Experience of Incorporating Solar Power into Water System Operations

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Los Angeles County Waterworks Districts

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Chevron Energy Solutions
Outline

• 350 kW single-axis tracker PV
• Waterworks background
• Why are we doing it
• What we have done so far
  – Choosing a site
  – Cost estimate
  – Bid solicitation/awarding
  – CEQA, CSI, Permitting
  – Construction
Outline

- Financing Options
- Funding Sources
- Design Considerations
- Changes in the Industry
Los Angeles County Waterworks Districts

Districts

- Kagel Canyon
- Malibu and Marina Del Ray
- Val Verde
- Acton
- Antelope Valley
District 40, Antelope Valley

- Lancaster
- Desert View Highlands
- Sun Village
- Littlerock
- Northeast LA County
- Lake LA
- Pearblossom
- Rock Creek

8 regions
170,000 customers
District No. 40, Antelope Valley

- 170,000 residents / 55,000 connections
- Current Demand: 50,000 AF/yr
- Average Day Demand: 750 gallons / customer
- Water Sources:
  - 40% Ground Water
  - 60% AVEK-SWP
- Ground Water Sources:
  - 50 GW wells,
  - 85 Booster Pumps,
  - 12 turnouts
- Power Consumption: 10-30 million kWh/yr
- Power Cost: $1-3 million/yr
Population of District 40

<table>
<thead>
<tr>
<th>Year</th>
<th>Accounts</th>
<th>Population</th>
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<tbody>
<tr>
<td>2000</td>
<td>41,000</td>
<td>127,000</td>
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<tr>
<td>2005</td>
<td>49,000</td>
<td>149,000</td>
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<tr>
<td>2010</td>
<td>55,000</td>
<td>172,000</td>
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Population^ \rightarrow Demand/Supply^ \rightarrow Energy^
SCE Energy Cost Trend

- Increasing rate shows greater need for alternative energy source

Cents / kWh

7% escalation

U.S. Energy Information Administration (EIA)
Antelope Valley Solar Efficiency

Note: The uncertainty of the contoured values is generally ±10%. In mountainous and other areas of complex terrain, the uncertainty may be higher.
Objectives

To implement a cost effective means to secure competitive, stable, long-term electricity prices, reduce carbon footprint, and improve sustainability.

To be able to implement the proper process for selecting a design-build contractor to develop renewable energy projects; anticipate the environmental compliance process; and evaluate the various funding sources available.
Doing the Research

• Other Water Utilities
• Solar Consultants (may not be able to bid)
• SCE classes
• California Solar Initiative (CSI) website
• Association of California Water Agencies (ACWA) webcasts
• National Renewable Energy Laboratories (NREL)
How to Choose a Site

- Adequate un-shaded land
- Consume large amount of energy
- Flexible operation
- Long term land-use planning
Cost Estimating

- Design = $250,000
- Construction = $3 per kilowatt-hour/yr
- Maintenance = $0.025 per DCwatt + 2% annual inflation
- Consider CSI rebate (use trigger tracker)
- Compare to energy savings over 25 year life
- Payback period ~ 13 years
CSI Trigger Tracker

<table>
<thead>
<tr>
<th>Administrator</th>
<th>Customer Class *</th>
<th>Current Step</th>
<th>Initial MW in Step</th>
<th>Unused MW from Previous Steps</th>
<th>Revised Total MW in Step</th>
<th>Issued Conditional Reservation Letters (MW)</th>
<th>MW Remaining</th>
<th>MW Under Review</th>
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<td>PGE</td>
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<td>50.50</td>
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<td>SCE</td>
<td>Residential</td>
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<td>38.00</td>
<td>1.74</td>
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<td>11.90</td>
<td>0.24</td>
<td>12.14</td>
<td>6.12</td>
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<td>7.04</td>
<td>24.34</td>
<td>12.69</td>
<td>11.65</td>
<td>0.01</td>
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Incentive MW Available by Step, by Program Administrator and Customer Class

CSI Step table: CSI Rebate Levels by Incentive Step and Rebate Type

<table>
<thead>
<tr>
<th>Step</th>
<th>Statewide MW in Step</th>
<th>EPBB Payments (per Watt)</th>
<th>PBI Payments (per kWh)</th>
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<td></td>
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<td>EPBB Non-Residential</td>
<td>EPBB Government/Non-Profit</td>
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<td></td>
<td>Commercial</td>
<td>Government/Non-Profit</td>
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<td>50</td>
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<td>n/a</td>
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<td>2</td>
<td>70</td>
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<td>4</td>
<td>130</td>
<td>$1.90</td>
<td>$1.90</td>
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<td>5</td>
<td>160</td>
<td>$1.55</td>
<td>$1.55</td>
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<td>6</td>
<td>190</td>
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<td>7</td>
<td>215</td>
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<td>$0.65</td>
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<td>8**</td>
<td>250</td>
<td>$0.35</td>
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<td>9**</td>
<td>285</td>
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<tr>
<td>10**</td>
<td>350</td>
<td>$0.20</td>
<td>$0.20</td>
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Bid Process & Scope of Work

- Select List vs. RFP vs. ISD
- Fixed Tilt vs. Tracker
- Range of system sizes
- Engineering/Design; Installation
- Environmental impact initial study;
- CSI requirements
- Start-up, commissioning, and demonstration
- Operation and maintenance training.
Awarding

Design Build Contractor Selection Qualifications

– Project Manager & key team experience
– Company experience
– References / Reputation
– Financial Stability
– Total cost & Unit Cost (per kWh/yr)

The system chosen was based on technology, payback period, available land, and site energy consumption.
Environmental Permitting

• California Environmental Quality Act (CEQA) is a statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible
  – Initial Study
  – Negative Declaration
  – Community Meeting
Construction Permitting

• Building & Safety
  – Structural, electrical, geotechnical
• Fire Department
• SWPPP
• Air Quality Mgmt District (Construction activities)
• Energy Utility Interconnection
Construction
Key Points

Solar is ideal in Southern California

Keep an eye on Trigger Tracker as you move forward

Get on CEQA and CSI right away

Allow extra time for permitting hiccups

Explore all possible financing and funding options
Financing Options

• Direct Buy/ownership
  – Streamlined and low cost
  – Takes risk and maintenance

• Tax Exempt Lease Purchase

• Power Purchase Agreement (PPA)
  – Investor owns and sells electricity
  – Federal tax benefits
Supplemental Funding Sources

• Utility Incentives (CSI)
• Renewable Energy Credits (RECs)
• California AB32 compliance credits
• Federal & State Grants

• DSIRE™ – Database of State Incentives for Renewable and Efficiency (www.dsireusa.org)
Utility Incentives - CA

- Reserve Early!
- *CSI Trigger Tracker*
- Run calculations to estimate incentive
- Expected Performance Based Buydown (EPBB) vs. Performance Based Incentive (PBI)
- PBI requires 3rd Party reporting
- Award (incentive) received in Lump Sum (EPBB) or Periodically (PBI)
Net Energy Meter

NEM is a gateway to optimizing the rate of return on a solar investment.

• Allows customers to zero-out their bills.
• Credits customer accounts at full retail rates.
• Accurately captures energy generated and consumed, providing customers with annual performance data.
Design Considerations

• Site Conditions
  – Load to be offset
  – Shape and size of site
  – Terrain

• Fixed vs. Single Axis vs. Two Axis
  – Fixed: lowest first cost, least production
  – Single Axis: medium first cost, ~15%-25% more production, increased maintenance cost
  – Two Axis: highest first cost, ~30%-40% more production, highest maintenance cost
Maintenance Considerations

Scope to consider:
- Periodic washing
- Electrical equipment maintenance (thermal scan, annual cleaning & testing)
- Tracker system maintenance

In-house vs. Contracted
- Qualified skills, availability
- Tools & equipment

Costs depend on system, scope & level of service.
- Maintenance only
- Comprehensive warranty
- Emergency response
- Monitoring services

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>COST (Estimated)</th>
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</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>$0.015 - $0.020 / kWh</td>
</tr>
<tr>
<td>1- Axis</td>
<td>$0.025 - $0.030 / kWh</td>
</tr>
<tr>
<td>2- Axis</td>
<td>$0.035 - $0.040 / kWh</td>
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</tbody>
</table>

Consider hybrid solution
Questions

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Waterworks Districts

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