Proposed Amended Rule 1135

Emissions of Oxides of Nitrogen from Electricity Generating Facilities

Working Group Meeting #5

March 27, 2024

Join Zoom Webinar Meeting: https://scaqmd.zoom.us/j/94648515982

Webinar ID: 946 4851 5982

Teleconference Dial-In: 1-669-900-6833

Agenda

- Summary of Rulemaking Activities Since the Last Working Group Meeting
- Overview of Electric Generating Equipment at Pebbly Beach Generating Station
- Southern California Edison (SCE) Grid Stability Study
- Response to SCE's Propane Availability Analysis Comment Letter
- SCE Proposed Rule Language
- Particulate Matter 2.5 (PM 2.5) Air Quality Management Plan (AQMP) and Updates to BARCT Assessment
- Next Steps

Summary of Rulemaking Activities Since the Last Working Group Meeting

- Public Workshop held on February 22, 2023
  - Discussed preliminary draft rule language
  - Shared results of some impact assessments, including the cost-effectiveness and incremental cost-effectiveness analysis
- Staff received SCE's Grid Stability Study on September 29, 2023
- Staff provided SCE with a propane availability analysis
  - In response, SCE provided a propane availability analysis comment letter on January 4, 2024
- SCE's Grid Stability Study and comment letter are posted on the PAR 1135 proposed rules webpage*

*https://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book/proposed-rules/rule-1135/comment-letters

Overview of Electric Generating Equipment at Pebbly Beach Generating Station (PBGS)

- Over 90% of the power generated at PBGS is from diesel engines
  - The diesel engines range from 29 to 66 years in age
- PBGS NOx emissions account for more than 10% of NOx emissions from all electricity generating facilities in South Coast AQMD, while providing less than 0.06% of the power***
- NOx emissions from PBGS diesel engines are between 10 to 70 times more than other electric generating units subject to Rule 1135

Equipment	Rating (MW)	Construction Year	NOx Emissions (ppmv)
PBGS Unit 7	1	1958	97*
PBGS Unit 8	1.5	1964	97*
PBGS Unit 10	1.125	1968	140*
PBGS Unit 12	1.5	1976	82*
PBGS Unit 14	1.4	1985	103*
PBGS Unit 15	2.8	1995	51*
Rule 1135 Boilers	-	-	5**
Rule 1135 Combined Cycle Gas Turbines	-	-	2*
Rule 1135 Simple Cycle Gas Turbines	-	-	2.5*

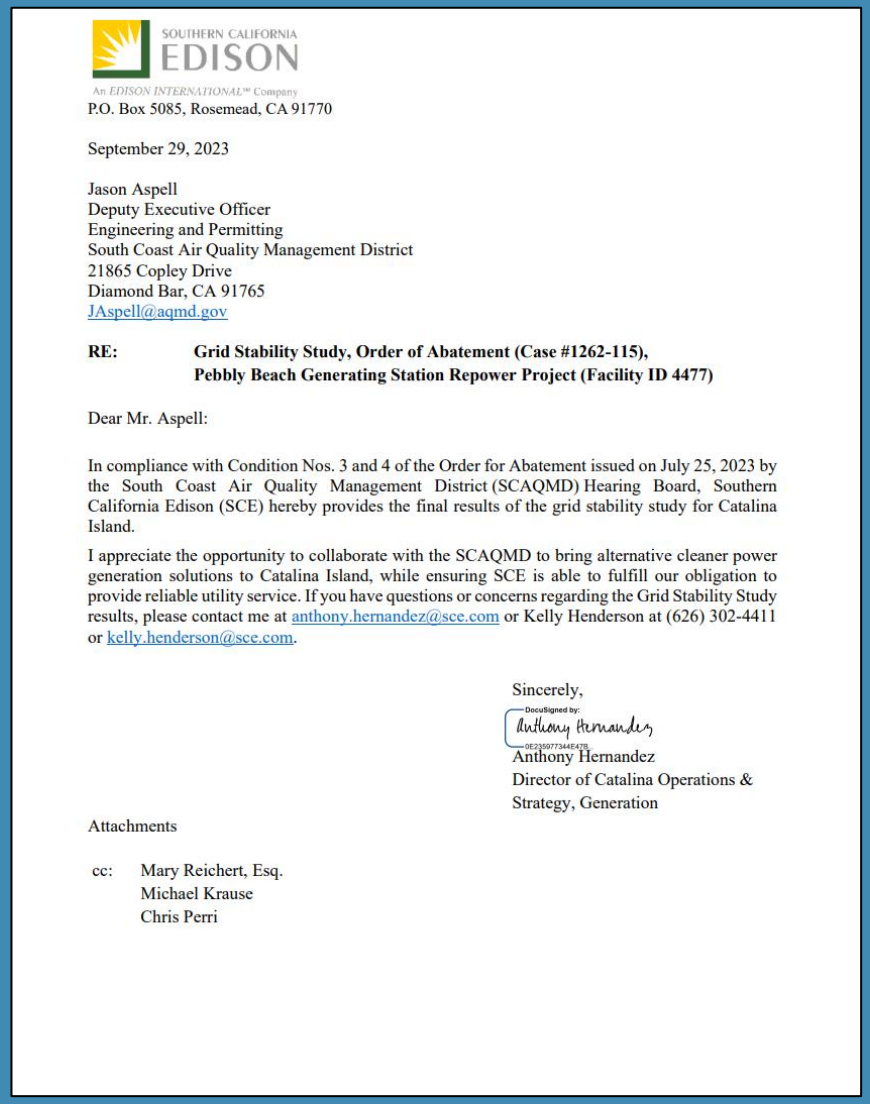
*15% oxygen, dry
** 3% oxygen, dry

***Based on the Final Staff Report for the 2018 amendment to Rule 1135 (9 MWh/15,904 MWh and 0.2 tpd/1.9 tpd)

SCE Grid Stability Study

Summary of SCE's Grid Stability Study

- SCE's Grid Stability Study expressed their perspective that:
  - A minimum of three Tier 4 final diesel engines are necessary
  - SCE must retain existing diesel engines to serve as backup
  - The maximum annual amount of propane available for power generation is 400,000 gallons due to fire suppression regulations and concerns from the City of Avalon Fire Chief
  - Propane-fueled inverter-based resources could supply up to 14% of annual energy production
  - Solar generation at the Middle Ranch site could provide nearly 30% power annually and approximately 70% instantaneously



SOUTHERN CALIFORNIA EDISON
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P.O. Box 5085, Rosemead, CA 91770

September 29, 2023

Jason Aspell
Deputy Executive Officer
Engineering and Permitting
South Coast Air Quality Management District
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Diamond Bar, CA 91765
JAspell@aqmd.gov

RE: Grid Stability Study, Order of Abatement (Case #1262-115), Pebbly Beach Generating Station Repower Project (Facility ID 4477)

Dear Mr. Aspell:

In compliance with Condition Nos. 3 and 4 of the Order for Abatement issued on July 25, 2023 by the South Coast Air Quality Management District (SCAQMD) Hearing Board, Southern California Edison (SCE) hereby provides the final results of the grid stability study for Catalina Island.

I appreciate the opportunity to collaborate with the SCAQMD to bring alternative cleaner power generation solutions to Catalina Island, while ensuring SCE is able to fulfill our obligation to provide reliable utility service. If you have questions or concerns regarding the Grid Stability Study results, please contact me at anthony.hernandez@sce.com or Kelly Henderson at (626) 302-4411 or kelly.henderson@sce.com.

Sincerely,

DocuSigned by:
Anthony Hernandez
0E23597734E47B...

Anthony Hernandez
Director of Catalina Operations & Strategy, Generation

Attachments

cc: Mary Reichert, Esq.
Michael Krause
Chris Perri

Repower Scenarios for the Grid Stability Study

- SCE evaluated 22 repower scenarios in the Grid Stability Study
  - SCE created 20 repower scenarios, all of which contained three Tier 4 final diesel engines and three legacy diesel engines
  - Staff provided SCE with two repower scenarios to evaluate, including a scenario with parameters aligned with the final proposed BARCT limit of 65% near-zero emission (NZE) technology, 30% zero-emission (ZE) technology, and 5% Tier 4 final diesel engines
- After an initial screening, SCE removed 12 of their proposed repower scenarios citing that:
  - Eight scenarios included a quantity of propane "impossible to accommodate" without a fourth propane tank
  - One included a propane reciprocating engine ("dismissed in favor of the greater operational flexibility of the propane linear generators")
  - Three either had no solar farm or a solar farm without paired energy storage

#	Details	Outcome
5	• Retain existing battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 750,000-gallon annual supply)	Eliminated
6	• Retain existing battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 750,000-gallon annual supply) • Solar farm (no battery)	Eliminated
7	• Retain existing battery at PBGS • Five 250 kW propane linear generators (with 750,000-gallon annual supply)	Eliminated
8	• Retain existing battery at PBGS • Five 250 kW propane linear generators (with 750,000-gallon annual supply) • Solar farm (no battery)	Eliminated
9	• Upgrade battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 400,000-gallon annual supply)	Eliminated
10	• Upgrade battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 400,000-gallon annual supply) • Solar farm (no battery)	Eliminated
11	• Upgrade battery at PBGS • Five 250 kW propane linear generators (with 400,000-gallon annual supply)	Eliminated
12	• Upgrade battery at PBGS • Five 250 kW propane linear generators (with 400,000-gallon annual supply) • Solar farm (no battery)	Eliminated
13	• Upgrade battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 750,000-gallon annual supply)	Eliminated
14	• Upgrade battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 750,000-gallon annual supply) • Solar farm (no battery)	Eliminated
15	• Upgrade battery at PBGS • Five 250 kW propane linear generators (with 750,000-gallon annual supply)	Eliminated
16	• Upgrade battery at PBGS • Five 250 kW propane linear generators (with 750,000-gallon annual supply) • Solar farm (no battery)	Eliminated

Results of SCE's Grid Stability Study

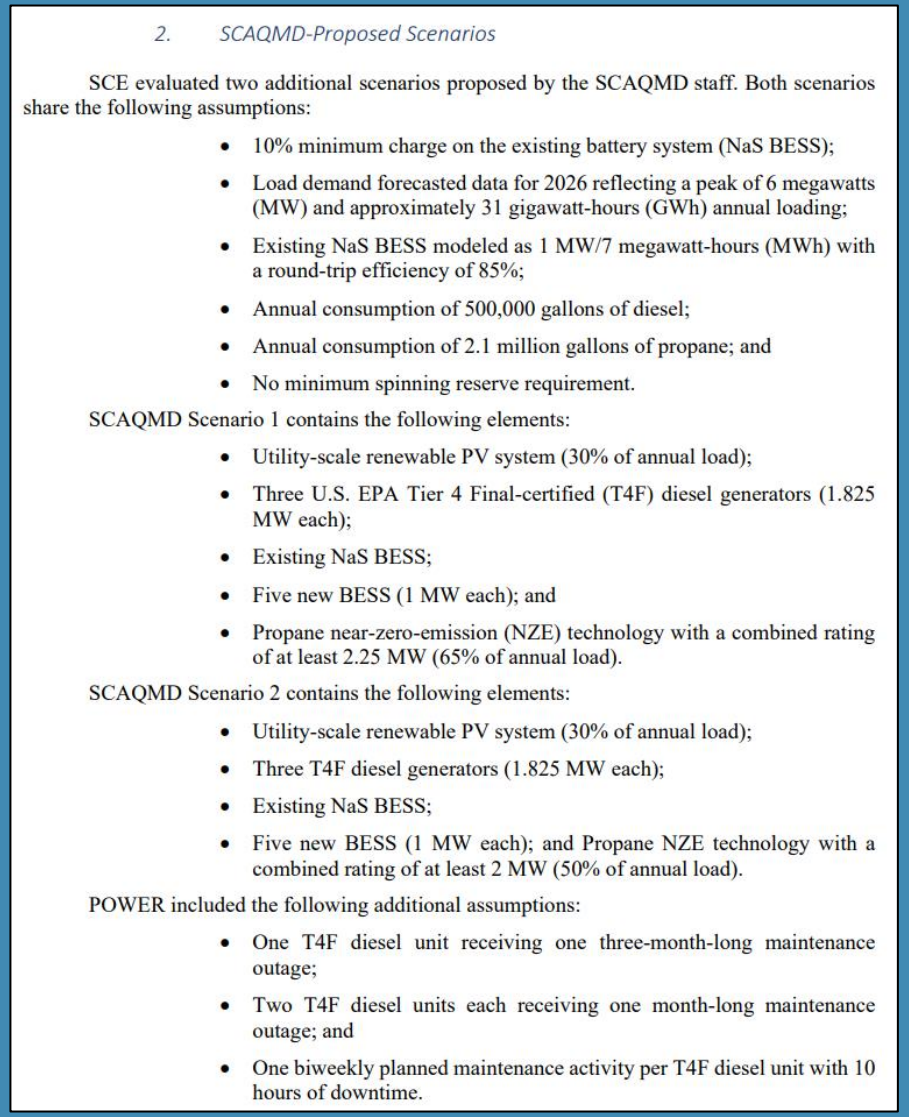
- SCE stated that staff's repower scenarios did not pass the grid stability analysis due to insufficient power generation
- Only two of SCE's repower scenarios (Scenarios #3 and #4b) were determined to provide sufficient power generation and grid stability
- SCE stated that linear generators showed similar improvement in rate of change of frequency* to adding a second Tier 4 final diesel generator
- The most stringent repower scenario evaluated that passed SCE's Grid Stability Study (Scenario #4b) consisted of:
  - Three Tier 4 final diesel engines
  - Three legacy diesel engines
  - Five 250kW propane-fueled linear generators (capped at 400,000 gallons of propane per year)
  - Solar farm with battery
  - Upgrading the existing battery
- SCE Scenario #4b would result in approximately 10 tons per year (tpy) NOx

#	Details	Outcome
1	• Retain existing battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 400,000-gallon annual supply)	Completed HOMER but excluded from further analysis
2	• Retain existing battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 400,000-gallon annual supply) • Solar farm (no battery)	Modified and rerun as No. 2(a)
2a	• Retain existing battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 400,000-gallon annual supply) • Solar farm with battery	Modified and rerun as No. 2(b)
2b	• Upgrade battery at PBGS • One 2.097 MW prime-rated propane reciprocating generator (with 400,000-gallon annual supply) • Solar farm with battery	Completed HOMER but excluded from further analysis
3	• Retain existing battery at PBGS • Five 250 kW propane linear generators (with 400,000-gallon annual supply)	Completed HOMER and advanced to PSCAD & CYME analysis
4	• Retain existing battery at PBGS • Five 250 kW propane linear generators (with 400,000-gallon annual supply) • Solar farm (no battery)	Modified and rerun as No. 4(a)
4a	• Retain existing battery at PBGS • Five 250 kW propane linear generators (with 400,000-gallon annual supply) • Solar farm with battery	Modified and rerun as No. 4(b)
4b	• Upgrade battery at PBGS • Five 250 kW propane linear generators (with 400,000-gallon annual supply) • Solar farm with battery	Completed HOMER and advanced to PSCAD & CYME analysis

*SCE Grid Stability Study states that the rate of change of frequency of generation resources is used as a means of evaluating frequency stability

Staff's Response to the Grid Stability Study

- The proposed final BARCT limit accounts for three Tier 4 final engines in the event propane cannot be delivered
- Existing diesel fuel storage provides 30-days of fuel reserve
- Staff disagrees that three legacy diesel engines must be retained, as cleaner alternatives are available
- Staff disagrees that the maximum amount of propane for power generation is 400,000 gallons per year
  - SCE confirmed that there are no fire code regulations that prevent additional propane deliveries
  - Based on the barge schedule and propane tanker capacity, over 2,300,000 gallons of propane can be delivered annually
- SCE has not provided evidence showing that staff's proposed final BARCT limit is technologically infeasible
  - SCE evaluated the minimum megawatts for NZE technology specified in staff's requests and then stated that insufficient power generation was the reason the scenarios failed
  - Other combinations of technologies (e.g. fuel cells) with higher megawatt ratings could have been evaluated but were not



2. SCAQMD-Proposed Scenarios

SCE evaluated two additional scenarios proposed by the SCAQMD staff. Both scenarios share the following assumptions:

- 10% minimum charge on the existing battery system (NaS BESS);
- Load demand forecasted data for 2026 reflecting a peak of 6 megawatts (MW) and approximately 31 gigawatt-hours (GWh) annual loading;
- Existing NaS BESS modeled as 1 MW/7 megawatt-hours (MWh) with a round-trip efficiency of 85%;
- Annual consumption of 500,000 gallons of diesel;
- Annual consumption of 2.1 million gallons of propane; and
- No minimum spinning reserve requirement.

SCAQMD Scenario 1 contains the following elements:

- Utility-scale renewable PV system (30% of annual load);
- Three U.S. EPA Tier 4 Final-certified (T4F) diesel generators (1.825 MW each);
- Existing NaS BESS;
- Five new BESS (1 MW each); and
- Propane near-zero-emission (NZE) technology with a combined rating of at least 2.25 MW (65% of annual load).

SCAQMD Scenario 2 contains the following elements:

- Utility-scale renewable PV system (30% of annual load);
- Three T4F diesel generators (1.825 MW each);
- Existing NaS BESS;
- Five new BESS (1 MW each); and Propane NZE technology with a combined rating of at least 2 MW (50% of annual load).

POWER included the following additional assumptions:

- One T4F diesel unit receiving one three-month-long maintenance outage;
- Two T4F diesel units each receiving one month-long maintenance outage; and
- One biweekly planned maintenance activity per T4F diesel unit with 10 hours of downtime.

Updated Slide

CEQA Comment vs. Grid Stability Study

- SCE sent a comment letter to South Coast AQMD's California Environmental Quality Act team on November 17, 2023
- Although SCE's own Grid Stability study concludes that implementing NZE and ZE technology at PBGS is technologically feasible, the comment letter states that:

> *"SCE currently does not have any long-term or short-term plans outside of the current proposal to replace the existing Units 8, 10, and 15 with newer T4F units."*

- Based on historical and projected electricity demand, SCE will not be in compliance with either the proposed or existing final BARCT emission limits in Rule 1135 with their current proposal
  - The final BARCT limit in Rule 1135 is currently 13 tpy NOx, while SCE's proposal is estimated to result in over 25 tpy NOx
  - SCE is already under an Order for Abatement for non-compliance with Rule 1470

Response to Comment Letter

Updated Slide

Background on Propane Availability Analysis

- Staff provided SCE with a propane availability analysis to demonstrate that the existing propane storage infrastructure is sufficient to implement the proposed final BARCT scenario
  - There are approximately 3 days of propane storage at the average capacity of 67%
- SCE wrote a comment letter in response to staff's propane availability analysis which concluded that:
  - SCE does not support increasing the annual propane usage for power generation beyond 400,000 gallons
  - Staff's analysis does not account for operational and logistical constraints
- Staff will respond to each of SCE's comments in the following slides
- SCE is reviewing and considering opportunities in increasing propane throughput

Figure 12. *SCAQMD's Propane Calculation (provided December 5, 2023)*

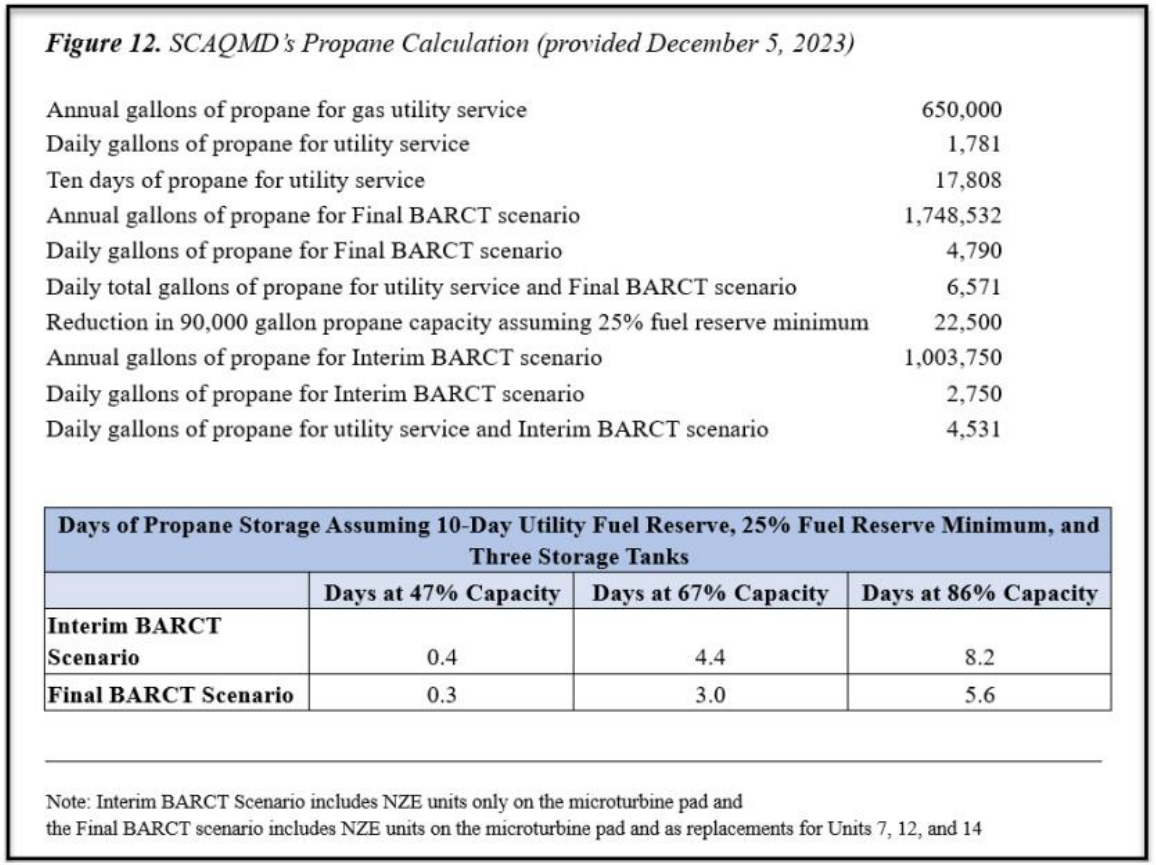


Figure 12. *SCAQMD's Propane Calculation (provided December 5, 2023)*

Annual gallons of propane for gas utility service	650,000
Daily gallons of propane for utility service	1,781
Ten days of propane for utility service	17,808
Annual gallons of propane for Final BARCT scenario	1,748,532
Daily gallons of propane for Final BARCT scenario	4,790
Daily total gallons of propane for utility service and Final BARCT scenario	6,571
Reduction in 90,000 gallon propane capacity assuming 25% fuel reserve minimum	22,500
Annual gallons of propane for Interim BARCT scenario	1,003,750
Daily gallons of propane for Interim BARCT scenario	2,750
Daily gallons of propane for utility service and Interim BARCT scenario	4,531

Days of Propane Storage Assuming 10-Day Utility Fuel Reserve, 25% Fuel Reserve Minimum, and Three Storage Tanks			
	Days at 47% Capacity	**Days at 67% Capacity**	**Days at 86% Capacity**
Interim BARCT Scenario	0.4	4.4	8.2
Final BARCT Scenario	0.3	3.0	5.6

Note: Interim BARCT Scenario includes NZE units only on the microturbine pad and the Final BARCT scenario includes NZE units on the microturbine pad and as replacements for Units 7, 12, and 14

SCE Obligations and Propane Tank Limitations

Comment	Response
SCE is obligated to serve Catalina with critical utilities and must prioritize distribution of propane to gas customers	Staff's propane availability analysis incorporates a 10-day utility fuel reserve and used the same gas utility assumption as SCE (650,000 gallons annually)
The fourth propane tank cannot be returned to service due to fire code restrictions	Staff's propane availability analysis does not include the fourth propane tank
Propane tank levels must be kept between 25% and 86% full	Staff's propane analysis incorporated a 25% fuel reserve minimum and an 86% fill maximum
The tanks are interconnected, resulting in a maximum aggregate tank capacity of approximately 83%	Staff can update the propane availability analysis to include a maximum fill volume of 83%

Propane Tank Temperature and Maintenance Impacts

Comment

Tank levels are further restricted by pressure, temperature, and periodic maintenance needs

Response

- Staff's propane availability analysis includes days of propane storage at the lowest known maximum fill of 47% due to extreme heat, the average fill of 67%, and the maximum fill of 86%
- SCE data regarding temperature impacts on propane tank fill did not demonstrate the need to adjust the BARCT limits
  - No correlation between temperature and tank fill (R^2<0.009)
  - According to SCE provided data, over the past 5 years, the highest temperature for any tank was 73°F and it was filled to 60% capacity
    - Tank fill of 60% capacity results in two days of fuel storage for the proposed final BARCT limit
- Staff will update PAR 1135 to include an adjusted BARCT limit during propane tank maintenance events
  - Internal tank inspections require tanks to be drained and occur every 10 years

Updated Slide

Propane Fuel Reserve and Maximum Throughput

Comment	Response

SCE must maintain at least a 10-day fuel reserve for gas utility service and power generation	• Staff agrees that a 10-day propane fuel reserve is necessary for utility service
	• Staff disagrees that the maximum annual propane available for power generation is 400,000 gallons, as it primarily relies upon the assumption that a 10-day propane fuel reserve for power generation is necessary
	  • SCE has a 30-day diesel fuel reserve for power generation
	  • Staff's proposed final BARCT limit incorporates the use of diesel engines when propane fuel is unavailable

The maximum available annual propane throughput available for power generation is 400,000 gallons- *SCE is reviewing and considering opportunities in increasing propane throughput*	

Compliance with Permit Requirements

Comment

A 10-day propane reserve for power generation is necessary because propane usage for power generation will become an increasingly integral part of compliance with permit requirements

Response

Permitting process allows for removal or alteration of permit conditions regarding minimum propane-related power output in the future if:

1. Rule 1135 contains BARCT limits that rely upon NZE/ZE technology being implemented at PBGS; and
2. The altering of the condition allows SCE to more readily implement the NZE/ZE technologies

Climate Risks and Barge Shipments

Comment

Climate risks such as rising sea levels and storm surges present a significant challenge for propane delivery and storage due to the proximity of PBGS and the local access road to the shoreline

- There is a limited window for barge shipments
- Propane shipments are also at risk of being canceled or postponed at the last minute due to inclement weather or other more urgent barge prioritization needs

Response

- Rising sea levels, storm surges, barge service hours, inclement weather, and barge prioritization are not exclusive to propane deliveries
- Diesel fuel is also delivered via barge and would be impacted by the same factors
- Therefore, staff disagrees on the use of these factors to justify SCE's claim that propane for power generation cannot exceed 400,000 gallons annually

Propane Delivery Concerns

Comment	Response
Propane shortages have periodically occurred, especially during the winter months when demand is typically the highest and inclement weather disrupts barge traffic	• Staff evaluated historic barge availability as part of the BARCT assessment • Staff's proposed final BARCT limit incorporates the use of diesel engines when propane fuel is unavailable
Securing additional barge shipments of propane is an obstacle for PBGS due to its isolated location and the finite resources available for transport	Staff's proposed final BARCT limit incorporates ZE technology, which will result in approximately 80 fewer barge trips than current operations on an annual basis
Increasing fuel deliveries increases safety risks	

Maximizing Efficiency of Propane Deliveries

Comment

- To maximize efficiency (and reduce transportation-related emissions), trucks should be shipped full and returned empty
- This is a significant drawback to the District's scenario, which would require the use of partially full tanker trucks

Response

- Staff's proposed BARCT limits do not require partially full tanker trucks
- Staff estimates that one 9,100 gallon propane tanker truck will need to be delivered 5 days per week and one additional propane tank will need to be delivered every 5-7 weeks to meet utility and power generation needs for the proposed final BARCT limit

SCE Proposed Rule Language

SCE's Proposed Rule Language

- Staff received proposed rule language from SCE on March 21, 2024
- SCE proposed the following:
  - No installation of new diesel ICE after the three Tier 4 final engines that replace Units 8, 10, and 15
  - No installation of equipment that does not meet the definition of a Santa Catalina Island NZE or ZE electric generating unit after the installation of the three Tier 4 final engines
  - Annual NOx limit of 30 tpy by January 1, 2028
  - Annual NOx limit of 13 tpy by January 1, 2030
    - Technology assessment by January 1, 2029, to determine if 13 tpy NOx limit represents BARCT
    - Initiate rule development within six months if the technology assessment demonstrates BARCT requirements should be modified
- SCE's proposed rule language is available on the PAR 1135 proposed rules webpage*

*https://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book/proposed-rules/rule-1135/comment-letters

PM 2.5 AQMP and Updates to BARCT Assessment

Background on PM 2.5 AQMP and Renewable Diesel

- South Coast AQMD is currently in the preliminary phases of developing an AQMP for PM 2.5
- Staff was asked to assess the use of renewable diesel, NZE technology, and ZE technology at PBGS for PM 2.5 emission reductions
- Staff assumed PM 2.5 emission reductions as a co-benefit to NOx emission reductions

Renewable diesel is produced from non-petroleum resources, such as cooking oils and waste fats

- Production process and properties are different than biodiesel

Renewable diesel benefits include:

- Reduction in emissions, including NOx, PM, and greenhouse gases when compared to petroleum diesel*
- Longer storage life than petroleum diesel
- Can be substituted or blended with petroleum diesel (meets ASTM D975)**

SCE indicated that renewable diesel could have a nominal cost difference in comparison to petroleum diesel for PBGS

Staff is considering the use of renewable diesel as part of the proposed BARCT emission limits

*https://www.mtu-solutions.com/na/en/technical-articles/2022/hvo-fuel-proven-to-be-effective-for-diesel-generator-sets.html and https://www.neste.fi/sites/neste.fi/files/neste_renewable_diesel_handbook.pdf

** https://afdc.energy.gov/fuels/renewable_diesel.html

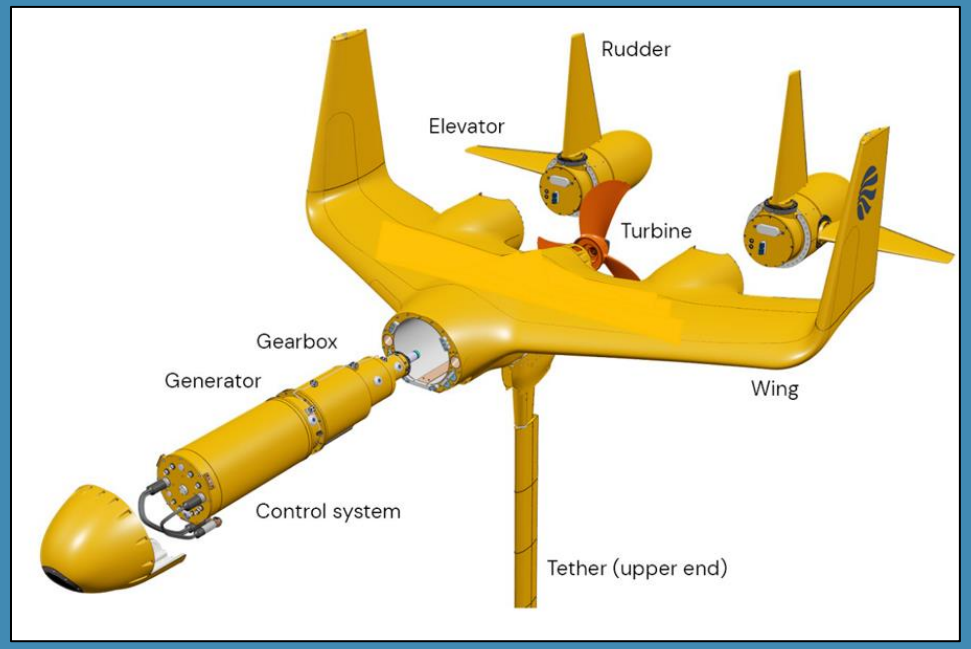
Updated Cost-Effectiveness for Proposed Final BARCT Emission Limit

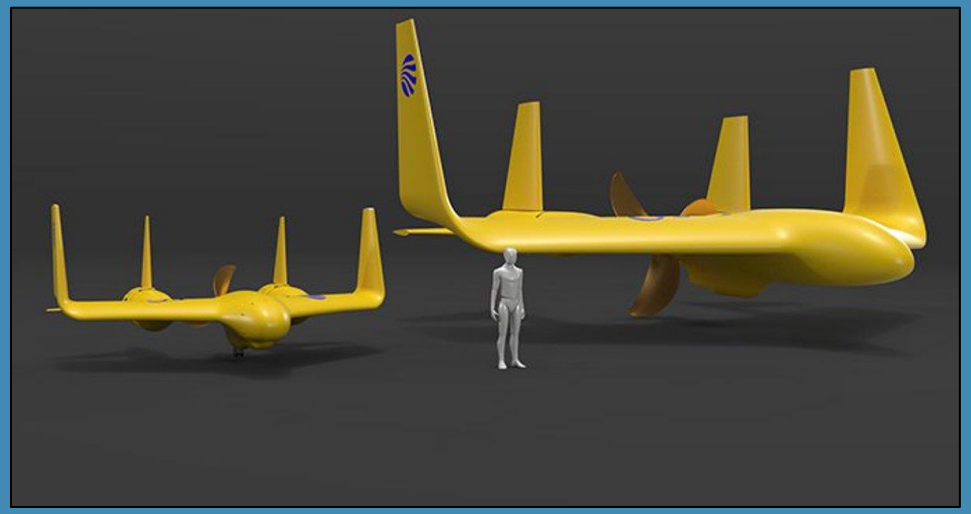
Updated Slide

- Staff updated the costs of the final proposed BARCT limit to include:
  - Refined land lease costs for ZE technology from SCE
  - Revised costs associated with NZE technology
- Staff's final proposed BARCT limit (65% NZE, 30% ZE, and 5% T4F diesel ICE) is still cost-effective and incrementally cost-effective
  - Cost effectiveness: $43,000/ton NOx reduced
  - Incremental cost-effectiveness when compared to TF4 diesel ICE: $48,000
  - Incremental cost-effectiveness when compared to 95% NZE and 5% TF4 diesel ICE: $(2,199,000)
- The proposed final BARCT limit at PBGS is unchanged at 1.6 tpy NOx at this time

Technology Assessment Update

- Staff is currently assessing tidal and current energy harvesting systems as another potential technology to repower PBGS
- Tidal and current energy harvesting systems are a renewable ZE technology that generate electricity from tidal streams and ocean currents
  - The wing uses hydrodynamic lift force created by the underwater current
  - The turbine is pulled through the water at a water flow higher than the stream speed
  - The turbine shaft turns the generator which outputs electricity to the grid via a power cable
- Smaller system is 0.1 MW rated capacity while the larger is 1.2 MW rated capacity



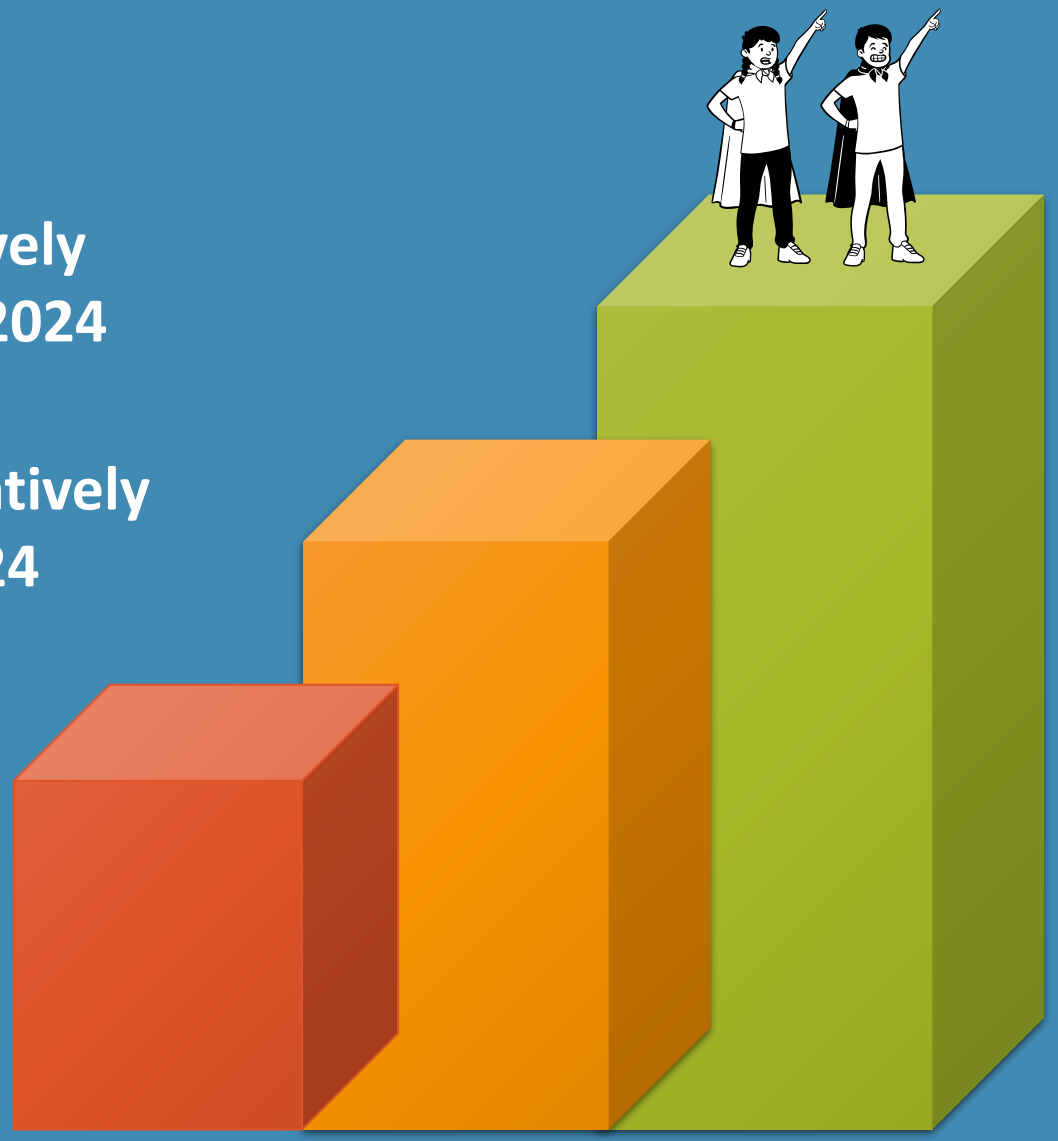


Next Steps

3. Public Hearing tentatively scheduled for August 2024

2. Public Workshop tentatively scheduled for May 2024

1. Ongoing meetings with stakeholders



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PAR 1135 Proposed Rules Web Page

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