell, V., & Samuelsen, S. (2009). Analysis of NO x Formation in a Hydrogen-Fueled Gas Turbine Engine. *Journal of Engineering for Gas Turbines and Power*.
[24] U.S Environmental Protection Agency. (2024) PM-2.5 (2012) Designated Area/State Information. https://www3.epa.gov/airquality/greenbook/kbtc.html
[25] U.S Environmental Protection Agency. (2024) 8-Hour Ozone (2015) Nonattainment Area Partial County Descriptions. https://www3.epa.gov/airquality/greenbook/jnca.html#Ozone_8-hr.2015

carcinogen with the same non-cancer health effects as PM2.5.[26] Estimates attribute 70% of the total known cancer risk from air toxics in California to diesel particulate matter.[27]

The Intervention Model Air Pollution (InMAP) is a peer-reviewed tool that estimates in high geospatial resolution (up to 1 km grid in highly populated areas) how changes in primary $PM_{2.5}$ and $PM_{2.5}$ precursor emissions influence atmospheric $PM_{2.5}$ concentrations and, consequently, premature mortality.[28] The tool takes inputs of $PM_{2.5}$, VOC, NOx, and SOx emissions to calculate changes in annual atmospheric $PM_{2.5}$ concentrations. Then, based on a concentration-response function from the epidemiological literature, an estimate of statistical mortality linked to $PM_{2.5}$ changes is generated. For this analysis, we used the concentration-response function from Qian Di et al.[29] Then, to quantify the monetary value of the estimated mortality, we used the EPA's 2023 Value of a Statistical Life (VSL) of $14,012,045.[30]

We used InMAP to model the annual $PM_{2.5}$-related mortality impacts of Vendors B (the preferred Vendor) and C (the vendor with, on average, slightly lower emissions) based on emissions data reported in Appendix B of the Scattergood DEIR (Table 4-13).[31] Our analysis incorporates total daily emissions from operations (assuming peak emissions are maintained throughout the day) and emissions from one daily startup and shutdown. We scaled the daily emissions to tons per year to estimate maximum annual emissions, assuming one startup and shutdown per day. Since the operating capacity factor of the proposed CCGS is still unknown, we evaluated three potential scenarios: 10%, 25%, and 40%. The 25% capacity factor reflects the historical operation of Units 1 and 2, while the 40% capacity factor aligns with the SLTRP's projection for the Scattergood facility in 2030.[32] Additionally, we assessed health impacts for a 10% capacity factor, as the Scattergood DEIR indicates that the updated unit will operate at a reduced capacity compared to the existing units. Emissions estimates for each capacity factor were derived from the maximum annual emissions (**Table 3**).

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[26] California Air Resources Board. Overview: Diesel Exhaust & Health. https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health.

[27] ibid.

[28] Tessum, C. W., Hill, J. D., & Marshall, J. D. (2017). InMAP: A model for air pollution interventions. *PloS one*, 12(4), e0176131.

[29] Di, Q., Wang, Y., Zanobetti, A., Wang, Y., Koutrakis, P., Choirat, C., ... & Schwartz, J. D. (2017). Air pollution and mortality in the Medicare population. *New England Journal of Medicine*, 376(26), 2513-2522.

[30] COBRA User Manual v5.1, page F-2, Exhibit F-2. https://www.epa.gov/system/files/documents/2024-06/cobra-user-manual-v5.1.pdf.

[31] LADWP Scattergood Generating Station Units 1 and 2 Green Hydrogen-Ready Modernization Project DEIR. October 2024 Appendix B. Air Quality, Greenhouse Gas Emissions, and Health Risk Assessment Analysis Report. https://www.ladwp.com/sites/default/files/2024-10/Scattergood%20Modernization%20Project%20-%20Appendix%20B%20-%20Air%20Quality%2C%20GHG%2C%20HRA%20Report.pdf.

[32] Los Angeles Department of Water and Power. (2022). 2022 Power Strategic Long-Term Resources Plan. Figure 4-18. https://www.ladwp.com/sites/default/files/2023-08/2022%20LADWP%20Power%20Strategic%20Long-Term%20Resource%20Plan_0.pdf. Accessed Feb 11, 2025.

The InMAP analysis framework is used to evaluate the impact of both primary and secondary $PM_{2.5}$ on statistical mortality. However, $PM_{2.5}$ is linked to a range of adverse health outcomes beyond mortality, including asthma incidence and exacerbation, emergency department visits for respiratory illnesses, and cardiovascular disease. Additionally, emissions from the proposed Project will contribute to ground-level ozone formation—a pollutant associated with premature mortality and other adverse health effects.[33] To provide a more comprehensive evaluation of the Project's health impacts, we supplement the InMAP analysis with an assessment using the Environmental Protection Agency's (EPA) Co-Benefits Risk Assessment (COBRA) tool.[34]

COBRA estimates changes in atmospheric $PM_{2.5}$ and ozone concentrations resulting from emissions of primary $PM_{2.5}$, VOCs, NOx, and SOx. It then quantifies the impact of annual $PM_{2.5}$ changes on a variety of adverse health outcomes and calculates their associated monetary value (using EPA's 2023 VSL). While COBRA employs a methodology similar to InMAP, the two tools differ in their underlying atmospheric chemistry models, concentration-response functions, and demographic data. Notably, COBRA estimates ozone-related health impacts—which InMAP does not—and evaluates a broader range of health endpoints. In contrast, InMAP focuses exclusively on mortality. However, COBRA's geospatial resolution is limited to the county level, which can lead to less accurate health impact estimates in large counties with substantial heterogeneity in air pollution levels and population distribution,[35, 36] such as Los Angeles. For this reason, we used COBRA only to obtain a rough estimate of ozone-related health impacts and the morbidity outcomes associated with $PM_{2.5}$ and ozone.

Using COBRA, we analyzed the annual health impacts of Vendor B 100% gas at a 10%, 25%, and 40% capacity factor. Similar to the InMAP analysis, we derived maximum annual emissions from the total peak daily emissions reported in Appendix B of the Scattergood DEIR (Table 4-13)[37] and then scaled them to the respective capacity factor for use as inputs in the COBRA model.

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[33] American Lung Association. What Makes Air Unhealthy: Ozone. https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/ozone. Accessed Feb 11, 2025.
[34] COBRA User Manual v5.1. https://www.epa.gov/system/files/documents/2024-06/cobra-user-manual-v5.1.pdf.
[35] Paolella, David A., et al. "Effect of model spatial resolution on estimates of fine particulate matter exposure and exposure disparities in the United States." *Environmental Science & Technology Letters* 5.7 (2018): 436-441
[36] Goodkind, Andrew L., et al. "Fine-scale damage estimates of particulate matter air pollution reveal opportunities for location-specific mitigation of emissions." *Proceedings of the National Academy of Sciences* 116.18 (2019): 8775-8780
[37] LADWP Scattergood Generating Station Units 1 and 2 Green Hydrogen-Ready Modernization Project DEIR. October 2024 Appendix B. Air Quality, Greenhouse Gas Emissions, and Health Risk Assessment Analysis Report. https://www.ladwp.com/sites/default/files/2024-10/Scattergood%20Modernization%20Project%20-%20Appendix%20B%20-%20Air%20Quality%2C%20GHG%2C%20HRA%20Report.pdf.

Table 3: **Air Pollution Emissions**. Annual emissions from the Project used in the InMAP and COBRA analysis. These emissions were calculated from the total daily peak emissions (including start-up and shutdown emissions) provided in Appendix B Table 4-13.[38]

Capacity factor	Vendor B (tons/year)		Vendor C (tons/year)	
	100% Gas	70% Gas & 30% Hydrogen	100% Gas	70% Gas & 30% Hydrogen
VOC:				
10%	17.04	16.97	4.59	4.55
25%	42.61	42.43	11.49	11.38
40%	68.18	67.89	18.39	18.22
NOx:				
10	10.45	10.45	8.74	8.57
25	26.14	26.14	21.85	21.43
40	41.82	41.82	34.96	34.29
SOx:				
10	0.86	0.77	0.73	0.64
25	2.17	1.93	1.82	1.61
40	3.47	3.09	2.92	2.58
PM2.5:				
10	4.35	4.12	3.96	4.27
25	10.89	10.31	9.90	10.67
40	17.43	16.49	15.84	17.082

b. Health Impacts Results and Discussion

Combined-cycle generators based on natural gas combustion emit various air pollutants. Transitioning from natural gas fuel to a hydrogen blend would decrease emissions of toxic air pollutants associated

[38] ibid.

with fossil fuel combustion such as VOCs and primary $PM_{2.5}$.[39] However, studies have shown that hydrogen combustion can lead to higher NOx emissions compared to natural gas if the proper control technologies are not used.[40, 41] We observed that air pollution emissions reported in the DEIR do not vary substantially based on the fuel type, which is extremely unusual. Due to insufficient details in the DEIR regarding both the emissions modeling methodology and the planned NOx control technology, we are unable to assess the validity of the reported emissions. Emissions from the 100% natural gas scenario (regardless of the vendor) are nearly identical to those from the 70% natural gas and 30% hydrogen scenarios. Consequently, we do not expect, based on the provided emissions data, notable air quality or health benefits from using a 30% hydrogen fuel blend. For Vendor C, primary $PM_{2.5}$ emissions are actually higher in the 70/30 fuel blend compared to the 100% natural gas scenario. Given the minimal differences in emissions across vendors and fuel types, the capacity factor emerged as the primary determinant of the magnitude of health impacts and their associated monetary value in our analysis.

Our InMAP analysis indicates that the health impacts of the Project could be substantial. Operation with a 25% capacity factor, roughly the historical average for Units 1 and 2 as stated in the DEIR, would result in 2.2 to 2.7 annual $PM_{2.5}$-related mortalities nationwide (**Table 4**), with a monetary value of $31.6 to $38.0 million annually. Over a typical 30-year lifespan, these impacts would accumulate to **67.8 to 81.3 PM2.5-related mortalities valued at about $1 billion**. The SLTRP anticipates a base case capacity factor of 40% by 2030, which can result in even greater health impacts as seen in **Table 4**. Emissions under the 10% capacity factor scenario are lower but still linked with approximately one $PM_{2.5}$-related mortality annually, amounting to roughly 30 $PM_{2.5}$-related mortalities over the unit's lifetime valued at over $400 million.

Using COBRA, we estimated ozone-related mortality and $PM_{2.5}$- and ozone-related morbidity impacts, which were not calculated in the InMAP analysis. These health impacts are based on vendor B emission at a 100% natural gas fuel and 10%, 25%, and 40% capacity factor. Given the minimal variation in the emissions reported in the DEIR, the health impact estimates for the other vendors and fuel compositions are expected to be similar. Annually, assuming a 25% capacity factor, the ozone-related mortality impact has a monetary value of approximately $2 million, and the total annual $PM_{2.5}$- and ozone-related morbidity monetary impacts are around $600,000. These include 409 annual asthma exacerbations, 136 ozone-related school loss days due to illness, and 54 PM-related work loss days, among others (**Table 5**). These values increase accordingly under a 40% capacity factor (**Table 6**).

[39] Montero-Montoya, R., López-Vargas, R., & Arellano-Aguilar, O. (2018). Volatile organic compounds in air: sources, distribution, exposure and associated illnesses in children. *Annals of global health*, *84*(2), 225.
[40] Shilling, N. Z. (2023). Emissions and Performance Implications of Hydrogen Fuel in Heavy Duty Gas Turbines. Clean Air Task Force. https://cdn.catf.us/wp-content/uploads/2023/07/13144950/emissions-performance-implications-hydrogen-fuel-heavy-duty-gas-turbines.pdf
[41] Electric Power Research Institute. (2022). Executive Summary: Hydrogen Cofiring Demonstration at New York Power Authority's Brentwood Site: GE LM6000 Gas Turbine. Low-Carbon Resources Initiative. https://www.epri.com/research/products/000000003002025166.

Furthermore, these results are likely an underestimate given COBRA's course geospatial resolution. COBRA analysis at the county level does not capture the heterogeneity of the population and pollution distribution which is mainly concentrated in the Los Angeles City area, where the Scattergood facility is located.

While the health impacts of the proposed unit's emissions would extend more broadly, most effects would be on the nearby communities (**Figure 1**). For Vendor B, 100% gas at 25% capacity factor, the estimated per capita health impact in El Segundo ranges from \$100 to \$600 annually (estimates for Vendor C and other fuel scenarios are similar). Given that Scattergood is located in the Los Angeles basin, the second most populous city in the US, the emissions impact a large population resulting in substantial health impacts per capita. Air pollutants emissions in densely populated areas pose greater impact due to the large number of people exposed. Consequently, Scattergood nearby communities experience not only the highest per capita health impact due to their proximity but also the greatest total impact relative to further away communities, driven by the region's dense population (**Figure 2**).

Our health impacts evaluation has a number of limitations, for instance, the InMAP and COBRA analyses capture only the health impacts associated with primary and secondary $PM_{2.5}$, and ozone in the case of COBRA. These analyses do not account for the direct health impacts of NOx and VOCs, meaning the estimates presented in this report likely underestimate the full extent of the Project's public health impacts. NOx is a known respiratory irritant that can inflame the airways, exacerbate conditions such as asthma and chronic obstructive pulmonary disease, and increase the risk of respiratory infections.[42,43] Similarly, exposure to certain VOCs is associated with various health risks, including liver and kidney damage, central nervous system impairment, and an elevated risk of cancer.[44] Furthermore, our health impacts analysis included only emissions from the unit operation and did not consider emissions from the construction, projected to last 3.5 years, and the commissioning phases. Notably, in the Scattergood Modernization Project Appendix B,[45] the authors mentioned that PM_{10} and $PM_{2.5}$ are the pollutants of greatest concern in the construction phase, which we did not include in our estimates.

The transition to renewable energy offers a significant opportunity to enhance air quality and, by extension, public health. Cities like Los Angeles, which are heavily burdened by air pollution, would

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[42] US EPA. Basic Information about NO2. https://www.epa.gov/no2-pollution/basic-information-about-no2. Accessed Feb 11, 2025.
[43] American Lung Association. What Makes Air Unhealthy: Nitrogen Dioxide. https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/nitrogen-dioxide. Accessed Feb 11, 2025.
[44] American Lung Association. What Makes Air Unhealthy: Volatile Organic Compounds. https://www.lung.org/clean-air/indoor-air/indoor-air-pollutants/volatile-organic-compounds. Accessed Feb 11, 2025
[45] LADWP Scattergood Generating Station Units 1 and 2 Green Hydrogen-Ready Modernization Project DEIR. October 2024 Appendix B. Air Quality, Greenhouse Gas Emissions, and Health Risk Assessment Analysis Report. https://www.ladwp.com/sites/default/files/2024-10/Scattergood%20Modernization%20Project%20-%20Appendix%20B%20-%20Air%20Quality%2C%20GHG%2C%20HRA%20Report.pdf.

benefit substantially from adopting renewable technologies that minimize adverse air quality impacts—such as fuel cells and energy storage systems. In contrast, hydrogen combustion produces NOx emissions that, if not adequately controlled, may diminish the air quality benefits gained from reducing fossil fuel combustion. Additionally, transporting hydrogen by truck to the facility—given the lack of dedicated hydrogen pipelines—would further exacerbate air pollution. Our analysis of the proposed CCGS project, which utilizes a blend of natural gas and hydrogen, indicates that it is unlikely to improve air quality. Specifically, emissions of toxic pollutants and $PM_{2.5}$ precursors, including VOCs, SO_2, and $PM_{2.5}$ itself, remain on par with those observed under a 100% natural gas scenario. Over a 30-year lifetime and a 25% capacity factor, we estimated the project's health impact to be around $1 billion, irrespective of the fuel mix. Given these findings, we recommend exploring alternative renewable energy options, such as those discussed in **Section 6** below.

Table 4. InMAP Health Impact Estimates. Projected annual statistical mortality and the associated monetary value (in parenthesis) linked to the Scattergood Project. These estimates were modeled using InMAP.

	Vendor B		**Vendor C**	
Capacity Factor (%)	100 % Gas	70% Gas & 30% Hydrogen	100% Gas	70% Gas & 30% Hydrogen
10	1.08 ($15.21 M)	1.03 ($14.48 M)	0.90 ($ 12.67 M)	0.96 ($13.47 M)
25	2.71 ($38.03 M)	2.54 ($36.21 M)	2.26 ($ 31.69 M)	2.40 ($33.66 M)
40	4.34 ($60.85 M)	4.13 ($57.94 M)	3.61 ($ 50.71 M)	3.84 ($53.86 M)

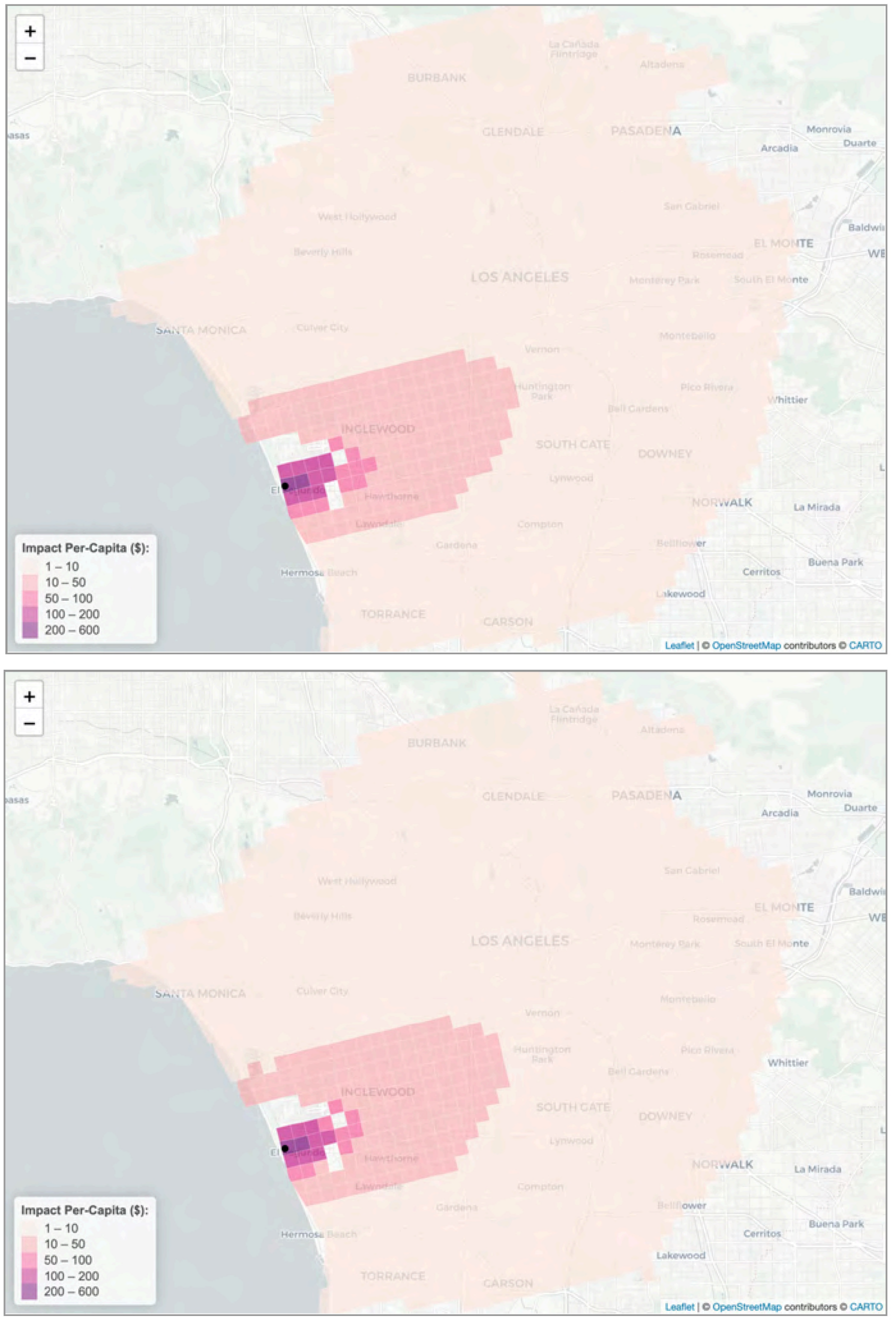

Figure 2. Annual Per Capita Impacts. Spatial distribution of annual per capita health impacts ($) associated with the Scattergood Project operating at 25% capacity factor. Top image: Vendor B, 100% natural gas. Bottom image: Vendor B, 70% natural gas and 30% hydrogen. Values are given in 2023 dollars. The location of the Scattergood plant is shown as a black dot. Maps are from InMAP model runs using emissions in Table 3 and include only mortality as a health outcome.

Figure 3. Annual Total Impacts. Spatial distribution of total (across the population) health impacts ($) associated with the Scattergood Project operating at 25% capacity factor. Top image: Vendor B, 100% natural gas. Bottom Image: Vendor B, 70% natural gas and 30% hydrogen. Values are given in 2023 dollars. The location of the Scattergood plant is shown as a black dot. Maps are from InMAP model runs using emissions in Table 3 and include only mortality as a health outcome.

Table 5. **COBRA Health Impact Estimates**. Annual health impacts associated with Vendor B 100% natural gas scenario, based on peak daily emissions and 25% capacity factor. These health effects were estimated using COBRA and are likely an underestimate given the coarse geospatial resolution of the modeling.

Health Endpoint	**Incidence**		**Monetary Value**	
	Low	High	Low	High
Total Health Impacts			$7,106,553	$12,192,653
Total Mortality	0.44	0.79	$6,457,957	$11,544,057
All PM-Related Mortality	0.29	0.64	$4,202,140	$9,288,240
All O3-related Mortality	0.15		$2,255,817	
Total Asthma Symptoms	409.02		$84,804	
PM-related Asthma Symptoms (Albuterol Use)	189.51		$121	
O3-related Asthma Symptoms (Chest Tightness)	60.48		$23,331	
O3-Asthma Symptoms (Cough)	71.33		$27,520	
O3-Asthma Symptoms (Shortness of Breath)	30.52		$11,774	
O3-Asthma Symptoms (Wheeze)	57.17		$22,057	
Total Asthma Incidence	2.49		$189,730	
PM-related Asthma Incidence	1.03		$78,311	
O3-related Asthma Incidence	1.46		$111,418	
Total Incidence Hay Fever Rhinitis	15.83		$17,634	
PM-related Incidence Hay Fever Rhinitis	6.53		$7,276	
O3-related Incidence Hay Fever Rhinitis	9.30		$10,358	
Total ER Visits for (Respiratory)	0.67		$1,086	
PM-related ER Visits (Respiratory)	0.23		$373	
O3-related ER Visits (Respiratory)	0.44		$714	
PM-related Nonfatal Heart Attacks	0.24		$19,848	
PM-related Minor Restricted Activity Days	317.43		$39,908	
PM-related Work Loss Days	53.96		$17,067	
O3-related School Loss Days (All Cause)	136.57		$231,941	

Table 6. **COBRA Health Impact Estimates**. Annual health impacts associated with Vendor B 100% natural gas scenario, based on peak daily emissions and 40% capacity factor. These health effects were estimated using COBRA and are likely an underestimate given the coarse geospatial resolution of the modeling.

Health Endpoint	**Incidence**		**Monetary Value**	
	Low	High	Low	High
Total Health Impacts			$11,370,485	$19,508,244
Total Mortality	0.71	1.27	$10,332,732	$18,470,491
All PM-Related Mortality	0.46	1.02	$6,723,425	$14,861,183
All O3-related Mortality	0.25		$3,609,307	
Total Asthma Symptoms	654.43		$135,686	
PM-related Asthma Symptoms (Albuterol Use)	303.22		$194	
O3-related Asthma Symptoms (Chest Tightness)	96.76		$37,330	
O3-Asthma Symptoms (Cough)	114.14		$44,033	
O3-Asthma Symptoms (Shortness of Breath)	48.83		$18,838	
O3-Asthma Symptoms (Wheeze)	91.48		$35,291	
Total Asthma Incidence	3.98		$303,567	
PM-related Asthma Incidence	1.64		$125,298	
O3-related Asthma Incidence	2.34		$178,269	
Total Incidence Hay Fever Rhinitis	25.32		$28,214	
PM-related Incidence Hay Fever Rhinitis	10.45		$11,641	
O3-related Incidence Hay Fever Rhinitis	14.87		$16,573	
Total ER Visits for (Respiratory)	1.07		$1,738	
PM-related ER Visits (Respiratory)	0.37		$596	
O3-related ER Visits (Respiratory)	0.70		$1,142	
PM-related Nonfatal Heart Attacks	0.38		$31,756	
PM-related Minor Restricted Activity Days	507.90		$63,853	
PM-related Work Loss Days	86.33		$27,308	
O3-related School Loss Days (All Cause)	218.51		$371,105	

5. Hydrogen Impacts and Considerations

The DEIR does not adequately address the potentially significant environmental impacts of green hydrogen within this Project. The DEIR indicates that "the proposed project [i]s integral to the goal of implementing a carbon--free energy system providing reliable and sustainable electrical power for the City of Los Angeles." However, the Project as outlined will not enable carbon-free, reliable energy generation at Scattergood until there is a significant and available supply of green hydrogen and a carbon-free method of transporting it to the facility has been implemented.

Given the still-developing nature of the U.S. green hydrogen market, the DEIR leaves "the installation of the infrastructure for the production, delivery, and storage of hydrogen" for a separate environmental review "when the necessary information to support an adequate analysis of potential impacts is available." While we are sympathetic to the lack of data and numerous unknowns surrounding the future of hydrogen in California, this infrastructure is required in order for the Project to meet its objectives and may have potentially significant environmental impacts.

a. Potential New Construction

While the DEIR assesses the impact of construction for this Project, it does not assess the impacts of the planned conversion to burn 100% hydrogen. LADWP plans to use 100% hydrogen for all in-basin combustion by 2035.[46] Unless the turbines selected for this Project are capable of operating using 100% hydrogen fuel, the Project has a maximum useful lifespan of 5 years as-is before the equipment must be upgraded or replaced. The DEIR is clear that Vendor B's turbine is not capable of operating solely on hydrogen, but does not state if Vendors A and C have this capability or would require upgrades.

Commercial turbines capable of operating with natural gas / hydrogen blends of up to 100% hydrogen are currently confined to demonstration projects or planned projects with co-located green hydrogen production and storage. This includes a small pilot project as part of Duke Energy's DeBarry power plant in Florida, which is currently renovating one 83 MW turbine to pair with an existing 300,000-panel solar array with on site electrolyzers and hydrogen storage tanks.[47] Plans are also underway for a 200 MW power plant in Australia, but this will be part of a larger green hydrogen project with a 250 MW electrolyzer and 100 tons of hydrogen storage on-site.[48] While equipment manufacturers are testing

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[46] Los Angeles Department of Water and Power. (2022). 2022 Power Strategic Long-Term Resources Plan. https://www.ladwp.com/sites/default/files/2023-08/2022%20LADWP%20Power%20Strategic%20Long-Term%20Resource%20Plan_0.pdf

[47] Patel, S. (Nov 16, 2023). Pioneering Hydrogen-Powered Gas Peaking: Inside Duke Energy's DeBarry Project. *POWER*. https://www.powermag.com/pioneering-hydrogen-powered-gas-peaking-inside-duke-energys-debary-project/

[48] Patel, S. (Nov 19, 2024). GE Vernova Unveils 100% Hydrogen-Fueled Aeroderivitive Gas Turbine Solution, Secures First Customer. *POWER*. https://www.powermag.com/ge-vernova-unveils-100-hydrogen-fueled-aeroderivative-gas-turbine-solution-secures-first-customer/

turbines capable of operating using fuel blends and up to 100% hydrogen, none appear to be commercially operational yet with the exception of specialized projects such as the above.

The environmental impact of potential turbine upgrades would depend on the level of modification required. While likely not significant on their own, these impacts are not addressed or included in the DEIR despite LADWP's plans to operate Scattergood with 100% hydrogen within 5 years of the Project's completion.

b. Greenhouse Gas Emissions

The final objective of the Project is to "reduce the emissions of greenhouse gases (GHG) from power generation consistent with the LADWP transition to a carbon-free electrical power system." While improving the efficiency of Scattergood Units 1 and 2 and operating them less frequently will lower GHG emissions compared to the existing units, LADWP relies on combusting green hydrogen to achieve a carbon-free electrical power system.

Given the lower energy density of hydrogen compared to natural gas, a 30% by volume hydrogen blend would only reduce net CO_2 emissions by roughly 9%.[49] It would require 75% hydrogen by volume to achieve a 50% reduction in emissions and roughly 90% hydrogen by volume to achieve a 75% GHG reduction.[50] This level of emissions reduction can only be achieved if the hydrogen used is produced entirely with clean energy. This may be difficult to achieve in practice, as it requires hydrogen producers to either build dedicated renewable energy resources for their projects, use curtailed renewables that are only available during specific times in specific places, or ensure their project meets the three pillars for hydrogen produced with grid electricity (e.g., additionality, regional alignment, and time matching).[51] These GHG emissions reductions may also be offset by the emissions generated when transporting hydrogen to the facility (discussed below) and/or the impact of hydrogen leakage.

While not itself a GHG, hydrogen has indirect climate impacts when released into the atmosphere. A recent study aggregating numerous models estimated that hydrogen's warming effect was 22.3 - 52.4 times more than CO_2 over a 20 year period.[52] Blends of hydrogen and natural gas are also shown to

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[49] Shilling, N. Z. (2023). Emissions and Performance Implications of Hydrogen Fuel in Heavy Duty Gas Turbines. Clean Air Task Force. https://cdn.catf.us/wp-content/uploads/2023/07/13144950/emissions-performance-implications-hydrogen-fuel-heavy-duty-gas-turbines.pdf.

[50] ibid.

[51] Krieger, E., Kwoka, B., Lukanov, B. (2024). Green Hydrogen Proposals Across California. PSE Healthy Energy. https://www.psehealthyenergy.org/wp-content/uploads/2024/05/Green-Hydrogen-Proposals-Across-California.pdf.

[52] Sand, M., Skeie, R. B., Sandstad, M., Krishnan, S., Myhre, G., Bryant, H., Derwent, R., Hauglustaine, D., Paulot, F., Prather, M., & Stevenson, D. (2023). A multi-model assessment of the Global Warming Potential of hydrogen. *Nature Communications Earth & Environment*, 4(1), 203.

leak at higher rates than natural gas alone.[53] While in situ data on hydrogen leakage rates is scarce, estimates from the full value chain of hydrogen—including production, transportation, storage, and use—range from 0.2 - 20%.[54] Numerous studies have indicated that a 10% leakage rate could reduce or eliminate the climate benefit of replacing fossil fuels with green hydrogen.[55, 56, 57]

The small contribution of hydrogen to GHG emissions reductions in this project is addressed in the DEIR in part by considering the project's GHG emissions assuming operations use 100% natural gas. The DEIR indicates that the GHG emissions using only natural gas fall below the federal NSPS TTTT and state SB 1368 standards for GHG emissions thresholds for new fossil fuel projects. However, this does not address the warming potential from hydrogen leakage. It is also not in line with the goals outlined in the SLTRP and does not address the long-term policy goals stated in the project objectives. The City of Los Angeles and CARB's Scoping Plan both aim to eliminate GHG emissions from power generation. This would require switching entirely to green hydrogen with no combustion of natural gas.

c. Energy Availability

Given the Project's use of hydrogen, maintaining a reliable fuel supply has potential environmental impacts not addressed in the DEIR. In this and the following subsections, we outline some of the potential impacts that would result from differing energy security strategies. First, a limited hydrogen supply that prompts natural gas-only operations impacts long-term operational air pollution and GHG emissions. Second, storing hydrogen on site to ensure a ready supply of this fuel has construction- and potential operational GHG-related impacts. Third, different methods to transport hydrogen have different associated construction and operational air quality and GHG emissions impacts.

One of the stated Project objectives is to "establish a generation source that is always available, dispatchable, and local relative to the LADWP service area." A combined-cycle gas turbine is dispatchable, but the availability of hydrogen fuel is a significant risk. The green hydrogen market in California is still nascent, with little existing supply.[58] While California's hydrogen market is poised to develop, BloombergNEF notes that announced hydrogen projects have not always materialized and

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[53] Penchev, M., Lim, T., Todd, M., Lever, O., Lever, E., Mathaudhu, S., Martinez-Morales, A., & Raju, A. S. K. (2022). Hydrogen Blending Impacts Study Final Report. Agreement Number: 19NS1662. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M493/K760/493760600.PDF.

[54] Esquivel-Elizondo, S., Mejia, A. H., Sun, T., Shrestha, E., Hamburg, S. P., & Ocko, I. B. 2023. Wide range in estimates of hydrogen emissions from infrastructure. *Frontiers in Energy Research*, 11, 1207208.

[55] Ocko, I. B., & Hamburg, S. P. (2022). Climate consequences of hydrogen emissions. *Atmospheric Chemistry and Physics*, 22(14), 9349-9368.

[56] Sun, T., Shrestha, E., Hamburg, S. P., Kupers, R., & Ocko, I. B. (2024). Climate impacts of hydrogen and methane emissions can considerably reduce the climate benefits across key hydrogen use cases and time scales. *Environmental Science & Technology*, 58.

[57] Bertagni, M. B., Pacala, S. W., Paulot, F., & Porporato, A. (2022). Risk of the hydrogen economy for atmospheric methane. *Nature Communications*, 13(1), 7706.

[58] IEA. (2024). IEA Hydrogen Production Projects Database. https://www.iea.org/data-and-statistics/data-product/hydrogen-production-and-infrastructure-projects-database. Accessed Feb 11, 2025.

project timelines are often delayed.[59] CARB's Scoping Plan suggests that California will need to grow its hydrogen supply by 1,700x to meet green hydrogen demand in non-power sector applications; although the Scoping Plan proposes hydrogen's use in power plants for emergency backup, it does not allocate any of California's hydrogen supply for this use.[60] This indicates competition for a future green hydrogen supply and the risk of fuel insecurity.

The Project can operate entirely on natural gas if hydrogen is unavailable. However, this is not in line with long-term local, regional, or state decarbonization policy or with LADWP's long-term plans. The potential for fuel insecurity suggests the need for on-site hydrogen storage (discussed below) to achieve these policy objectives.

Citing the early nature of the industry, LADWP does not discuss the potential environmental impacts of hydrogen infrastructure beyond those related to the construction of the hydrogen-capable turbine and the air pollution impacts of combusting a 70% natural gas, 30% hydrogen fuel mix. The air pollution and GHG impacts of using higher percentages of hydrogen are not discussed in the DEIR, though such analyses would be applicable for comparisons to possible project alternatives.

d. Hydrogen Transport and Storage

The methods for production, transport, and storage of green hydrogen will play a significant role in the environmental impact of using this fuel. For example, the method of transporting hydrogen to Scattergood could influence local pollution, construction emissions, and potential leakage rates.

There is little room to produce green hydrogen in the L.A. Basin, so this fuel will need to be brought in from further away. If a ready supply of green hydrogen is available, the most efficient way to transport it to Scattergood would be via pipeline. However, it would take years to build a pipeline and, given the stated low capacity factor, the cost effectiveness of building such a pipeline is questionable. Hydrogen could also be blended into existing natural gas pipelines or existing pipelines could be converted to carry hydrogen. However, each of these options has its own environmental impacts.

Hydrogen blending is an active area of research, with some studies suggesting that blends of up to 20% by volume may operate normally in existing pipelines while some pipeline operators have indicated that significant upgrades would be required for safe operations at this volume.[61] Blending hydrogen into existing natural gas pipelines can cause embrittlement, and research suggests that

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[59] BloombergNEF. (2024, May 14). Hydrogen Supply Outlook 2024: A Reality Check. https://about.bnef.com/blog/hydrogen-supply-outlook-2024-a-reality-check/. Accessed Feb 11, 2025.
[60] California Air Resources Board. (2022). 2022 Scoping Plan for Achieving Carbon Neutrality. https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf. Accessed Feb 11, 2025.
[61] Martin, P. (2023, November 9). Gas grids can already cope with 20% hydrogen blends? That simply isn't true, says new report from network operator. *Hydrogen Insight*. https://www.hydrogeninsight.com/production/gas-grids-can-already-cope-with-20-hydrogen-blends-that-simply-isnt-true-says-new-report-from-network-operator/2-1-1551369. Accessed Feb 11, 2025.

blends as low as roughly 5% may increase this risk.[62] As mentioned, leakage rates are also higher for natural gas / hydrogen blends than natural gas alone. The Project indicates a 30% minimum hydrogen blend for blended operations and LADWP plans to operate Scattergood entirely with hydrogen by 2035, so new pipeline construction or major retrofits would be required if LADWP opts for pipeline transport. If dedicated hydrogen pipelines are built, or natural gas pipelines are retrofitted to accommodate hydrogen blends, there will be additional construction and potential leakage impacts, neither of which are considered in the DEIR.

In the near term, hydrogen is likely to be trucked to where it is needed. This could increase local air pollution, depending on the volume of hydrogen required and whether diesel trucks or clean vehicles such as hydrogen- or battery-powered trucks are used. Scattergood's operational emissions would increase if large quantities of hydrogen are transported to the facility using diesel trucks.

For example, we estimate that roughly 40 trucks of hydrogen per day would be required for Scattergood to operate at a 25% capacity factor, assuming a 30% hydrogen by volume blend and a standard 380 kg hydrogen tube trailer.[63, 64] Optimistically assuming that hydrogen is transported using recently developed composite vessels that can hold up 560-900 kg of hydrogen per trailer,[65] we estimate that Scattergood would require 15-24 trucks per day to operate at a 25% capacity factor with a 30% hydrogen blend. The higher Scattergood's capacity factor and the greater the percentage of hydrogen, the more trucks would be required. These trucks would need to travel large distances from outside of the LA Basin. The potential ongoing emissions from transporting hydrogen to Scattergood via these trucks are not considered in the DEIR.

The fuel availability concerns discussed above suggest a need for on-site hydrogen storage. This would require both physical space and the construction of storage infrastructure, which are not considered in the DEIR. Hydrogen's energy content by volume is lower than natural gas and liquid fuels like gasoline—10 KJ/Nm3 for hydrogen versus 36 KJ/Nm3 for methane, the main component of natural gas.[66] Hydrogen's energy density can be increased through compression to higher pressures, but this

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[62] Penchev, M., Lim, T., Todd, M., Lever, O., Lever, E., Mathaudhu, S., Martinez-Morales, A., & Raju, A. S. K. (2022). Hydrogen Blending Impacts Study Final Report. Agreement Number: 19NS1662. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M493/K760/493760600.PDF.

[63] A 346 MW CCGS with a 25 percent capacity factor generates 2,076 MWh per day. Hydrogen has a higher heating value of 0.134 MMBtu/kg and constitutes roughly 12.5 percent of the energy in a 30 percent hydrogen, 70 percent natural gas by volume blend. This leads to an energy need of roughly 260 MWh from the hydrogen component alone. Assuming a 50 percent combustion efficiency, a 380 kg hydrogen tube trailer can transport approximately 6 MWh worth of hydrogen.

[64] United States Department of Energy. (n.d.). Hydrogen Tube Trailers. https://www.energy.gov/eere/fuelcells/hydrogen-tube-trailers. Accessed February 3, 2025.

[65] ibid.

[66] Shilling, N. Z. (2023). Emissions and Performance Implications of Hydrogen Fuel in Heavy Duty Gas Turbines. Clean Air Task Force.

requires an increasing amount of energy[67] and would increase costs for both compression and storage as well as the potential for leakage and safety concerns (discussed below). Hydrogen can also be stored cryogenically as a liquid, where it has a much higher energy density. However, the liquefaction process is energy intensive, with current processes requiring 11.9 - 15 kWh/kg H_2, which is equivalent to 35 - 45% of the fuel's heating value.[68] Liquid hydrogen also suffers boil off losses of 0.1 - 4 percent per day depending on tank insulation and cooling, pressure, and tank size.[69] As LADWP intends to burn hydrogen infrequently, this method of storage may not make economic sense. While other potential methods of hydrogen storage are being explored, they are still under development and may not be viable on the timeframe required.

Subsequently, significant storage space may be required to keep the fuel reserve necessary to cover anticipated peak demand and the emergency events Scattergood is intended to cover. The DEIR cites a lack of available space as a core reason a battery energy storage system (BESS) is not a viable alternative to this project. But Project documentation does not address the space for or associated construction-related impacts of on-site hydrogen storage infrastructure.

e. Additional Hydrogen Considerations

Decarbonizing in-basin energy generation by switching from natural gas to hydrogen combustion faces additional risks and challenges, some of which may have downstream environmental impacts.

As discussed above, combustion turbines that operate on natural gas / hydrogen blends are a newer technology, and turbines that operate using 100% hydrogen are not well commercialized.[70] This opens the door for potential cost and operational risk. This is particularly true for future 100% hydrogen operations in line with LADWP's Strategic Long Term Resources Plan as well as the GHG emissions goals in various policy targets. If the infrastructure installed for this project is not sufficient to achieve those future objectives, further new construction and its associated environmental impacts would be required. These are not discussed within the DEIR.

The flammability of hydrogen also introduces safety concerns, particularly in regards to transport and storage. Hydrogen ignites more easily and at lower concentrations than natural gas.[71] It is also a smaller molecule than natural gas. Given its lower energy density by volume, it is transported and

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[67] Krieger, E., Kwoka, B., Lukanov, B. (2024). Green Hydrogen Proposals Across California. PSE Healthy Energy. https://www.psehealthyenergy.org/wp-content/uploads/2024/05/Green-Hydrogen-Proposals-Across-California.pdf. Accessed Feb 11, 2025.

[68] Ghafri et al. (2022). Hydrogen liquefaction: a review of the fundamental physics, engineering practice and future opportunities. *Energy Environ. Sci.*, 15, 2690-2731.

[69] ibid.

[70] Krieger, E., Kwoka, B., Lukanov, B. (2024). Green Hydrogen Proposals Across California. PSE Healthy Energy. https://www.psehealthyenergy.org/wp-content/uploads/2024/05/Green-Hydrogen-Proposals-Across-California.pdf. Accessed Feb 11, 2025.

[71] U.S. Department of Energy. (n.d.). Hydrogen Safety. https://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/h2_safety_fsheet.pdf. Accessed January 24, 2025.

stored under higher pressure and hydrogen / natural gas blends have been shown to leak at higher rates than natural gas on its own, increasing the risk of a safety incident. As noted above, existing natural gas pipelines are at risk of embrittlement from hydrogen blends at the minimum 30% by volume concentrations proposed for this project. Thus, alongside new safety measures, new pipelines and the associated environmental impacts of construction would be required for the safe transport and use of hydrogen.

f. Summary of Findings Regarding Use of Hydrogen

Green hydrogen infrastructure could have significant environmental impacts that are not addressed within this DEIR. Whether the hydrogen used at Scattergood is truly zero emission impacts the level of GHG emission reductions hydrogen can provide. How LADWP plans to ensure a reliable supply of green hydrogen, both in terms of transport and on-site storage, impacts both local air quality and GHG emissions. The exclusion of these impacts in this DEIR is understandable given the significant uncertainties in this space. But given their potentially significant environmental impacts, we recommend these questions be addressed so this project can be appropriately compared to the alternative options before significant investments are made. This would include assessments of scenarios for storage, transport, and combustion of both hydrogen blends and pure hydrogen and ranges of values using recent studies to assess their potential impacts. These impacts would include climate impacts from leakage, round trip efficiency of hydrogen transport and combustion and estimates of the carbon intensity of the grid in case renewables are redirected to hydrogen production, and the footprint of storage systems for local hydrogen storage.

6. Project Alternatives

a. Alternatives Explored in the DEIR

Following are the alternatives discussed in the DEIR.

i. No Project

We agree that no project is not a good alternative. Given future load growth and transmission constraints, development of local energy assets using existing land and interconnection capacity should be pursued at Scattergood.

ii. Energy Storage

The DEIR does not sufficiently consider the use of on-site energy storage. We find that estimates of the amount of storage that could be sited at Scattergood are low and do not consider alternatives that could potentially increase the storage by a factor of two or more using existing technology. It further does not consider improved battery energy storage technologies already being actively deployed in California and elsewhere that can provide substantially higher capacities and/or longer durations. Importantly, a battery energy storage system (BESS) would avoid environmental impacts and simultaneously provide additional benefits to the grid by maximizing the impact of intermittent renewables year-round. We thus find that a BESS is a viable option to meet the goals of the Project as stated and needs further consideration both as a stand-alone alternative and as a component to a hybrid alternative discussed in **Section 6c** below.

The DEIR acknowledges that a grid-scale BESS is “technically feasible” and can “reduce some environmental impacts.” The DEIR argues, however, that it would not provide “comparable generation capacity.” This is for two reasons. First, it would require “substantially more real estate” to match the capacity of the Project. Second, it would not “provide requirements for a reliable, resilient, and readily dispatchable longer duration energy source during periods of critical demand.” However, the DEIR also acknowledges that a BESS “provides for multiple services such as operating as a fast response and reserve for unpredictable variations in demand or generation system failures, helping reduce loading on transmission and distribution systems during peak times, and providing reliable capacity to meet peak system demand.” In short, a BESS provides services throughout the year since it does not generate any emissions and can be freely operated throughout the year as opposed to the proposed project which is planned to be used “substantially less” than the current capacity factor of roughly 25%.

First, we explore the concern of real estate. The DEIR claims BESS’ produce “approximately 45 MWh per 1 acre in 4 hours”. The source for this estimate is from one potential provider and a study of a proposed solar and storage site in rural Colorado. Using typical values for areal density BESSs is misleading as these systems are often built alongside solar farms where the impact of the area requirements of batteries is negligible compared to the need for solar and so efforts to constrain them are limited. However, for in-basin energy resources where real estate is a large constraint, significantly higher densities of energy storage are possible using proven technologies. Existing installations studied in a recent article found lithium ion batteries can range as high as 62 MWh per 1 acre using Tesla Inc. Megapacks in blocks of two.[72] Importantly, this installation is at Moss Landing, the site of a previous gas generation facility in California that was converted into a BESS.

Even higher densities and durations will be possible by the expected date of deployment in five years given the rapidly advancing technological improvements in the field. Below is a survey of just a few technologies that may provide substantially higher capacity and densities. These are at a similar, or even more advanced, stage in their development compared to the hydrogen blend CCGS in the proposed Project.

- Envision Energy demonstrated an 8 MWh battery using 700 Ah lithium-iron phosphate (LFP) battery cells in a 20 foot container.[73] This is roughly twice as dense as the current configuration

[72] Reber, David, Sam Jarvis, and Michael Marshak. (2022). The role of energy density for grid-scale batteries. https://chemrxiv.org/engage/api-gateway/chemrxiv/assets/orp/resource/item/63752e8ae70b0a2d469f8fd5/original/the-role-of-energy-density-for-grid-scale-batteries.pdf.
[73] Emerging Technology News. (Sept 9, 2024). Envision unveils 8 MWh grid-scale BESS with superior energy density. https://interestingengineering.com/energy/new-envision-energy-storage. Accessed Feb 11, 2025.

of Tesla Megapacks cited above at Moss Landing with roughly 4 MWh[74] per unit container with a slightly larger footprint.[75]

- FORM energy builds 100-hour iron-air batteries that provide storage of 300 MWh per acre[76] and are expected to begin operation by the end of 2025.[77] Although their energy density is very high, these cells discharge slower and would be less suitable for the Scattergood parcel as they would need a considerable footprint to meet the peak load. They could, however, provide essential long-duration capacity if sited on neighboring parcels as discussed in **Section 6c** below.
- ESS started development of a long-duration iron flow 200 MW/2 GWh BESS with a duration of up to 12 hours for the Sacramento Municipal Utility District.[78] Domestic production of these have already begun. These batteries have much lower energy densities than lithium ion batteries with a little more than 1 MWh per container,[79] but they provide benefits in terms of longer duration and reduced fire risk and may be candidates for neighboring parcels as discussed in **Section 6c** below.
- Average prices for battery packs have also decreased by roughly 30% in the two years alone since the SLTRP was written in 2022 according to Bloomberg.[80]

Furthermore, the DEIR states that only 10 acres are available for a BESS at Scattergood. This includes the 3 acres for the proposed site and an additional 7 acres at the southern parcel of the site. We appreciate the consideration of the unutilized land on this site. However, elsewhere the DEIR states that there are 13.5 acres of unused space at that southern parcel. It is not clear why only roughly half of the parcel can be used. One concern mentioned in the DEIR is the flatness of the parcel, but grading

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[74] Tesla Megapacks provide an energy density of 3.9 MWh according to Tesla although this value can vary between module options. Tesla https://www.tesla.com/megapack. Accessed Feb 11, 2025.

[75] Tesla. (2024) Tesla Lithium Ion Battery Emergency Response Guide. https://www.tesla.com/sites/default/files/downloads/Lithium-Ion_Battery_Emergency_Response_Guide_en.pdf. Accessed Feb 11, 2025.

[76] MIT Department of Materials Science and Engineering. (Mar 4, 2024). Power when the sun doesn't shine. https://dmse.mit.edu/news/power-when-the-sun-doesnt-shine/. Accessed on February 4, 2025.

[77] California Energy Commission. (December 13, 2023). "CEC Awards $30 Million to 100-Hour, Long-Duration Energy Storage Project". https://www.energy.ca.gov/news/2023-12/cec-awards-30-million-100-hour-long-duration-energy-storage-project. Accessed Feb 11, 2025.

[78] ESS Tech Inc. (September 20, 2022) Accelerating Decarbonization, ESS Inc. and SMUD Announce Agreement to Deploy up to 200 MW / 2 GWh of Long-Duration Energy Storage Solutions. https://essinc.com/accelerating-decarbonization-ess-inc-and-smud-announce-agreementto-deploy-up-to-200-mw-2-gwh-of-long-duration-energy-storage-solutions/. Accessed Feb 11, 2025.

[79] ESS Energy Center Datasheet. (2024). https://21814608.fs1.hubspotusercontent-na1.net/hubfs/21814608/2024-05-ESS-EnergyCenter-datasheet-rev5.pdf. Accessed on February 9, 2025.

[80] Bloomberg NEF (Dec 10, 2024). Lithium-Ion Battery Pack Prices See Largest Drop Since 2017, Falling to $115 per Kilowatt-Hour. https://about.bnef.com/blog/lithium-ion-battery-pack-prices-see-largest-drop-since-2017-falling-to-115-per-kilowatt-hour-bloombergnef/. Accessed Feb 11, 2025.

should be a straightforward solution to siting more storage. Furthermore, we note that once Units 1 and 2 are retired, a further 1-2 acres will be available based on rough GIS estimates.

Using 62 MWh per acre and 18 acres—the values of a more spatially optimized BESS and the area available in the southern parcel, the proposed site, and the area occupied by Units 1 and 2—we find instead a total energy storage capacity of 1,116 MWh and power capacity of 279 MW. This could provide 80% of the discharge capacity of the proposed project. The DEIR, however, cites values that are 68% lower without sufficient explanation.

Moreover, if the Envision Energy batteries cited above with capacities of 8 MWh per 20 foot container were used in the same configuration as the Megapacks, that could roughly double the capacity of the installation to over 500 MW of four hour storage, higher than the Project capacity of 346 MW. Given the constrained footprint of the parcel, LADWP should consider more ambitious BESS installations rather than the modest value they estimated. The DEIR, moreover, should include the solicitation of proposals from multiple vendors to optimize this capacity in order to properly inform the feasibility of a BESS installation.

Second, we explore the concern of generation capacity. We acknowledge that the generation profile of a BESS is significantly different from that of a CCGS, as a BESS needs to be recharged. However, we note that the 2022 SLTRP includes the need for “significant quantities” of new stand-alone storage. Given the imprecise nature of the first goal, it is difficult to ascertain which type of generation profile is to be expected from this Project. The SLTRP does state that “Even during periods of peak customer demand, model results show that green hydrogen would be rarely dispatched.” This suggests that the broader power system will likely cover future demand and that the proposed Project will be needed primarily for meeting peak demand, for which BESSs are well suited. This also agrees with the “significantly lower” than 25% capacity factor stated in the DEIR. If, however, the Project is expected to provide a much higher capacity factor than described in the DEIR, then a BESS may be insufficient. We discuss in a later section how, through a strategic combination with other resources, the ability of a BESS to meet the stated first objective could be significantly increased.

We wish to add that BESSs incur a significant risk of fire that is not discussed in the DEIR. These fires also include the potential for the release of toxins that can impact local air quality if such a fire does occur, such as the recent BESS fire at Moss Landing. This risk should be adequately addressed and mitigations proposed. However, safety standards have rapidly improved for the developing BESS technologies and the recent fire at Moss Landing was caused by a battery manufactured by LG relying on a different chemistry than the Tesla batteries discussed here.[81]

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[81] Canary Media. (January 2025). Why we don’t need to worry too much about the latest grid battery fire. https://www.canarymedia.com/articles/energy-storage/moss-landing-fire-reveals-flaws-in-the-battery-industrys-early-designs. Accessed Feb 11, 2025.

In addition to meeting the goals outlined in the Project, BESSs provide further strategic advantages listed below, many of which stem from their modular nature.

- We expect lower impacts from construction compared to the Project as the battery fabrication occurs off-site.
- BESSs can be installed and scaled relatively quickly to match the needs of the grid. They can also be upgraded to systems with higher capacity and duration with minimal to no interruption to customers.
- BESSs provide a low risk of stranded costs and low regrets, as they provide a variety of vital services given the increasing proportion of intermittent renewables on the grid and retain significant value at the end of their lifetime.
- BESSs can avoid curtailment of solar and other renewables throughout the year and offset the use of combustion sources all year round, not just when peaks are the highest, and thus maximize the utility of intermittent resources.

Conversely, the proposed Project has a lifetime of 30 years, risking a combination of 30 years of adverse impacts and stranded costs if run at the stated low capacity factors. As such, a BESS has the ability not only to avoid the local impacts from a CCGS, but also provide benefits through reduced impacts from combustion elsewhere throughout the entire year.

iii. Green Hydrogen Powered Fuel Cells

While fuel cells can, in principle, generate firm dispatchable power, the DEIR raises multiple concerns that we largely agree with. They are a technology unproven at this scale with this footprint. Moreover, as with the Project, they would heavily rely on a hydrogen delivery and storage system that also carries local air pollution, safety, and climate risks. These impacts are discussed in **Section 5** above.

iv. Eliminate Vendor B

The DEIR proposes to not use the vendor that has the highest emissions. Otherwise, this alternative seems largely the same according to our study of the DEIR. This alternative is presented as the Environmentally Superior Alternative. Given the high degree of similarity with the Project, choice of an alternative that is more significantly different from the Project as the Environmentally Superior Alternative would provide a much higher degree of differences between impacts.

b. Alternatives Considered But Dismissed from Consideration in the DEIR

The DEIR categorizes the following alternatives as "Considered But Dismissed from Consideration"

i. Increased Demand Side Management

Demand-side management programs were excluded from consideration as LADWP claims they cannot increase beyond the level at which they are pursuing these resources. While demand-side management would certainly be insufficient to meet the goals of the Project, they can play an important component in a suite of resources that supply the same capacity as the Project.

Furthermore, increases in demand-side management are attainable as LADWP can increase the rate of adoption. Moreover, demand-side management, including the investment in resilient back-up resources, would directly address the third Project goal of managing "energy demand in the Scattergood service area, which includes Los Angeles International Airport, Hyperion Water Reclamation Plant, and the western districts of the City of Los Angeles." We discuss this in greater detail in **Section 6c**.

ii. Increased In-Basin Clean Energy Generation

In-basin generation, largely described as distributed resources such as rooftop PV, were excluded from further consideration as LADWP claims they cannot increase beyond the level at which they are pursuing these resources. We agree that it would be challenging to plan an additional level of these resources locally to match the full capacity of the 346 MW of Units 1 and 2. However, in combination with battery energy storage, this resource could be part of an improved alternative. Moreover, incentives, programs, and distribution-side investments have the ability to greatly increase the rate at which generation is deployed on the distribution side. Thus, LADWP can indeed increase the rate at which these are deployed. A large degree of in-basin capacity remains to be installed which, when combined with energy storage, can aid in meeting the goals of the Project. We discuss this in greater detail in **Section 6c**.

iii. New and Upgraded Transmission Lines

LADWP assumes Scattergood must remain online to meet in-basin peak demand in part due to limited transmission capacity into West Los Angeles.[82] However, in previous comments we demonstrated that one of the key transmission lines into the area (Sylmar) is underutilized, with more than 90% of this line's transfer capacity available in the Real Time Pre-Dispatch market on average between August 2023 and August 2024.[83] Exploring ways to take advantage of this existing capacity, for instance through strategically placed renewables and energy storage, would reduce the need for in-basin generation from Scattergood. Advanced reconductoring of other transmission lines[84] whose existing capacity serves as a bottleneck to supplying power that could ultimately flow into the L.A. Basin could also enable LADWP to meet normal peaks in demand using renewable resources from further afield.

Transmission upgrades alone cannot address interruptions in the delivery of out-of-basin renewable energy. But LADWP should have examined whether transmission upgrades paired with strategically sited BESSs of different durations and high levels of local DER could ensure there is enough dispatchable power to cover the rare instances this project would be needed.

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[82] Los Angeles Department of Water & Power. (2024b, March 21). 2024 SLTRP Kickoff Meeting. https://www.ladwp.com/sites/default/files/2024-03/SLTRP%202024%20Overview%20Presentation.pdf.

[83] PSE Healthy Energy. (2024). Comments on LADWP's 2024 Strategic Long-Term Resource Plan Modeling Assumptions. Prepared by PSE Healthy Energy for the Regenerate Coalition.

[84] Chojkiewicz, Emilia, et al. (2024). Accelerating transmission capacity expansion by using advanced conductors in existing right-of-way. *Proceedings of the National Academy of Sciences* 121.40: e2411207121.

c. Discussion of Findings from NREL's Alternatives Assessment

The National Renewable Energy Laboratory (NREL) released a report entitled "Scattergood Modernization Project Alternatives: Summary of Findings" in February 2025 after the initial DEIR comment deadline and drafting of this report. The modeling performed by NREL is key to understanding many of the questions we pose elsewhere in this report regarding the ability of alternatives to meet the demand and resilience needs of the Project. Unfortunately, due to unnecessary constraints on the alternatives under consideration, many of these questions still remain. We update our report in response to NREL's finding below by responding to each finding from their executive summary.

i. **NREL Finding #1:** "*New dispatchable capacity is needed to replace the retiring once-through cooling units at Scattergood.*"

We concur with this finding and the DEIR that new dispatchable capacity is needed. As discussed throughout this report, there are alternatives to the Project such as energy storage that are also able to meet this goal while avoiding the Project's negative impacts.

ii. **NREL Finding #2:** *"New or upgraded transmission does not appear to be a viable alternative by the 2030 requirement."*

We agree that new transmission alone will not be sufficient to replace the capacity at Scattergood. We also agree that "[n]ew transmission typically requires more than 5 years to deploy, meaning it cannot be available by the end of 2029 and therefore is not considered a viable alternative to an in-basin resource." However, in a fair comparison, it is important to state that there is significant risk that the Project will not be fully operational by the end of 2029 given the still-developing nature of the requisite hydrogen infrastructure and supply. This will be further compounded by long lead times for even traditional gas turbines. According to a recent article, "*If you're building a project that involves a gas turbine, the largest manufacturers say you should be talking to your OEMs as long as seven or eight years out.*"[85]

iii. **NREL Finding #3:** "*Energy storage durations required to achieve the same level of reliability are at least 10 hours, resulting in a footprint that exceeds the land available at the Scattergood site.*"

Due largely to the footprint consideration, the NREL report **omits storage dominant alternatives from modeling of cost or reliability.** This omission is unnecessary and severely limits the utility of this analysis. As such, little new information is gained from this report regarding storage except that roughly 21 acres of land are needed for 10-hour lithium-ion storage. Alternatives relying heavily on energy storage are likely among the most cost effective with the least negative impacts. However, due to the omission from modeling based on needlessly strict footprint constraints from LADWP, we lack

[85] Clark, Kevin. Power Engineering. (February 2025). Long lead times are dooming some proposed gas plant projects. https://www.power-eng.com/gas/turbines/long-lead-times-are-dooming-some-proposed-gas-plant-projects/

information about this alternative. Importantly, storage is more established with less risk than the hydrogen alternatives that were, in fact, included in the models. We outline gaps with the analysis LADWP requested from NREL both in the bullets below and elsewhere throughout this section.

- The parcel size was unnecessarily constrained. According to the DEIR, the southern parcel size is 15 acres with 1.5 acres under lease for oil-drilling facilities. The DEIR already reduced these 13.5 acres by 6.5 acres to 7 acres because of "excess soil from previous construction activities" stored there. Reserving 6.5 acres in the LA basin for the storage of excess soil is not a wise usage of land. The NREL report goes further to limit the area from 7 acres down to 6 acres because of the parcel's shape, which was likely already accounted for in the DEIR. As such, in total, the NREL report limits the parcel availability to just 9 acres (3 acres on the proposed site and 6 acres on the southern parcel). In **Section 6.a.ii**, we instead estimate that there could be up to 18 acres in total available for this project, nearly equal to the 21 acres the NREL reports is needed.
- The areal density (MW/acre) of storage was constrained to estimates from existing installations. However, this constraint was not applied to the fuel cell alternative. If it had been, this alternative would also have been eliminated from consideration. NREL also includes substation-related equipment in their footprint estimates, which they acknowledge may be redundant as it is also required by the proposed Project and not included in the Project's allocated footprint. We note that there are at least three straightforward alternatives to drastically increase the areal density of the storage. **Any one of these three feasible alternatives could be sufficient to site storage for which NREL reports 21 acres is needed.**
    1. Use recently demonstrated lithium batteries that have roughly doubled the energy available per battery storage unit (see **Section 6.a.ii** for more details).
    2. Lease land at adjacent parcels for storage (see **Section 6d** for more details). NREL's report identifies the challenge of "significant uncertainty around the amount of time and process required to locate, obtain full site control and conduct environmental reviews on additional land located near Scattergood." However, we note that the Project also has significant uncertainty around environmental reviews, especially regarding the pipeline construction or upgrades required to transport hydrogen to Scattergood from outside of the LA basin.
    3. Stack battery units on top of each other. This alone could potentially double the amount of energy storage available. Stacked storage units have already been demonstrated (photo right[86] as an example).

[86] Lempriere, Molly (August 3, 2022). Current. Limejump begins optimising Voltalia's 32MW Hallen battery.

- Due to the omission from PLEXOS modeling, cost considerations of energy storage are not up to date. The NREL report states that "[t]he original LA100 study found battery storage technologies that could be sited at Scattergood were an uneconomic alternative compared to renewably fueled combustion turbines for replacing all the services provided by the existing Scattergood OTC unit." However, they go on to state that "[s]ince the publication of the LA100 study [in March 2021], there have been both considerable deployment of Li-ion batteries and continued reductions in cost." Due to the omission of energy storage from cost modelling of the Project and possible alternatives, however, we cannot know the economics of storage in this case. However, we can speculate that, given the many completed and in-progress installations, storage may now be a cost-competitive technology compared to the Project.

iv. **NREL Finding #4:** "*Fuel cells using 100% green hydrogen are unlikely to be a viable alternative to SMP by 2030. Fuel cells using hydrogen/natural gas blends may be a technically viable alternative but at a significantly higher cost premium and will face increased technical and operational risk/uncertainty.*"

We agree that a fuel cell alternative faces great uncertainty. This is due both to the ability to construct a fuel cell at this scale and the ability to access the requisite amount of hydrogen, an uncertainty also faced by the Project. Moreover, we find it surprising that the fuel cell alternative passed the screening process for construction by the end of 2029 given the substantial number of technical hurdles needed to overcome a project of this scale as outlined by NREL.

v. **NREL Finding #5:** "*Demand response, as a stand-alone alternative, does not appear to be available in sufficient quantity in the area near the Scattergood site.*"

We agree demand response alone is not sufficient. However, demand response can provide critical additional megawatts of capacity in the event of emergency grid conditions and should be considered as an incremental capacity resource for a hybrid alternative to the Project.

vi. **NREL Finding #6:** "*Combination options can reduce the cost premium of the alternatives but are still likely more expensive and do not eliminate significant technology risks.*"

We appreciate that NREL considered pairings of resources. Unfortunately, the report only considered two combinations, both with fuel cells. For the combination with storage, NREL indicates that "the combination would reduce the high cost of fuel cells," particularly as "the battery has lower capital costs per unit of capacity compared to the fuel cell. The storage is also potentially eligible for the investment tax credit." Limiting alternatives solely to options dominated by fuel cells is not sensible. An alternative of combined demand response and storage, both of which are well established and rapidly progressing technologies, is not considered. This is due, again, to the artificial footprint constraint discussed above. As such, the report lacks critical information about the economics of an alternative that is dominated by storage but supplemented by demand response.

To better inform an assessment of the alternatives, we ask that LADWP consider scenarios where the full capacity of the Project can be met with storage alongside another scenario where the majority is met with storage with a smaller portion of capacity met with demand response. These scenarios should be run through the PLEXOS model with comparisons made both with alternatives and the Project itself. Moreover, these results should be framed to answer potential concerns NREL identified regarding reliable operations with energy storage given possible charging constraints during periods of extreme peak demand, as well as possible cost savings from energy storage as "operational savings associated with the battery (per unit of capacity) are substantially higher than with [the Project] due to the ability to [sic] the battery to charge with lower cost energy." This data would then help inform whether reliance on more proven alternatives without negative impacts can also be cost effective. If so, more effort should be put into determining the feasibility of the strategies above to increase the potential of these alternatives with feedback from vendors. As the DEIR and this report stands currently, many questions still remain.

d. Suggested Alternative: Energy Storage and Demand-Side Hybrid

An alternative not explored in the DEIR is a combination of a BESS and local demand-side resources. For this alternative, we limit consideration solely to assets in the vicinity of Scattergood to avoid the complexity of the full LADWP grid. Even with this limitation, we find a viable suite of assets that can meet the stated goals with existing technology and avoid the impacts of the Project. These resources are summarized in **Table 7** below. While the additional potential of each asset requires further investigation, we note that only a subset of these assets is needed to provide the stated 346 MW which provides redundancy in case one or more of these solutions are not viable.

Table 7: Summary of proposed resources in suggested alternative

Local Resource	Resource Summary
On-site BESS	Roughly 280 MW to 550 MW of 4-hour storage may be possible using optimized storage as discussed in **Section 6.a.ii**. These resources would directly use the interconnection access at Scattergood.
Adjacent site BESS	In addition to the availability of up to 18 acres at Scattergood, Hyperion, a water reclamation facility, and Los Angeles International Airport (LAX) are adjacent sites with footprints of 144 and 3,500 acres respectively. Land could be leased at these sites for BESS that could provide resilience for these critical loads. Using only one percent of the land at Hyperion could provide 20-40 MW of 4-hour storage (80-160 MWh respectively) using the two density estimates discussed above. Using only one percent of the land at LAX for iron-air BESS could provide 100 MW of 100 hour storage or 10,000 MWh of energy storage. Use of a blend of storage durations can build resilience to a broader set of scenarios. Given the close proximity, these BESSs could feasibly use the interconnection access at Scattergood.
Local demand management	Local buildings and facilities can shift operations in order to reduce the peaks in power demand the Project is designed to provide power for. For example, Hyperion has a load of 19 MW. LAX has a load that is significantly higher although it already uses technology to shift some of its HVAC power consumption to lower-cost hours. Loads from EVs that motivate much of the expected load growth are also flexible. It is difficult, however, to quantify the additional capacity possible beyond the assumptions made in the LA100 study that motivate the Project goals without more data.
Local demand-side generation	Increases in local solar+storage can help build resilience and charge batteries. LAX has "a possible capacity of up to 23.5 megawatts of power"[87] which was not accounted for in the underlying LA 100 study, and Hyperion could also site 6 MW of solar using just 5% of its site. Substantially more is possible on nearby homes, commercial buildings, and parking lots. It is difficult, however, to quantify the additional capacity possible beyond the assumptions made in the LA100 study that motivate the Project goals without more data.

Below, we elaborate on each of the resources summarized in **Table 7**.
On-site BESS is discussed in more detail in **Section 6.a.2**. above in the Energy Storage section.

Adjacent-site BESS can help fill gaps in storage, providing a combination of longer-duration or increased capacity while also providing resilience for substantial critical loads. Adjacent to Scattergood is the Hyperion Water Reclamation Site[88] (shown directly north of Scattergood in **Figure**

[87] Los Angeles World Airports. (April 2020). LAX at a Glance: Sustainability. https://www.flylax.com/-/media/flylax/media-center/pdfs/fs---sustainability-april-2020. Accessed Feb 11, 2025.
[88] King County Department of Natural Resources and Parks. Appendix D Overview of Treatment Plants and Processes.

4), the city's largest wastewater treatment facility with a footprint of 144 acres. No physical barriers separate the two, thus minimizing any barriers to facilitating connection. LADWP could lease space on Hyperion's larger footprint to site solar and storage systems. Just four acres of this land would be enough to site the remaining storage needed to meet the capacity of the proposed system using the lower density assumed above of 62 MWh per acre and 18 acres available at Scattergood. This system would also provide enough capacity to run Hyperion at full load for over four hours in the event of an outage.

Adjacent to Hyperion is Los Angeles International Airport (LAX) on a drastically larger parcel of 3,500 acres (**Figure 4**). One road and Hyperion separates LAX from Scattergood, making direct connection to the transmission grid potentially feasible. LADWP could lease land here for siting storage that can also be used to provide backup energy resilience at LAX. Moreover, given that outages at LAX have led to flight cancellations and lost revenue[89], the risk of such outages can be reduced with a BESS. The drastically larger footprint would be ideal for siting BESS with longer durations and reduced fire risk but rated with lower discharge power such as the iron flow batteries with duration of up to 12 hours or the iron-air batteries with durations of 100 hours listed in **Section 6.a.2**. Using FORMs iron-air batteries, only one percent of the parcel would be needed to provide 100 hours of 100 MW generation. Such a BESS, in combination with shorter duration on-site storage, would provide significantly higher resilience to longer-duration disruptions to the grid in alignment with the Project objectives.

89 CNN. Power outage at LAX airport leaves travelers stranded as airlines cancel flights. June 6, 2019.

Figure 4. Scattergood and Adjacent Facilities. Approximate boundaries of Project site and adjacent Hyperion Water Treatment facility and Los Angeles International Airport (LAX). Satellite imagery data from Google Maps.

Local demand-side management. Peak load for Hyperion is roughly 19 MW.[90] Previously, Hyperion used a cogeneration gas combustion system for electricity using biogas collected from wastewater.[91] However, LADWP and Hyperion switched to an agreement where Hyperion sends biogas to Scattergood in order to earn an improved rate.[92] This existing relationship between these two entities can be built upon to maximize the potential role of using Hyperion's assets and load to meet power needs. There are multiple potential alternatives LADWP could explore to reduce the peak demand from Hyperion. First, the existing agreement could switch from the current flat rate to a time-of-use rate that would encourage shifts in demand. Second, they could set an incentive for demand response which would pay Hyperion for intervals of reduced demand. Many potential options exist for water treatment facilities for municipal utilities to shift the time of their power consumption.[93] These efforts could result in financial savings for both parties and thus savings for utility customers. When combined with a BESS and/or solar system, even greater mutually beneficial opportunities can be achieved.

LAX represents an even larger load than Hyperion. From 2017-2021, LAX used an average of 175 GWh annually.[94] While peak load data could not be found, this annual consumption indicates a peak load significantly larger than 20MW. Some generation happens on site and the upgrade to the Central Utility Plant has already developed demand flexibility, which means a portion of the additional potential for shifting demand has already been realized.[95] However, additional shifting may be possible and provide additional incentive to house BESS and solar systems.

Local in-basin distributed generation can also help reduce demand and provide energy to the above proposed BESS. For example, renewables at LAX are currently limited and under active development, including installation of the first solar system of 75 kW in 2021 at the airport police facility.[96] Moreover, Los Angeles World Airports "is exploring on-site power generation at LAX, with a feasibility study

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[90] King County Department of Natural Resources and Parks. Appendix D Overview of Treatment Plants and Processes. https://your.kingcounty.gov/dnrp/library/wastewater/wtd/pubs/9912Benchmarking/om-appx-d.pdf. Accessed Feb 11, 2025.
[91] ibid
[92] ibid
[93] Lima, Derick, Li Li, and Gregory Appleby. (2024). A Review of Renewable Energy Technologies in Municipal Wastewater Treatment Plants (WWTPs). *Energies* 17.23 (2024): 6084.
[94] Los Angeles World Airports. (n.d.) Sustainability Elements: Energy Management. https://www.lawa.org/lawa-sustainability/sustainability-elements-energy. Accessed February 4, 2025.
[95] Los Angeles World Airports. (2015) LAX Central Utility Plant Fact Sheets. https://www.lawa.org/UI/Lawa/Assets/Sustainability_LAX_files/documents/LAX-Central-Utility-Plant-Fact-Sheets.pdf. Accessed February 4, 2025.
[96] ibid.

suggesting a possible capacity of up to 23.5 megawatts of power".[97] To our knowledge, this capacity is not accounted for in either the LA100 study or the SLTRP. As such, demand-side management through a combination of increased solar, proposed BESS, and the existing generation can minimize demand or even provide power directly to Scattergood while also providing financial savings for both the airport and LADWP. Moreover, these increased energy systems at LAX would provide essential energy resilience to the airport and potentially offset emissions from their current gas generation, thus reducing negative climate and health impacts from LAX.

Furthermore, a survey of nearby clusters of other commercial buildings reveal that the vast majority of commercial rooftops currently do not house solar systems. More research is needed regarding the expected rates of solar deployment in the area and what the cost would be to increase the speed of this deployment even further.

In summary, given this suite of available resources, we recommend the addition of an alternative described as a hybrid BESS/demand-side resource investment. This resource should be informed by the inclusion of estimates of dense BESS deployment from multiple vendors for the existing parcel. It should also include considerations of the major loads being served in the immediate proximity and distributed resources including solar+storage and demand flexibility in West LA more broadly. Importantly, this alternative does not rely on additional capacity from the transmission upgrades discussed above or the non-local alternatives discussed below.

Our estimates suggest that, in contradiction to the DEIR, significantly higher levels of local potential energy resources exist and merit further consideration. This alternative, not included in the DEIR, avoids the impacts of the Project discussed both in the DEIR and in the above sections of this report while further reducing existing impacts. Moreover, these resources can simultaneously provide additional benefits including community and operational resilience for critical facilities and grid balancing services. As such, we believe this option is likely environmentally superior to both the proposed project and the proposed Environmentally Superior Alternative of choosing another vendor for the Project.

e. Non-local Alternatives Not Discussed

LADWP states that in-basin generation is key to building a resilient power system in both the LA100 study and the SLTRP. While we agree, there are alternatives to gas/hydrogen combustion that were not fully considered in these proposals. Moreover, since those proposals were written, the cost and feasibility of these alternatives have shifted. While beyond the scope of this analysis, we note that

[97] Los Angeles World Airports. (April 2020). LAX at a Glance: Sustainability. https://www.flylax.com/-/media/flylax/media-center/pdfs/fs---sustainability-april-2020. Accessed Feb 11, 2025.

further alternatives beyond the Scattergood area studied exist. We quote from our previous study below.[98]

> *While a full analysis of alternatives to the repowering Scattergood with hydrogen is beyond [the] scope [of] this report, we will note a few technologies that were not fully considered in the SLTRP. For example, LADWP did not fully consider long-duration energy storage technologies, which are also under development but are beginning to build real-world demonstration projects (CEC, 2023c).[99] One study has suggested that all of California's gas plants could be replaced with long-duration energy storage (Go et al., 2023).[100] While these projects will certainly face scale and deployment challenges, much like hydrogen, they should be included in the potential resource deployment mix as candidates for helping reach peak demand. In addition, LADWP did not fully explore the potential for demand management—in particular, utilizing the rapidly electrifying vehicle fleet—to mitigate peak demand. Finally, the state is rapidly moving forward with offshore wind, including sites off the coast of Southern California, which tend to have the highest wind speeds on summer evenings, which aligns relatively well with LADWP's identified time of projected peak demand (Wang et al., 2019;[101] Musial et al., 2016;[102] LADWP, 2022a[103]). It would be valuable to model the impact of integrating this offshore wind supply into LADWP's modeling to identify its impacts on LADWP's identified need for in-basin hydrogen combustion.*

f. Summary of Alternatives

Alternatives to the proposed project exist that do not share the same negative climate, environmental, health, and safety risks while simultaneously mitigating existing impacts.

We recommend that LADWP explore in greater depth an alternative entailing on-site BESS to match the majority or all of the generation capacity that is supplemented by solar and storage sited at neighboring facilities, local load flexibility, and distributed resources including solar+storage. In

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98 PSE Healthy Energy. (2024). Green Hydrogen Proposals Across California. https://www.psehealthyenergy.org/wp-content/uploads/2024/05/Green-Hydrogen-Proposals-Across-California.pdf.

99 California Energy Commission. (December 13, 2023). "CEC Awards $30 Million to 100-Hour, Long-Duration Energy Storage Project". https://www.energy.ca.gov/news/2023-12/cec-awards-30-million-100-hour-long-duration-energy-storage-project. Accessed Feb 11, 2025.

100 California Energy Commission. (Dec 2023). Assessing the Value of Long-Duration Energy Storage in California. https://www.energy.ca.gov/sites/default/files/2024-01/CEC-500-2024-003.pdf.

101 Wang, M., et al. (2022). Power Generation and Mechanical Drivers. *Machinery and Energy Systems for the Hydrogen Economy*, 426-427. https://www.sciencedirect.com/science/article/abs/pii/B9780323903943000060

102 Wang, Y. H., Walter, R. K., White, C., Farr, H., & Ruttenberg, B. I. (2019). Assessment of surface wind datasets for estimating offshore wind energy along the Central California Coast. *Renewable energy*, *133*, 343-353.

103 Los Angeles Department of Water and Power. (2022). 2022 Power Strategic Long-Term Resources Plan. https://www.ladwp.com/sites/default/files/2023-08/2022%20LADWP%20Power%20Strategic%20Long-Term%20Resource%20Plan_0.pdf

relation to goal (1), this alternative will provide not only resilience for the grid by serving peak loads, it will also provide resilience for vulnerable populations and critical loads. In relation to goal (2), the resources can be strategically used to be available when needed and the use of a mixture of resources will allow for greater resilience. Storage will need to be charged, but these loads are regularly anticipated and storage can be charged in advance and recently demonstrated technologies have drastically increased both the density and the duration of BESSs. In relation to goal (3), this alternative will provide a greater level of services to the large nearby loads and also additional grid balancing services that a CCGS cannot. In relation to goal (4), this alternative will provide much greater emissions reductions than a CCGS. A more thorough consideration of this proposed hybrid alternative, built on these more established technologies, should be performed before choosing the ideal alternative.

7. Summary

We find that the Project will have negative impacts, not all of which are sufficiently addressed in the DEIR. We further find that alternatives to the Project that could meet the outlined goals while avoiding negative impacts were not sufficiently investigated or were underestimated. We suggest an increased survey of the impacts described above and a more thorough investigation of low-regrets alternatives that avoid these impacts.