Board of Directors Meeting Agenda

Date: November 20, 2025

Time: 6:00 p.m.

Location: SMUD Headquarters Building, Auditorium
6201 S Street, Sacramento, California

Powering forward. Together.

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AGENDA

SACRAMENTO MUNICIPAL UTILITY DISTRICT
BOARD OF DIRECTORS MEETING
SMUD HEADQUARTERS BUILDING
AUDITORIUM – 6201 S STREET
SACRAMENTO, CALIFORNIA

November 20, 2025 – 6:00 p.m.

Virtual Viewing or Attendance:
Live video streams (view-only) and indexed archives of meetings are available at: https://www.smud.org/Corporate/About-us/Company-Information/Board-Meetings/Watch-or-Listen-online

Zoom Webinar Link: Join SMUD Board of Directors Meeting Here
Webinar/Meeting ID: 160 265 6572
Passcode: 020343
Phone Dial-in Number: 1-669-254-5252 or 1-833-568-8864 (Toll Free)

Verbal Public Comment:
Members of the public may provide verbal public comment by:

- Completing a sign-up form at the table outside of the meeting room and giving it to SMUD Security.
- Using the "Raise Hand" feature in Zoom (or pressing *9 while dialed into the telephone/toll-free number) during the meeting at the time public comment is called. Microphones will be enabled for virtual or telephonic attendees when the commenter's name is announced.

Written Public Comment:
Members of the public may provide written public comment on a specific agenda item or on items not on the agenda (general public comment) by submitting comments via email to PublicComment@smud.org or by mailing or bringing physical copies to the meeting. Email is not monitored during the meeting. Comments will not be read into the record but will be provided to the Board and placed into the record of the meeting if received within two hours after the meeting ends.

Call to Order.
a. Roll Call.

1. Approval of the Agenda.

2. Committee Chair Reports.

   a. Committee Chair report of November 11, 2025, Strategic Development Committee
   b. Committee Chair report of November 12, 2025, Policy Committee
   c. Committee Chair report of November 18, 2025, Finance & Audit Committee
   d. Committee Chair report of November 19, 2025, Energy Resources & Customer Services Committee

Item 6 was reviewed by the November 11, 2025, Strategic Development Committee. Items 7, 8 and 10 were reviewed by the November 12, 2025, Policy Committee. Item 9 was reviewed by the November 19, 2025, Energy Resources & Customer Services Committee.

Comments from the public are welcome when these agenda items are called.

Consent Calendar:

3. Approve revised Board member compensation for service rendered at the request of the Board (pursuant to Resolution No. 25-04-02) for the period of September 16, 2025, through October 15, 2025.

4. Approve Board member compensation for service rendered at the request of the Board (pursuant to Resolution No. 25-04-02) for the period of October 16, 2025, through November 15, 2025.

5. Approval of the minutes of the meeting of October 16, 2025.

6. Authorize the Chief Executive Officer and General Manager to negotiate and award a contract to **KloudGin, Inc.**, for Field Service Management Software and associated implementation services, during the period from November 21, 2025, through November 20, 2030, for a not-to-exceed amount of $5,699,739. **Strategic Development Committee 11/11. (Suresh Kotha)**

7. Accept the monitoring report for **Strategic Direction SD-16, Information Management and Security**. **Policy Committee 11/12. (Suresh Kotha)**

8. Accept the monitoring report for **Strategic Direction SD-17, Enterprise Risk Management**. **Policy Committee 11/12. (Scott Martin)**

9. a. Authorize the Chief Executive Officer and General Manager (CEO/GM) to execute an **Amended and Restated Power Purchase Agreement (PPA)** consisting of two confirmations with **Geysers Power Company, LLC**, for up to 150 MW of geothermal energy, substantially in the form attached.

   b. Approve the **California Energy Commission (CEC) Emission Performance Standard (EPS)** compliance filing and authorize the CEO/GM to sign the compliance filing attestation.

Energy Resources & Customer Services Committee 11/19. (Laura Lewis)

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Discussion Calendar:

10. Discuss, with possible action, **Election of Officers for 2026** (President and Vice President) for the SMUD Board of Directors. **Policy Committee 11/12. (President Fishman)**

    Presenter: President Fishman

* * * * * *

Public Comment:

11. Items not on the agenda.

Board and CEO Reports:

12. Directors' Reports.

13. President's Report.

14. CEO's Report.
    a. Board Video

Summary of Board Direction

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Board Committee Meetings and Special Meetings of the Board of Directors are held at the SMUD Headquarters Building, 6201 S Street, Sacramento

November 18, 2025	Finance and Audit Committee and Special SMUD Board of Directors Meeting [Budget Meeting]	Auditorium*	6:00 p.m.
November 19, 2025	Energy Resources & Customer Services Committee and Special SMUD Board of Directors Meeting	Auditorium	6:00 p.m.
December 9, 2025	Finance and Audit Committee and Special SMUD Board of Directors Meeting	Auditorium	6:00 p.m.
December 10, 2025	Policy Committee and Special SMUD Board of Directors Meeting	Auditorium	6:00 p.m.

* * * * * * *

The Auditorium is located in the lobby of the SMUD Headquarters Building, 6201 S Street, Sacramento, California.

Regular Meetings of the Board of Directors are held at the SMUD Headquarters Building, 6201 S Street, Sacramento

December 11, 2025	Auditorium*	6:00 p.m.

The Auditorium is located in the lobby of the SMUD Headquarters Building, 6201 S Street, Sacramento, California.

Members of the public shall have up to three (3) minutes to provide public comment on items on the agenda or items not on the agenda, but within the jurisdiction of SMUD. The total time allotted to any individual speaker shall not exceed nine (9) minutes.

Members of the public wishing to inspect public documents related to agenda items may click on the Information Packet link for this meeting on the smud.org website or may call 1-916-732-7143 to arrange for inspection of the documents at the SMUD Headquarters Building, 6201 S Street, Sacramento, California.

ADA Accessibility Procedures: Upon request, SMUD will generally provide appropriate aids and services leading to effective communication for qualified persons with disabilities so that they can participate equally in this meeting. If you need a reasonable auxiliary aid or service for effective communication to participate, please email Toni.Stelling@smud.org, or contact by phone at 1-916-732-7143, no later than 48 hours before this meeting.

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DRAFT

RESOLUTION NO. _____

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

That this Board hereby approves revised Board member compensation for service rendered at the request of the Board (pursuant to Resolution No. 25-04-02) for the period of September 16, 2025, through October 15, 2025.

DRAFT

RESOLUTION NO. _____

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

That this Board hereby approves Board member compensation for service rendered at the request of the Board (pursuant to Resolution No. 25-04-02) for the period of October 16, 2025, through November 15, 2025.

DRAFT

Sacramento, California

October 16, 2025

The Board of Directors of the Sacramento Municipal Utility District met in regular session simultaneously in the Auditorium of the SMUD Headquarters Building at 6201 S Street, Sacramento, and via virtual meeting (online) at 6:00 p.m.

Roll Call:

Presiding: President Fishman

Present: Directors Rose, Bui-Thompson (6:03 p.m.), Herber, Kerth, Tamayo, and Sanborn

Present also were Paul Lau, Chief Executive Officer and General Manager; Laura Lewis, Chief Legal & Government Affairs Officer and General Counsel and Secretary, other members of SMUD's executive management; and SMUD employees and visitors.

Director Rose shared the 2030 Climate Action Tip.

President Fishman called for approval of the agenda. Director Sanborn moved for approval of the agenda, Director Herber seconded, and the agenda was unanimously approved.

Director Bui-Thompson, Chair, presented the report for the Strategic Development Committee meeting held on October 7, 2025.

Director Sanborn, Chair, presented the report for the Policy Committee meeting held on October 8, 2025.

Director Kerth, Chair, presented the report for the Finance & Audit Committee meeting held on October 14, 2025.

Director Rose, Chair, presented the report for the Energy Resources & Customer Services Committee meeting held on October 15, 2025.

President Fishman then called for public comment for items on the agenda, but none was forthcoming.

President Fishman then addressed the Consent Calendar consisting of Items 3 through 9 and 11. Director Kerth moved for approval of the

Consent Calendar, Vice President Tamayo seconded, and Resolution Nos. 25-10-01 through 25-10-07 were unanimously approved.

RESOLUTION NO. 25-10-01

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

That this Board hereby approves Board member compensation for service rendered at the request of the Board (pursuant to Resolution No. 25-04-02) for the period of September 16, 2025, through October 15, 2025.

Approved: October 16, 2025

INTRODUCED: DIRECTOR KERTH				
SECONDED: DIRECTOR TAMAYO				
DIRECTOR	AYE	NO	ABSTAIN	ABSENT
FISHMAN	X			
ROSE	X			
BUI-THOMPSON	X			
HERBER	X			
KERTH	X			
TAMAYO	X			
SANBORN	X			

RESOLUTION NO. 25-10-02

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

This Board accepts the monitoring report for **Strategic Direction SD-6, Safety Leadership**, substantially in the form set forth in **Attachment A** hereto and made a part hereof.

Approved: October 16, 2025

INTRODUCED: DIRECTOR KERTH				
SECONDED: DIRECTOR TAMAYO				
DIRECTOR	AYE	NO	ABSTAIN	ABSENT
FISHMAN	X			
ROSE	X			
BUI-THOMPSON	X			
HERBER	X			
KERTH	X			
TAMAYO	X			
SANBORN	X			

Attachment A
to Resolution No. 25-10-02

SACRAMENTO MUNICIPAL UTILITY DISTRICT

OFFICE MEMORANDUM

TO: Board of Directors **DATE:** September 24, 2025

FROM: Claire Rogers *9/24/25*

SUBJECT: **Audit Report No. 28007872**
Board Monitoring Report; SD-6: Safety Leadership

Internal Audit Services (IAS) received the SD-6 *Safety Leadership* first-half 2025 Biannual Board Monitoring Report and performed the following:

- Selected a sample of statements and assertions in the report for review.
- Compared sample to the corresponding supporting documentation to identify potential discrepancies.

All items sampled within the SD Report aligns with the supporting documentation provided at the time of review.

CC:

Paul Lau

Board Monitoring Report 1st and 2nd Quarters, 2025 Strategic Direction SD-6, Safety Leadership

1. Background

Strategic Direction (SD) 6, Safety Leadership states that:

Creating a safe environment for employees and the public is a core value of SMUD.

Through best practice methods and continuous improvement, SMUD will be recognized as a leader in employee safety while also assuring the safety of the public related to SMUD operations and facilities. SMUD commits to a proactive approach, including the active involvement of SMUD leadership, employees, contractors, and the community, as well as comprehensive monitoring of organizational and public safety performance.

Therefore, SMUD will continue to improve safety results to:

a) Workplace Safety

i. Reduce SMUD's injury severity incidents to 13 or less than by 2025, as measured by OSHA's Days Away Restricted Time (DART), a rate that demonstrates top quartile safety performance for similar size utilities using the Bureau of Labor Statistics (BLS) work-related safety data.

ii. Provide timely, quality health care for injured employees that aids their recovery while maintaining positive financial performance of the workers' compensation program.

b) Contractor Safety

i. Support contractors to reduce and eliminate potential hazards for Serious Injuries and/or Fatality (SIF) when conducting high risk work.

c) Public Safety

i. Track and report injuries to the public related to SMUD operations or facilities.

ii. Implement measures to protect the public from injuries related to SMUD operations or facilities.

2. Executive Summary

SMUD is in compliance with SD-6 and is in alignment with SMUD's 5-year strategy of working toward a zero-incident culture.

Workplace Safety

SMUD has recorded 16 OSHA Recordable cases through the first half of 2025, including 7 DART cases and 9 Other Recordables. This marks a 45% increase from the cases in the first half of last year (5 DART and 6 Other Recordables). Among the 7 DART cases, one was a non-preventable vehicle accident that resulted in restricted work duties. Additionally, four of the DART cases were related to slips, trips, and falls. The utility industry average for DART rate is 1.0, SMUD was at a .62 DART rate at the end of Q2.

Staff reviewed DART data for the last 10 years to look for patterns. We could easily see that almost twice as many DART incidents occur in Q3 than in other quarters. In an effort to prevent a doubling of accidents in Q3, we proactively reached out to our Field Forces, increasing awareness of this trend and reminding staff to take care of each other, not get complacent, be mindful of external distractions, ensure you're fit for duty when arriving to work, and employee's right and obligation to Stop Work when conditions change or a hazard presents itself. Additionally, Safety highlighted the variety of incidents that occurred, the fact that many of the injuries are occurring in employees at SMUD five years or less and led discussions during Business Unit Safety meetings to brainstorm possible causes and preventions for each work group. Messaging continued into Q3, also highlighting the prevention of slips, trips, and falls

Quality care of injured employees is measured through the Workers' Compensation program's performance, which is assessed annually by an independent actuary. SMUD continues to have a reduction in indemnity benefits over the past five years as presented below. However, the number of claims and injury frequency rates have increased.

Fiscal Year	2020	2021	2022	2023	2024
No. of Claims (Medical & Indemnity)	89	59	54	46	63
Incident rate per 100 employees	2.3	2.4	2.2	1.8	2
Rates per $100 payroll	.94	.85	.67	.58	.50

Contractor Safety

SMUD continues to use ISN to evaluate safety records and performance for high-risk contractors. This evaluation focuses on Contractor Fatality History, OSHA Citation History, DART and Total Recordable Incident Rates (TRIR), Insurance Experience Ratio, Safety Culture Questions, and Safety Program Review. Currently SMUD has **160** contractors in the ISN system.

This year we have increased the number of site safety evaluations for high-risk contractors to validate safety performance on the jobsites. Safety completed **231 site safety visits** in Q1 & Q2 2025 which is on target to exceed our 2025 goal of **250 safety visits**. These visits focus on SMUD contractors who work with Power Generation, Line, Substation, Facilities, Vegetation Management and Environmental Services on projects where high-risk work is performed. This work includes high voltage work, working at heights, vegetation management, confined spaces, excavations, etc. SMUD has onboarded two new Vegetation Line Clearance Contractors and focused audits have been completed by SMUD's Contractor safety Team and Vegetation Management Team. The Safety Management System (SMS) system is utilized for inspections, incident tracking, reporting and investigations of SMUD contractors. This allows SMUD to verify

safe working practices by our contractors to reduce the potential for serious injuries or property damage. Contractor reported incidents require an investigation to be completed and typically will warrant additional site safety visits to verify corrective measures have been put into place to reduce further occurrences.

The Contractor Safety Team is expanding the use of the ISN safety training qualifications tool. This tool will allow a more efficient method of verifying Contractor Employee qualifications. This tool allows SMUD to verify individual Contractor Employee qualifications and assures appropriate competence for the high hazard work. An additional example of this is the SMUD Substation Entry Training that will allow SMUD to communicate safe work practice expectations to our contractors through the ISN platform. The Contractor Safety Team continued its partnership with the Vegetation Management Team for the 2025 Contractor Safety Day and the New Contractor Onboarding event. This event is an effective way to reach and set expectations for our Vegetation Contractor employees doing high risk work.

Public and Community Safety

Public Safety Statistics

SMUD tracks public and community incidents in the Safety Incident Tracking System (SITS) involving car-pole, electrical contacts, dig-in incidents, and injuries to the public that are related to SMUD's operations or facilities. The following statistics are reported for the 1st half of 2025:

- There were 125 incidents where the public struck a SMUD asset with a vehicle, with one fatality from such events.
- There were three electrical contacts reported with no report of injuries from these events.
- There were 40 dig-in incidents reported with no injuries. In response to these dig-ins, SMUD's public safety team has sent out nine notification letters to contractors and customers responsible for the dig-in occurrence as a proactive effort to provide further awareness and education on best practices to avoid future occurrences. No responses or escalations have been provided.

Public Safety Events

SMUD's Safety team has attended several local events within the SMUD territory in support of delivering public safety messages with a variety of partnerships. The Safety team has coordinated and participated in the following events for 2025:

- Deterding Elementary School "Public Safety Day"
- Elk Grove "Regional Public Safety Day"
- Sacramento Metro "Kid's FIRE CAMP"
- Jackson Laboratory "Employee Safety Day"
- Safetyville "Public Safety Day"

New Public Safety Initiatives

The Public Safety team is partnering with other SMUD business units to develop a "Dig Safe" committee in support of preventing underground line strikes and near misses to SMUD infrastructure. Additionally, the public safety team has begun using public safety data to support the decision-making processes of "Vehicle vs. Assets" committee.

3. Additional Supporting Information

The current SD-6 Safety Direction became effective September 2023. Our goal is to achieve the desired performance objectives by year-end 2025. This report summarizes safety performance in the first half of 2025.

Safety Leadership
The Safety Team continues with its integration efforts to support Executive Leadership's 5-year plan that emphasizes zero incidents and injuries and a focus on a zero-accident safety culture. SMUD's Executive Leadership team continue to emphasize our Safety priority with all personnel, contractors and in the public. We continue to grow our Safety for Life culture by reducing the risk of serious injuries and fatalities, targeting messages to staff on topics beyond work-related risks, and looking for new ways to maintain engagement. These goals are outlined in SMUD's Safety Road Map.

Safety Management System (SMS)
During the first half of 2025, SMUD has made significant strides in optimizing Benchmark Gensuite, our safety management system (SMS). As we move forward, new projects and process improvements are continually evolving, leading to increased utilization and greater visibility among our workforce. These initiatives demonstrate our dedication to creating a safer, more efficient workplace for all employees, enhancing both operational performance and employee well-being.

Safety Standards Development
The Safety Team is continuously reviewing and updating SMUD's Health & Safety Standards to support the organization's World Class Safety initiatives. The Core Standards Team has adopted a streamlined review routing process utilizing SharePoint. This approach has reduced the amount of time required from review to final signature. Additionally, the Standards Team is piloting using AI for standards reference, regulatory updates, and procedural alignment.

The Core Standards team continue to meet monthly to ensure progress is made and tracked. A total of seven (7) standards have been reviewed, signed off, and published to the Health and Safety Standard SharePoint site for all personnel to access. These standards include Silica: Exposure Control Standard; Incident Reporting & Investigation Standard; Training Required Equipment Standard; Electro Magnetic Field (EMF) Standard; Public Safety Standard; Injury and Illness Prevention Program (IIPP) Appendix B – Workplace Violence Prevention Plan; and Heat Illness Prevention Standard.

Supervisor-Employee Interactions
The Safety Team has made impressive strides in enhancing the Supervisor-Employee Interaction process. With an ambitious Enterprise Performance Goal of 8,440 interactions for 2025, the organization completed 4,534 interactions in the first half of the year, putting us on track to meet this important goal. Driven by a commitment to support leaders, we have created and developed user-friendly PowerPoint materials outlining supervisor-employee interaction goals and targets. Our team has effectively presented this information during director leadership meetings, staff meetings, and through one-on-one training sessions, ensuring clarity and understanding from all involved. Additionally, we created a PowerBI table that shows the number of interactions occurring by work groups.

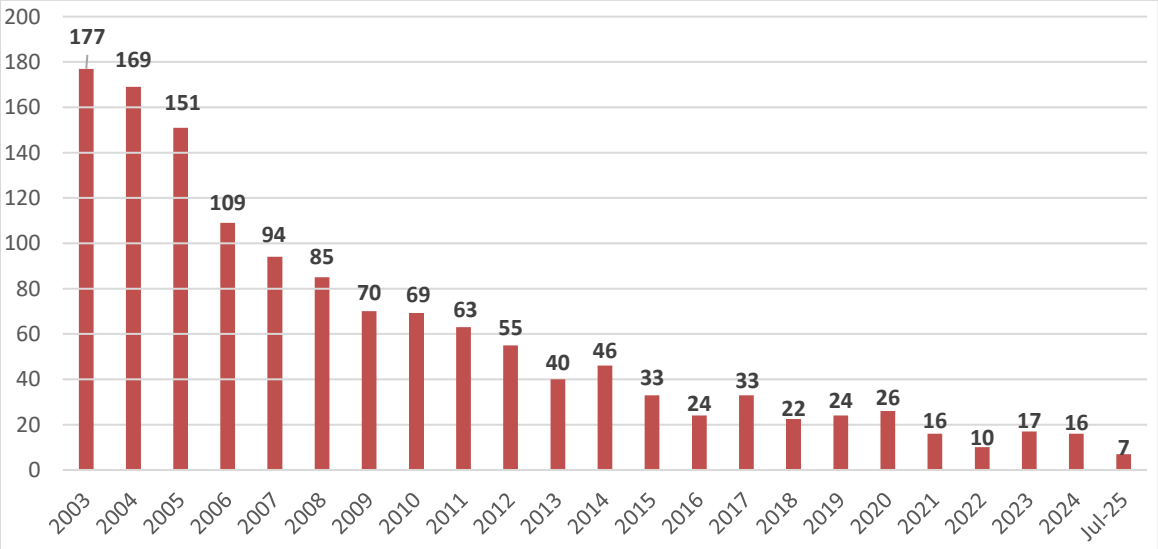
Our focus for in office personnel was targeting ergonomic risks and slip, trip, and fall hazards. Hybrid and remote employees also received tailored support to improve workstation setups and minimize hazards at home. The proactive measures and informative sessions led to significant interactions, underscoring our dedication to fostering a strong safety culture and enhancing communication across all levels. This year, through our concerted efforts, we are not only achieving goals but shaping a sustainable safety environment for every employee at SMUD, regardless of their work location.

Near Miss and Positive Observation/Good Catch Reporting
Leadership remains committed to fostering a culture that values and promotes the reporting of near misses and positive observations, often referred to as "good catches." This initiative aims to identify learning opportunities before incidents take place, enhancing our overall safety and operational effectiveness. Throughout the first half of the year, we have successfully recorded 28 near miss and positive observation reports in the Safety Management System.

4. Challenges

At the end of Q2, SMUD had 7 DARTs, which put us generally on track to meet our SD-6 goal of 13 DARTs or less by 2025. However, thus far in Q3, we have had 4 DARTs, which means that if we continue at the same rate, we will exceed the goal of 13 DARTs for the year.

Over the last 4 years, we have averaged about 15 DARTs per year. This is a marked decrease from where we were in 2003 when we had 177 DARTs. However, similar to the Zero Carbon Plan, getting SMUD to zero DARTs is going to be a challenge. Thankfully, high-risk DART cases remain very low and the amount of time employees are away from their regular work as a result of their incident remains low. The Safety department will continue to identify trends, collaborate with leadership, proactively address hazards, and promote safe work practices.



DART Count 2003-2025

5. Recommendation

SMUD is committed to becoming a recognized leader in safety. Both SMUD's leadership team and employees recognize that to achieve success we must integrate safety into all that we do. It is recommended that the Board accept the Monitoring Report for SD-6.

6. Appendices - World Class Safety Program Improvements & Supporting Information

Safety for Life
Safety and Environmental Day planning has begun. The event will take place at Safety Center's Safetyville in October 2025. All SMUD employees and their families are welcome to attend. There will be plenty of vendors, SMUD Trades groups sharing their crafts, as well as food, games, and prizes.

Sparky's Crew continues to get families involved in safety by sending 194 safety postcards and quarterly newsletters to SMUD children enrolled.

Our Safety for Life communications continue. This year we have placed emphasis on doing "About Me's" for the SMUD Safety team so employees can get to know all of the Safety Team members. Safety for Life experiences from employees are being shared in our bi-weekly newsletter and resonate the most with employees resulting in the most readership.

Driver Safety
So far in 2025, Safety hosted a driving rodeo for the Line Design team and their leadership. The preventable vehicle accident (PVA) review team continues to review SMUD's PVAs regularly, looking for trending data, which is used during the rodeos, to have discussions with employees, and during safety meetings, to prevent further PVAs. Safe driving behaviors are being emphasized in vehicle reports that are provided to directors, managers, and key contacts for participating in business units. The reports capture speeding data as well as seat belt use. Leaders can use this information in their interactions to reinforce safe driving behaviors and help mitigate unsafe driving behaviors. Modifications to the report continue to be made based on feedback from leaders and their business unit.

SMITH training continues to be provided to new hires, as well as existing employees due for a refresher, continuing to elevate their driving performance. This is performed by both internal trainers and SMITH corporate instructors. In response to current PVA trends, the Safety team is working to enhance training for backing maneuvers, with the goal of increasing success when backing is unavoidable. The Safety team also trained additional leadership under ED&O to perform driving-based SCORCH observations with their staff, adding value and focus to their observations.

Last year's highly visible banners with safe driving messages are being re-deployed in the ECOC Yard. Digital messaging with the same content continues to be shown on the monitors in the ECOC buildings. With this messaging, staff are given meaningful safe driving reminders before even getting in their work vehicle for the day. To increase awareness, messaging in Q3 safety meetings is being geared towards specific trends in preventable vehicle accidents. Meanwhile, certain groups are evaluating approaches to reduce our potential to be involved in 3rd party fault accidents.

Wildfire Smoke
Annual training was delivered to all field crew personnel in June/July 2025. Examples of resources available to SMUD employees are the Purple Air monitoring system, in-cab vehicle HEPA air filters, PPE, and scheduling. Staff also offered new wildfire smoke applications such as Watch Duty, which can help track the fires that impact our infrastructure and field personnel.

Fire Retardant Clothing
All employees who work on or around energized equipment are allotted a yearly flame resistant (FR) clothing allowance to ensure they are adequately protected. SMUD works with an FR vendor to ensure employees have access to clothing, which meets the Arc Flash requirements of SMUD equipment and the latest FR material technologies to improve their level of comfort in various types of weather conditions (i.e., storms, cold, rain, or heat). New electrical trades employees will receive FR Clothing training by a Safety Representative and ensure they are added to the FR Clothing portal and are apprised of the proper care and maintenance of their clothing.

Field Ergonomics
The Field Ergonomics Committee continues to drive significant improvements by collaborating with leadership and crews to implement ergonomic solutions in the field. Recent field ergo visits have allowed for meaningful enhancements to workstations in various locations, including the Station G, Elverta substation, and for the Folsom Administrative Office Building (FAOB) project team, ensuring that employees have access to appropriate ergonomic equipment. Furthermore, the completion of two separate, 8-week strength and conditioning program, demonstrated positive outcomes for thirteen participants, all reporting some level of improvements across strength, mobility, and flexibility. This success reflects SMUD's commitment to advancing employee well-being through robust field practices and ongoing ergonomic assessments. Collectively, these efforts signify a strong commitment to a proactive safety culture, underscoring the organization's dedication to reducing injuries and fostering a sustainable work environment.

Joint Labor Management Safety Committees
Hydro JLMSC – As a VPP audit finding, this committee was tasked with assuring quality of leading indicators. Continued support for VPP follow-up audit is scheduled for July. New Labor Chairs nomination openings for JLMSC and Emergency Drills subcommittee and will be confirmed Q3. Fall Protection inspections completed through the inventory merging process with the ECOC Tool Room. Many committee members volunteered for the Fresh Pond Safety Fair in June. The Safety Fair was an event for SMUD families to engage in hands-on activities, with a focus on industrial safety and our Upper American River Project's (UARP) partnerships with the local community. Attendees tested their climbing skills on a rock-climbing wall, met some feathered friends, explored the inside of a helicopter and even met Smokey Bear.

Line Assets JLMSC – A variety of safety improvements are in progress or already completed through the Line Assets JLMSC. Key improvements to highlight are: 1) Distribution of communication plans to customers regarding the importance of maintaining clear access to SMUD equipment on customer properties for both customer reliability and safety of our employees. 2) Helicopter Communication device is currently being built to assist employees performing work in remote locations. 3) Non-FR Raingear was updated to provide additional sizes as well as SMUD branding to accommodate employees of different sizes and increase employee safety by making it clear they are SMUD employees. 4) A new model of hydro-vac trailer was tested and selected for use which is quieter and much better ergonomically compared to other models. 5) Electronic device policy updated to allow for the use of iPads as navigational tools. SMS and calling features are disabled by IT.

Substation, Telecom, & Metering (STM) JLMSC –
Current Near misses and Safety Alerts are shared at the beginning of the Quarterly JLMSC meetings to remain current on conditions, incidents, or accidents and possibly discuss solutions.

STM JLMSC has re-established a new JLMSC Charter which includes new member representatives. The following initiatives have been established as key actions items by all the department member representatives:

- SMUD-wide Arc Flash Study
- Ergonomic Tool Improvements in the Field (Mobile Workstations)
- Vehicle Yard Safety, Housekeeping & Maintenance
- Insulated Tools for Battery Installation
- Trauma Training (Emergency and First Aid Support)
- Continuing Education Program for Journeyman & Foreman
- Indoor Heat Illness Prevention (Battery Powered Units)
- Emergency Procedure Training

Safely Conducted Observations Reduce Common Hazards (SCORCH)
Observation Engagement & Behavior Trends
A total of 1,386 field employees under the CFAS-Field (Customer, Finance. Administrative Services) and Electrical Trades process, were observed over the first half of 2025. Observation feedback speaks to the continued consistency in which Hand Protection is worn, making it the top observed safe behavior for CFAS-field. Observation feedback reinforces the value employees see in wearing the appropriate hand protection as a proactive step for minimizing exposure. The awareness for minimizing exposures to hazardous situations was displayed by employees when it came to vehicle Parking, making it the top observed safe behavior for the Electrical Trades. Comments highlighted the effectiveness of using pull-through parking (when applicable) to avoid the need for backing and how worksite locations nearest to entry point parking spots may not be the safest parking spots. Great awareness for avoiding highly congested areas.

The opportunity for improvement was related to the top at-risk behaviors of Tailboard and Eyes, Face, Skin protection. Employees displayed a low perception of risk for ensuring all employees are “cut in” on the scope of work/task prior to start of task or when work conditions changed. SCORCH Risk Reduction Reminders highlighted the value of performing a thorough and documented Tailboard. To positively reinforce a commitment to change a “post lunch tailboard” was recommended based on time-of-day data displaying a spike in behaviors marked at-risk following the lunch break. To elevate awareness for protecting Eyes, Face & Skin, Risk Reduction Reminders focused employees not allowing a low perception of risk make them vulnerable no matter their duration have task employees should always wear the appropriate eye protection and a commitment to having a backup pair available what is a value add element to avoid not having safety glasses/PPE on hand at all.

Throughout the first half of 2025, a total of 2,690 employees were observed under the Office & Professional process. Employee awareness and ownership for maintain good Back Posture made it the top observed safe behavior. Employees see the value in keeping the back in a neutral posture with head shoulders and hips in alignment when seated. This is combined with a mindfulness to avoid sustained awkward posture positions for periods of time. The increased comments related to taking more frequent “micro stretch breaks” also show a growing desire by employees to log out with less aches and pains at the end of the day, as the norm.

The behavior of Hips/Legs/Feet Posture was logged as the top at-risk behavior. Based on feedback comments, exposure was tied to incorrect seat pan depth, prolonged awkward postures and low perception of risk. Risk Reduction Reminders for maintaining a 2-finger width gap of space from the back of the knees and the front edge of the chair to reduce pressure and maintain good blood flow circulation throughout the legs were shared. Encourage the use of setting personal posture reminders to aid in recognizing when sitting with legs crossed at the ankles or with a single leg tucked under the body. Raised awareness for the cumulative trauma and the stress placed on the tendons and joints that have quality of life impacting potential.

SCORCH Behavior Influencing Highlights:
Internal/Safety for Life Engagement – SCORCH launched its first at-home "Spring Cleaning" observation event. The event and home observation card were used to display SMUD's cultural commitment to Safety for Life and tie behavior awareness to seasonal norm employees were most likely going to be performing. Positive feedback and comments were received, highlighting employee thankfulness, behavior awareness elevation, pro-active planning, ergonomic smart setup and fatigue monitoring brought to light. SCORCH continues to create new formats for engaging in conversations about safety at home and at-play. Activity trends, observed/marked behaviors and comment feedback will be used to create additional seasonal opportunities of engagement and "Best Practice" shares to further expand its influencing reach. SCORCH successfully held its first ever SCORCH Appreciation Day. This was a one-day event that was held at both campuses to say Thank you to everyone who has contributed to the historical success of SCORCH. Process trivia, Management Sponsor Q&A panel session and safety shares. This was an effective way to showcase the wide range of employees who have and continue to contribute to SCORCH from frontline employees to elevated levels of leadership. This was considered a major process win, that was highly attended by employees at all levels and across SMUD.

After attending DEKRA's 2025 National Safety in Action Conference. Committee members held a two-day (In-person/virtual) SCORCH Mini Conference to share lessons learned and industry best practices. The new addition of the Management Sponsor Q&A panel discussion was used to kick off the event. This was well received by the attendees and provided them with the opportunity to hear how engaged leaders are in support of SCORCH. A total of 12 presentations were provided to all employees highlighting personal ownership and awareness for working safely. Topic shares ranged from Leading Without Authority, Back Injury Prevention, Fostering a Speak-Up Culture and Capacity to Prevent Soft-tissue Injuries. Positive feedback related to the relevance and thought-provoking topics was received from attendees with high audience numbers for both the in-person and virtual formats.

Heat Illness
SMUD continues to identify heat as one of the main hazards our employees face during the hot summer months. SMUD continues to train field-based employees each year on the signs/symptoms of heat illness, appropriate measures to reduce the potential for heat illness, as well as how to respond appropriately in the event of a heat-related emergency. SMUD's Tool Room continues to offer a variety of solutions to combat working in the heat, including water, ice, coolers, electrolyte supplements for water, portable shade structures, and shade visors for hard hats.

Medical Monitoring
The Safety team worked with Procurement to extend the contracts for our audiogram vendors. There were 3 onsite hearing events, 2 at ECOC and 1 at Fresh Pond. Approximately 175 employees completed their annual hearing exams during the three onsite events. The Safety

team worked with foreman, supervisors, and managers to ensure that all required employees were in the appropriate Medical Monitoring Program(s). The Safety team continues to organize, coordinate and schedule employees for their medical exams. There were 2 onsite “pop-up clinics” for our medical surveillance vendor at the ECOC. Approximately 30 employees had their annual medical exams completed during those two events. Safety will continue to ensure all employees are current on their medical monitoring.

Awards

The American Public Power Association (APPA) recognized the top utilities from across the country for their safe operating practices in 2024. We’re excited to announce that SMUD earned the APPA’s 2024 Safety Award of Excellence, achieving Diamond Status. The Diamond designation is the highest status awarded by APPA to utilities who demonstrate a strong commitment to its employees, customers and the community. The Diamond Status was awarded to SMUD during Q1 of 2025.

The National Safety Council (NSC) recognized SMUD in Q1 of 2025 for the 2024 Occupational Excellence Achievement Award. This award recognizes organizations with injury and illness records better than or equal to 50% of the Bureau of Labor Statistics for their NAICS code.

RESOLUTION NO. 25-10-03

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

This Board accepts the monitoring report for **Strategic Direction SD-10, Innovation**, substantially in the form set forth in **Attachment B** hereto and made a part hereof.

Approved: October 16, 2025

INTRODUCED: DIRECTOR KERTH				
SECONDED: DIRECTOR TAMAYO				
DIRECTOR	AYE	NO	ABSTAIN	ABSENT
FISHMAN	X			
ROSE	X			
BUI-THOMPSON	X			
HERBER	X			
KERTH	X			
TAMAYO	X			
SANBORN	X			

Attachment B
to Resolution No. 25-10-03

SACRAMENTO MUNICIPAL UTILITY DISTRICT

OFFICE MEMORANDUM

TO: Board of Directors **DATE:** September 24, 2025

FROM: Claire Rogers *CR 9/24/25*

SUBJECT: **Audit Report No. 28007873**
Board Monitoring Report; SD-10: Innovation

Internal Audit Services (IAS) received the SD-10 *Innovation* 2025 Annual Board Monitoring Report and performed the following:

- Selected a sample of statements and assertions in the report for review.
- Compared sample to the corresponding supporting documentation to identify potential discrepancies.

All items sampled within the SD Report aligns with the supporting documentation provided at the time of review.

CC:

Paul Lau

Board Monitoring Report 2025
Strategic Direction, SD-10 Innovation

1) Background

SD-10 States: Delivering innovative solutions, products and services to our customers is a core value. To assure our long-term competitiveness, SMUD shall invest in research and development projects that support its core and key values, and integrate emerging technologies and new business models into SMUD's customer offerings in a way that balances risk and opportunity and benefit our customers and community.

2) Executive Summary

To assure SMUD's long term competitiveness and delivery of the Clean Energy Vision, the Research & Development (R&D) team provides subject matter expertise, project planning and execution in support of SMUD's core and key values. R&D evaluates emerging technologies, and business models and accelerates integration into SMUD's operations in a way that balances risk and opportunity. The R&D portfolio contains both short term and multi-year projects focused on enabling thermal transition, scaling load flexibility, and facilitating electrification of buildings and transportation. We support SMUD through research, analysis, development and demonstration of emerging technologies that benefit our customers and community. Including the transition of vetted technologies into operations, and analysis of energy and climate change policies.

Our conclusion is that SMUD is in compliance with SD-10 Innovation.

SD Requirement	Purpose	Outcome	Notes
	Project distribution indicates breadth of portfolio diversity and prioritization of program areas.	25 active projects in 2025. 4 projects are completed as of July 1, 2025[1].	This reflects a 14% increase in active projects and a 20% reduction in completions compared to the previous reporting period.
Risk	Technology risk assesses ability to meet expected performance goals. Implementation risk assesses the probability of deployment.	76% of projects are deemed low to medium-low technology risk. 72% are deemed low to medium-low implementation risk.	The risk portfolio is consistent with the previous reporting period. Potential risks are managed by creating a diversified portfolio and partnering with other entities to distribute risk and mitigation.
Benefits	Research stage and benefits timeframe indicate the relevance of portfolio to address customer needs and strategic planning.	68% of projects are in stages 4-5[2]. 96% are expected to provide benefits to SMUD or customers within 5 years.	The percentage of stages 4-5 is consistent with 64% in 2024, reflecting the focus on near-term applications. The benefits time frame is consistent with the 2024 portfolio.

Table 1: SD Requirements Compliance

[1] Reporting metrics and achievements reflect the reporting period of July 1, 2024 – June 30, 2025.

[2] Stage 1 - Preliminary Investigation, Stage 2 - Concept Definition/Lab scale, Stage 3 - Concept Development (Prototype/bench scale), Stage 4 - Technology Development and Verification (pilot scale; field testing), Stage 5 - Commercialization

3) **Additional Supporting Information Project Implementation:** SMUD's Research and Development team has the primary responsibility of meeting SD-10; however, notable innovation occurs throughout SMUD.

Electric Transportation (ET)

Transportation electrification advances SMUD's sustainability goals by improving air quality, reducing local emissions and petroleum use, and generating new revenue. SMUD is committed to increasing EV adoption and expanding charging access to serve a wider range of customers and use cases. At the same time, we are addressing grid impacts from EV charging through pricing incentives and remote charging management, investigating managed charging (V1G) and Vehicle-to-Grid (V2G) technologies to better understand their potential benefits and challenges.

Key Achievements:

- SMUD has agreements pending signature for the eFuel program to begin deploying EV chargers to underserved multi-family homes in Q4 2025 as part of the ChargeReady Community project, a $2M CEC REACH grant awarded to SMUD in 2022.
- Installation of 3 smart outlet products to test the installation, setup process and user experience, to enable greater deployment of EV charging at multifamily properties.
- The Residential Managed EV Charging pilot enrolled over 1,000 vehicles from Tesla, Ford and BMW (GM left the Chargescape collaborative and therefore is no longer included in this pilot). Final M&V report is planned for Q3 2025 release. Pilot is extended through end of 2025 to bridge the gap between pilot end and program launch.
- SMUD was awarded $2.9 million by the California Energy Commission to deliver the FAST grant, that would deploy 150KW+ fast chargers at the Sacramento International Airport, Sacramento Valley Amtrak Station and Sacramento State University. As part of the grant SMUD scoped out requirements for the development of a SMUD-branded EV Charging App. Offering a convenient single account access to multiple third-party charging networks through an integration with an e-Roaming platform. The app will provide varied rate structures for specific customer groups, such as on-demand transportation drivers, multifamily residents, and income qualified residents. These varied rates are intended to provide affordable charging options for those without access to home based charging and to reduce the opportunity cost associated with charging as an on-demand transportation driver.
- EPRI EVs2Scale project developed the GridFast portal, enabling EV fleet operators to exchange information with utilities before applying for service. SMUD provided data to the EPRI eRoadMap (https://eroadmap.epri.com/), and is using data exported from the EPRI eRoadMap to develop SMUD's internal analytics and planning tool (EVmap).
- The V2G Commercial Expansion project is recruiting the first commercial customer and detailing the test plan for the initial technical demonstration with electric school buses.

Energy Efficiency (EE) & Electric Buildings (EB)

This portfolio optimizes energy delivery costs and balances infrastructure investments with demand growth via targeted, time-specific energy efficiency and building

electrification. R&D explores emerging and underutilized technologies, working to lower barriers to technology adoption.

Key Achievements:

- The **Home Infrastructure Planning project** is complete. The vendor delivered a Residential End State model to estimate load profiles for single family residential customers after full electrification. Work is underway to deploy this model in the SMUD environment and scale up analysis to represent SMUD's full single family residential population, to help distribution planners and customers make optimal decisions regarding utility service upgrades and supporting residential electrification.
- **The panel upgrade mitigation demo** has completed vetting in-house OEM testing for SPAN and is undergoing the same process for Schneider Electric and Lumin/ABB products. The project team is recruiting customers that require panel upgrades due to electrification upgrades funded by the Community Impact Plan.

DER Integration and Load Flexibility

This program portfolio supports cost-effective, reliable, and scalable flexible resource growth to serve future grid needs. R&D determines functional, operational and market viability of flexible loads to align supply and demand, give customers bill management options, improve air quality, improve grid asset utilization and reduce carbon emissions.

Key Achievements:

- DER Interconnection Tool Enhancement - NREL has been active in multiple projects involving the **PRECISE** tool. They've partnered with Consolidated Edison to show the tool's capability in network secondary systems and are deploying it with the US Virgin Islands Water and Power Authority. Additionally, they are enhancing the PRECISE tool through advanced research using neural networks and large language models through laboratory directed research and development funding.
- R&D staff collaborated with the strategy, interconnection, field metering and distribution operations teams to establish a process for vetting new technologies submitted for interconnection, starting with meter socket adapters.
- Smart inverters allow utilities to monitor residential PV and storage (potentially as an alternative to submeters) and provide control functionality to assist in grid support. This project tested smart inverter communication via two pathways: direct connection and aggregators. Data analysis via Direct Connection showed monitoring accuracy within 1% for voltage and power and 4% for current, as compared to a revenue grade meter. The existing interoperability issues should largely be fixed in the next CSIP revision, CSIP 3.0 (based on IEEE 2030.5-2023). The Aggregator pathway finished lab and customer testing using an IEEE 2030.5-CSIP server. This test was successful, with minor issues relating to interoperability, configuration and setup. Direct connection was demonstrated as a feasible option for standards-based access to specific inverters, while the aggregator pathway leveraged OEM and aggregator relationships to establish pilot access agreements, making them applicable to a broader range of smart inverters.

Thermal Transition

R&D pursues innovative grid, storage and generation solutions to facilitate SMUD's goal of zero carbon and accelerate interconnection of grid-connected systems and devices for safe and efficient operation. This portfolio supports system reliability and emission reduction by aligning DERs and zero-carbon generation with grid needs. Improving grid reliability through reduced outage frequency and duration, control of the distribution system, voltage and frequency variations, including overload conditions; and optimizing grid benefits of DERs through advanced integration standards and coordinated automation.

Key Achievements:

- Pilot of the ANYbotics Robot Inspection Dog has commenced. This tool is paired with substation inspection workers to perform daily tasks like SF6 gas monitoring and infrared, and partial discharge testing to look for early signs of trouble. The Substation, Metering and Telecommunications team work closely with IT to streamline data access. Once programmed and adapted to substation work, potential use cases with other workgroups within SMUD will be explored.
- MEPPI Lithium-ion battery testing began at Hedge (Sacramento Power Academy) to transition from scheduled operation to DSO dispatch.
- Conclusion to ESS pilot and coming removal of ESS Energy Warehouse batteries from Hedge (Sacramento Power Academy).
- Demonstration of the OnSight Owl Computer Vision AI System to provide pre-emptive thermal runaway detection for utility scale lithium-ion batteries. A proactive supplement to traditional fire alarm systems, which also enables real-time monitoring.
- Phase 3 of the Fire Protection & Mitigation project with EPRI began, to revise the emergency response plan and develop a plume modeling report, along with conducting tabletop drills to increase the emergency readiness of SMUD staff and first responders.

Climate Change

This program provides technical, economic, and policy expertise on climate change and impacts to SMUD territory. It compliments SMUD's Zero Carbon Plan and aligns with board direction to address climate vulnerabilities, along with partnering with our customers and community on mitigation opportunities and regenerative net positive projects.

Key Achievements:

- Carbon Farming and Ecosystem Service Research is a four-year study aimed to restore California prairies and native pollinator habitat under PV panels in surrounding perimeter areas at Rancho Seco II. In its final year, the project's focus shifted to emphasizing low-maintenance methods on an expanded footprint and an effort to achieve Bee-Better Electric certification. This project will help identify and demonstrate strategies to integrate ecosystem services and agricultural value into large scale solar projects, helping to mitigate their environmental impact and build public support for their continued construction, assisting SMUD in achieving the 2030 ZCP.

Enterprise-Wide Innovations

While SD-10 innovation goals are met within the R&D research portfolio, additional notable achievements occurred across SMUD.

- DERMS phases 2 and 3 went live in Q4 2024, providing distribution operators with tools to manage localized grid support from large-scale DER and dynamically coordinated grid support from groups of small DER.
- Staff kicked off the planning stages of two microgrid-powered resiliency centers at high schools in Sac City Unified and Twin Rivers School Districts.
- Deployed SMUD GPT, an alternative to ChatGPT, so staff can research topics, summarize documents, and generate content while keeping data local to SMUD.
- In addition to SMUD GPT, staff have developed AI solutions trained on SMUD-specific data. These Retrieval Augmented Generation (RAG) solutions have been implemented for multiple topics, including: Critical Energy Infrastructure Information Summaries; Wildfire Mitigation; Credit Knowledge Base; Billing Knowledge Base; Subscription-Based Information Technology Arrangements (e.g. software-as-a-service); North American Electric Reliability Corporation (NERC); Corporate Communications; Distributions Team; Design & Construction Services; CPUC G.0.95 Safety Guidelines; Board Materials; and Safety team.
- Staff developed a machine learning model to estimate potential outages of a storm, based on the weather forecast. Wind gust has been identified as a key indicator in the forecasting algorithm.
- EVmap; an analytics and planning tool developed by SMUD staff to visualize available capacity on SMUD's distribution grid, layered with data points identifying EV charger locations, multifamily housing developments, DAC zones, and other information to support strategic identification of sites for charger deployment and customer recruitment.

Summary: As SMUD advances toward implementation of the 2030 Zero Carbon Plan, R&D has ramped up support for thermal transition and load flexibility technologies and business models, focused on energy storage and electric transportation, while continuing to advance research in climate change and technologies that enable building electrification. These innovations mitigate grid infrastructure impacts, maintain customer choice and offer new solutions toward a low carbon future. Our diverse portfolio maintains long-term competitiveness and balances risk with potential environmental and economic benefits, ensuring community benefits.

4) Challenges: Uncertainty of federal incentives, tariffs, supply chain lead times, inflationary impacts all require careful navigation. Staff resources remain focused on providing subject matter expertise for efforts supporting zero carbon by 2030, balanced between grant planning, acquisition and delivery to reduce SMUD's costs for R&D and project planning and implementation.

5) Recommendation: Recommend the Board accept the SD-10 Monitoring Report.

SD-10 Innovation 2025 Board Monitoring Report
Appendix

Table 2: R&D Projects

Research Program	ID	Project Name	Project Description	SD-10 Benefits	Start Date	End Date	Ward
Building Electrification	131	Panel Upgrade Mitigation Demo	Currently project team is working with external partners to setup operational validation testing at their labs or in the SMUD HAN lab. In parallel project team is finalizing the customer consent agreement documents with SMUD's internal legal department and the Measurement and Validation plan with our external partners.	Single-family households face barriers to electrification due to the limitations of existing electrical systems, which often necessitate costly panel and service upgrades. This project aims to assess various smart panel/breaker solutions through field research in homes in the Sacramento area to better understand the true costs, performance, and customer impacts. The expected outcomes of this project are a better understanding of: Best practices for deciding when and where to deploy each panel mitigation strategy. Identification of unforeseen barriers to smart panel/breaker technology. Frequency of load nearing or reaching the service limit. The technology readiness level of various manufacturers for mitigating service upgrades.	11/19/2024	9/30/2026	All
Building Electrification	120	Home Infrastructure Planning Phase II (HIP II)	This project developed a Residential End State model to forecast the load shapes of residential homes following full electrification. This data improves SMUD's ability to estimate the likely magnitude of impacts from residential electrification due to panel upgrades and distribution grid upgrades.	Better understanding of the infrastructure needs for fully electrified residences should help reduce the costs incurred by SMUD and our residential customers as they electrify their homes and vehicles. This will help to reduce future rate increases expected from the 2030 Zero Carbon Plan and accelerate the decarbonization of residential homes.	5/1/2023	12/30/2025	All

Building Electrification	127	RTU Engagement Tool - Small, Medium Business (SMB)	The tool is exiting its initial development phase. The project will be moving into field testing by the SAA's. This testing will go on for two weeks and feedback from the SAA team will shape the final product.	The tool will provide estimated bill impacts, including demand charges, for retrofitting roof top HVAC units at small and medium businesses to electric heat, information to assist in the decision to electrify equipment in commercial facilities. The customer engagement tool will enhance SMUD strategic account advisors' (SAAs') ability to target and encourage customer electrification by providing precise, customer-specific analysis of the realistic impacts on each customer's bill. This will allow customers to make informed decisions about electrification, which will lead to accelerated decarbonization, with associated energy savings, and overall emission reductions. It will also allow facility staff to enter equipment and other information to refine and improve cost estimates if they so choose.	8/30/2024	9/15/2025	All
Climate Change	64	Carbon Farming and Ecosystem Service Research at RSSII	Conduct field experiments at Rancho Seco to research ecosystems and evaluate the use of native species/pollinators to reduce the operational costs associated with vegetation management, erosion control, and fire protection. The project will explore the effects of vegetation and panel layout on PV generation and soil carbon.	The project will help identify and demonstrate strategies to integrate ecosystem services and agricultural value into large scale solar projects, helping to mitigate their environmental impact and build public support for their continued construction, assisting SMUD in achieving the 2030 ZCP.	1/30/2021	1/30/2026	2
Electric Transportation	107	V2G Commercial Expansion	This project will build off the electric school bus project with Twin Rivers Unified School District. The project will demonstrate and test Automated Load Management, Managed Charging, and Vehicle to Grid functionality with electric school buses and other capable EVs.	Reduce grid impacts, reduced customer infrastructure build-out cost, wholesale energy or capacity cost avoidance, and mirror characteristics of stationary storage using V2G.	1/1/2022	12/31/2027	All

Electric Transportation	97	ChargeReady Community	In early 2022, SMUD was awarded the CEC's Reliable, Equitable, and Accessible Charging for multi-family Housing (REACH) grant (GFO-21-603) to deploy charging infrastructure to multi-family housing units (MFHs) in underserved communities. The main goal of the project is to develop a technical and business model to inform future deployments and disseminate knowledge in the industry. Project partners include Mutual Housing and the SMAQMD. The project team will install at least 108 Level II handles at up to 11 locations in Sacramento, utilizing SMUD's eFuel program for design and construction. OLD description: ChargeReady Community is the Sacramento region's replicable, equity-first EV charging solution for multi-family housing (MFH). Powered by Sacramento Municipal Utilities District (SMUD) and in partnership with community-based organization (CBO) and site host Mutual Housing California (Mutual Housing) and Sacramento Metropolitan Air Quality Management District (SMAQMD), ChargeReady Community will deploy a pilot model that transitions EV charging in under-resourced communities from inaccessible amenity to expected, critical infrastructure.	Help SMUD better understand the challenges and opportunities of deploying EVSEs in multi-unit dwelling in underserved communities, helping SMUD advance the adoption of electric transportation, which contributes to GHG emissions reductions, and promoting equity in transportation.	5/11/2022	6/30/2025	All

Electric Transportation	125	EPRI EVs2Scale2030	The "EVs2Scale2030" initiative is a three-year project focused on leveraging the scale of the utility industry to help galvanize and align all market stakeholders as electric vehicles are deployed at scale and as EV goals increasingly target 50% EV market share by 2030. The initiative will focus on what needs to get done over the next 7 years to reach the 2030 goals. EPRI plans to broadly collaborate with utilities, vehicle manufacturers, charging providers, industry experts, trade associations, consumer groups, civil society, federal agencies and labs to support the rapid deployment and charging of millions of electric vehicles – while minimizing grid impacts and enabling critical grid benefits.	Deliverables include best practice templates and guidelines for various areas in transportation electrification, the nation's most comprehensive and consolidated resource for industry stakeholders, including utilities and state agencies, to vet products and equipment for the deployment of electric vehicle charging and hardware systems, two new software tools: eRoadMap2030 - an industry-first fleet data collection and analysis that provides the necessary data-backed level of detail to provide utility leaders and regulators data-supported confidence for proactive, focused grid investment needed to meet 2030 electrification goals. GridFAST - A platform-based grid interconnection online data exchange to expedite the sharing of fleet electrification plans and grid capacity between fleet customers and distribution planners.	7/14/2022	12/31/2026	All
Electric Transportation	133	FAST Grant Implementation	Sacramento Municipal Utility District (SMUD), in partnership with Sacramento International Airport (SMF), Sacramento Valley Station (SVS), California State University, Sacramento (CSUS), and ChargerHelp! (CH!), are deploying Direct Current Fast Charging stations (DCFCs) at three locations in Sacramento. With CEC match funding, this project will support the deployment of three fast charging hubs, with a total of 15 stations and 30 ports, strategically located in optimum locations with high on-demand transportation volume, near multi-family housing properties, and with quick and easy access to main transportation corridors. SMUD is currently developing a mobile app, integrated with an e-Roaming platform, to enable convenient access to locate chargers, activate sessions, and pay for charging across multiple charging networks through a single account.	Increase EV adoption by delivering electric mobility solutions throughout transportation corridors, promoting electric transportation as a benefit for drivers while lowering charging costs to increase access to electric vehicle (EV) charging for ride-share drivers, food delivery drivers, rental car fleets, shared mobility services, and residents	4/23/2024	3/30/2026	All
Electric Transportation	22	Residential Managed EV Charging (V1G)	Actively manage residential EV charging times and peak power consumption. Managed EV charging can enable deferment of distribution system upgrades, smooth the duck curve, reduce renewable generation curtailment, and provide import and export arbitrage opportunities.	Benefits include reduction of the financial risks associated with transportation electrification, specifically by mitigating the risk of overloading electrical distribution infrastructure. Another secondary benefit is to better align energy delivery for charging with low-cost energy supply.	10/1/2021	12/31/2025	All

Electric Transportation	130	Smart Outlet Evaluation	SMUD staff are evaluating three smart outlet products to gain first-hand knowledge and experience with their performance. This will influence programmatic policies and direction, and allows program managers directly involved in consulting with customers or performing direct installations of chargers to evaluate these products and influence the market toward adoption of suitable technology.	Smart outlets promise advantages over traditional corded Electric Vehicle Charging Station (EVCS), including lower initial cost, simpler installation, lower physical profile, lower maintenance costs, and reduced maintenance burden for site hosts.	11/1/2024	9/30/2025	All
Electric Transportation	24	SMUD-Owned EVSE	Operation and maintenance of SMUD's public level 2 and DCFC charging stations.	Increase EV adoption by having publicly available working charging stations in high trafficked areas.	1/1/2014	12/31/2027	All
Electric Transportation	17	Del Paso Mobility Hub	Help create an e-Mobility hub for different modes of transportation, such as taxis, Uber, Jump, buses, etc. It will also include EV charging capability as well as gig cars. The first project in execution is the Del Paso Mobility Hub.	This is a novel project and transportation facility concept. It includes electric and fuel cell vehicles, including an electric shuttle, EV charging, shared vehicles, electric micro-mobility (ebikes and electric scooters) and transportation services.	9/1/2022	2/28/2025	5
Electric Transportation	104	Light Duty Fleet V2G	This project will test and demonstrate V2X functionality on campus with a Nissan Leaf and Fermata chargers. In partnership with TEPCO (Tokyo Electric Power Company) we will evaluate the interconnection process, installation requirements, and V2X functionality. Furthermore, we will explore the V2X optimization systems using the simple price API from both Virtual Peaker and Fermata. This demonstration and evaluation will help us discover issues and gain insights into V2X in a very low risk environment. This research will help inform a potential V2X pilot in the future.	Informed deployment of light-duty V2X will reduce grid impacts and customer infrastructure build-out costs. LDV fleet management can also offer wholesale energy or capacity cost avoidance, and mirror characteristics of stationary storage.	1/1/2022	7/31/2025	All
Electric Transportation	20	Twin Rivers Commercial Managed Charging (V1G, V2G)	Incorporate electric school buses and light duty vehicles to evaluate the effectiveness of managed charging and vehicle-to-grid capabilities to balance impacts on customer and utility electrical distribution and create value through grid services.	V1G findings will support smart charging applications which can mitigate customer charging costs and support grid management and deferred infrastructure upgrades. Reduce grid impacts, reduced customer infrastructure build-out cost, wholesale energy or capacity cost avoidance, and mirror characteristics of stationary storage using V2G.	1/30/2021	3/31/2025	5
Energy Storage	138	EPRI Phase 3 Fire Protection & Mitigation	Develop an Emergency Response Plan for the Hedge Lithium-Ion battery and perform tabletop drills for SMUD personnel and first responders.	Better understand the requirements for safety and reliability for utility scale batteries. Develop resources to train SMUD stakeholders and first responders to understand lithium-ion battery storage fire hazards and response for existing and future battery systems.	3/3/2025	12/31/2026	3

Energy Storage	122	Hedge 4 MW/8MWh Monitoring and Maintenance	Operation of a 4 MW / 8 MWh utility-scale storage battery to test different operational modes and grid interactions.	The operation and testing of the Hedge Lithium-ion battery will inform the installation and direction of SMUD's future battery projects as they ramp up to meet the 2030 plan of ~3000MW of renewables and storage.	1/20/2024	1/19/2029	3
Energy Storage	132	OnSight Owl Computer Vision AI System	This technology serves as a pre-emptive thermal runaway detection for utility-scale lithium-ion batteries, that supplements traditional fire detection and alarming. As soon as something abnormal is spotted or sensed by AI analysis of the camera feed, such as smoke or a rapid/significant increase in temperature above our threshold, the Owl sends out text message and email alerts within seconds. Additionally, there is a real-time monitoring dashboard which allows us to view the lithium-ion batteries at Hedge.	Benefits of this technology include avoiding thermal runaway and preventing battery systems from igniting on fire.	11/1/2024	10/31/2025	3
Grid Evolution	136	ANYbotics Robot Inspection	Improve issue identification for preventative maintenance to reduce unexpected failures in operation and significant cost to failure of preventative maintenance. There are 4 employees dedicated to monitoring 264 substations every month, this technology will aid existing inspection staff. This will increase data collection and accuracy through robot assistance with manual and autonomous missions.	This technology will supplement the substation walkdowns done by substation operators. As the substation operator is conducting their inspection routine, the robot will aid in identifying smaller failures that are not noticeable by the human eye until it becomes a bigger failure. Being able to catch failures earlier can help minimize cost and risk.	5/28/2025	5/27/2028	All
Grid Evolution	137	Implications of Transmission Modernization and Investments to Aid Decarbonization	This project explored the implications of transmission modernization in the context of FERC 1920, using the Sacramento Municipal Utility District (SMUD) as a case study. It examined how regulatory changes influence investment decisions, regional coordination, and system-wide cost efficiency. This project analyzed how modernizing transmission infrastructure can enable the integration of renewable energy, reduce congestion, and support the path toward zero-carbon electricity systems.	Reduced Congestion Costs Lower Generation Costs Reduced Transmission Losses Capacity Cost Savings Improved resource adequacy Reduced Transmission Costs Enhanced climate resilience	3/3/2025	6/9/2025	All
Load Flexibility	139	Grant Union Resiliency Center	Develop a microgrid-powered Community Resiliency Center (CRC) at Grant Union High School in the Twin Rivers Unified School District (TRUSD).	Deploy a first-of-its-kind microgrid to demonstrate how a microgrid can provide additional benefits beyond resiliency centers by using SMUD's SolarShares and Commercial VPP programs. Serve as a template for future school installations.	6/2/2025	9/30/2026	5

Load Flexibility	134	PRECISE DER Interconnection Tool Enhancements	Evaluate DER interconnection applications and identify the advanced inverter settings that each DER (Batteries, Solar+Battery, Large-Scale DER, Flexible and Limited Generation Profiles LGP, EV Charging Stations, and V2H/V2G) system to be set to. This process will significantly save SMUD engineer's time and yet maximize the benefit of each asset.	Increased safety and avoiding reprogramming of advanced inverters post-install, and minimizing curtailment. Deploying the tool in a real utility environment would advance chances of commercialization of PRECISE and revenues to SMUD. Save an estimated 45 minutes per interconnection application, approximately 600 engineering hours annually. Reduce labor demands, enabling engineers to focus on more complex tasks without adding staff. Expedite turn-around on customer interconnection applications Increase DER Hosting Capacity on SMUD's grid. Interconnection process handles additional DER types (Batteries, Solar+Battery, Large-Scale DER, Flexible and Limited Generation Profiles LGP, EV Charging Stations, and V2H/V2G).	1/1/2025	12/31/2026	All
Load Flexibility	135	New Customer Technology Evaluation Process	Provide technical review of Meter Socket Adapters which allow the customer the ability to potentially avoid panel upgrades from PV/Battery installation via an adapter that interconnects between the utility meter and the customer main panel.	Potentially allows customer to avoid panel upgrades from installation of PV/EV. Could lead to increased adoption and penetration of DER	6/26/2025	8/31/2025	All
Load Flexibility	89	Smart Inverters	This project will test smart inverter connection via two pathways: direct connection and through vendors/aggregators. Direct connection will assist in development of the DERMS, while the vendor/aggregator pathway leverage OEM and aggregator relationships to establish pilot access agreements to a broader range of smart inverters.	Smart inverters are new technology that allows SMUD to monitor residential PV and storage and provides control functionality to assist in grid support. Ensuring that IEEE 2030.5-CSIP is a reliable communication protocol will help open up this communications pathway for many devices.	7/1/2021	7/31/2025	All

Load Flexibility	69	EnergyKit HEMS field demo	Ynventive, CLTC, Panasonic and SMUD have partnered to install the EnergyKit home energy management system into eight residential homes and evaluate it's performance managing residential loads in response to price signals and demand thresholds. Final update: AC usage is almost equivalent to the rest of the loads coming from a home (dryer, washer, dishwasher, lights, etc.). TOU cost nudges or delay sliders nudges on these none-AC loads were not enough to persuade customers to load shift with any significance. As possible next steps, CLTC would like to test CPP rate and nudges with existing customers. Adding customer to CPP rate may yield better load shift results.	Assuming the EnergyKit EMS performs as expected, it could enable customers to reliably shift their loads due to price signals and providean alternative to panel upgrades for capacity constrained customers interested in electrification.	4/30/2021	12/31/2024	All
Load Flexibility	141	Multi-family VPP Planning	Planned a deployment of up to 100 behind the meter batteries paired with rooftop solar at a multifamily complex in Rancho Cordova. SMUD will have complete dispatch control of the batteries. Developed business requirements for integration between Sonnen batteries and Itron's Intellisource platform using IEEE 2030.5. Detailed business requirements and process for coordination between Distribution System Operators, Interconnection, Distribution Planning, Energy Trading, Distribution Operations Engineering, IT's Customer and Grid Operations, and Distributed Energy Solutions teams.	SMUD specified a battery operation schedule to mitigate distribution infrastructure constraints. Identified the need to update and clarify interconnection guidelines, requirements and fees for multifamily customers, and to account for utility visibility and control of distributed generation assets.	10/2/2023	6/1/2025	2

Building Electrification	131	Panel Upgrade Mitigation Demo	Currently project team is working with external partners to setup operational validation testing at their labs or in the SMUD HAN lab. In parallel project team is finalizing the customer consent agreement documents with SMUD's internal legal department and the Measurement and Validation plan with our external partners.	Single-family households face barriers to electrification due to the limitations of existing electrical systems, which often necessitate costly panel and service upgrades. This project aims to assess various smart panel/breaker solutions through field research in homes in the Sacramento area to better understand the true costs, performance, and customer impacts. The expected outcomes of this project are a better understanding of: Best practices for deciding when and where to deploy each panel mitigation strategy. Identification of unforeseen barriers to smart panel/breaker technology. Frequency of load nearing or reaching the service limit. The technology readiness level of various manufacturers for mitigating service upgrades.	11/19/2024	9/30/2026	All
Building Electrification	120	Home Infrastructure Planning Phase II (HIP II)	This project developed a Residential End State model to forecast the load shapes of residential homes following full electrification. This data improves SMUD's ability to estimate the likely magnitude of impacts from residential electrification due to panel upgrades and distribution grid upgrades.	Better understanding of the infrastructure needs for fully electrified residences should help reduce the costs incurred by SMUD and our residential customers as they electrify their homes and vehicles. This will help to reduce future rate increases expected from the 2030 Zero Carbon Plan and accelerate the decarbonization of residential homes.	5/1/2023	12/30/2025	All

Table 3: Enterprise-Wide Initiatives

Initiative Name	Initiative Description	Initiative Benefits	Start Date	End Date	Ward
DERMS	Strategic business partnership with OSI to develop a Distributed Energy Resource Management System whereas SCADA and behind the meter resources can be used to solve distribution constraints, participate in the market, and manage flexible loads.	Leverage DER capabilities to meet economic objectives, peak load reduction, local constraint issues, deferred infrastructure investment, and grid optimization. As OSI's partner, SMUD shares revenue from future sales.	2018	2028	All

SD-10 Innovation 2025 Board Monitoring Report
Appendix

SMUD GPT	SMUD GPT is a locally hosted alternative to ChatGPT. It allows staff to summarize documents, research topics, and generate new content while keeping all data local to SMUD.	As of June 30, SMUD GPT had 365 active weekly users, creating 1,190 conversations per week. Use cases are varied, including code generation, technical troubleshooting, research, training content development	2025	N/A	All
SMUD GPT RAG Solutions	These are AI solutions that have been trained on SMUD-specific data. They allow staff to quickly research technical topics with answers that are grounded in curated information repositories.	Implemented custom Retrieval-Augmented Generation solutions for: • Critical Energy Infrastructure Information Summaries • Wildfire Mitigation • Credit Knowledge Base • Billing Knowledge Base • Subscription-Based Information Technology Arrangements (e.g. software-as-a-service) • NERC • Corporate Communications • Distributions Team • Design & Construction Services • CPUC G.0. 95 safety guidelines • Board Materials • Safety Team	2025	2025	All
Storm Forecasting Model	Staff created a model to estimate the number of outages a storm will cause, based on the weather forecast. The model considers wind speeds, temperatures, recent precipitation, and other factors. This data can be considered when developing staffing plans for storms.	Initial Machine Learning model developed based on historical weather. Accuracy is strongly influenced by the accuracy of the weather forecast. Also explored variation using historical forecast rather than actuals for comparison. Wind gust identified is a key indicator in forecasting algorithm.	2025	2025	All
Gridscope	SMUD initiated a 3-year pilot project with Gridware, to install about 500 “Gridscope” devices on our transmission and distribution poles in the Upper American River Project (UARP) and in our service area, targeting distribution circuits with high fire risk, high number of outages, and a high percentage of outages with unknown cause.	The purpose of these solar-powered monitoring devices is to detect early signs of potential hazards like vibrations from car-pole incidents, bird strikes, fallen tree limbs, wind damage and downed wires. This allows for more rapid identification of outage cause and damage location, speeding restoration and allowing more targeted preventive measures.	2025	2027	2,3,4,5,7

RESOLUTION NO. 25-10-04

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

This Board accepts the monitoring report for **Strategic Direction SD-19, Diversified Business**, substantially in the form set forth in **Attachment C** hereto and made a part hereof.

Approved: October 16, 2025

INTRODUCED: DIRECTOR KERTH				
SECONDED: DIRECTOR TAMAYO				
DIRECTOR	AYE	NO	ABSTAIN	ABSENT
FISHMAN	X			
ROSE	X			
BUI-THOMPSON	X			
HERBER	X			
KERTH	X			
TAMAYO	X			
SANBORN	X			

Attachment C
to Resolution No. 25-10-04

SACRAMENTO MUNICIPAL UTILITY DISTRICT

OFFICE MEMORANDUM

TO: Board of Directors **DATE:** September 24, 2025

FROM: Claire Rogers *CR 9/24/25*

SUBJECT: **Audit Report No. 28007874**
Board Monitoring Report; SD-19: Diversified Business

Internal Audit Services (IAS) received the SD-19 *Diversified Business* 2024 Annual Board Monitoring Report and performed the following:

- Selected a sample of statements and assertions in the report for review.
- Compared sample to the corresponding supporting documentation to identify potential discrepancies.

All items sampled within the SD Report aligns with the supporting documentation provided at the time of review.

CC:

Paul Lau

Board Monitoring Report 2024
SD-19, Diversified Business

1) Background

Strategic Direction SD-19 states that:
Broadening and diversifying the products and services that SMUD offers is a key value. The desired results are to: a) generate new revenues that contribute to SMUD's long-term financial health; b) spur the creation of innovative products and services; c) capture the value of SMUD's brand and intellectual property; d) better leverage and optimize SMUD's assets; and e) enable SMUD to continue to attract and retain a talented workforce.

Therefore:

a) SMUD shall broaden and diversify its lines of business, which may include:
   i. Being an external service provider;
   ii. Expanding wholesale energy market opportunities;
   iii. Capitalizing on intellectual property and assets to develop products and services either solely or through strategic partnerships;
   iv. Selling products and services aligned with SMUD's purpose and Strategic Directions.

b) SMUD shall ensure any new lines of business:
   i. Benefit SMUD's customers and our community;
   ii. Achieve a balanced, diversified portfolio of rewards and risks;
   iii. Create economic value without compromising SMUD's financial health;
   iv. Do not pose unreasonable risk to SMUD's reputation;
   v. Align with, leverage, and optimize SMUD's strengths, assets and expertise;
   vi. Position SMUD for the future.

2) Executive Summary

a) The 2030 Zero Carbon Plan has positioned SMUD as a leader in the utility industry. The Diversified Business portfolio utilizes that leadership position to build revenue generating partnerships with technology developers, pursue external funding (grants) to support innovation and partnership, enable technology solutions to become fully commercialized through real world pilots and demonstrations, and expand regional access to green careers.

b) **SMUD is in compliance with SD-19, Diversified Business.**

c) Eliminating the final 10% of emissions from SMUDs energy supply requires the development of new technology and business models.

d) The Grants Program manages or monitors 11 active competitively won grants at both the State and Federal level for a total of $239M in total project costs and $93M in award. The Grants Team supports SD-19 with grants that offset planned work or strategically introduce new work. In all cases, the pursuit and management of grants is a net financial positive to SMUD and represents a renewable and diverse funding stream.

External funding (2024)

Total Project Costs	Award Amount	SMUD Cost Share
$239,149,326	**$93,463,703**	**$145,685,622**

Looking more closely at the Grants currently being implemented at SMUD, there are four projects that most closely align with SD-19 efforts. Three are related to electric vehicle charging and the fourth is focused on workforce development efforts. Each of the electric vehicle projects deploys a different model with nuances on how they might best align with SD-19. Additional details are found in Appendix A.

e) New Business Development logged over 20 strategic opportunities in its database in 2024; after an initial review, a handful of these went on to the next evaluation stage. Although no new partnerships were entered into in 2024, considerable work was done to improve internal processes, strategic direction and thresholds to better focus resources on the most valuable opportunities for SMUD.

Partnership benefits to SMUD may include revenue sharing agreements, intellectual property development, future pricing commitments, service-based payments and/or partner commitments to regional investment. Partners benefit from SMUDs zero carbon leadership, subject matter expertise and collaboration on real world pilots and full-scale demonstrations.

Strategic Partners and Revenue Generating Relationships

Partner	Area of Focus
AspenTech (Formerly Open Systems International, Inc.)	ADMS / DERMS
ESS Inc.	Long Duration Energy Storage
Cal EPIC (Formerly California Mobility Center)	Mobility Innovation and Workforce Development
Itron	Smart meter and customer data platform
Simple Energy (Uplight)	Customer engagement and load flexibility
Smart Energy Water (SEW)	Customer Experience Platform Development
Community Choice Aggregators	Operational support and consulting services

Portfolio Revenue

2024 Gross Revenue*	2024 Costs	2024 Net Revenue
$16,637,807	$13,915,625	$2,722,182

*Partnership revenue may include revenue sharing agreements, intellectual property royalties, and/or service-based payments. Future product discounts, stock warrant value, and other unrealized benefits are not accounted for as revenue.

3) Additional Supporting Information

a) Additional funding
Funding is most often pursued through grants; however, this category is not limited to grants. SMUD considers foundation funding, disaster recovery funds, state and federal funding allocations and other sources of funding in this category. Descriptions of 2024 funding are listed in Appendix A.

b) Community Choice Aggregator Services
SMUD currently provides 11 specific services to seven (7) community choice aggregators representing 2.6M meters. SMUD has, on average, added approximately one new CCA client and one new service launch per year. Specific details on these CCA's are listed in Appendix B.

c) Technology and Industry Partners
Diversified business is often an outcome of technology and industry partnerships. These relationships often build on the successes of individual pilots, projects, or other innovation initiatives. Specific details of projects and innovation are outlined in the SD-10, Innovation monitoring report. Additional strategic partnership details are included in Appendix C of this report.

4) Challenges

a) With a new President elected in 2024, changes to the acquisition and implementation of Federal funding are imminent. It appears that grant funding will likely be at the mercy of shifting presidential priorities and that California in general could be a target for cancellation of awards.

b) SMUD's leadership position in pushing towards zero carbon has created a significant number of potential opportunities and partnerships to consider. The prevalence of funding opportunities and the volume of companies with a desire to work with SMUD create challenges in filtering through the volume of opportunities in pursuit of the best opportunities. Strategic partnerships are often made more complex because they often involve technologies that are not fully commercialized or market ready. This combination of technology maturity and the broad scope of funding opportunities means that SMUD must be highly selective in choosing who to partner with and which funding opportunities to pursue. Developing the correct portfolio of grants and partnerships is critical to meeting the goal and intent of SD-19. Pursuing too many initiatives in parallel can result in a lack of support on the most important areas of focus. Additionally, it is critical that the efforts pursued have strong alignment with each other and the overall zero carbon plan.

c) Zero Carbon by 2030 is a critical and aggressive timeline. As SMUD evaluates grants, partnerships and new business opportunities, it must be done in the context of achieving zero carbon by 2030. This timeline constraint must be considered when looking at the technology and commercial readiness levels of companies SMUD is considering partnering with. Similarly, grants and other external funds that have timelines that extend beyond 2030 may lack alignment with the 2030 Zero Carbon Plan. Pursuit of diversified business to help achieve zero carbon is a priority, but this pursuit will extend beyond 2030.

5) Recommendation

It is recommended that the Board accept the Fiscal Year 2024 Monitoring Report for SD-19, Diversified Business.

APPENDIX A

External Funding Descriptions

1. Catalyst Fund- Workforce Development Grant

Project Name: Catalyst Fund Workforce Development Grant

Funding Awarded: $508,000

The 'Capitol Region Skilled Trades Workforce Pipeline Program' (Project) leverages regional experts in the Utilities, Transportation Infrastructure, and Commercial Construction Opportunity Industry Sectors to formally analyze the region's pipeline of skilled trades workforce with particular attention to identifying barriers to entry for disinvested community members. Utilizing detail from the initial analysis, this same cohort will co-create a robust curriculum that focuses on 'Common Skills' shared amongst the employer pool. The expectation for this Exploratory project is for members to consider and commit to pursuing shared training opportunities with potential to operationalize strategies that foster inclusion and ensure equitable outcomes. The concept for this Exploratory project originated from available regional data paired with repeated anecdotal evidence shared amongst employers within the project's targeted opportunity sectors. The throughline of the data and evidence was repeated emphasis on applicants having 'missing skills' due to lack of appropriate training.

2. FAST Grant

Project name: *SACommunity EV Hubs*

Funding Awarded: $2,812,421

Sacramento Municipal Utility District (SMUD), in partnership with Sacramento International Airport (SMF), Sacramento Valley Station (SVS), California State University, Sacramento (CSUS), ChargerHelp! (CH!), and AECOM, proposed the deployment of Direct Current Fast Charging stations (DCFCs) at three locations in Sacramento, enabling increased access to electric vehicle (EV) charging for ride-share drivers, food delivery drivers, rental car fleets, shared mobility services, and residents. The project will support the deployment of three fast charging hubs, with a total of 15 stations and 30 ports, strategically located in optimum locations with high on-demand transportation volume, near multi-family housing properties, and with quick and easy access to main transportation corridors. SMUD will develop a mobile app, integrated with an e-Roaming platform, to enable convenient access to locate chargers, activate

sessions, and pay for charging across multiple charging networks through a single account. Development of this single public charging interface will allow users to find, compare, and use multiple public charging options, without having to create and manage multiple proprietary apps. Development of this app and use of the e-Roaming platform will also allow SMUD to offer discounts and special rates to on-demand drivers and other target customer groups. SMUD's *SACommunity EV Hubs* project will support the Sacramento region's access to charging infrastructure for high mileage on-demand transportation services and the public. *SACommunity EV Hubs* will deploy a model that transitions charging in high-traffic communities from a constrained amenity to accessible infrastructure. These plazas will enhance access to public charging while attracting service drivers with affordable rates and shared infrastructure to ease their financial burden.

3. <u>REACH 2.0 Grant</u>

Project Name: SMUD Multifamily EV Charging Community

Funding Awarded: $5,000,000

Sacramento Municipal Utility District (SMUD), in partnership with the Sacramento Metropolitan Air Quality Management District (SMAQMD), Uber, and dozens of Sacramento area property owners, managers, and developers, has been awarded funding to deploy and demonstrate a replicable and scalable approach to delivering affordable electric vehicle (EV) charging for multifamily homes (MFH). SMUD Multifamily EV Charging Community proposes to deploy over 400 AC chargers at 26 multifamily (MF) residential and MF-adjacent locations across Sacramento, with 92% of sites located within disadvantaged, low-income, or affordable housing communities.

The SMUD Multifamily EV Charging Community project increases regional at-home EV charging access while testing and validating a scalable, replicable business case and promising technology solutions to catalyze the deployment of level 1 and 2 electric vehicle service equipment (EVSE) at and near MFH. The project proposes to deploy best-fit design and engineering solutions at each site, combined with a newly developed SMUD EV app featuring an integrated e-Roaming platform to offer novel rate designs through member charging networks. The project will also leverage existing programs and organizational resources to prepare for scale. The combination will deliver an equitable, streamlined, high-quality, and cost-effective charging experience.

4. <u>REACH 1.0 Grant</u>

Funding Awarded: $2,290,000

Funded by the California Energy Commission, the goals of the REACH grant program are to 1) Demonstrate replicable and scalable business and technology models for large-scale deployment of electric vehicle (EV) charging infrastructure to benefit and be used by multi-family housing (MFH) residents, 2) Improve education and awareness regarding EVs to increase EV travel by MFH residents, including

MFH residents in disadvantaged communities, low-income communities, and/or residents of affordable housing, and 3) Provide affordable, reliable, and conveniently accessible charging infrastructure for MFH residents.

To achieve these goals, the focus of these efforts' centers around infrastructure, education, affordability, reliability and accessibility. This includes installation of 108 Level 2 EV charging stations across 6 MFH sites, increasing resident understanding of EV and EVSE technology, establishing a car sharing program provided by SMAQMD, developing no- or low-cost EV charging for MFH residents with high reliability.

APPENDIX B

Community Choice Aggregator Detail

SMUD Community Energy Services currently provides 11 services to seven (7) community choice aggregators representing 2.7M meters. CES has averaged approximately one new CCA client and one new service launch per year. There are 25 operational CCAs in California representing 14M customers or about 36% of California. SMUD continues to invest in new CCA, utility, jurisdiction and energy company business activities.

Customer Care and Operations	Data and Insights	Engagement and Branding
• Contact Center • Billing • Debt Collections • CRM Systems	• Data Management • Market Research • Data Analytics • Custom Reporting	• Customer Programs • Electrification Concierge • Marketing

Community Choice Aggregator Clients

In 2002, Assembly Bill 117 was passed to establish Community Choice Aggregation in the State by authorizing Community Choice Aggregators ("CCAs") to aggregate customer electric load and purchase electricity for customers. SMUD sees the growth of CCAs as an opportunity to support organizations with values closely aligned with SMUD's values, while also generating additional revenue for SMUD. CCA programs are proliferating in the State thanks to support for expanding renewable energy use and desire for local control, particularly for electricity procurement. There are numerous CCAs operating in the State, and more are anticipated to launch in the future. CCAs are responsible for procuring wholesale power, setting the generation rate, providing customer care, understanding customer needs, and engaging customers through programs and other services. The local investor-owned utility ("IOU") continues to deliver electricity from the electric grid, maintain its electric infrastructure, bill customers and collect payments.

In October 2017, SMUD contracted with Valley Clean Energy ("VCE"). VCE is a joint powers agency formed in 2016 by the City of Woodland, the City of Davis and Yolo County to implement a local CCA program. The service territory expanded to include the City of Winters in 2021.

In February 2018, SMUD contracted with Ava Community Energy ("Ava" formerly East Bay Community Energy). Ava is a joint powers agency formed in 2016 by the cities of Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Oakland, Piedmont, San Leandro and Union City in Alameda County to implement a local CCA

program. Ava expanded its territory to the cities of Pleasanton, Newark, and Tracy in April 2021. An expansion of Stockton is planned for 2025.

In June 2019, SMUD contracted with Silicon Valley Clean Energy ("SVCE"). SVCE is a joint powers agency formed in 2016 by the cities of Campbell, Cupertino, Gilroy, Lost Altos, Los Altos Hills, Los Gatos, Milpitas, Monte Sereno, Morgan Hill, Mountain View, Saratoga, Sunnyvale and Unincorporated Santa Clara County to implement a local CCA program.

In October 2022, SMUD contracted with Marin Clean Energy ("MCE"). MCE is a joint powers agency formed in 2010 and represents 37 member communities across four Bay Area counties: Contra Costa, Marin, Napa and Solano.

In December 2022, SMUD contracted with Sonoma Clean Power ("SCP"). SCP is a joint powers agency that serves Sonoma and Mendocino counties.

In May 2024, SMUD contracted with Central Coast Community Energy ("3CE"). 3CE is a joint powers agency representing County of Monterey, County of San Benito, County of Santa Cruz, County of Santa Barbara, Arroyo Grande, Buellton, Capitola, Carmel, Carpinteria, Del Rey Oaks, Goleta, Gonzales, Greenfield, Grover Beach, Guadalupe, Hollister, Marina, Monterey, Morro Bay, Pacific Grove, Paso Robles, Pismo Beach, Salinas, Sand City, San Juan Bautista, San Luis Obispo, Santa Cruz, Santa Maria, Scotts Valley, Seaside, Soledad, Solvang, and Watsonville. Atascadero and unincorporated San Luis Obispo County are anticipated to begin service in January 2025.

In August 2024, SMUD contracted with San Jose Clean Energy ("SJCE"). SJCE is a joint powers agency that serves San Jose.

Appendix C

Partner List and Description

1) **AspenTech (AZPN) (Formerly: Open System International, Inc.)**: Strategic technology partnership to implement and deploy an industry-leading Distributed Energy Resource Management System (DERMS). SMUD will receive royalties from future sales of the enhanced product suite for DERMs. DERMs Phase 1 and ADMS development is complete, implemented Q3 2022. DERMS Phase 2 and Phase 3 design and development completed and implemented in Q3 2024. Phase 4 design has begun continuing development of the core DERMS system functionality. DERMS Phase 4 functionality is planned to go-live in mid-2026.

   OSI Inc. was bought by Emerson for $1.6 billion in an all-cash transaction on October 1, 2020. The acquisition added to Emerson's existing $1 billion standalone software and associated engineering implementation services portfolio. Then in May 2022, Emerson combined its industrial software businesses – OSI Inc. and its Geological Simulation Software business – with AspenTech to create a global industrial software leader. Shares of new AspenTech began trading on NASDAQ under the ticker symbol "AZPN" in May 2022. The AspenTech partnership continues to contribute revenue to the portfolio.

2) **ESS Inc.:** ESS is a long duration energy storage system developer whose technology is based on earth-abundant iron, salt and water to deliver environmentally safer solutions capable of providing up to 8 hours of flexible energy capacity for commercial and utility-scale energy storage applications, with a long-term design target of 12-17 hours duration. Established in 2011, ESS Inc. aspires to deploy reliable, sustainable long-duration energy storage solutions for independent power producers, utilities and other large energy users.

   SMUD and ESS established a joint collaboration agreement in 2022 to provide up to 200 megawatts (MW) / 2 gigawatt-hours (GWh) of ESS' environmentally safe and sustainable long duration energy storage solutions. The agreement called for ESS to deliver a mix of its Energy Warehouse™ and Energy Center™ long-duration energy storage (LDES) solutions for integration with the SMUD electric grid beginning in 2023.

   In 2023, SMUD installed and commissioned 6 Energy Warehouse™ products as part of its partnership with ESS, with a combined energy storage capacity of 3 MWh. Each Energy Warehouse iron-flow battery is packaged in a standard 40' shipping cargo container modified to house the electrolyte tanks, cell stack, and ancillary equipment such as pumps and electronics.

   In 2025, before proceeding with the Energy Center™ phase of the partnership, ESS began a transition process involving corporate restructuring, furlough of employees, and a strategic shift to their next generation product the Energy Base which is a larger format package and focuses on a longer duration design target of 12-17 hours duration. As a result, SMUD had decided to conclude the pilot with ESS's older products and shift to an approach of monitoring progression of ESS's next generation products.

California's fast-growing long-duration energy storage resources.

3) **Cal EPIC (formerly the California Mobility Center)** developed new organizational policies and procedures required under the grant agreements, while it continued to refine its workforce development and training delivery models. They successfully met all grant reporting deadlines in 2024 with emphasis to optimize the recruiting and training strategies under the Federal and City grants. Strong partnerships were continued with community-based organizations serving underrepresented communities through the External Affairs Coordinator. This role has a direct line of communication with these organizations and regularly attends career fairs, communicates with partner orgs, and helps schedule and organize workforce development programming. These partners include but are not limited to Women's Empowerment, Saint John's, Greater Sacramento Urban League, Asian Resources Incorporated, CA Asian Chamber of Commerce, La Familia, and Community Resource Project. Partnership with other leading organizations for trainings were also strengthened by including ChargerHelp!, Rivian, Center for Manufacturing a Green Economy (nonprofit arm of the United Auto Workers), and a partnership with the California Masonic Foundation and the Sacramento City Unified School District in workforce development programs. For the 2024 calendar year, the CMC trained approximately 355 people.

4) **Itron:** Itron Networked Solutions, Inc. has been a SMUD strategic partner for over 25 years, and in September 2024 SMUD entered into a Joint Sales Agreement (JSA) as part of a Strategic Value Partnership with ITRON. The JSA has the potential to generate revenue to off-set software fees, as SMUD co-market products with ITRON to support and develop functionalities that enable Grid Edge intelligence to increase grid stability, resiliency, and reliability through visibility, management, and control of devices on the grid. In addition, SMUD also have a Joint Collaboration Agreement (JCA), if an opportunity presents itself in the future for co-development.

5) **Simple Energy (Uplight):** Since 2017, SMUD has partnered with Simple Energy to operate the SMUD Energy Store (smudenergystore.com) through a collaborative revenue-sharing agreement that generates approximately 4% of gross merchandise value in revenue. The online store offers a wide range of smart thermostats, connected home products, EV chargers, lighting, and water-saving products, many with instant rebates that significantly reduce costs on popular items like Nest thermostats and Phillips LED bulbs. This partnership has fostered a strong, productive relationship that supports SMUD's energy efficiency goals, promotes customer programs, results in high levels of customer satisfaction, enhanced customer engagement, and correlates to higher Value for Pay scores.

   Several new product additions were added in 2023, including an expanded EV charger, smart thermostat, smart home, lighting and water savings product offerings. Over 4,500 thermostats were pre-enrolled in My Energy Optimizer, added Wi-Fi window ACs and the Google Nest 4th Gen thermostat. Efforts this year include a pilot Offer Center providing free thermostats to low/moderate-income customers, new renter weatherization products, a Meadowview LED giveaway, and a Holiday District

Campaign promoted thermostats and My Energy Optimizer incentives.

6) **Smart Energy Systems, Inc. dba Smart Energy Water (SEW):** SEW is a digital platform developer dedicated to solving global energy and water crises. SMUD and SEW are Co-developing innovative utility centric communication tools such as, customer facing self-service modules, payment processing (through SEW subsidiary I Pay Smart), prepay, eMobility, and advanced analytics for grid resilience. These tools support SMUD in our zero-carbon journey and may generate future shared revenue if the tools are adopted by other utilities. Both the SEW and I Pay Smart Joint Collaboration Agreements (JCAs) were extended through 12/31/2036.

   As SMUD continues to build its eco-system with SEW, we anticipate the platform will be one of their most robust examples in North America by the end of 2027. As we are standing up the SEW platform, revenue or licensing offsets have not yet materialized. In 2024, efforts are underway for a more solidified revenue share addendum to the SMUD and SEW Joint Collaboration Agreement (JCA). In 2026, we anticipate co-developing new features with SEW as part of the EV App Phase 2 project. Co-development of net-new products with SEW will likely be de-emphasized until 2028.

RESOLUTION NO. 25-10-05

WHEREAS, in May 2025, SMUD issued Request for Proposal No. Doc5195526389 (RFP) to solicit proposals from qualified firms to provide hydroelectric design and engineering services for a five-year period; and

WHEREAS, nine proposals submitted in response to the RFP were evaluated; **NOW, THEREFORE,**

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

Section 1. As a result of such examination, **GFT Infrastructure, Inc., Mesa Associates, Inc., HDR Engineering, Inc.,** and **Stantec Consulting Services, Inc.** are hereby determined and declared to be the four highest evaluated responsive proposers to provide hydroelectric design and engineering services.

Section 2. The Chief Executive Officer and General Manager, or his designee, is authorized, on behalf of SMUD, to negotiate and award contracts to **GFT Infrastucture, Inc., Mesa Associates, Inc., HDR Engineering, Inc.,** and **Stantec Consulting Services, Inc.** (collectively, the **Contracts**) for hydroelectric design and engineering services for an approximate five-year period from October 20, 2025, to October 31, 2030, for an aggregate not-to-exceed amount of $15,000,000 for the **Contracts**.

Section 3. The Chief Executive Officer and General Manager, or his designee, is authorized to make future changes to the terms and conditions of the **Contracts** that, in his prudent judgment: (a) further the primary purpose of the **Contracts**; (b) are intended to provide a net benefit to SMUD; and (c) does not exceed the authorized contract amounts and applicable contingencies.

Approved: October 16, 2025

INTRODUCED: DIRECTOR KERTH				
SECONDED: DIRECTOR TAMAYO				
DIRECTOR	AYE	NO	ABSTAIN	ABSENT
FISHMAN	X			
ROSE	X			
BUI-THOMPSON	X			
HERBER	X			
KERTH	X			
TAMAYO	X			
SANBORN	X			

RESOLUTION NO. 25-10-06

WHEREAS, in June 2025, SMUD issued Request for Proposal No. Doc5223839238 (RFP) to solicit proposals from qualified firms for geotechnical engineering services for a five-year period; and

WHEREAS, nine proposals submitted in response to the RFP were evaluated; **NOW, THEREFORE,**

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

Section 1. As a result of such examination, **Kleinfelder, Inc., GFT Infrastructure, Inc., GEI Consultants, Inc., Terracon Consultants, Inc., HDR Engineering, Inc.,** and **KGS International, Inc.** are hereby determined and declared to be the six highest evaluated responsive proposers to provide geotechnical engineering services.

Section 2. The Chief Executive Officer and General Manager, or his designee, is authorized, on behalf of SMUD, to negotiate and award contracts to **Kleinfelder, Inc., GFT Infrastructure, Inc., GEI Consultants, Inc., Terracon Consultants, Inc., HDR Engineering, Inc.,** and **KGS International, Inc.** (collectively, the **Contracts**) for geotechnical engineering services for an approximate five-year period from October 20, 2025, to October 31, 2030, for an aggregate not-to-exceed amount of $10,000,000 for the **Contracts**.

Section 3. The Chief Executive Officer and General Manager, or his designee, is authorized to make future changes to the terms and conditions of the **Contracts** that, in his prudent judgment: (a) further the primary purpose of the **Contracts**; (b) are intended to provide a net benefit to SMUD; and (c) does not exceed the authorized contract amounts and applicable contingencies.

Approved: October 16, 2025

INTRODUCED: DIRECTOR KERTH				
SECONDED: DIRECTOR TAMAYO				
DIRECTOR	AYE	NO	ABSTAIN	ABSENT
FISHMAN	X			
ROSE	X			
BUI-THOMPSON	X			
HERBER	X			
KERTH	X			
TAMAYO	X			
SANBORN	X			

RESOLUTION NO. 25-10-07

WHEREAS, since 1990, in collaboration with **Sacramento Tree Foundation (STF)**, SMUD has provided free shade trees to customers to, among other things, reduce their summer cooling costs and help reduce summer peak demand for electricity; and

WHEREAS, over the years, additional benefits realized have included community plantings, mitigation of urban heat island effects, air quality improvements, and carbon sequestration; and

WHEREAS, **STF** is a local, non-profit, community-based organization with a mission to grow healthy, livable communities in the Sacramento region by building the best regional urban forest in the nation; and

WHEREAS, **STF** has over 40 years of experience in urban forestry management practices and over 30 years of experience in delivering the Shade Tree program for SMUD in the greater Sacramento area; and

WHEREAS, SMUD desires to include a greater emphasis on community plantings, including shrubs and fruit trees, and focus on increasing the tree canopy in under-canopied neighborhoods; and

WHEREAS, **STF** is the only provider in the Sacramento region with extensive long-term relationships with local and regional tree growers and retail nurseries and urban community foresters; and

WHEREAS, there are no other urban forestry organizations in the region who could deliver this type of urban tree planting program for energy efficiency benefits; and

WHEREAS, given **STF's** history of success in delivering SMUD's urban tree planting program, expertise and the benefit **STF** provides, the contact pricing is deemed fair and reasonable; and

WHEREAS, it would not be productive or in the best interest of SMUD to advertise for competitive bids for the services referred to above because **STF** is the only urban forestry organization of its type in the region; **NOW, THEREFORE**,

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

Section 1. The Chief Executive Officer and General Manager, or his designee, is authorized, on behalf of SMUD, to negotiate and execute a sole source contract with the **Sacramento Tree Foundation** to provide shade trees to SMUD customers during the period January 1, 2026, to December 31, 2028, for a not-to-exceed amount of $6,034,461.

Section 2. The Chief Executive Officer and General Manager, or his designee, is authorized to make future changes to the terms and conditions of the contract that, in his prudent judgment: (a) further the primary purpose of the contract; (b) are intended to provide a net benefit to SMUD; and (c) do not exceed the authorized contract amount and applicable contingencies.

Approved: October 16, 2025

INTRODUCED: DIRECTOR KERTH				
SECONDED: DIRECTOR TAMAYO				
DIRECTOR	AYE	NO	ABSTAIN	ABSENT
FISHMAN	X			
ROSE	X			
BUI-THOMPSON	X			
HERBER	X			
KERTH	X			
TAMAYO	X			
SANBORN	X			

President Fishman turned to Discussion Calendar Item 12, to cast a vote on Sacramento Local Agency Formation Commission (LAFCo) ballot regarding the election of a Special District Representative (two seats) and Alternate Special District Representative (one seat).

Laura Lewis, Chief Legal & Government Affairs Officer, gave a presentation regarding Discussion Calendar Item 12. A copy of the slides used in her presentation is attached to these minutes.

Written public comment, a copy of which is attached to these minutes, was received from the following member of the public:

- Gay Jones

After some discussion, President Fishman stated he would entertain a motion to cast SMUD's vote on the LAFCo ballot for Gay Jones for the four-year regular term, for Brandon Rose for the two-year regular term, and for Charlea Moore for the four-year alternate term. Director Herber moved for approval, Director Rose seconded, and Resolution No. 25-10-08 was unanimously approved.

RESOLUTION NO. 25-10-08

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

Section 1. This Board casts its vote for Gay Jones as Special District Commissioner (four-year regular term) to the **Sacramento Local Agency Formation Commission (LAFCo)**.

Section 2. This Board casts its vote for Brandon D. Rose as Special District Commissioner (two-year regular term) to the **Sacramento Local Agency Formation Commission (LAFCo)**.

Section 3. This Board casts its vote for Charlea Moore as Alternate Special District Commissioner (four-year term) to the **Sacramento Local Agency Formation Commission (LAFCo)**.

Approved: October 16, 2025

INTRODUCED: DIRECTOR HERBER				
SECONDED: DIRECTOR KERTH				
DIRECTOR	AYE	NO	ABSTAIN	ABSENT
FISHMAN	X			
ROSE	X			
BUI-THOMPSON	X			
HERBER	X			
KERTH	X			
TAMAYO	X			
SANBORN	X			

Attachment D
to Resolution No. 25-10-08

SACRAMENTO LOCAL AGENCY FORMATION COMMISSION
1112 I Street, Suite 100 • Sacramento, CA 95814 • (916) 874-6458
www.saclafco.org

Mail to: LAFCO
1112 I Street, Suite 100
Sacramento, CA 95814
Or email:
commissionclerk@saclafco.org

ELECTION BALLOT

Special District Representative to LAFCo
Regular Seat #7

The election ends on November 21,2025 at 5:00 p.m. or until a quorum of Special District ballots is received, whichever occurs later.

Four-Year Regular Term Candidate & District	**Select one (1)**
Gay Jones*, Sacramento Metropolitan Fire District	✓
Jim Frazier, Hearld Fire Protection	
Robert "Bob" Wichert, Sacramento Suburban Water District	

Two-Year Regular Term Candidate & District	**Select one (1)**
Beau Reynolds, North Highlands Recreation and Park District	
Brandon D. Rose, Sacramento Municipal Utility District	✓
Jim Frazier, Hearld Fire Protection	
Robert "Bob" Wichert, Sacramento Suburban Water District	

Four-Year Alternate Term Candidate & District	**Select one (1)**
Charlea Moore*, Rio Linda Elverta Recreation and Park District	✓
Jim Frazier, Hearld Fire Protection	

*Incumbent

BALLOT CONTINUES ON THE NEXT PAGE

***SIGNATURE OF PRESIDING OFFICER** (Original Signature Required):*

_____

Note:** **Presiding Officer is the Chair/President. Any other signature invalidates this ballot, unless accompanied by Meeting Minutes designating an alternate.

***PRINTED NAME OF PRESIDING OFFICER** (Required):*

Gregg Fishman

AGENDA ATTACHED** (Optional):* ***Yes ____ ***No*** X

Attest:

_____

District Secretary, Clerk or General Manager

President Fishman clarified no verbal public comment was forthcoming for Discussion Calendar Item 12.

President Fishman then called for public comment for items not on the agenda.

Written public comment, copies of which are attached, was received from the following member of the public:

- John Weber

President Fishman then turned to Directors' Reports.

Director Rose reported on his attendance at the Sun Day and Climate Justice Festival, the Folsom Chamber of Commerce's Future of Folsom event, and the Sacramento Metropolitan Chamber of Commerce's Study Mission to Boston.

Director Bui-Thompson reported on her attendance at the Summerfest Wine & Food Gala in Rancho Murieta, the Hope Cooperative's Stand Up Sacramento event, the Sacramento Zoo Twilight Safari event, and the international convening of the German Marshall Fund and Marshall Memorial Fellowship.

Director Herber reported on her speaking engagement with the Elk Grove Chamber of Commerce business mixer, her attendance at the Sacramento Hispanic Chamber of Commerce's 2025 State of Hispanics event, the Sacramento Cultural Hub's Exceptional Women of Color Expo and Awards, the Mirasol Village Early Learning Center Construction Completion Celebration where Congresswoman Matsui was in attendance, the Sacramento Zoo Twilight Safari event, and the Sacramento Annual Literacy Festival. She then reported on her attendance at SMUD's Connecting our Communities Resource Expo, InnoGrove's 10-year anniversary open house event, and her building tour of the American River College (ARC) Center for Technical Education.

Director Kerth reported on his attendance at the Twin Rivers School District Citizen's Bond Oversight Committee meeting, his participation in the business walk for the R Street Sacramento Partnership, as well as the Metro Chamber's Study Mission to Boston.

Vice President Tamayo reported on his Ward 6 Listening Session with Community Leaders and thanked Rhonda Staley-Brooks, Director of Community Relations Outreach & Support, for facilitating it, his attendance at the InnoGrove event, and the Magkaisa event at Laguna Town Center for Filipino American History Month. He announced that he would also be attending two more upcoming events hosted by the Filipino American National Historical Society (Sacramento Chapter) and the Filipino Community of Sacramento and Vicinity. He then reported on his attendance at the Sustainable Communities Partnership Summit and commended DEIB & Sustainable Communities Manager Shiloh Costello on her work for the event. He reported on his speaking engagement for SMUD's Emerging Leaders Energy Summit, his attendance at the Sacramento Hispanic Chamber of Commerce's 2025 State of Hispanics, the Community Resource Project Literacy event at Rainbow Park, and the Terra Madre Americans Grant Tasting event. He concluded by reporting on his attendance at the Food Literacy Center's Veggie of the Year event.

Director Sanborn reported on her attendance at the Women's Empowerment Gala and the Habitat for Humanity Hard Hats and High Heels event and commended Habitat Board President Shiloh Costello for her leadership in raising over $500,000. She then reported on her participation in a tree planting with the Kiwanis Club of Carmichael, her attendance at the Sacramento Native American Health Center's First Foods Dinner, the Sacramento Valley Conservancy's Treasures of the Valley event, and the Carmichael Chamber of Commerce's elected officials mixer along with Senator Niello, Assemblymember Hoover, Supervisor Desmond and Congressman Bera. She concluded by reporting on her building tour of the American River College (ARC) Center for Technical Education.

President Fishman reported on his attendance at the Sacramento Republic FC Hispanic Heritage Night Noche Latina, the Asian Resources, Inc.'s Autumn Moon Dinner, the Sacramento Native American Health Center First Foods Dinner, and the Iu Mien Community Services Annual Honoring our Journey Banquet. He then reported on his speaking engagements at the Habitat

for Humanity Hard Hats and High Heels event and the American River College (ARC) Center for Technical Education building tour. He reported on his participation in the Great American River Cleanup and noted he is on the Board of the American River Parkway Foundation. He concluded by reporting on this attendance at the Northern California Power Agency conference.

Paul Lau, Chief Executive Officer and General Manager, thanked Vice President Tamayo for creating the venue for the Ward 6 listening session and inviting the Neighborhood Associations and nonprofits serving that area. He then reported on the following items:

1) **SMUD Cares Employee Giving Campaign.** I would like to start by sharing some good news! The SMUD Cares Employee Giving Campaign exceeded its goal of $440,000, raising over $500,000! Twenty-eight percent of our employees participated by donating to causes and local nonprofits they are passionate about. Every dollar makes a difference, and I want to thank our employees for their deep generosity and commitment to our community! And a huge special thanks to Lora Anguay, Chief Zero Carbon Officer, who was our executive leading the charge, creating fun events like golfing, bowling, and doing all things for our community.
2) **Milestones.** And now for an exciting milestone: We surpassed 20,000 heat pump installations in the Sacramento market, using rebates, customer education and the SMUD Contractor Network to achieve this clean energy milestone. Together with more than 390 approved multilingual contractors and electricians, we helped Sacramento families replace gas heating systems with efficient electric heat pumps. These installations will eliminate 20,000 tons of carbon emissions each year – the equivalent to removing 8,000 gas-powered cars from local roads. And, each of these customers will save about $500 per year on their utility bills by going electric.

3) **Connecting Our Communities Resource Expo.** This past month, we were proud to host our third Connecting our Communities Resource Expo. We know bringing SMUD resources to our customers is important – and so is making it easier for them to access wrap-around services from our community partners. Customers and community members engaged with our SMUD teams and resources, connecting with more than 35 organizations and signed up for vital programs and services. The event had over 500 attendees - even in the rain! Thank you to the teams who work hard each day to make it possible for our community to get the support they need.

4) **Awards.** Team SMUD was recognized with several well-deserved awards this month. First, PR Daily awarded us with two honors. First was in the media category for our 2024 press event with Congresswoman Doris Matsui for our Meadowview work, and in the social media category for our People Behind the Promise campaign. The Public Relations Society of America California Capitol Chapter honored SMUD with a PRSA Influence Award for our Clean Power Promise Campaign. I know Farres and members of the team are at the ceremony receiving the award tonight. The U.S. Department of Labor's Veterans' Employment and Training Service (VETS) recognized SMUD with a Hire Vets Medallion Award for our veteran hiring and recruiting. Finally, I was deeply honored to receive the George Westinghouse Top Innovator in Leadership in Innovation award at the Smart Electric Power Alliance - Public Utilities Fortnightly Top Innovators Conference in Washington, D.C. earlier this week.

5) **Board Video.** For tonight's video, we are going on the clock with the Power System Operations (PSO) team. The Power System Operation Team manages our transmission from both

an engineering and operations perspective 24/7, 365 days a year. Our transmissions planning team is always monitoring our current set up with the grid, the resources for transmission, as well as calculating for needs over the next 5-10 years. The PSO is essential in the orchestration of serving electricity to the distribution service operators to then serve customers all over our region.

President Fishman requested the Summary of Board Direction, but there were no items.

President Fishman called for public comment on the closed session agenda, but none was forthcoming.

President Fishman then announced the Board would enter into closed session to discuss the following item:

1. **Public Employment.**

Pursuant to section 54957 of the Government Code:

CEO and General Manager.

No further business appearing, President Fishman stated the Board would not be taking action on the closed session item and adjourned the meeting into closed session at 6:55 p.m.

President Fishman re-opened the meeting and adjourned the meeting at 7:10 p.m.

Approved:

_____ _____

President Secretary

Exhibit to Agenda Item #12

Cast vote on **Sacramento Local Agency Formation Commission (LAFCo)** ballot regarding the election of a Special District Representative (two seats) and Alternate Special District Representative (one seat).

Board of Directors Meeting

Thursday, October 16, 2025, scheduled to begin at 6:00 p.m.

SMUD Headquarters Building, Auditorium

LAFCo Ballot

- Due to the size of the Special District Selection Committee, LAFCo has determined to conduct the Committee's business in writing pursuant to Gov. Code § 56332(f).
- All votes are due in writing on or before 5:00 p.m. on November 21, 2025.
- Election Ballot:
    1) Special District Representative (two regular, voting seats).
    2) Alternate Special District Representative (one seat).

Election of Special District Representative to LAFCo (four-year regular term)

Nominees (in alphabetical order) – Select One:

1) Gay Jones, Sacramento Metropolitan Fire District [Incumbent]
2) Jim Frazier, Herald Fire Protection District
3) Robert “Bob” Wichert, Sacramento Suburban Water District

Election of Special District Representative to LAFCo (two-year regular term)

Nominees (in alphabetical order) – Select One:

1) Beau Reynolds, North Highlands Recreation and Park District
2) Brandon D. Rose, Sacramento Municipal Utility District
3) Jim Frazier, Herald Fire Protection
4) Robert “Bob” Wichert, Sacramento Suburban Water District

Election of Alternate Special District Representative to LAFCo (four-year term)

Nominees (in alphabetical order) – Select One:

1) Charlea Moore, Rio Linda Elverta Recreation and Park District [Incumbent]

2) Jim Frazier, Herald Fire Protection

Requested Action

1) Select a candidate for SMUD's vote to serve as Special District Representative:
    - One four-year regular seat
    - One two-year regular seat
2) Select a candidate for SMUD's vote to serve as Alternate Special District Representative:
    - One four-year alternate seat

From: h2ogay@pacbell.net
To: Public Comment; Board Office
Subject: [EXTERNAL] FW: LAFCO Commissioner Election
Date: Thursday, October 16, 2025 5:31:45 PM
Attachments: 2025 S.D. Commissioner Stmt.docx

Good Evening,

Please forward attached to Board Members.
Thank you, Chrystal, for your help.

Gay Jones

From: h2ogay@pacbell.net <h2ogay@pacbell.net>
Sent: Thursday, October 16, 2025 10:39 AM
To: 'board_office@smud.org' <board_office@smud.org>
Subject: LAFCO Commissioner Election

Good Morning,

Would you please forward my letter to the SMUD Board for tonight's meeting. It is regarding consideration in the balloting for Special District Commissioner, 4 year term.
Thank you in advance for your assistance. Please feel free to call me with any questions or comments.

Sincerely,

Gay Jones

Commissioner, Sacramento LAFCO
Director, Sacramento Metropolitan Fire District
916-208-0736

Board of Directors,

I am requesting your vote and continued support as your special District Commissioner to Sacramento Local Agency Formation Commission (LAFCO).

As challenges to Special Districts continue, I am committed to ensuring that all District voices are heard. Everyone needs to be included in conversations regarding efficient delivery of municipal services and boundary changes, whether they be annexations, detachments, consolidations, spheres of influence or incorporations.

Current activities include the following items: Municipal Service Reviews (MSRs) for Southgate Parks and Rec, Orangevale Parks and Rec, Florin County Water District and Metro Fire are underway, as well as various annexations to SacSewer. Additional MSRs for applications from Omochumne Hartnell Water District and Florin Resource Conservation District are ongoing.

Future discussions need to happen regarding the future of Cemetery Districts as well as policy decisions for potential growth throughout our Sacramento County.

I look forward to having all these conversations with our Special District Advisory Committee to Sacramento LAFCO (SDAC). This group provides a great resource for us Commissioners and staff.

Another resource I bring to our Commission is my long-term participation as a Director for the California Association of LAFCOs (CALAFCO). This state association of LAFCOs offers me an amplified view on the many legislative activities that have potential to affect all of us. Working with Special Districts across the state, as well as with the California Special Districts Association, is very important to me as your commissioner.

I ask for your continued support and vote to represent you as your Special District Commissioner to Sacramento County LAFCO.

Sincerely,

Gay Jones

Commissioner, Sacramento LAFCO

Director, Sacramento Metropolitan Fire District

916-208-0736

From:	John W
To:	Public Comment
Subject:	[EXTERNAL] Additional written comments for the Oct 15th meeting and please post them for the Oct 16th board meeting as well.
Date:	Wednesday, October 15, 2025 9:38:11 PM
Attachments:	m20reprocessing20190914F.pdf

Chair, Board, and Committee,

I wish to answer some of the questions board members brought up that weren't answered by the presenters.

Regarding the current status of temporary waste disposal. In Texas, the oil companies and environmentalists teamed up and got the Governor's support to block temporary waste disposal in Texas. It went all the way to the Supreme Court earlier this year. The Supreme Court ruled against Texas but it isn't over yet.
https://www.texastribune.org/2025/06/19/texas-nuclear-waste/ Even though Texas is promoting nuclear, they don't want the waste in their state.

The other site was in New Mexico. This story just came out within the last week.
https://sourcenm.com/2025/10/09/holtec-no-longer-seeks-to-store-nuclear-waste-in-new-mexico/

So, even temporary nuclear waste storage hasn't been decided. Keep in mind this stuff is radioactive for thousands of years. PU-239 has a half-life of 24,000 years. The radioactive life is about 10 times the half-life. How many generations will have to care for the waste and at what expense?

Both of these stories have been closely followed by everyone on the nuclear sphere. The presenters must have known about them. Now you know.

A full-length documentary for date night- https://www.youtube.com/watch?v=iXZXqLliP3E

The attached document should answer the questions regarding recycling (reprocessing). As the presenters stated. It isn't done here because is in not economical to do. It is also very polluting.

"Reprocessing of spent fuel is an extremely costly and polluting process. Reprocessing greatly enhances the
health hazards posed by nuclear power, because many pathways are created along which the radionuclides

from the spent fuel can enter the human environment. Reprocessing also raises severe security problems.
because fissile materials are separated from the fission products and become accessible."

Please let me know if you have any questions.

Best regards,
John

Reprocessing of spent nuclear fuel

Jan Willem Storm van Leeuwen
independent consultant

member of the Nuclear Consulting Group

November 2019
storm@ceedata.nl

Note

In this document the references are coded by Q-numbers (e.g. Q6). Each reference has a unique number in this coding system, which is consistently used throughout all publications by the author. In the list at the back of the document the references are sorted by Q-number. The resulting sequence is not necessarily the same order in which the references appear in the text.

Contents

TABLES

FIGURES

Roots of reprocessing

Reprocessing technology has been developed during the late 1940s and during the Cold War to recover plutonium from spent fuel from special military reactors for the production of nuclear weapons. In the 1960s and 1970s civil applications of the military reprocessing technology were developed, when de breeder concept came into the picture.
Main purpose of the civil reprocessing plants at La Hague in France and Sellafield in Great Brittain was to recover the plutonium and unused uranium from spent fuel from conventional nuclear power plants with light-water reactors (LWRs), in the belief that uranium and plutonium recycling in the breeder cycle (LMFBR: Liquid-Metal-cooled Fast Breeder Reactor) would soon become the base of civil nuclear power.
The currently most advanced power reactors cannot fission more than 0.5% of the nuclei in natural uranium. The nuclear industry promised (and is still promising) that a closed-cycle reactor system (breeder) could fission 50-100 times more nuclei present in natural uranium, and consequently generate 50-100 times more energy from 1 kg uranium, than the conventional once-through system based on light-water reactors (LWRs). France (*'tout électrique, tout nucléaire'*) and the UK (*'too cheap to meter'*) embarked at the time (early 1970s) on the materialization of the breeder concept, expecting that this could make their energy supply largely independent of fossil fuels within a few decades.

The world has nearly 30 plants for spent fuel reprocessing, according to [ENS 2016] Q667 and [nucl-reproc-wiki 2016] Q668, with nominal processing capacities vaying from 1 Mg used uranium per year to about 3000 Mg U/a. Many of these plants, military installations from the Cold War or experimental plants from the 1960s, are shut down, but none is decommissioned yet. Some 12 reprocessing plants are still operating.

Country	Location	Capacity tU/a	Commissioning or operating period
B	Mol	60	1966-1974
D	Karlsruhe	35	1971-1990
F	Marcoule, UP 1	600	1958-1997
F	La Hague, UP 2	800	1966-1974
F	La Hague, UP 2-400	400	1976-2003
F	La Hague, UP 2-800	1,000	1996
F	La Hague, UP 3	1,000	1990
GB	Windscale	300/750	1951-1964
GB	Sellafield, Magnox	1,500	1964
GB	Dounreay	8	1980-1998
GB	Sellafield, THORP	900	1994
IND	Trombay	60	1965
IND	Tarapur	100	1982
IND	Kalpakkam	100	1998
J	Tokai Mura	90	1977-2006
J	Rokkashomura	800	2006/2007
RUS	Mayak B*	400	1948-196?
RUS	Tscheljabinsk	400	1971
RUS	Krasnojark	800	
USA	Hanford, T-Plant *		1945-1956
USA	Hanford, B-Plant *	1 t/d	1945-1957
USA	Hanford, REDOX *	15 t/d	1952-1967
USA	Hanford, PUREX *	2,400	1956-1972/1983-1988
USA	Savannah, River Site *	~ 3,000	1952-2002
USA	West Valley	300	1966-1972

Table 1

Reprocessing plants, world-wide, * only military use. Source: [ENS 2016] Q667. Not listed here are reprocessing plants in China and Pakistan, see [nucl-reproc-wiki 2016] Q668.

In 1977 President Jimmy Carter banned the reprocessing of commercial reactor spent nuclear fuel in the USA. The key issue driving this policy was the serious threat of nuclear weapons proliferation by diversion

of plutonium from the civilian fuel cycle, and to encourage other nations to follow the USA lead. President Reagan lifted the ban in 1981, but did not provide the substantial subsidy that would have been necessary to start up commercial reprocessing. Up until this moment no civil reprocessing occurs in the USA. Military reprocessing plants are still operating in the USA.
Several countries operating nuclear power plants have chosen for the reprocessing option, but is unclear to which extent civil spent fuel is actually reprocessed. In Europe two large reprocessing plants are operating: Sellafield in the United Kingdom and La Hague in France. China, India, Japan, Pakistan and Russia have their own reprocessing plants.
A number of countries has chosen for direct disposal of spent fuel: Canada, Finland, Germany, Spain and Sweden.

When it became evident – though not admitted by the nuclear industry – that the breeder cycle would be technically infeasible, reprocessing became essentially superfluous. The nuclear industry quietly switched to other arguments to justify the exceedingly high investments of a reprocessing plant (counted in tens of billions of euros). Now the *raison d'être* of reprocessing is said to be:

- recovery of the unused uranium from spent fuel for recycling in new nuclear fuel,
- recovery of the plutonium from spent fuel for use in LWR's in MOX fuel and so increasing the retrievable energy content a given mass of uranium,
- volume reduction of the high-level nuclear waste by vitrification,
- closed-cycle reactors, said to be able to generate about 50 times more energy from a given amount of uranium
- transmutation of long-lived hazardous radionuclides into radionuclides with short radioactive half-lifes by partitioning and transmutation (P&T), especially the minor actinides (MAs)
- use of thorium as fertile material in the thorium232/uranium-233 cycle.

These envisioned applications will be briefly discussed in this chapter. However, reprocessing raises also issues concerning nuclear security, health hazards and safety.

Once-through and closed-cycle systems

The present nuclear power plants operate in the once-through mode, using enriched uranium as nuclear fuel. During the fission process in the reactor the content of fission products increases and the content of fissile nuclei in the fuel decreases. After a certain amount of fissions the fission process cannot be sustained anymore, then the spent nuclear fuel is discharged from the reactor and replaced by fresh enriched uranium fuel. Spent nuclear fuel is not suitable for reuse and is stored in cooling pools to let decay the high level of radioactivity and the coupled residual heat generation. In the once-through mode not more than 0.5% can be fissioned of the nuclei in the natural uranium the enriched uranium (nuclear fuel) is made from.
In order to utilise a higher fraction of the uranium nuclei for energy generation, the spent fuel has to be recycled. Recycling of uranium and other fissile nuclei is only possible after removing the fission products and other nuclei that impede the fission process; this separation process is called reprocessing of spent fuel. Closed-cycle nuclear power systems are are addressed in the following sections, along with some other issues inevitably arising from reprocessing.

Reprocessing of spent nuclear fuel

Reprocessing is a complex sequence of chemical and physical separation processes, aimed at separation of spent nuclear fuel into several fractions:

- unused uranium, only a few percent of the uranium nuclei are fissioned in the reactor
- plutonium, generated in the reactor from uranium by neutron absorption,
- fission products,
- minor actinides, mainly neptunium, americium and curium, also formed from uranium by neutron capture,
- zircalloy cladding hulls of the nuclear fuel elements. highly radioactive by neutron capture.

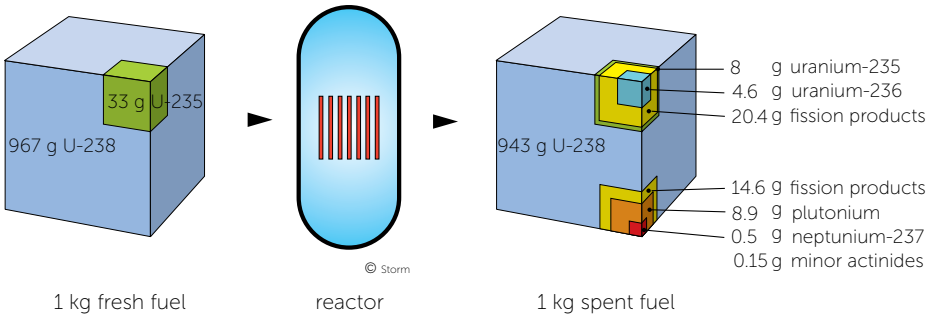


Figure 1

Mass composition of fresh and spent nuclear fuel after three years in a thermal neutron reactor, corresponding with burnup of about 33 GWday/Mg. Source: [Cohen 1977] Q214, [CNRS/EDP 2017] Q744 cites almost the same figures. The amounts of the components other than U-238 in fresh and spent fuel of the newest types of LWRs may be larger, due to a higher burnup of the fuel.

In this diagram the various components of fresh and spent fuel are shown separately. but actually the atoms of the isotopes and elements are dispersed on molecular level. Complete separation is not possible. All new components, represented by the small cubes, are strongly radioactive. The total mass remains nearly constant, a minute fraction is converted into energy during fission. The small cubes at top right represent the mass of the nuclides originating from U-235, the cubes on the lower right corner are formed from U-238.

In addition to the fuel, about 0.6-2 kg zircalloy cladding + spacers and about 25 g silver-indium-cadmium alloy control rods are loaded and discharged with each kilogram of fuel.

In the reprocessing plant the spent fuel elements are chopped into pieces and the contents are dissolved in boiling nitric acid. The resulting solution contains dozens of different elements: fission products, uranium, plutonium and higher actinides. The empty cladding hulls of the chopped and leached fuel pins hardly dissolve and are separated from the solution. Not all fuel dissolves either.

A part of the fission products is gaseous (e.g. noble gases) or easily form gaseous compounds and escape from the liquid. Most of those nuclides are difficult to fix, chemically or physically, into solid materials or containers, notably tritium, carbon-14, iodine-129 and the noble gases such as krypton-85. These nuclides are discharged into the air or sea. In addition a significant fracion of the water-soluble nuclides are discharged with the liquid effluents, notably strontium-90, technetium-99, ruthenium-106 and cesium-137.

Because of the massive releases of radioactive substances into the environment, reprocessing is an exceedingly polluting process. Europe's two operating reprocessing plants, at Sellafield and at La Hague, are situated at the sea coast, for obvious reasons.

Spent fuel is highly radioactive and complicated mixture of many dozens of chemical species: nearly the whole Periodic System of the elements is represented in spent fuel. This results in the occurrence of

substantial losses in the separation processes to obtain pure uranium and plutonium and the fact that the recovered metals are unavoidably contaminated with other elements. Process losses and impurities in the products increase with increasing radioactivity of the mixtures.

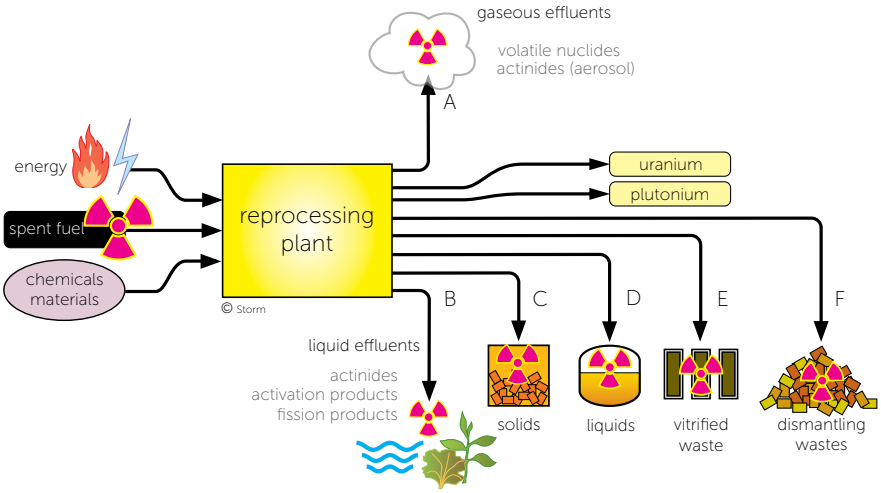


Figure 2

Reprocessing of spent fuel. The input of a reprocessing plant consists of spent fuel, chemicals and energy (electricity and fossil fuels). Spent fuel is separated into seven fractions: unfissioned uranium, newly formed plutonium and five waste fractions A-E:

A gaseous effluents, discharged into the atmosphere, containing gaseous and volatile fission products, activation products, noble gases and some aerosols of other fission products and actinides,

B liquid efflents, discharged into the sea, containing some U and Pu and other actinides, in addition to a substantial part of the highly soluble fission products; this fraction cannot be vitrified,

C insoluble solid waste consisting of spent fuel cladding hulls, undissolved fuel and and other solids, containing U, Pu, fission products, activation products and actinides, this fraction cannot be vitrified,

D liquid wastes containing fission products, activation products, uranium, plutonium and other actinides, resulting from imperfect separation and purification processes, this fraction cannot be vitrified

E the fraction of fission products, activation products and actinides that can be vitrified.

F An eighth radioactive waste stream, fraction F, consisting of decommissioning and dismantling wastes, will be released after final shutdown of the reprocessing plant, when the plant will be decommissioned and dismantled. This waste consists of decontamination wastes, and radioactive rubble en scrap.

Reprocessing and the Second Law

Separation

Separation processes play a vital role in the process industry, especially in the nuclear process chain. The nuclear process chain starts with the extraction of uranium from its ore, a sequence of physical and chemical separation processes, but also in other processes of the nuclear chain separation processes are important. Separation processes are based on chemical and physical distribution equilibria. These dynamic equilibria are governed by the laws of thermodynamics and never go to completion, as a consequence of the Second Law. For that reason it is impossible to separate a mixture of *n* different chemical species into *n* separate fractions that are 100% pure. There always will be losses and contaminations.
Separation of atomes and molecules implies lowering the entropy of the system: the mixture to be fractionated, and becomes more demanding and goes less completely as:

- more different kinds of species are present in the mixture,
- the concentration of the desirable species in the mixture is/are lower,
- the constituents of the mixture are chemically and/or physically more alike,
- the purity specifications of one or more of the fractions are more stringent,
- the mixture is more radioactive.

Complete separation is a fiction. As a consequence of the above mentioned factors a part of each desired fraction will be lost in the waste streams and each fraction will be contaminated with species from other fractions. The selectivity of separating a certain fraction from a mixture can be enhanced, at the expense of more specialistic chemicals and equipment and consequently more energy, and more losses of other fractions.
Radioactive and non-radioactive isotopes of the same element cannot be separated.
The amount of radioactivity in spent fuel does not change by the mechanical and chemical treatments in the reprocessing plant, it simply means a reshuffling of the radionuclides from one material flow to several other. Inevitably, mixing an amount of radionuclides, compacted in a solid (spent fuel), with nonradioactive fluids or other substances increases the volume of the radioactive waste, complicating the waste disposal problems.
As pointed out above separation of the elements in a solid or solution never can be complete, partly due to the chemical properties of the components of a mixture, partly due to inherent chemical and physical limitations of extraction equilibria, partly due to technical imperfections. Economic considerations and the human factor are left aside here. The difficulties increase with the number of compounds or elements in the mixture which are to be separated.

Purification

Purification of a substance is based on separation processes, aimed at removal of contaminants from the substance. A higher purity means a lower concentration of contaminants. Extracting a species at a lower concentration requires more useful energy and is coupled to greater material losses. Higher purity means better predictable properties of a material. As pointed out above 100% pure materials are impossible. Purity specifications depend on the application of a material. Actually the purity of a material in the process industry is an economic notion.
A single substance can be made more pure at the expense of

- more loss of that substance into the waste streams,
- consumption of more chemicals,
- consumption of larger amounts of energy,
- the need for more complex equipment.

Reprocessed uranium

Recycled uranium, from reprocessed spent fuel, also called reprocessed uranium U(rep), has a different composition than natural uranium and contains a number of nuclides which degrade its properties as nuclear fuel [Forsey & Dickson 1987] Q239 such as:

- uranium-232,decaying to thallium-208 with high alpha and gamma activity
- uranium-234, a strong alpha emitter
- uranium-236, a strong neutron absorber; fuel with this isotope needs a higher enrichment assay or more fissionable plutonium to compensate for it,
- traces of fission products, like ruthenium-106 and technetium-99, which increase the gamma activity of the uranium
- traces of trans-uranium elements, e.g. neptunium and plutonium.

Above problems worsen each time the fuel passes the fuel cycle. The gamma activity of recycled uranium increases with the number of cycles, because of a growing content of gamma-emitting decay products.

Recycled uranium needs addition of more fissile plutonium than depleted or natural uranium, because of the neutron absorbing properties of U-232, U-234 and U-236. These even-numbered isotopes of uranium are not fissile.
Enrichment of recycled uranium by gasdiffusion or ultracentrifuge is questionable, because the uranium is enriched more effectively in the two lightest isotopes U-232 and U-234 than in U-235 and is enriched also in U-236, to lesser extent, making the enriched product strongly radioactive. The reenriched uranium would contain the largest part of the unwanted uranium isotopes and some other unwanted nuclides mentioned above as well. Besides, the enrichment plant would be contaminated with highly radioactive compounds, hampering its operation.
For above reasons reprocessed uranium has not been used in power reactors. In addition the fabrication of fuel elements containing reprocessed uranium is difficult and has to be done by remotely controlled equipment due to its high radioactivity. Utilisation of reprocessed uranium has a negative energy balance, due to high energy consumption of fuel fabrication and the high energy investments of reprocessing of spent fuel including dismantling of the reprocessing plant at the end of its operational lifetime.

The World Nuclear Association [WNA-*mox* 2016] Q246 cites a figure of 45 Gg reprocessed uranium being available for reuse, which would be equivalent to 50 Gg (1 Gg = 1000 Mg) of natural uranium. The displacement figure of 50 Gg is inconsistent with the publication [Foresey & Dickson 1987] Q239. Reprocessed uranium contains slightly more U-235 than natural uranium (around 0.8% vs 0.7%) indeed, but it needs a higher fissile content than equivalent conventional nuclear fuel, as pointed out above.
Evidently this highly radioactive material poses health risks when released into the public domain, by accidents, terroristic actions or otherwise.

Plutonium

Plutonium is generated from uranium-238 (non-fissile) by neutron irradiation in nuclear reactors. The isotopic composition of the plutonium varies with the irradiation time in the reactor. At first the fissile plutonium-239 is formed and from this isotope heavier isotopes are formed by subsequent neutron captures: Pu-240 (non-fissile), Pu-241 (fissile) and Pu-242 (non-fissile). In nuclear fuel at low burnup little Pu-239 is transformed into heavier isotopes. The higher burnup of the fuel, the longer the stay time in de reactor and the more non-fissile heavy plutonium isotopes are generated.

Weapons-grade plutonium contains typically 93.6% Pu-239 [O'Connor 2003] Q599 is produced by neutron irradiation of uranium in special military reactors. The nuclear fuel from these reactors has a very low burnup (about 100 MW(th).days/Mg) before reprocessing, so only small amounts of the higher isotopes of plutonium (e.g. the non-fissile isotope Pu-240) are formed. Higher isotopes of plutonium and trans-plutonium elements make plutonium more radioactive and less suitable for production of nuclear weapons.

Reactor-grade plutonium originates from spent fuel from civil power reactors and contains typically less than 65% fissile plutonium isotopes (Pu-239 + Pu-241). In commercial reactors the fuel elements stay far longer and get a higher burnup (33000-46000 MW(th).days/Mg) than in military reactors. Due to longer stay times in the reactor, more of the heavier plutonium isotopes are formed: Pu-240, Pu-241 and Pu-242, but also Pu-238. The even isotopes are not fissile in LWR's and in bombs. Moreover, trans-plutonium elements, e.g. Am-241, Am-243, Cm-244, are formed from plutonium isotopes by neutron capture. According to [WNA-*pu* 2016] Q247:

> The term 'fissionable' applies to isotopes that can be made to undergo fission. If a fissionable isotope only requires neutrons with low kinetic energy to undergo fission, then it is said to 'fissile'. Thus, all fissile isotopes are fissionable. Pu-240 is fissionable, as it undergoes fission in a fast neutron reactor - but it is not a fissile isotope.

Contrary to statements of the nuclear industry [WNA 2012b] Q541 reactor-grade plutonium is suitable for nuclear explosives, according to [Barnaby 2005a] Q339 and [Barnaby 2005b] Q240, [Glaser 2005] Q593, [Schneider 2007] Q590.
Plutonium has a much lower critical mass than uranium. The bare-sphere critical mass of weapons-grade plutonium is 11.5 kg (diameter 10.5 cm) and of reactor-grade plutonium 14.6 kg (diameter 11.5 cm). With a neutron reflector of 15 cm the figures are: 3.71 kg (7.20 cm), respectively 4.58 kg (7.72 cm), according to [Glaser 2005] Q593.

Pu-238 is a strong alpha emitter. By beta decay, plutonium-241 is transformed into americium-241; Am-241 is a strong gamma emitter, greatly increasing the gamma activity of the plutonium. Within a few years storage time, the concentration of Am-241 builds up to a level the plutonium cannot be handled safely anymore. With a content of Am-241 higher than 1% it has to be purified again [Hulst & Mostert 1979] Q242, a costly process. For recycled plutonium from LWR with MOX fuel, the repurifying limit due to Am-241 may be reached about one year after reprocessing. Americium-241 decays to neptunium-237, a fissile nuclide.
Most plutonium and trans-plutonium isotopes emit neutrons, as some of their nuclei spontaneously fission (the other nuclei decay by alpha or beta emission). The presence of all these nuclides makes reactor-grade plutonium a hazardous substance, with troublesome properties as reactor fuel. The problems with increasing gamma, alpha and neutron radiation aggravate with each recycling of the plutonium. The same holds true for the burnup of the fuel from which the plutonium is extracted: the higher the burnup, the longer its stay in the reactor and consequently the less the isotopic quality of the plutonium.

Neptunium-237

During the fission process in the reactor the short-lived neptunium-239 isotope is formed from uranium-238 by neutron capture. Neptunium-239 decays with a half-life of 2.35 days to plutonium-239, a first-rate bomb material. In addition sizeable quantities of the long-lived isotope neptunium-237 (half-life 2.14 million years) are formed, mainly by neutron capture of uranium-235 and decay of americium-241. According to [KfK 1983] Q587 roughly 400-700 g Np-237 per metric ton spent fuel are formed, depending on the burnup of the nuclear fuel. Np-237 can be separated by chemically means from the other elements in spent fuel, due to its specific chemical properties: it is a separate chemical element. After a cooling period of less than a year Np-237 is the only neptunium isotope remaining in spent fuel. Consequently it is possible to obtain a pure fissile material from spent fuel just by chemical means, without enrichment.

Neptunium-237 is fissile and can be used to produce a nuclear explosive device. Its critical mass is comparable to that of uranium-235. One or more nuclear weapon states may have tested a nuclear explosive using Np-237. Historically, neptunium 237 has been separated by the nuclear weapon states in only small quantities, principally for non-explosive uses, as target material for plutonium-238 production. Pu-238 can be used as neutron initiator of nuclear weapons.
By the end of 1997, the world inventory of neptunium and americium was estimated to exceed 80 metric tonnes, or enough for more than 2,000 nuclear weapons, and the amount is growing at a rate of as many as 10 tonnes per year. If actinide separation becomes routine, inventories of separated neptunium-237 and americium will escalate, according to [ISIS 1999] Q552.

Americium

According to [KfK 1983] Q587 about 120 g americium isotopes per metric ton spent fuel are formed at a burnup 33 GWe.day/Mg; at higher burnups the yield is proportionally larger. Americium has to be separated from plutonium and uranium after reprocessing, for reason of the high radioactivity of the americium isotopes and their unfavorable nuclear properties as reactor fuel. Assuming the isotope Am-242 (half-life 16 hours) has already decayed to Cm-242, the main isotopes of americium in spent fuel are Am-241, Am-242m and Am-243. Just like neptunium, americium can be separated by chemically means from the other elements in spent fuel, due to its specific chemical properties.

All americium isotopes are fissile and can be used to produce a nuclear explosive device, so it is possible to obtain undiluted bomb material from spent fuel just by chemical means. Estimates of the bare-sphere critical mass of the americium isotopes vary from 9-150 kg. However, under special conditions the critical mass of Am-242m may be as low as 7 grams, according to [Ronen *et al*. 2000] Q243.
Historically, americium has been separated by the nuclear weapon states in only small quantities, principally for non-explosive uses: for smoke detectors, neutron generators, and research activities. During reprocessing of spent fuel americium is usually discarded in the high-level waste streams.
The world inventory of Am-241 at the end of 1997 is estimated at some 45 tonnes and is growing by about 4 tonnes/year. This amount of Am-241 is the result of the decay of plutonium-241. In nuclear weapon programs and civil plutonium recycle programs, americium-241 is separated from aging plutonium to purify it and reduce the material handling problems caused by americium's radioactive emissions [ISIS 1999] Q552. ISIS estimates the worldwide separation of americium at some 100 kg/yr.

MOX fuel in LWRs

The plutonium recovered from spent fuel, usually labeled reactor-grade plutonium Pu_{rg} could be used to fabricate MOX (Mixed OXide) fuel elements consisting of natural or depleted uranium oxide and plutonium oxide instead of a higher content of uranium-235, to be used in light-water reactors (LWRs). At present about 30 nuclear power plants, mostly in Europe, are using MOX fuel elements, not more than about 30% of the core. Special reactor designs are required to replace all enriched uranium fuel in the core fully by MOX fuel. Reprocessing of commercial nuclear fuel to make MOX is done in the United Kingdom and France, and to a lesser extent in Russia, India and Japan [wiki-*mox* 2017] Q741.
Plutonium from reprocessed fuel is usually fabricated into MOX as soon as possible to avoid problems with the decay of short-lived isotopes, in particular Pu-241 that decays (half-life 14.1 years) to americium-241, a strong gamma emitter. Within 5 years typical reactor-grade plutonium would contain too much Am-241 to safely handle [WNA-*mox* 2016] Q246.

How much natural uranium could be displaced by using MOX fuel instead of enriched uranium in nuclear power stations?
According to [WNA-*mox* 2016] the current commercial MOX fuel, equivalent with enriched uranium at 4.2% U-235, has an average plutonium content of 9.5%, containing 65% fissile plutonium (Pu-239 + Pu-241). This study assumes that depleted uranium is used for the MOX fuel. The fissile content of U-235 (about 0.3%) of the depleted uranium is ignored for convenience.
Based on these figures 1 Mg reactor-grade plutonium would correspond with 10.5 Mg MOX, of which 9.5 Mg depleted uranium. To produce an equivalent amount of enriched uranium (4.2% U-235) about 100 Mg natural uranium would be needed, assumed a feed/product ratio of 9.5 and 0.3% U-235 tails assay of the enrichment. So 1 Mg Pu_{rg} could save 100 Mg U_{nat}.
[WNA-*mox* 2016] states that the present global inventory of reactor-grade plutonium available for commercial reactors is 320 Mg and that this amount could save 60000 Mg natural uranium. According to the estimate of this study 320 Mg Pu_{rg} would be equivalent to 32000 U_{nat}. This is about one half of the current world annual consumption of U_{nat}. It is unclear how the World Nuclear Asdsociation derived its estimate.
If all spent fuel of the global nuclear fleet would be reprocessed some 60 Mg/year of Pu_{rg} would become available for MOX fabrication. This could save about 6000 Mg/ year of U_{nat} less than 10% of the current annual consumption.

During burning of MOX the ratio of fissile (odd numbered) isotopes to non-fissile (even) drops from around 65% to 20% depending on burnup [wiki-*mox* 2017] Q741. For that reason used MOX fuel is not reprocessed.
By recycling, the composition of plutonium shifts like that of uranium. The amounts of trans-plutonium elements increase with each reprocessing cycle. Due to this, the alpha-, gamma- and neutron radiation rise (with a factor 3), as well as the specific heat generation of the plutonium by radioactive decay with a factor 7 [ORNL-TM-2879 1970] Q254, [Fischer 1986] Q240 and [Roepenack et al. 1987] Q241.
Some isotopes have a very low critical mass for a fission chain reaction. Serious criticallity problems highly complicate the reprocessing of fuel with high trans-plutonium content. For example, the critical mass of Am-242m may be as low as 7 grams, according to [Ronen et al. 2000] Q243.
Besides the rising radioactivity, the proportion of fissile isotopes declines each time the plutonium is recycled. Both effects cause a rapid deterioration of the practical use of recycled plutonium. MOX fuel cannot be reprocessed [WNA inf13 2003] Q245, or only once or twice [WNA inf15 2002] Q247, because of deteriorating isotopic quality of the plutonium (see above).
Nonetheless, recycling of LWR MOX fuel is considered as means of destruction of plutonium and as energy source . A MOX cycle lasts at least 11 years, which may be a problem in itself [NEA ppr 2003] Q249.
The production MOX fuel is costly, because of the high radioactivity of de components. MOX fuel complicates power plant operation for utilities, introducing more risks and higher costs.

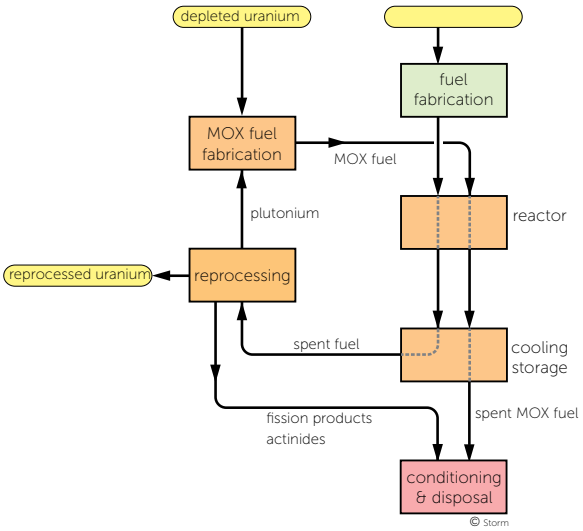


Figure 3

Outline of plutonium recycling in LWRs. The reactor starts up loaded with conventional enriched uranium fuel. The spent fuel is reprocessed, after a cooling period. The recovered plutonium is used to enrich depleted uranium. The resulting MOX fuel is placed into the reactor. Spent MOX fuel is not reprocessed. The reprocessed uranium is seldom reused, because it has a troublesome isotopic composition and is contaminated by fission products.

The MOX option has a negative energy balance, as other nuclear concepts that depend on reprocessing of spent fuel. It takes more energy to reprocess spent fuel, including a proportional part of the energy requirements of the dismantling of the reprocessing plant, and to fabricate MOX fuel than can be generated from that fuel. Moreover, the use of MOX fuel poses serious proliferation and terroristic hazards, as will be discussed in one of the following sections.

Destruction of HEU and Pu: burning the Cold War legacy

Reactor-grade fuel can be made by blending weapons-grade Pu and Highly Enriched Uranium (HEU) from nuclear weapons, with depleted or natural uranium.
A rough estimate of the contribution to the world energy supply by 'burning' these materials can be made, starting with the following figures:

- depleted uranium: about 1.2 million Mg world wide [WNA inf14 2002] Q244
- weapons-grade plutonium (90% Pu-239), about 260 Mg [WNA inf13 2003] Q245
- Highly Enriched Uranium (HEU), weapons-grade 93% U-235 'diluted' to about 2000 Mg 20% U-235, still called HEU ([WNA inf13 2003] Q245.

For a reference reactor of 1 GW(e) which uses a reload of 20.30 Mg fuel for each 0.82 full-power year, the weapons-grade materials would be sufficient to produce about 725 reloads, assuming the use of depleted uranium, enriched to 5% Pu or 4.2% U-235. This amount of reloads corresponds with about 600 full-power years and would meet the world demand (360 GW(e) in 2002) for about 1.7 years. To produce this fuel, about 14000 Mg depleted uranium would be needed.

In addition to the military plutonium, reactor-grade plutonium (typically less than 70% fissile) from the civil reprocessing plants is available. An amount of 400 Mg would be sufficient for about 280 MOX reloads with an enrichment of 7% Pu [WNA inf29 2003] Q246 and [WNA inf15 2002] Q247. This would meet the world demand for about 0.6 years. A mass of about 5300 Mg depleted uranium would be used in this MOX fuel. Together, the military materials and the civil plutonium would be sufficient to meet the present needs of the world nuclear fuel consumption for about 2.3 years, using nearly 20000 Mg depleted uranium.

Figuring the energy consumption and production of the processes involved, fuelling reactors with Pu and HEU would not add energy resources in the simply way as it may look, because the energy consumption in obtaining the Pu and HEU has to be taken into account.
Use of depleted uranium would add some energy resources because the energy consumption of its production is taken into account in the HEU and Pu production. The net energy result of the use of Pu, HEU and depleted uranium probably is not significant, or may be even negative. Moreover, on global scale the contribution would be marginal, even when the energy consumption of the Pu and HEU production is neglected.

Uranium-plutonium breeder systems

In its publication *Radioactive Wastes – Myths and Realities* [WNA 2016c] Q542 the World Nuclear Association states:

> The fuel for nuclear power is virtually unlimited, considering both geological and technological aspects. There is plenty of uranium in the Earth's crust and furthermore, well-proven (but not yet fully economic) technology means that we can extract about 60 times as much energy from it as we do today.

Obviously this statement refers to the closed-cycle technology, the breeder system, that would generate more fissile nuclides from fertile nuclides than it consumes.

What is called a 'fast reactor' or breeder is not just a reactor but a cyclic system consisting of a fast-neutron nuclear reactor plus reprocessing plant plus fuel fabrication plant. Each of the three components of the breeding cycle would have to operate flawlessly and finely tuned to each other for decades without interruption. If one component fails in any respect, the whole system fails and breeding is out of question. Operation of the cyclic system is further complicated by the high radioactivity of the materials to be processed, increasing with each following cycle.
Decades of intensive research in several countries (e.g. USA, UK, France, Germany, the former Soviet Union) and investments of some $100bn, have proved that the breeding cycle is technically infeasible.

The causes of this failure have nothing to do with arguments like: 'not economically attractive' (obviously a technically unfeasible system is not economically attractive) nor with protests of environmental activists. The failure of materialization of the breeder concept can be traced back to fundamental laws of nature, particularly the Second Law of thermodynamics. From this law it follows, among other consequences, that separation processes of mixtures of different substances never go to completion and consequently perfect materials are not possible. From the Second Law it also follows that the deterioration of materials by ageing processes are inevitable.

Pivotal in the breeder cycle is the reprocessing of the spent fuel as soon as possible after unloading from the reactor, to avoid the decay of some isotopes, for example plutonium-241 into americium-241. Due to the rapidly increasing radioactivity of the spent fuel with each cycle, reprocessing and fuel fabrication become increasingly difficult. The isotopic compositions of the recovered uranium and plutonium become less favourable each cycle. Due to the unavoidable and increasing separation losses, the cycle produces less fissile nuclides than it consumes. For these reasons, among other, the breeder cycle is technically infeasible.

Summarised, the breeder concept is inherently unfeasible, because is implicitely based on infeasible assumptions:

- availability of perfect materials, not subject to spontaneous degrading processes (ageing)
- technical systems with 100% predictable properties and behavior across decades
- 100% perfect separation of a mixture of a large number of different chemical species into pure fractions, regardless of the radioactivity of the mixture.

All three conditions are inconflict with the Second Law of thermodynamics.

This conclusion is also valid for the proposed thorium breeder cycle and the partitioning & transmutation (P&T) system, both to be discussed in the following sections.

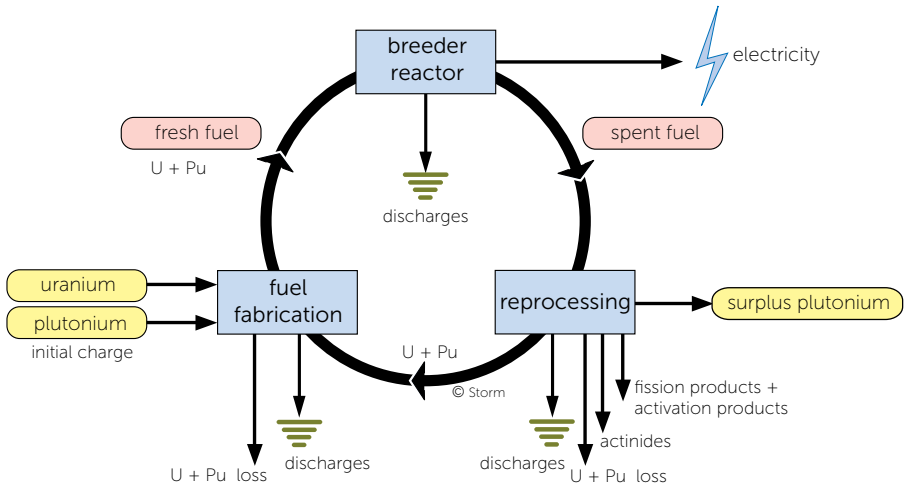


Figure 4

Outline of the concept of the breeder system in steady state. By repeatedly recycling spent fuel, it would be theoretically possible to fission the main part of natural uranium. If all goes well, the cycle produces during its operational life a plutonium gain, large enough to start up two or more new breeders: one to replace the closed down unit, and one or more additional breeders. The cycle represents the mass flows of uranium and the nuclides originating from the nuclear processes in the reactor (fission, activation and decay). The initial plutonium charge to start up the breeder reactor is about 3 Mg Pu for a 1 GW(e) FBR.

Reprocessing of FBR fuel

Reprocessing of Fast Breeder Reactor (FBR) fuel, which would have a high burnup (typically 70-100 GW(th). day/Mg) is more troublesome than of LWR fuel, with a burnup of 30-50 GW(th).day/Mg. Burnup is a measure of the stay time in the reactor and of the neutron flux the fuel gets in the reactor. The higher the burnup, the more atoms per Mg fuel are fissioned and the higher is the neutron flux. This results in higher concentrations of plutonium, in more trans-plutonium actinides and in larger specific amounts of fission products than in LWR fuel. Spent FBR fuel is much stronger radioactive than spent LWR fuel.

High burnup and the high Pu content (15-20 times greater than that of irradiated LWR fuel) have some difficult consequences for the dissolving and separation processes in the reprocessing plant [UNIPEDE/CEC 1981] Q58:

- Certain reactions are no longer of a secondary significance, as in LWR fuels, e.g. radiolysis, precipitation, insolubility and corrosion. A high metallic fission product concentration increases the proportion of insoluble material, which may trap plutonium and has a high heat and radiation output.
- Higher plutonium concentration entails a lower dissolution rate and the formation of insoluble compounds in significant quantities.
- Higher specific radioactivity causes more radiolyse of the extraction liquid, an organic solvent (tributylposphate TBP). Solvent degradation products may clog pipelines and extractors, thus blocking the entire process.
- Plutonium may accumulate by formation of complex compounds with solvent degradation products, enhancing the risk of criticality accidents.
- More unsoluble compounds and noble metal alloys (Ru, Rh, Tc, Mo, Pd), possibly containing plutonium, and undissolved MOX particles remain in the dissolver. The undissovedparticles cause high plutonium losses, solvent degradation by high heat and radiation emission and plugging of lines and equipment.
- Higher specific heat generation demands more elaborate temperature control.
- The high plutonium-uranium ratio and the presence of large specific amounts of fission products make the extraction process more complex and less efficient. Short contact times between the organic and

aqueous phase might be required, even if this feature reduces the effectiviness of plutonium separation. More U and Pu is lost in the waste streams and the U and Pu product stream is more contaminated with actindes and fission products.

- Higher concentrations of plutonium and other actinides enhance criticality problems in the separation system.This necessesitates a design combining safe geometry and proper monitoring. To overcome geometry constraints a modular design may be needed. In that case the FBR fuel reprocessing plant would benefit less from advantage of scale than a LWR fuel reprocessing plant.

Some other difficulties, specific for spent FBR fuel are:
The fuel assemblies of a FBR, made of stainless steel, have to be disassembled before the fuel pins can be chopped into smalle pieces. Because of the high radioactivity and heat output of the irradiated fuel and dimensional changes as result of the fast neutron irradiation, this part of the process will be difficult.
Keeping out-of-pile time as short as possible, needed for a high plutonium gain in the cycle, enhances problems with transport and handling of the irradiated fuel elements.
As result of the short cooling time after removing from the reactor core – preferable less than 1 year versus LWR fuel cooling times of 3 years or more – the shearing of the fuel elements releases gaseous highly active short living fission products, such as I-131. The effluent release after short cooling times causes two main problems. First, the higher decontamination factors required on gaseous effluent for reduction to acceptable operational release levels. Second, the higher potential risk of accidental release and the necessity of increased engineered safety measures, to reduce the overall risk to acceptable levels.

Discharges to the environment (water and air) of actinides may be higher than in a LWR cycle, because of the higher actinide content in FBR fuel.
Costs of FBR fuel reprocessing could be at least twice as much as that of LWR fuel [UNIPEDE/CEC 1981] Q58 .

Thorium for fission power

Thorium is a radioactive metal, more abundant in the Earth's crust than uranium. The concept of the thorium reactor is based on the conversion by neutron capture of non-fissile thorium-232 into uranium-233, which is as fissile as plutonium-239. In common with the uranium-plutonium breeder the thorium-uranium breeder is not just an advanced reactor, it is an intricate cyclic system of reactor, reprocessing plant and fuel element fabrication plant. Each of the three components of the cycle has to operate flawlessly for decades, finely tuned to the two other components.
The feasibility of the thorium breeder system is even more remote than that of the U-Pu breeder. After four decades of research there are still no solutions for the basic problems mentioned by [ORNL-*5388* 1978] Q376. The fundamental obstacles that render the U-Pu breeder technically unfeasible apply also to the thorium breeder. A major drawback of the thorium cycle is that a thorium reactor cannot sustain a fission process in combination with breeding uranium-233 from thorium-232, but will always need an external accelerator-driven neutron source, or the addition of extra fissile material, such as plutonium or uranium-235 from conventional reactors.

Building up a Th-U-233 breeder system would pose a severe logistic problem, even if the system would work as advertised. Only small quantities of U-233 exist in the world at this moment, the USA has 1710 kg of it in storage, 905 kg of which still contained in spent fuel. The U-233 stocks in other countries are unknown. The largest DOE reactor currently operating could produce only about 0.3 kg/year.
It would take decades to obtain sufficient U-233 from special reactors to start up the first operating Th-232–U-233 breeder system. After that it would take more than 8 doubling times to attain a thorium breeder capacity equalling the current nuclear capacity (about 370 GW). Even with an assumed unrealistically short doubling time of 20 years more than 8 doubling times would mean nearly two centuries.

Among a number of other countries, the USA conducted Th-232/U-233 research in the 1960s and 1970s (e.g. in the Shippingport reactor), the research has not been continued. U-233 has been envisioned as fuel in very compact military reactors for special applications, and in spacecraft. Although U-233 reportedly would have about the same properties as plutonium for use in nuclear weapons, no such weapons seem to have been developed. Apparently there exist good reasons not to use U-233 in military reactors and weapons and not to continue the research towards the thorium power reactor. India seems to be the only country at this moment still conducting some research on Th-232/U-233 fuel cycle. An overview of research projects in the past and of advanced thorium reactor concepts is given in [WNA-*Th* 2015] Q302.

The realisation of the thorium-U-233 breeder cycle has a number of hurdles to overcome according to [ORNL-*5388* 1978] Q376, [ORNL-*6952* 1999] Q377 and [PSR-IEER 2009] Q617 such as:

- the separation processes needed to recycle fissionable material are inherently incomplete, so significant losses are unavoidable
- the recycling of Th-232/U-233 fuel has yet to be demonstrated
- assumed the recycling would be technically feasible, it is still unknown if the cycle would produce sufficient U-233 to expand the Th-232/U-233 capacity, or even to maintain itself
- the radioactivity of the spent fuel and recycled U-233 increases with every cycle, while its isotopic quality decreases, consequently its usefulness as fissile material decreases
- due to the increasing radioactivity the separation processes deteriorate and the separation will get even more incomplete
- due to the increasing radioactivity the fuel handling and fresh fuel fabrication becomes increasingly difficult.

Since the publication of the above mentioned ORNL reports no publications are found reporting a solution to each of these challenges, a *conditio sine qua non* for materialisation of the thorium-U-233 breeder cycle.

Uranium-233

Uranium-233 is a fissile nuclide that is prepared from non-fissile thorium -232 by neutron irradiation in a nuclear reactor. After irradiation the thorium target elements are to be reprocessed to separate the U-233 from the remaining Th-232. U-233 has been used during the 1950s and 1960s in the development of nuclear rockets, nuclear ramjets for an atomic bomber, but also for civil power reactors. These technical developments were halted in the 1970s, apparently due to various problems. One of these problems is the presence of uranium-232, a strong gamma-emitter, which makes U-233 difficult to handle. Methods to limit the content of U-232 are expensive.
Uranium-233 has a critical mass much less than U-235 and is comparable to plutonium in terms of weapons-usability. Between 1955 and 1968 several nuclear weapons test were conducted using uranium-233 [Alvarez 2012] Q594.
In the United States about 1550 kg of U-233 was separated. Of this amount about 123 kg may be unaccounted for, enough for some 13 nuclear explosive devices. The radiation level from contaminants is not considered to be an adequate barrier to prevent a terrorist from making an improvised nuclear device. Storage of the US stockpile of U-233 is a safeguard, security and safety risk. The production of the stockpile also has left a disposal burden [Alvarez 2012] Q594.

How is the situation concerning U-233 in elsewhere in the world? Some countries may be still involved in the development of a thorium-232/uranium-233 nuclear breeder system.

Molten salt reactor

In many publications on thorium-fuelled reactors and on partioning & transmutation systems the concept of the Molten Salt Reactor (MSR) comes up. In this type reactor the nuclear fuel is dissolved in a mixture of molten fluoride salts at high temperatures. Advocated advantages of the MSR would be: compactness, inherent safety, operation at atmospheric pressure and high operating temperatures in the range of 600-900 °C. Fast neutron and thermal neutron designs are proposed, in once-through as well in breeder modes.

The concept of the MSR was established in the 1950s. As far as known only three MSRs are ever built, and that went critical, according to [wiki-*msr* 2017] Q693, all three in the USA:

- Aircraft Reactor Experiment (ARE), designed for use as an engine in a nuclear-powered bomber. Power 2.5 MWth, peak temperature 860 °C, produced 100 MWh in nine days in 1954.
- Pratt & Whitney Aircraft Reactor-1 (PWAR-1); the experiment run for a few weeks in 1957, the reactor was critical at zero nuclear power, temperature 675 °C.
- Molten-Salt Reactor Experiment (MSRE), operated at a power of 7.4 MWth and temperature of 650 °C, during the period 1965-1969.

As of 2011 the ARE and MSRE remained the only MSRs ever operated. After these experiments a number of research projects in various countries were set up, among other thorium breeder designs, see the overviews in [wiki-*msr* 2017] Q693 and [WNA-*msr* 2016] Q739. As far as known none of those designs after 1969 ever were built and operated.
From the above observations may be concluded that the promising MSR concept is not viable. Doubtless Second Law phenomena are playing an important part in the MSR demise.

Partitioning & transmutation

Partitioning & transmutation (P&T) is a technologic concept proposed by the nuclear industry as a means of 'destroying' long-lived radionuclides. If the concentrations of the long-lived dangerous radionuclides in the nuclear wastes could be reduced to below an official standard (which standard is not indicated), the waste would be safe for release into the public domain after a storage time of 'only a few' centuries to a thousand years, instead of 1000000s of years.
In such way the amount of high level waste to be stored permanently in a geologic repository could be reduced to a small fraction of the spent fuel. See also for example [CEA 2002] Q448, [DOE-NE 2009] Q450, [NWMO 2008] Q446, [ORNL 2011] Q449, [NRC 1996] Q16 and [SKB 2010] Q447.
Some publicaties suggest even the possibility of nuclear energy with (almost) no radioactive waste for example [LPSC 2001] Q451 and [ORNL 2013] Q539.

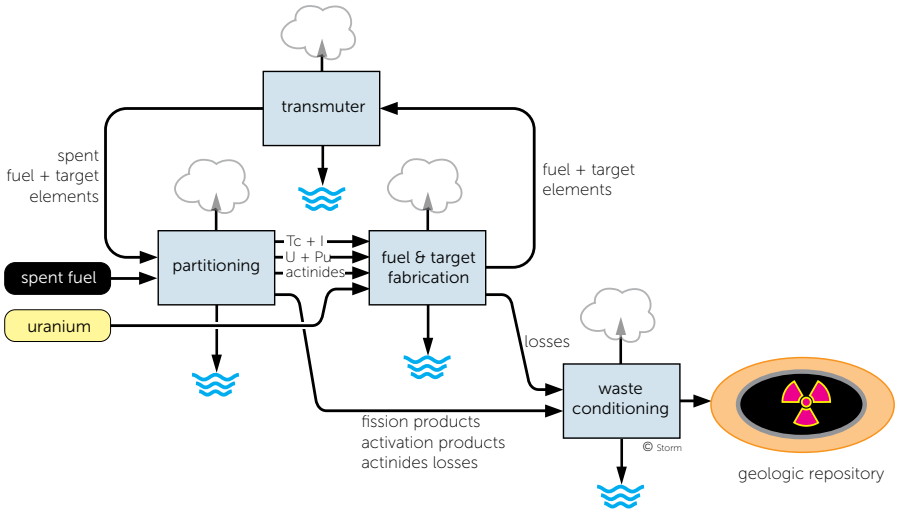


Figure 5
Principle of a partitioning & transmutation system. All material flows indicated by the arrows and all discharges into the biosphere are hightly radioactive,

A partitioning & transmutation system is a cyclic system consisting of three components: a transmuter reactor, a partioning plant and fuel fabrication plant. Each of the three components of the cycle would have to operate flawlessly and finely tuned to each other for decades without interruption, if one component fails in any respect, the whole system fails.
In the partitioning plant, a more advanced reprocessing plant, spent fuel would be separated into more partitions than in a conventional reprocessing plant. For this reason partioning is more demanding and more energy-intensive than conventional reprocessing.
Some partitions, especially the minor actinides (MAs), would be incorporated in special fuel and target elements. Due to the high level of radioactivity fuel and target fabrication is a demanding process, to be done by robotic equipment.
In the transmuter reactor the long-lived adionuclides would be transmuted into shorter-lived radionuclides by neutron capture. The neutrons are to be produced by fission of fissile nuclei in the mixture, and/or by an external source.

Three principal transmuter reactor concepts are based on respectively a thermal-neutron reactor, a fast-neutron reactor and an accelerator-driven subcritical nuclear reactor. As thermal reactor the light water reacor (LWR), PWR or its Russian counterpart, is proposed. The fast reactor should be the advanced liquid

metal reactor (ALMR), sodium- or lead-cooled. Several variants of the accelerator-driven transmuter are proposed, e.g. ATW (Accelerator Transmutation of Waste) and Phoenix in the USA and the ADS-800 in Russia [NRC 1996] Q16, [Bergelson *et al.* 2002] Q50. Other transmuter concepts are the PBR (particle bed reactor or pebble bed reactor), a helium-cooled fast reactor, and molten salt reactors (MSRs), see for example [WNA-*reproc* 2016] Q738 and [WNA-*ane* 2016] Q740.

An inherent limitation of the P&T concept is that not all long-lived radionuclides can be transmuted into short-lived or stable nuclides for physical reasons.
Even with a perfectly operating P&T system it would take centuries of continuous and flawless operation to reduce a given quantity of certain long-lived fission products and actinides to 1% of the original quantity.
In the most optimistic scenario it would take many decades to a century of continuous and flawless operation to reduce a given quantity of actinides to 1% of the original quantity. This would require a unproved type reactor as transmuter (Accelerator-Driven System), which is not suitable for transmutation of fission products.

By recycling, the composition of plutonium shifts like that of uranium. The amounts of trans-plutonium elements increase with each reprocessing cycle. Due to this, the alpha-, gamma- and neutron radiation rise (with a factor 3), as well as the specific heat generation of the plutonium by radioactive decay with a factor 7 [ORNL-TM-*2897* 1970] Q254, [Fischer 1986] Q240 and [Roepenack *et al.* 1987] Q241. Evidently these long-known facts cause mounting difficulties in the handling of the recycled uranium and plutonium. High burnup and the high Pu content have some difficult consequences for the dissolving and separation processes in the reprocessing plant [UNIPEDE/CEC 1981] Q58.
Some isotopes have a very low critical mass for a fission chain reaction. Serious criticality problems complicate the reprocessing of fuel with high trans-plutonium content. For example, the critical mass of Am-242m may be as low as 7 grams, according to [Ronen *et al.* 2000] Q243.

According to the Swedish study [SKB 2010] Q447 the development of a functioning P&T system would take several decades. In view of the experiences in the past with the development of the U-Pu breeder cycle and the fact that a P&T cycle is more demanding than the U-Pu breeder cycle, this estimate might be optimistic, assumed these systems woulld be feasible. To fission the existing amounts of actinides would require the perfect functioning of a number of P&T systems during at least one century and probably longer [SKB 2010].

Even in case of a flawlessly operating system according to the design specifications, extremely long transmutation operating times for TRUs are needed. Assuming a constant level of nuclear power in the future, a transmutation time of a thousand years would be required to reach a hundredfold reduction in TRUs inventory using the accelerator-driven transmuter and many thousands of years using an LWR or ALMR transmuter. This time could be reduced to a few centuries if nuclear power were to be terminated as rapidly as possible [NRC 1996] Q16.

Other conclusions are formulated by [Pistner *et al.* 2015] Q734, such as:

- Partitioning and transmutation of actinides does not result in a relevant reduction of dose rates from final repositories, despite the huge efforts and costs involved, as the dose rates are dominated by nuclides such as I-129, Se-79, Cl-36, C-14 that will not be separated according to current P&T concepts.
- P&T does not reduce timelines for safe isolation of the waste, as dose rates are dominated with long-lived mobile fission and activation products, that are not influence by a P&T treatment.
- Recycling is not possible with some exceptions.
- Interim storage is not sustainable in the long term.
- Transmute would have high costs and sophistication, long duration, low benefit with respect to final disposal of high level wastes.
- Deep geologic repository is the best currently available option.

Apart from the demanding properties of the transmuter reactor, partitioning and fuel/target fabrication are two very energy-intensive processes. In addition all facilities are to be dismantled after their operational lifetime. This may be needed several times during one sequence of cycles (one or more centuries) of one P&T system. Decommissioning and dismantling likely would require very high energy investments, due to the highly radioactive construction materials. The P&T system would be an energy sink to such extent that a nuclear energy system consisting of a number of nuclear power plants coupled to associated P&T systems might be an energy sink instead of a net energy source.

The P&T cycle (Figure 5) would be an exceedingly polluting system. The material flows in the cycle are strongly radioactive, even more than in the breeder cycle, and discharges into the human environment by each component of the cycle would be unavoidable, caused by Second law phenomena. Due to the fact that relatively large amounts of minor actinides, that are highly radiotoxic, would circulate in the system, discharges and leaks would pose serious health hazards. Even without accidents the pollution by long-lived radioactive materials would become considerable.
Accidents could have very serious consequences and the chance of severe accidents might be more serious than in the conventional nuclear power plants due to the presence of large amounts of strongly radioactive materials in mobile form at different locations during decades or even centuries.
Another point of concern would be increased risks of nuclear terrorism for the same reasons. Substantial amounts of fissile materials would be circulating in the P&T cycle. The risks of dirty bombs could also increase with time as a consequence of the increasing amounts of radioactive materials in mobile form with time.
Partitioning of spent fuel, separation into a number of fractions , is prerequisite for a P&T system would be even more demanding than reprocessing in the breeder cycle. Materialisation of a P&T system is infeasible for it is based on assumptions that are in conflict with the Second Law, the same as discussed in the sections on the breeder cycle and thorium reactor.

Nuclear terrorism

MOX is the acronym of Mixed OXide fuel, nuclear fuel with plutonium instead of U-235. MOX fuel is relatively little radioactive and can be handled without specialized equipment. A terrorist group would have little difficulty in making a crude atomic bomb from MOX fuel. Separating uranium dioxide and plutonium dioxide from MOX fuel can be done using straightforward chemistry. Converting the plutonium dioxide into plutonium metal, and assembling the metal together with conventional explosives to produce a crude nuclear explosive does not require materials from special suppliers. The information required to carry out these operations is available in the open literature [Barnaby 2005a] Q339, [Barnaby 2005b] Q340. Technology needed to make nuclear bombs from fissile material is available outside of the established nuclear-armed countries and in the open literature, as proven in '*Nth Country Experiment*' [Frank 1967] Q591, [Schneider 2007] Q590.
The authors of [MIT 2003-2009] Q280 considered the proliferation and safety risks of reprocessing and the use of mixed-oxide (MOX) fuel unjustified. But there are also economic reasons not to recycle in their view.
Studies by the Oxford Research Group show that MOX fuel poses a large and underrated terrorist risk [Barnaby & Kemp 2007] Q360. The 6 kg of plutonium contained in the Nagasaki bomb would fit in a soft drink can.

Nuclear weapons can be made from reactor-grade plutonium, as pointed out above, although those made using weapons-grade plutonium are more effective. The USA and UK exploded devices based on reactor-grade plutonium in 1956 and in the 1960s. A good nuclear weapons designer could construct a nuclear weapon from 4-5 kg of reactor-grade plutonium. Less reliability or a less predictable explosive yield than a military weapon would not be a problem for a terrorist group planning an attack in the center of a large town. This is the reason why so many scientists all over the world are strongly opposing the reprocessing of spent fuel and the use of MOX fuel in civilian reactors.

A considerable part of nuclear security problems concerning fissile materials suitable to make crude nuclear explosives, plutonium, neptunium and americium, originate from one source: reprocessing of civil spent fuel. In addition uranium-233 is recovered by reprocessing spent fuel from special thorium-uranium reactors. Do the benefits of reprocessing outweigh the security and health risks it generates plus the costs of safeguarding the separated dangerous materials?
Without reprocessing the only way to acquire fissile bomb material would be enrichment of uranium.

Vitrification

According to [WNA 2012b] Q541 a typical 1 GWe reactor produces each year about 700 kg high-level wastes, contained in about 23 Mg (metric tons) of spent fuel. With 'high-level wastes' WNA likely refers to the fission products plus actinides in spent fuel, but does not mention them explicitely. After separation from spent fuel in a reprocessing plant the liquid high-level wastes are evaporated to solids, mixed with glass-forming materials, melted and poured into stainless steel canisters which are then sealed by welding. The vitrified waste from the operation of a 1 GWe reactor for one year would fill about twelve canisters, each 1.3 m high and 0.4 m diameter and holding 400 kg of glass, according to WNA.
The canisters are to be placed in a geological repository for permanent disposal. In another process, called Synroc, the wastes are calcined and mixed wich several metaloxides for conversion at high temperatures into a crystalline ceramic material (synthetic rock).
Applying the vitrification concept the mass holding the highly radioactive materials would be reduced from 23 Mg spent fuel to 4.8 Mg borosilicate glass, a reduction of a factor of less than five.
According to a popular view within the nuclear industry the option of vitrification could reduce the high-level waste problem to a routine job, nothing to worry about, see for example [MacKay 2009] Q399.
This concept sounds simple and may seem plausible at a first glance. However, on closer examination the feasibility as radioactive waste reduction strategy proves to be based on fallacies and ignorance of the Second Law of thermodynamics.

Long-lived fission products and the minor actinides are considered to be the most dangerous radionuclides in spent fuel. The idea behind the vitrification concept is to separate these dangerous radionuclides from spent fuel and to chemically immobilise them in a matrix of borosilicate glass. The fission products and actinides (other than U and Pu) then are converted into oxides, which are mixed with a glassmaking frit and melted to form a borosiicate glass. The molten glass is poured into appropiate stainless steel containers, which are to be placed in a geological repository for permanent disposal. The remaining radioactive wastes are considered to be not dangerous, because of a lower specific activity, and could be disposed of in a less expensive way, a routine job according to MacKay.
As a means of volume reduction of high-level waste the vitrification concept turns out to be a fallacy: the radioactive waste volumes increase enormously by reprocessing, as will explained below.
By reprocessing the radioactive contents of the spent fuel are distributed among large volumes of different materials, and only a part of it ends up in the vitrified waste, see Figure 6. This greatly enhances the chances of dispersal and of severe accidents involving massive amounts of radioactivity. A significant part of the radioactive contents is released into the environment.

In its communication to the public on the waste vitrification concept the nuclear industry does not pay attention to some practical aspects of the proposed technique, such as:

- All gaseous fission products and a substantial fraction of other fission products and of the actinides are inevitably discharged into the environment by the reprocessing plant.
- Generation of large volumes of other radioactive wastes during reprocessing because substantial fractions of the radionuclides from spent fuel are spread among non-radioactive solids and liquids and do not end up in the glass. Actually the radioactive waste volume increases to a great multiple of the volume of spent fuel.
- Immense amounts of radioactive waste, contaminated by fission products and actinides, will result from decommissioning and dismantling of nuclear power plants and reprocessing plants.
- Some nuclides are discharged during solidifying the liquid waste stream (calcination) and subsequent vitrification of the solid residu. Not all nuclides can be effectively fixed into a glass, such as: Se-79, Ru-106, I-129, since they hardly form stable compounds with the borosilicate matrix, or become volatile during the calcination process.

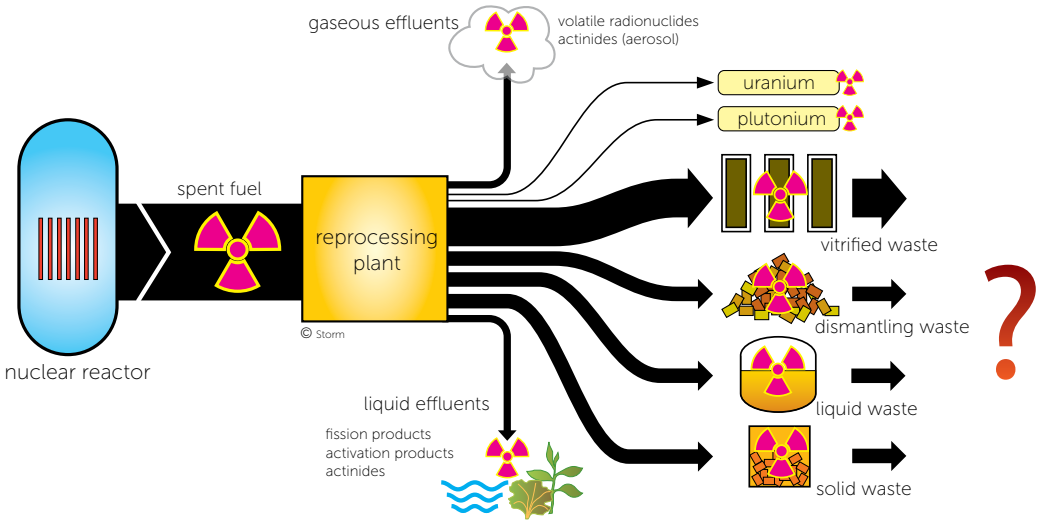


Figure 6

Redistribution of the radioactive contents of spent fuel in the waste streams from reprocessing. In order to recover uranium and plutonium from spent fuel, the radioactivity from the spent fuel is partitioned into a number waste streams. Significant amounts of radionuclides are discharged into the environment. Only a part of the radionuclides from the spent fuel can be vitrified.

One radioactive waste stream, consisting of dismantling wastes, will be released after final shutdown of the reprocessing plant, when the plant is decommissioned, cleaned up and dismantled.

How to safely isolate the radioactive waste streams from the biosphere is still an open question.

The assumption that 100% complete separation of all chemical elements constituting spent fuel is feasible is in conflict with the Second Law of thermodynamics. Consequently significant parts of the fission products and actinides remain inevitably in the waste streams of the reprocessing plant.

Furthermore the vitrification concept is (implicitely) based on the questionable assumption that the borosilicate glass will remain stable for hundreds or even thousands of years and that no severe problems will arise with the borosilicate glass, caused by radiolytic reactions, heat generation, (re)crystallization and segregation of elements. How long will the stainless steel containers last in contact with water at elevated temperatures and in the presence of nuclear radiation?

Deep geological repositories are still needed in this waste management option, even more than in case of direct disposal of spent nuclear fuel, because the volumes of highly radioactive waste other than the vitrified fraction are larger. Still no safe final disposal facility for the highly radioactive glass is operational, only paper concepts and experiments exist.

The energy consumption of spent fuel reprocessing is exceedingly high, particularly if the energy investments of the construction and of the cleanup + dismantling of the reprocessing plant would be included. For that reason the energy balance of an LWR system operating in the once-though mode with vitrification might be negative, even including the recycling plutonium and uranium as MOX fuel: the energy requirements to operate such a system from cradle to grave would surpass its useful energy production.

Discharges

Reprocessing is an extremely intricate complex of chemical processes. Each separation step produces inevitably waste streams, containing unwanted nuclides. Even very low concentrations of long-living radionuclides, e.g. I-129, Tc-99 and actinides in ground water or surface water, may be hazardous.

In the reprocessing plant the spent fuel elements are chopped into pieces and the contents are dissolved in boiling nitric acid. The resulting solution contains a host of elements: fission products, uranium, plutonium and higher actinides. The empty cladding hulls of the chopped and leached fuel pins hardly dissolve and are separated from the solution. Not all fuel dissolves either.
A part of the fission products is gaseous (e.g. noble gases) or easily form gaseous compounds and escape from the liquid. Most of that nuclides are difficult to fix, chemically or physically, into solid materials or containers, notably tritium (mainly as HTO), carbon-14 (mainly as $^{14}CO_2$), iodine-129 (various compounds, e.g. as $H^{129}I$ or $^{129}I_2$) and the noble gases such as krypton-85. The nuclides are discharged into the air or sea. In addition a significant fracion of the soluble nuclides are discharged with the liquid effluents, notably Sr-90, Tc-99, Ru-106 and Cs-137.

Table 2
Discharges of radionuclides in the liquid and gaseous effluents of a reprocessing plant. Sources: [NEA 1980] Q75, [Pigford et al. 1973] Q112 and various NCRP reports.

	NEA 1980 TBq/GW(e).a	Pigford 1973 TBq/GW(e).a	NCRP TBq/GW(e).a	
H-3	630	885	555-925	NCRP-62 1995
C-14	0.4 - 0.6	–	0.74	NCRP-81 1993
Kr-85	14000	13800	11000	NCRP-44 1975
Ru-106	–	0.136	–	
I-129	0.05	0.022	0.042	NCRP-75 1983
other fission products	–	0.340	–	
transuranics	–	0.00014	–	

Table 3
Discharge limits of reprocessing plants to the sea in 2000.
n.a. = not available. Source: [OSPAR 2002] Q236

radionuclide	discharge limits La Hague TBq/yr	discharge limits Sellafield TBq/yr
tritium	37000	25000
total alpha	17	1
total beta	1700	400
plutonium	n.a.	0.70
uranium	n.a.	2000 kg/yr

Table 4
Discharge limits of reprocessing plants at La Hague.
n.a. = not available. Source: [Malherbe 1991] Q17

radionuclide	gaseous effluent TBq/yr	liquid effluent TBq/yr
tritium	2200	37000
Kr	480000	–
halogens	0.11	n.a.
aerosols	0.074	–
total alpha	n.a	1.7
total beta	n.a	1700
of which Cs-137 + Sr-90		220

Data on radioactive discharges by reprocessing plants, and by nuclear power stations as well, are scarce in the open literature.
Lower discharges than the permitted limits do not necessarily mean a better retainment of the radionuclides, but might be caused by a lower throughput of the plant, or by reprocessing spent fuel of lower burnup.

Entropy generation by reprocessing

Reprocessing of spent fuel is an extremely costly and polluting process. Reprocessing greatly enhances the health hazards posed by nuclear power, because many pathways are created along which the radionuclides from the spent fuel can enter the human environment. Reprocessing also raises severe security problems. because fissile materials are separated from the fission products and become accessible.

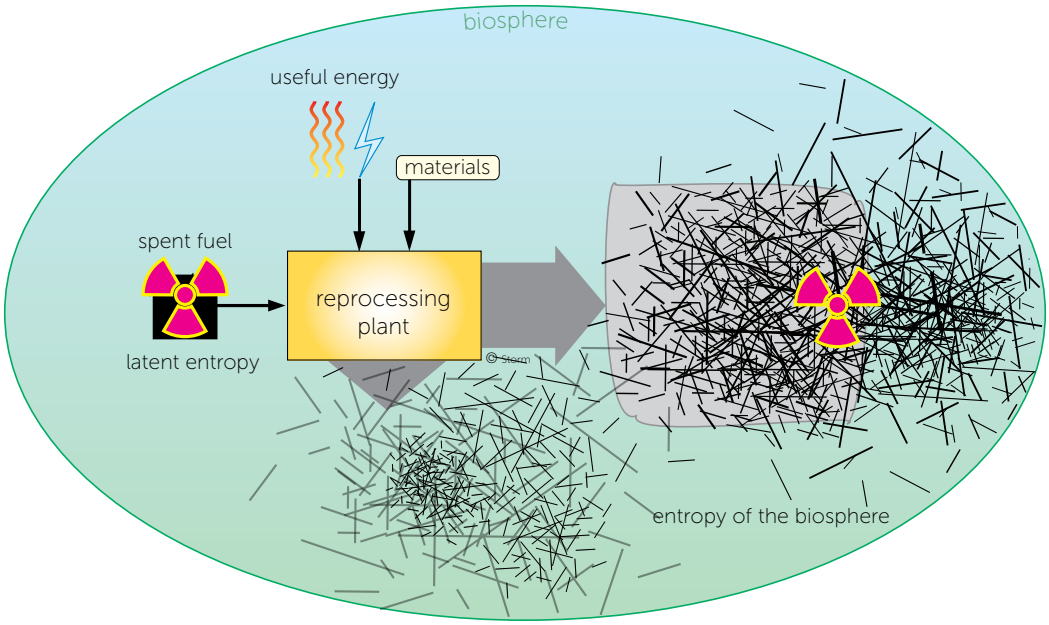


Figure 7

Symbolic representation of the entropy production by reprocessing of spent fuel. In spent fuel is a large amount of latent and delayed entropy confined to the volume of the spent fuel elements. In the reprocessing plant a substantial part of the content of the spent fuel is released into the environment and its latent entropy becomes an acute entropy increase of the biosphere. The other part is distributed over large volumes of originally non-radioactive materials, greatly increasing the entropy of that systems.

In the reprocessing sequence the contents of the spent fuel are distributed over large volumes of non-radioactive materials (see figure 6), greatly increasing the entropy of the spent fuel contents. A signicant part of the radionuclides are discharged into the biosphere via aerosols, gaseous effluents and liquid effluents, causing the conversion of latent entropy into entropy of the biosphere.
New entropy is generated, according to the Second Law, by the consumption of energy and ordered materials in the separation processes. Entropy is also generated by the construction of the reprocessing plant.
In addition to the above mentioned entropy increases, reprocessing generates another form of latent entropy present in the construction materials that became contaminated during the operation of the plant by all kinds of radionuclides from the spent fuel. At issue is to prevent this latent entropy becoming entropy of the biosphere as a result of decommissioning & dismantling of the reprocessing plant itself.
The total quantity of radioactivity does not change by processes in the reprocessing plant, only the extent of dispersion changes.

Reprocessing offers no solution of radioactive waste problems, on the contrary, as is explained in the previous sections on P&T and vitrification. The amount of radioactivity in the nuclear waste streams is not influenced by the mechanical and chemical operations in a reprocessing plant. Discharging a significant part of the radioactive substances into the environment cannot be conceived as a ‘solution’ to the nuclear

waste problem. Actually the radioactivity from the spent fuel is dispersed over large volumes and masses of non-radioactive substances. Instead of volume reduction, the vitrification option results in a huge volume increase, worsening the waste problems beyond control.

The best way to handle spent fuel might be keeping the spent fuel elements intact, - in the fuel elements fissile and other radionuclides are compacted in the smallest possible volume -, to pack them in very durable containers and to dispose of in a safe geological repository (see report m32 *Geologic repositories*). Direct disposal poses the least risks and consumes the least materials and energy, prevents latent entropy in the spent fuel becoming entropy of the biosphere and prevents entropy generation by construction, operation and dismantling.
A number of countries, among other USA, Sweden, Finland and Canada, has chosen for this option.
It is a fallacy to believe in 'retrievable' storage of spent fuel. In no way it is possible to extract net usable energy from it, when all industrial processes needed to achieve reuse of spent fuel are accounted for. The Second Law is relentless.

Concluding notes

Reprocessing of spent fuel is a polluting process, discharging large amounts of radioactive materials into the environment.

Reprocessing increases the risks of severe nuclear accidents, causing dispersion of very large amounts of radioactive materials, possibly more than Chernobyl and Fukushima. Massive amounts of spent fuel are present in reprocessing plants, to be counted in thousands of nuclear bomb equivalents.
Reprocessing increases also the risk of nuclear terrorism.

Reprocessing of spent fuel is an energy-intensive process in itself. Decommissioning and dismantling of a reprocessing plant will require massive investments of energy, materials and human effort. For that reason application of proposed nuclear technologies dependent of reprocessing would result in a negative energy balance of nuclear energy generation.

Separation of any mixture of different chemical species into fractions never goes to incompletion, due to Second Law phenomena. Incomplete separation implies also incomplete purification, so 100% pure materials with 100% predictable properties and behaviour cannot be produced.

All materials are subject to spontaneous degrading processes (ageing), due to Second Law phenomena.

Based on the above observations can be concluded that the following concepts are inherently infeasible:
- uranium-plutonium breeder cycle
- thorium-uranium breeder cycle
- partioning & transmutation, as presented by the nuclear industry.

In addition: inherently safe nuclear power is inherently impossible.

Vitrification of high-level radioactive waste results in an increase of the volumes of radioactive waste that has to be disposed of in geologic repositories, instead of a decrease, as stated by the nuclear industry.

By reprocessing large fractions of the latent entropy confined in spent fuel elements are released as an irreversible entropy increase of the biosphere, in addition to the entropy generation by the processes themselves.

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From: John W
To: Public Comment
Subject: [EXTERNAL] Public Comment, Oct 15 and Oct 16
Date: Wednesday, October 15, 2025 6:00:06 PM
Attachments: lazards-lcoeplus-june-2025.pdf

The below public comment is for the Energy Resources and Customer Services Committee Meeting on Oct 15, 2025 and for the Board of Directors Meeting on Oct 16, 2025.

Committee and Board of Directors,

Below I will provide material and references for more details regarding my Oct 15 public comment. Please feel free to reach out to me if you have any questions.

Thank you,
John Weber

Alternate Energy Holdings, Inc. Letter to NRC- https://www.nrc.gov/docs/ML1027/ML102780562.pdf
SEC filing- https://www.sec.gov/enforcement-litigation/distributions-harmed-investors/sec-v-alternate-energy-holdings-inc-et-al-case-no-10-cv-00621-ejl-reb-d-idaho
"In May of 2015, Ms. Ransom's co-defendant, Donald Gillispie, failed to appear for two scheduled arraignment hearings. He remains a fugitive and is being pursued by the United States Marshals Service."
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In-situ (ISR) mining- https://www.mining-technology.com/projects/goliadprojecttexas/?cf-view&cf-closed

"The ISR method reverses the natural process through which uranium deposits are formed. Compared to conventional open-pit mining, it causes fewer disturbances to the ground. It, however, results in contamination of the groundwater surrounding the ore."

New mining- https://insideclimatenews.org/news/01122024/texas-uranium-mining-nuclear-renaissance/?ref=chismecollective.com

Stanford professor, less than 2 minutes- https://www.youtube.com/watch?v=EKszV0ipCnk

The below quotes came from- https://www.utilitydive.com/news/grid-planners-and-experts-on-why-markets-keep-choosing-renewables/758233/

"The levelized cost of electricity for utility-scale solar and onshore wind remain "the most cost-effective forms of new-build energy generation on an unsubsidized basis," according to Lazard analysis. Calculating a technology's LCOE involves its capital cost, fuel cost, capacity factor, and other values that vary by location and time."

"The newest, most efficient natural gas peaker plants are expensive to build and are likely to become more expensive to run because of competition for natural gas," Garza said. "The market's answer to load growth is still to build more wind, solar, and batteries because they are the cheaper and faster to build."

In a past SMUD meeting, a SMUD employee mentioned working with RMI (Rocky Mountain Institute). This is a thoughtful piece their co-founder recently penned.

https://www.utilitydive.com/news/nuclear-power-smr-ai-amory-lovins/758660/


Teneo
Roland Berger

Table of Contents

I Executive Summary

Executive Summary—Selected Key Findings from Lazard's 2025 LCOE+

Lazard's 2025 LCOE+ Report is organized around three key areas: Energy Generation, Energy Storage and the Energy System

Energy Generation

Levelized Cost of Energy Version 18.0

- **Renewables Remain Competitive:** On an unsubsidized $/MWh basis, renewable energy remains the most cost-competitive form of generation. As such, renewable energy will continue to play a key role in the buildout of new power generation in the U.S. This is particularly true in the current high power demand environment, where renewables stand out as both the lowest-cost and quickest-to-deploy generation resource
- **Increasing Competitiveness of Existing Gas Generation:** The gap between the LCOE of new wind and solar and the marginal cost of operating CCGTs has widened due to, among other things, persistent low gas prices, high energy demand and increasing renewable LCOEs
- **Significant Shifts Expected:** Unless otherwise indicated, Lazard's LCOE is an LTM analysis focused on "today" and is not a forecasting tool. As such, the outcomes included herein are representative of current development and construction timelines, which vary by technology. For example, while this year's analysis shows only a slight increase in the LCOE of CCGTs, turbine shortages, rising costs and long lead times are expected to drive steep LCOE increases for gas technologies in the near term, as illustrated herein. Additionally, cost declines across Vogtle units 3 and 4 indicate nuclear is poised to benefit from scale and development efficiencies

Energy Storage

Levelized Cost of Storage Version 10.0

- **Storage Cost Decline:** This year's analysis shows notable declines in the LCOS of utility scale and C&I battery energy storage systems. Key drivers of such results include both market dynamics (e.g., lower-than-expected EV demand and the resulting oversupply of cells) and technological advancements (e.g., increased cell capacity and energy density)
- **Tariffs Increase Uncertainty:** While current pricing is further benefiting from aggressive competition, widening LCOS spreads indicate increased volatility as uncertainty related to the ultimate tariff regime is shaping market dynamics in real time. For example, supply chain relocation to Southeast Asia and India is well underway, and market participants are executing on forward procurement strategies to mitigate future pricing risk
- **Market Expansion Is Underway:** The LCOS value snapshots show increased returns reflecting the confluence of lower costs and higher prices in several regions. Energy storage adoption is expanding beyond ISO/RTO-driven wholesale markets and into states where municipal procurement and data center growth is prevalent (e.g., Arizona, Colorado, Florida). Lazard expects continued expansion as backup power and grid resilience become increasingly important in high-growth markets

Energy System

Cost of Firming Intermittency

- **Firming Value Rises as Renewable Penetration Increases:** The cost of firming helps grid operators evaluate resources based on a region's existing generation mix and load characteristics, ensuring the right balance between reliability and affordability. The results of this year's firming analysis show that as the penetration of low-cost intermittent generation increases, the value of firm capacity rises
- **ISO Approaches to System Analysis Are Evolving:** Several independent system operators are adjusting their capacity accreditation methodologies in ways that are generally increasing firming costs. Both CAISO and PJM have reduced capacity accreditation values for highly correlated resources (e.g., solar and shorter-duration storage). Continued development of more sophisticated capacity accreditation frameworks, such as incorporation of seasonal adjustments or diversity benefits, could have material impacts on future firming costs
- **Diverse Generation Sources and Innovation Are Needed:** The results of Lazard's LCOE+ have consistently supported deploying a diverse mix of energy resources. Despite the sustained unsubsidized cost competitiveness of renewable energy, resource planning metrics indicate diverse generation fleets will be required over the long term to meet power needs, likely bolstered by now-emerging technologies such as long duration energy storage, geothermal, nuclear small modular reactors, pumped storage hydropower and carbon capture and storage, among others

LCOE

II Energy Generation

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Lazard's Levelized Cost of Energy Analysis—Version 18.0

LAZARD

Introduction

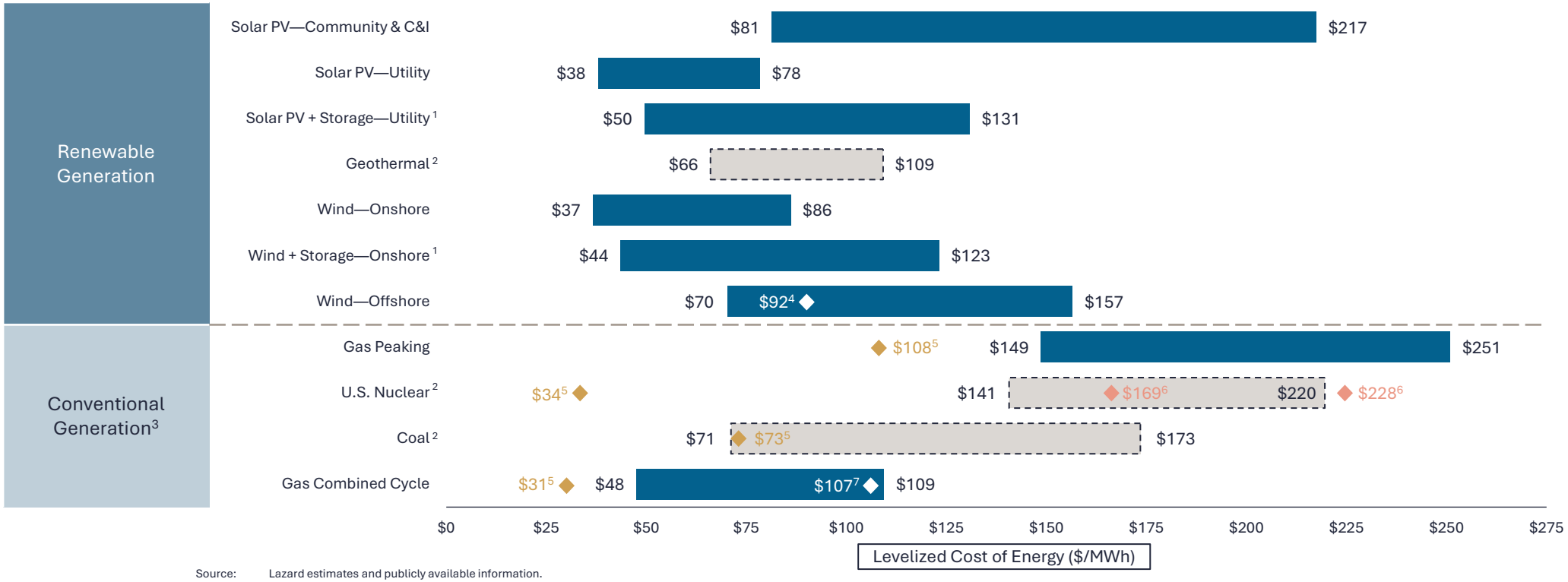
Lazard's Levelized Cost of Energy analysis addresses the following topics:

- Comparative LCOE analysis for various generation technologies on a $/MWh basis, including sensitivities for U.S. federal tax subsidies, fuel prices, carbon pricing and cost of capital
- Illustration of how the LCOE of onshore wind, utility-scale solar and hybrid projects compare to the marginal cost of selected conventional generation technologies
- Historical LCOE comparison of various technologies
- Illustration of the historical LCOE declines for onshore wind and utility-scale solar
- Appendix materials, including:
  - An overview of the methodology utilized to prepare Lazard's LCOE analysis
  - A summary of the assumptions utilized in Lazard's LCOE analysis
  - Deconstruction of the LCOE for various generation technologies by capital cost, fixed operations and maintenance ("O&M") expense, variable O&M expense and fuel cost

Other factors would also have a potentially significant effect on the results contained herein but have not been examined in the scope of this current analysis. These additional factors, among others, may include: recent tariff-related cost impacts; implementation and interpretation of the full scope of the IRA; economic policy, transmission queue reform, network upgrades and other transmission matters, congestion, curtailment or other integration-related costs; permitting or other development costs, unless otherwise noted; and costs of complying with various environmental regulations (e.g., carbon emissions offsets or emissions control systems). This analysis is intended to represent a snapshot in time and utilizes a wide, but not exhaustive, sample set of Industry data. As such, we recognize and acknowledge the likelihood of results outside of our ranges. Therefore, this analysis is not a forecasting tool and should not be used as such given the complexities of our evolving Industry, grid and resource needs. Except as illustratively sensitized herein, this analysis does not consider the intermittent nature of selected renewables energy technologies or the related grid impacts of incremental renewable energy deployment. This analysis also does not address potential social and environmental externalities including, for example, the social costs and rate consequences for those who cannot afford distributed generation solutions as well as the long-term residual and societal consequences of various conventional generation technologies that are difficult to measure (e.g., airborne pollutants, greenhouse gases, etc.).

Levelized Cost of Energy Comparison—Version 18.0

Selected renewable energy generation technologies remain cost-competitive with conventional generation technologies under certain circumstances



Source: Lazard estimates and publicly available information.

Note: Here and throughout this analysis, unless otherwise indicated, the analysis assumes 60% debt at an 8% interest rate and 40% equity at a 12% cost. See page titled "Levelized Cost of Energy Comparison—Sensitivity to Cost of Capital" for cost of capital sensitivities.

1 Reflects the LCOE for a system composed of standalone generation plus standalone storage less the combined system-level synergies (assumed to be 10% of storage capital costs and 25% of inverter costs). The synergies capture potential cost reductions or efficiency gains from integrating generation and storage, such as shared interconnection infrastructure, improved energy dispatch, enhanced capacity utilization and operational efficiencies.

2 Given the limited public and/or observable data available for new-build geothermal, coal and nuclear projects, the LCOE presented herein reflects Lazard's LCOE v14.0 results adjusted for inflation and, for nuclear, are based on then-estimated costs of the Vogtle Plant. Coal LCOE does not include cost of transportation and storage.

3 The fuel cost assumptions for Lazard's LCOE analysis of gas-fired generation, coal-fired generation and nuclear generation resources are $3.45/MMBTU, $1.47/MMBTU and $0.85/MMBTU, respectively, for year-over-year comparison purposes. See page titled "Levelized Cost of Energy Comparison—Sensitivity to Fuel Prices" for fuel price sensitivities.

4 Represents the illustrative midpoint LCOE for Dominion's Coastal Virginia Offshore Wind ("CVOW") project, based on the publicly disclosed capital cost of ~$8.7 billion (excluding onshore transmission costs) and offshore wind estimates from Lazard. Dominion's projected LCOE for CVOW as of February 2025 is $91/MWh in 2027 dollars, with an expected COD in 4Q 2026.

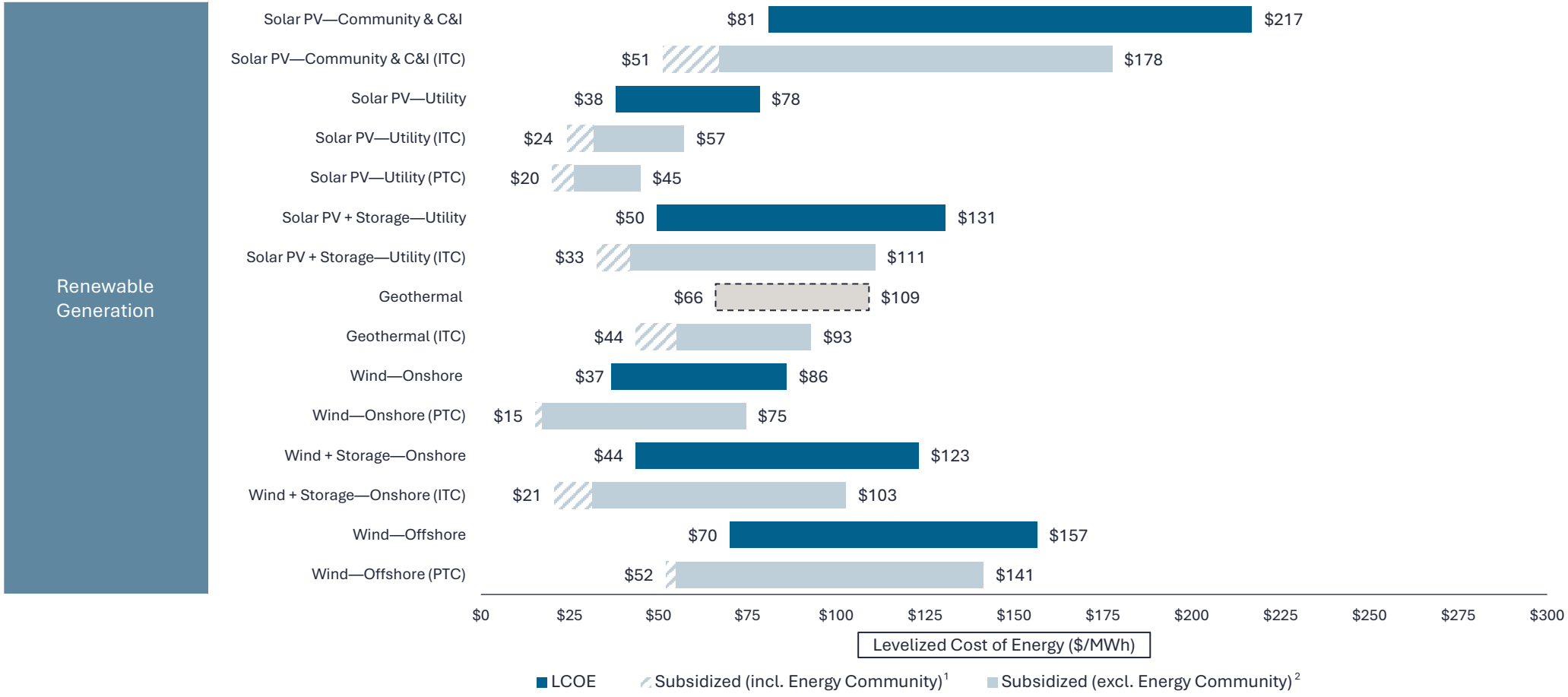
5 Reflects the average of the high and low LCOE marginal cost of operating fully depreciated gas peaking, gas combined cycle, coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned gas or coal asset is equivalent to its decommissioning and site restoration costs. Inputs are derived from a benchmark of operating gas, coal and nuclear assets across the U.S. Capacity factors, fuel, variable and fixed operating expenses are based on upper- and lower-quartile estimates derived from Lazard's research. See page titled "Levelized Cost of Energy Comparison—New Build Renewable Generation vs. Marginal Cost of Conventional Generation" for additional details.

6 Represents illustrative LCOE values for Vogtle nuclear plant's units 3 and 4. The analysis is based on publicly available estimates and suggestions from selected industry experts, indicating a cost "learning curve" of ~30% between Vogtle units 3 and 4. Analysis assumes total operating capacity of ~2.2 GW, total capital cost of ~$32.3 billion, capacity factor of ~97%, operating life of 70 years and other operating parameters estimated by Lazard's LCOE v14.0 results, adjusted for inflation.

7 Illustrative high case reflects elevated capital costs ($2,400/kW – $2,600/kW) based on recently observed market quotes for CCGT projects in early stages of development (post-2028 COD).

Levelized Cost of Energy Comparison—Sensitivity to U.S. Federal Tax Subsidies

The Investment Tax Credit ("ITC"), Production Tax Credit ("PTC") and Energy Community adder, among other provisions in the IRA, are important components of the LCOE for renewable energy technologies



Source: Lazard estimates and publicly available information.

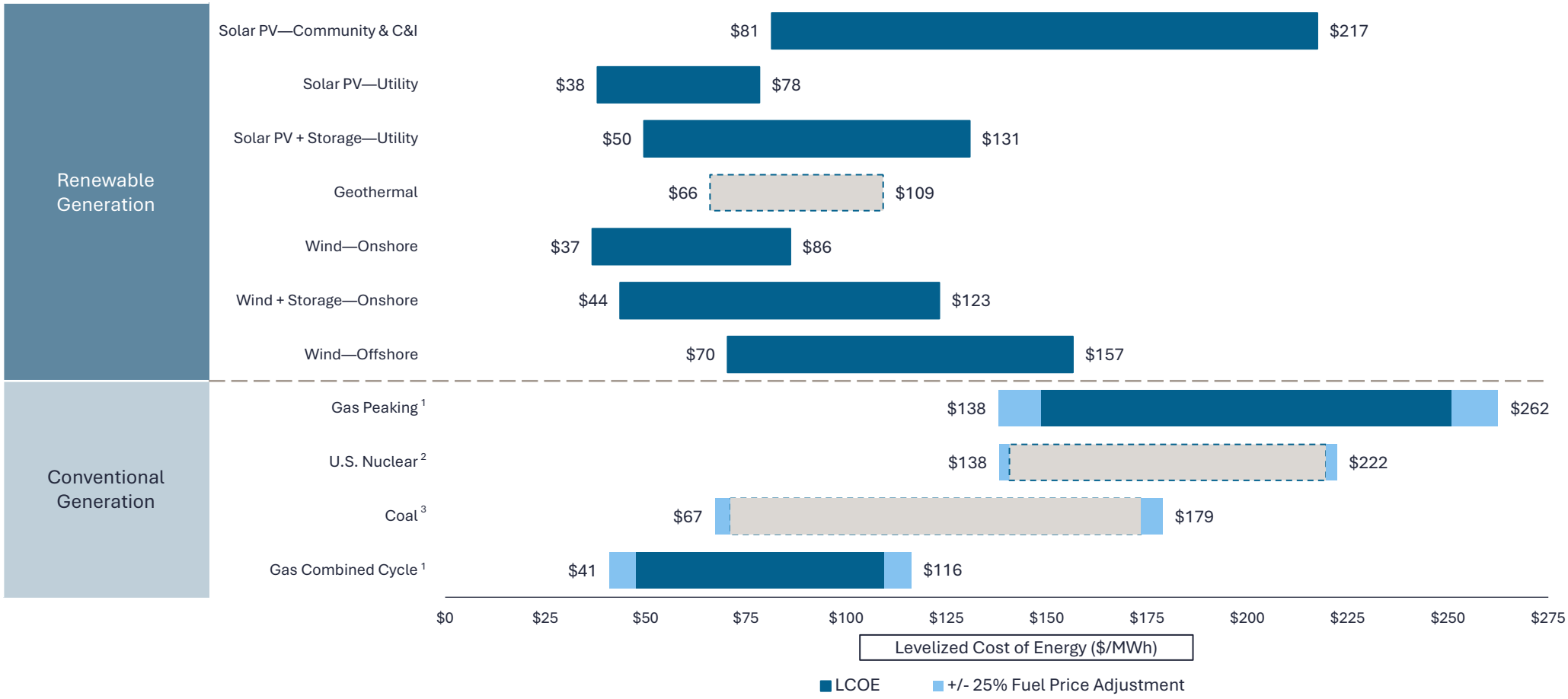
Note: Unless otherwise indicated, this analysis does not include other state or federal subsidies (e.g., domestic content adder, etc.). The IRA is a comprehensive and evolving piece of legislation that is still being implemented and remains subject to interpretation—important elements of the IRA are not included in our analysis and could impact outcomes. Lazard's LCOE analysis assumes, for year-over-year reference purposes, 60% debt at an 8% interest rate and 40% equity at a 12% cost (together implying an after-tax IRR/WACC of 7.7%).

1 This sensitivity analysis assumes that projects qualify for the full ITC/PTC, have a capital structure that includes sponsor equity, debt and tax equity and assumes the equity owner has taxable income to monetize the tax credits and also includes an Energy Community adder of 10% for ITC projects and $3/MWh for PTC projects.

2 This sensitivity analysis assumes that projects qualify for the full ITC/PTC, have a capital structure that includes sponsor equity, debt and tax equity and assumes the equity owner has taxable income to monetize the tax credits.

Levelized Cost of Energy Comparison—Sensitivity to Fuel Prices

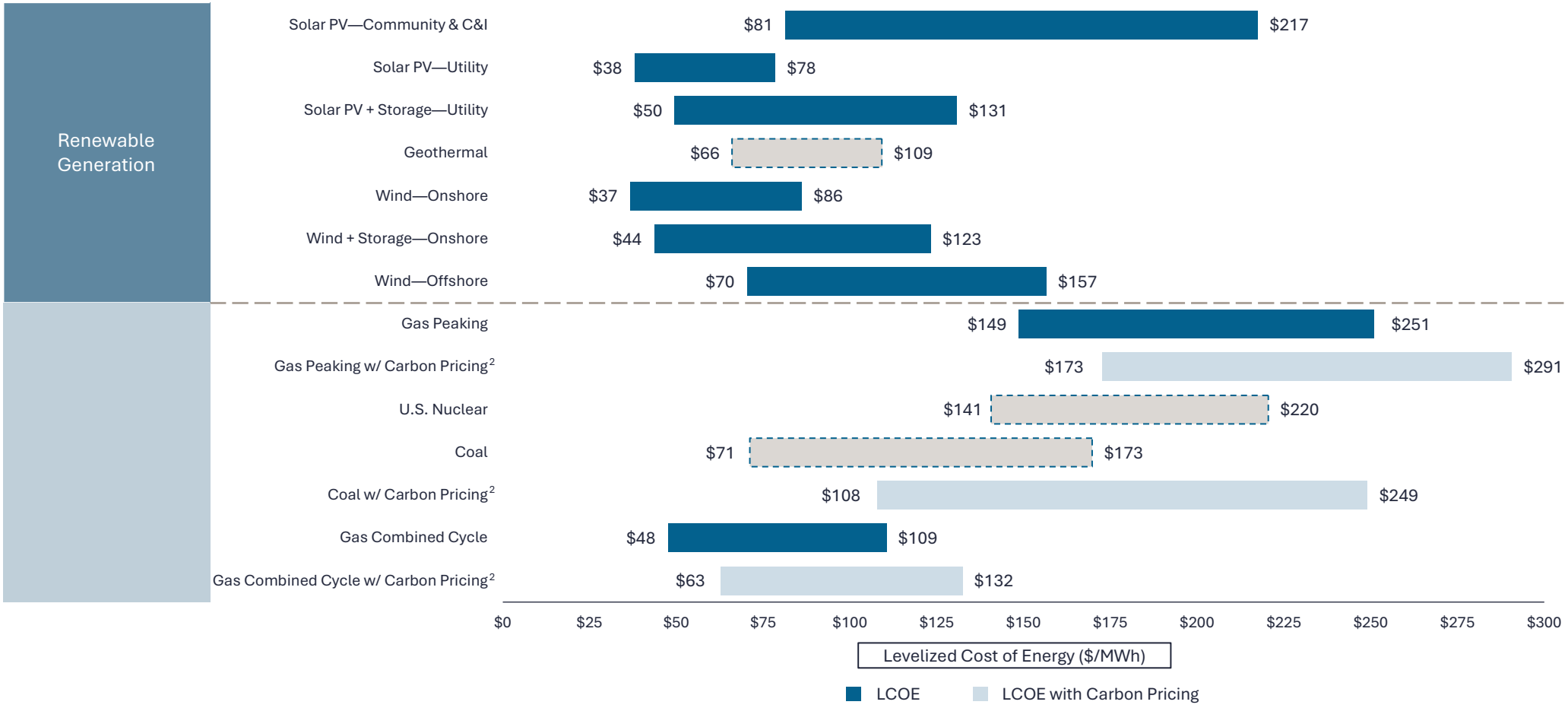
Variations in fuel prices can materially impact the LCOE of conventional generation technologies



Source: Lazard estimates and publicly available information.
Note: Unless otherwise noted, the assumptions used in this sensitivity correspond to those used in the LCOE analysis as presented on the page titled "Levelized Cost of Energy Comparison—Version 18.0".
1 Assumes a fuel cost range for gas-fired generation resources of $2.59/MMBTU – $4.31/MMBTU (representing a sensitivity range of ± 25% of the $3.45/MMBTU used in the LCOE).
2 Assumes a fuel cost range for nuclear generation resources of $0.64/MMBTU – $1.06/MMBTU (representing a sensitivity range of ± 25% of the $0.85/MMBTU used in the LCOE).
3 Assumes a fuel cost range for coal-fired generation resources of $1.10/MMBTU – $1.84/MMBTU (representing a sensitivity range of ± 25% of the $1.47/MMBTU used in the LCOE).

Levelized Cost of Energy Comparison—Sensitivity to Carbon Pricing

Carbon pricing is one avenue for policymakers to address carbon emissions; a carbon price range of $40 – $60/Ton[1] of carbon would increase the LCOE for certain conventional generation technologies, as indicated below

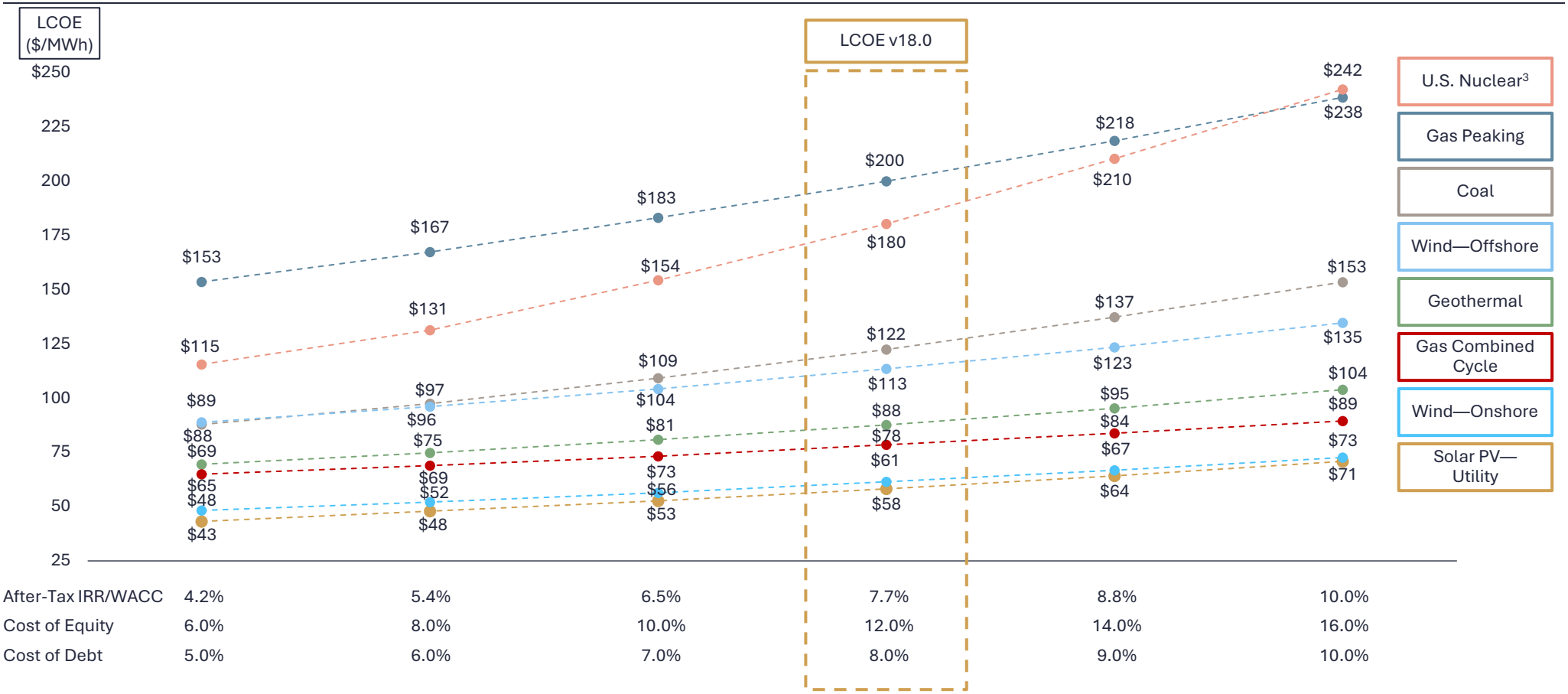


Source: Lazard estimates and publicly available information.
Note: Unless otherwise noted, the assumptions used in this sensitivity correspond to those used in the LCOE analysis as presented on the page titled "Levelized Cost of Energy Comparison—Version 18.0". LCOE with Carbon Pricing is limited to carbon emissions directly related to generation and does not include the impacts of carbon pricing on embodied carbon.
1 The current administration no longer maintains an estimate of the monetized impacts of greenhouse gas emissions. Previous administrations estimated the social cost of carbon to range from $5/Ton (first Trump Administration) to over $200/Ton (Biden Administration).
2 The low and high ranges reflect the LCOE of selected conventional generation technologies including an illustrative carbon price of $40/Ton and $60/Ton, respectively.

Levelized Cost of Energy Comparison—Sensitivity to Cost of Capital[1]

A key consideration in determining the LCOE for utility-scale generation technologies is the cost, and availability, of capital[1]. In practice, this dynamic is particularly significant because the cost of capital for each asset is related to its specific operational characteristics and the resulting risk/return profile

Average LCOE[2]

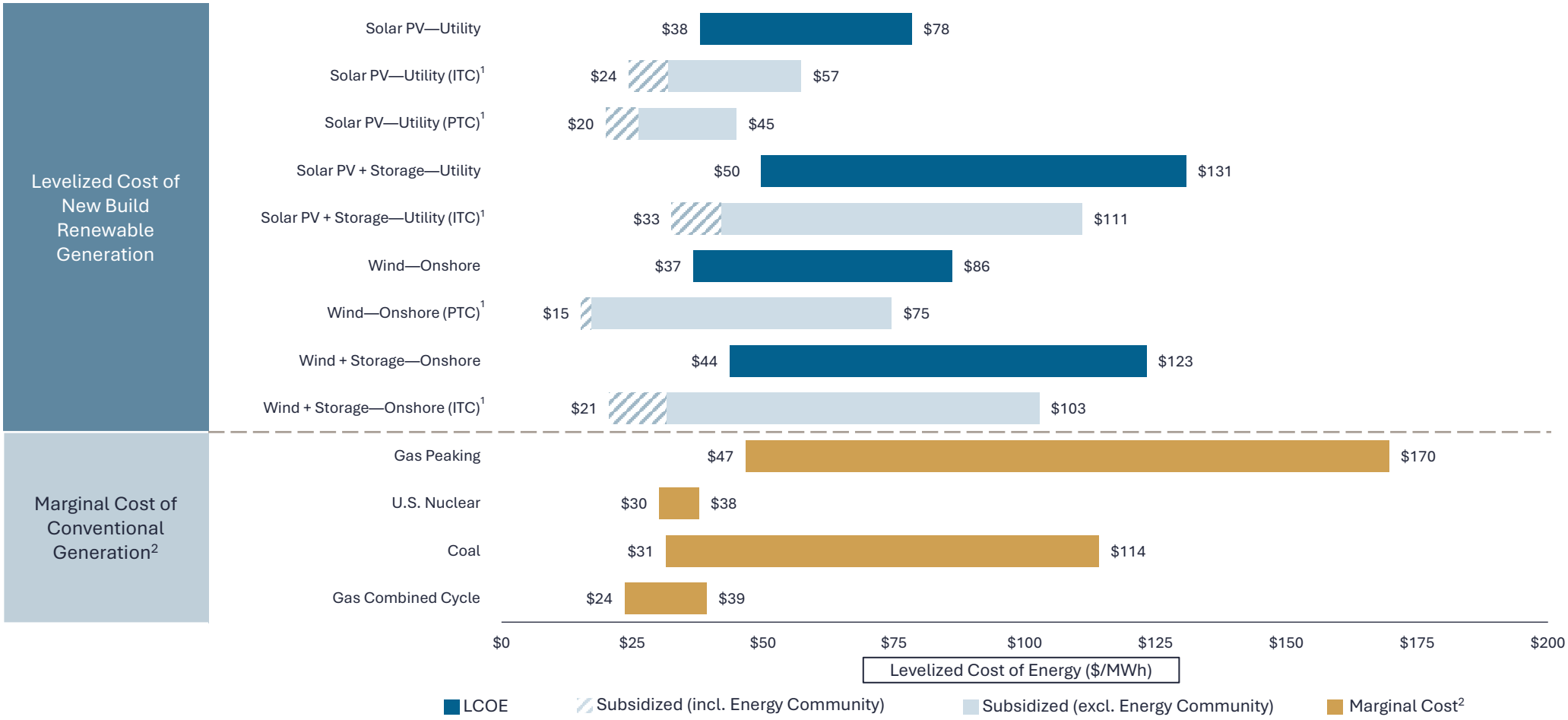


After-Tax IRR/WACC	4.2%	5.4%	6.5%	7.7%	8.8%	10.0%
Cost of Equity	6.0%	8.0%	10.0%	12.0%	14.0%	16.0%
Cost of Debt	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%

Source: Lazard estimates and publicly available information.
Note: Analysis assumes 60% debt and 40% equity. Unless otherwise noted, the assumptions used in this sensitivity correspond to those used on the page titled "Levelized Cost of Energy Comparison—Version 18.0".
1 Cost of capital as used herein indicates the cost of capital applicable to the asset/plant and not the cost of capital of a particular investor/owner.
2 Reflects the average of the high and low LCOE for each respective cost of capital assumption.
3 Given the limited public and/or observable data available for new-build nuclear projects, the LCOE presented herein reflects Lazard's LCOE v14.0 results adjusted for inflation and are based on then-estimated costs of the Vogtle Plant.

Levelized Cost of Energy Comparison—New Build Renewable Generation vs. Marginal Cost of Conventional Generation

Certain renewable energy generation technologies have an LCOE that is competitive with the marginal cost of selected conventional generation technologies—notably, as incremental, intermittent renewable energy capacity is deployed and baseload gas-fired generation utilization rates increase, this gap closes, particularly in low gas pricing and high energy demand environments

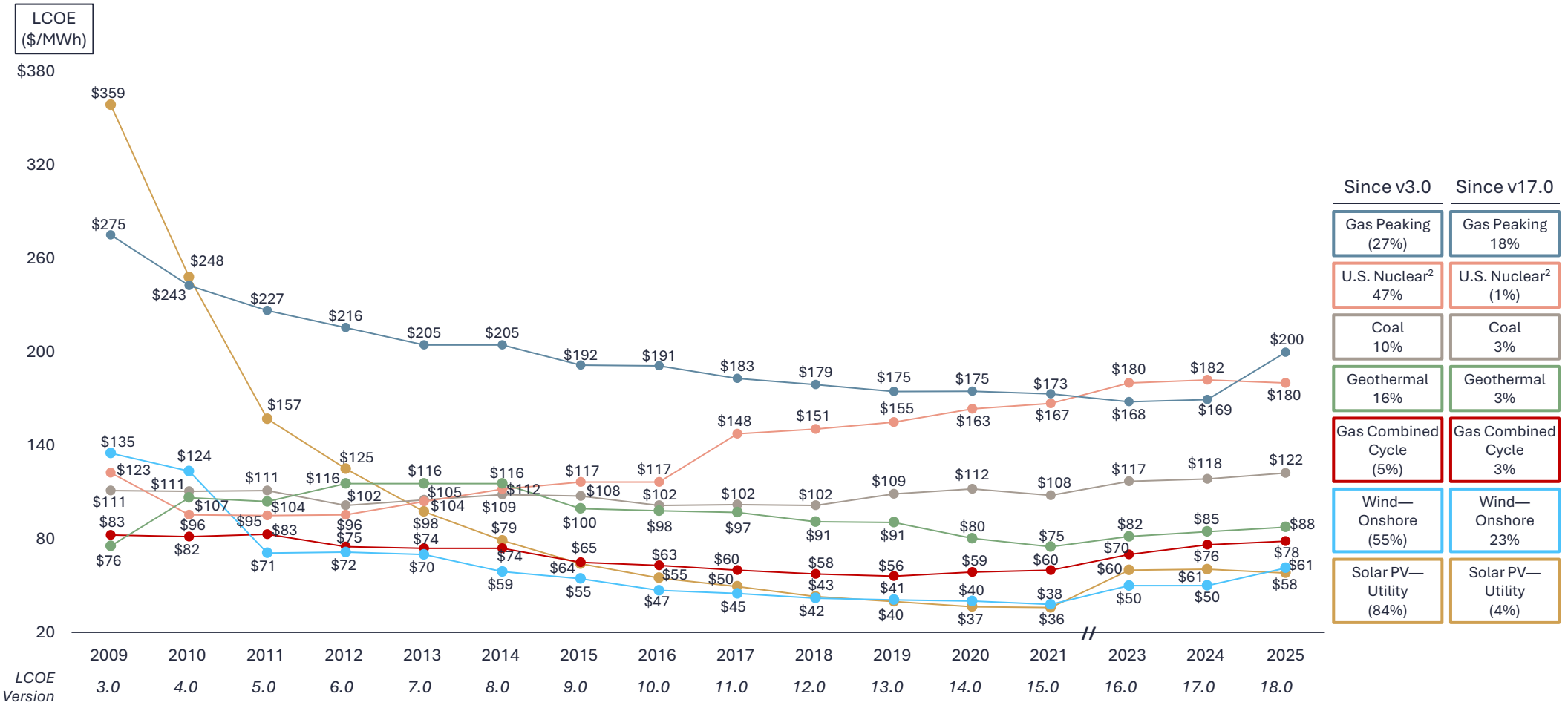


Source: Lazard estimates and publicly available information.
Note: Unless otherwise noted, the assumptions used in this sensitivity correspond to those used on page titled "Levelized Cost of Energy Comparison—Version 18.0".
1 See page titled "Levelized Cost of Energy Comparison—Sensitivity to U.S. Federal Tax Subsidies" for additional details.
2 Reflects the marginal cost of operating fully depreciated gas, coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned gas or coal asset is equivalent to its decommissioning and site restoration costs. Inputs are derived from a benchmark of operating gas, coal and nuclear assets across the U.S. Capacity factors, fuel, variable and fixed O&M are based on upper- and lower-quartile estimates derived from Lazard's research.

Levelized Cost of Energy Comparison—Historical LCOE Comparison

Lazard's LCOE analysis indicates significant historical cost declines for utility-scale renewable energy generation technologies, which has begun to level out and even slightly increase in recent years

Selected Historical Average LCOE Values[1]

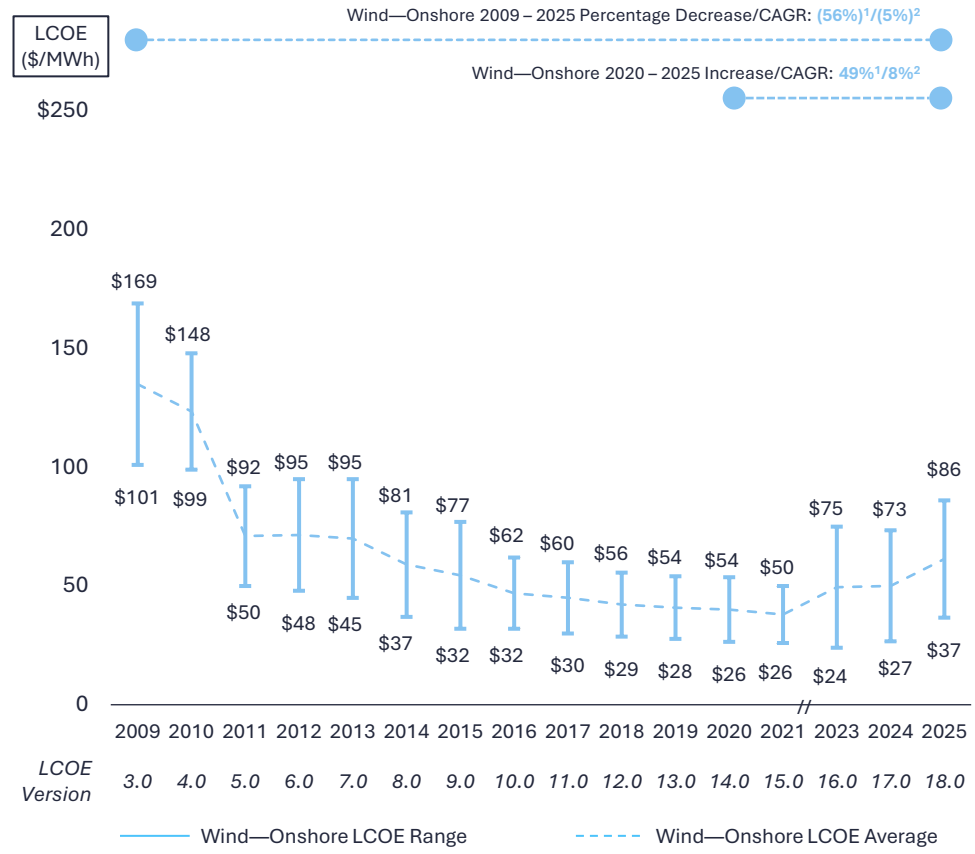


Source: Lazard estimates and publicly available information.
1 Reflects the average of the high and low LCOE for each respective technology in each respective year. Percentages represent the total change in the average LCOE since Lazard's LCOE v3.0 and LCOE v17.0, respectively.
2 Given the limited public and/or observable data available for new-build nuclear projects, the LCOE presented herein reflects Lazard's LCOE v14.0 results adjusted for inflation and are based on then-estimated costs of the Vogtle Plant.

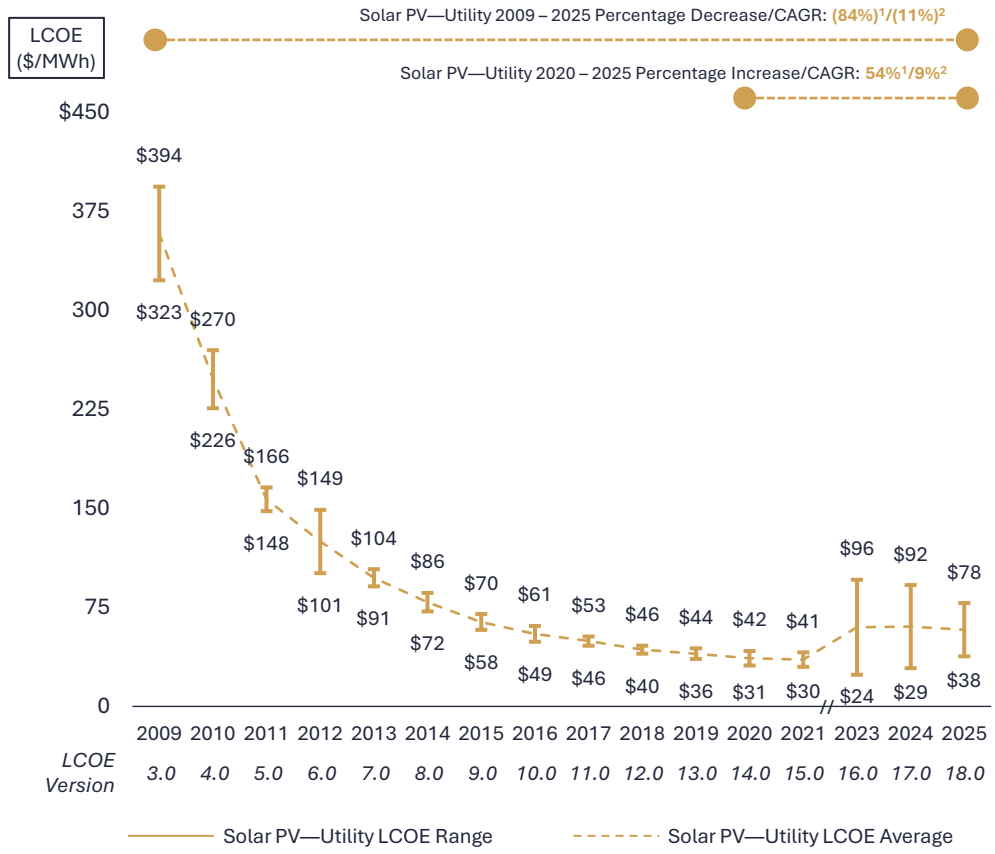
Levelized Cost of Energy Comparison—Historical Renewable Energy LCOE

This year's analysis shows a divergence in trends between wind and solar with solar costs declining slightly and wind costs increasing, likely reflecting the difference in supply chain conditions across each technology

Wind—Onshore



Solar PV—Utility



Source: Lazard estimates and publicly available information.
1 Reflects the average percentage increase/(decrease) of the high end and low end of the LCOE range.
2 Reflects the average compounded annual growth rate of the high end and low end of the LCOE range.

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III Energy Storage

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Lazard's Levelized Cost of Storage Analysis—Version 10.0

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Introduction

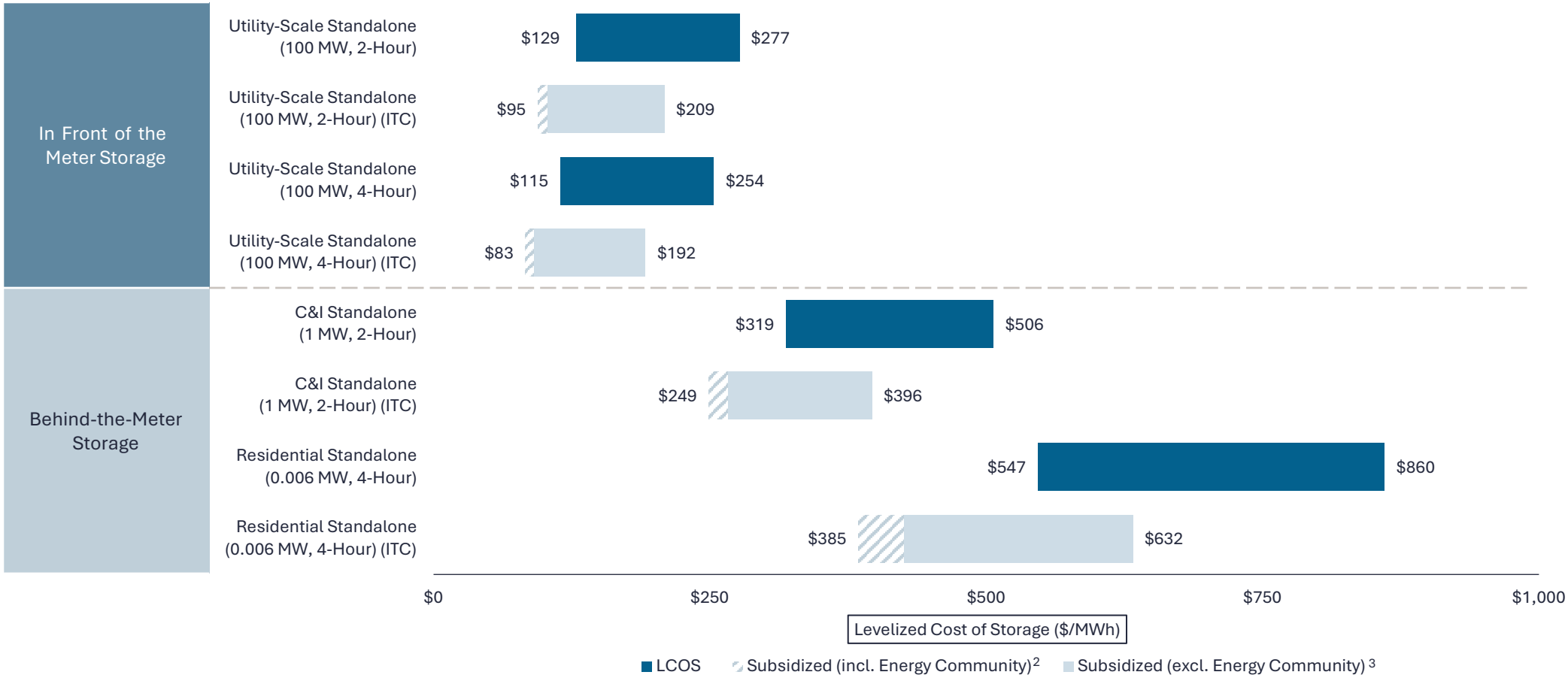
Lazard's Levelized Cost of Storage analysis addresses the following topics:

- LCOS Analysis:
  - Comparative LCOS analysis for various energy storage systems on a $/MWh basis
  - Comparative LCOS analysis for various energy storage systems on a $/kW-year basis
- Storage Value Snapshot Case Studies:
  - Overview of potential revenue applications for various energy storage systems
  - Overview of the Storage Value Snapshot Case Studies analysis and identification of selected geographies for each use case analyzed
  - Results from the Storage Value Snapshot Case Studies analysis
- Appendix Materials, including:
  - An overview of the use cases and operational parameters of selected energy storage systems for each use case analyzed
  - An overview of the methodology utilized to prepare Lazard's LCOS analysis
  - A summary of the assumptions utilized in Lazard's LCOS analysis
  - Deconstruction of the LCOS for various generation technologies by capital cost, fixed operations and maintenance ("O&M") expense and charging cost

Other factors would also have a potentially significant effect on the results contained herein but have not been examined in the scope of this current analysis. These additional factors, among others, may include: recent tariff-related cost impacts; implementation and interpretation of the full scope of the IRA; economic policy, transmission queue reform, network upgrades and other transmission matters; congestion, curtailment or other integration-related costs; permitting or other development costs, unless otherwise noted; and costs of complying with various regulations (e.g., federal import tariffs or labor requirements). This analysis also does not address potential social and environmental externalities as well as the long-term residual and societal consequences of various energy storage system technologies that are difficult to measure (e.g., resource extraction, end-of-life disposal, lithium-ion-related safety hazards, etc.). This analysis is intended to represent a snapshot in time and utilizes a wide, but not exhaustive, sample set of Industry data. As such, we recognize and acknowledge the likelihood of results outside of our ranges. Therefore, this analysis is not a forecasting tool and should not be used as such given the complexities of our evolving Industry, grid and resource needs.

Levelized Cost of Storage Comparison—Version 10.0 ($/MWh)

Lazard's LCOS analysis evaluates standalone energy storage systems on a levelized basis to derive cost metrics across energy storage use cases and configurations[1]



Source: Lazard estimates and publicly available information.

Note: Here and throughout this section, unless otherwise indicated, the analysis assumes 20% debt at an 8% interest rate and 80% equity at a 12% cost, which is a different capital structure than Lazard's LCOE analysis. Capital costs include the storage module, balance of system and power conversion equipment, collectively referred to as the energy storage system, equipment (where applicable) and EPC costs. Augmentation costs are not included in capital costs in this analysis and vary across use cases due to usage profiles and lifespans. Charging costs are assessed at the weighted average hourly pricing (wholesale energy prices) across an optimized annual charging profile of the asset. See Appendix B for charging cost assumptions and additional details. The projects are assumed to use a 5-year MACRS depreciation schedule.

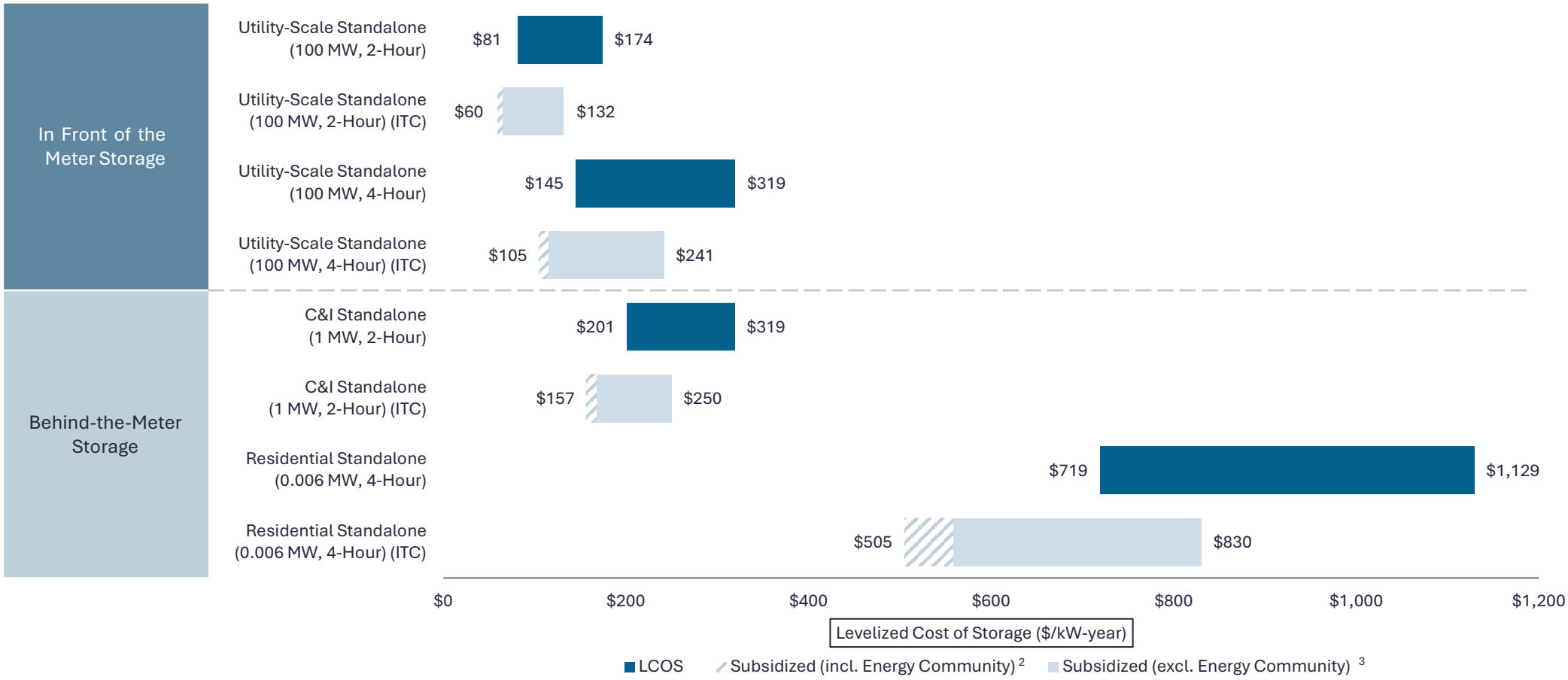
1 See Appendix B for a detailed overview of the use cases and operational parameters analyzed in the LCOS.

2 This sensitivity analysis assumes that projects qualify for the full ITC and have a capital structure that includes sponsor equity, debt and tax equity and also includes a 10% Energy Community adder.

3 This sensitivity analysis assumes that projects qualify for the full ITC and have a capital structure that includes sponsor equity, debt and tax equity.

Levelized Cost of Storage Comparison—Version 10.0 ($/kW-year)

Lazard's LCOS analysis evaluates standalone energy storage systems on a levelized basis to derive cost metrics across energy storage use cases and configurations[1]

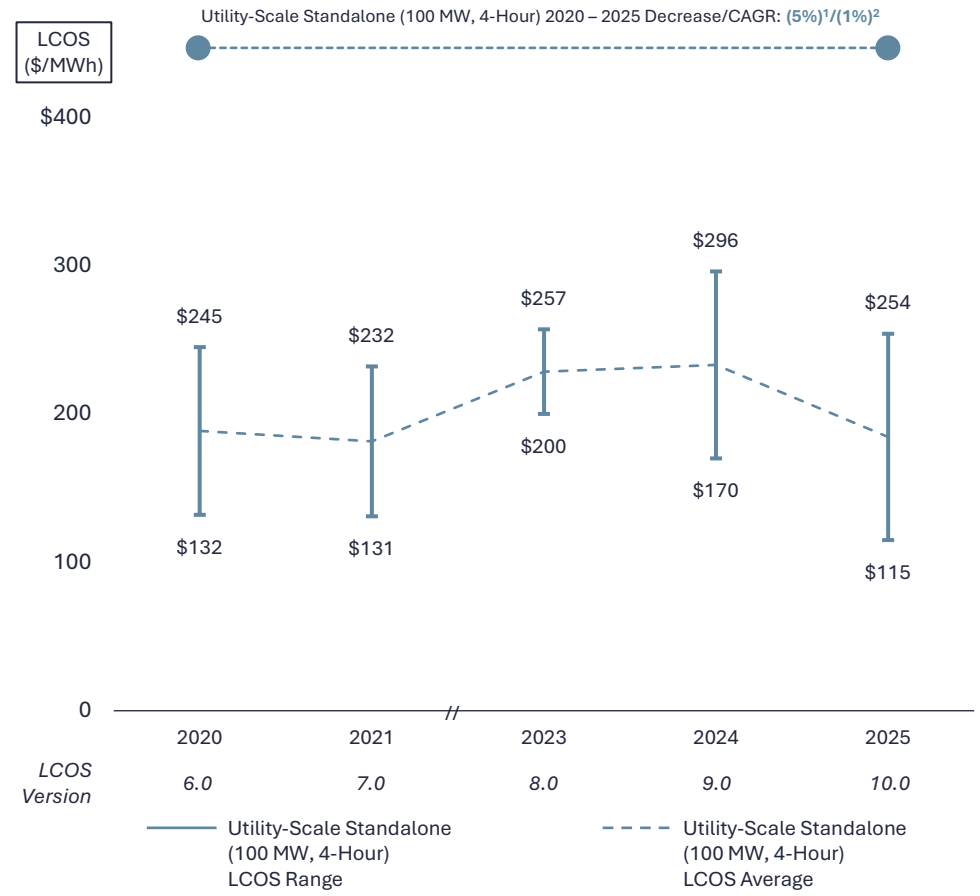


Source: Lazard estimates and publicly available information.
1 See Appendix B for a detailed overview of the use cases and operation parameters analyzed in the LCOS.
2 This sensitivity analysis assumes that projects qualify for the full ITC and have a capital structure that includes sponsor equity, debt and tax equity and also includes a 10% Energy Community adder.
3 This sensitivity analysis assumes that projects qualify for the full ITC and have a capital structure that includes sponsor equity, debt and tax equity.

Levelized Cost of Storage Comparison—Historical LCOS Comparison

This year's analysis shows notable declines in the LCOS of utility scale and C&I battery energy storage systems. Key drivers include both market dynamics—slower-than-expected EV demand and the resulting oversupply of cells—and technological advancements, including increased cell capacity and energy density

Utility-Scale Standalone (100 MW, 4-Hour)



C&I Standalone (1 MW, 2-Hour)

Source: Lazard estimates and publicly available information.
Note: The methodology for the Levelized Cost of Storage has evolved between v1.0 and v10.0 given technological advances and data availability. Page presents the most comparable Utility-Scale and C&I Standalone storage technologies included in the Levelized Cost of Storage report for that year.
1 Reflects the average percentage increase/(decrease) of the high end and low end of the LCOS range.
2 Reflects the average compounded annual growth rate of the high end and low end of the LCOS range.

Storage Value Snapshot Case Studies—Revenue Potential for Selected Use Cases

The numerous potential sources of revenue available to energy storage systems reflect the benefits provided to customers and the grid

- The scope of revenue sources is limited to those captured by existing or soon-to-be commissioned projects—revenue sources that are not clearly identifiable or without publicly available data have not been analyzed

			Use Cases[1]				
		Description	Utility-Scale Standalone	Utility-Scale PV + Storage	Utility-Scale Wind + Storage	Commercial & Industrial Standalone	Commercial & Industrial PV + Storage
Wholesale	Demand Response—Wholesale	• Manages high wholesale price or emergency conditions on the grid by calling on users to reduce or shift electricity demand				✓	✓
Wholesale	Energy Arbitrage	• Storage of inexpensive electricity to sell later at higher prices (only evaluated in the context of a wholesale market)	✓	✓	✓		
Wholesale	Frequency Regulation	• Provides immediate (4-second) power to maintain generation-load balance and prevent frequency fluctuations	✓	✓	✓		
Wholesale	Resource Adequacy	• Provides capacity to meet generation requirements at peak load	✓	✓	✓		
Wholesale	Spinning/Non-Spinning Reserves	• Maintains electricity output during unexpected contingency events (e.g., outages) immediately (spinning reserve) or within a short period of time (non-spinning reserve)	✓	✓	✓		
Utility	Demand Response—Utility	• Manages high wholesale price or emergency conditions on the grid by calling on users to reduce or shift electricity demand				✓	✓
Customer	Bill Management	• Allows reduction of demand charge using battery discharge and the daily storage of electricity for use when time of use rates are highest				✓	✓
Customer	Incentives	• Payments provided to residential and commercial customers to encourage the acquisition and installation of energy storage systems				✓	✓

Source: Lazard estimates and publicly available information.
1 Represents the universe of potential revenue streams available to the various use cases. Does not represent the use cases analyzed in the Storage Value Snapshot Case Studies.

Storage Value Snapshot Case Studies—Overview

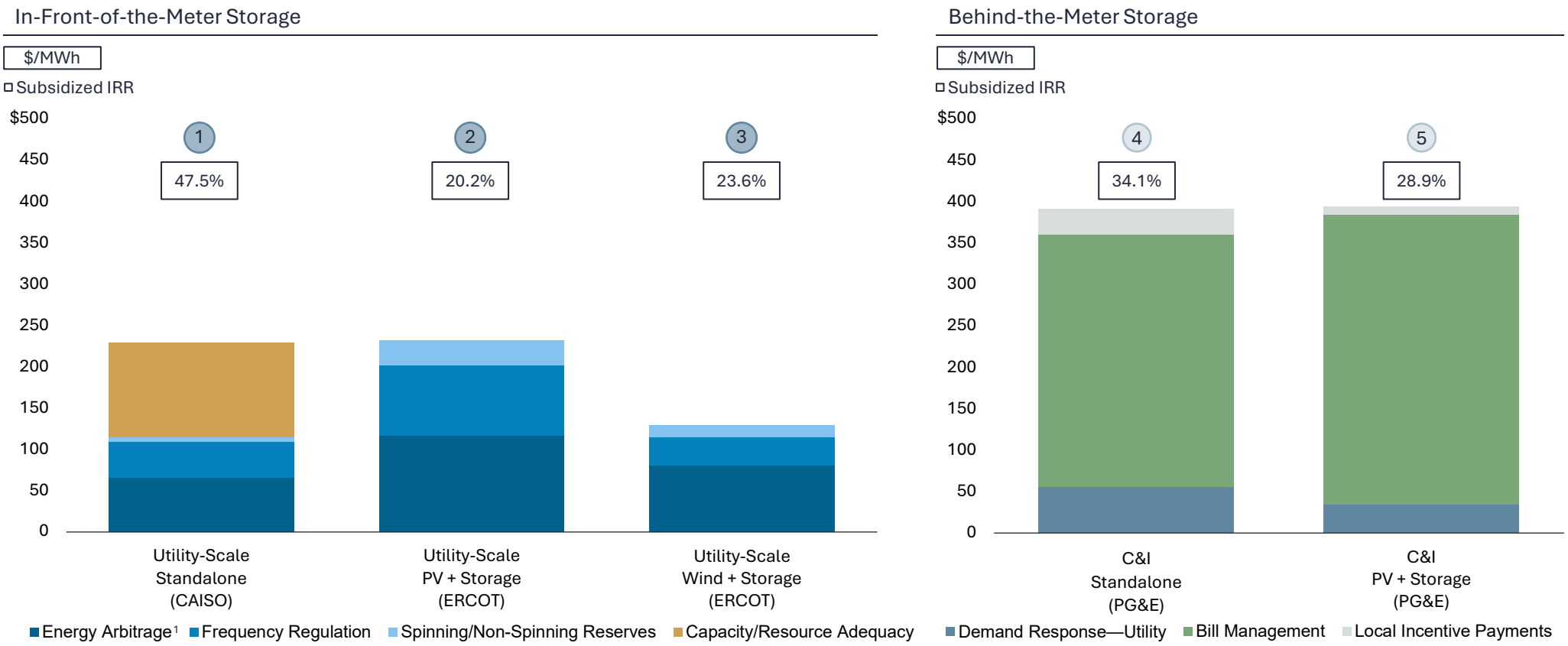
Lazard's Storage Value Snapshots analyze the financial viability of illustrative energy storage systems designed for selected use cases and geographies

		Location	Description	Storage (MW)	Generation (MW)	Storage Duration (hours)	Revenue Streams
In Front of the Meter Storage	Utility-Scale Standalone	CAISO[1] (SP-15)	Large-scale energy storage system	100	–	4	• Energy Arbitrage • Frequency Regulation • Resource Adequacy • Spinning/Non-Spinning Reserves
	2 Utility-Scale PV + Storage	ERCOT[2] (South Texas)	Energy storage system designed to be paired with large solar PV facilities	50	100	4	
	3 Utility-Scale Wind + Storage	ERCOT[2] (South Texas)	Energy storage system designed to be paired with large wind generation facilities	50	100	4	
Behind-the-Meter Storage	4 Commercial & Industrial Standalone	PG&E[3] (California)	Energy storage system designed for behind-the-meter peak shaving and demand charge reduction for C&I energy users	1	–	2	• Demand Response—Utility • Bill Management • Incentives • Tariff Settlement, Demand Response Participation, Avoided Costs to Commercial Customer and Local Capacity Resource Programs
	5 Commercial & Industrial PV + Storage	PG&E[3] (California)	Energy storage system designed for behind-the-meter peak shaving and demand charge reduction services for C&I energy users	0.5	1	4	

Source: Lazard estimates and publicly available information.
Note: Actual project returns may vary due to differences in location-specific costs, revenue streams and owner/developer risk preferences.
1 Refers to the California Independent System Operator.
2 Refers to the Electricity Reliability Council of Texas.
3 Refers to the Pacific Gas & Electric Company.

Storage Value Snapshot Case Studies—Results

Project economics evaluated in the Storage Value Snapshot Case Studies continue to evolve year-over-year as costs change and the value of revenue streams adjust to reflect underlying market conditions, utility rate structures and policy developments. Notably, this year capacity/resource adequacy payments nearly doubled which, combined with LCOS declines, significantly increased project returns



Source: Lazard estimates and publicly available information.

Note: Levelized costs presented for each Value Snapshot reflect local market and operating conditions (including installed costs, market prices, charging costs and incentives) and are different in certain cases from the LCOS results for the equivalent use case on the page titled "Levelized Cost of Storage Comparison—Version 10.0 ($/MWh)", which are more broadly representative of U.S. storage market conditions as opposed to location-specific conditions. Levelized revenues in all cases are gross revenues (not including charging costs). Subsidized levelized cost for each Value Snapshot reflects: (1) average cost structure for storage, solar and wind capital costs, (2) charging costs based on local wholesale prices or utility tariff rates and (3) all applicable state and federal tax incentives, including 30% federal ITC for solar and/or storage and $27.50/MWh federal PTC for wind. Value Snapshots do not include cash payments from state or utility incentive programs. Revenues for Value Snapshots (1) – (3) are based on hourly wholesale prices from the 365 days prior to December 31, 2024. Revenues for Value Snapshots (4) – (5) are based on the most recent tariffs, programs and incentives available as of February 1, 2025.

1 In previous versions of this analysis, Energy Arbitrage was referred to as Wholesale Energy Sales.

LCOE

IV

Energy System

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A Cost of Firming Intermittency

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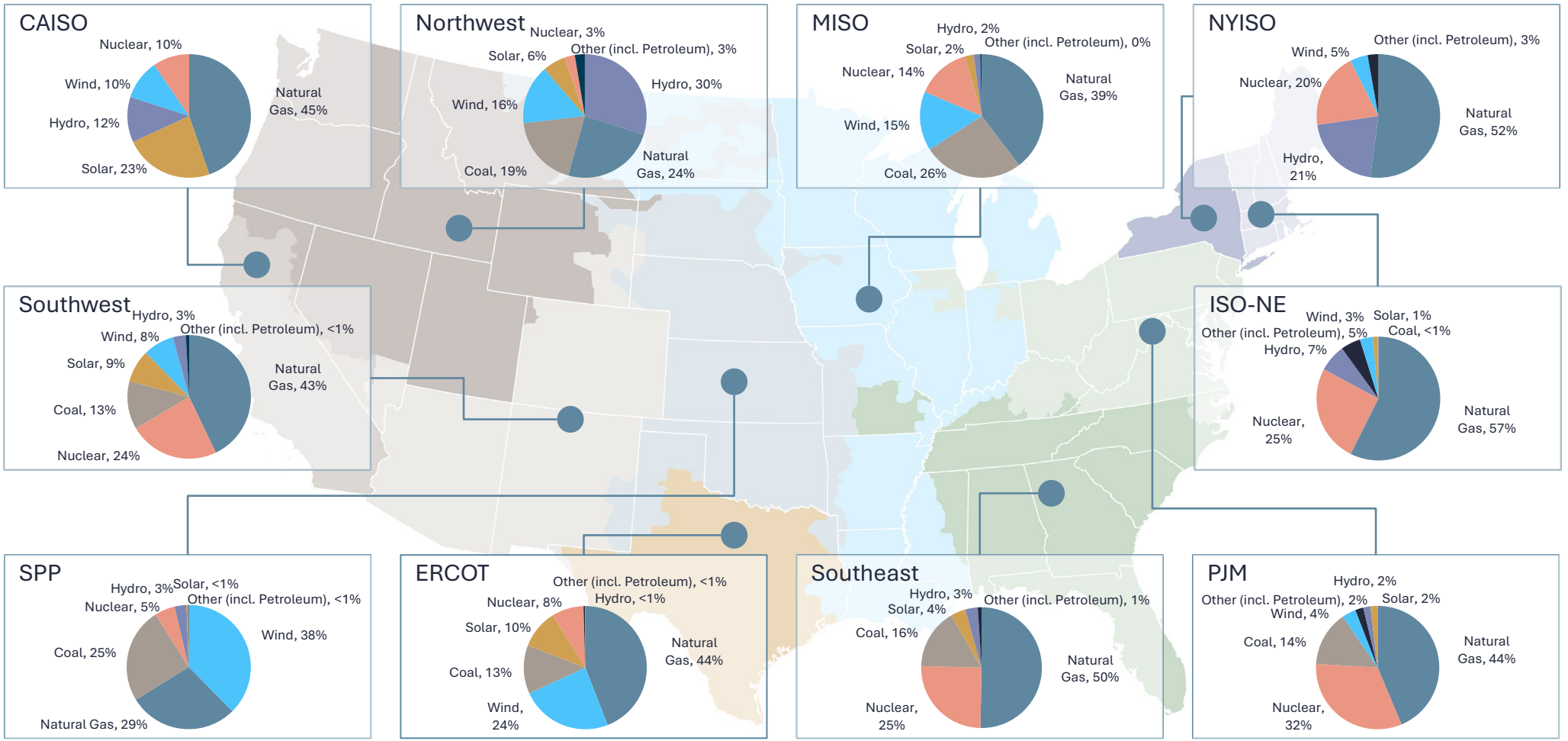
Market Overview—Current Generation Mix

The current generation mix across the U.S. varies significantly by market—resource availability, operational constraints, load profiles, transmission infrastructure, seasonal weather patterns and regulatory constructs, among other factors, are key drivers of such variation

2024 Generation Mix by Region



Source: Publicly available information.
Note: Numbers may not sum due to rounding.

Market Overview—Current Firming Cost Frameworks

Many grid operators and utilities use effective load-carrying capability ("ELCC") to measure the reliability of new power generation resources to contribute to the electricity grid at key periods of demand, particularly intermittent ones like wind and solar. Combined with the net cost of new entry ("Net CONE")[1], as determined by the grid operator, ELCC helps to guide decisions on resource planning, capacity adequacy and system reliability. Balancing authorities ("BA"s) such as MISO, CAISO, SPP, PJM and ERCOT have adopted ELCC accreditation frameworks to ensure a reliable and efficient grid

- ELCC measures the performance of a resource at times of greatest "capacity need" for the system, where capacity need is a function of electricity demand patterns and the generation mix in each region—in general, the higher the renewable resource penetration, the lower the ELCC accreditation for each additional renewable resource

	BA-Specified "Firming" Source	ELCC Values[2]	Net CONE[1] ($/kW-month)	Selected Market Commentary
MISO	Natural Gas Peaker	Solar: 39% Wind: 26%	$10.03	• In March 2024, MISO adopted the FERC Reliability Availability and Need ("RAN") seasonal capacity construct for wind and solar resources • Seasonal wind accredited capacity values are 18.1% for summer, 18.6% for fall, 53.1% for winter and 18.0% for spring • Solar capacity values are 50% for all seasons except winter, which is 5%
CAISO	4-Hour Lithium-Ion Battery	Solar: 7% PV + Storage[3]: 41% Wind: 12%	$18.92	• Increasing levels of solar penetration in CAISO have shifted peak demand later in the day, reducing the ELCC value for solar • CAISO significantly reduced ELCC values for 4-hour battery storage systems, driven by significant growth in 4-hour storage capacity
SPP	Natural Gas Peaker	Solar: 51% Wind: 20%	$8.38	• SPP published seasonal accreditation values based on 2024, assigning separate values to resources for summer and winter seasons • Summer wind and solar contributions are 15.2% and 25.5%, respectively, whereas winter values shift to 39.1% for wind and 62.2% for solar
PJM	Natural Gas Peaker	Solar: 12% PV + Storage[3]: 33% Wind: 38%	$10.29	• PJM adopted a new, marginal ELCC methodology to begin in the 2025/2026 delivery year that reduces the reliability value of highly correlated resources, such as solar and short-duration storage[4] • The update is expected to better capture expected resource performance during system peak
ERCOT	Natural Gas Peaker	Solar: 38% Wind: 25%	$9.92	• ERCOT maintains notably high ELCC values despite having the highest renewable penetration by capacity of the U.S. regulatory markets • ERCOT updates its capacity scheme every three years; the most recent publication was December 2022

Source: Publicly available information.
1 Net "CONE" is defined as capital and operating costs less expected market revenues for a new, firm resource (e.g., gas peaker or battery storage). Net CONE is established by the respective balancing authority.
2 ELCC values are calculated by the respective balancing authority. ELCC is an indicator of the incremental reliability contribution of a given resource to the electricity grid based on its contribution to meeting peak electricity demand. For example, a 1 MW wind resource with a 15% ELCC provides 0.15 MW of capacity contribution and would need to be supplemented by 0.85 MW of additional firm capacity to represent the addition of 1 MW of firm system capacity. Where seasonal accreditation values exist, values have been annualized.
3 For PV + Storage cases, the effective ELCC value is represented. CAISO and PJM assess ELCC values separately for the PV and storage components of a system. Storage ELCC value is provided only for the capacity that can be charged directly by the accompanying resource up to the energy required for a 4-hour discharge during peak load. Any capacity available in excess of the 4-hour maximum discharge is attributed to the system at the solar ELCC. ELCC values for storage range from 55% to 75% for PJM and CAISO, respectively.
4 This year's analysis does not reflect this future methodology.

Cost of Firming Intermittency—Methodology

Lazard's Cost of Firming Intermittency analysis builds on the LCOE results by evaluating system-level costs associated with supplementing intermittent renewable energy on the grid with firm capacity to ensure reliable electricity delivery during peak demand periods. The analysis utilizes ELCC and Net CONE values assessed and published by grid operators for each regional market to determine these costs

- The firm capacity value of a new resource is calculated as Nameplate Capacity × ELCC %, where:
  - Nameplate Capacity of a resource refers to its maximum potential energy output, and
  - ELCC measures the performance of a resource at times of greatest "capacity need" for the system, where capacity need is a function of electricity demand patterns and the generation mix in each region
- Over time, increased renewable penetration or changes in demand patterns can shift the timing of the capacity need, impacting ELCC
- The remaining non-firm capacity (Nameplate Capacity × (1 – (ELCC %))) is "firmed" at the Net CONE, a $/kW-month figure which is intended to reflect capital and operating costs less expected market revenues for a new, firm resource (e.g., gas peaker or battery storage)
  - Net CONE is assessed and published by grid operators for each regional market

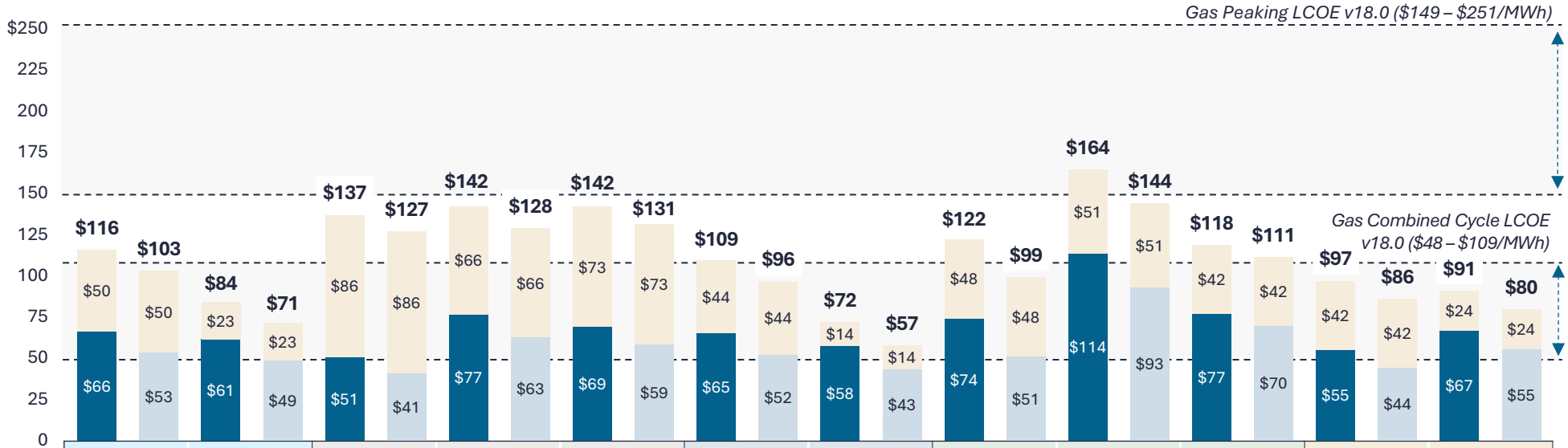
In the following analysis, the Levelized Firming Cost is defined as the additional capacity payment, priced at Net CONE, required to bring the ELCC of the combined system (intermittent and firming resource) to 100%. The LCOE plus Levelized Firming Cost varies between ISOs, due to (1) the standalone LCOE in the region based on regional capacity factor for wind or solar, (2) the ELCC value of the standalone renewable resource and (3) the region's Net CONE

$$\frac{\text{Nameplate Capacity (kW)} \times (1 - \text{ELCC (\%)}) \times \text{Net CONE (\$/kW-month)} \times 12 \text{ Months}}{\text{Nameplate Capacity (MW)} \times \text{Regional Capacity Factor (\%)} \times 8{,}760 \text{ Hours}} = \text{Levelized Firming Cost (\$/MWh)}$$

Cost of Firming Intermittency—Results

The Cost of Firming Intermittency or "firming cost" is the incremental cost to firm[1] solar, solar + storage or wind resources through additional monthly capacity payments to a firming resource under current regional system planning constructs

LCOE plus Levelized Firming Cost ($/MWh)[2]



	Solar	Wind	Solar	PV + Storage	Wind	Solar	Wind	Solar	PV + Storage	Wind	Solar	Wind
ELCC[3]	39%	26%	7%	41%[4]	12%	51%	20%	38%	33%[4]	38%	38%	25%
Capacity Factor	20%	37%	27%	27%	33%	21%	40%	18%	18%	30%	24%	34%
Resource Penetration	13%	26%	43%	43%	17%	2%	61%	2%	2%	5%	34%	46%
	MISO		CAISO			SPP		PJM			ERCOT	

■ Unsubsidized Regional LCOE[2] ■ Subsidized Regional LCOE (excl. Energy Community)[4,5] ■ Levelized Firming Cost [1]

Source: Lazard estimates and publicly available information.

Note: Total, including firming cost, does not represent the cost of building a 24/7 firm resource on a single project site but, instead, the LCOE of a renewable resource and the additional capacity costs required to achieve the resource adequacy requirement in the relevant reliability region based on the net cost of new entry ("Net CONE"). ISO ELCC data as of April 2025 and representative of annualized ELCC values.

1 Firming costs reflect the cost of additional capacity required to supplement the net capacity of the renewable resource (nameplate capacity * (1 – ELCC)) and the Net CONE of a new firm resource (capital and operating costs, less expected market revenues). Net CONE is assessed and published by grid operators for each regional market. Grid operators use a natural gas peaker as the assumed new resource in MISO ($10.03/kW-mo), SPP ($8.38/kW-mo), PJM ($10.29/kW-mo) and ERCOT ($9.92/kW-mo). In CAISO, the assumed new resource is a 4-hour lithium-ion battery storage system ($18.92/kW-mo). For the PV + Storage cases in CAISO and PJM, assumed storage configuration is 50% of PV capacity and 4-hour duration.

2 Reflects the average of the high and low of Lazard's LCOE v18.0 for each technology using the regional capacity factor, as indicated, to demonstrate the regional differences in project costs.

3 ELCC is an indicator of the incremental reliability contribution of a given resource to the electricity grid based on its contribution to meeting peak electricity demand. For example, a 1 MW wind resource with a 15% ELCC provides 0.15 MW of capacity contribution and would need to be supplemented by 0.85 MW of additional firm capacity in order to represent the addition of 1 MW of firm system capacity.

4 For PV + Storage cases, the effective ELCC value is represented. CAISO and PJM assess ELCC values separately for the PV and storage components of a system. Storage ELCC value is provided only for the capacity that can be charged directly by the accompanying resource up to the energy required for a 4-hour discharge during peak load. Any capacity available in excess of the 4-hour maximum discharge is attributed to the system at the solar ELCC. ELCC values for storage range from 55% to 75% for PJM and CAISO, respectively.

5 This sensitivity analysis assumes that projects qualify for the full ITC, have a capital structure that includes sponsor equity, debt and tax equity and assumes the equity owner has taxable income to monetize the tax credits.

V Appendix

CONFIDENTIAL

LCOE

LCOE v18.0

LAZARD

Levelized Cost of Energy Comparison—Methodology

($ in millions, unless otherwise noted)

Lazard's LCOE analysis consists of creating a power plant model representing an illustrative project for each relevant technology and solving for the $/MWh value that results in a levered IRR equal to the assumed cost of equity (see subsequent "Key Assumptions" pages for detailed assumptions by technology)

Unsubsidized Onshore Wind — Low Case Sample Illustrative Calculations

Year[1]		*0*	*1*	*2*	*3*	*4*	*5*	*30*
Capacity (MW)	(A)		300	300	300	300	300	300
Capacity Factor	(B)		55%	55%	55%	55%	55%	55%
Total Generation ('000 MWh)	(C)* = (A) x (B)		1,445	1,445	1,445	1,445	1,445	1,445
Levelized Energy Cost ($/MWh)	***(D)***		***$36.7***	***$36.7***	***$36.7***	***$36.7***	***$36.7***	***$36.7***
Total Revenues	**(E)* = (C) x (D)**		**$53.0**	**$53.0**	**$53.0**	**$53.0**	**$53.0**	**$53.0**
Total Fuel Cost	(F)		--	--	--	--	--	--
Total O&M	(G)*		7.4	7.5	7.7	7.9	8.0	14.0
Total Operating Costs	**(H) = (F) + (G)**		**$7.4**	**$7.5**	**$7.7**	**$7.9**	**$8.0**	**$14.0**
EBITDA	**(I) = (E) - (H)**		**$45.7**	**$45.5**	**$45.3**	**$45.1**	**$45.0**	**$39.0**
Debt Outstanding - Beginning of Period	(J)		$342.0[2]	$339.0	$335.7	$332.2	$328.4	$28.1
Debt - Interest Expense	(K)		(27.4)	(27.1)	(26.9)	(26.6)	(26.3)	(2.3)
Debt - Principal Payment	(L)		(3.0)	(3.3)	(3.5)	(3.8)	(4.1)	(28.1)
Levelized Debt Service	**(M) = (K) + (L)**		**($30.4)**	**($30.4)**	**($30.4)**	**($30.4)**	**($30.4)**	**($30.4)**
EBITDA	(I)		$45.7	$45.5	$45.3	$45.1	$45.0	$39.0
Depreciation (MACRS)	(N)		(114.0)	(182.4)	(109.4)	(65.7)	(65.7)	0.0
Interest Expense	(K)		(27.4)	(27.1)	(26.9)	(26.6)	(26.3)	39.0
Taxable Income	**(O) = (I) + (N) + (K)**		**($95.7)**	**($164.0)**	**($91.0)**	**($47.1)**	**($47.0)**	**($2.3)**
Tax Benefit (Liability)[3]	**(P) = (O) x (tax rate)**		**$38.5**	**$65.9**	**$36.6**	**$18.9**	**$18.9**	**($14.8)**
After-Tax Net Equity Cash Flow	**(Q) = (I) + (M) + (P)**	**($228.0)**[4]	**$53.7**	**$81.0**	**$51.5**	**$33.7**	**$33.5**	**($6.2)**
IRR For Equity Investors		**12%**						

Key Assumptions[5]	
Capacity (MW)	300
Capacity Factor	55%
Fuel Cost ($/MMBtu)	$0.00
Heat Rate (Btu/kWh)	0
Fixed O&M ($/kW-year)	$24.5
Variable O&M ($/MWh)	$0.0
O&M Escalation Rate	2.25%
Capital Structure	
Debt	60.0%
Cost of Debt	8.0%
Equity	40.0%
Cost of Equity	12.0%
Taxes and Tax Incentives:	
Combined Tax Rate	40%
Economic Life (years)[6]	30
MACRS Depreciation (Year Schedule)	5
Capex	
EPC Costs ($/kW)	$1,900
Additional Owner's Costs ($/kW)	$0
Transmission Costs ($/kW)	$0
Total Capital Costs ($/kW)	$1,900
Total Capex ($m)	$570

Source: Lazard estimates and publicly available information.
Note: Numbers presented for illustrative purposes only.
* Denotes unit conversion.
1 Assumes half-year convention for discounting purposes.
2 Reflects initial debt financing to fund capex.
3 Assumes full monetization of tax benefits or losses immediately.
4 Reflects initial cash outflow from equity investors to fund capex.
5 Reflects a "key" subset of all assumptions for methodology illustration purposes only. Does not reflect all assumptions.
6 Economic life sets debt amortization schedule.

Technology-Dependent

Consistent Across Versions/Technologies

Levelized Cost of Energy—Key Assumptions

		Renewable Energy: Solar PV					
	Units	Community and C&I			Utility		
		Low		High	Low		High
Net Facility Output	MW	2.0			150		
Total Capital Cost	$/kW	$1,600	–	$3,300	$1,150	–	$1,600
Fixed O&M	$/kW-yr	$13.00	–	$20.00	$11.00	–	$14.00
Variable O&M	$/MWh	—			—		
Heat Rate	Btu/kWh	—			—		
Capacity Factor	%	20%	–	15%	30%	–	20%
Fuel Price	$/MMBTU	—			—		
Construction Time	Months	6			15		
Facility Life	Years	30			35		
Levelized Cost of Energy	$/MWh	$81	–	$217	$38	–	$78

Source: Lazard estimates and publicly available information.

Levelized Cost of Energy—Key Assumptions (cont'd)

		Renewable Energy					
	Units	Geothermal		Wind—Onshore		Wind—Offshore	
		Low	High	Low	High	Low	High
Net Facility Output	MW	250		300		900	
Total Capital Cost	$/kW	$5,000 –	$6,460	$1,900 –	$2,300	$3,450 –	$6,550
Fixed O&M	$/kW-yr	$14.50 –	$15.75	$24.50 –	$40.00	$60.00 –	$91.50
Variable O&M	$/MWh	$9.05 –	$24.80	—		—	
Heat Rate	Btu/kWh	—		—		—	
Capacity Factor	%	90% –	80%	55% –	30%	55% –	45%
Fuel Price	$/MMBTU	—		—		—	
Construction Time	Months	36		18		24	
Facility Life	Years	25		30		30	
Levelized Cost of Energy	$/MWh	$66 –	$109	$37 –	$86	$70 –	$157

Source: Lazard estimates and publicly available information.

Levelized Cost of Energy—Key Assumptions (cont'd)

		Renewable Energy: Hybrid Generation + Storage					
	Units	Solar PV + Storage—Utility			Wind + Storage—Onshore		
		Low		High	Low		High
Storage							
Power Rating	MW		50			50	
Duration	Hours		4			4	
Usable Energy	MWh		200			200	
90% Depth of Discharge Cycles/Year	%		350			350	
Roundtrip Efficiency	%		92%			92%	
Inverter Cost	$/kW	$19	–	$50	$19	–	$50
Total Capital Cost (excl. Inverter)	$/kWh	$122	–	$313	$122	–	$313
Storage O&M	$/kWh	$3.00	–	$8.02	$3.00	–	$8.02
Generation							
Capacity	MW		100			100	
Capacity Factor	%	30.0%	–	20.0%	55.0%	–	30.0%
Project Life	Years		35			30	
Total Capital Cost	$/kW	$1,150	–	$1,600	$1,900	–	$2,300
Fixed O&M	$/kW	$11.00	–	$14.00	$24.50	–	$40.00
Extended Warranty Start	Year		3			3	
Warranty Expense % of Capital Costs	%	0.7%	–	1.9%	0.7%	–	1.9%
Charging Cost	$/MWh		$0.00			$0.00	
Unsubsidized LCOE	$/MWh	$50	–	$131	$44	–	$123

Source: Lazard estimates and publicly available information.
Note: Hybrid scenarios assume 10% cost synergies for storage capital costs and 25% synergies for inverter costs due to colocation of the storage and generation asset.

Levelized Cost of Energy—Key Assumptions (cont'd)

		Conventional Energy							
	Units	Gas Peaking (New Build)		U.S. Nuclear (New Build)		Coal (New Build)		Gas Combined Cycle (New Build)	
		Low	High	Low	High	Low	High	Low	High
Net Facility Output	MW	550 – 175		2,200		600		1,225 – 750	
Total Capital Cost	$/kW	$1,150 – $1,450		$9,020 – $14,820		$3,405 – $7,210		$1,200 – $1,600	
Fixed O&M	$/kW-yr	$10.00 – $17.00		$136.00 – $158.00		$40.85 – $94.35		$10.00 – $25.50	
Variable O&M	$/MWh	$3.50 – $5.00		$4.40 – $5.15		$3.10 – $5.70		$2.75 – $5.00	
Heat Rate	Btu/kWh	10,275 – 11,175		10,450		8,750 – 12,000		6,475 – 6,550	
Capacity Factor	%	15% – 10%		92% – 89%		85% – 65%		90% – 30%	
Fuel Price	$/MMBTU	$3.45		$0.85		$1.47		$3.45	
Construction Time	Months	24		84		60 – 66		24	
Facility Life	Years	30		70		40		30	
Levelized Cost of Energy	$/MWh	$149 – $251		$141 – $220		$71 – $173		$48 – $109	

Source: Lazard estimates and publicly available information.

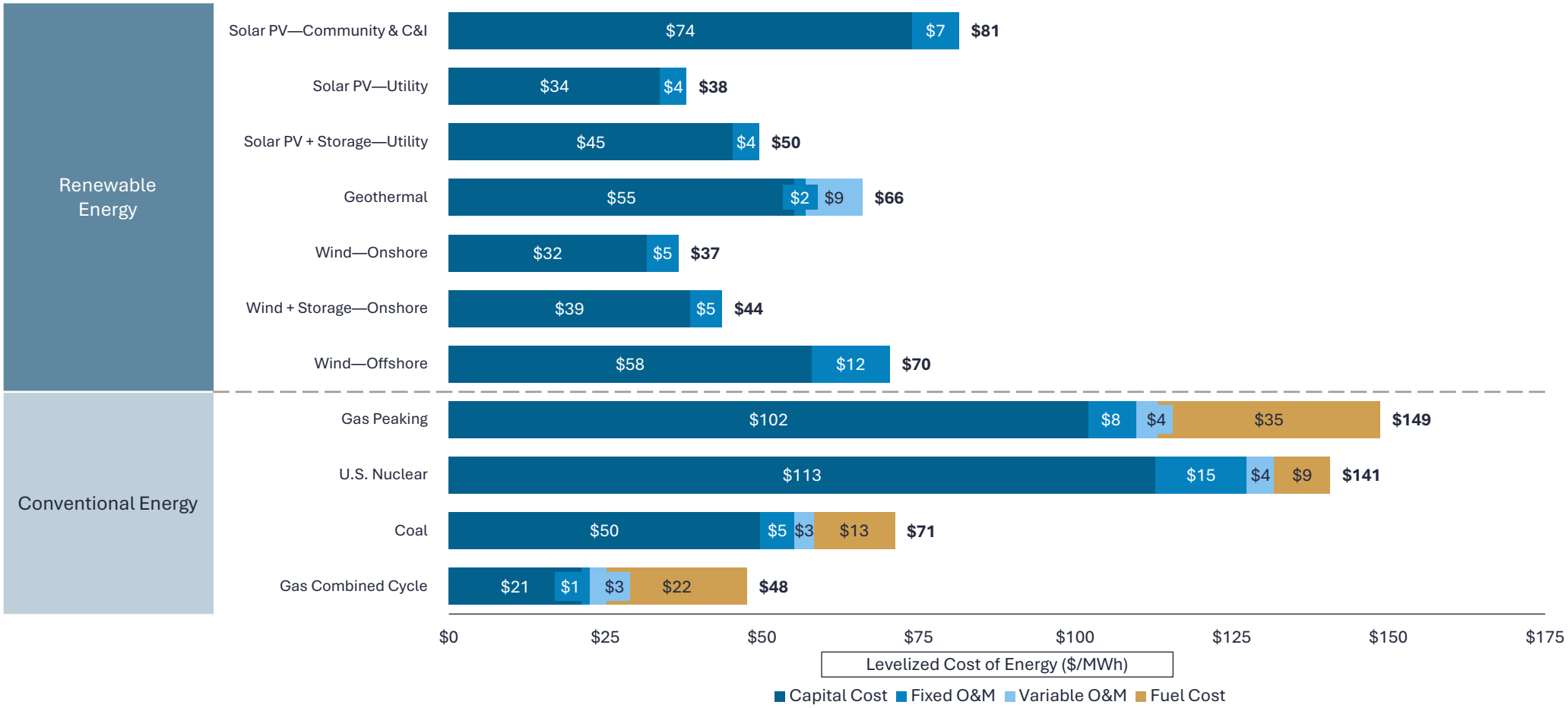
Levelized Cost of Energy—Key Assumptions (cont'd)

		Marginal Cost of Selected Existing Conventional Generation							
	Units	Gas Peaking (Operating)		U.S. Nuclear (Operating)		Coal (Operating)		Gas Combined Cycle (Operating)	
		Low	High	Low	High	Low	High	Low	High
Net Facility Output	MW	240 – 50		2,200		600		550	
Total Capital Cost	$/kW	$0		$0		$0		$0	
Fixed O&M	$/kW-yr	$4.00	$6.10	$89.00	$121.60	$21.70	$33.80	$8.90	$13.60
Variable O&M	$/MWh	$2.70	$9.30	$2.70	$3.90	$3.20	$7.20	$0.80	$1.80
Heat Rate	Btu/kWh	10,900	12,550	10,400	10,400	10,250	11,800	6,950	7,475
Capacity Factor	%	5%	1%	91%	87%	49%	7%	62%	17%
Fuel Price	$/MMBtu	$2.50	$2.90	$0.80	$0.80	$1.70	$2.40	$2.50	$2.90
Construction Time	Months	24		84		60		24	
Facility Life	Years	30		70		40		30	
Levelized Cost of Energy	$/MWh	$47	$170	$30	$38	$31	$114	$24	$39

Source: Lazard estimates and publicly available information.

Levelized Cost of Energy Components—Low End ($/MWh)

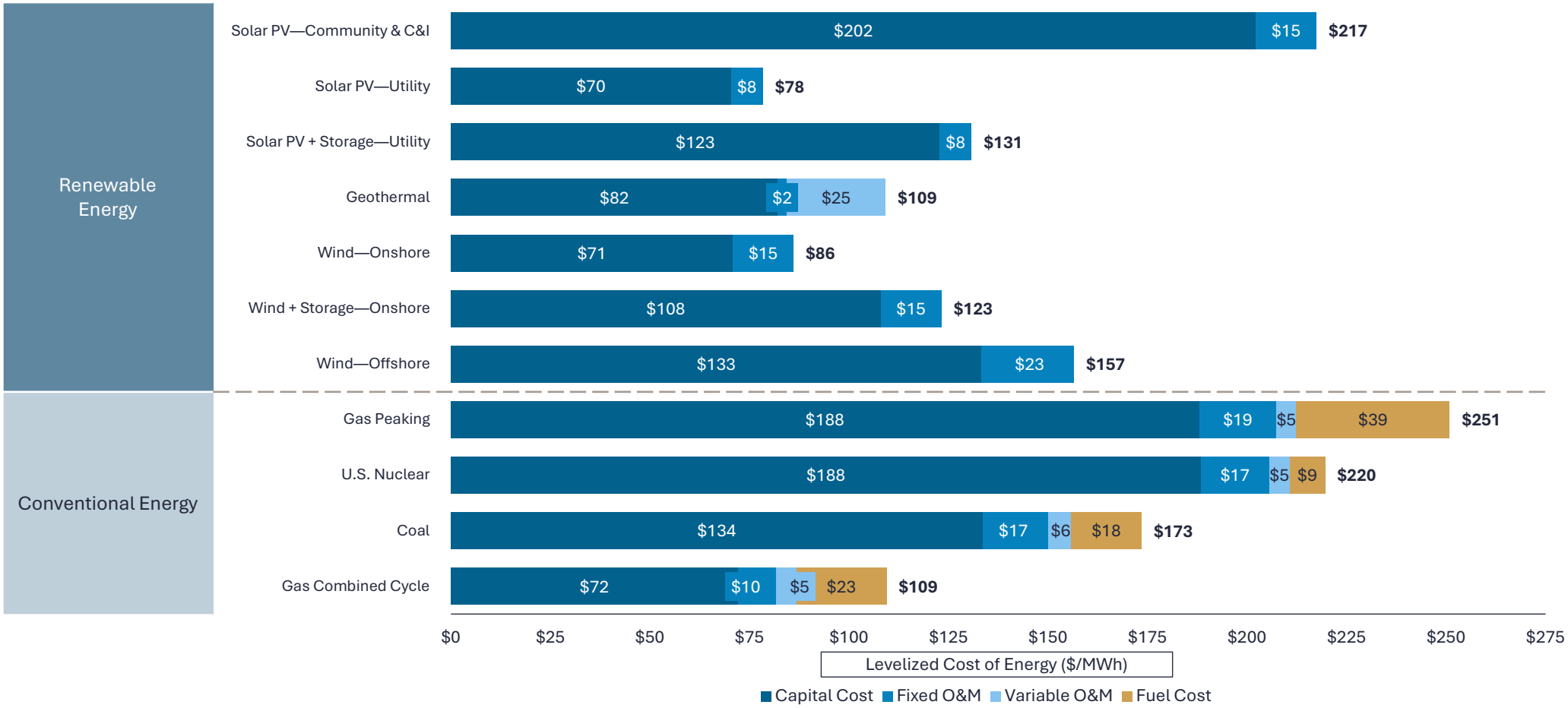
Certain renewable energy generation technologies are already cost-competitive with conventional generation technologies; key factors regarding the continued cost decline of renewable energy generation technologies are the ability of technological development and Industry scale to continue lowering operating expenses and capital costs for renewable energy generation technologies



Source: Lazard estimates and publicly available information.
Note: Figures may not sum due to rounding.

Levelized Cost of Energy Components—High End ($/MWh)

Certain renewable energy generation technologies are already cost-competitive with conventional generation technologies; key factors regarding the continued cost decline of renewable energy generation technologies are the ability of technological development and Industry scale to continue lowering operating expenses and capital costs for renewable energy generation technologies



LAZARD

Source: Lazard estimates and publicly available information.
Note: Figures may not sum due to rounding.

CONFIDENTIAL

LCOE+

LCOS v10.0

LAZARD

Levelized Cost of Storage Comparison—Methodology

($ in millions, unless otherwise noted)

Lazard's LCOS analysis consists of creating a power plant model representing an illustrative project for each relevant technology and solving for the $/MWh value that results in a levered IRR equal to the assumed cost of equity (see subsequent "Key Assumptions" page for detailed assumptions by technology)

Subsidized Utility-Scale Standalone (100 MW/200 MWh)—Low Case Sample Calculations

Year[1]		*0*	*1*	*2*	*3*	*4*	*5*	*20*
Capacity (MW)	(A)		100	100	100	100	100	100
Available Capacity (MW)		110	109	107	104	102	110	110
Total Generation ('000 MWh)[2]	(B)*		63	63	63	63	63	63
Levelized Storage Cost ($/MWh)	***(C)***		***$95***	***$95***	***$95***	***$95***	***$95***	***$95***
Total Revenues	**(D)* = (B) x (C)**		**$6.0**	**$6.0**	**$6.0**	**$6.0**	**$6.0**	**$6.0**
Total Charging Cost[3]	(E)		(2.3)	(2.3)	(2.4)	(2.4)	(2.5)	(3.3)
Total O&M, Warranty, & Augmentation[4]	(F)*		(0.6)	(0.6)	(0.8)	(0.8)	(2.6)	(1.1)
Total Operating Costs	**(G) = (E) + (F)**		($2.9)	($2.9)	($3.2)	($3.3)	($5.1)	($4.5)
EBITDA	**(H) = (D) - (G)**		**$3.1**	**$3.0**	**$2.8**	**$2.7**	**$0.9**	**$1.5**
Debt Outstanding - Beginning of Period	(I)		$6.8[5]	$6.6	$6.4	$6.3	$6.1	$0.6
Debt - Interest Expense	(J)		(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.1)
Debt - Principal Payment	(K)		(0.1)	(0.2)	(0.2)	(0.2)	(0.2)	(0.6)
Levelized Debt Service	**(L) = (J) + (K)**		**(0.7)**	**(0.7)**	**(0.7)**	**(0.7)**	**(0.7)**	**(0.7)**
EBITDA	(H)		$3.1	$3.0	$2.8	$2.7	$0.9	$1.5
Depreciation (MACRS)	(M)		(5.4)	(8.6)	(5.2)	(3.1)	(3.1)	0.0
Interest Expense	(J)		(0.5)	1.7	0.0	0.0	0.0	(0.5)
Taxable Income	**(N) = (H) + (M) + (J)**		**($2.9)**	**($3.9)**	**($2.4)**	**($0.4)**	**($2.2)**	**$1.1**
Tax Benefit (Liability)	**(O) = (N) x (Tax Rate)**		**$1.2**	**$1.6**	**$1.0**	**$0.2**	**$0.9**	**($0.4)**
Federal Investment Tax Credit (ITC)	**(P)**		**$13.5**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**
After-Tax Net Equity Cash Flow	**(Q) = (H) + (L) + (O) + (P)**	**($27.0)**[6]	**$17.0**	**$3.9**	**$3.1**	**$2.2**	**$1.1**	**$0.4**
IRR For Equity Investors		**12.0%**						

Key Assumptions[7]	
Power Rating (MW)	100
Duration (Hours)	2
Usable Energy (MWh)	200
90% Depth of Discharge Cycles/Day	1
Operating Days/Year	350
Charging Cost ($/kWh)	$0.033
Fixed O&M Cost ($/kWh)	$3.00
Fixed O&M Escalator (%)	2.5%
Charging Cost Escalator (%)	1.97%
Efficiency (%)	91%
Capital Structure	
Debt	20.0%
Cost of Debt	8.0%
Equity	20.0%
Cost of Equity	12.0%
Taxes	
Combined Tax Rate	40.2%
Economic Life (years)	20
MACRS (Year Schedule)	5 Years
Federal ITC - BESS	40%
Capex	
Total Initial Installed Cost ($/kWh)[8]	$169
Extended Warranty (% of Capital Cost)	0.7%
Extended Warranty Start Year	3
Total Capex ($m)	$34

Technology-Dependent

Consistent Across Versions/Technologies

Source: Lazard estimates and publicly available information.
Note: Numbers presented for illustrative purposes only.
* Denotes unit conversion.
1 Assumes half-year convention for discounting purposes.
2 Total Generation reflects (Cycles) x (Available Capacity) x (Depth of Discharge) x (Duration). Note for the purpose of this analysis, Lazard accounts for degradation in the available capacity calculation.
3 Charging Cost reflects (Total Generation) / [(Efficiency) x (Charging Cost) x (1 + Charging Cost Escalator)].
4 O&M costs include general O&M (BESS plus any relevant Solar PV or Wind O&M, escalating annually at 2.5%), augmentation costs (incurred in years needed to maintain usable energy at original storage module cost) and warranty costs starting in year 3.
5 Reflects initial debt financing to fund capex.
6 Reflects initial cash outflow from equity sponsor.
7 Reflects a "key" subset of all assumptions for methodology and illustration purposes only. Does not reflect all assumptions.
8 Initial Installed Cost includes inverter cost, module cost, balance-of-system cost and EPC cost.

Levelized Cost of Storage—Key Assumptions

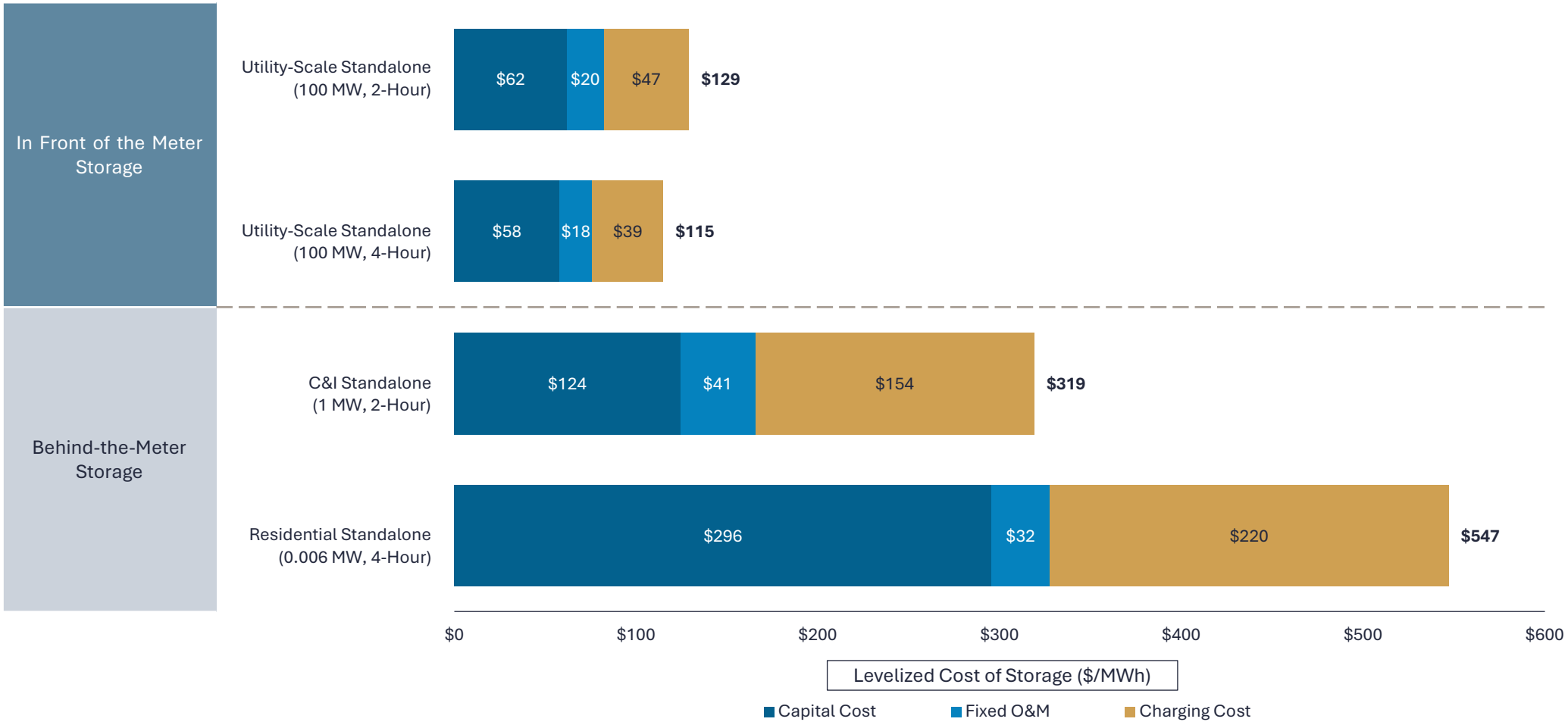
		Utility-Scale Standalone						C&I Standalone			Residential Standalone		
	Units	(100 MW/200 MWh)			(100 MW/400 MWh)			(1 MW/2 MWh)			(0.006 MW/0.025 MWh)		
Power Rating	MW	100			100			1			0.006		
Duration	Hours	2.0			4.0			2.0			4.2		
Usable Energy	MWh	200			400			2			0.025		
90% Depth of Discharge Cycles/Day	#	1			1			1			1		
Operating Days/Year	#	350			350			350			350		
Solar/Wind Capacity	MW	0.00			0.00			0.00			0.000		
Annual Solar/Wind Generation	MWh	0			0			0			0		
Project Life	Years	20			20			20			20		
Annual Storage Output	MWh	63,000			126,000			630			8		
Lifetime Storage Output	MWh	1,260,000			2,520,000			12,600			158		
Initial Capital Cost—DC	$/kWh	$113	–	$244	$107	–	$232	$238	–	$445	$721	–	$1,338
Initial Capital Cost—AC	$/kW	$26	–	$70	$25	–	$67	$40	–	$80	$0	–	$0
EPC Costs	$/kWh	$29	–	$122	$28	–	$116	$56	–	$168	$0	–	$0
Solar/Wind Capital Cost	$/kW	$0	–	$0	$0	–	$0	$0	–	$0	$0	–	$0
Total Initial Installed Cost	M$	$31	–	$80	$56	–	$146	$1	–	$1	$0	–	$0
Storage O&M	$/kWh	$3.0	–	$8.2	$3.0	–	$8.0	$7.3	–	$9.1	$0.0	–	$0.0
Extended Warranty Start	Year	3			3			3			3		
Warranty Expense % of Capital Costs	%	0.65%	–	1.50%	0.66%	–	1.85%	0.50%	–	1.30%	0.00%	–	0.00%
Investment Tax Credit (Solar)	%	0%			0%			0%			0%		
Investment Tax Credit (Storage)	%	30.00%	–	40.00%	30.00%	–	40.00%	30.00%	–	40.00%	30.00%	–	40.00%
Production Tax Credit	$/MWh	$0			$0			$0			$0		
Charging Cost	$/MWh	$33			$27			$111			$152		
Charging Cost Escalator	%	1.97%			1.97%			1.97%			1.97%		
Efficiency of Storage Technology	%	91%	–	87%	92%	–	86%	92%	–	88%	91%	–	88%
Unsubsidized LCOS	$/MWh	$129	–	$277	$115	–	$254	$319	–	$506	$547	–	$860

Source: Lazard estimates and publicly available information.

Note: All cases were modeled using 90% depth of discharge and 10% overbuild. Wholesale charging costs reflect weighted average hourly wholesale energy prices across a representative charging profile of a standalone storage asset participating in wholesale revenue streams. Escalation is derived from the EIA's "AEO 2022 Energy Source–Electric Price Forecast (20-year CAGR)".

Levelized Cost of Storage Components—Low End ($/MWh)

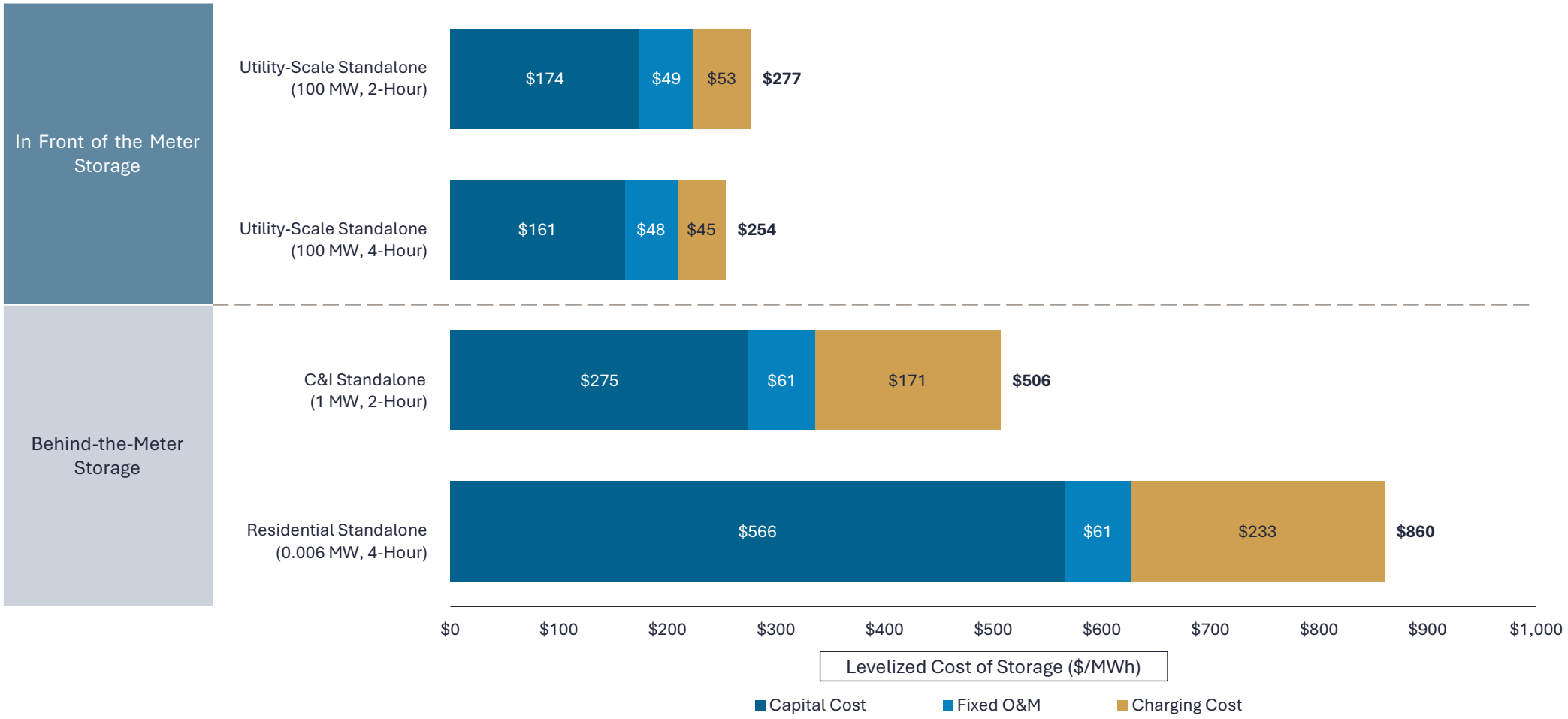
Capital costs, fixed operating costs and charging costs contribute to the all-in cost in varying proportions depending on the specific energy storage use case and configuration



Source: Lazard estimates and publicly available information.
Note: Figures may not sum due to rounding.

Levelized Cost of Storage Components—High End ($/MWh)

Capital costs, fixed operating costs and charging costs contribute to the all-in cost in varying proportions depending on the specific energy storage use case and configuration



Source: Lazard estimates and publicly available information.
Note: Figures may not sum due to rounding.

Energy Storage Use Cases—Overview

By identifying and evaluating selected energy storage applications, Lazard's LCOS analyzes the cost of energy storage for in-front-of-the-meter and behind-the-meter use cases

		Use Case Description	Technologies Assessed
In Front of the Meter Storage	Utility-Scale Standalone	• Large-scale energy storage system designed for rapid start and precise following of dispatch signal • Variations in system discharge duration are designed to meet varying system needs (i.e., short-duration frequency regulation, longer-duration energy arbitrage[1] or capacity, etc.) – To better reflect current market trends, this analysis analyzes 2- and 4-hour durations[2]	• Lithium Iron Phosphate (LFP) • Lithium Nickel Manganese Cobalt Oxide (NMC)
Behind-the-Meter Storage	Commercial & Industrial Standalone	• Energy storage system designed for behind-the-meter peak shaving and demand charge reduction for C&I users – Units are often configured to support multiple commercial energy management strategies and provide optionality for the system to provide grid services to a utility or the wholesale market, as appropriate, in a given region	• Lithium Iron Phosphate (LFP) • Lithium Nickel Manganese Cobalt Oxide (NMC)
	Residential Standalone	• Energy storage system designed for behind-the-meter residential home use—provides backup power and power quality improvements – Depending on geography, can arbitrage residential time-of-use ("TOU") rates and/or participate in utility demand response programs	• Lithium Iron Phosphate (LFP) • Lithium Nickel Manganese Cobalt Oxide (NMC)

Source: Lazard estimates and publicly available information.

1 For the purposes of this analysis, "energy arbitrage" in the context of storage systems paired with solar PV includes revenue streams associated with the sale of excess generation from the solar PV system, as appropriate, for a given use case.

2 The Value Snapshot Case Studies only evaluate the 4-hour utility-scale use case.

Energy Storage Use Cases—Illustrative Operational Parameters

Lazard's LCOS evaluates selected energy storage applications and use cases by identifying illustrative operational parameters [1]

- Energy storage systems may also be configured to support combined/"stacked" use cases

		A Project Life (Years)	B Storage (MW)[2]	Solar/ Wind (MW)	Battery Degradation (per annum)	C Storage Duration (Hours)	B x C = D Nameplate Capacity (MWh)[3]	E 90% DOD Cycles/ Day[4]	F Days/ Year[5]	D x E x F = G Annual MWh[6]	A x G = H Project MWh
In Front of the Meter Storage	Utility-Scale Standalone	20	100	–	2.6%	2	200	1	350	63,000	1,260,000
		20	100	–	2.6%	4	400	1	350	126,000	2,520,000
Behind-the-Meter Storage	Commercial & Industrial Standalone	20	1	–	2.6%	2	2	1	350	630	12,600
	Residential Standalone	20	0.006	–	1.9%	4	0.025	1	350	8	158

= "Usable Energy"[7]

Source: Lazard estimates and publicly available information.
Note: Operational parameters presented herein are applied to Value Snapshot and LCOS calculations. Annual and Project MWh in the Value Snapshot analysis may vary from the representative project.
1 The use cases herein represent illustrative current and contemplated energy storage applications.
2 Indicates power rating of system (i.e., system size).
3 Indicates total battery energy content on a single, 100% charge or "usable energy". Usable energy divided by power rating (in MW) reflects hourly duration of system. This analysis reflects common practice in the market whereby batteries are upsized in year one to 110% of nameplate capacity (e.g., a 100 MWh battery actually begins project life with 110 MWh).
4 "DOD" denotes depth of battery discharge (i.e., the percent of the battery's energy content that is discharged). A 90% DOD indicates that a fully charged battery discharges 90% of its energy. To preserve battery longevity, this analysis assumes that the battery never charges over 95%, or discharges below 5%, of its usable energy.
5 Indicates number of days of system operation per calendar year.
6 Augmented to nameplate MWh capacity as needed to ensure usable energy is maintained at the nameplate capacity, based on Year 1 storage module cost.
7 Usable energy indicates energy stored and available to be dispatched from the battery.

Lazard's LCOE+ will continue to evolve over time, and we appreciate that there can, and will be, varied views regarding the specifics of our analyses. Accordingly, we would be happy to discuss any of our underlying assumptions and analyses in further detail—and, to be clear, we welcome these discussions as we try to improve our studies over time. In that regard, the studies remain our attempt to contribute in a differentiated and impactful manner to the Industry.

More generally, Lazard remains committed to our Power, Energy & Infrastructure Group clients, who remain our highest priority. In that regard, we believe that we have the greatest allocation of resources and effort devoted to this sector of any investment bank. Further, we have an ongoing and intense focus on strategic issues that require long-term commitment and planning. Accordingly, Lazard strives to maintain its preeminent position as a thought leader and leading advisor to clients on their most important matters, especially in this Industry.

If you have any questions regarding this memorandum or Lazard's LCOE+, please feel free to contact any member of the Lazard Power, Energy & Infrastructure Group, including those listed below.

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SSS No. SCS 25-254

BOARD AGENDA ITEM
STAFFING SUMMARY SHEET

Committee Meeting & Date
Strategic Development – 11/11/25
Board Meeting Date
November 20, 2025

TO		TO	
1.	Jason McAlister	6.	Scott Martin
2.	Amber Connors	7.	Jose Bodipo-Memba
3.	Casey Fallon	8.	Farres Everly
4.	Suresh Kotha	9.	**Legal**
5.	Frankie McDermott	10.	**CEO & General Manager**

Consent Calendar	X	**Yes**		**No** *If no, schedule a dry run presentation.*	**Budgeted**	X	**Yes**		**No** *(If no, explain in Cost/Budgeted section.)*

FROM (IPR)	DEPARTMENT	MAIL STOP	EXT.	DATE SENT
Austin Svien	Procurement	EA404	5159	11/05/25

NARRATIVE:

Requested Action: Authorize the Chief Executive Officer and General Manager, or his designee, to negotiate and award a contract to KloudGin, Inc., for Field Service Management Software and associated implementation services, during the period from November 21, 2025, through November 20, 2030, for a not-to-exceed amount of $5,699,739.

Summary: SMUD's existing Click Software Field Service Management solution is end of life. SMUD relies heavily on its field service management solution to coordinate and optimize its mobile workforce to deliver services at customer locations or other off-site locations. SMUD issued Request for Proposal DOC5044974652 (RFP) in February 2025, to solicit proposals from qualified firms for a replacement field service management software solution and associated implementation services, with the intent to award one contract to the highest ranked proposer. SMUD received 10 proposals in response to the RFP, five proposers did not satisfy SMUD's mandatory requirements, and the remaining five proposers were evaluated thoroughly. Evaluations included technical and commercial considerations, and the five shortlisted vendors were given an opportunity to demonstrate their proposed solution to SMUD's end users. SMUD's procurement team engaged in pricing negotiation with KloudGin, Inc., who submitted a best and final offer that was $768,480 lower than their original proposal, presenting SMUD with a cost savings of 12.92%. The result of the evaluation and the award recommendation are shown below.

Recommendation: Award to the Highest Evaluated Responsive Proposer: KloudGin, Inc.

Bidders/Proposers Notified by Procurement:	26
Bidders/Proposers Downloaded:	91
Pre-Bid/Pre-Proposal Conference Attendance:	15
Bids/Proposals Received:	10

Responsive Proposals Received	Pass/ Fail	SEED Points	Tech. Points	Price Points	Total Score	Rank	Proposal Amount	SEED Credit	Evaluated Proposal Amount	Proposed Award Amount
		10	60	30	100					
KloudGin, Inc.	P	5.05	58.05	30.00	93.10	1	$4,187,020	$21,144	$4,165,876	$5,699,739
Deloitte Consulting LLP	P	10.00	54.60	23.92	88.52	2	$5,433,900	$209,351	$5,224,549	
Smart Energy Systems, Inc. dba Smart Energy Water	P	10.00	47.69	25.90	83.59	3	$5,034,375	$209,351	$4,825,024	
OverIT International Inc.	P	10.00	45.91	18.41	74.33	4	$6,997,005	$209,351	$6,787,654	
CGI Technologies and Solutions Inc.	P	1.30	50.26	18.45	70.00	5	$6,784,226	$8,819.49	$6,775,406	

Delaware North America, LLC	Did not satisfy mandatory pass/fail requirements
Diabsolut Ltd.	Did not satisfy mandatory pass/fail requirements
Evora IT Solutions Inc.	Did not satisfy mandatory pass/fail requirements
Hitachi Energy USA, Inc.	Did not satisfy mandatory pass/fail requirements
Workheld GmbH	Did not satisfy mandatory pass/fail requirements

Board Policy: *(Number & Title)* Board-Staff Linkage BL-8, Delegation to the CEO with Respect to Procurement.

Benefits: A fully functional Field Service Management solution from the highest ranked proposer, with a cost savings of $768,480 or 12.92% through successful pricing negotiations.

Cost/Budgeted: $5,699,739; Budgeted for 2025-2030 by Information Technology

Alternatives: Do not award contract. As the current solution is end of life, this could present significant issues to SMUD in regard to its field service management needs.

Affected Parties: Information Technology, Supply Chain Services, and Contractor

Coordination: Information Technology and Supply Chain Services

Presenter: Amber Connors, Director, Customer & Grid Operations Tech Center

Additional Links:

SUBJECT

Field Service Management Software and Services Contract Award

ITEM NO. ***(FOR LEGAL USE ONLY)***

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ITEMS SUBMITTED AFTER DEADLINE WILL BE POSTPONED UNTIL NEXT MEETING.

DRAFT

RESOLUTION NO. _____

WHEREAS, in February 2025, SMUD issued Request for Proposal No. DOC5044974652 (RFP) to solicit proposals from qualified firms for field service management software and associated implementation services for a five-year period; and

WHEREAS, 10 proposals were submitted in response to the RFP; and

WHEREAS, the staff process for determining the highest ranked proposer is complete; **NOW, THEREFORE,**

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

Section 1. As a result of such examination, **KloudGin, Inc.** is hereby determined and declared to be the highest evaluated responsive proposer to provide field service management software and associated implementation services.

Section 2. The Chief Executive Officer and General Manager, or his designee, is authorized, on behalf of SMUD, to negotiate and award a contract to **KloudGin, Inc.** for field service management software and associated implementation services for a five-year period from November 21, 2025, through November 20, 2030, for a not-to-exceed amount of $5,699,739.

Section 3. Software maintenance fees for future years will be approved by this Board as part of the annual budget.

Section 4. The Chief Executive Officer and General Manager, or his designee, is authorized to make future changes to the terms and conditions of the contract that, in his prudent judgment: (a) further the primary purpose of the contract; (b) are intended to provide a net benefit to SMUD; and (c) do not exceed the authorized contract amount and applicable contingencies.

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SSS No. GM 25-145

BOARD AGENDA ITEM
STAFFING SUMMARY SHEET

Committee Meeting & Date
Policy – 11/12/25
Board Meeting Date
November 20, 2025

TO		TO	
1.	Claire Rogers	6.	Farres Everly
2.	Steve Kustin	7.	
3.	Scott Martin	8.	
4.	Suresh Kotha	9.	**Legal**
5.	Brandy Bolden	10.	**CEO & General Manager**

Consent Calendar	X	**Yes**		**No** *If no, schedule a dry run presentation.*	**Budgeted**	X	**Yes**		**No** *(If no, explain in Cost/Budgeted section.)*

FROM (IPR)	DEPARTMENT	MAIL STOP	EXT.	DATE SENT
David Bitter	Cybersecurity	K112	6901	10/21/25

NARRATIVE:

Requested Action: Accept the monitoring report for Strategic Direction SD-16, Information Management and Security.

Summary: Present the 2024-2025 Board Monitoring Report for SD-16, Information Management and Security.

Board Policy: *(Number & Title)* Strategic Direction SD-16, Information Management and Security

Benefits: Provides an update to the Board of Directors on the progress and status of Information Security, Privacy, and Records Management programs.

Cost/Budgeted: Costs contained in internal labor budget.

Alternatives: Receive information via memo or written report through the Chief Executive Officer and General Manager.

Affected Parties: All SMUD Departments

Coordination: Cybersecurity, Facilities, Security & Emergency Operations, and Information Management & Compliance

Presenter: Steve Kustin, Interim Director, Cybersecurity
Kirsten DePersis, Director, Facilities, Security & Emergency Operations
Kelsey McFadyen, Program Manager, Information Management & Compliance

Additional Links:

SUBJECT	ITEM NO. *(FOR LEGAL USE ONLY)*
Strategic Direction SD-16, Information Management and Security Monitoring Report	**7**

ITEMS SUBMITTED AFTER DEADLINE WILL BE POSTPONED UNTIL NEXT MEETING.

SACRAMENTO MUNICIPAL UTILITY DISTRICT

OFFICE MEMORANDUM

TO: Board of Directors **DATE:** October 29, 2025

FROM: Claire Rogers *CR 10/29/25*

SUBJECT: **Audit Report No. 28007875**
Board Monitoring Report; SD-16: Information Management and Security

Internal Audit Services (IAS) received the SD-16 *Information Management and Security* 2025 Annual Board Monitoring Report and performed the following:

- Selected a sample of statements and assertions in the report for review.
- Compared sample to the corresponding supporting documentation to identify potential discrepancies.

All items sampled within the SD Report aligns with the supporting documentation provided at the time of review.

CC:

Paul Lau

DRAFT

Board Monitoring Report 2025
SD-16 Information Management and Security

1) Background

Strategic Direction Information Management and Security policy states that:

Proper management of cyber and physical information, as well as physical security, is a core value. Robust information management and physical security practices are critical to effective risk management and to ensure regulatory compliance, business resiliency and customer satisfaction. SMUD shall take prudent and reasonable measures to accomplish the following:

a) **Cybersecurity**: SMUD will protect customer, employee and third-party information, and SMUD technology systems are protected from unauthorized access, use, disclosure, disruption, modification, or destruction.

b) **Physical Security**: SMUD will safeguard its employees while at work as well as customers and visitors at SMUD facilities. SMUD will also protect its facilities and functions that support the reliability of the electric system and overall operation of the organization from unauthorized access or disruption of business operations.

c) **Customer Privacy**: SMUD will annually notify customers about the collection, use and dissemination of sensitive and confidential customer information. Except as provided by law or for a business purpose, SMUD will not disseminate sensitive and confidential customer information to a third party for non-SMUD business purposes unless the customer first consents to the release of the information. Where sensitive and confidential information is disseminated for a business purpose, SMUD will ensure: (i) the third party has robust information practices to protect the sensitive and confidential customer or employee information, and (ii) use of the information by the third party is limited to SMUD's business purpose. SMUD will maintain a process that identifies the business purposes for which SMUD will collect, use and disseminate sensitive and confidential customer and employee information.

d) **Information Management**: SMUD will maintain the efficient and systematic control of the creation, capture, identification, receipt, maintenance, use, disposition, and destruction of SMUD information, in accordance with legal requirements and Board policies.

2) Executive summary

a) SMUD's Cybersecurity, Physical Security, Customer Privacy, and Information Management programs and initiatives align directly with the "Safety and Reliability" Core Values of SMUD's 2030 Clean Energy Plan. These programs work towards ensuring

that SMUD continues to be a good steward over technology systems, cyber and physical security, privacy, and information in accordance with our customers' high expectations.

b) SMUD is substantially in compliance with SD-16 Information Management and Security Policy.

c) Summary:

SD Requirement	Program/initiative/policy	Purpose	Outcome	Notes
Cybersecurity: protect systems and information from unauthorized access	Cybersecurity program; AP 07.03.01 Information Security Concepts and Roles	Protect systems and information; provide policy supporting the Cybersecurity program	Security controls and processes are in place to protect people, processes, and technology	
Customer Privacy: Notify customers about use of information	Annual notice of privacy practices	Notify customers of our privacy practices	Notice sent in the May bill package	Changes this year explain information use and the purpose of the notice
Customer Privacy: Ensure security where data is shared	System Security Plans and SOC 2 audit report requirements	Evaluate the information practices and security controls of third parties	Confidence that vendors have robust cybersecurity programs to protect SMUD information	
Customer Privacy: Identify purposes for information collection and dissemination	Data Sharing Policy, Data Sharing Request/Approval Process	Track NDAs, the data being shared, and the business justification for sharing	Formal data sharing process is being observed and maintained	
Information Management: Identify and manage records and information	Records Evaluations and Information Migration	Evaluate, classify and migrate records, and ensure retrieval, disposal and protection.	Migration of 35 out of 40 total business areas with expected completion of 40 by end of 2025, for an estimated 7 million documents migrated and classified.	
Information Management: Ensure all information systems are compliant with IMC best practices and requirements	Data Loss Prevention	Implementation of tools and polices in information repositories	Creation of a sustainable model for SMUD to classify/label documents and prevent inappropriate distribution and access.	
Physical Security:	- Annual Workplace Violence Training	Proactively equip employees and	Increased employee awareness and	Despite improvements,

Safeguard employees while at work	- Situational Awareness Training for Field Crews & Awareness Campaign - Civil Standby by Law Enforcement - Beakon Threat Awareness Tool - Mandatory ballistic vests for Officers	visitors to recognize, report, and respond to workplace threats, ensuring security at SMUD facilities.	preparedness significantly reduce the risk and impact of workplace violence, fostering a culture of safety & vigilance at all SMUD sites.	workplace violence risks persist; ongoing training and law enforcement collaboration remain essential.
Physical Security: Safeguard customers & visitors at SMUD facilities	- CSC Lobby Improvements - Security Presence in Public Lobbies - Risk Threat Vulnerability Assessment (RTVA) - Event Metal Detection - Board Meeting Security - VOA Partnership	Create a welcoming yet secure environment for customers & visitors by mitigating risks related to physical safety, theft & privacy at SMUD facilities.	Enhanced security controls & physical modifications ensure customer & visitor safety, minimize incidents & maintain trust in SMUD's commitment to protect its interests.	Security improvements reduce risks, but challenges with disgruntled customers and the unhoused require ongoing vigilance and adaptive measures.
Physical Security: Protect overall operation from unauthorized access or disruption	- Design & Budgeting of Folsom Administrative Office Building - Perimeter Intrusion Detection Systems at Critical Impact Protection Sites - UARP Technology - No Findings for NERC Audit - Physical Access Control System (PACS)	Ensure uninterrupted operations by preventing unauthorized access and disruptions at critical sites using advanced security technology and compliance.	Implementation of robust physical access controls & detections systems results in higher operational resilience, regulatory compliance & reduced risk of operational disruptions.	Controls reduce vulnerabilities but evolving threats require continuous assessment and updates.

3) **Additional supporting information**

<u>Cybersecurity</u>

SMUD, customer, employee and third-party information and SMUD information systems are protected from unauthorized access, use, disclosure, disruption, modification, or destruction.

SMUD's Cybersecurity program continues to evolve and mature to keep pace with the evolving cyber threats we face and to manage our cyber, privacy, legal, regulatory and compliance risk. This includes the adoption of a Zero Trust Architecture strategy, aligned to the Technology and security excellence objective of SMUD's 2025 Enterprise Strategy. The program aligns to the National Institute of Standards and Technology (NIST) Cybersecurity Framework (CSF) to establish prudent and reasonable measures intended to protect SMUD's operations from a cyber-attack, disruption and other threats to enterprise technologies, processes, and information. The six core functions of the CSF (Identify, Protect, Detect, Respond, Recover, and Govern) comprise both administrative and technical controls to effectively manage information and cybersecurity risk. Cybersecurity is actively working to implement the CSF controls through SMUD policies to enhance and govern information management and security risk management

practices and processes in support of SD-16. Cybersecurity will highlight the cybersecurity capabilities provided in an update to the board for SD-16 during an upcoming closed session.

Physical Security

SMUD will safeguard its employees while at work as well as customers and visitors at SMUD facilities

SMUD is committed to safeguarding the safety and well-being of its employees, customers, and visitors across all facilities. Recognizing the various risks—including workplace violence, disgruntled customers, civil unrest, and challenges posed by an open campus—SMUD has implemented comprehensive initiatives to create a secure environment. For employees, mandatory annual workplace violence and situational awareness training equip staff to recognize and respond to potential threats, while campaigns like “See Something, Say Something” and “Power of Hello” promote vigilance and communication. Asset protection officers are now equipped with ballistic vests, and partnerships with law enforcement provide civil standbys and threat intelligence support through tools such as Beakon. For customers and visitors, security enhancements focus on high-traffic, customer-facing areas with measures such as lobby redesigns for improved visibility, increased security presence, and metal detection for large or high-risk events. Ongoing Risk Threat Vulnerability Assessments guide targeted improvements, and visible security presence at Board meetings ensures public safety. Collaboration with community partners like Volunteers of America further strengthens social support and security around facilities, particularly addressing vulnerabilities related to unhoused populations. Through these combined efforts, SMUD fosters a vigilant, prepared, and welcoming environment for all who work at and visit its premises, while maintaining ongoing vigilance to address emerging threats.

SMUD will also protect its facilities and functions that support the reliability of the electric system and overall operation of the organization from unauthorized access or disruption of business operations.

Protecting electric system infrastructure is essential to SMUD’s mission of reliable power delivery. Substations, control centers, and transmission sites face threats such as theft, vandalism, trespassing, and terrorism. SMUD applies stringent security standards, advanced surveillance technologies—including mobile trailers, thermal radar, Perimeter Intrusion Detection Systems (PIDS), and CCTV—and landscape hardening with enhanced fencing to secure these sites. Integration with Computer Aided Dispatch (CAD) and Letters of Agency with local law enforcement ensure swift incident response and information sharing. Ongoing technology upgrades, such as those addressing security gaps at the Upper American River Project, align with FERC and internal recommendations. SMUD’s zero-findings 2025 NERC audit validates the effectiveness of current controls, though continuous monitoring and innovation remain critical to counter evolving threats.

Customer Privacy

SMUD will annually notify customers about the collection, use and dissemination

of sensitive and confidential customer information.

SMUD sent out our annual privacy notice via email and as a bill insert to customers during the May bill cycle. The language in the notice was updated this year to be clearer about its purpose and to be easier to understand. The notice continues to include plain language regarding SMUD's collection, use, and release of customer sensitive and confidential information, the business purposes for which it is used, as well as a reaffirmation of SMUD's commitment to customer privacy.

Except as provided by law or for a business purpose, SMUD will not disseminate sensitive and confidential customer information to a third party for non-SMUD business purposes unless the customer first consents to the release of the information.

No sensitive and confidential customer information has been sent to a third party for non-SMUD business purposes this year.

Where sensitive and confidential information is disseminated for a business purpose, SMUD will ensure: (i) the third party has robust information practices to protect the sensitive and confidential customer information, and (ii) use of the information by the third party is limited to SMUD's business purpose.

Where business requires sensitive and confidential information to be shared with a third party, Cybersecurity's risk management team evaluates third party artifacts, attestations, and independent reports to ensure that robust information practices are in place sufficient to protect customer information. The American Institute of CPAs (AICPA) Service Organization Control 2 (SOC 2) Type 2 continues to be our standard as it is an independent assessment focused on a solution's security controls which includes tests of the security controls' efficacy. SOC 2 Type 2 reports provide staff confidence that vendor security controls are robust and sufficient to protect SMUD information. Contract and non-disclosure agreement language is used to provide assurance that SMUD provided sensitive and confidential information will not be used for any unapproved purposes.

SMUD will maintain a process that identifies the business purposes for which SMUD will collect, use and disseminate sensitive and confidential customer information.

MP 07.03.01.122 - Data Sharing requires an approved data sharing request prior to sharing information with a third party for SMUD business purposes. This year the request form was updated to require clear declaration when a request is for non-SMUD business purposes.

<u>Information Management</u>

The efficient and systematic control of creation, capture, identification, receipt, maintenance, use, disposition, and destruction of SMUD records, in accordance with legal requirements and Board policies.

The IMC Program in collaboration with the Enterprise Content Management (ECM) team launched a mass content migration (Enterprise Shared Drive Migration) project at the beginning of 2023. Using completed IMC records evaluations, this effort has migrated content from 35 business areas out of 40, with expected completion of 40 by end of 2025, for an estimated total of 7 million documents classified and migrated. The project has identified, organized, and migrated content for each business area from non-approved records repositories into approved record repositories. This allows content to be managed in accordance with SD-16.

Information Management & Compliance is partnering with Cybersecurity and Organizational Change Management to implement a Data Loss Prevention (DLP) program. This initiative establishes a sustainable governance model to classify and protect sensitive information, monitor at-risk activities, and reduce the risk of data breaches. It is critical for ensuring regulatory compliance, safeguarding our reputation, and protecting the organization from potential financial and operational impacts. The IMC Program continues to collaborate with the Enterprise Content Management team, Cybersecurity, the CIP Program, Data Governance, and other business partners to ensure compliance with records policies and information management requirements.

4) **Challenges**

Cybersecurity

Industry and federal partners and agencies all continue to warn SMUD and the industry of the heightened geopolitical tension and associated nation state cyber actors targeting critical infrastructure. Cybersecurity takes these warnings seriously, ingesting threat intelligence and taking precautions to protect against known attacks and threat actors. Mandatory annual training and year-round awareness activities keep employees informed of the risks we face and their role in keeping things secure. Additionally, Cybersecurity participated once again in efforts to ensure we maintain cybersecurity insurance.

AI has brought a new set of risks and challenges this year. The Cybersecurity team has been involved to ensure that the risks associated with AI are appropriately understood and managed.

SMUD's current Payment Card Industry (PCI) card payment transaction volume continues to classify SMUD as a PCI Level 2 Merchant. Each year SMUD engages a third-party Payment Card Industry Professional (PCIP) to validate our compliance. All required assessment documents attesting to our compliance were submitted to Chase Paymentech in June.

The Cybersecurity team continues to work hard to ensure compliance with the NERC Critical Infrastructure Protection (CIP) standards. This year was our triennial CIP compliance audit, where we not only had zero findings, but received two positive observations. The CIP team is now preparing for additional standards which become enforceable in 2026 and beyond, requiring additional resources not only from the Cybersecurity team but from others as well.

Our Zero-Trust Cybersecurity Strategy remains a core part of IT work, and positions SMUD to secure sensitive data, systems, and services. IT continues to make progress in this area, working with Cybersecurity to ensure upcoming projects and efforts align to this strategy.

Physical Security

Physical Security remains SMUD's frontline defense for its people, facilities, and infrastructure. A current comprehensive Risk Threat Vulnerability Assessment (RTVA) is identifying gaps in staffing, technology, access controls, and processes needed to address evolving threats such as unauthorized access and sophisticated disruptions. Early findings highlight vulnerabilities in perimeter security, remote site protection, and response capabilities, especially within the open campus environment and substations. Since 2014, SMUD's growth has outpaced security enhancements, necessitating a critical reassessment similar to recent cybersecurity investments. The RTVA will guide improvements in resources, technology, and operations to ensure regulatory compliance and industry best practices, enabling SMUD to effectively safeguard its assets, people, and business continuity amid increasing risks and complexity.

Customer Privacy

We continue to receive SMUD customer data sharing requests for regulatory, compliance, municipal collaboration, and internal program needs related to SMUD business purposes. In rare cases data is requested to be shared for purposes that are not considered primary or core SMUD business, and in those situations the data is aggregated or de-identified before sharing so it is no longer considered personally identifiable information (PII).

Information Management

The IMC program continues to integrate information management best practices into SMUD's daily operations. Business areas are actively collaborating with IMC in the creation of information management and recordkeeping policies/procedures specific to their day-to-day operational needs. SMUD's continued development of the IMC program further reduces the risk of potential multi-million-dollar fines and reputational damage associated with lack of records management controls.

The DLP program is now in the pilot phase, testing the solution's sensitivity labels with selected teams, gathering feedback to refine technical rules, training, and communications. This work will reduce the risk of data breaches, reputational harm, and costly regulatory fines, while building a sustainable governance model for information protection across SMUD.

5) Recommendation

It is recommended that the Board accept the Monitoring Report for SD-16 Information Management Policy Monitoring Report.

6) **Appendices**

Definitions and acronyms:

NIST – National Institute of Standards and Technology
CSF – Cybersecurity Framework
AICPA – American Institute of CPAs
SOC 2 – Service Organization Control 2
IMC – Information Management & Compliance
ECM – Enterprise Content Management
DLP – Data Loss Prevention
PCI – Payment Card Industry
PCIP – Payment Card Industry Professional
CIP – Critical Infrastructure Protection
CEOP – Cybersecurity Emergency Operations Program
RTVA – Risk Threat Vulnerability Assessment

DRAFT

RESOLUTION NO. _____

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

This Board accepts the monitoring report for **Strategic Direction SD-16, Information Management and Security**, substantially in the form set forth in **Attachment ___** hereto and made a part hereof.

8

SSS No. CFO 25-015

BOARD AGENDA ITEM

STAFFING SUMMARY SHEET

Committee Meeting & Date
Policy – 11/12/25
Board Meeting Date
November 20, 2025

TO		TO	
1.	Claire Rogers	6.	
2.	Scott Martin	7.	
3.	Brandy Bolden	8.	
4.	Farres Everly	9.	**Legal**
5.	Suresh Kotha	10.	**CEO & General Manager**

Consent Calendar	X	**Yes**		**No** *If no, schedule a dry run presentation.*	**Budgeted**	X	**Yes**		**No** *(If no, explain in Cost/Budgeted section.)*

FROM (IPR)	DEPARTMENT	MAIL STOP	EXT.	DATE SENT
Jillian Rich	Enterprise Strategy & Planning	B356	6454	10/17/25

NARRATIVE:

Requested Action: Accept the monitoring report for Strategic Direction SD-17, Enterprise Risk Management.

Summary: The Enterprise Risk Management Report summarizes activities that have occurred since the November 2024 annual report. It includes historical risk profiles for the enterprise risk focus areas of 2024-2025, mitigation strategies, and the current residual risk exposure status of identified enterprise risks.

Board Policy: *(Number & Title)* Strategic Direction SD-17, Enterprise Risk Management

Benefits: Provide the scheduled monitoring report as requested by the Board of Directors and Executive staff. The report provides an opportunity to make recommendations or policy revisions, as necessary.

Cost/Budgeted: Costs are contained within the budget for internal labor.

Alternatives: Provide via written report through the Chief Executive Officer and General Manager.

Affected Parties: Board of Directors, Executive Office

Coordination: Enterprise Risk Management activities are closely coordinated enterprise-wide throughout SMUD.

Presenter: Jillian Rich, Manager, Enterprise Strategy & Risk

Additional Links:

SUBJECT	ITEM NO. *(FOR LEGAL USE ONLY)*
Strategic Direction SD-17, Enterprise Risk Management Monitoring Report	**8**

ITEMS SUBMITTED AFTER DEADLINE WILL BE POSTPONED UNTIL NEXT MEETING.

SACRAMENTO MUNICIPAL UTILITY DISTRICT

OFFICE MEMORANDUM

TO: Board of Directors **DATE:** October 29, 2025

FROM: Claire Rogers *CR 10/29/25*

SUBJECT: **Audit Report No. 28007876**
Board Monitoring Report; SD-17: Enterprise Risk Management

Internal Audit Services (IAS) received the SD-17 *Enterprise Risk Management* 2025 Annual Board Monitoring Report and performed the following:

- Selected a sample of statements and assertions in the report for review.
- Compared sample to the corresponding supporting documentation to identify potential discrepancies.

All items sampled within the SD Report aligns with the supporting documentation provided at the time of review.

CC:

Paul Lau

DRAFT

Board Monitoring Report 2025
SD-17 Enterprise Risk Management

1) Background

Strategic Direction 17 states: Effectively balancing and managing risk to further SMUD's policies and business goals is a core value of SMUD.

Therefore:
SMUD will implement and maintain an integrated enterprise risk management process that identifies, assesses, prudently manages, and mitigates a variety of risks facing SMUD, including financial, supply, operational, physical and cyber security, climate change, legal, legislative and regulatory, and reputational risk.

2) Executive summary

SMUD is in compliance with SD-17, Enterprise Risk Management.

In 2025, staff modernized our Enterprise Risk Management (ERM) framework in response to a 2024 maturity assessment conducted by KPMG, a global consulting firm. The refreshed framework is now complete and will be used as the basis for risk monitoring, reporting and decision-making going forward.

SMUD's new risk framework:

- provides a cross-functional, top-down view of risk that allows staff, executives and the Board to discuss risk more holistically before examining details;
- increases alignment to SMUD's Strategic Direction;
- includes detailed risk definitions and an enhanced rating system to more clearly communicate risk; and,
- conveys the impact of mitigations and controls by tracking our risk environment level (inherent risk) separately from remaining risk (residual risk).

While the risk refresh was in process, SMUD continued to strategically manage risk in a way that proactively reduced the chance of loss. For example, action at the Federal level caused several risks to escalate in the first half of the year, including those related to renewable energy projects, the economy, grants and supply chain. SMUD increased its monitoring and communication around these risks and introduced additional mitigations and safeguards where possible.

Our new risk framework is a baseline against which future changes will be compared. The changes we made in our former risk framework to supply chain, economic, grant, and renewable project risk are included in the new risk levels outlined below. Our strategic risks have the following residual ratings:

Strategic Risk	Residual Risk Level
Safety & Security: Risks related to safety and security events involving our people, community and critical assets.	Medium-High
Financial: Risk related to our affordable rates.	Medium-High
Environmental: Risks related to our clean energy goals and environmental stewardship.	Medium
Reliability: Risk related to keeping the lights on.	Medium
Process & Technology: Risk related to our operational support systems, processes, and technologies.	Medium
Customer & Community: Risks related to SMUD's engagement with customers and the community.	Low
Our People: Risk related to building an inclusive, engaged and future-ready workforce.	Low

These risk ratings account for the potential impact of the risk, the likelihood of it occurring, and how quickly SMUD would have to respond should the risk occur. A low risk rating does not mean low priority. If anything, it means that the risk has fewer influences outside of our control. For instance, we cannot influence global politics that may impact supply chain and cybersecurity risk, but we have significant influence over our employee experience.

Moving forward, SMUD will continue to monitor bottom-up risk and communicate it through our new risk framework. Our 2026 work plan will focus on further improving our risk-aware culture, launching new training and tools for business area leaders to identify, manage and communicate risk consistent with our new framework.

3) Additional supporting information

a) 2025 ERM Program Highlights

In 2025, SMUD's ERM program:

- finished a refresh of the enterprise risk framework to better communicate, anticipate, and accommodate our changing risk landscape,
- continued to support the organization in the facilitation of risk conversations and embedding risk into our decision-making, such as prioritization decisions,
- enhanced cross-functional governance and thorough understanding of major risk issues by leveraging six committees: the Enterprise Risk Oversight Committee (EROC), Risk Champions Network (RCN), Trading Operations Risk Committee (TORC), Reliability committee, and Zero Carbon Plan Steering Committee, and Three Lines of Defense Working Team,
- made several updates to risk levels and took corresponding action, largely in response to new Federal policy changes,
- updated our uniform risk rating rubric to include more specific key risk indicators, and

- created new dashboards, reports and tools to better communicate, monitor, compare, rate and update risks.

Attachment A provides further details about our 7 Strategic Risks, which are broken down into 26 sub-risks or Enterprise Risks. The attachment includes:

- Risk definitions & Strategic Direction (SD) alignment
- Risk scores: Subject matter experts and senior leaders rated each risk based on the potential cross-functional impacts, the likelihood of the risk occurring, and the speed at which SMUD would have to respond should the risk occur. There are two ratings per risk: the risk environment (inherent risk) if SMUD did nothing to control or mitigate the risk and remaining risk (residual risk) after SMUD mitigations and controls are considered. We use the following scale:
-

Level	Risk Level	ERM significance (residual risk)
L	Low	Risk is mitigated to a low level. ERM reviews periodically.
M	Medium	Risk is moderately mitigated. ERM reviews periodically.
MH	Medium High	Risk is moderately mitigated. ERM monitors regularly.
H	High	Considered a focus area for risk mitigation. ERM monitors regularly.
EH	Extremely High	Risk is immediate and substantial resources are needed to mitigate risk.

- Risk forecast: Anticipated trend for the coming year based on key risk indicators and subject matter expert opinion:

Risk level may increase	Risk level expected to be maintained	Risk level may decrease
⬆	=	⬇

b) 2025 Risk Management Highlights

SMUD completed several efforts in 2025 that either reduce the impact of risk or demonstrate that our current controls and mitigations are performing as expected. Highlights of those efforts are provided below.

2025 Risk Highlight	Strategic Risk(s)	Description
Prudent fiscal management	Financial	In 2025, we took several actions to preserve our strong financial health including securing a $91M direct Investment Tax Credit payment and setting aside funds in reserves and stabilization funds to ensure funding availability and mitigate any rate impacts for customers.

2025 Risk Highlight	Strategic Risk(s)	Description
Enhanced field safety	Safety & Security	We improved field safety by deploying advanced communication technologies, including radio repeaters and Starlink satellite connectivity. These enhancements ensure reliable and continuous communication for field crews, especially in remote or disaster-affected areas, supporting safer and more efficient operations.
Rate case below inflation	Customer & Community	With SMUD's approved rate changes for 2026-2027, our rates remain among the lowest in California, which positively impacts our risks related to customer affordability and inclusive economic development.
Western Electricity Coordinating Council (WECC) audit	Reliability	We successfully completed the 2025 WECC audit with no non-compliance findings, demonstrating strong adherence to reliability standards and effective operational controls.
Innovative technologies	Process & Technology	We piloted new robotics to assist substation maintenance workers with daily tasks such as sulfur hexafluoride (SF6) gas monitoring, infrared inspections, and partial discharge testing.

c) Global Risk Trends & Benchmarking

SMUD's ERM program actively monitors global risk trends and compares our risk landscape to that of others in the energy industry to stay ahead of potential changes.

Global risk trends impacting SMUD in 2025-2026:

- **Affordability:** Rising costs and uncertainty driven by supply chain disruptions, inflation, tariffs and escalating labor expenses put additional financial pressure on utilities. This heightens the risk of continuing to meet our affordability goal and may increase cost of living pressures for our customers in general, particularly those in vulnerable communities.
- **Supply Chain Disruptions:** Delays in delivery times, changing expectations for service agreements and increased costs for equipment – including transformers, materials and technology – affect the way the utility industry approaches grid modernization and expansion of clean energy resources.
- **Regulatory and Policy Uncertainty:** Rapidly changing policy decisions such as those related to Federal funding priorities pose significant challenges for long-term planning and capital investment decisions. These uncertainties can lead to unexpected costs and potential delays in project execution.
- **Climate change and weather-related impacts:** Climate change continues to be a major driver of uncertainty for utilities. Increased frequency and severity of wildfire, heatwaves and severe storms poses a threat to grid resiliency and

critical assets. Additionally, the costs associated with structure hardening, vegetation management and advanced monitoring systems is driving the need for greater risk-based decision-making for the replacement and maintenance of our assets.

- **Technology Integration:** The integration of new, cloud-based technologies and distributed energy resources introduces great opportunity for utilities and also several challenges. Challenges include changing cybersecurity vulnerabilities and the need for standards development to address the regulatory and compliance implications of integration.

These global risk trends are also impacting our peers in the energy industry. As in previous years, SMUD relied on the North Carolina State University's (NCSU) Enterprise Risk Management Initiative and Protiviti 2025 & 2035 Executive Perspectives on Top Risks for a benchmark of short-term and long-term risks from 1,215 global board members and executives.

Attachment B compares SMUD's top enterprise risks to the top 10 Energy and Utility risks identified in NCSU and Protiviti study. Overall, SMUD's refreshed risk framework aligns to the industry benchmarking and will allow us to make productive comparisons with our peers moving forward.

d) Looking forward

In 2026, ERM will work with leaders to continue to mature ERM at SMUD based on the KPMG recommendations of standardization, prioritization, aggregation and interconnectedness of risks. Staff will facilitate executive leadership in the development of risk tolerances and key risk indicators to enhance decision-making and greater understanding of strategic priorities. We will also provide staff with tools, education, and escalation processes to increase risk awareness and reporting.

4) Challenges

Today's risk environment is increasingly becoming more complex, interconnected and fluid. In response, the refreshed enterprise risk management framework looks holistically across the organization to identify and mitigate risk cross-functionally. Moving to an approach that identifies and manages risk both from a top-down and bottom-up perspective will improve risk governance across the enterprise, our ability to identify and manage emerging risks, and provide management with improved quantitative tools to make resource decisions.

5) Recommendation

It is recommended that the Board accept the Monitoring Report for SD-17, Enterprise Risk Management.

6) Appendices

Attachment A: **New Strategic and Enterprise Risks**

See Section 3a of this report for the legend. For risks with a positive or negative forecast, we include a rationale in the last column entitled “forecast notes”.

Strategic Risk | *Enterprise Risk*	2025 risk rating			2025 mitigation and control accomplishments
	Inherent	Residual	Forecast	
Safety & Security (SD-6; SD-16) Risks related to safety and security events involving our people, community and critical assets.	H	MH		• Increased employee/supervisor safety interactions, which are preventative communications to help identify and remove barriers to safe work • Enhanced safety training qualifications for contractors • Invested in enhanced ergonomics and safety tools such as car mounts for navigation devices and improved tower grounding safety gear • Implemented Privileged Access Management improving permissions for critical systems • Continued implementation of our Zero Trust cybersecurity strategy and program aligned to National Institute of Standards & Technology (NIST) • Initiated third-party risk management process enhancements including the acquisition of a third-party risk management application, additional monitoring and reporting tools, and a new third-party and cybersecurity governace committee
Safety There is a risk that the safety of our employees, contractors, and public will be compromised.	H	L	=	
Physical Security There is a risk that SMUD-owned property and assets will be accessed by unauthorized individuals.	H	M	=	
Cybersecurity There is a risk that SMUD’s data, information assets, systems and networks will be accessed by unauthorized individuals or groups.	EH	H	=	
Third-Party There is a risk that a third party will fail to represent SMUD's interests, standards or expectations.	H	MH	=	

Strategic Risk | *Enterprise Risk*	2025 risk rating			2025 mitigation and control accomplishments
	Inherent	Residual	Forecast	
Reliability (SD-4; SD-14) Risk related to keeping the lights on.	H	M		• On track to meet 2025 System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI) reliability limits • Completed the North American Electric Reliability Corporation (NERC) audit with no findings • Introduced a new compliance tracking interface for Power Generation assets • Inspected transmission line towers, including an advanced assessment of towers in the High Fire Threat District in the Upper American River Project (UARP) • Patrolled thousands of miles of transmission and distribution overhead lines • Continued to improve storm response, including more accurate estimations and enhanced communication • Enhanced vegetation management with new data collection applications to improve patrol efficiency and geospatial tracking • Trimmed tens of thousands of trees to reduce wildfire and storm risk • Completed and received approval from Federal Emergency Management Association (FEMA) for the 2024-2028 Hazard Mitigation Plan • Updated the Wildfire Mitigation Plan • Enhanced remote monitoring solutions at thermal plants
Resource Adequacy There is a risk that SMUD's electricity load could exceed available supply.	H	M	=	
System Adequacy There is a risk that SMUD's transmission and distribution equipment could be insufficient for current and future capacity requirements.	H	M	=	
Operational Adequacy There is a risk that SMUD's asset capabilities could be insufficient or our resources too inflexible to reliably operate SMUD's system or interact with the interconnected grid.	H	MH	=	
Grid Resiliency There is a risk that SMUD's critical infrastructure may not be resilient to hazards such as wildfire, extreme weather or other natural and man-made disruptions.	H	M	=	
Reliability Compliance There is a risk that SMUD's internal controls are inadequate, that SMUD is unable to evolve with changing regulatory requirements, and that SMUD may not comply with applicable laws and regulations.	H	L	=	

Strategic Risk | *Enterprise Risk*	2025 risk rating			2025 mitigation and control accomplishments
	Inherent	Residual	Forecast	
Environmental Risk (SD-7; SD-9) Risks related to our clean energy goals and environmental stewardship.	H	M		• Continued progress on multiple utility-scale projects including Country Acres, Coyote Creek, Curry Creek, Grace, Hatchet Ridge, Oveja Ranch, Sunzia, and Terra-Gen • Completed Sloughhouse Solar • Finished the Cosumnes Power Plant turndown project • Implemented a new customer facing online residential electrification tool to support education and awareness of building decarbonization technologies • Reached a major building electrification milestone with 20,000 heat pump heating ventilation and air conditioning (HVAC) systems incentivized to date • Advanced the Energy Management System (EMS) upgrade project enabling enhanced renewable integration, system monitoring, and control supporting our transition to clean energy resources • Implemented the Habitat Conservation Plan focused on endangered species protection Forecast notes: • Staff anticipates that Clean Energy Resources and Community Decarbonization risks will increase as we adjust to the changing priorities of Federal funding like tax credits and grants.
Clean Energy Resources There is a risk that the transition to clean energy resources could be delayed or be insufficient to meet regulatory requirements.	H	MH	⬆	
Community Decarbonization There is a risk that our customer programs may not effectively decarbonize buildings and vehicles in the region.	H	MH	⬆	
Environmental Stewardship There is a risk that inadequate environmental stewardship or non-compliance with environmental rules and regulations could occur.	MH	M	=	
Climate Change There is a risk that the escalating impacts of climate change, including extreme weather events, rising temperatures, and loss of snowpack could impact our operations and infrastructure.	H	MH	=	

Strategic Risk | *Enterprise Risk*	2025 risk rating			2025 mitigation and control accomplishments
	Inherent	Residual	Forecast	
Customer & Community Risk (SD-5; SD-12; SD-13; SD-15) Risks related to SMUD's engagement with customers and the community.	M	L		• Extensive market research and customer preference testing prior to launching new customer messaging or offerings like the new smud.org going live in 2026 • Executed our Community Impact Plan to support energy efficiency and electrification for communities that need it most • Expanded lobby days to encourage customers to enroll in our Customer Assistance offerings like the Energy Assistance Program Rate (EAPR) and Medical Equipment Discount (MED) rate • Launched our new Solar & Storage for Nonprofits program • Maintained high customer satisfaction and Value for What You Pay • Delivered educational courses, hosted community events, and supported extensive volunteer and tree planting activities • Deployed the Smart Energy and Water (SEW) Enterprise Portal for commercial customers • Received Catalyst grant funding to conduct feasibility study on regional utility worker training program • Funded Shine awards and supported Sustainable Communities partners • Held the 2025 Meet the Buyers & Business Resource Expo to promote local business participation in our operations
Customer Experience There is a risk of not meeting customer expectations.	MH	L	=	
Reputational There is a risk of lost credibly with the community, industry partners, board and/or governmental entities.	MH	M	=	
Inclusive Energy Transition There is a risk under-resourced populations may bear an undue burden of the zero carbon transition.	M	L	=	
Inclusive Economic Development There is a risk Sacramento's regional economy may not thrive or may not benefit all communities equally.	L	L	=	
Customer Affordability There is a risk customers may be unable to reduce their electric energy bill burden.	M	L	=	

Strategic Risk | *Enterprise Risk*	2025 risk rating			2025 mitigation and control accomplishments
	Inherent	Residual	Forecast	
Financial Risk (SD-2; SD-3; SD-11; SD-19) Risk related to our affordable rates	H	MH		• Planned for future risks and market volatility to ensure rate stability for customers by fully funding insurance reserves and stabilization funds • Received $91.7 million investment tax credits for Solano 4 Wind project • Supported our grant strategy, securing funding for our efforts despite shifts in focus for Federal funding • Issued the nation's first green commercial paper by a municipal utility • Received Fitch (AA) and Moody's (Aa2) rating affirmations maintaining low borrowing costs • Reduced costs by consolidating the SMUD Financing Authority (SFA)
Economic Conditions & Financial Management There is a risk of rising costs and unpredictable economic fluctuations.	H	M	=	
Commodity Management There is a risk of increasing volatility in commodity prices or supply.	H	MH	=	
Process & Technology Risk (SD-10; SD-16) Risk related to our operational support systems, processes, and technologies.	H	M		• Deployed a secure Artificial Intelligence (AI) chatbot for employees • Piloted AI tools enhancing customer intelligence, operational support, and quality assurance • Set a strong foundation for the transition to SAP S/4HANA • Managed new supply chain volatility by reviewing contracts and proactively reaching out to suppliers to understand and minimize impacts such as those from tariffs Forecast notes: • Staff anticipates that Technology Systems will increase in the coming year with the implementation of multiple technology upgrade projects, including an enterprise-wide transformational effort SAP S/4HANA
Technology Systems There is a risk that technology systems may not meet the current and future needs of the organization.	H	M	↑	
Data Governance & Privacy There is a risk of data integrity and and/or unauthorized access, disclosure, or misuse of personal or sensitive information.	H	M	↓	
Supply Chain There is a risk of supply chain disruptions and unavailability of resources.	H	M	=	

Strategic Risk | *Enterprise Risk*	2025 risk rating			2025 mitigation and control accomplishments
	Inherent	Residual	Forecast	
Artificial Intelligence (AI) & Emerging Technologies There is a risk of effective integration of Artificial Intelligence into SMUD's business models.	M	L	⬆	• Data Governance & Privacy risk will decrease in the coming year with the completion of our Data Loss Prevention Project • AI & Emerging Technology risk at SMUD is well controlled, but staff anticipates an increase in risk exposure as new and emerging technologies are incorporated into SMUD's existing systems and business models
Our People Risk (SD-8; SD-12) Risk related to building an inclusive, engaged and future-ready workforce	H	L		• Expanded summer internships • Launched new Paid Family Leave and enhanced disability insurance benefits • Updated job descriptions and conducted analysis to align compensation and broader market trends • Enhanced our efforts to ensure a pipeline of talented leaders for now and the future • Launched a new employee recognition platform
Talent Management There is a risk of attracting or retaining talent with the skillsets to meet business needs.	H	L	=	
Employee Experience There is a risk of employee turnover and disengagement.	M	L	=	
Strategic Workforce There is a risk that the skills and talent of the current workforce may not align with future business objectives.	H	L	=	

Attachment B: Risk Benchmarking

Below is a comparison of SMUD's new risk framework to industry benchmarking provided by North Carolina State University (NCSU) and Protiviti in the 2025 & 2035 Executive Perspectives on Top Risks.

Overall, the study found that risks are becoming increasingly interrelated and pose significant challenges to current business models and the ability of modern organizations to be resilient and agile. Energy and utility executives are increasingly concerned that climate-related trends and evolving policies are significantly reshaping the energy and utilities industry, presenting both risks and opportunities. Key worries include the financial impact of transitioning to clean energy resources, costs tied to infrastructure upgrades for grid resiliency tied to wildfire and extreme weather events, and uncertainties stemming from shifting regulatory landscapes.

Nationwide, Executives recognize the need to accelerate decarbonization efforts and grid modernization while managing affordability and reliability for customers. There is also a strong focus on leveraging new technologies and business models to capitalize on emerging opportunities, but concerns remain about supply chain constraints, cybersecurity threats, and the pace of policy changes that could affect long-term planning and investment decisions. Climate change is seen as a driving force requiring adaptable strategies to ensure sustainable, reliable, and cost-effective energy delivery.

NCSU ERM Initiative and Protiviti Top 10 near-term risks, Energy & Utilities, abbreviated and ranked	**SMUD corresponding enterprise risks and residual risk level**	
1. Climate change	Climate Change	MH
2. Regulatory changes and scrutiny	Reliability Compliance	L
3. Catastrophic natural disasters and weather	Grid Resiliency	M
4. Increasing labor costs	Economic Conditions & Financial Management	M
5. Supply Chain	Supply Chain	M
6. Geopolitical shifts, regional conflicts and instability	Supply Chain	M
7. Economic Conditions	Economic Conditions & Financial Management	M
8. Talent and labor availability	Talent Management	L
9. Global markets and trade policies	Supply Chain	M
10. Third-party risks	Third-party	MH

DRAFT

RESOLUTION NO. _____

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

This Board accepts the monitoring report for **Strategic Direction SD-17, Enterprise Risk Management**, substantially in the form set forth in **Attachment ___** hereto and made a part hereof.

SSS No. ET&C 25-048

BOARD AGENDA ITEM
STAFFING SUMMARY SHEET

Committee Meeting & Date
ERCS – 11/19/2025
Board Meeting Date
November 20, 2025

TO		TO	
1.	Jon Olson	6.	Lora Anguay
2.	Bryan Swann	7.	Suresh Kotha
3.	Jennifer Restivo	8.	Frankie McDermott
4.	Scott Martin	9.	**Legal**
5.	Brandy Bolden	10.	**CEO & General Manager**

Consent Calendar	X	**Yes**		**No** *If no, schedule a dry run presentation.*	**Budgeted**	X	**Yes**		**No** *(If no, explain in Cost/Budgeted section.)*

FROM (IPR)	DEPARTMENT	MAIL STOP	EXT.	DATE SENT
Jon Olson	Energy Trading & Contracts	A404	5494	10/24/25

NARRATIVE:

Requested Action:

a. Authorize the Chief Executive Officer and General Manager (CEO/GM), or his designee, to execute an Amended and Restated Power Purchase Agreement (PPA) consisting of two confirmations with Geysers Power Company, LLC for up to 150 MW of geothermal energy, substantially in the form attached.

b. Approve the California Energy Commission (CEC) Emission Performance Standard (EPS) compliance filing and authorize the CEO/GM, or his designee, to sign the compliance filing attestation.

Summary: In 2022, SMUD executed a 100 MW power purchase agreement with Geysers Power Company, LLC, for a term of 10 years (2023-2032). In 2023, SMUD approached Calpine (the parent company of Geysers Power Company, LLC) seeking to extend and increase the energy, capacity, and environmental attributes, including Portfolio Content Category 1 Renewable Energy Credits (PCC1 RECs) from its Geysers project in Lake and Sonoma Counties. The Geysers project currently provides SMUD with 100 MWs of around-the-clock carbon-free baseload geothermal energy (including PCC1 RECs) plus 100 MWs of resource adequacy capacity, which SMUD can export from the California Independent System Operator (CAISO) as firm capacity. The Amended and Restated PPA will increase to 125 MWs in 2028 and to 150 MWs in 2030. The delivery term will extend from December 31, 2032, to December 31, 2042. The 2030 Zero Carbon Plan specifically identifies the need for incorporation of a geothermal resource into the SMUD portfolio.

Senate Bill 1368 (2006) prohibits publicly-owned utilities from entering into covered long-term procurements that do not meet the greenhouse gas EPS adopted by the CEC. CEC regulations provide that power plants that meet the criteria of a renewable electricity generation facility, as defined by the California Renewables Portfolio Standard (RPS) legislation and guidelines, are "determined to be compliant" with the EPS. The Geysers Power Company's geothermal project qualifies for RPS and is therefore determined to be compliant. The EPS regulations require the SMUD Board make a determination whether this prospective covered procurement complies with the EPS by approving the compliance filing and also requires SMUD submit the compliance filing to the CEC within 10 business days following execution of the PPA.

Board Policy: *(Number & Title)* Strategic Direction SD-2, Competitive Rates; Strategic Direction SD-4, Reliability; Strategic Direction SD-7, Environmental Leadership; Strategic Direction SD-9, Resource Planning: This contract provides economic, zero carbon power and will be a key contributor to achieving our 2030 Zero Carbon Plan. Allows access to relatively low cost and carbon-free power generated and delivered to CAISO.

Benefits: SMUD currently receives 876,000 MWh/year of carbon-free energy and PCC1 RECs generated in California as well as 100MWs of firm capacity each hour for resource adequacy. SMUD will receive 1,095,000 MWh/year at 125 MWs and 1,314,000 MWh/year at 150 MWs as well as the increased firm capacity each hour for resource adequacy.

Cost/Budgeted: The current expenses for the project have been included in our financial forecast. The current annual cost is approximately $61.3 million for energy, RECs, and capacity in 2026 and 2027. In 2028 and 2029, the approximate average annual cost will be $96 million. In 2030 through 2042, the approximate average annual cost will be $149 million.

Alternatives:	Rely on other sources for carbon-free energy.
Affected Parties:	Energy Trading & Contracts, Energy Settlements, Resource Strategy, Budget Office, Grid Operations, Treasury, and Commodity Risk Management.
Coordination:	Energy Trading & Contracts and Legal
Presenter:	Jon Olson, Director, Energy Trading & Contracts

Additional Links:

SUBJECT	ITEM NO. *(FOR LEGAL USE ONLY)*
Amended and Restated Calpine Geysers Agreements	**9**

ITEMS SUBMITTED AFTER DEADLINE WILL BE POSTPONED UNTIL NEXT MEETING.

DRAFT

CALPINE

Geysers Power Company, LLC
10350 Socrates Mine Road
Middletown, CA 95416

Final Draft 11/13/2025

AMENDED AND RESTATED
WESTERN SYSTEMS POWER POOL AGREEMENT
CONFIRMATION LETTER (ENERGY)
BETWEEN GEYSERS POWER COMPANY, LLC
AND
SACRAMENTO MUNICIPAL UTILITY DISTRICT

To:	Sacramento Municipal Utility District
Attention:	Energy Trading, MS A404
Email:	powercontractsadmin@smud.org
From:	Geysers Power Company, LLC
Re:	Deal Number:

This Confirmation sets forth the terms and conditions of the transaction between Buyer and Seller, each individually a "Party" and together the "Parties," as of the Effective Date specified below, in which Seller agrees to sell and deliver, and Buyer agrees to purchase and receive, the Product, as such term is defined herein (the "Transaction"). This Transaction is subject to the terms and conditions of the Western Systems Power Pool Agreement (Effective Version: October 21, 2024) together with any and all exhibits, schedules or supplements thereto or incorporated therein by reference, but no further modification unless agreed by the Parties (collectively, the "WSPP Agreement"), as amended and supplemented by this Confirmation. The definitions and provisions contained in the WSPP Agreement and in the tariffs and protocols of the California Independent System Operator ("CAISO"), as amended from time to time ("Tariff"), shall apply to this Confirmation Agreement and are incorporated by reference; provided that, to the extent that this Confirmation Agreement is inconsistent with any provision of the WSPP Agreement, this Confirmation shall govern the rights and obligations of the Parties hereunder. This Confirmation, together with the WSPP Agreement will constitute a single agreement between the Parties with respect to the Transaction. This Confirmation supersedes and replaces any prior oral or written confirmation or agreement, including broker confirmations, regarding this Transaction.

The Parties are currently parties to that certain Western Systems Power Pool Agreement Confirmation Letter Energy) dated March 30, 2022 (the "**Existing Confirmation**") with respect to the purchase and sale of the Product described below, but for a different contract quantity, price and delivery term than are provided for herein. The Parties wish to amend and restate the Existing Confirmation on the terms and conditions set forth herein, effective as of the beginning of the

Delivery Term set forth below. Accordingly, this Confirmation will be binding on the Parties as of the Effective Date, but the Existing Confirmation will continue in effect until 2400 Pacific time on the day prior to the beginning of the Delivery Term set forth below, at which time it will be superseded by this Confirmation and be of no further force or effect.

We confirm the following terms of our Transaction:

Buyer: Sacramento Municipal Utility District

Seller: Geysers Power Company, LLC

Effective Date: [_____], 2025

Delivery Term: **The "Delivery Term" shall be from January 1, 2026 to December 31, 2042, inclusive. Notwithstanding the foregoing, for the sole purpose of matching delivery of Renewable Energy Credits (RECs) with Delivered Energy from the Project, such period will extend through the date that all RECs associated with such energy have been delivered from Seller to Buyer in accordance with this Confirmation.**

Product: "Product" means Delivered Energy on an hourly basis which meets the criteria for Section 399.16(b)(1)(A) of the California Public Utilities Code, comprised of: (1) energy, (2) RECs generated by the Project and transferred by Seller through a WREGIS Certificate to Buyer under this Confirmation, and (3) all Green Attributes associated with the renewable energy delivered to Buyer as part of this Confirmation. To the extent not inconsistent with the foregoing, the Product is a Resource Contingent Bundled REC as such is described under Section R-2.3.4 of WSPP Service Schedule R. The Product does not include any other non-renewable and non-environmental attributes (e.g., ancillary services or resource adequacy capacity). Buyer may use the Product for any RPS, voluntary programs, or any other purpose.

Project: The term "Project" means one or more of the geothermal power plants owned or controlled by Seller and located in Lake and Sonoma Counties, California that will be used to provide the Contract Quantity. Due to the portfolio nature of the Geysers, Buyer acknowledges that Seller is making sales and deliveries from the Project to other purchasers. **Exhibit A** identifies each of the plants as of the Effective Date. Following the Effective Date, Seller may add or remove generating facilities to Exhibit A with prior written notice to Buyer, and any added plants will thereafter be considered part of the Project for all purposes under this Confirmation, provided that each facility added is a geothermal power plant certified by the CEC as an ERR and meets the RPS compliance requirements for PCC 1; provided, that, to the extent that addition of the generating facility(ies) was not approved by the CEC prior to delivery, delivery of Product from the added generating facility(ies) is conditioned on the CEC making a final decision pursuant to the California Code of Regulations, Title 20, Section

2910 that the covered procurement complies with EPS, and, in the event the CEC makes a final decision that the added generating facility(ies) does not comply with the EPS, the change to Exhibit A shall be void and all pending Product deliveries from such added generating facility(ies) shall be terminated no later than the effective date of the CEC's decision; provided, further, that Buyer's consent shall be required to remove generating facilities from Exhibit A for reasons other than repair, mothballing, decommissioning, Uncontrollable Forces, or the sale of such facility.

Delivery Point: "Delivery Point" means NP 15 EZ Gen Hub.

Meter Data: To provide evidence of Delivered Energy, in connection with submission of its monthly invoice and upon the request of Buyer, Seller shall provide to Buyer records of metered data, including CAISO metering and transaction data sufficient to document and verify the generation and delivery of the Delivered Energy by the Project (and upon Buyer's reasonable request access to any records, including invoices or settlement data from the CAISO, necessary to verify the invoice).

Payment: For each MWh of Delivered Energy in accordance with this Confirmation, not to exceed the Contract Quantity, Buyer shall pay Seller the Contract Price, which has no escalation during the Delivery Term. "Contract Price" is as follows:

Contract Years	Price ($/MWh)
2026 - 2027	[redacted]
2028	
2029	
2030	
2031	
2032 - 2042	

Contract Quantity:

Contract Years	Contract Quantity
2026 - 2027	**100 MW delivered each hour on a 7x24 hour schedule**
2028 -2029	**125 MW delivered each hour on a 7x24 hour schedule**
2030 - 2042	**150 MW delivered each hour on a 7x24 hour schedule**

Renewable Energy

Credit Certificates: To provide evidence of Green Attributes, Seller shall transfer to Buyer the RECs to Buyer's WREGIS account(s) within fifteen (15) Business Days after WREGIS creates certificates from each month's meter data (approximately four months after flow under current WREGIS operating conditions). If Buyer's WREGIS account ID is not available as of the start of the Delivery Term, Buyer will provide it to Seller promptly once Buyer receives the WREGIS account ID. REC deliveries will be made by transfer of WREGIS Certificates to Buyer's WREGIS account pursuant to WREGIS Operating Rules. Seller shall, at its option, transfer the WREGIS Certificate using forward certificated transfer or any other transfer permitted under the WREGIS Operating Rules. With respect to REC deliveries, Product flow shall be considered the month in which the WREGIS Certificates are created by WREGIS under current operating conditions.

Scheduling and CAISO Revenues: Seller shall provide (or cause to be provided) all Scheduling Coordinator services for the Project (and all units constituting the Project) and for delivery of Product to the Delivery Point. Buyer shall provide (or cause to be provided) all Scheduling Coordinator services for Product at and from the Delivery Point. The Parties will purchase and sell the Contract Quantity of Product through Inter-SC Trades scheduled on a Day-Ahead basis at the NP15 EZ Gen Hub in compliance with the CAISO Tariff. As between Buyer and Seller, Seller shall be responsible for all CAISO costs (including penalties and other charges) and shall be entitled to all CAISO revenues (including credits and payments) associated with the Project and the delivery of Product to the Delivery Point.

ADDITIONAL TERMS:

a) Seller, and, if applicable, its successors, represents and warrants that throughout the Delivery Term of this Agreement that: (i) the Project qualifies and is certified by the CEC as an ERR; and (ii) the Project's output delivered to Buyer qualifies under the requirements of the California Renewables Portfolio Standard. To the extent a Change in Law occurs after execution of this Agreement that causes this representation and warranty to be materially false or misleading, it shall not be an Event of Default if Seller has used commercially reasonable efforts to comply with such Change in Law.

b) Seller shall agree to reasonably assist Buyer with Buyer's California Renewables Portfolio Standard Program compliance filings as requested by Buyer. In connection with the foregoing, neither Seller nor its affiliates shall be required to (i) expend or incur any legal costs (either internal or external) in providing such assistance or (ii) prepare or defend a filing or otherwise advocate on behalf of Buyer.

c) This Agreement and the rights and duties of the Parties hereunder shall be governed by and construed, enforced and performed in accordance with the laws of the state of California, without regard to principles of conflicts of Law.

d) Seller shall, at its sole cost and expense, take all actions and execute all documents or

instruments necessary to ensure that the RECs sold hereunder can be transferred to Buyer utilizing WREGIS. Seller shall comply with all laws, including, without limitation, the WREGIS Operating Rules effective as of the date of this Confirmation regarding the certification and transfer of RECs sold hereunder to Buyer. During the Delivery Term, Seller shall have in-place, or shall submit documentation to establish, an account with WREGIS. Seller shall transfer RECs to Buyer in accordance with WREGIS reporting protocols and WREGIS Operating Rules. Seller shall be responsible for all customary expenses associated with WREGIS Certificate issuance fees and utilizing WREGIS to transfer the RECs to Buyer, or its designee, except for any costs incurred by Buyer with respect to Buyer's registration with WREGIS and Buyer's WREGIS account.

e) Seller hereby provides and conveys all Green Attributes associated with the electricity generation from the Project delivered to Buyer as part of the Product. Seller represents and warrants that Seller holds the rights to all such Green Attributes, and Seller agrees to convey and hereby conveys all such Green Attributes to Buyer as included in the delivery of the Product from the Project.

f) Because WREGIS Certificates will only be created for whole MWh amounts of output generated, any fractional MWh amounts will be carried forward during the Delivery Term until sufficient generation is accumulated for the creation of a WREGIS Certificate.

g) Seller shall be responsible, at its sole expense, for validating, adjusting, and disputing data with WREGIS so that the data from the Project's meter(s) corresponds with the quantity of RECs conveyed hereunder. Upon request Seller shall provide Buyer with copies of all correspondence or documentation to or from WREGIS with respect to any such validation, adjustment, or dispute.

h) Without limiting Seller's obligations, if a WREGIS Certificate deficit is caused solely by an error or omission of WREGIS or the California Independent System Operator, the Parties shall cooperate in good faith to cause WREGIS to correct its error or omission. If WREGIS changes the WREGIS Operating Rules after the Effective Date or applies the WREGIS Operating Rules in a manner inconsistent with this Confirmation, the Parties promptly shall modify this Agreement as reasonably required to preserve the intended economic benefits of this transaction for both Parties, and so cause and enable Seller to transfer to Buyer's WREGIS Account the RECs sold to Buyer hereunder.

i) Seller and, if applicable, its successors, represents and warrants that throughout the Delivery Term of this Agreement the RECs transferred to Buyer conform to the definition and attributes required for compliance with the California Renewables Portfolio Standard, as set forth in California Public Utilities Commission Decision 08-08-028, and as may be modified by subsequent decision(s) of the California Public Utilities Commission or by subsequent legislation. To the extent a Change in Law occurs after execution of this Agreement that causes this representation and warranty to be materially false or misleading, it shall not be an Event of Default if Seller has used commercially reasonable efforts to comply with such Change in Law.

j) Seller warrants that all necessary steps to allow the RECs transferred to Buyer to be tracked in the Western Renewable Energy Generation Information System will be taken prior to

the first delivery under the contract.

k) Notwithstanding anything else in this Confirmation, and subject to Seller's obligations under this Confirmation, Buyer acknowledges and agrees that the sale of energy and RECs by Seller from the Project is nonexclusive.

l) Confidentiality: Seller acknowledges that Buyer is a public agency subject to the requirements of the California Public Records Act (Cal. Gov. Code, Section 7920.000 et seq.).

m) Change in Law: Seller shall make commercially reasonable efforts to comply with Changes in Law in the California RPS, provided that Seller shall not be required to incur costs greater than an aggregate amount of $750,000 during the entire Delivery Term (the "Capped Amount"). The Parties acknowledge and agree that any such Change in Law shall not (i) entitle Buyer to a change in the Contract Price or Payment terms, (ii) result in any change to the Contract Quantity, (iii) give either Party the right to terminate this Agreement, or (iv) allow for the severability of any provisions of this Confirmation pursuant to the WSPP Agreement. This provision shall not apply to any Product that was Delivered and Accepted prior to any Change in Law if such Product complies with the California RPS.

n) Seller Credit Requirements: Concurrently with the execution of this Confirmation, Seller and Buyer are entering into that certain Amended and Restated Non-RA Export Capacity Transaction Confirmation of even date herewith (the "A&R Non-RA Export Capacity Confirmation"). Seller shall post and maintain from time to time security in the amounts and for the periods set forth on **Schedule 1** to secure its obligations under both this Confirmation and the A&R Non-RA Export Capacity Confirmation; provided that Buyer may only draw on such security pursuant to this Confirmation to recover damages payable under this Confirmation; and provided further that, for the avoidance of doubt, Seller shall not be required to simultaneously post and maintain duplicative security under both the Existing Confirmation and this Confirmation. If the A&R Non-RA Export Capacity Confirmation is terminated for any reason, but this Confirmation continues in force, the amounts on **Schedule 1** will be reduced to reflect the proportionate reduction in Buyer's overall exposure as a result of the termination of the A&R Non-RA Export Capacity Confirmation, and the Parties will amend and replace **Schedule 1** to reflect this reduction within thirty (30) days after termination of the A&R Non-RA Export Capacity Confirmation. Such security may be provided in cash or by a letter of credit in substantially the form attached hereto as **Exhibit D**. On the date(s) when the required amount of such security is reduced as set forth on **Schedule 1** (as may be amended from time to time in accordance with the terms of this Confirmation), if the security has been provided in cash, Buyer shall return any cash security that it holds in excess of the required amount, and if the security has been provided in the form of a letter of credit, Buyer will cooperate with Seller in substituting a revised letter of credit in the appropriate amount for the one held by Buyer. Once Seller has achieved an Investment Grade Rating, or if its obligations are guaranteed by an entity with an Investment Grade Rating, Seller shall no longer be required to post security under the Existing Confirmation, this Confirmation or the A&R Non-RA Export Capacity Confirmation. Buyer shall return any cash or letters of credit held as security thereunder or hereunder to Seller within 30 days after written notice from Seller

that it has achieved an Investment Grade Rating or Buyer's receipt of a guaranty of Seller's obligations by an entity with an Investment Grade Rating, as applicable.

o) Buyer Credit Requirements. As long as Buyer maintains an Investment Grade Rating, Buyer will not be required to provide security for the performance of its obligations hereunder and under the A&R Non-RA Export Capacity Confirmation. If Buyer ceases to maintain an Investment Grade Rating, Buyer will promptly provide Seller notice thereof and will, within 30 days after ceasing to maintain an Investment Grade Rating, post and thereafter maintain from time to time security in the amounts and for the periods set forth on **Schedule 1** (as amended, if applicable) to secure its obligations under both this Confirmation and the A&R Non-RA Export Capacity Confirmation; provided that Seller may only draw on such security pursuant to this Confirmation to recover damages payable under this Confirmation. Such security may be provided in cash or by a letter of credit in substantially the form attached hereto as **Exhibit D** (with such changes as are necessary for a letter of credit to be delivered by Buyer to Seller). On the date(s) when the required amount of such security is reduced to the extent applicable as set forth on **Schedule 1** (as may be amended from time to time in accordance with the terms of this Confirmation), if the security has been provided in cash, Seller shall return any cash security that it holds in excess of the required amount, and if the security has been provided in the form of a letter of credit, Seller will cooperate with Buyer in substituting a revised letter of credit in the appropriate amount for the one held by Seller. If Buyer subsequently regains an Investment Grade Rating, Buyer shall not be required to post security under this Confirmation. Seller shall return any cash or letters of credit held as security hereunder to Buyer within 30 days after written notice from Buyer that it has achieved an Investment Grade Rating.

p) Buyer Limited Assignment Right: Notwithstanding anything to the contrary in Section 14 of the Master Agreement, the Buyer may from time to time assign the right to receive all or a portion of the Delivered Energy that would otherwise be delivered to Buyer hereunder. In connection with any such assignment, Buyer and Seller agree to negotiate in good faith the execution of the limited assignment agreement attached hereto as **Exhibit B**. For the avoidance of doubt, any limited assignment will not affect Seller or Buyer's rights or responsibilities under this Agreement except to the extent set forth in the limited assignment, and Buyer will remain responsible for all its obligations under this Agreement related to such assignment, including (i) the obligation to pay for such Delivered Energy to the extent the assignee thereof does not do so, and (ii) any damages associated with such assignee's failure to take any such Delivered Energy.

q) Seller Permitted Assignment: Notwithstanding anything to the contrary in Section 14 of the Master Agreement, Seller may, without the prior written consent of Buyer, transfer or assign this Agreement to a Qualified Transferee. A Qualified Transferee is : (1) any affiliate of Seller, or (2) any person succeeding to all or substantially all of the assets of Seller (whether voluntary or by operation of law) that (i) for the three (3) preceding years, has owned or operated (or had access to the expertise required to operate through committed management agreements with its affiliates at least 100MWs of renewable energy generation facilities and (ii) either itself or its direct or indirect parent, has (x) a tangible net worth of at least $50,000,000 or (y) a credit rating of "BB-" or higher by S&P or "Ba3" or higher by Moody's; provided that Seller shall provide at least fifteen (15) Business Days notice to Buyer prior to any such transfer or assignment, Seller shall not be relieved of its

obligations under the Agreement prior to the effective date of the transfer or assignment, and Seller's assignee shall agree in writing to assume all of Seller's obligations and liabilities under this Agreement.

r) Seller Collateral Assignment: Seller may also assign this Agreement as collateral for any financing or refinancing of the Facility. In connection with any financing or refinancing of the Facility by Seller, Buyer shall in good faith work with Seller and its lender to execute a consent to collateral assignment of this Agreement substantially in the form attached hereto as **Exhibit C**.

s) Governing Law. Notwithstanding anything in the WSPP Agreement, including Section 24 thereof, to the contrary, the Agreement shall be governed by the laws of the State of California (without reference to conflict of laws rules that would apply the law of another jurisdiction).

t) Counterparts. This Confirmation may be signed in any number of counterparts with the same effect as if the signatures to the counterparts were upon a single instrument. The Parties may rely on electronic, or scanned signatures as originals under this Confirmation. Delivery of an executed signature page of this Confirmation by electronic mail transmission (including PDF) shall be the same as delivery of a manually executed signature page.

u) Emission Performance Standard. This Agreement is a "covered procurement" under the CEC's EPS and Buyer shall make the required compliance filing with the CEC within 10 Business Days of the Effective Date. The Parties agree that this Agreement shall be void and all pending Product deliveries terminated no later than the effective date of any final decision by the CEC pursuant to the California Code of Regulations, Title 20, Section 2910 that the covered procurement fails to comply with EPS. The Parties acknowledge that the Project is "determined to be compliant" pursuant to 20 CCR §§ 2903(b)(1) or (2).

v) WSPP Agreement Amendments**.** For this Transaction, the WSPP Agreement shall be amended as follows:

1. Section 21.1 of the WSPP Agreement is amended by deleting "other direct" in the ninth line thereof. The Parties also agree that the waiver on the fifth line of that section does not apply to any damages or other remedies expressly provided for in this Confirmation.

2. Section 21.3(a) of the WSPP Agreement is modified by (i) deleting the words "as follows" in the sixth line of the first sentence thereof and substituting the phrase "as set forth in the applicable Confirmation", (ii) deleting subsections (1), (2) and (3) thereof, (iii) deleting the phrase "and the Contract Price of the Confirmation to which the non-performed transaction is identified, and the Contract Quantity of the non-performed transaction, shall be applied to the calculation of amounts due under Section 21.3(a)(1) through (3), as applicable" at the end of the first paragraph of subsection (5) thereof and substituting the phrase "and damages shall be calculated in accordance with the applicable Confirmations", and (iv) deleting the balance of subsection (5) after the first two paragraphs thereof.

3. Section 21.3(d) of the WSPP Agreement is modified by (i) changing "the full amount of damages" on the second and third lines to "the undisputed amount of damages", and (ii) deleting the second sentence thereof.

4. Section 22.1 of the WSPP Agreement is modified by deleting subsection (d) and replacing it with [intentionally omitted]" and by inserting the following new text at the end thereof:

"(f) the failure of the Defaulting Party to perform any material covenant or obligation set forth in this Agreement (except to the extent constituting a separate Event of Default, and except for such Party's obligations to deliver or receive the quantities of Product due under this Agreement, the exclusive remedy for which is provided in Section 21.3) if such failure is not remedied within thirty (30) days after written notice;

(g) the termination of the A&R Non-RA Export Capacity Confirmation as the result of a default by the Defaulting Party thereunder;

(h) the failure of the Defaulting Party to pay its debts generally as they become due or the Defaulting Party's admission in a writing that is unable to generally pay its debts as they become due;

(i) the institution, by the Defaulting Party, of a general assignment for the benefit of its creditors; or

(j) the application for, consent to, or acquiescence to, by the Defaulting Party, the appointment of a receiver, custodian, trustee, liquidator, or similar official for all or a substantial portion of its assets."

5. Section 22.2(b) of the WSPP Agreement is amended by (i) inserting in Section 22.2, "and is continuing" after "Event of Default occurs" in the first line of the first paragraph thereof, (ii)deleting the second sentence in the first paragraph thereof, and (iii) deleting the second paragraph thereof in its entirety.

6. Section 22.3 of the WSPP Agreement is amended by:

   (a) In Section 22.3(b), replacing the second sentence thereof with "The "Present Value Rate" shall mean an annual rate equal to the "prime rate" as published in the Wall Street Journal from to time plus 2%.";

   (b) In Section 22.3(c), deleting the third sentence thereof and replacing it with the following: "If the Non-Defaulting Party's aggregate Gains exceed its aggregate Losses and Costs, if any, resulting from the termination of this Agreement or a Confirmation, the Termination Payment for all such Terminated Transactions shall be zero, notwithstanding any provision in this Section or Agreement to the contrary."

   (c) In Section 22.3(e), delete the entire provision (including subsections) and replace it with the following: "[Intentionally omitted]"

(d) In Section 22.3(f), delete the entire provision and replace it with the following:

"If the Defaulting Party disagrees with the calculation of the Termination Payment and the Parties cannot otherwise resolve their differences, and provided that Defaulting Party has paid the undisputed part of the Termination Payment to the Non-Defaulting Party as provided under Section 22.3(c), and that any amounts disputed by the Defaulting Party are disputed in good faith, then the Defaulting Party may submit the calculation issue to Dispute Resolution pursuant to Section 34."

7. Section 24 of the WSPP Agreement is amended by deleting "Utah" in the second line thereof and replacing it with "California".

8. Section 27 of the WSPP Agreement is deleted in its entirety and replaced with "[intentionally omitted]".

9. The netting provisions of Section 28, NETTING, of the WSPP Agreement shall apply to the transaction covered by this Confirmation as if Buyer and Seller had both executed Exhibit A, NETTING, to the WSPP Agreement. Both Parties intend for the netting provisions of Exhibit A to the WSPP Agreement to be effective on the first day of the Delivery Term.

10. Section 30.1 of the WSPP Agreement is amended by inserting "or requested" after the word "required" in Section 30.1(4), by deleting "or" immediately before clause (7), and by adding the following at the end of the first sentence: "; or (8) to the Party's and such Party's affiliates' lenders and potential lenders, investors or potential investors, counsel, accountants, advisors and agents who have a need to know such information and have agreed to keep such terms confidential".

11. Section 31 of the WSPP Agreement is amended by deleting the second sentence thereof.

12. The second and third sentences of Section 32.5 of the WSPP Agreement are deleted.

13. Sections 34.1 and 34.2 of the WSPP Agreement are hereby deleted and replaced with the following:

"34.1 INFORMAL DISPUTE RESOLUTION

IN THE EVENT OF ANY DISPUTE ARISING UNDER THIS TRANSACTION, WITHIN TEN (10) DAYS FOLLOWING THE RECEIPT OF A WRITTEN NOTICE FROM EITHER PARTY IDENTIFYING SUCH DISPUTE, THE PARTIES SHALL MEET, NEGOTIATE AND ATTEMPT, IN GOOD FAITH, TO RESOLVE THE DISPUTE QUICKLY, INFORMALLY AND INEXPENSIVELY. IF THE PARTIES ARE UNABLE TO RESOLVE A DISPUTE ARISING HEREUNDER WITHIN THIRTY (30) DAYS AFTER RECEIPT OF SUCH NOTICE, THEN EITHER PARTY MAY SEEK ANY AND

ALL REMEDIES AVAILABLE TO IT AT LAW OR IN EQUITY, SUBJECT TO THE LIMITATIONS SET FORTH IN THIS TRANSACTION."

"34.2 EXCLUSIVE JURISDICTION

EACH PARTY SUBMITS TO THE EXCLUSIVE JURISDICTION OF THE STATE OR FEDERAL COURTS LOCATED IN SAN FRANCISCO, CALIFORNIA, FOR ANY ACTION OR PROCEEDING RELATING TO THIS AGREEMENT OR ANY TRANSACTION, AND EXPRESSLY WAIVES ANY OBJECTION IT MAY HAVE TO SUCH JURISDICTION OR THE CONVENIENCE OF SUCH FORUM."

14. The phrase "arbitration or" is hereby deleted from the first line of Section 34.4.

15. The following shall be inserted as a new Section 34.5:

"34.5 LIMITATION OF DAMAGES. FOR BREACH OF ANY PROVISION OF THIS CONFIRMATION AGREEMENT FOR WHICH AN EXPRESS REMEDY OR MEASURE OF DAMAGES IS PROVIDED, THE EXPRESS REMEDY OR MEASURE OF DAMAGES PROVIDED IS THE SOLE AND EXCLUSIVE REMEDY UNDER THIS AGREEMENT AND ALL OTHER REMEDIES FOR DAMAGES AT LAW OR IN EQUITY ARE WAIVED. IF NO EXPRESS REMEDY OR MEASURE OF DAMAGES IS PROVIDED IN THIS AGREEMENT FOR A PARTICULAR BREACH, LIABILITY FOR THE BREACH IS LIMITED TO DIRECT DAMAGES ONLY, WHICH SHALL BE THE SOLE AND EXCLUSIVE REMEDY UNDER THIS AGREEMENT FOR SUCH BREACH, AND ALL OTHER REMEDIES FOR DAMAGES AT LAW OR IN EQUITY ARE WAIVED. NEITHER PARTY IS LIABLE FOR ANY OTHER TYPE OF DAMAGE, INCLUDING INCIDENTAL, PUNITIVE, EXEMPLARY, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES OF ANY NATURE (INCLUDING DAMAGES ASSOCIATED WITH LOST PROFITS, BUSINESS INTERRUPTION AND LOSS OF GOODWILL) ARISING AT ANY TIME, WHETHER IN TORT (INCLUDING THE SOLE OR CONTRIBUTORY NEGLIGENCE OF EITHER PARTY OR ANY RELATED PERSON), WARRANTY, STRICT LIABILITY, CONTRACT OR STATUTE, UNDER ANY INDEMNITY PROVISION, OR OTHERWISE; PROVIDED, HOWEVER, THAT THE FOREGOING SHALL NOT LIMIT EITHER PARTY'S RIGHT TO RECOVER DAMAGES UNDER EXPRESS INDEMNITY PROVISIONS SET FORTH IN THE CONFIRMATION."

16. Section 37 of the WSPP Agreement is amended by inserting the following in the beginning of the section: "On the date of entering into this Confirmation,".

17. Section 41 "Witness" of the WSPP Agreement is renumbered Section 42 and the following new Section 41 entitled "Standard of Review" shall be inserted between Sections 40 and 42:

41. STANDARD OF REVIEW

The Parties agree as follows:

41.1 Absent the agreement of all Parties to the proposed change, the standard of review for changes to any section of this Agreement (including all Transactions and/or Confirmations) specifying the rate(s) or other material economic terms and conditions agreed to by the Parties herein, whether proposed by a Party, a non-party or FERC acting sua sponte, shall be the "public interest" standard of review set forth in *United Gas Pipe Line Co. v. Mobile Gas Service Corp.*, 350 U.S. 332 (1956) and *Federal Power Commission v. Sierra Pacific Power Co*., 350 U.S. 348 (1956)(the "Mobile-Sierra" doctrine) and clarified in *Morgan Stanley Capital Group, Inc. v. Public Util. Dist. No. 1 of Snohomish* 554 U.S. 527 (2008) and *NRG Power Marketing LLC v. Maine Pub. Util. Comm'n*, 558 U.S. 165 (2010).

41.2 The Parties, for themselves and their successors and assigns, (i) agree that this "public interest" standard shall apply to any proposed changes in any other documents, instruments or other agreements executed or entered into by the Parties in connection with this Agreement and (ii) hereby expressly and irrevocably waive any rights they can or may have to the application of any other standard of review, including the "just and reasonable" standard.

ADDITIONAL DEFINITIONS:

"A&R Non-RA Export Capacity Confirmation" has the meaning defined in Section (n) of the "Additional Terms" above.

"Agreement" or "agreement" has the meaning specified in the introductory paragraph hereof.

"CAISO" means the California Independent System Operator Corporation or any successor entity performing similar functions.

"CAISO Grid" means the system of transmission lines and associated facilities of the Participating Transmission Owner that have been placed under the CAISO's operational control.

"CAISO Tariff" means the CAISO Operating Agreement and Tariff, including the rules, protocols, procedures and standards attached thereto, as it may be amended, modified, supplemented or replaced (in whole or in part) from time to time.

"California Renewables Portfolio Standard" or "RPS" means the renewable energy program and policies established by California State Senate Bills 1038 (Statutes of 2002) and 1078 (Statutes of 2002) as amended and codified in California Public Utilities Code Sections 399.11 through 399.31 and California Public Resources Code Sections 25740 through 25751, as such provisions are amended or supplemented from time to time and as defined by the CEC RPS Eligibility Guidebook, as those obligations may be amended or supplemented from time to time or otherwise consistent with applicable regulations promulgated by the CEC.

"CEC" means the California Energy Commission, or any successor entity.

"CPUC" means the California Public Utilities Commission, or any successor entity.

"Credit Rating" means, with respect to Seller, the rating on its senior secured long-term debt obligations by S&P or Moody's. If Seller is rated by both S&P and Moody's, and the Credit Ratings are not equivalent, the lower Credit Rating shall govern.

"Delivered Energy" means energy generated and metered from the Project with associated Green Attributes that is scheduled in accordance with this Confirmation.

"Eligible Renewable Energy Resource" or "ERR" means an Eligible Renewable Energy Resource as defined in California Public Utilities Code Section 399.12 or 399.16, as may be amended or supplemented from time to time, as such provisions are supplemented or interpreted by the CEC Renewables Portfolio Standard Eligibility Guidebook, as may be amended or supplemented from time to time.

"Emission Performance Standard" or "EPS" means the requirements set-forth in California Code of Regulations (CCR) Title 20, Chapter 11, Article 1, Section 2900 et seq.

"Green Attributes" means any and all credits, benefits, emissions reductions, offsets, and allowances, howsoever entitled, attributable to the generation from the Project, and its avoided emission of pollutants. Green Attributes include but are not limited to RECs, as well as: (1) any avoided emission of pollutants to the air, soil or water such as sulfur oxides (Sox), nitrogen oxides (Nox), carbon monoxide (CO) and other pollutants; (2) any avoided emissions of carbon dioxide (CO2), methane (CH4), nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride and other greenhouse gases (GHGs) that have been determined by the United Nations Intergovernmental Panel on Climate Change, or otherwise by law, to contribute to the actual or potential threat of altering the Earth's climate by trapping heat in the atmosphere; (3) the reporting rights to these avoided emissions, such as Green Tag Reporting Rights. Green Tag Reporting Rights are the right of a Green Tag Purchaser to report the ownership of accumulated Green Tags in compliance with federal or state law, if applicable, and to a federal or state agency or any other party at the Green Tag Purchaser's discretion, and include without limitation those Green Tag Reporting Rights accruing under Section 1605(b) of The Energy Policy Act of 1992 and any present or future federal, state, or local law, regulation or bill, and international or foreign emissions trading program. Green Tags are accumulated on a MWh basis and one Green Tag represents the Green Attributes associated with one (1) MWh of Energy. Green Attributes do not include (i) any energy, capacity, reliability or other power attributes from the Project, (ii) production tax credits associated with the construction or operation of the Project and other financial incentives in the form of credits, reductions, or allowances associated with the project that are applicable to a state or federal income taxation obligation, (iii) fuel-related subsidies or "tipping fees" that may be paid to Seller to accept certain fuels, or local subsidies received by the generator for the destruction of particular preexisting pollutants or the promotion of local environmental benefits, or (iv) emission reduction credits encumbered or used by the Project for compliance with local, state, or federal operating and/or air quality permits.

"Green Tag Purchaser" means Buyer.

"Investment Grade Rating" means a rating of BBB- or better from S&P or a rating of Baa3 or better from Moody's.

"Locational Marginal Price" has the meaning specified in the CAISO Tariff.

"Moody's" means Moody's Investors Service, Inc. or its successor.

"NERC" means the North American Electric Reliability Corporation.

"NP15 EZ Gen Hub" has the meaning specified in the CAISO Tariff.

"Participating Transmission Owner" means Pacific Gas and Electric Company in its capacity as the owner of certain transmission facilities placed under the operational control of the CAISO pursuant to the terms of the CAISO Tariff.

"Portfolio Content Category 1" or "PCC1" means renewable energy comprised of energy and Green Attributes meeting the criteria defined by the CEC Renewables Portfolio Standard Eligibility Guidebook, for Portfolio Content Category 1, as may be amended or supplemented from time to time, and meeting any applicable regulations promulgated by the CEC.

"Renewable Energy Credit" or "REC" has the meaning set forth in the California Public Utilities Code Section 399.12, as may be amended or supplemented from time to time or as further supplemented by applicable law, is evidenced by a WREGIS Certificate, and is equivalent to one (1) MWh of energy from the Project which shall be qualified and certified as an ERR.

"S&P" means S&P Global Ratings (a subsidiary of S&P Global, Inc.), or its successor.

"Scheduling Coordinator" means an entity certified by CAISO as qualifying as a Scheduling Coordinator pursuant to the CAISO Tariff for the purposes of undertaking the functions specified in "Responsibilities of a Scheduling Coordinator," of the CAISO Tariff, as amended from time to time.

"WREGIS" means Western Renewable Energy Generating Information System.

"WREGIS Certificate" has the same meaning as "Certificate" as defined by WREGIS in the WREGIS Operating Rules and are designated by applicable law as eligible for complying with the California Renewables Portfolio Standard.

"WREGIS Operating Rules" means the operating rules and requirements adopted by WREGIS, as amended from time to time.

[*SIGNATURE PAGE FOLLOWS*]

ACKNOWLEDGED AND AGREED TO AS OF THE EFFECTIVE DATE:

Geysers Power Company, LLC	**Sacramento Municipal Utility District**
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____

SCHEDULE 1

Amount of Required Security

Period	Amount
1/1/2026 - 12/31/2027	$5,000,000
1/1/2028 – 12/31/2029	$6,250,000
1/1/2030 – 12/31/2039	$7,500,000
1/1/2040 – 12/31/2042	$5,000,000

EXHIBIT A

Project Information

Name of Facility	CEC RPS ID
Aidlin Power Plant	60115A
Sonoma Power Plant	60010A
Geysers Units 5&6	60002A
Geysers Units 7&8	60003A
Geysers Unit 11	60025A
Geysers Unit 12	60004A
Geysers Unit 13	60005A
Geysers Unit 14	60026A
Geysers Unit 16	60006A
Geysers Unit 17	60007A
Geysers Unit 18	60008A
Calistoga Power Plant	60117A
Geysers Unit 20	60009A

EXHIBIT B

Form of Limited Assignment Agreement

This Limited Assignment Agreement (this "**Assignment Agreement**" or "**Agreement**") is entered into as of [____], 20__ by and among [____], a [____] ("**PPA Seller**"), [Participant], a [____] ("**PPA Buyer**"), and [Assignee], and relates to that certain power purchase agreement (the "**PPA**") between PPA Buyer and PPA Seller as described on Appendix 1. Unless the context otherwise specifies or requires, capitalized terms used but not defined in this Agreement have the meanings set forth in the PPA. To the extent there is any inconsistency between this Assignment Agreement and the PPA, the terms of the PPA shall prevail.

In consideration of the premises above and the mutual covenants and agreements herein set forth, PPA Seller, PPA Buyer and [Assignee] (the "**Parties**" hereto; each is a "**Party**") agree as follows:

1. Limited Assignment and Delegation.

(a) PPA Buyer hereby assigns, transfers and conveys to [Assignee] all right, title and interest in and to the rights of the Delivered Energy under the PPA described on Appendix 1 (the "**Assigned Products**") during the Assignment Period (as defined in Appendix 1), as such rights may be limited or further described in the "Further Information" section on Appendix 1 (the "**Assigned Product Rights**"). All Assigned Products shall be delivered pursuant to the terms and conditions of this Agreement during the Assignment Period as provided in Appendix 1. All other rights of PPA Buyer under the PPA are expressly reserved for PPA Buyer.

(b) PPA Buyer hereby delegates to [Assignee] the obligation to pay for all Assigned Products that are actually delivered to [Assignee] pursuant to the Assigned Product Rights during the Assignment Period (the "**Delivered Product Payment Obligation**" and together with the Assigned Product Rights, collectively the "**Assigned Rights and Obligations**"). All other obligations of PPA Buyer under the PPA are expressly retained by PPA Buyer. To the extent [Assignee] fails to pay for any Assigned Products by the due date for payment set forth in the PPA, PPA Buyer agrees that it will remain jointly and severally responsible as primary obligor (and not as surety) for such payment within five (5) Business Days (as defined in the PPA) of receiving notice of such non-payment from PPA Seller and that, regardless of receiving such notice, it will indemnify and hold PPA Seller harmless from and against all losses, costs, damages, liabilities and expenses of any kind as a result of or arising from assignment, transfer, conveyance and delegation described in clauses (a) and (b) of this paragraph 1, the failure of [Assignee] to make any such payment in respect of Delivered Product Payment Obligation as and when due under the PPA (and disregarding the effects of any stay or other suspension rights, including without limitation under sections 362 or 365 of the Bankruptcy Code or similar laws), whether due to bankruptcy, insolvency or any other cause.

(c) [Assignee] hereby accepts and PPA Seller hereby consents and agrees to the assignment, transfer, conveyance and delegation described in clauses (a) and (b) above.

(d) All scheduling of Assigned Products and other communications related to the PPA shall take place between PPA Buyer and PPA Seller pursuant to the terms of the PPA; provided that (i) title to Assigned Product will pass from PPA Seller to [Assignee] upon delivery by PPA Seller of Assigned Product in accordance with the PPA; (ii) PPA Buyer is hereby authorized by [Assignee] to and shall act as [Assignee]'s agent with regard to scheduling Assigned Product; (iii) PPA Buyer will promptly provide copies to [Assignee] of any Notice (as defined in the PPA) that PPA Buyer sends or receives pursuant to the PPA; (iv) PPA Seller will provide copies to [Assignee] of all invoices and supporting data provided to PPA Buyer pursuant to the PPA (provided that failure to provide such copies shall not excuse the performance of any other Party hereunder so long as in the case of [Assignee], it has received notices of any payments required to be made by it hereunder); and (v) PPA Buyer and PPA Seller, as applicable, will provide copies to [Assignee] of any other information reasonably requested by [Assignee] relating to Assigned Products (provided that failure of PPA Seller to provide such information shall not excuse the performance of any other Party hereunder).

(e) [PPA Seller acknowledges that (i) [Assignee] intends to immediately transfer title to any Assigned Products received from PPA Seller through one or more intermediaries such that all Assigned Products will be re-delivered to PPA Buyer, and (ii) [Assignee] owns or has the right to purchase receivables due from PPA Buyer for any such Assigned Products. To the extent [Assignee] owns or purchases any valid, lien-free receivables due from PPA Buyer for Assigned Product, [Assignee] may transfer good, marketable and lien-free title to such receivables to PPA Seller and, so long as PPA Buyer does not have any defense in respect of such receivables other than a defense that would have arisen under the PPA if this Assignment Agreement were not in effect apply the face amount thereof as a reduction to any Delivered Product Payment Obligation owed by [Assignee] to PPA Seller; provided that no such transfer or application shall reduce or limit PPA Buyer's obligations under Section 1(b) above].

(f) In the event the PPA described on Appendix 1 or the Assigned Product Rights are rejected or terminated or both, in or as a result of any bankruptcy, insolvency, reorganization or similar proceeding affecting [Assignee], PPA Buyer shall, at the option of PPA Seller exercised within 30 days after such rejection or termination, enter into a new agreement with PPA Seller having identical terms as the PPA described on Appendix 1 (subject to any conforming changes necessitated by the substitution of parties and other changes as the parties may mutually agree), provided that the term under such new agreement shall be no longer than the remaining balance of the term specified in the PPA described on Appendix 1.

2. Assignment Early Termination.

(a) The Assignment Period may be terminated early upon the occurrence of any of the following:

(1) delivery of a written notice of termination by either [Assignee] or PPA Buyer to each of the other Parties hereto;

(2) delivery of a written notice of termination by PPA Seller to each of [Assignee] and PPA Buyer following [Assignee]'s failure to pay when due any amounts owed to PPA Seller in respect of any Delivered Product Payment Obligation and such failure continues for one business day following receipt by [Assignee] of written notice thereof;

(3) delivery of a written notice by PPA Seller to the other Parties hereto if any of the events described in Section [__] [Bankruptcy] of the PPA occurs with respect to [Assignee]; or

(4) delivery of a written notice by [Assignee] if any of the events described in Section [__] [Bankruptcy] of the PPA occurs with respect to PPA Seller.

(b) The Assignment Period will end at the end of last delivery hour on the date specified in the termination notice provided pursuant to Section 2(a), which date shall not be earlier than the end of the last day of the calendar month in which such notice is delivered if termination is pursuant to clause (a)(1) or (a)(2) above. All Assigned Rights and Obligations shall revert from [Assignee] to PPA Buyer upon the early termination of the Assignment Period, provided that (i) [Assignee] shall remain responsible for the Delivered Product Payment Obligation with respect to any Assigned Product delivered to [Assignee] prior to the end of the Assignment Period, and (ii) any legal restrictions on the effectiveness of such reversion (whether arising under bankruptcy law or otherwise) shall not affect the expiration or early termination of the Assignment Period in respect of the Parties not subject inter se to such restrictions, provided that [Assignee] will not have any further obligations (other than the obligation pursuant to the foregoing clause (i)) hereunder following an early termination of the Assignment Period regardless of any such legal restrictions on the effectiveness of such reversion.

(c) The Assignment Period will automatically terminate upon the expiration or early termination of the PPA. All Assigned Rights and Obligations shall revert from [Assignee] to PPA Buyer upon the expiration of or early termination of the PPA, provided that (i) [Assignee] shall remain responsible for the Delivered Product Payment Obligation with respect to any Assigned Product delivered to [Assignee] prior to the end of the Assignment Period, and (ii) any legal restrictions on the effectiveness of such reversion (whether arising under bankruptcy law or otherwise) shall not affect the expiration or early termination of the Assignment Period in respect of the Parties not subject inter se to such restrictions, provided that [Assignee] will not have any further obligations (other than the obligation pursuant to the foregoing clause (i)) hereunder following an early termination of the Assignment Period regardless of any such legal restrictions on the effectiveness of such reversion.

3. Representations and Warranties. The PPA Seller and the PPA Buyer represent and warrant to [Assignee], each with respect to itself only, that as of the date hereof (a) the PPA is in full force

and effect; (b) to the best of its knowledge, no event or circumstance exists (or would exist with the passage of time or the giving of notice) that would give either of them the right to terminate the PPA or suspend performance thereunder; and (c) all of its obligations under the PPA required to be performed on or before the date hereof have been fulfilled.

4. Notices. Any notice, demand, or request required or authorized by this Assignment Agreement to be given by one Party to another Party shall be delivered in accordance with Section [__] and the Cover Sheet of the PPA and to the addresses of each of PPA Seller and PPA Buyer specified in the PPA. PPA Buyer agrees to notify [Assignee] of any updates to such notice information, including any updates provided by PPA Seller to PPA Buyer. Notices to [Assignee] shall be provided to the following address, as such address may be updated by [Assignee] from time to time by notice to the other Parties:

[_____
_____
_____
_____]

5. Miscellaneous. Sections [__] (Buyer's Representations and Warranties), [__] (Confidential Information), Sections [__] (Severability), [__] (Counterparts), [__] (Amendments), [__] (No Agency), [__] (Mobile-Sierra), [__] (Counterparts), [__] (Facsimile or Electronic Delivery), Section [__] (Binding Effect) and [__] (No Recourse to Members of Buyer) of the PPA are incorporated by reference into this Agreement, *mutatis mutandis*, as if fully set forth herein.

6. U.S. Resolution Stay Provisions.

(a) In the event that [Assignee] becomes subject to a proceeding under (i) the Federal Deposit Insurance Act and the regulations promulgated thereunder or (ii) Title II of the Dodd-Frank Wall Street Reform and Consumer Protection Act and the regulations promulgated thereunder (a "U.S. Special Resolution Regime") the transfer from [Assignee] of this Agreement, and any interest and obligation in or under, and any property securing, this Agreement, will be effective to the same extent as the transfer would be effective under the U.S. Special Resolution Regime if this Agreement, and any interest and obligation in or under, and any property securing, this Agreement were governed by the laws of the United States or a state of the United States.

(b) In the event that [Assignee] or an Affiliate becomes subject to a proceeding under a U.S. Special Resolution Regime, any Default Rights (as defined in 12 C.F.R. §§ 252.81, 47.2 or 382.1, as applicable ("Default Right")) under this Agreement that may be exercised against [Assignee] are permitted to be exercised to no greater extent than such Default Rights could be exercised under the U.S. Special Resolution Regime if this Agreement were governed by the laws of the United States or a state of the United States.

(1) Limitation on Exercise of Certain Default Rights Related to an Affiliate's Entry Into Insolvency Proceedings. Notwithstanding anything to the contrary in this Agreement, the Parties expressly acknowledge and agree that:

i. PPA Buyer and PPA Seller shall not be permitted to exercise any Default Right with respect to this Agreement or any Affiliate Credit Enhancement that is related, directly or indirectly, to an Affiliate of [Assignee] becoming subject to receivership, insolvency, liquidation, resolution, or similar proceeding (an "Insolvency Proceeding"), except to the extent that the exercise of such Default Right would be permitted under the provisions of 12 C.F.R. 252.84, 12 C.F.R. 47.5 or 12 C.F.R. 382.4, as applicable; and

ii. Nothing in this Agreement shall prohibit the transfer of any Affiliate Credit Enhancement, any interest or obligation in or under such Affiliate Credit Enhancement, or any property securing such Affiliate Credit Enhancement, to a transferee upon or following an Affiliate of [Assignee] becoming subject to an Insolvency Proceeding, unless the transfer would result in PPA Buyer or PPA Seller being the beneficiary of such Affiliate Credit Enhancement in violation of any law applicable to PPA Buyer or PPA Seller, as applicable.

(2) U.S. Protocol. To the extent that PPA Buyer and PPA Seller each adhere to the ISDA 2018 U.S. Resolution Stay Protocol, as published by the International Swaps and Derivatives Association, Inc. as of July 31, 2018 (the "ISDA U.S. Protocol"), after the date of this Agreement, the terms of the ISDA U.S. Protocol will supersede and replace the terms of this Section 6.

(3) For purposes of this Section 6:

"Affiliate" is defined in, and shall be interpreted in accordance with, 12 U.S.C. § 1841(k).

"Credit Enhancement" means any credit enhancement or credit support arrangement in support of the obligations of [Assignee] under or with respect to this Agreement, including any guarantee, collateral arrangement (including any pledge, charge, mortgage or other security interest in collateral or title transfer arrangement), trust or similar arrangement, letter of credit, transfer of margin or any similar arrangement.

7. Governing Law, Jurisdiction.

(a) **Governing Law.**

THIS ASSIGNMENT AGREEMENT AND THE RIGHTS AND DUTIES OF THE PARTIES UNDER THIS ASSIGNMENT AGREEMENT WILL BE GOVERNED BY AND CONSTRUED, ENFORCED AND PERFORMED IN ACCORDANCE WITH THE LAWS OF THE STATE OF NEW YORK, WITHOUT REFERENCE TO ANY CONFLICTS OF LAWS PROVISIONS THAT WOULD DIRECT THE APPLICATION OF ANOTHER JURISDICTION'S LAWS; PROVIDED, HOWEVER, THAT THE AUTHORITY OF THE PPA BUYER TO ENTER INTO AND PERFORM ITS

OBLIGATIONS UNDER THIS ASSIGNMENT AGREEMENT SHALL BE DETERMINED IN ACCORDANCE WITH THE LAWS OF THE STATE OF CALIFORNIA.

(b) **[Reserved].**[1]

[Remainder of Page Intentionally Blank]

[1] NOTE: Parties to negotiate and agree upon jurisdiction provision, if any, at the time of execution.

EXHIBIT C

FORM OF

CONSENT AND AGREEMENT

among

[***Insert Name of Contracting Party***],
a [_____]
(Contracting Party)

and

GEYSERS POWER COMPANY, LLC,
a Delaware limited liability company
(Assignor)

and

MUFG UNION BANK, N.A.,
(First Lien Collateral Agent)

Dated as of [___]

This CONSENT AND AGREEMENT, dated as of [_____], 20[__] (this "Consent"), is *entered into by and among* ***[Insert name of Contracting Party]***, a [_____] [organized][formed] and existing under the laws of the State of [_____] (together with its permitted successors and assigns, "Contracting Party"), MUFG UNION BANK, N.A., in its capacity as collateral agent for the First Lien Secured Parties referred to below (together with its successors, designees and assigns in such capacity, "First Lien Collateral Agent"), and GEYSERS POWER COMPANY, LLC, a limited liability company formed and existing under the laws of the State of Delaware (together with its permitted successors and assigns, "Assignor").

RECITALS

A. Assignor owns the following geothermal electric generating facilities located in the Geysers area of Northern California (Sonoma and Lake Counties) (collectively, the "Projects"):

(a) The Aidlin project, an approximately 18 megawatt geothermal facility located in Sonoma County, CA.

(b) The Sonoma project, an approximately 53 megawatt geothermal facility located in Sonoma County, CA.

(c) The two-unit McCabe project, an approximately 84 megawatt geothermal facility located in Sonoma County, CA.

(d) The two-unit Ridge Line project, an approximately 76 megawatt geothermal facility located in Sonoma County, CA.

(e) The Eagle Rock project, an approximately 68 megawatt geothermal facility located in Sonoma County, CA.

(f) The Cobb Creek project, an approximately 51 megawatt geothermal facility located in Sonoma County, CA.

(g) The Big Geysers project, an approximately 61 megawatt geothermal facility located in Lake County, CA.

(h) The Sulphur Springs project, an approximately 47 megawatt geothermal facility located in Sonoma County, CA.

(i) The Quicksilver project, an approximately 53 megawatt geothermal facility located in Lake County, CA.

(j) The Lake View project, an approximately 54 megawatt geothermal facility located in Sonoma County, CA.

(k) The Socrates project, an approximately 50 megawatt geothermal facility located in Sonoma County, CA.

(l) The two-unit Calistoga project, an approximately 69 megawatt geothermal facility located in Lake County, CA.

(m) The Grant project, an approximately 41 megawatt geothermal facility located in Sonoma County, CA.

B. In order to finance the operation and maintenance of the Projects, Assignor has entered into that certain Credit Agreement, dated as of June 9, 2020 (as amended, amended and restated, supplemented or otherwise modified from time to time, the "Credit Agreement"), with GEYSERS INTERMEDIATE HOLDINGS LLC, a Delaware limited liability company, as Holdings ("Holdings"), GEYSERS COMPANY, LLC, a Delaware limited liability company ("Geysers Company"), WILD HORSE GEOTHERMAL, LLC, a Delaware limited liability company ("Wild Horse") and CALISTOGA HOLDINGS, LLC, a Delaware limited liability company ("Calistoga," and, together with Holdings, Geysers Company and Wild Horse, each a "Guarantor" and together, the "Guarantors"), MUFG BANK, LTD., as administrative agent for the Lenders, MUFG UNION BANK, N.A., as collateral agent for the First Lien Secured Parties, and the financial institutions from time to time parties thereto in such other capacities as described therein (collectively, the "Lenders").

C. Contracting Party and Assignor have entered into that certain [***Insert description of relevant Major Project Contract(s)***], dated as of [_____] [____], [_____] (as amended, amended and restated, supplemented or otherwise modified from time to time in accordance with the terms thereof and hereof, the "Assigned Agreement").

D. As security for Assignor's obligations under the Credit Agreement and related financing documents with respect to the Loans and related obligations, Assignor has granted, pursuant to a security agreement executed by Assignor and First Lien Collateral Agent (as amended, amended and restated, supplemented or otherwise modified from time to time, the "Security Agreement"), to the First Lien Collateral Agent, for the benefit of the First Lien Secured Parties, a first priority lien on all of Assignor's right, title and interest in the Projects and other rights and interests relating thereto, whenever arising, including, without limitation, the Assigned Agreement and all of Assignor's right, title and interest under (but not any of Assignor's obligations, liabilities or duties with respect thereto) the Assigned Agreement;

AGREEMENT

NOW, THEREFORE, in consideration of the foregoing, and for other good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, and intending to be legally bound, the parties hereto hereby agree, notwithstanding anything in the Assigned Agreement to the contrary, as follows:

1. Assignment and Agreement.

1.1 Consent to Assignment. Contracting Party (a) is hereby notified and acknowledges that the Lenders have entered into the Credit Agreement and made the extensions of credit contemplated thereby in reliance upon the execution and delivery by Contracting Party of the Assigned Agreement and this Consent, (b) consents to the collateral assignment under the Security Agreement of all of

Assignor's right, title and interest in, to and under the Assigned Agreement, including, without limitation, all of Assignor's rights to receive payment and all payments due and to become due to Assignor under or with respect to the Assigned Agreement (collectively, the "Assigned Interests") and (c) acknowledges the right of First Lien Collateral Agent or a Subsequent Owner (as defined below), in the exercise of First Lien Collateral Agent's rights and remedies pursuant to the Security Agreement, upon written notice to Contracting Party, to make all demands, give all notices, take all actions and exercise all rights of Assignor under the Assigned Agreement.

1.2 Subsequent Owner.

(a) Contracting Party agrees that, if First Lien Collateral Agent notifies Contracting Party in writing that, pursuant to the Security Agreement, it has assigned, foreclosed or sold the Assigned Interests or any portion thereof, then (i) First Lien Collateral Agent or its successor, assignee and/or designee, or any purchaser of the Assigned Interests (a "Subsequent Owner") shall be substituted for Assignor under the Assigned Agreement and (ii) Contracting Party shall (1) recognize First Lien Collateral Agent or the Subsequent Owner, as the case may be, as its counterparty under the Assigned Agreement and (2) continue to perform its obligations under the Assigned Agreement in favor of First Lien Collateral Agent or the Subsequent Owner, as the case may be; provided that First Lien Collateral Agent or such Subsequent Owner, as the case may be, has assumed in writing all of Assignor's rights and obligations (including, without limitation, the obligation to cure any then existing payment and performance defaults, but excluding any obligation to cure any then existing performance defaults which by their nature are incapable of being cured) under the Assigned Agreement.

(b) **[*Insert the following only if warranties are provided by Contracting Party under the relevant Assigned Agreement:*** Without limiting anything herein, the warranties provided by Contracting Party under the Assigned Agreement shall continue in full force and effect (until the expiration of the applicable warranty periods set forth in the Assigned Agreement) in the event that First Lien Collateral Agent or a Subsequent Owner succeeds to Assignor's right, title and interest in the Assigned Agreement.]

1.3 Right to Cure. If Assignor defaults in the performance of any of its obligations under the Assigned Agreement, or upon the occurrence or non-occurrence of any event or condition under the Assigned Agreement which would immediately or with the passage of any applicable grace period or the giving of notice, or both, enable Contracting Party to terminate or suspend its performance under the Assigned Agreement (each hereinafter a "default"), Contracting Party shall not terminate or suspend its performance under the Assigned Agreement until it first gives written notice of such default to First Lien Collateral Agent and affords First Lien Collateral Agent a period of at least 15 days (or if such default is a nonmonetary default, such longer period (not to exceed 60 days) as may be required to cure such default) from receipt of such notice to cure such default; provided, however, that (a) if possession of the Projects is necessary to cure such nonmonetary default and First Lien Collateral Agent has commenced foreclosure

proceedings, First Lien Collateral Agent shall be allowed a reasonable time to complete such proceedings, and (b) if First Lien Collateral Agent is prohibited from curing any such nonmonetary default by any process, stay or injunction issued by any governmental authority or pursuant to any bankruptcy or insolvency proceeding or other similar proceeding involving Assignor, then the time periods specified herein for curing a default shall be extended for the period of such prohibition.

1.4 No Amendments.

(a) [reserved]

(b) Except for the Buyer Limited Assignment Right under section (p) of the Additional Terms of the Assigned Agreement, Contracting Party agrees that it shall not, without the prior written consent of First Lien Collateral Agent, which consent shall not be unreasonably withheld, (i) sell, assign or otherwise transfer any of its rights under the Assigned Agreement, (ii) terminate, cancel or suspend its performance under the Assigned Agreement (unless it has given First Lien Collateral Agent notice and an opportunity to cure in accordance with Section 1.3 hereof), (iii) consent to any assignment or other transfer by Assignor of its rights under the Assigned Agreement, or (iv) consent to any voluntary termination, cancellation or suspension of performance by Assignor under the Assigned Agreement.

1.5 Replacement Agreements. In the event the Assigned Agreement is rejected or terminated as a result of any bankruptcy, insolvency, reorganization or similar proceeding affecting Assignor, Contracting Party shall, at the option of First Lien Collateral Agent exercised within 30 days after such rejection or termination, enter into a new agreement with First Lien Collateral Agent having identical terms as the Assigned Agreement (subject to any conforming changes necessitated by the substitution of parties and other changes as the parties may mutually agree), provided that (i) the term under such new agreement shall be no longer than the remaining balance of the term specified in the Assigned Agreement, and (ii) upon execution of such new agreement, First Lien Collateral Agent cures any outstanding payment and performance defaults under the Assigned Agreement, excluding any performance defaults which by their nature are incapable of being cured.

1.6 Limitations on Liability. Unless and until First Lien Collateral Agent has assumed Assignor's rights and obligations under the Assigned Agreement or entered into a new agreement, Contracting Party acknowledges and agrees that First Lien Collateral Agent shall not have any liability or obligation to Contracting Party under the Assigned Agreement as a result of this Consent, the Security Agreement or otherwise, nor shall First Lien Collateral Agent be obligated or required to (a) perform any of Assignor's obligations under the Assigned Agreement, except during any period in which First Lien Collateral Agent has assumed Assignor's rights and obligations under the Assigned Agreement pursuant to Section 1.2[(a)] above, or (b) take any action to collect or enforce any claim for payment assigned under the Security Agreement. If First Lien Collateral Agent has assumed Assignor's rights and obligations under the Assigned Agreement pursuant to

Section 1.2[(a)] above or has entered into a new agreement pursuant to Section 1.5 above, First Lien Collateral Agent shall be subject to liability and obligations to Contracting Party under the Assigned Agreement or such new agreement for the period that it is party to the Assigned Agreement or such new agreement.

1.7 Delivery of Notices. Contracting Party shall deliver to First Lien Collateral Agent, concurrently with the delivery thereof to Assignor, a copy of each notice, request or demand given by Contracting Party to Assignor pursuant to the Assigned Agreement relating to (a) a default by Assignor under the Assigned Agreement, and (b) any matter that would require the consent of First Lien Collateral Agent pursuant to Section 1.4 above.

1.8 Transfer. First Lien Collateral Agent shall have the right to assign all of its interest in the Assigned Agreement or a new agreement entered into pursuant to the terms of this Consent; provided that such transferee assumes in writing the obligations of Assignor or First Lien Collateral Agent, as applicable, under the Assigned Agreement or such new agreement. Upon such assignment, First Lien Collateral Agent shall be released from any further liability under the Assigned Agreement or such new agreement to the extent of the interest assigned.

1.9 Refinancing. [Contracting Party hereby acknowledges that Assignor may, from time to time during the term of the Assigned Agreement, refinance the indebtedness incurred under the Credit Agreement pursuant to another bank financing, an institutional financing, a capital markets financing, a lease financing or any other combination thereof or other form of financing. In connection with any such refinancing, Contracting Party hereby consents to any collateral assignment or other assignment of the Assigned Agreement in connection therewith and agrees that the terms and provisions of this Consent shall apply with respect to such assignment and shall inure to the benefit of the parties providing such refinancing. In furtherance of the foregoing, Contracting Party agrees that (i)(1) references in this Consent to the "First Lien Collateral Agent" and the "First Lien Secured Parties" shall be deemed to be references to the applicable financing parties providing such refinancing, and (2) references in this Consent to the "Credit Agreement" and the "Security Agreement" shall be deemed to be references to the corresponding agreements entered into in connection with such refinancing, and (ii) if reasonably requested by Assignor, it shall enter into a new consent, substantially in the form of this Consent (including any material changes from this form of Consent as may be agreed by Contracting Party) in favor of the parties providing such refinancing.][2]

[*Insert the following only if Contracting Party is an Affiliate of Assignor under the relevant Assigned Agreement:* 1.10 No Obligations. Notwithstanding anything to the contrary herein or in the Assigned Agreement, in the event that First Lien Collateral Agent or its designee(s) or assignee(s) succeed to the Assignor's interest under the Assigned Agreement or foreclose on the equity interests of

[2] This Section 1.9 to be included at Borrowers election and with such changes as Borrower may reasonably request.

Assignor, First Lien Collateral Agent or its designee or assignee shall have the right, which must be exercised within thirty (30) days following such person succeeding to Assignor's interest under the Assigned Agreement or such foreclosure on the Assignor's equity interests, to terminate the Assigned Agreement upon written notice to Contracting Party and neither it nor any First Lien Secured Party nor the Assignor shall have any further obligations under the Assigned Agreement, including without limitation, obligations in respect of the payment of any fees, commissions or expenses, provided that such termination shall not affect obligations incurred prior to the date of termination for services provided.]

2. Payments under the Assigned Agreement.

2.1 Payments. Contracting Party shall pay all amounts (if any) payable by it under the Assigned Agreement in the manner and as and when required by the Assigned Agreement directly into the account specified on Exhibit A hereto, or to such other person, entity or account as shall be specified from time to time by First Lien Collateral Agent to Contracting Party in writing. Notwithstanding the foregoing, if any entity or person has become a Subsequent Owner pursuant to the terms hereof, then Contracting Party shall pay all such amounts directly to such Subsequent Owner or an account designated by Subsequent Owner.

2.2 No Offset, Etc. All payments required to be made by Contracting Party under the Assigned Agreement shall be made without any offset, recoupment, abatement, withholding, reduction or defense whatsoever, other than those allowed by the terms of the Assigned Agreement.

3. Representations and Warranties of Contracting Party. Contracting Party hereby represents and warrants, in favor of First Lien Collateral Agent, as of the date hereof, that:

(a) Contracting Party (i) is a [_____] duly [**formed**][**organized**] and validly existing under the laws of the State of [_____], (ii) is duly qualified, authorized to do business and in good standing in every jurisdiction necessary to perform its obligations under the Assigned Agreement and this Consent, and (iii) has all requisite power and authority to enter into and to perform its obligations hereunder and under the Assigned Agreement, and to carry out the terms hereof and thereof and the transactions contemplated hereby and thereby;

(b) the execution, delivery and performance by Contracting Party of this Consent and the Assigned Agreement have been duly authorized by all necessary corporate or other action on the part of Contracting Party and do not require any approvals, filings with, or consents of any entity or person which have not previously been obtained or made;

(c) each of this Consent and the Assigned Agreement is in full force and effect, has been duly executed and delivered on behalf of Contracting Party by the appropriate officers of Contracting Party, and constitutes the legal, valid and binding obligation of Contracting Party, enforceable against Contracting Party in accordance with its terms, except as the enforceability thereof may be limited by (i) bankruptcy, insolvency, reorganization or other similar laws affecting the

enforcement of creditors' rights generally, and (ii) general equitable principles (whether considered in a proceeding in equity or at law);

(d) there is no litigation, action, suit, proceeding or investigation pending or (to the best of Contracting Party's knowledge) threatened against Contracting Party before or by any court, administrative agency, arbitrator or governmental authority, body or agency which, if adversely determined, individually or in the aggregate, (i) could adversely affect the performance by Contracting Party of its obligations hereunder or under the Assigned Agreement, or which could modify or otherwise adversely affect any required approvals, filings or consents which have previously been obtained or made, (ii) could have a material adverse effect on the condition (financial or otherwise), business or operations of Contracting Party, or (iii) questions the validity, binding effect or enforceability hereof or of the Assigned Agreement, any action taken or to be taken pursuant hereto or thereto or any of the transactions contemplated hereby or thereby;

(e) the execution, delivery and performance by Contracting Party of this Consent and the Assigned Agreement, and the consummation of the transactions contemplated hereby and thereby, will not result in any violation of, breach of or default under any term of its formation or governance documents, or of any contract or agreement to which it is a party or by which it or its property is bound, or of any license, permit, franchise, judgment, injunction, order, law, rule or regulation applicable to it, other than any such violation, breach or default which could not reasonably be expected to have a material adverse effect on Contracting Party's ability to perform its obligations under the Assigned Agreement;

(f) neither Contracting Party nor, to the best of Contracting Party's knowledge, any other party to the Assigned Agreement, is in default of any of its obligations thereunder;

(g) to the best of Contracting Party's knowledge, (i) no event of force majeure exists under, and as defined in, the Assigned Agreement, and (ii) no event or condition exists which would either immediately or with the passage of any applicable grace period or giving of notice, or both, enable either Contracting Party or Assignor to terminate or suspend its obligations under the Assigned Agreement; and

(h) the Assigned Agreement, this Consent, the Limited Assignment (a form of which is attached as Exhibit B to the Assigned Agreement0, if and when signed, and that certain [WSPP Export Non-Resource Adequacy Confirmation] dated [____] between Assignor and Contracting Party are the only agreements between Assignor and Contracting Party with respect to the Project, and all of the conditions precedent to effectiveness under the Assigned Agreement have been satisfied or waived.

Each of the representations and warranties set forth in this Section 3 shall survive the execution and delivery of this Consent and the Assigned Agreement and the consummation of the transactions contemplated hereby and thereby.

4. Miscellaneous.

4.1 Notices. Any communications between the parties hereto or notices provided herein to be given may be given to the following addresses:

If to Assignor:

Geysers Power Company, LLC
717 Texas Avenue, Suite 11.043C
Houston, Texas 77002
Facsimile: (832) 325-1582
Telephone: (832) 325-1581
Attention: Chief Legal Officer

If to Contracting Party:

Sacramento Municipal Utility District
PO Box 15380
Sacramento Ca 95852-0830
Facsimile: 916-397-9692
Telephone:
Attention: Energy Trading, MS A404

If to First Lien Collateral Agent:

_____
_____
_____
Facsimile: _____
Telephone: _____
Attention: _____

All notices or other communications required or permitted to be given hereunder shall be in writing and shall be considered as properly given (a) if delivered in person, (b) if sent by overnight delivery service (including Federal Express, UPS, DHL and other similar overnight delivery services), (c) in the event overnight delivery services are not readily available, if mailed by first class United States Mail, postage prepaid, registered or certified with return receipt requested, (d) if sent by prepaid telegram or by facsimile or (e) if sent by other electronic means (including electronic mail) confirmed by facsimile or telephone. Any party may change its address for notice hereunder by giving of 30 days' notice to the other parties in the manner set forth hereinabove.

4.2 Governing Law; Submission to Jurisdiction.

(a) THIS CONSENT AND THE RIGHTS AND OBLIGATIONS OF THE PARTIES HEREUNDER SHALL BE CONSTRUED IN ACCORDANCE WITH, AND BE GOVERNED BY, THE LAWS OF THE STATE OF NEW YORK (WITHOUT GIVING EFFECT TO THE PRINCIPLES THEREOF RELATING TO CONFLICTS OF LAW EXCEPT SECTIONS 5-1401 AND 5-1402 OF THE NEW YORK GENERAL OBLIGATIONS LAW).

(b) Any legal action or proceeding with respect to this

Consent and any action for enforcement of any judgment in respect thereof may be brought in the courts of the State of New York or of the United States of America for the Southern District of New York, and, by execution and delivery of this Consent, Contracting Party hereby accepts for itself and in respect of its property, generally and unconditionally, the non-exclusive jurisdiction of the aforesaid courts and appellate courts from any appeal thereof. Contracting Party irrevocably consents to the service of process out of any of the aforementioned courts in any such action or proceeding by the mailing of copies thereof by registered or certified mail, postage prepaid, to Contracting Party at its notice address provided pursuant to Section 4.1 hereof. Contracting Party hereby irrevocably waives any objection which it may now or hereafter have to the laying of venue of any of the aforesaid actions or proceedings arising out of or in connection with this Consent brought in the courts referred to above and hereby further irrevocably waives and agrees not to plead or claim in any such court that any such action or proceeding brought in any such court has been brought in an inconvenient forum. Nothing herein shall affect the right of First Lien Collateral Agent to serve process in any other manner permitted by law or to commence legal proceedings or otherwise proceed against Contracting Party in any other jurisdiction.

4.3 Counterparts. This Consent may be executed in any number of counterparts and by the different parties hereto on separate counterparts, each of which when so executed and delivered shall be an original, but all of which shall together constitute one and the same instrument. Delivery of an executed counterpart to this Consent by facsimile or "pdf" transmission shall be as effective as delivery of a manually signed original.

4.4 Headings Descriptive. The headings of the several sections and subsections of this Consent are inserted for convenience only and shall not in any way affect the meaning or construction of any provision of this Consent.

4.5 Severability. In case any provision in or obligation under this Consent shall be invalid, illegal or unenforceable in any jurisdiction, the validity, legality and enforceability of the remaining provisions or obligations, or of such provision or obligation in any other jurisdiction, shall not in any way be affected or impaired thereby.

4.6 Amendment, Waiver. Neither this Consent nor any of the terms hereof may be terminated, amended, supplemented, waived or modified except by an instrument in writing signed by Contracting Party and First Lien Collateral Agent.

4.7 Successors and Assigns. This Consent shall bind and benefit Contracting Party, First Lien Collateral Agent, and their respective successors and assigns.

4.8 Third Party Beneficiaries. Contracting Party and First Lien Collateral Agent hereby acknowledge and agree that the First Lien Secured Parties are intended third party beneficiaries of this Consent.

4.9 [intentionally omitted]

4.10 Entire Agreement. This Consent and any agreement, document or

instrument attached hereto or referred to herein integrate all the terms and conditions mentioned herein or incidental hereto and supersede all oral negotiations and prior writings between the parties hereto in respect of the subject matter hereof. In the event of any conflict between the terms, conditions and provisions of this Consent and any such agreement, document or instrument (including, without limitation, the Assigned Agreement), the terms, conditions and provisions of this Consent shall prevail.

4.11 Termination of Consent. This Consent shall terminate upon the earliest to occur of (a) the termination or cancellation of the Assigned Agreement in accordance with its terms and in accordance with the terms of this Consent (it being understood that this Consent shall not terminate but shall remain in effect in the circumstances described in Section 1.5 above in respect of any new agreement entered into in accordance with such Section), (b) the expiration of the term of the Assigned Agreement and (c) the termination of the Security Agreement in accordance with its terms.

[*REMAINDER OF PAGE INTENTIONALLY LEFT BLANK*]

IN WITNESS WHEREOF, the parties hereto, by their officers duly authorized, intending to be legally bound, have caused this Consent and Agreement to be duly executed and delivered as of the date first above written.

GEYSERS POWER COMPANY, LLC,
a Delaware limited liability company,
as Assignor

By: _____
Name:
Title:

Sacramento Municipal Utility District,
a local publicly owned electric utility in the State of California,
as Contracting Party

By: _____
Name:
Title:

Accepted and Agreed to:

MUFG UNION BANK, N.A.,
solely in its capacity as First Lien Collateral Agent

By: _____
Name:
Title:
By: _____
Name:
Title:

EXHIBIT A to
Consent and Agreement

PAYMENT INSTRUCTIONS

[*INSERT PAYMENT INSTRUCTIONS FOR APPROPRIATE ACCOUNT(S)*]

EXHIBIT D

FORM OF LETTER OF CREDIT

IRREVOCABLE STANDBY LETTER OF CREDIT NO. _____
[ISSUER]
[ADDRESS]
[CITY, STATE ZIP]
ATTENTION:

DATE:_____, 20__

BENEFICIARY	APPLICANT
Sacramento Municipal Utility District	Calpine Corporation on behalf of Geysers Power Company, LLC.

LADIES AND GENTLEMEN:

AT THE REQUEST AND FOR THE ACCOUNT OF CALPINE CORPORATION (THE 'APPLICANT"), 717 TEXAS AVENUE, SUITE 1000, HOUSTON, TEXAS 77002, AND ON BEHALF OF GEYSERS POWER COMPANY, LLC (THE "ACCOUNT PARTY") WE, [ISSUER] (THE "ISSUER"), HEREBY ESTABLISH, EFFECTIVE IMMEDIATELY, IN YOUR FAVOR SACRAMENTO MUNICIPAL UTILITY DISTRICT THE "BENEFICIARY") OUR IRREVOCABLE STANDBY LETTER OF CREDIT NO._____ IN THE AGGREGATE AMOUNT OF _____ NO/100 UNITED STATES DOLLARS (U.S. $_____.00) (AS SUCH AMOUNT MAY BE REDUCED FROM TIME TO TIME BY PARTIAL DRAWS HEREUNDER, THE "STATED AMOUNT").

WE ARE INFORMED BY THE APPLICANT THAT THIS LETTER OF CREDIT IS BEING ISSUED PURSUANT TO, AND IN ACCORDANCE WITH THAT CERTAIN AMENDED AND RESTATED WESTERN STATES POWER POOL CONFIRMATION LETTER (ENERGY) DATED __, 2025, BETWEEN THE ACCOUNT PARTY AND THE BENEFICIARY (THE "AGREEMENT").

THIS LETTER OF CREDIT IS ISSUED, PRESENTABLE AND PAYABLE AT THE OFFICE LOCATED AT [INSERT NAME AND ADDRESS OF ISSUER], AND EXPIRES WITH OUR

CLOSE OF BUSINESS ON _____, 20__ (THE "EXPIRATION DATE"); PROVIDED THAT THIS LETTER OF CREDIT SHALL BE DEEMED AUTOMATICALLY EXTENDED WITHOUT AN AMENDMENT FOR A ONE YEAR PERIOD BEGINNING ON SUCH EXPIRATION DATE HEREOF, AND UPON EACH ANNIVERSARY OF SUCH DATE, UNLESS AT LEAST SIXTY (60) DAYS PRIOR TO ANY SUCH EXPIRATION DATE, WE HAVE SENT YOU WRITTEN NOTICE BY COURIER SERVICE OR OVERNIGHT MAIL AT THE ABOVE ADDRESS THAT WE ELECT NOT TO PERMIT THIS LETTER OF CREDIT TO BE SO EXTENDED BEYOND, AND WILL EXPIRE ON ITS THEN CURRENT EXPIRATION DATE. NO PRESENTATION MADE UNDER THIS LETTER OF CREDIT AFTER SUCH EXPIRATION DATE WILL BE HONORED.

FUNDS IN PAYMENT OF A DRAWING UNDER THIS LETTER OF CREDIT ARE AVAILABLE TO THE BENEFICIARY BY PAYMENT AGAINST PRESENTATION AT THE OFFICE AS STIPULATED HEREIN ABOVE, OF THE BENEFICIARY'S SIGNED AND APPROPRIATELY COMPLETED SIGHT DRAFT(S) IN THE FORM OF EXHIBIT 1 ATTACHED HERETO, THE BENEFICIARY'S SIGNED AND APPROPRIATELY COMPLETED DRAWING CERTIFICATE(S) IN THE FORM OF EXHIBIT 2 ATTACHED HERETO AND COPIES OF THE ORIGINAL LETTER OF CREDIT AND AMENDMENTS (IF ANY).

IF A DRAWING IS PRESENTED, ON OR PRIOR TO THE EXPIRATION DATE, AT THE ADDRESS NOTED ABOVE, DELIVERED TO US BY OVERNIGHT COURIER OR FAXED TO US AT XXX-XXX-XXXX AT OR PRIOR TO 11:00 A.M. NEW YORK TIME ON A BUSINESS DAY, PAYMENT OF THE AMOUNT SPECIFIED IN SUCH DRAFT SHALL BE MADE ON THE THIRD SUCCEEDING BUSINESS DAY. IF SUCH DRAFT IS PRESENTED AT OUR COUNTERS, DELIVERED TO US BY OVERNIGHT COURIER OR FAXED TO US AFTER 11:00 A.M. NEW YORK TIME ON A BUSINESS DAY, PAYMENT OF THE AMOUNT SPECIFIED IN SUCH DRAFT SHALL BE MADE ON THE FOURTH SUCCEEDING BUSINESS DAY.

PARTIAL AND MULTIPLE DRAWINGS ARE PERMITTED HEREUNDER. ANY DRAWING HONORED HEREUNDER BY THE ISSUER SHALL REDUCE THE STATED AMOUNT AVAILABLE FOR DRAWINGS BY THE AMOUNT OF ANY DRAWING HONORED BY THE ISSUER.

THIS LETTER OF CREDIT IS NOT TRANSFERABLE. WE IRREVOCABLY WAIVE ANY AND ALL RIGHTS OF SUBROGTATION, WHETHER AS PROVIDED BY STATUTE OR OTHERWISE, NOW OR HEREAFTER THAT MIGHT, BUT FOR SUCH WAIVER, EXIST, IN RESPECT OF THIS LETTER OF CREDIT OR ANY PAYMENT MADE UNDER IT, AS TO THE APPLICANT, THE BENEFICIARY, OR THE TRANSACTION BETWEEN

BENEFICIARY AND APPLICANT. WE FURTHER GIVE IRREVOCABLE NOTICE THAT WE ARE NOT NOW AND WILL NOT BE THE SECONDARY OBLIGOR OR CO-OBLIGOR OF APPLICANTS OBLIGATIONS AND LIABILITIES TO BENEFICIARY FOR ANY PURPOSE.

ALL BANKING CHARGES ASSOCIATED WITH THIS LETTER OF CREDIT ARE FOR THE ACCOUNT OF THE APPLICANT.

AS USED HEREIN, "BUSINESS DAY" MEANS ANY DAY OTHER THAN SATURDAY, SUNDAY OR A LEGAL HOLIDAY IN NEW YORK, NEW YORK.

THIS LETTER OF CREDIT IS SUBJECT TO AND GOVERNED BY THE INTERNATIONAL STANDBY PRACTICES, INTERNATIONAL CHAMBER OF COMMERCE (ICC) PUBLICATION NO. 590 ("ISP98"). AS TO MATTERS NOT ADDRESSED BY THE ISP98, AND TO THE EXTENT NOT INCONSISTENT WITH THE ISP98, THIS LETTER OF CREDIT SHALL BE GOVERNED BY AND CONSTRUED IN ACCORDANCE WITH THE LAWS OF THE STATE OF NEW YORK (INCLUDING, WITHOUT LIMITATION, ARTICLE 5 OF THE UNIFORM COMMERCIAL CODE OF THE STATE OF NEW YORK).

THIS LETTER OF CREDIT SETS FORTH IN FULL THE TERMS OF OUR UNDERTAKING AND SUCH UNDERTAKING SHALL NOT IN ANY WAY BE MODIFIED, AMENDED OR AMPLIFIED BY REASON OF OUR REFERENCE TO ANY AGREEMENTS OR INSTRUMENT REFERRED TO OR IN WHICH THIS LETTER OF CREDIT IS REFERRED TO. ANY SUCH AGREEMENTS OR INSTRUMENT SHALL NOT BE DEEMED INCORPORATED HEREIN BY REFERENCE.

SINCERELY,

[ISSUER]

NAME: _____

TITLE: _____

EXHIBIT 1

[BENEFICIARY LETTERHEAD]

SIGHT DRAFT

[DATE]

[ISSUER]
[ADDRESS]
[CITY, STATE ZIP]
ATTENTION:

RE: IRREVOCABLE STANDBY LETTER OF CREDIT NUMBER ¬¬¬¬¬¬_____

FOR THE VALUE RECEIVED, PAY TO THE ORDER OF _____ BY WIRE TRANSFER OF IMMEDIATELY AVAILABLE FUNDS TO THE FOLLOWING ACCOUNT:

[NAME OF ACCOUNT]
[ACCOUNT NUMBER]
[NAME AND ADDRESS OF BANK AT WHICH ACCOUNT IS MAINTAINED]
[ABA NUMBER]
[REFERENCE]

THE FOLLOWING AMOUNT:

[INSERT NUMBER OF DOLLARS IN WRITING] UNITED STATES DOLLARS
(US$ [INSERT NUMBER OF DOLLARS IN FIGURES])

DRAWN UPON YOUR LETTER OF CREDIT NO. _____ DATED _____, 2010

BY: _____

NAME: _____

TITLE: _____

EXHIBIT 2

DRAWING CERTIFICATE

[DATE]

[ISSUER]
[ADDRESS]
[CITY, STATE ZIP]
ATTENTION:

RE: IRREVOCABLE STANDBY LETTER OF CREDIT NUMBER _____

LADIES AND GENTLEMEN:

THE UNDERSIGNED, A DULY AUTHORIZED OFFICER OF _____ (THE "BENEFICIARY") OF THE CAPTIONED LETTER OF CREDIT (THE "LETTER OF CREDIT"), HEREBY CERTIFIES TO [ISSUER] (THE "ISSUER") WITH RESPECT TO THE LETTER OF CREDIT (THE TERMS DEFINED THEREIN AND NOT OTHERWISE DEFINED HEREIN BEING USED HEREIN AS THEREIN DEFINED) THAT:

(1) [_____] (THE "ACCOUNT PARTY") HAS DEFAULTED UNDER THAT CERTAIN [AMENDED AND RESTATED WESTERN STATES POWER POOL CONFIRMATION LETTER (ENERGY) DATED __, 2025 BETWEEN THE ACCOUNT PARTY AND THE BENEFICIARY] [AND] THAT CERTAIN AMENDED AND RESTATED NON-RA EXPORT CAPACITY CONFIRMATION DATED __, 2025 BETWEEN THE ACCOUNT PARTY AND THE BENEFICIARY] (THE "AGREEMENT[S]"); AND

(2) THE AMOUNT BEING DRAWN PURSUANT TO THIS CERTIFICATE IS THE AMOUNT DUE AND OWING TO BENEFICIARY BEYOND ANY APPLCIABLE NOTICE GRACE PERIODS APPLICABLE UNDER THE AGREEMENT[S].

– OR –

(1) THIS LETTER OF CREDIT WILL EXPIRE IN THIRTY (30) CALENDAR DAYS OR LESS AND THE ACCOUNT PARTY HAS NOT PROVIDED ALTERNATE SECURITY AS REQUIRED PER THE TERMS OF THE AGREEEMENT.

IN WITNESS WHEREOF, THE UNDERSIGNED HAS EXECUTED THIS DRAWING CERTIFICATE AS OF THE _____ DAY OF _____ 20___.

BY:

NAME:

TITLE:

AMENDED AND RESTATED NON-RA EXPORT CAPACITY TRANSACTION CONFIRMATION

This Amended and Restated Non-RA Export Capacity Transaction Confirmation ("**Confirmation**"), dated [_____], 2025 (the "**Effective Date**"), is made and entered into by Geysers Power Company, LLC ("**Seller**") and the Sacramento Municipal Utility District ("**Buyer**") pursuant to the Western Systems Power Pool Agreement (Effective Version: October 21, 2024) together with any and all exhibits, schedules or supplements thereto or incorporated therein by reference, but no further modification unless agreed by the Parties (the "**WSPP Agreement**"), and is subject to the terms and conditions of the WSPP Agreement, except as modified by this Confirmation. Seller and Purchaser are sometimes each referred to herein as a "**Party**" and collectively as the "**Parties**". Terms used but not defined herein shall have the meanings ascribed to them in the WSPP Agreement. In the event of any inconsistency between any of the terms herein and in the WSPP Agreement, the terms of this Confirmation shall control. This Confirmation and the WSPP Agreement are referred to collectively as the "**Agreement**".

NOW, THEREFORE, the Parties agree as follows:

Seller:	Geysers Power Company, LLC:
Buyer:	Sacramento Municipal Utility District
Amendment and Restatement of Existing Confirmation:	The Parties are currently parties to that certain Non-RA Export Capacity Transaction Confirmation dated March 30, 2022 (the "**Existing Confirmation**") with respect to the purchase and sale of the Product described below, but for a different contract quantity, price and delivery term than are provided for herein. The Parties wish to amend and restate the Existing Confirmation on the terms and conditions set forth herein, effective as of the beginning of the Delivery Term set forth below. Accordingly, this Confirmation will be binding on the Parties as of the Effective Date, but the Existing Confirmation will continue in effect until 2400 Pacific time on the day prior to the beginning of the Delivery Term set forth below, at which time it will be superseded by this Confirmation and be of no further force or effect.
Product:	Capacity from the Project (as defined below) to support Self-Schedules for the export from the CAISO Balancing Area Authority to an external Balancing Area Authority of energy purchased by Buyer from Seller. Buyer intends to use capacity from the Project identified by Seller as provided below (the "**Non-Resource Adequacy Capacity**" or "**Non-RA Capacity**"), to support the export of Self-Scheduled energy as a high priority non-recallable export, which will be defined as the priority established for "Self-Schedules of exports at Scheduling Points explicitly sourced by non-Resource Adequacy Capacity" pursuant to Section 31.4 of the CAISO Tariff or for "Price

Taker (PT) exports" pursuant to Section 2.5.5.1 of the CAISO Market Operations Business Practice Manual. The Non-Resource Adequacy Capacity in support of exports from the CAISO Balancing Area Authority to an external Balancing Area Authority is sometimes referred to as a "**Supporting Resource**." Buyer's rights hereunder to the Product do not include any rights to the electrical output of the Units or the Alternate Capacity, and no Energy or Ancillary Services associated with any Unit is required to be made available to Buyer pursuant to this Confirmation. In the event Buyer elects to join the CAISO Extended Day-Ahead Market ("**EDAM**"), and if the provisions of the CAISO Tariff, Business Practice Manuals and/or other rules and regulations relating to EDAM require modification of the foregoing description of the Product, the Parties will meet and negotiate in good faith to make such revisions to this Transaction as may be necessary to comply with such provisions and to restore the costs, benefits and burdens of performance by each Party to those existing as of the Effective Date.

Project:

Subject to the provisions in the section titled "Alternate Capacity", the Product will be provided from one or more geothermal power plants ("**Units**") owned or controlled by Seller in Lake and Sonoma Counties, California. The Units as of the Effective Date are listed on Exhibit A attached hereto. However, due to the portfolio nature of the Geysers geothermal facility, Buyer acknowledges that Seller is making sales and deliveries from the Project to other purchasers. Following the Effective Date, Seller may (i) remove generating facilities and/or Designated Alternate Capacity Units from Exhibit A with prior written notice to Buyer and/or (ii) add generating facilities and/or Designated Alternate Capacity Units to Exhibit A with prior written consent from Buyer, such consent not to be unreasonably withheld. Any added generating facility(ies) will thereafter be considered Units for all purposes under this Confirmation; provided that, to the extent that addition of the generating facility(ies) was not approved by the CEC prior to delivery, the delivery of Product from the added generating facility(ies) is conditioned on the CEC making a final decision pursuant to the California Code of Regulations, Title 20, Section 2910 that the covered procurement complies with EPS, and in the event the CEC makes a final decision that the added generating facility(ies) does not comply with the EPS, the change to Exhibit A shall be void and all pending Product deliveries from such added generating facility(ies) shall be terminated no later than the effective date of the CEC's decision. The Unit or Units from which the Product is delivered and the amount of Product delivered from each Unit may change from time to time during the Delivery Term, and the capacity of a Unit may be allocated wholly or partially to the delivery of the Product.

Contract Quantity: First Delivery Period: 100 MW
Second Delivery Period: 125 MW
Third Delivery Period: 150 MW

Contract Quantity is measured on the same basis as NQC. Any difference between the actual capacity of a Unit and such Unit's NQC due to operating conditions will be treated as an Unexcused Outage if Seller does not provide Alternate Capacity.

Contract Price: First Delivery Period: [redacted]/kW-month
Second Delivery Period and Third Delivery Period: [redacted]/kW-month

Delivery Term: January 1, 2026 through December 31, 2042

First Delivery Period: January 1, 2026 through December 31, 2027
Second Delivery Period: January 1, 2028 through December 31, 2029
Third Delivery Period: January 1, 2030 through December 31, 2042

The Contract Price and the Contract Quantity applicable during each Delivery Period are set forth above.

Monthly Payment: Buyer will make a monthly payment to Seller calculated as follows:

Monthly Payment = ([Contract Quantity – Planned Outage Quantity – Designated Unexcused Outage Quantity] X Contract Price X Monthly Shape Factor) + NPD Amount – Damage Payment Amount

where

"**Planned Outage Quantity**" means the amount of Product not provided due to a Planned Outage to the extent that Seller does not replace such Product with Alternate Capacity. For any month, the Planned Outage Quantity will be equal to the Contract Quantity times a fraction, the numerator of which is the number of hours of Planned Outage in such month and the denominator of which is the total number of hours in such month. For purposes of the foregoing calculation, if the amount of Product is only partially reduced as a result of a Planned Outage, such reduction will be treated as a portion of an hour of Planned Outage equal to the pro rata portion of the Product that was not provided.

"**Designated Unexcused Outage Quantity**" means the amount of Product not provided due to a Designated Unexcused Outage to the extent that Seller does not replace such Product with Alternate

Capacity. For any month, the Designated Unexcused Outage Quantity will be equal to the Contract Quantity times a fraction, the numerator of which is the number of hours of Designated Unexcused Outage in such month and the denominator of which is the total number of hours in such month. For purposes of the foregoing calculation, if the amount of Product is only partially reduced as a result of a Designated Unexcused Outage, such reduction will be treated as a portion of an hour of Designated Unexcused Outage equal to the pro rata portion of the Product that was not provided.

"**Monthly Shape Factor**" means the applicable percentage for the month set forth on Exhibit B.

"**NPD Amount**" means the total negative price differential amount, if any, for the month, as provided in the section titled "Delivery of Product".

"**Damage Payment Amount**" means the amount of damages, if any, payable by Seller as provided in the section titled "Damages for Unexcused Failure to Provide Product".

Delivery of Product: Seller will notify Buyer at least 30 days before the beginning of each calendar month during the Delivery Term of the Unit or Units from which the Product will be provided for that month, the amount of Product (in MW) that will be provided from each such Unit, and the CAISO Resource ID number(s) for such Unit(s). Seller may revise the Units and quantities of Product from each Unit designated in such notice (or designate Alternate Capacity as provided below, as applicable) from time to time until two (2) hours before the scheduling deadline for the submission of Bids into the Day Ahead Market or such later time (including real time) to the extent allowed by the CAISO. Buyer and Seller will cooperate and take reasonable actions to enable substitution of other Units or Alternate Capacity after the foregoing deadline to the extent allowed by the CAISO.

Seller will be deemed to have delivered the Product in a given hour to the extent it has done the following:

(1) Seller has designated an amount of capacity equal to the Contract Quantity from one or more Units and/or from Alternate Capacity that satisfy the following requirements:

(a) The Units or Alternate Capacity designated by Seller are identified in their respective Master Files as eligible for sale to an out-of-balancing authority area Load Serving Entity;

(b) No CAISO Load Serving Entity has a right to the designated capacity;

(c) The capacity is capable of supporting energy exports during the entire hour; and

(d) The capacity is deliverable and has Full Capacity Deliverability Status as identified on the CAISO's Net Qualifying Capacity (NQC) list.

(2) Seller offers the designated capacity in the Day-Ahead Residual Unit Commitment Market ("**RUC Market**") to support the Contract Quantity; provided that, not more than ten (10) times in any contract year (or as otherwise agreed by Buyer and Seller), Buyer may, by notice to Seller no later than 0500 Pacific time on the applicable WECC Pre-Schedule Day, direct Seller not to offer any of the designated capacity into the RUC Market on a given day and instead to offer all (but not less than all) of the designated capacity in the Real Time Market (RTM) on that day. Bids into the RUC Market shall be at a price of zero dollars ($0.00) per MW.

(3) Seller has given Buyer timely notice of the Units or Alternate Capacity from which the Product will be provided and the information necessary for Buyer to schedule energy exports supported by such Units or Alternate Capacity as a Supporting Resource.

(4) The designated capacity has not been reduced as the result of forced outages or derates of the designated Units and/or Alternate Capacity that has been allocated to Buyer, it being understood that any reduction will reduce the amount of Product delivered.

For those days that Buyer directs Seller to offer all of the designated capacity in the RTM instead of the RUC Market as provided in clause (2), Buyer will hold Seller harmless from any negative price differential between the prices in the Day Ahead Market and RTM at the PNode(s) for the designated capacity. The price differential (defined as the Day Ahead Market price minus the RTM price) for the Contract Quantity will be calculated on an hourly basis for all hours in an applicable day, and the cumulative differential amount will be payable by Buyer to Seller monthly as provided below, but the monthly amount will not be less than zero (i.e. Seller will not be required to make a payment to Buyer.

In the event Buyer elects to join EDAM, and if the provisions of the CAISO Tariff, Business Practice Manuals and/or other rules and regulations relating to EDAM require modification of the requirements

for delivery of the Product, the Parties will meet and negotiate in good faith to make such revisions to this Transaction as may be necessary to comply with such provisions and to restore the costs, benefits and burdens of performance by each Party to those existing as of the Effective Date. Without limiting the generality of the foregoing, any EDAM requirements related to the receipt of the Product, including any requirement for firm transmission capacity from the point(s) where energy is exported from the CAISO system, shall be Buyer's responsibility.

Scheduling Coordinator; Other CAISO Revenues: Seller will be the Scheduling Coordinator for the Units and will take such actions as may be reasonably necessary to enable Seller to perform its obligations under this Confirmation. Except as otherwise expressly provided herein or in another agreement between Buyer and Seller, Seller shall be entitled to retain any revenues it may receive from the CAISO or a third party from sales of other products from the Units, including energy, ancillary services and unit contingent call rights to provide energy, so long as such sales to not interfere with or confer any right to any Product sold hereunder.

Adjustments to Contract Quantity: If and to the extent the Units are not available to provide the full amount of the Contract Quantity in any given hour, Seller may elect either not to provide the unavailable portion of the Contract Quantity or to provide Alternate Capacity to replace the unavailable portion of the Contract Quantity. Except as provided section titled "Excused Outages and Other Delivery Excuses", if Seller elects not to provide Alternate Capacity to replace unavailable Contract Quantity, Seller will be liable for damages as provided below.

Alternate Capacity: If Seller is unable to provide the full amount of the Contract Quantity from the Units initially designated to provide the Product, Seller may supply capacity from other Units, from a Designated Alternate Capacity Unit, or from other generating resources in the CAISO Balancing Authority Area that satisfy the requirements for Non-RA Capacity set forth above in the section titled "Delivery of Product" ("**Alternate Capacity**"); provided, however, that such Alternate Capacity provided from other generating resources in the CAISO Balancing Authority Area that are not Units or Designated Alternate Capacity Units shall not exceed 15% of the forecasted Product to be delivered over the entire Delivery Term and shall only be procured under the conditions set forth in 20 CCR section 2906(b)(2); provided, further, commencing on August 1, 2029, and on each August 1 thereafter during the Delivery Term, Buyer may inform Seller that Buyer does not want to continue to allow Seller to provide Alternate Capacity from resources other than the Units from and after January 1, 2030, or the January 1 following the date of the notice, as applicable,

through the remainder of the Delivery Term, in which case Seller shall not designate a resource that is not a Unit as Alternate Capacity after such date; provided, further, that if Buyer's board of directors adopts a policy (or revises an existing policy) that requires Buyer not to purchase energy or capacity from resources that emit greenhouse gases earlier than January 1, 2030, Buyer shall have the foregoing option as of the date five (5) months before the effective date of such new or revised policy. For the avoidance of doubt, Designated Alternate Capacity Units shall only be used as Alternate Capacity.

Remarketing Rights: During the Delivery Term, Buyer will have exclusive rights to offer, bid, or otherwise submit the Product, or any component thereof, from the Project for resale into the market or to any third party, and retain and receive any and all related revenues; *provided* that Buyer may not assign (in part or in full) this Confirmation or any of its rights and obligations hereunder in connection with such marketing and resale activities without Seller's prior written consent or unless otherwise in compliance with Section 14 of the WSPP Agreement, as modified by this Confirmation. Seller shall use commercially reasonable efforts to work with Buyer to finalize remarketing arrangements that will allow Buyer to remarket Product to third parties during the Delivery Term upon reasonable written request from Buyer; *provided* that Buyer shall reimburse Seller for any reasonable and material costs associated with such efforts and any remarketing or reselling of Product, and Seller shall incur no additional liabilities pursuant to the terms of any remarketing or resale arrangement.

Planned Outages: Planned Outage shall be scheduled in accordance with applicable CAISO procedures during the Non-Summer Months. Planned Outages will be limited to 45 days per calendar year. Planned Outages where the affected Contract Quantity is replaced by Alternate Capacity shall not be counted against the 45 days per year allowance for Planned Outages. Planned Outages affecting less than all of the Contract Quantity will be considered a Planned Outage for a part of a day corresponding to the pro rata amount of the affected Contract Quantity.

Excused Outages and Other Excused Events: Seller shall be excused from providing the Product or Alternate Capacity to the extent such failure is due to (i) an Excused Outage, (ii) Buyer's failure to perform any of its obligations hereunder, or (iii) any curtailment or reduction in priority of Buyer's export of energy outside of the CAISO Balancing Authority Area, including transmission outages and system emergencies, that is not the result of a failure of performance by Seller hereunder.

If Buyer notifies Seller that Seller may not provide Alternate Capacity from resources other than the Units as provided above in the section

titled "Alternate Capacity", Seller shall thereafter be excused from providing Product or Alternate Capacity to the extent the Units are not available to provide the full Contract Quantity except as the result of a Designated Unexcused Outage.

Each of the foregoing reasons for Seller being excused from providing the Product or Alternate Capacity is referred to herein as an "**Excused Event**". Buyer accepts the risk of Excused Events and agrees that there shall be no reduction in the monthly payment as a result of any failure to provide Product or Alternate Capacity due to an Excused Event.

Damages for Unexcused Failure To Provide Product: If in any month Seller fails to deliver at least 94.5% of the Contract Quantity from the Units or Alternate Capacity on average, calculated over all of the Assessment Hours in such month for reasons that are not Excused Events, Seller shall be subject to damages equal to the penalties that would be payable under the CAISO Tariff for failure to deliver the same amount of Resource Adequacy Capacity. Buyer and Seller acknowledge and agree that, as of the Effective Date, those penalties are RAAIM penalties equal to 60% of the CPM Soft-Cap Price (as provided in Section 40.9.6.1(b) of the CAISO Tariff), but those penalties may change as provided in the preceding sentence. Damages (if any) will be calculated on an hourly basis, but paid monthly as provided in the section title "Monthly Payment". Upon Buyer's reasonable request, Seller will provide access to any records, including outage reporting or settlement data from the CAISO necessary to verify the invoice.

Review of Unit Availability: From time to time as reasonably requested by Buyer, the Parties will meet and confer regarding the availability of the Unit(s). If the availability of the Unit(s) persistently is materially less than the then-applicable Contract Quantity, the Parties will discuss in good faith opportunities to improve such availability and, if they agree (each in its sole discretion) to make any appropriate amendments to this Transaction, including, but not limited to, adjustments to the Contract Quantity. However, unless and until the Parties enter into any such amendments, this Transaction shall continue in full force and effect.

Change In Law: In the event of any change in law or regulations, including but not limited to the CAISO Tariff, Scheduling Infrastructure Business Rules (SIBR), and/or Business Practice Manuals, that materially affects the requirements for capacity that supports energy exports from the CAISO Balancing Authority Area to an external Balancing Authority Area (i.e., a Supporting Resource) or that materially changes the rights or obligations of a Party or the costs, benefits or burdens of performance by a Party under this Confirmation, then, at the request

of the affected Party, the Parties will meet and negotiate in good faith to make such revisions to this Transaction as may be necessary to restore the costs, benefits and burdens of performance by each Party to those existing as of the Effective Date. If the Parties are unable to agree on such amendments after 90 days, this Transaction will continue in force, but Buyer may, at its option, resell the Product as Resource Adequacy Capacity, and Seller will cooperate with Buyer in effectuating such resale. Notwithstanding the foregoing, changes or delay resulting from Buyer's election to join EDAM shall be governed by the provisions of the sections entitled "Product" and "Delivery of Product".

Without limiting the foregoing, if during the Delivery Term the CAISO or the CPUC either replaces NQC as the value utilized to measure the qualifying capacity of a Unit with a successor value such as unforced capacity ("**UCAP**"), or utilizes such successor value as a supplemental means of measuring the qualifying capacity of a Unit together with NQC, then, at Seller's request, the Parties shall negotiate an amendment to this Confirmation so that, from and after the effective date of such replacement or supplement, the amount of Product to be provided by Seller to Buyer is no less than Buyer's pro rata share of the total qualifying capacity of the Units after such replacement or supplement (based on the ratio of the Contract Quantity to the total qualifying capacity of the Units before such replacement); provided that Seller may, at its option, agree to provide Product in excess of such amount up to the Contract Quantity.

Credit Support: Seller and Buyer are entering into the A&R RPS Agreement (as defined below) concurrently with the execution of this Confirmation. The security posted by Seller under the A&R RPS Agreement shall secure its obligations under both this Confirmation and the A&R RPS Agreement; provided that Buyer may only draw on such security pursuant to this Confirmation to recover damages payable under this Confirmation. The provisions of the A&R RPS Agreement shall govern the posting, maintenance and release of this security. However, if the A&R RPS Agreement is terminated for any reason, but this Confirmation continues in force, the Parties will amend this Confirmation within thirty (30) days after such termination to include the relevant portions of the A&R RPS Agreement relating to posting, maintenance, reduction and release of the security (with such changes as may be necessary to reflect the differences between the two confirmations), except that the amount(s) on Schedule 1 to the A&R RPS Agreement will be reduced to reflect the proportionate reduction in Buyer's overall exposure as a result of the termination of the A&R RPS Agreement (such reduction to be determined in proportion to the ratio of baseline payments (Contract Price x Contract Quantity) owing

from Seller pursuant to this Confirmation and the A&R RPS Agreement, in each case, as of the last full month ended prior to termination of the A&R RPS Agreement). Once Seller has achieved an Investment Grade Rating, or its obligations are guaranteed by an entity with an Investment Grade Rating, Seller shall no longer be required to post security under this Confirmation or the A&R RPS Agreement, and Buyer shall return any cash or letters of credit held as security as provided in the A&R RPS Agreement.

As long as Buyer maintains an Investment Grade Rating, Buyer will not be required to provide security for the performance of its obligations hereunder and under the A&R RPS Agreement. If Buyer ceases to maintain an Investment Grade Rating, Buyer will post and maintain security for its obligations hereunder and under the A&R RPS Agreement as provided in the A&R RPS Agreement; provided that Seller may only draw on such security pursuant to this Confirmation to recover damages payable under this Confirmation. If Buyer subsequently regains an Investment Grade Rating, Buyer shall not be required to post security under this Confirmation or the A&R RPS Agreement, and Seller shall return any cash or letters of credit held as security as provided in the A&R RPS Agreement.

Early Termination: The Parties have entered into a separate amended and restated agreement for the purchase and sale of renewable energy from the Units, which is dated concurrently with the Effective Date (the "**A&R RPS Agreement**"). In the event the A&R RPS Agreement is terminated for reasons other than as the result a default by a Party thereunder, either Party may also terminate this Agreement by written notice to the other Party within thirty (30) days after the termination of the A&R RPS Agreement. Any such termination shall be "without fault", and neither Party shall be subject to damages or ongoing obligations as a result of such termination.

Assignment: Notwithstanding anything in Section 14 of the WSPP Agreement to the contrary, Seller may, without the prior written consent of Buyer, transfer or assign this Confirmation and its rights and obligations hereunder to a Qualified Transferee; provided that Seller shall provide at least fifteen (15) Business Days notice to Buyer prior to any such transfer or assignment, and Seller shall not be relieved of its obligations under the Agreement prior to the effective date of such transfer or assignment and Seller's assignee having agreed in writing to assume all of Seller's obligations and liabilities under this Agreement. Upon any such assignment and the assumption in writing by the Affiliated assignee of all of Seller's obligations hereunder, Seller shall be released from any further obligation or liability under this Confirmation.

Seller may also assign this Confirmation as collateral for any financing or refinancing of some or all of the Units. In connection with any financing or refinancing of some or all of the Units by Seller, Buyer shall in good faith work with Seller and its lender to execute a consent to collateral assignment of this Agreement substantially in the form attached hereto as Exhibit D.

Limitation on Damages:

THE PARTIES CONFIRM THAT THE EXPRESS REMEDIES AND MEASURES OF DAMAGES PROVIDED IN THIS AGREEMENT SATISFY THE ESSENTIAL PURPOSES HEREOF. IF ANY PROVISION OF THIS AGREEMENT PROVIDES FOR AN EXPRESS REMEDY OR MEASURE OF DAMAGES, SUCH EXPRESS REMEDY OR MEASURE OF DAMAGES SHALL BE THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF THAT PROVISION, AND ALL OTHER REMEDIES OR DAMAGES AT LAW OR IN EQUITY FOR A BREACH OF SUCH PROVISION ARE WAIVED. IF NO REMEDY OR MEASURE OF DAMAGES IS EXPRESSLY PROVIDED, A PARTY'S LIABILITY FOR BREACH SHALL BE LIMITED TO DIRECT DAMAGES ONLY. EXCEPT FOR DAMAGES OWED TO UNAFFILIATED THIRD PARTIES WHICH MAY BE SUBJECT TO INDEMNIFICATION, NEITHER PARTY SHALL HAVE ANY LIABILITY FOR ANY CONSEQUENTIAL, INCIDENTAL, SPECIAL, INDIRECT, PUNITIVE OR EXEMPLARY DAMAGES OF ANY KIND, INCLUDING LOSS OF PROFITS OR BUSINESS OPPORTUNITIES, ARISING OUT OF OR RELATING TO THIS AGREEMENT OR THE ACTIVITIES CONTEMPLATED HEREBY, WHETHER ASSERTED IN CONTRACT, TORT OR OTHERWISE AND NOTWITHSTANDING THE INADEQUACY OR CLAIMED INADEQUACY OF ANY LIMITED REMEDY.

NOTWITHSTANDING ANYTHING HEREIN TO THE CONTRARY, SELLER'S TOTAL LIABILITY HEREUNDER AND UNDER THE A&R RPS AGREEMENT SHALL NOT EXCEED THE AMOUNTS SET FORTH ON SCHEDULE 1 TO THE A&R RPS AGREEMENT FOR THE PERIOD IN QUESTION.

Emission Performance Standard

This Agreement is a "covered procurement" under the CEC's EPS and Buyer shall make the required compliance filing with the CEC within 10 Business Days of the Effective Date. The Parties agree that this Agreement shall be void and all pending Product deliveries terminated no later than the effective date of any final decision by the CEC pursuant to the California Code of Regulations, Title 20, Section 2910 that the covered procurement fails to comply with EPS. The Parties acknowledge that the Project is a "determined to be compliant" power plant pursuant to 20 CCR §§ 2903(b)(1) or (2).

General Representations:

In addition to the representations and warranties contained in Section 37 of the Master Agreement, each of Purchaser and Seller represents and warrants to the other party that, as of the Effective Date:

(a) it is duly organized, validly existing and in good standing under the laws of the jurisdiction of its formation;

(b) it has all contractual, governmental, regulatory and legal authorizations necessary for it to legally perform its obligations under this Confirmation;

(c) the execution, delivery and performance of this Confirmation are within its powers, have been duly authorized by all necessary action;

(d) this Confirmation and each other document executed and delivered in accordance with this Confirmation constitutes its legally valid and binding obligation enforceable against it in accordance with its terms, subject to any bankruptcy, insolvency, reorganization and other laws affecting creditors' rights generally, and with regard to equitable remedies, the discretion of the court before which proceedings to obtain same may be pending; and

(e) it is acting for its own account, has made its own independent decision to enter into this Confirmation and as to whether this Confirmation is appropriate or proper for it based upon its own judgment, is not relying upon the advice or recommendations of the other Party in doing so, and is capable of assessing the merits of and understanding, and understands and accepts, the terms and conditions and risks of this Confirmation.

Certain Modifications of the WSPP Agreement:

The WSPP Agreement is hereby modified as follows:

(1) Section 21.1 of the WSPP Agreement is amended by deleting "other direct" in the ninth line. The Parties also agree that the waiver on the fifth line of that section does not apply to any damages or other remedies expressly provided for in this Confirmation.

(2) Section 21.3(a) of the WSPP Agreement is modified by (i) deleting the words "as follows" in the sixth line of the first sentence thereof and substituting the phrase "as set forth in the applicable Confirmation", (ii) deleting subsections (1), (2) and (3) thereof, (iii) deleting the phrase "and the Contract Price of the Confirmation to which the non-performed transaction is identified, and the Contract Quantity of the non-performed transaction, shall be applied to the calculation of amounts due under Section 21.3(a)(1) through (3), as applicable" at the end of the first paragraph of subsection (5) thereof and substituting the phrase "and damages shall be calculated in

accordance with the applicable Confirmations", and (iv) deleting the balance of subsection (5) after the first two paragraphs thereof.

(3) Section 21.3(d) of the WSPP Agreement is revised by (i) changing "the full amount of damages" on the second and third lines to "the undisputed amount of damages", and (ii) deleting the second sentence thereof.

(4) Section 22.1 of the WSPP Agreement is modified as follows:

(a) Subsection (d) is deleted and replaced with [intentionally omitted]":

(b) Subsections (f) through (j) are added as follows:

"(f) the failure of the Defaulting Party to perform any material covenant or obligation set forth in this Agreement (except to the extent constituting a separate Event of Default, and except for such Party's obligations to deliver or receive the quantities of Product due under this Agreement, the exclusive remedy for which is provided in Section 21.3) if such failure is not remedied within thirty (30) days after written notice;

(g) the termination of the A&R RPS Agreement as the result of a default by the Defaulting Party thereunder;

(h) the failure of the Defaulting Party to pay its debts generally as they become due or the Defaulting Party's admission in a writing that is unable to generally pay its debts as they become due;

(i) the institution, by the Defaulting Party, of a general assignment for the benefit of its creditors; or

(j) the application for, consent to, or acquiescence to, by the Defaulting Party, the appointment of a receiver, custodian, trustee, liquidator, or similar official for all or a substantial portion of its assets."

(5) Section 22.2(b) of the WSPP Agreement is amended by (i) inserting "and is continuing" after "Event of Default occurs" in the first line of the first paragraph, (ii) deleting the second sentence in the first paragraph, and (iii) deleting the second paragraph in its entirety.

(6) Section 22.3 of the WSPP Agreement is amended as follows:

(a) The second sentence of Section 22.3(b) is deleted and replaced with the following: "The "Present Value Rate" shall mean an annual rate equal to the "prime rate" as published in the Wall Street Journal from to time plus 2%."

(b) The third sentence of Section 22.3(c) is deleted and replaced with the following: "If the Non-Defaulting Party's aggregate Gains exceed its aggregate Losses and Costs, if any, resulting from the termination of this Agreement or a Confirmation, the Termination Payment for all such Terminated Transactions shall be zero, notwithstanding any provision in this Section or Agreement to the contrary."

(c) Section 22.3(e) (including all subsections) is deleted in its entirety and replaced with the following: "[intentionally omitted]"

(d) Section 22.3(f) is deleted in its entirety and replaced with the following:

"If the Defaulting Party disagrees with the calculation of the Termination Payment and the Parties cannot otherwise resolve their differences, and provided that Defaulting Party has paid the undisputed part of the Termination Payment to the Non-Defaulting Party and that any amounts disputed by the Defaulting Party are disputed in good faith, then the Defaulting Party may submit the calculation to dispute resolution pursuant to Section 34."

(7) Section 24 is amended by deleting "Utah" in the second line and replacing it with "California".

(8) Section 27 is deleted in its entirety and replaced with the following: "[intentionally omitted]".

(9) The netting provisions of Section 28 of the WSPP Agreement shall apply to the transaction covered by this Confirmation as if Buyer and Seller had both executed Exhibit A to the WSPP Agreement. Both Parties intend for the netting provisions of Exhibit A to the WSPP Agreement to be effective on the first day of the Delivery Term.

(10) Section 30.1 is amended by (a) inserting "or requested" after the word "required" in clause (4), (b) deleting "or" immediately before clause (7), and (c) adding the following at the end of the first sentence: "; or (8) to the Party's and such Party's affiliates' lenders and potential lenders, investors or potential investors, counsel, accountants, advisors

and agents who have a need to know such information and have agreed to keep such terms confidential".

(11) The second sentence of Section 31 of the WSPP Agreement is deleted.

(12) The second and third sentences of Section 32.5 of the WSPP Agreement are deleted.

(13) Sections 34.1 and 34.2 are deleted in their entirety and replaced with the following:

34.1 INFORMAL DISPUTE RESOLUTION

In the event of any dispute arising under this Confirmation, within ten (10) days following the receipt of a written notice from either Party identifying such dispute, the Parties shall meet, negotiate and attempt in good faith to resolve the dispute informally. If the Parties are unable to resolve a dispute arising hereunder within thirty (30) days after receipt of such notice, then each Party may seek any and all remedies available to it at law or in equity, subject to the limitations set forth in this Confirmation.

34.2 JURISDICTION; VENUE

Each Party submits to the jurisdiction of the state and federal courts located in Sacramento County, California, for any action or proceeding relating to this Confirmation or any transaction, and expressly waives any objection it may have to such jurisdiction or the convenience of such forum. Any litigation brought to enforce or interpret this Agreement shall be brought in the state or federal courts located in Sacramento County, California.

(14) The phrase "arbitration or" in the first line of Section 34.4 is deleted.

(15) The phrase "as of the date of execution of this Confirmation," is inserted after "to the other(s)" in the first line of Section 37.

(16) Section 41 of the WSPP Agreement is renumbered Section 42 and the following new Section 41 entitled "Standard of Review" is inserted between Sections 40 and 42:

41. STANDARD OF REVIEW

The Parties agree as follows:

41.1 Absent the agreement of all Parties to the proposed change, the standard of review for changes to any section of this Agreement (including all Transactions and/or Confirmations) specifying the rate(s) or other material economic terms and conditions agreed to by the Parties herein, whether proposed by a Party, a non-party or FERC acting *sua sponte*, shall be the "public interest" standard of review set forth in *United Gas Pipe Line Co. v. Mobile Gas Service Corp.*, 350 U.S. 332 (1956) and *Federal Power Commission v. Sierra Pacific Power Co*., 350 U.S. 348 (1956)(the "Mobile-Sierra" doctrine) and clarified in *Morgan Stanley Capital Group, Inc. v. Public Util. Dist. No. 1 of Snohomish* 554 U.S. 527 (2008) and *NRG Power Marketing LLC v. Maine Pub. Util. Comm'n*, 558 U.S. 165 (2010).

41.2 The Parties, for themselves and their successors and assigns, (i) agree that this "public interest" standard shall apply to any proposed changes in any other documents, instruments or other agreements executed or entered into by the Parties in connection with this Agreement and (ii) hereby expressly and irrevocably waive any rights they can or may have to the application of any other standard of review, including the "just and reasonable" standard.

Notices: All notices hereunder will be in writing and will be sent to the Parties at the notice addresses set forth on Exhibit C attached hereto.

Definitions: In addition to the defined terms in the WSPP Agreement, the following capitalized terms used in this Confirmation will have the meanings set forth below or defined elsewhere in this Confirmation. Excepted as otherwise defined herein, capitalized terms used in this Confirmation and defined in the CAISO Tariff will have the meanings defined in the CAISO Tariff.

"**A&R RPS Agreement**" has the meaning defined in the section titled "Early Termination."

"**Alternate Capacity**" has the meaning defined in the section titled "Alternate Capacity".

"**Assessment Hour**" means an "Availability Assessment Hour", pursuant to Section 40.9.3.1 of the CAISO Tariff.

"**Bid**" has the meaning defined in the CAISO Tariff.

"**Business Practice Manuals**" means the Business Practice Manuals issued by the CAISO addressing the administration, operation, planning and accounting requirements of the CAISO and the CAISO market.

"**CAISO**" means the California Independent System Operator Corporation or successor entity, or entities, with similar function(s).

"**CAISO Tariff**" means the CAISO's open access transmission tariff filed with, and approved by, the Federal Energy Regulatory Commission, as that tariff may be amended from time-to-time.

"**Day Ahead Market**" has the meaning defined in the CAISO Tariff.

"**Designated Unexcused Outage**" means Seller's failure to deliver the Product due to (i) its failure to designate in the applicable Master File(s) sufficient capacity at the Project or Alternate Capacity as eligible for sale to a Load Serving Entity outside of the CAISO Balancing Authority Area, (ii) its designation of capacity as Non-RA Capacity hereunder that has also been designated on a Supply Plan as a Resource Adequacy Resource, or (iii) its failure to provide Alternate Capacity after it has notified Buyer that it would provide Alternate Capacity.

"**Effective Date**" has the meaning defined in the preamble to this Confirmation.

"**Emission Performance Standard**" or "**EPS**" means the requirements set-forth in California Code of Regulations (CCR) Title 20, Chapter 11, Article 1, Section 2900 et seq.

"**Excused Event**" has the meaning defined in the section titled "Excused Outages and Other Excused Events".

"**Excused Outage**" means (i) an outage due to Uncontrollable Force, system emergencies, full or partial transmission outages (including public safety power shutoffs), actions by the CAISO or similar events or circumstances, and (ii) a Planned Outage.

"**Governmental Authority**" means any federal, state, local or municipal government, governmental department, commission, board, bureau, agency, or instrumentality, or any judicial, regulatory or administrative body, having jurisdiction as to the matter in question.

"**Investment Grade Rating**" means a rating of BBB- or better from S&P or a rating of Baa3 or better from Moody's.

"**Load Serving Entity**" has the meaning defined in the CAISO Tariff.

"**Master File**" has the meaning defined in the CAISO Tariff.

"**Moody's**" means Moody's Investors Service, Inc. or its successor.

"**Planned Outage**" means a Maintenance Outage (as defined in the CAISO Tariff) of any of the Units and any other outage characterized by the CAISO as a "planned outage" of any of the Units.

"**Net Qualifying Capacity**" or "**NQC**" has the meaning defined in the CAISO Tariff.

"**Non-Resource Adequacy Capacity**" or "**Non-RA Capacity**" has the meaning defined in the section titled "Product".

"**Qualified Transferee**" means (1) an Affiliate of Seller, or (2) any person succeeding to all or substantially all of the assets of Seller (whether voluntarily or by operation of law) that either itself or its direct or indirect parent, has (x) a tangible net worth of at least $50,000,000 or (y) a credit rating of "BB-" or higher by S&P or "Ba3" or higher by Moody's

"**Real Time Market**" or "**RTM**" has the meaning defined in the CAISO Tariff.

"**Resource Adequacy Capacity**" has the meaning defined in the CAISO Tariff.

"**RUC Market**" has the meaning defined in the section titled "Delivery of Product".

"**S&P**" means S&P Global Ratings (a subsidiary of S&P Global, Inc.), or its successor.

"**Supporting Resource**" has the meaning defined in the section titled "Product".

"**Unexcused Outage**" means and outage that is not an Excused Outage.

"**Units**" has the meaning defined in the section titled "Project".

"**WECC Pre-Schedule Day**" means, with respect to any day, the prescheduling day set forth in the applicable prescheduling calendar issued from time to time by the Western Electricity Coordinating Council.

EXHIBIT A

UNITS

Name of Facility	**CAISO Resource ID**
Aidlin Power Plant	ADLIN_1_UNITS
Sonoma Power Plant	SMUDGO_7_UNIT 1
Geysers Units 5&6	GYS5X6_7_UNITS
Geysers Units 7&8	GYS7X8_7_UNITS
Geysers Unit 11	GEYS11_7_UNIT11
Geysers Unit 12	GEYS11_7_UNIT12
Geysers Unit 13	GEYS11_7_UNIT13
Geysers Unit 14	GEYS11_7_UNIT14
Geysers Unit 16	GEYS11_7_UNIT16
Geysers Unit 17	GEYS11_7_UNIT17
Geysers Unit 18	GEYS11_7_UNIT18
Calistoga Power Plant	SANTFG_7_UNITS
Geysers Unit 20	GEYS11_7_UNIT20

EXHIBIT A

DESIGNATED ALTERNATE CAPACITY UNITS

Name of Facility	**CAISO Resource ID**
Delta Energy Center	DELTA_2_PL1X4

Exhibit B

MONTHLY SHAPE FACTOR

Month	Percentage of Average Annual Price
January	75.00%
February	75.00%
March	50.00%
April	41.67%
May	41.67%
June	100.00%
July	200.00%
August	200.00%
September	200.00%
October	100.00%
November	41.67%
December	75.00%

EXHIBIT C

NOTICES

Sacramento Municipal Utility District ("Buyer")	**Geysers Power Company, LLC ("Seller")**
All Notices:	**All Notices**:
PO Box 15380 Sacramento, CA 95852-0830 Attn: Energy Trading, MS A404 Phone: 916-732-5494 E-mail: powercontractsadmin@smud.org Duns: Federal Tax ID:	717 Texas Avenue, Suite 11.043C Houston, TX Zip: 77002 Attn: Contract Administration Phone: (713) 830-8845 E-mail: CommodityContracts@Calpine.com Duns: Federal Tax ID:
With a copy to:	With copies to:
Sacramento Municipal Utility District Attn: Energy Trading, MS A404 PO Box 15830 Sacramento, CA 95852-0830	Geysers Power Company, LLC 10350 Socrates Mine Road Middletown, CA 95461 Attn: Vice President, Regional Operations, Geyser Management
With a copy to:	and
Sacramento Municipal Utility District Attn: Commodity Settlements, MS A404 PO Box 15830 Sacramento, CA 95852-0830 Email: energysettlements@smud.org	Geysers Power Company, LLC 717 Texas Avenue, Suite 11.043C Houston, TX 77002 Attn: Associate General Counsel Email: ChiefLegalOfficer@calpine.com
Invoices: Attn: Commodity Settlements Email: energysettlemetns@smud.org Facsimile: (916) 732-5554	**Invoices:** Attn: Power Accounting Phone: (713) 830-2000 Facsimile: (713) 830-8749
Scheduling: Attn: Day Ahead Trading Email: dayaheadtrading@smud.org Phone: (916) 7325099	**Scheduling:** Attn: Scheduling Phone: (713) 830-8612 Facsimile: (713) 830-8722
Real Time Operations: Attn: Real Time Trading Email: rtt1@smud.org, rrt2@smud.org	**Payments:** Attn: Power Accounting

Phone: (916) 732-5177

Wire Transfer:
BNK:
ABA:
ACCT:
Account Name:

Credit and Collections:
Attn: Commodity Settlements
Email: energysettlements@smud.org
Facsimile: (916) 732-5554

With additional Notices of an Event of Default or Potential Event of Default to**:**

Attn: Randip Bhungal
Phone: (916) 732-6022
E-mail: randip.bhungal@smud.org

Phone: (713) 830-2000
Facsimile: (713) 830-8749

Wire Transfer:
BNK:
ABA:
ACCT:

Credit and Collections:
Attn: Power Accounting
Phone: (713) 830-2000
Facsimile: (713) 830-8749

With additional Notices of an Event of Default or Potential Event of Default to:

Attn: Associate General Counsel
Phone: (925) 557-2283
E-mail: ChiefLegalOfficer@calpine.com

EXHIBIT D

FORM OF CONSENT TO ASSIGNMENT

FORM OF

CONSENT AND AGREEMENT

among

[***Insert Name of Contracting Party***],
a [_____]
(Contracting Party)

and

GEYSERS POWER COMPANY, LLC,
a Delaware limited liability company
(Assignor)

and

MUFG UNION BANK, N.A.,
(First Lien Collateral Agent)

Dated as of [___]

This CONSENT AND AGREEMENT, dated as of [_____], 20[__] (this "Consent"), is *entered into by and among* ***[Insert name of Contracting Party]***, a [_____] [organized][formed] and existing under the laws of the State of [_____] (together with its permitted successors and assigns, "Contracting Party"), MUFG UNION BANK, N.A., in its capacity as collateral agent for the First Lien Secured Parties referred to below (together with its successors, designees and assigns in such capacity, "First Lien Collateral Agent"), and GEYSERS POWER COMPANY, LLC, a limited liability company formed and existing under the laws of the State of Delaware (together with its permitted successors and assigns, "Assignor").

RECITALS

A. Assignor owns the following geothermal electric generating facilities located in the Geysers area of Northern California (Sonoma and Lake Counties) (collectively, the "Projects"):

The Aidlin project, an approximately 18 megawatt geothermal facility located in Sonoma County, CA.

The Sonoma project, an approximately 53 megawatt geothermal facility located in Sonoma County, CA.

The two-unit McCabe project, an approximately 84 megawatt geothermal facility located in Sonoma County, CA.

The two-unit Ridge Line project, an approximately 76 megawatt geothermal facility located in Sonoma County, CA.

The Eagle Rock project, an approximately 68 megawatt geothermal facility located in Sonoma County, CA.

The Cobb Creek project, an approximately 51 megawatt geothermal facility located in Sonoma County, CA.

The Big Geysers project, an approximately 61 megawatt geothermal facility located in Lake County, CA.

The Sulphur Springs project, an approximately 47 megawatt geothermal facility located in Sonoma County, CA.

The Quicksilver project, an approximately 53 megawatt geothermal facility located in Lake County, CA.

The Lake View project, an approximately 54 megawatt geothermal facility located in Sonoma County, CA.

The Socrates project, an approximately 50 megawatt geothermal facility located in Sonoma County, CA.

The two-unit Calistoga project, an approximately 69 megawatt geothermal facility located in Lake County, CA.

The Grant project, an approximately 41 megawatt geothermal facility located in Sonoma County, CA.

B. In order to finance the operation and maintenance of the Projects, Assignor has entered into that certain Credit Agreement, dated as of June 9, 2020 (as amended, amended and restated, supplemented or otherwise modified from time to time, the "Credit Agreement"), with GEYSERS INTERMEDIATE HOLDINGS LLC, a Delaware limited liability company, as Holdings ("Holdings"), GEYSERS COMPANY, LLC, a Delaware limited liability company ("Geysers Company"), WILD HORSE GEOTHERMAL, LLC, a Delaware limited liability company ("Wild Horse") and CALISTOGA HOLDINGS, LLC, a Delaware limited liability company ("Calistoga," and, together with Holdings, Geysers Company and Wild Horse, each a "Guarantor" and together, the "Guarantors"), MUFG BANK, LTD., as administrative agent for the Lenders, MUFG UNION BANK, N.A., as collateral agent for the First Lien Secured Parties, and the financial institutions from time to time parties thereto in such other capacities as described therein (collectively, the "Lenders").

C. Contracting Party and Assignor have entered into that certain [***Insert description of relevant Major Project Contract(s)***], dated as of [_____] [____], [_____] (as amended, amended and restated, supplemented or otherwise modified from time to time in accordance with the terms thereof and hereof, the "Assigned Agreement").

D. As security for Assignor's obligations under the Credit Agreement and related financing documents with respect to the Loans and related obligations, Assignor has granted, pursuant to a security agreement executed by Assignor and First Lien Collateral Agent (as amended, amended and restated, supplemented or otherwise modified from time to time, the "Security Agreement"), to the First Lien Collateral Agent, for the benefit of the First Lien Secured Parties, a first priority lien on all of Assignor's right, title and interest in the Projects and other rights and interests relating thereto, whenever arising, including, without limitation, the Assigned Agreement and all of Assignor's right, title and interest under (but not any of Assignor's obligations, liabilities or duties with respect thereto) the Assigned Agreement;

AGREEMENT

NOW, THEREFORE, in consideration of the foregoing, and for other good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, and intending to be legally bound, the parties hereto hereby agree, notwithstanding anything in the Assigned Agreement to the contrary, as follows:

1. Assignment and Agreement.

1.1 Consent to Assignment. Contracting Party (a) is hereby notified and

acknowledges that the Lenders have entered into the Credit Agreement and made the extensions of credit contemplated thereby in reliance upon the execution and delivery by Contracting Party of the Assigned Agreement and this Consent, (b) consents to the collateral assignment under the Security Agreement of all of Assignor's right, title and interest in, to and under the Assigned Agreement, including, without limitation, all of Assignor's rights to receive payment and all payments due and to become due to Assignor under or with respect to the Assigned Agreement (collectively, the "Assigned Interests") and (c) acknowledges the right of First Lien Collateral Agent or a Subsequent Owner (as defined below), in the exercise of First Lien Collateral Agent's rights and remedies pursuant to the Security Agreement, upon written notice to Contracting Party, to make all demands, give all notices, take all actions and exercise all rights of Assignor under the Assigned Agreement.

1.2 Subsequent Owner.

(a) Contracting Party agrees that, if First Lien Collateral Agent notifies Contracting Party in writing that, pursuant to the Security Agreement, it has assigned, foreclosed or sold the Assigned Interests or any portion thereof, then (i) First Lien Collateral Agent or its successor, assignee and/or designee, or any purchaser of the Assigned Interests (a "Subsequent Owner") shall be substituted for Assignor under the Assigned Agreement and (ii) Contracting Party shall (1) recognize First Lien Collateral Agent or the Subsequent Owner, as the case may be, as its counterparty under the Assigned Agreement and (2) continue to perform its obligations under the Assigned Agreement in favor of First Lien Collateral Agent or the Subsequent Owner, as the case may be; provided that First Lien Collateral Agent or such Subsequent Owner, as the case may be, has assumed in writing all of Assignor's rights and obligations (including, without limitation, the obligation to cure any then existing payment and performance defaults, but excluding any obligation to cure any then existing performance defaults which by their nature are incapable of being cured) under the Assigned Agreement.

(b) **[*Insert the following only if warranties are provided by Contracting Party under the relevant Assigned Agreement:*** Without limiting anything herein, the warranties provided by Contracting Party under the Assigned Agreement shall continue in full force and effect (until the expiration of the applicable warranty periods set forth in the Assigned Agreement) in the event that First Lien Collateral Agent or a Subsequent Owner succeeds to Assignor's right, title and interest in the Assigned Agreement.]

1.3 Right to Cure. If Assignor defaults in the performance of any of its obligations under the Assigned Agreement, or upon the occurrence or non-occurrence of any event or condition under the Assigned Agreement which would immediately or with the passage of any applicable grace period or the giving of notice, or both, enable Contracting Party to terminate or suspend its performance under the Assigned Agreement (each hereinafter a "default"), Contracting Party shall not terminate or suspend its performance under the Assigned Agreement until it first gives written notice of such default to First Lien Collateral Agent and affords

First Lien Collateral Agent a period of at least 15 days (or if such default is a nonmonetary default, such longer period (not to exceed 60 days) as may be required to cure such default) from receipt of such notice to cure such default; provided, however, that (a) if possession of the Projects is necessary to cure such nonmonetary default and First Lien Collateral Agent has commenced foreclosure proceedings, First Lien Collateral Agent shall be allowed a reasonable time to complete such proceedings, and (b) if First Lien Collateral Agent is prohibited from curing any such nonmonetary default by any process, stay or injunction issued by any governmental authority or pursuant to any bankruptcy or insolvency proceeding or other similar proceeding involving Assignor, then the time periods specified herein for curing a default shall be extended for the period of such prohibition.

1.4 No Amendments.

(a) [reserved]

(b) Except for the Buyer Limited Assignment Right under section (p) of the Additional Terms of the Assigned Agreement, Contracting Party agrees that it shall not, without the prior written consent of First Lien Collateral Agent, which consent shall not be unreasonably withheld, (i) sell, assign or otherwise transfer any of its rights under the Assigned Agreement, (ii) terminate, cancel or suspend its performance under the Assigned Agreement (unless it has given First Lien Collateral Agent notice and an opportunity to cure in accordance with Section 1.3 hereof), (iii) consent to any assignment or other transfer by Assignor of its rights under the Assigned Agreement, or (iv) consent to any voluntary termination, cancellation or suspension of performance by Assignor under the Assigned Agreement.

1.5 Replacement Agreements. In the event the Assigned Agreement is rejected or terminated as a result of any bankruptcy, insolvency, reorganization or similar proceeding affecting Assignor, Contracting Party shall, at the option of First Lien Collateral Agent exercised within 30 days after such rejection or termination, enter into a new agreement with First Lien Collateral Agent having identical terms as the Assigned Agreement (subject to any conforming changes necessitated by the substitution of parties and other changes as the parties may mutually agree), provided that (i) the term under such new agreement shall be no longer than the remaining balance of the term specified in the Assigned Agreement, and (ii) upon execution of such new agreement, First Lien Collateral Agent cures any outstanding payment and performance defaults under the Assigned Agreement, excluding any performance defaults which by their nature are incapable of being cured.

1.6 Limitations on Liability. Unless and until First Lien Collateral Agent has assumed Assignor's rights and obligations under the Assigned Agreement or entered into a new agreement, Contracting Party acknowledges and agrees that First Lien Collateral Agent shall not have any liability or obligation to Contracting Party under the Assigned Agreement as a result of this Consent, the Security Agreement or otherwise, nor shall First Lien Collateral Agent be obligated or required to (a)

perform any of Assignor's obligations under the Assigned Agreement, except during any period in which First Lien Collateral Agent has assumed Assignor's rights and obligations under the Assigned Agreement pursuant to Section 1.2[(a)] above, or (b) take any action to collect or enforce any claim for payment assigned under the Security Agreement. If First Lien Collateral Agent has assumed Assignor's rights and obligations under the Assigned Agreement pursuant to Section 1.2[(a)] above or has entered into a new agreement pursuant to Section 1.5 above, First Lien Collateral Agent shall be subject to liability and obligations to Contracting Party under the Assigned Agreement or such new agreement for the period that it is party to the Assigned Agreement or such new agreement.

1.7 Delivery of Notices. Contracting Party shall deliver to First Lien Collateral Agent, concurrently with the delivery thereof to Assignor, a copy of each notice, request or demand given by Contracting Party to Assignor pursuant to the Assigned Agreement relating to (a) a default by Assignor under the Assigned Agreement, and (b) any matter that would require the consent of First Lien Collateral Agent pursuant to Section 1.4 above.

1.8 Transfer. First Lien Collateral Agent shall have the right to assign all of its interest in the Assigned Agreement or a new agreement entered into pursuant to the terms of this Consent; provided that such transferee assumes in writing the obligations of Assignor or First Lien Collateral Agent, as applicable, under the Assigned Agreement or such new agreement. Upon such assignment, First Lien Collateral Agent shall be released from any further liability under the Assigned Agreement or such new agreement to the extent of the interest assigned.

1.9 Refinancing. [Contracting Party hereby acknowledges that Assignor may, from time to time during the term of the Assigned Agreement, refinance the indebtedness incurred under the Credit Agreement pursuant to another bank financing, an institutional financing, a capital markets financing, a lease financing or any other combination thereof or other form of financing. In connection with any such refinancing, Contracting Party hereby consents to any collateral assignment or other assignment of the Assigned Agreement in connection therewith and agrees that the terms and provisions of this Consent shall apply with respect to such assignment and shall inure to the benefit of the parties providing such refinancing. In furtherance of the foregoing, Contracting Party agrees that (i)(1) references in this Consent to the "First Lien Collateral Agent" and the "First Lien Secured Parties" shall be deemed to be references to the applicable financing parties providing such refinancing, and (2) references in this Consent to the "Credit Agreement" and the "Security Agreement" shall be deemed to be references to the corresponding agreements entered into in connection with such refinancing, and (ii) if reasonably requested by Assignor, it shall enter into a new consent, substantially in the form of this Consent (including any material changes from this form of Consent as may be agreed by Contracting Party) in favor of the parties providing

such refinancing.][1]

[*Insert the following only if Contracting Party is an Affiliate of Assignor under the relevant Assigned Agreement:* 1.10 No Obligations. Notwithstanding anything to the contrary herein or in the Assigned Agreement, in the event that First Lien Collateral Agent or its designee(s) or assignee(s) succeed to the Assignor's interest under the Assigned Agreement or foreclose on the equity interests of Assignor, First Lien Collateral Agent or its designee or assignee shall have the right, which must be exercised within thirty (30) days following such person succeeding to Assignor's interest under the Assigned Agreement or such foreclosure on the Assignor's equity interests, to terminate the Assigned Agreement upon written notice to Contracting Party and neither it nor any First Lien Secured Party nor the Assignor shall have any further obligations under the Assigned Agreement, including without limitation, obligations in respect of the payment of any fees, commissions or expenses, provided that such termination shall not affect obligations incurred prior to the date of termination for services provided.]

2. Payments under the Assigned Agreement.

2.1 Payments. Contracting Party shall pay all amounts (if any) payable by it under the Assigned Agreement in the manner and as and when required by the Assigned Agreement directly into the account specified on Exhibit A hereto, or to such other person, entity or account as shall be specified from time to time by First Lien Collateral Agent to Contracting Party in writing. Notwithstanding the foregoing, if any entity or person has become a Subsequent Owner pursuant to the terms hereof, then Contracting Party shall pay all such amounts directly to such Subsequent Owner or an account designated by Subsequent Owner.

2.2 No Offset, Etc. All payments required to be made by Contracting Party under the Assigned Agreement shall be made without any offset, recoupment, abatement, withholding, reduction or defense whatsoever, other than those allowed by the terms of the Assigned Agreement.

3. Representations and Warranties of Contracting Party. Contracting Party hereby represents and warrants, in favor of First Lien Collateral Agent, as of the date hereof, that:

(a) Contracting Party (i) is a [_____] duly [**formed**][**organized**] and validly existing under the laws of the State of [_____], (ii) is duly qualified, authorized to do business and in good standing in every jurisdiction necessary to perform its obligations under the Assigned Agreement and this Consent, and (iii) has all requisite power and authority to enter into and to perform its obligations hereunder and under the Assigned Agreement, and to carry out the terms hereof and thereof and the transactions contemplated hereby and thereby;

(b) the execution, delivery and performance by Contracting Party of this

[1] This Section 1.9 to be included at Borrowers election and with such changes as Borrower may reasonably request.

Consent and the Assigned Agreement have been duly authorized by all necessary corporate or other action on the part of Contracting Party and do not require any approvals, filings with, or consents of any entity or person which have not previously been obtained or made;

(c) each of this Consent and the Assigned Agreement is in full force and effect, has been duly executed and delivered on behalf of Contracting Party by the appropriate officers of Contracting Party, and constitutes the legal, valid and binding obligation of Contracting Party, enforceable against Contracting Party in accordance with its terms, except as the enforceability thereof may be limited by (i) bankruptcy, insolvency, reorganization or other similar laws affecting the enforcement of creditors' rights generally, and (ii) general equitable principles (whether considered in a proceeding in equity or at law);

(d) there is no litigation, action, suit, proceeding or investigation pending or (to the best of Contracting Party's knowledge) threatened against Contracting Party before or by any court, administrative agency, arbitrator or governmental authority, body or agency which, if adversely determined, individually or in the aggregate, (i) could adversely affect the performance by Contracting Party of its obligations hereunder or under the Assigned Agreement, or which could modify or otherwise adversely affect any required approvals, filings or consents which have previously been obtained or made, (ii) could have a material adverse effect on the condition (financial or otherwise), business or operations of Contracting Party, or (iii) questions the validity, binding effect or enforceability hereof or of the Assigned Agreement, any action taken or to be taken pursuant hereto or thereto or any of the transactions contemplated hereby or thereby;

(e) the execution, delivery and performance by Contracting Party of this Consent and the Assigned Agreement, and the consummation of the transactions contemplated hereby and thereby, will not result in any violation of, breach of or default under any term of its formation or governance documents, or of any contract or agreement to which it is a party or by which it or its property is bound, or of any license, permit, franchise, judgment, injunction, order, law, rule or regulation applicable to it, other than any such violation, breach or default which could not reasonably be expected to have a material adverse effect on Contracting Party's ability to perform its obligations under the Assigned Agreement;

(f) neither Contracting Party nor, to the best of Contracting Party's knowledge, any other party to the Assigned Agreement, is in default of any of its obligations thereunder;

(g) to the best of Contracting Party's knowledge, (i) no event of force majeure exists under, and as defined in, the Assigned Agreement, and (ii) no event or condition exists which would either immediately or with the passage of any applicable grace period or giving of notice, or both, enable either Contracting Party or Assignor to terminate or suspend its obligations under the Assigned Agreement; and

(h) the Assigned Agreement, this Consent, the Limited Assignment (a form of

which is attached as Exhibit B to the Assigned Agreement0, if and when signed, and that certain [WSPP Export Non-Resource Adequacy Confirmation] dated [____] between Assignor and Contracting Party are the only agreements between Assignor and Contracting Party with respect to the Project, and all of the conditions precedent to effectiveness under the Assigned Agreement have been satisfied or waived.

Each of the representations and warranties set forth in this Section 3 shall survive the execution and delivery of this Consent and the Assigned Agreement and the consummation of the transactions contemplated hereby and thereby.

4. Miscellaneous.

4.1 Notices. Any communications between the parties hereto or notices provided herein to be given may be given to the following addresses:

If to Assignor:

Geysers Power Company, LLC
717 Texas Avenue, Suite 11.043C
Houston, Texas 77002
Facsimile: (832) 325-1582
Telephone: (832) 325-1581
Attention: Chief Legal Officer
Email: ChiefLegalOfficer@calpine.com

If to Contracting Party:

_____
_____
_____
Facsimile: _____
Telephone: _____
Attention: _____

If to First Lien Collateral Agent:

_____
_____
_____
Facsimile: _____
Telephone: _____
Attention: _____

All notices or other communications required or permitted to be given hereunder shall be in writing and shall be considered as properly given (a) if delivered in person, (b) if sent by overnight delivery service (including Federal Express, UPS, DHL and other similar overnight delivery services), (c) in the event overnight delivery services are not readily available, if mailed by first class United States Mail, postage prepaid, registered or certified

with return receipt requested, (d) if sent by prepaid telegram or by facsimile or (e) if sent by other electronic means (including electronic mail) confirmed by facsimile or telephone. Any party may change its address for notice hereunder by giving of 30 days' notice to the other parties in the manner set forth hereinabove.

4.2 Governing Law; Submission to Jurisdiction.

(a) THIS CONSENT AND THE RIGHTS AND OBLIGATIONS OF THE PARTIES HEREUNDER SHALL BE CONSTRUED IN ACCORDANCE WITH, AND BE GOVERNED BY, THE LAWS OF THE STATE OF NEW YORK (WITHOUT GIVING EFFECT TO THE PRINCIPLES THEREOF RELATING TO CONFLICTS OF LAW EXCEPT SECTIONS 5-1401 AND 5-1402 OF THE NEW YORK GENERAL OBLIGATIONS LAW).

(b) Any legal action or proceeding with respect to this Consent and any action for enforcement of any judgment in respect thereof may be brought in the courts of the State of New York or of the United States of America for the Southern District of New York, and, by execution and delivery of this Consent, Contracting Party hereby accepts for itself and in respect of its property, generally and unconditionally, the non-exclusive jurisdiction of the aforesaid courts and appellate courts from any appeal thereof. Contracting Party irrevocably consents to the service of process out of any of the aforementioned courts in any such action or proceeding by the mailing of copies thereof by registered or certified mail, postage prepaid, to Contracting Party at its notice address provided pursuant to Section 4.1 hereof. Contracting Party hereby irrevocably waives any objection which it may now or hereafter have to the laying of venue of any of the aforesaid actions or proceedings arising out of or in connection with this Consent brought in the courts referred to above and hereby further irrevocably waives and agrees not to plead or claim in any such court that any such action or proceeding brought in any such court has been brought in an inconvenient forum. Nothing herein shall affect the right of First Lien Collateral Agent to serve process in any other manner permitted by law or to commence legal proceedings or otherwise proceed against Contracting Party in any other jurisdiction.

4.3 Counterparts. This Consent may be executed in any number of counterparts and by the different parties hereto on separate counterparts, each of which when so executed and delivered shall be an original, but all of which shall together constitute one and the same instrument. Delivery of an executed counterpart to this Consent by facsimile or "pdf" transmission shall be as effective as delivery of a manually signed original.

4.4 Headings Descriptive. The headings of the several sections and subsections of this Consent are inserted for convenience only and shall not in any way affect the meaning or construction of any provision of this Consent.

4.5 Severability. In case any provision in or obligation under this Consent shall be invalid, illegal or unenforceable in any jurisdiction, the validity, legality and enforceability of the remaining provisions or obligations, or of such provision or obligation in any other jurisdiction, shall not in any way be affected or impaired

thereby.

4.6 Amendment, Waiver. Neither this Consent nor any of the terms hereof may be terminated, amended, supplemented, waived or modified except by an instrument in writing signed by Contracting Party and First Lien Collateral Agent.

4.7 Successors and Assigns. This Consent shall bind and benefit Contracting Party, First Lien Collateral Agent, and their respective successors and assigns.

4.8 Third Party Beneficiaries. Contracting Party and First Lien Collateral Agent hereby acknowledge and agree that the First Lien Secured Parties are intended third party beneficiaries of this Consent.

4.9 [intentionally omitted]

4.10 Entire Agreement. This Consent and any agreement, document or instrument attached hereto or referred to herein integrate all the terms and conditions mentioned herein or incidental hereto and supersede all oral negotiations and prior writings between the parties hereto in respect of the subject matter hereof. In the event of any conflict between the terms, conditions and provisions of this Consent and any such agreement, document or instrument (including, without limitation, the Assigned Agreement), the terms, conditions and provisions of this Consent shall prevail.

4.11 Termination of Consent. This Consent shall terminate upon the earliest to occur of (a) the termination or cancellation of the Assigned Agreement in accordance with its terms and in accordance with the terms of this Consent (it being understood that this Consent shall not terminate but shall remain in effect in the circumstances described in Section 1.5 above in respect of any new agreement entered into in accordance with such Section), (b) the expiration of the term of the Assigned Agreement and (c) the termination of the Security Agreement in accordance with its terms.

[*REMAINDER OF PAGE INTENTIONALLY LEFT BLANK*]

IN WITNESS WHEREOF, the parties hereto, by their officers duly authorized, intending to be legally bound, have caused this Consent and Agreement to be duly executed and delivered as of the date first above written.

GEYSERS POWER COMPANY, LLC,
a Delaware limited liability company,
as Assignor

By: _____
Name:
Title:

[*Insert Name of Contracting Party*],
a [_____],
as Contracting Party

By: _____
Name:
Title:

Accepted and Agreed to:

MUFG UNION BANK, N.A.,
solely in its capacity as First Lien Collateral Agent

By: _____
Name:
Title:

By: _____
Name:
Title:

CALIFORNIA ENERGY COMMISSION
EMISSION PERFORMANCE STANDARD COMPLIANCE FILING

California Energy Commission
EPS Compliance
1516 Ninth Street
Sacramento, CA 95814-512
Attention: Compliance Filing

EPS@energy.state.ca.us

DRAFT
TO BE FINALIZED FOLLOWING CONTRACT EXECUTION.

This is to inform you that the Sacramento Municipal Utility District (SMUD) amended an existing long-term contract for renewable energy ("the Renewable Energy Contract") and a long-term contract for capacity (the "Capacity Contract") on [MONTH] [DAY], 2025 (hereinafter referred to collectively as the "Power Purchase Agreements"). The relevant information concerning these Power Purchase Agreements follows. The information is the same for both agreements except as expressly noted below:

Name of Counterparty: Geysers Power Company, LLC

Name of Facility:

Renewable Energy Contract and Capacity Contract facilities:

Table 1

Name of Facility	CEC RPS ID
Aidlin Power Plant	60115A
Sonoma Power Plant	60010A
Geysers Units 5&6	60002A
Geysers Units 7&8	60003A
Geysers Unit 11	60025A
Geysers Unit 12	60004A
Geysers Unit 13	60005A
Geysers Unit 14	60026A
Geysers Unit 16	60006A
Geysers Unit 17	60007A
Geysers Unit 18	60008A
Calistoga Power Plant	60117A
Geysers Unit 20	60009A

Capacity Contract only: In addition to the resources above, the Facility below may be used to provide Alternate Capacity only, under limited circumstances, as described more fully herein:

CALIFORNIA ENERGY COMMISSION
EMISSION PERFORMANCE STANDARD COMPLIANCE FILING

Table 2

Name of Facility	CAISO Resource ID	2024 Emissions Factors		
		mtons	Net mwh	Lbs/mwh
Delta Energy Center	DELTA_2_PL1X4	1,315,655	3,098,999	936

Location of Facility: Geothermal (Renewable Energy and Capacity Contracts): Lake County and Sonoma County. Natural Gas (Capacity Contract only): Contra Costa County

Technology/Fuel: Geothermal (Renewable Energy and Capacity Contracts); Natural Gas (Capacity Contract only)

Nameplate Capacity of Facility: Total of 13 geothermal generating units with a portfolio nameplate capacity of 725 MW. Additionally, under the Capacity Contract, 880 MW natural gas, combined cycle co-generation facility.

Product Description Initially: Generation portfolio, Baseload

Substitute Energy Allowed: No substitute energy/product allowed under the Renewable Energy Contract; substitute capacity/product allowed with the Capacity Contract under certain circumstances (see explanation below)

Delivery Start Date – Delivery End Date: The initial delivery term of the Power Purchase Agreements was from January 1, 2023 through December 31, 2032. The amendments at issue here become effective January 1, 2026 and extend the terms of each agreement through December 31, 2042.

Further description of technology, if necessary: None

Further description of facility output profile, if necessary: None

Description of contract terms related to the provision of substitute energy, if necessary:

Under the Renewable Energy Contract, substitute energy/product is not allowed unless the contract is further amended and the CEC approves a subsequent Emission Performance Standard filing for the new facility(ies).

Under the Capacity Contract, substitute capacity/product is not allowed unless the specified renewable geothermal units identified in Table 1 are unable to provide the contracted for capacity. Under such circumstances, the Seller may provide substitute capacity/product (referred to in the contract as Alternate Capacity) from:

(1) the Delta Energy Center (Table 2, above), a specified, EPS Compliant Source, consistent with Title 20, California Code of Regulations, Section 2906(b)(1); or

(2) unspecified sources in the CAISO Balancing Authority Area, but in an amount not to exceed 15% of the forecasted capacity/product to be delivered over the entire term of the contract, and only when the specified units (identified in Table 1, above) are unable to provide the contracted-

for capacity, and only under circumstances consistent with those set forth in Title 20, California Code of Regulations, Section 2906(b)(2). No other substitute capacity/product is allowed under the Capacity Contract unless the contract is further amended and the CEC approves a subsequent Emission Performance Standard filing for the new facility(ies).

Description of other relevant contract terms: SMUD's original Power Purchase Agreements contemplated the purchase and provision of 100 MW of energy, environmental attributes (including renewable energy credits), and resource adequacy capacity from the portfolio of facilities. The CEC determined these Power Purchase Agreements were compliant with the EPS in 2022. (See Order No. 22-0608-01a.) The amendment to the Power Purchase Agreements being presented through this Compliance Filing increases SMUD's procurement from 100 MW to 125 MW in 2028 and from 125 MW to 150 MW in 2030. It also extends the Power Purchase Agreements for an additional 10 years through December 31, 2042.

CALIFORNIA ENERGY COMMISSION
EMISSION PERFORMANCE STANDARD COMPLIANCE FILING

COMPLIANCE FILING ATTESTATION

I, the official named below, certify under penalty of perjury, the following:

1. I am an agent of the Sacramento Municipal Utility District (SMUD) authorized by its governing board to sign this attestation on its behalf;
2. The SMUD Board of Directors has reviewed and approved in a public meeting both the covered procurement and the compliance filing described above;
3. Based on the SMUD Board of Directors' knowledge, information, and belief, the compliance filing does not contain a material misstatement or omission of fact;
4. Based on the SMUD Board of Directors' knowledge, information, and belief, the covered procurement complies with Title 20, Division 2, Chapter 11, Article 1 of the California Code of Regulations; and
5. The covered procurement contains contractual terms or conditions specifying that the contract or commitment is void and all energy/product deliveries shall be terminated no later than the effective date of any Commission decision pursuant to Title 20, California Code of Regulations, section 2910, that the covered procurement fails to comply with Title 20, Division 2, Chapter 11, Article 1, of the California Code of Regulations.

Sacramento Municipal Utility District

By: _____

Paul Lau, CEO & General Manager

Date:

DRAFT

RESOLUTION NO. _____

WHEREAS, by Resolution No. 22-03-09, adopted March 17, 2022, this Board authorized the Chief Executive Officer and General Manager (CEO/GM), or his designee, to negotiate and execute the specific terms and conditions of a **Power Purchase Agreement (PPA)**, consisting of two confirmations, with **Geysers Power Company, LLC** (parent company Calpine Corporation) for a term of 10 years (2023-2032) from the **Geysers Project** in Lake and Sonoma Counties **(PPA1)**; and

WHEREAS, **PPA1** provides for 100 MW of around-the-clock carbon-free baseload geothermal energy, including **Portfolio Content Category 1 Renewable Energy Credits (PCC1 RECs)** plus 100 MW of resource adequacy capacity which SMUD can export from the **California Independent System Operator (CAISO)** as firm capacity, and

WHEREAS, SMUD and **Geysers Power Company, LLC** have mutually agreed to amend and extend **PPA1** to increase to 125 MW in 2028 and to 150 MW in 2030; and

WHEREAS, the delivery term will extend from December 31, 2032, to December 31, 2042; and

WHEREAS, SMUD's **2030 Zero Carbon Plan** specifically identifies the need for incorporation of a geothermal resource in SMUD's portfolio; and

WHEREAS, Senate Bill 1368 (2006) prohibits publicly-owned electric utilities from entering into covered long-term procurements for electricity that do not meet the Greenhouse Gas **Emission Performance Standard (EPS)** adopted by the **California Energy Commission (CEC)**; and

WHEREAS, the governing body of a local publicly-owned electric utility must determine whether prospective covered procurements comply with the **EPS**; and

WHEREAS, **CEC** regulations provide that power plants that meet the criteria of an eligible renewable electricity generation facility, as defined by the **California Renewables Portfolio Standard (RPS)** legislation and **CEC** guidelines adopted thereunder, are "determined to be compliant" with the **EPS**; and

WHEREAS, the **Geysers Project** meets the criteria of a renewable electricity generation facility, as defined by the applicable legislation and guidelines, and is, therefore, determined to be compliant under the **CEC** regulations and to the extent alternate capacity is provided from the **Delta Energy Center** if the **Geysers Project** is unavailable, it is otherwise compliant with the **CEC** regulations; and

WHEREAS, the price and other terms proposed in the **PPA** are commercially reasonable and benefit SMUD's ratepayers; **NOW, THEREFORE,**

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

Section 1. The Chief Executive Officer and General Manager (CEO/GM), or his delegate, is authorized to negotiate and execute the specific terms and conditions of an **Amended and Restated Power Purchase Agreement (PPA)**, which consists of two confirmations, with **Geysers Power Company, LLC**, for up to 150 MW of geothermal energy in substantial conformance with **Attachment ___** and **Attachment ___**.

Section 2. This Board approves the **California Energy Commission (CEC) Emission Performance Standard (EPS)** compliance filing and authorizes the

CEO/GM, or his designee, to sign the compliance filing attestation, in substantial conformance with **Attachment ___**.

Section 3. This Board authorizes the CEO/GM, or his designee, to make changes to the compliance filing that are required by the **CEC** or its staff.

Section 4. The CEO/GM, or his designee, is authorized to make future changes to the terms and conditions of the **PPA** that, in his prudent judgment: (a) further the primary purpose of the **PPA**; (b) are intended to provide a net benefit to SMUD; and (c) do not exceed the authorized **PPA** amounts and applicable contingencies.

SSS No. BOD 2025-015

BOARD AGENDA ITEM

STAFFING SUMMARY SHEET

Committee Meeting & Date
Policy – 11/12/25
Board Meeting Date
November 20, 2025

TO		TO	
1.	Farres Everly	6.	
2.	Suresh Kotha	7.	
3.	Brandy Bolden	8.	
4.		9.	**Legal**
5.		10.	**CEO & General Manager**

Consent Calendar		**Yes**	X	**No** *If no, schedule a dry run presentation.*	**Budgeted**	X	**Yes**		**No** *(If no, explain in Cost/Budgeted section.)*

FROM (IPR)	DEPARTMENT	MAIL STOP	EXT.	DATE SENT
Heidi Sanborn / Crystal Henderson	Board Office	B307	6155	10/14/25

NARRATIVE:

Requested Action: Discuss, with possible action, Election of Officers for 2026 (President and Vice President) for the SMUD Board of Directors.

Summary: The Directors will discuss and make recommendations for Board President and Vice President for January through December of the upcoming year.

Board Policy: *(Number & Title)* Governance Process GP-5, Election of the Board President and Vice President states in pertinent part that, "[t]he Board shall select each year a president and vice president to preside over it…." This discussion supports the governance process.

Benefits: Having this discussion will allow the directors a forum to voice their choices for President and Vice President for the upcoming year.

Cost/Budgeted: There is no budgetary impact for this item.

Alternatives: Not select Board Officers at this time.

Affected Parties: Board of Directors

Coordination: Board Office

Presenter: Gregg Fishman, Board President

Additional Links:

SUBJECT	ITEM NO. *(FOR LEGAL USE ONLY)*
Election of 2026 Board Officers	**10**

ITEMS SUBMITTED AFTER DEADLINE WILL BE POSTPONED UNTIL NEXT MEETING.

DRAFT

RESOLUTION NO. _____

WHEREAS, President Fishman called for the election of the President of the Board of Directors for the year 2026; and

WHEREAS, Director _____ nominated Director _____ for the position of President of the Board of Directors for 2026; and

WHEREAS, hearing no other nominations, the President closed the nominations and proceeded to a vote; **NOW, THEREFORE,**

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

That this Board hereby elects Director _____ to serve as President of the Board of Directors for the 2026 term commencing January 1, 2026, through December 31, 2026.

DRAFT

RESOLUTION NO. _____

WHEREAS, President Fishman called for the election of the Vice President of the Board of Directors for the year 2026; and

WHEREAS, Director _____ nominated Director _____ for the position of Vice President of the Board of Directors for 2026; and

WHEREAS, hearing no other nominations, the President closed the nominations and proceeded to a vote; **NOW, THEREFORE,**

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SACRAMENTO MUNICIPAL UTILITY DISTRICT:

That this Board hereby elects Director _____ to serve as Vice President of the Board of Directors for the 2026 term commencing January 1, 2026, through December 31, 2026.