Board Orientation - Power Resources

Monica Padilla, Director of Power Resources
March 5, 2021
Power Resources Team

Monica Padilla, Director of Power Resources
Ian Williams, Power Resources Manager
Eric Kim, Power Resources Planner
Thomas Messier, Power Resources Analyst
Karthik Rajan, Principal Power Analyst
Mike Wardell, Contractor

Power Analyst (vacant)
Power Supply Board Orientation

- Electricity 101
- Portfolio Planning & Management
- Energy Market Participants & Products
- California Grid
- SVCE’s Power Content Label
- Reliability & Resource Adequacy
Electricity 101

- **A Watt – measure of electricity**
  - Example: a light bulb can use 100 watts
  - 10 light bulbs = 1,000 watts or 1 kilowatt (kW)
  - 1,000,000 watts = 1,000 kW
  - 1,000 kW = 1 Megawatt (MW)

- **Demand is the instantaneous measure of power**
  - If you turn on 10 – 100-watt light bulbs at the same time the demand = 1,000 watts

- **Energy measures the amount of electricity used over time**
  - A 100-watt light bulb used for one hour = 1 kilowatt-hour (kWh)
    - Used over 2 hours = 2 kWh
    - 1 MW over 10 hours = 10 MWh
• Capacity Factor (CF) – the % of time a Power Plant can produce electricity
  • A 50 MW solar project can operate 30% of the time – 30% CF

• Voltage is the pressure needed to move electricity through wires
  • Measured in volts or kilo-volts (kV)
  • High Voltage moves through transmission lines such as 100-500 kV
  • Household plugs are at 110 volts

• Capacity is amount of electricity a Power Plant can produce at any one time measured in MW
How Much Electricity?

- Typical home uses 840 kWh in a month
- 10,080 kWh in a year or ~10 MWh

- SVCE’s peak Demand is ~800 MW
- SVCE’s Energy consumption is 4,000,000 MWh per year

- Solar Facility typical 50 to 200 MW capacity
- 50 MW Solar can generate 131,400 MWh per year – 3% of SVCE’s Energy needs
SVCE’s Load varies monthly

Peak Demand is in August/September at ~800 MW

Annual Energy is ~4,000,000 MWh
Load varies on an hourly basis

Supply must equal Demand
Clean energy generation profile

1 MW Annual Average Hourly Profiles By Technology

Varies hourly, monthly and seasonally
Market – Key Participants

• Load Serving Entities
  • Community Choice Aggregators
  • Investor-Owned Utilities (IOU)
  • Publicly or Municipal Owned Utilities or (Munis or POUs)
  • Energy Service Providers (ESPs) – serve Direct Access customers

• Wholesale Market Power Suppliers
  • Renewable Project Developers – through Power Purchase Agreements
  • Natural Gas & Other Generators
  • Marketers

• California Independent System Operator (CAISO) – The Grid Operator
• Western Energy Coordinating Council (WECC)
Electricity Products

• Clean and/or Carbon-Free Energy
  • Solar, wind, geothermal, large hydroelectricity, nuclear

• Renewable Portfolio Standard (RPS) – eligible resources
  • Wind, solar, small hydro, geothermal, biomass, biomethane
  • Buckets/Power Content Category (PCC) - **PCC1**, PCC2 & PCC3

• System Energy – “brown” energy from CAISO

• Unit Specified – brown or clean energy from a specific resource

• Asset Controlling Supplier – Northwest hydro provider

• Ancillary Services – regulation up/down & reserves

• Resource Adequacy Capacity - for reliability
The CAISO Operates the Grid and Balances Load & Supply Resources

- One of nine grid operators in North America
- 2/3 of the U.S. is supported by an ISO
- One of 38 balancing authorities in the western interconnection

SVCE Schedules 100% of its Load and Resources into the CAISO

The CAISO is responsible for the second-to-second balancing of Load and Supply
CAISO How it Works

Sellers

- Energy Marketers
- Generators

Buyers

- Load Serving Entities
- Transmission Owners

Settlements

SVCE interacts with the CAISO through an SC ZGlobal

The CAISO transmits power to customers through PG&E’s transmission system

Daily SVCE forecasts its hourly load and submits hourly schedules to the CAISO

Daily - hourly schedules of Supply resources are scheduled into the CAISO on behalf of SVCE

Marketers & generators submit daily, hourly schedules of Supply resources into the CAISO

CAISO How it Works
Energy Risk Management

- Load settled at CAISO at hourly prices (index)
- Board-approved Energy Risk Management Policies
  - Approved counterparties, products and quantity
  - Delegation of Authority – up to 5 years
  - Risk Oversight Committee
- Min/Max tolerance bands - % of load covered w/fixed-priced energy to hedge hourly load cost
  - “laddering strategy”
  - Price diversification
  - Improves budget certainty

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<th>Period (Calendar Year)</th>
<th>NOP Minimum Tolerance</th>
<th>NOP Maximum Tolerance</th>
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<tr>
<td>Prompt quarter</td>
<td>85%</td>
<td>105%</td>
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<td>Balance of year</td>
<td>80%</td>
<td>105%</td>
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<td>Year 2 (2022)</td>
<td>70%</td>
<td>90%</td>
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<td>Year 3 (2023)</td>
<td>55%</td>
<td>75%</td>
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<td>Year 4 (2024)</td>
<td>40%</td>
<td>60%</td>
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<tr>
<td>Year 5 (2025)</td>
<td>0%</td>
<td>50%</td>
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Physical Flow of Electricity

All load-serving entities in the CAISO, such as SVCE, receive electricity from the supply mix from the CAISO at that instant in time – “system power”

Each MWh of Clean energy generates Renewable Energy Certificates (REC) or Carbon-free attribute. The owner/buyer is the only entity that can claim the environmental attributes.
Power Content Label (PCL)

Demonstrates a load serving entities power supply mix & must have attributes & be verified

**GreenPrime**
100% Eligible Renewable (RPS) - Premium electricity offering

**GreenStart**
100% Clean - Standard electricity offering

50% RPS eligible renewables
50% Carbon-free, non-RPS

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<th>ENERGY RESOURCES</th>
<th>GreenPrime</th>
<th>GreenStart</th>
<th>2019 CA Power Mix</th>
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<tr>
<td>Biomass &amp; Biowaste</td>
<td>0.0%</td>
<td>3.5%</td>
<td>2.4%</td>
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<tr>
<td>Geothermal</td>
<td>0.0%</td>
<td>3.5%</td>
<td>4.8%</td>
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<tr>
<td>Eligible Hydroelectric</td>
<td>0.0%</td>
<td>8.3%</td>
<td>2.0%</td>
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<tr>
<td>Solar</td>
<td>25.0%</td>
<td>17.8%</td>
<td>12.3%</td>
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<tr>
<td>Wind</td>
<td>75.0%</td>
<td>15.6%</td>
<td>10.2%</td>
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<tr>
<td>Coal</td>
<td>0.0%</td>
<td>0.0%</td>
<td>3.0%</td>
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<tr>
<td>Large Hydroelectric</td>
<td>0.0%</td>
<td>53.5%</td>
<td>14.6%</td>
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<td>Natural Gas</td>
<td>0.0%</td>
<td>0.0%</td>
<td>34.2%</td>
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<tr>
<td>Nuclear</td>
<td>0.0%</td>
<td>0.0%</td>
<td>9.0%</td>
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<tr>
<td>Other</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.2%</td>
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<tr>
<td>Unspecified sources of power</td>
<td>0.0%</td>
<td>0.0%</td>
<td>7.3%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
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Percentage of Retail Sales Covered by Retired Unbundled RECs: 0.0%
SVCE’s Renewable Projects

2 RFOs w/Central Coast Community Energy
Executed Power Purchase Agreements
• 8 PPAs
• 40% of 2024 load
• 50 MW geothermal
• 353 MW Solar
• w/ 123 MW storage (458 MWh)
• 70% Solar + 30% Geo

2020 RFO in process w/3CE

On-track to exceed SB350 Long-term RPS Procurement Mandates

$1B+ worth of Renewable Contracts
Resource Adequacy

- California requires all LSE’s to demonstrate sufficient capacity for reliability purposes – Resource Adequacy (“RA”)
  - System RA – planning reserve margin (PRM) to cover 115% of peak capacity needs – SVCE peak is 800 MW
  - Local RA – capacity located in congested areas – will move to a Central Procurement Entity in 2023
  - Flexible RA – capacity to deal with “duck curve” ramping requirements
- Wind and solar qualify for RA, but not much and varies significantly per month
- Storage can meet RA requirements, but also have limits
- Geothermal is a baseload resource with high-capacity factor & RA
- CPUC in the process of revamping RA structure
The “Duck Curve”

- Net Load = Load minus Rooftop Solar
- Overgeneration of electricity from solar “belly of the duck”
- Prices during the belly of the duck are low, sometimes negative
- Curtailment of clean energy
- High ramp costs at “neck of the duck” 4 pm to 7 pm
- SVCE has a high penetration of rooftop solar & steep ramp
- Big problem for California & WECC
Reliability & Resource Adequacy

- Currently SVCE meets almost 100% of it’s RA with via natural gas power plants
- SVCE’s Renewable PPAs will help meet 25-30% RA needs with Clean capacity
- Demand Response RA will play an increasing role & help with Duck Curve
- Storage with solar is necessary to offset curtailment
- Clean baseload energy such as geothermal is essential, but expensive
- long-duration energy storage is necessary and may be mandated
- Natural gas fleet will remain essential for grid reliability through 2045

The State Forecasts a Gap in 2024

- Natural Gas Plants phasing out
- Diablo Canyon shut down in 2024
- Less imports
- Increasing renewables

Based on a 20% PRM - gap will grow to 7,500 MW in 2026
Compliance Requirements & Mandates

• Integrated Resource Planning (IRP) – GHG reduction, biannual to CPUC
• Load forecasting – CPUC and CEC
• SB 350 & SB 100 – sets RPS mandates
• RPS Procurement Plan – annual to CPUC
• RPS Compliance Report – annual to CPUC
• Power Content Label – annual
• Resource Adequacy Filings - annual & monthly to CPUC & CAISO
• Procurement Mandates – CPUC directed – as needed
  • Incremental RA for 2021-23, Summer 2021 RA
  • Possible: Long Duration Storage & Geothermal to fill the 2024-2026 Gap

Just a few of them...
Portfolio Planning, Management

Planning & Forecast
How Much, When, and For what reason

Procurement
When, what & where, and price

Schedule & Delivery
Matching of Demand and Supply

Settlements
What was delivered, settled & payment

& Compliance
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Questions?
# Sample Suppliers & Products

<table>
<thead>
<tr>
<th>Type/Name</th>
<th>Products</th>
<th>Term</th>
<th>Contract Type</th>
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</thead>
<tbody>
<tr>
<td>Developers:</td>
<td><strong>EDF, Slate, Ormat, Coso, Nextera, 8 Minute Energy, 174 Power Global,</strong></td>
<td><strong>RPS PCC1 bundled energy and RECs,</strong></td>
<td>Power Purchase Agreement</td>
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<tr>
<td></td>
<td></td>
<td><strong>capacity and resource adequacy</strong></td>
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<tr>
<td></td>
<td><strong>Global, First Solar</strong></td>
<td></td>
<td></td>
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<tr>
<td>Marketers:</td>
<td><strong>Calpine, SENA, Exelon, BP, Powerex, Nextera, Morgan Stanley,</strong></td>
<td><strong>Energy hedges,</strong> <strong>RPS PCC1</strong> <strong>(fixed</strong></td>
<td>Master Agreement – Edison Electric Institute or WSPP</td>
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<tr>
<td></td>
<td></td>
<td><strong>price and index plus REC), Resource</strong></td>
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<tr>
<td></td>
<td></td>
<td><strong>Adequacy, carbon-free energy,</strong></td>
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<td></td>
<td></td>
<td><strong>ACS</strong></td>
<td></td>
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<tr>
<td>Utilities &amp; Other</td>
<td><strong>LSEs:</strong> PG&amp;E, SCE, SDGE, 3CE, EBCE, PCE, etc</td>
<td><strong>RPS PCC1 and Resource Adequacy</strong></td>
<td>Master Agreement – Edison Electric Institute or WSPP</td>
</tr>
<tr>
<td>CAISO</td>
<td><strong>System energy, ancillary services, congestion revenue rights</strong></td>
<td><strong>Day Ahead and Real-time</strong></td>
<td>CAISO Agreement</td>
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</table>
SVCE Legislative and Regulatory Board Training

March 5, 2021
The Legislative and Regulatory Policy Team

• We advocate for policies that advance SVCE’s goals, by
  • Collaborating/meeting with legislators to change the law.
  • Working with and through other stakeholders to influence policymakers at all levels.
  • Appearing before the CPUC to provide input to inform policies.
Topics Covered

• Key CPUC terms
• Power Charge Indifference Adjustment
• Direct Access
• Resource Planning and Reliability
Key CPUC Terms

• CPUC uses a legal process that forms the basis of Orders that adopt regulations.
  • CPUC uses different forums to gather information to include on the record within a Proceeding

• CPUC Orders: Commissioners vote on "Decisions" and "Resolutions" developed by other commissioners or staff.
  • Most Proposed Decisions and Draft Resolutions must be issued at least 30 days before a vote to allow for public comment.
  • If a quorum vote in favor, then adopted Final Decisions and Final Resolutions become regulations.
Power Charge Indifference Adjustment (PCIA)

- Investor-owned utilities (IOUs) procure electricity on behalf of their customers.
  - When customers leave to take service under a CCA, they are responsible for paying for the costs of legacy resources purchased prior to their transition to a CCA.
  - Those costs are recovered via the PCIA.
PCIA Impacts and Trends

- As of March 1, the average PCIA is 4.6 cents/kWh.
- SVCE Customers pay a total PCIA of about $100 million annually.
- SVCE customers do not get the benefits of the resources purchased on their behalf.
- The PCIA has increased over 900% since 2013 with no signs of declining until after the closure of Diablo Canyon Power Plant.
• CCA customers see a line item for the PCIA fees on page 2 of their bills.

• The PCIA is charged monthly based on the amount of electricity use.

• Although utility customers currently do not see a specific line item for the PCIA, the IOUs are required to list the PCIA beginning 2022.
PCIA: Calculation Overview

- UOG (Capex, opex, return, taxes)
  - Fuel Costs

- Purchased Power Costs

- Bundled Load
  - RPS * MPB

- Sales Revenues
  - (RPS, RA, Energy, A/S)

- Bundled Load
  - RA * MPB

- IOU PORTFOLIO COSTS

- IOU PORTFOLIO VALUE

= INDIFFERENCE AMOUNT ($)

× BILLING DETERMINANTS (class/vintage)
Direct Access (DA)

- DA is CPUC program that allows nonresidential customers to purchase electricity from an electric service provider (ESP) up to an overall maximum load amount in each utility territory.
  - The utility delivers the electricity that the customer purchases from the ESP to the customer over its distribution system.
SB 237: Expansion of Direct Access

• SB 237 was signed into law in September 2018.
  • Phase 1: The DA cap was increased by 4,000 GWh.
    • SVCE is set to lose about 65 GWh over 2021-22; a small amount given that 70% of SVCE load is DA eligible.
  • Phase 2: The CPUC must make recommendations to the Legislature on implementing a further DA reopening schedule to completely lift the cap.
  • The recommendations are due on March 15th, 2021.
Integrated Resource Planning (IRP)

• IRP is a process to ensure that the electricity sector is on track to meet its portion of 2030 GHG reduction goals.
IRP Background

• **SB 350** (De León, 2015): Established a goal of total economy-wide goal of reducing emissions 40% below 1990 levels by 2030.
  - LSEs’ forecasted ability to meet a 2030 GHG target representing its pro rata share of the broader electricity sector target of 46 MMT

• LSEs must participate in a 2-year IRP process established by the CPUC.

• SVCE submitted its most recent IRP in September 2020.
The Two-Year CA IRP Process

- **Reference System Plan**: Models system-wide mitigation from a centralized, least-cost perspective.

- **Individual LSE IRPs**: Includes resource templates, GHG calculator, and narrative report.

- **Preferred System Plan**: Aggregates information from the individual IRPs into estimated emissions trajectory.

- **Procurement Track**: Compares RSP and PSP and identifies gaps and corrections needed.

- **CAISO TPP Process**: Ensures grid is prepared to serve a system that can meet policy goals.

**Silicon Valley Clean Energy**
Focus on Reliability

- Root Cause Analysis: Ordered by the Governor and conducted by CPUC, CEC and CAISO to understand events that lead to rotating blackouts.
  - Analysis identified actions in the near-term (2021), mid-term (2022 -25), and long-term (2026 and beyond).
  - CPUC is currently considering near-term and mid-term actions to address future extreme weather events.
  - A proposed decision on near-term actions is expected in March or April.
Reliability/Resource Adequacy (RA)

- RA is a regulatory construct developed to ensure that there will be sufficient resources available to serve electric demand under most conditions.
Additional Slides
## Exit Fee (PCIA): Source of Inputs

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<th>Source of Inputs</th>
<th>Description</th>
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<tr>
<td>Cost of Capital</td>
<td>(Triennial/Utility Specific)</td>
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<tr>
<td>General Rate Case</td>
<td>(Triennial/Utility Specific)</td>
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<tr>
<td>PCIA Rulemaking</td>
<td>(Ad hoc/Generic)</td>
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<tr>
<td>ERRA Forecast</td>
<td>(Annual/Utility Specific)</td>
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<tr>
<td>ERRA Compliance</td>
<td>(Annual/Utility Specific)</td>
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<tr>
<td>Advice Letters</td>
<td>(Ad hoc/Utility Specific)</td>
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**SILICON VALLEY CLEAN ENERGY**
Statewide DA Load Percentage 1998-2018

Source: CPUC DA Website
Risk Management Concepts
Overview
Discussion Items

• Risks Arising from Power Supply Portfolio
• Market Risk Measures
  • Positions
  • Mark to Market
  • Portfolio Risk
  • Risk Factors
• Credit Risk
• Collateral Posting
• Trade Offs Among Market, Credit, and Liquidity Risk
Portfolio Risk Management Objectives

- Reduce Risk

- Hedge and not speculate
  - We do not take a market view
  - Market is what is currently transactable
  - Execute transactions ratably over time
Risks

• Starts with our Load Obligation and Existing Portfolio Supply Positions

• Price Risk: Fluctuations in Market Price

• Credit Risk: Counterparty fails to meet its obligation

• Model Risk: Errors in forecasting and valuation models

• Operations Risk: Efficiently dispatching/scheduling of resources

• Enterprise Risk: Regulatory Uncertainty, Market Failures
Portfolio Positions

• Forwards
  • An agreement to buy/sell a specific amount of commodity at a specified price (Power Purchase Agreements)

• Options
  • The right, but not the obligation, to buy (call option) or sell (put option) a specific amount of commodity at a specified price and time

• Long Position
  • Price increases reduce portfolio cost

• Short Position
  • Price increases increase portfolio cost

• Open Position
  • Difference between long and short positions
Mark-to-Market (MTM)

• Similar to daily changes in valuation of your 401 portfolios
  • If you were to liquidate your portfolio what would be your profit or loss

• Example
  • Bought 25 MW of NP15 Peak Energy for delivery in August 2021 at price of $35 per MWh
  • Today the trading price for NP15 Peak Energy for August 2021 is at $50 per MWh
  • MTM: \((50 - 35) \times 25 \times 416 = 156,000\)
Portfolio Risk

- How large the deviation can be between portfolio value in the future and portfolio value today within a particular time horizon (such as fiscal year) and confidence interval.

- Typically computed using Monte Carlo Simulation for complex energy portfolios
  - Inputs: Forward Prices, Volatilities, Correlations, and Portfolio Positions
Credit Risk

- Counterparty fails to meet its contractual obligations
- Obligation is equal to MTM of forward positions plus any accrued balances
- Example: SVCE has a contract with Counterparty A to deliver 25 MW of NP15 Peak energy in August 2021 at price of $35 per MWh
  - If Counterparty A were to default on its obligation, SVCE would have to replace the energy at the prevailing market price.
  - If SVCE were to default on its obligation, then Counterparty A would have to sell the energy at the prevailing market price.
  - If current market price is at $50 per MWh, then SVCE has a $156,000 exposure
  - If current market price is at $25 per MWh, then Counterparty A has a $104,000 exposure
Credit Risk Management – Collateral Posting

• Letters of credit or cash are posted to manage credit risk

• Establish line of credit with counterparty
  • Line of credit = Unsecured credit granted by counterparty plus posted collateral
  • SVCE Posts: Line of Credit with Counterparty < SVCE’s Obligation to the counterparty
  • Counterparty Posts: Line of Credit Granted by SVCE < Counterparty’s obligation to SVCE
Liquidity risk: Inability to make payments because of insufficient cash/liquid assets.

- **Market Risks if Unhedged**
- **Liquidity and Credit Risk if Hedged**

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<th>Time</th>
<th>Market Risk</th>
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</table>

|           | Cost | Time | Liquidity Risk |
|-----------|------|------|               |
|          |      |      |               |

- **Upside**
- **Downside**
- **Expected**

SILICON VALLEY CLEAN ENERGY
THANK YOU