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

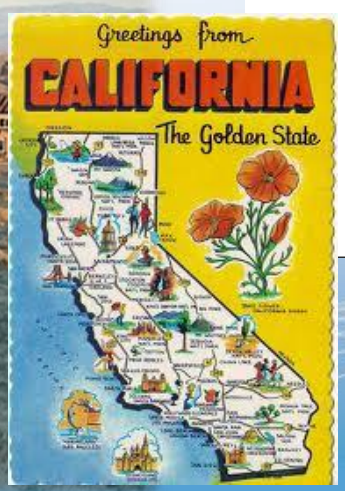
Outline

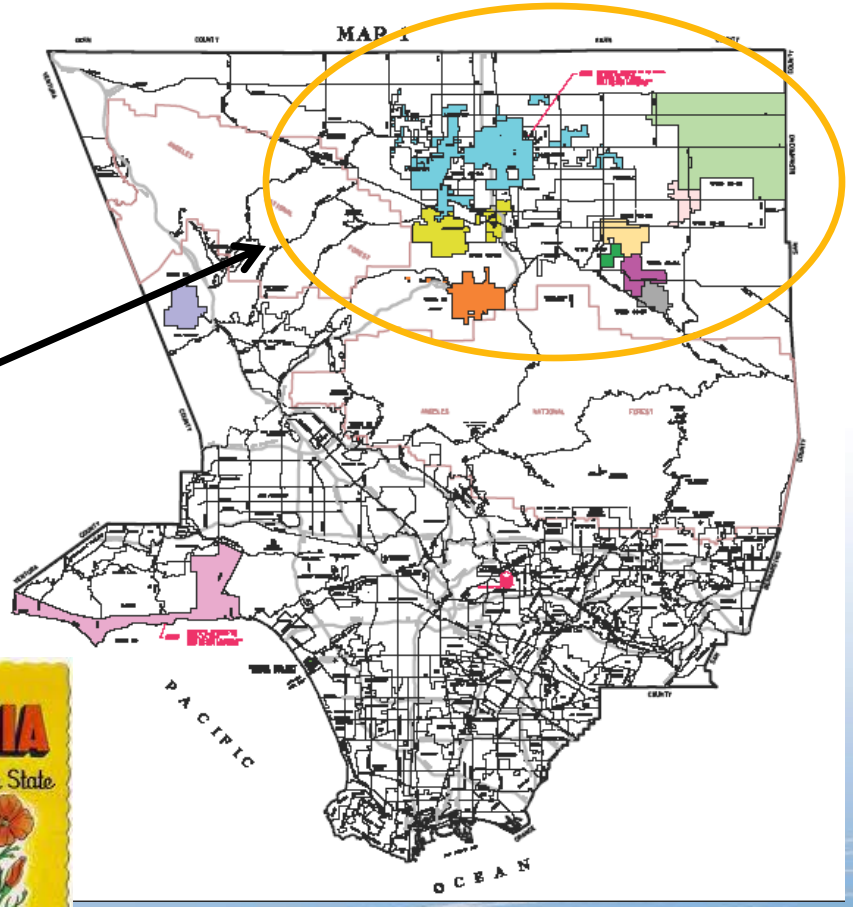
- Financing Options
- Funding Sources
- Design Considerations
- Changes in the Industry

Los Angeles County Waterworks Districts

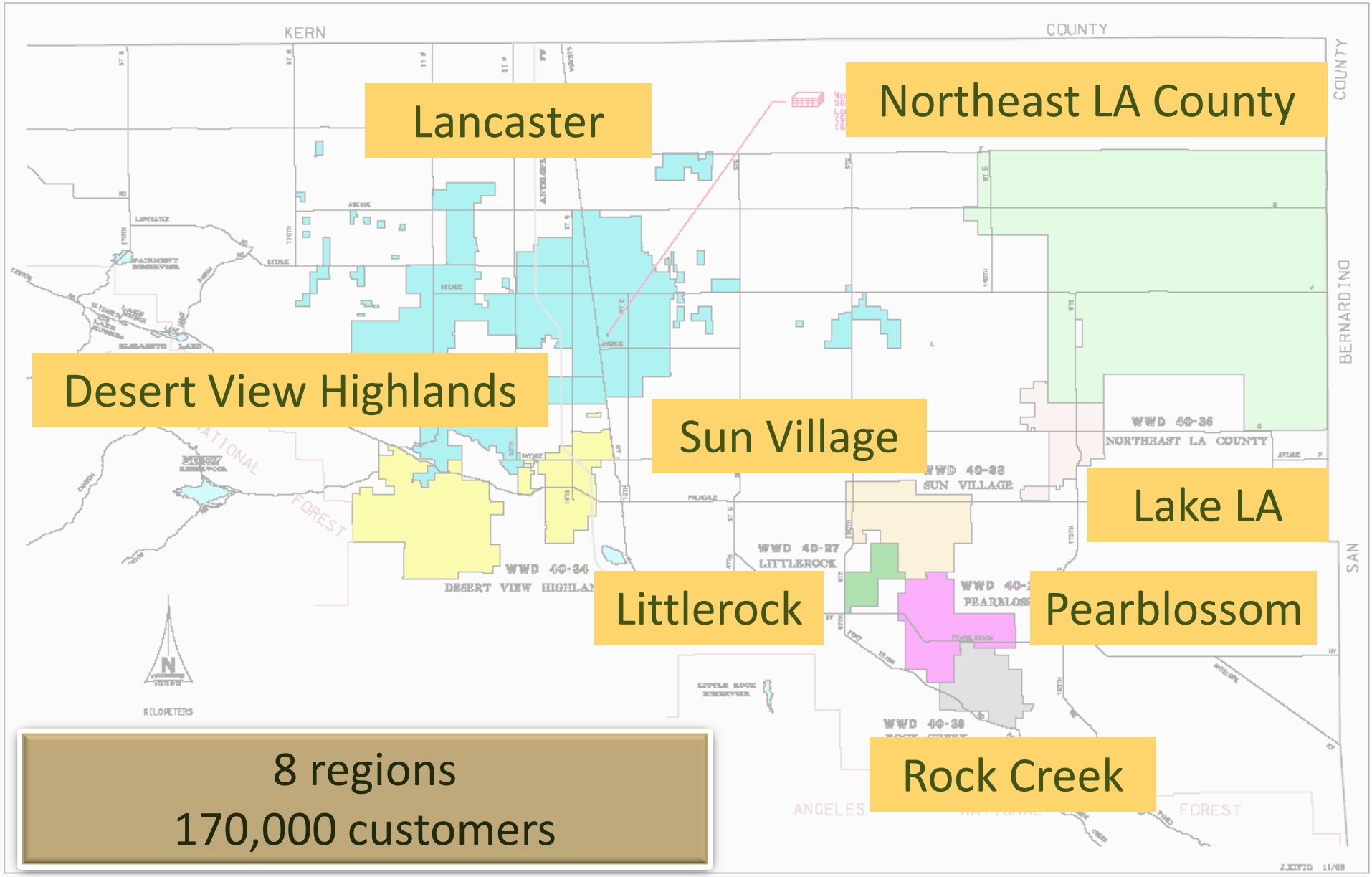
Districts

- Kagel Canyon
- Malibu and Marina Del Ray
- Val Verde
- Acton
- **Antelope Valley**





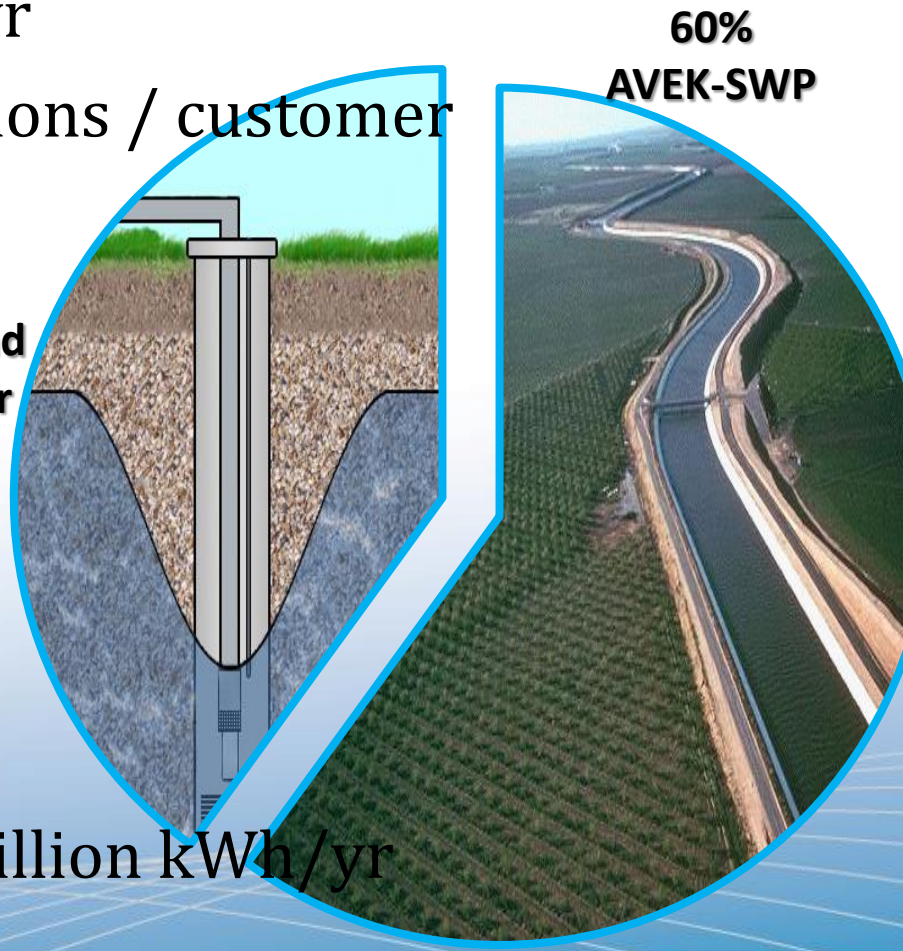
District 40, Antelope Valley



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



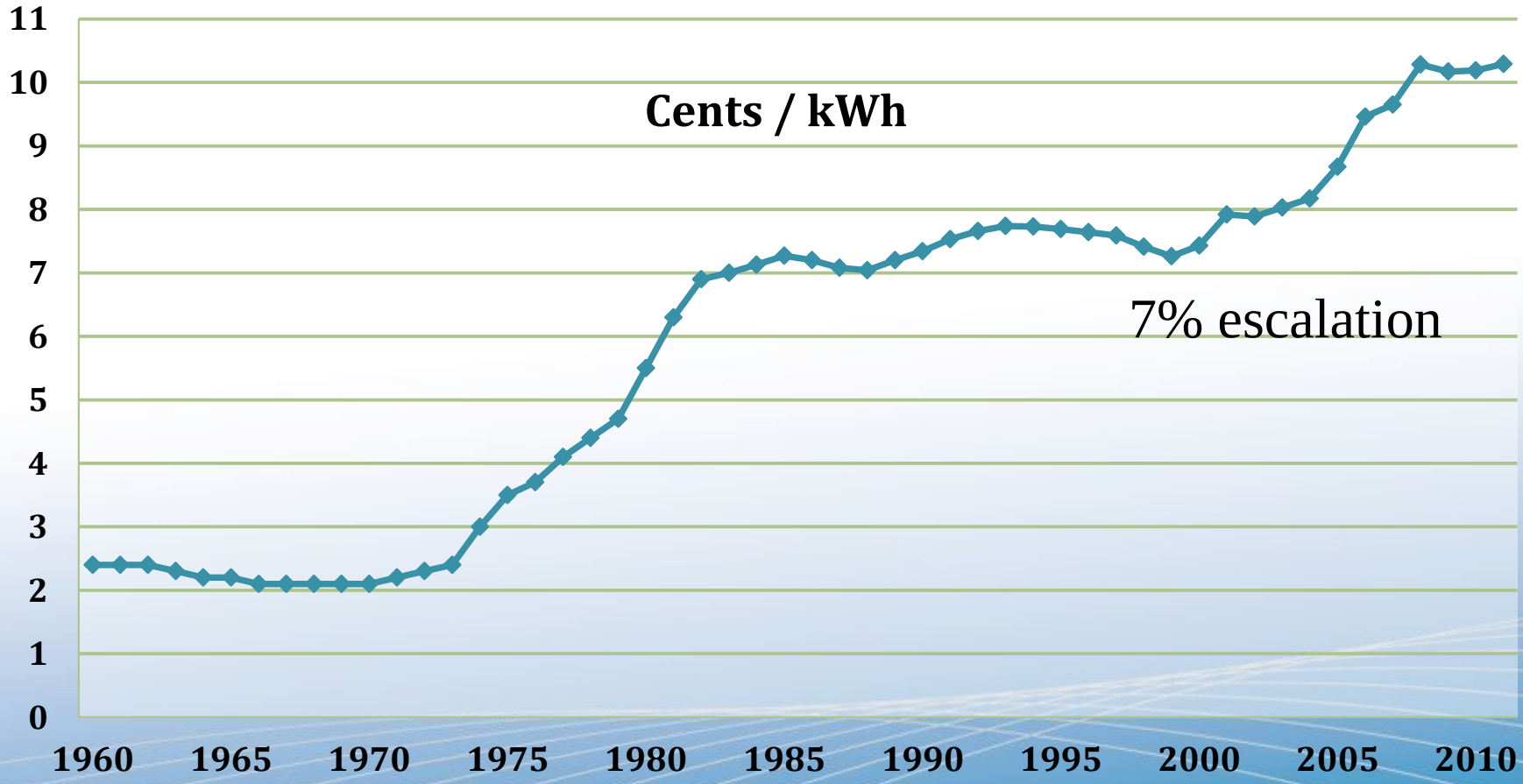
Population of District 40

	Accounts	Population
2000	41,000	127,000
2005	49,000	149,000
2010	55,000	172,000

Population^ → Demand/Supply^ → Energy^

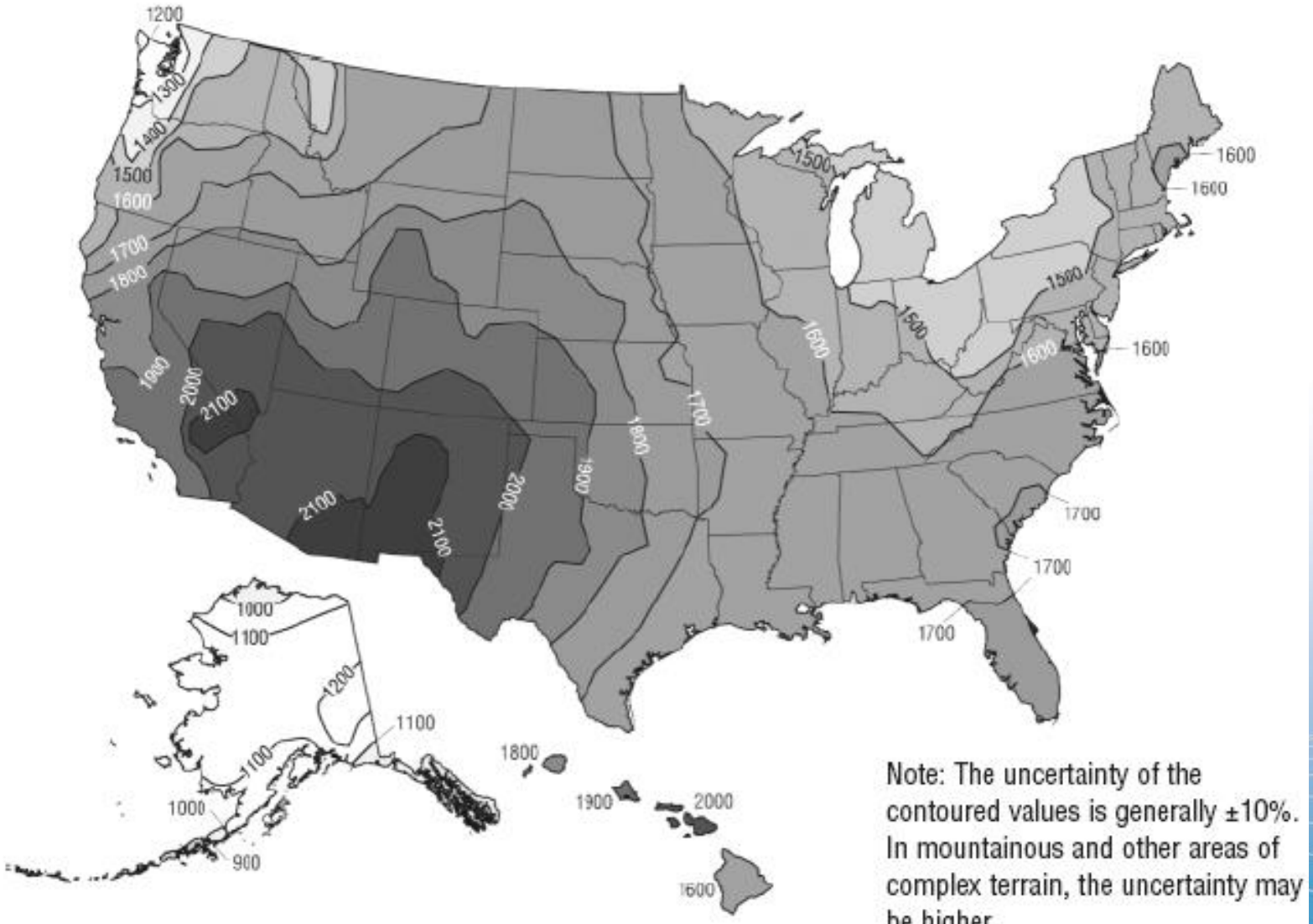
SCE Energy Cost Trend

- Increasing rate shows greater need for alternative energy source



U.S. Energy Information Administration (EIA)

Antelope Valley Solar Efficiency



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.

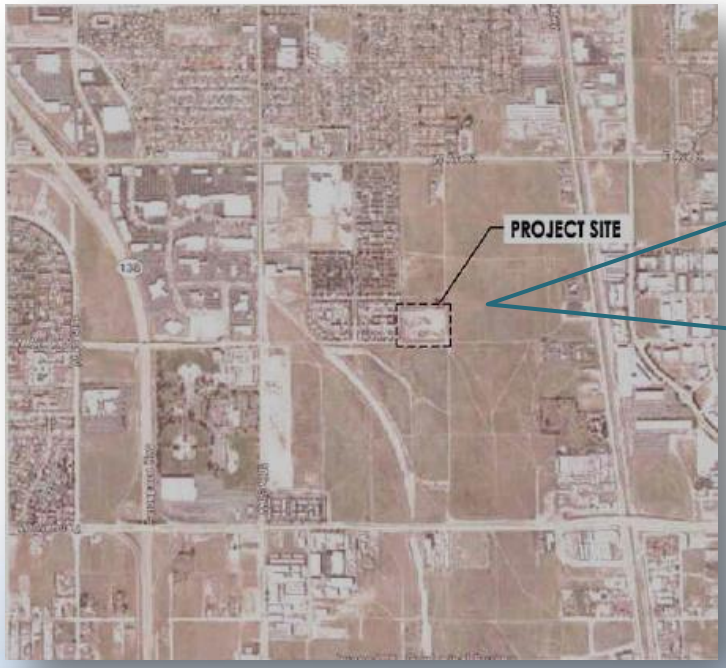
Doing the Research

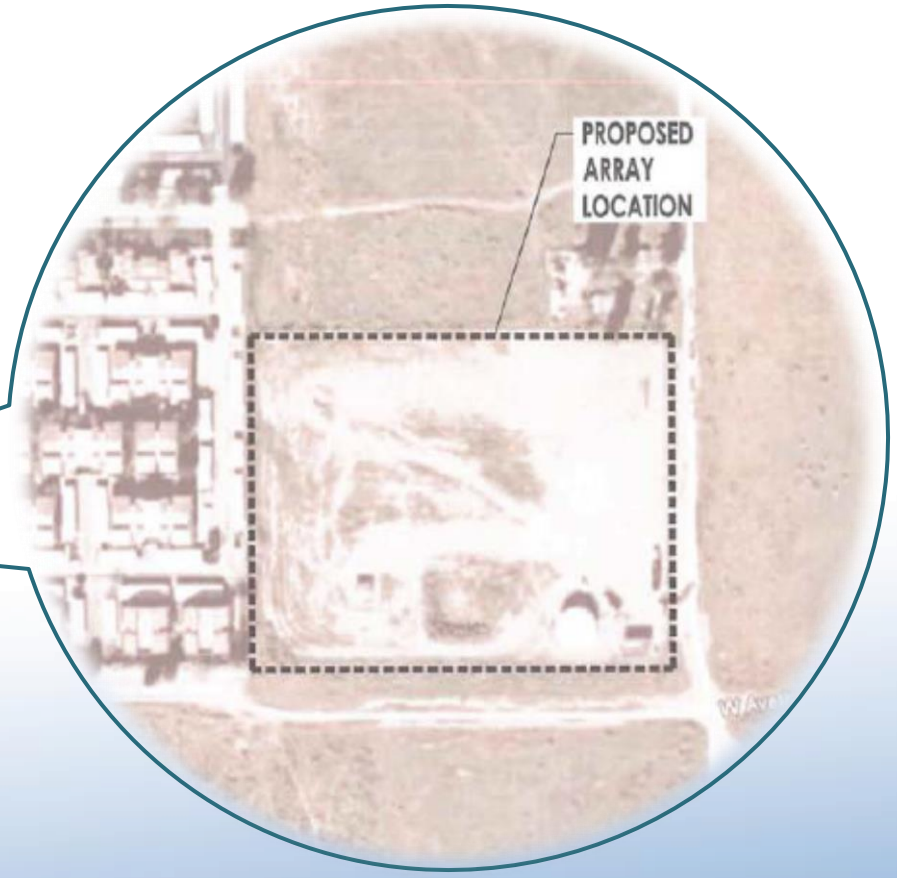
- Other Water Utilities
- Solar Consultants (may not be able to bid)
- SCE classes
- California Solar Initiative (CSI) website
- Association of California Water Agencies (ACWA) webcasts
- National Renewable Energy Laboratories (NREL)

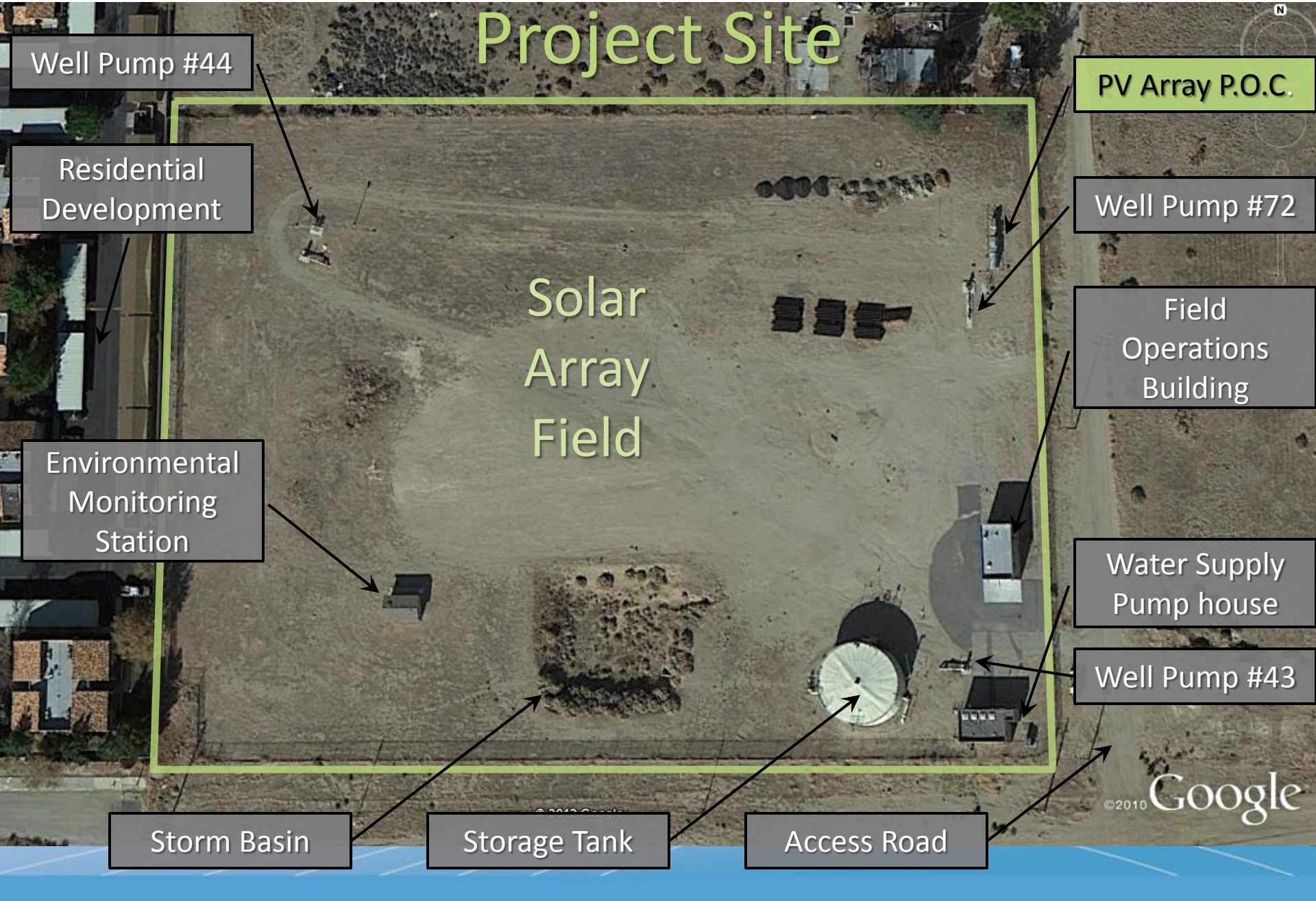
How to Choose a Site

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

Solar PV Site






Project Site
Well Pump #44
Residential Development
Environmental Monitoring Station
Storm Basin
Storage Tank
Access Road
PV Array P.O.C.
Well Pump #72
Field Operations Building
Water Supply Pump house
Well Pump #43
Solar Array Field
©2010 Google

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

Administrator	Customer Class *	Current Step	Initial MW in Step	Unused MW from Previous Steps	Revised Total MW in Step	Issued Conditional Reservation Letters (MW)	MW Remaining	MW Under Review
PGE	Residential	10	50.50	0.08	50.58	5.32	45.26	1.80
	Non-Residential	10	102.50	7.19	109.69	23.07	86.62	4.24
SCE	Residential	8	38.00	1.74	39.74	24.84	14.90	1.20
	Non-Residential	8	77.10	42.75	119.85	72.56	47.30	3.44
CCSE	Residential	10	11.90	0.24	12.14	6.12	6.02	1.25
	Non-Residential	8	17.30	7.04	24.34	12.69	11.65	0.01

Incentive MW Available by Step, by Program Administrator and Customer Class

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

		EPBB Payments (per Watt)			PBI Payments (per kWh)		
Step	Statewide MW in Step	Residential	Non-Residential		Residential	Non-Residential	
			Commercial	Government/ Non-Profit		Commercial	Government/ Non-Profit
1	50	n/a	n/a	n/a	n/a	n/a	n/a
2	70	$2.50	$2.50	$3.25	$0.39	$0.39	$0.50
3	100	$2.20	$2.20	$2.95	$0.34	$0.34	$0.46
4	130	$1.90	$1.90	$2.65	$0.26	$0.26	$0.37
5	160	$1.55	$1.55	$2.30	$0.22	$0.22	$0.32
6	190	$1.10	$1.10	$1.85	$0.15	$0.15	$0.26
7	215	$0.65	$0.65	$1.40	$0.09	$0.09	$0.19
8**	250	$0.35	$0.35	$1.10	$0.05 (a)/ $0.044 (b)	$0.05 (a)/ $0.044 (b)	$0.15 (a)/ $0.139 (b)
9**	285	$0.25	$0.25	$0.90	$0.03 (a)/ $0.032 (b)	$0.03 (a)/ $0.032 (b)	$0.12 (a)/ $0.114 (b)
10**	350	$0.20	$0.20	$0.70	$0.025	$0.025	$0.088

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)

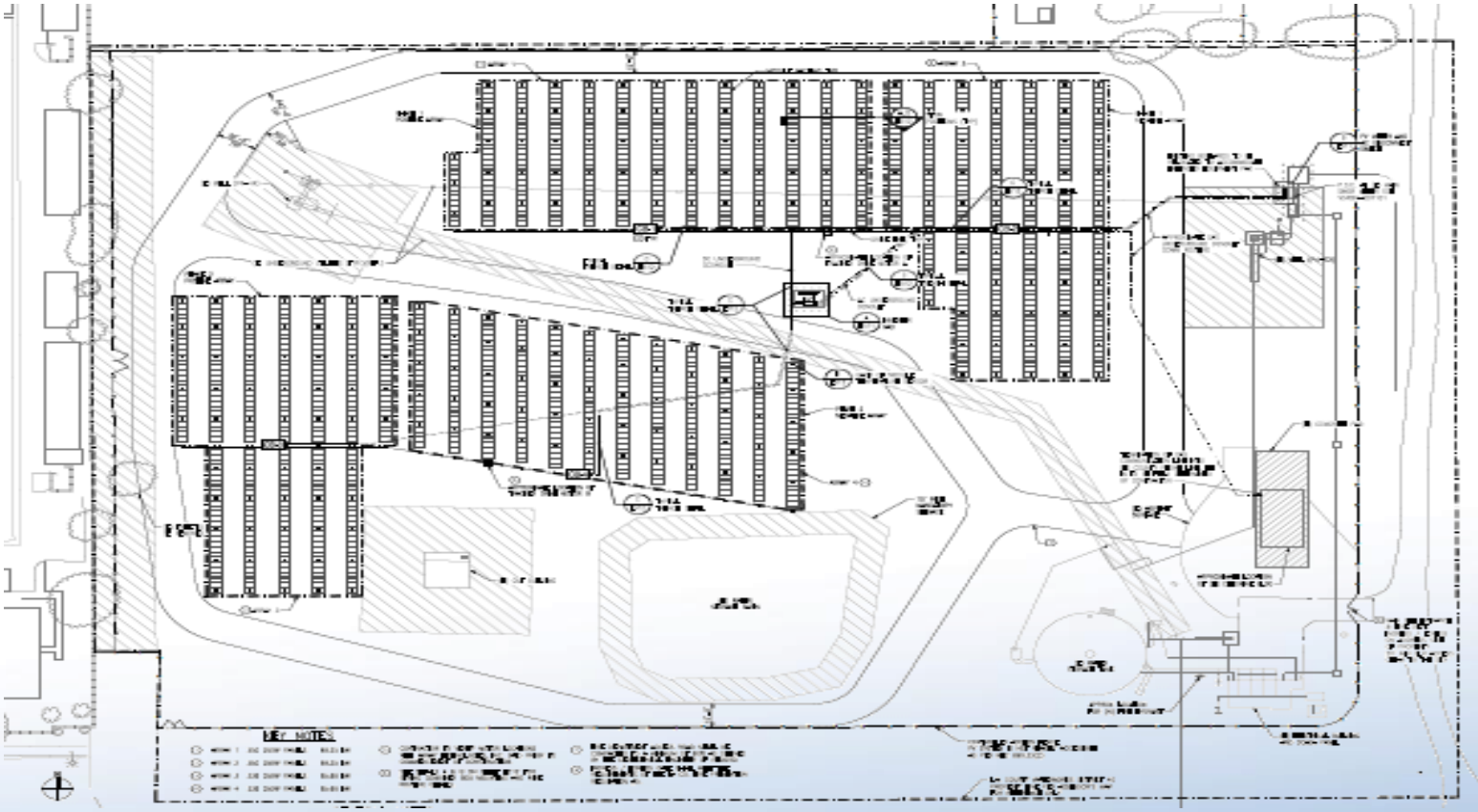
  is a statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible

  - 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



Construction

May 2012

July 25, 2012

July 26, 2012

August 2, 2012

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 (ww.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

SYSTEM	COST (Estimated)
Fixed	$0.015 - $0.020 / kWh
1- Axis	$0.025 - $0.030 / kWh
2- Axis	$0.035 - $0.040 / kWh

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

Consider hybrid solution

Questions

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Waterworks Districts

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