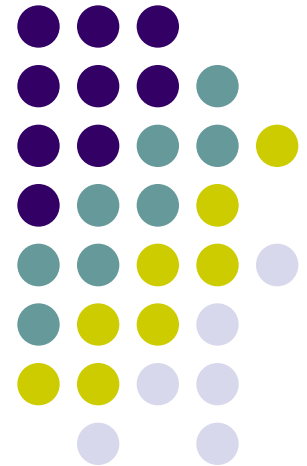
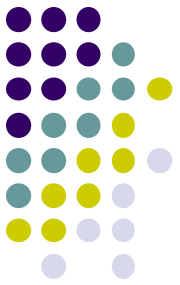


# Mt. San Antonio College Walnut, California

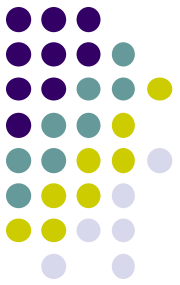
**Technical & Economic Evaluation**  
**1,765 kWdc/1,500 kWac Ground Mount Solar PV Project**  
**SCE SA # 000-2091-22**  
**SCE Tariff Basis: TOU-8-B-Standby**  
**(Existing 1,430 kW ICE-Cogeneration Operating)**  
**Direct Access (DA) Customer**  
**Investment/Purchase Option**  
**2<sup>nd</sup> Opinion Study - Confidential**  
**Intended for Customer Use Only**



# SCE Evaluation – Solar PV Project



<u>Background</u>	3
<u>SCE Evaluation – 1,750 kWdc/1,500 kWac Ground Mount solar PV Project</u>	
- <u>Technical Evaluation</u>	4-13
- <u>Economic/Financial</u>	14-20
- <u>Evaluation Summary</u>	21



## SCE Evaluation – Solar PV Project

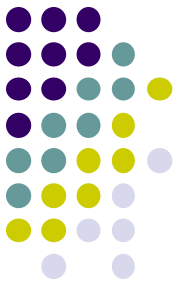
### Background

- P2S Engineering, Inc., has conducted an engineering study and evaluated various generation options for the campus, including, fuel cells, microturbine and IC engine based cogeneration, wind and photovoltaic systems. P2S has recommended an installation of solar PV system on the campus, ranging from 1,500 kWac – 2,000 kWac, to provide campus electricity.
- The customer takes SCE service at 12 kV (primary voltage). The customer currently purchases ~ 71 % of facility electricity from SCE (~ 16.1 Million kWh/year), and remaining 39 % is produced by on-site IC engine generator (~ 6.35 Million kWh/year). The native load energy consumption is ~ 22.4 Million kWh (annual); facility load is ~ 2,600 kW (average); and ~ 5,600 kW (peak)
- This solar PV project evaluation is for 1,500 kWac system.

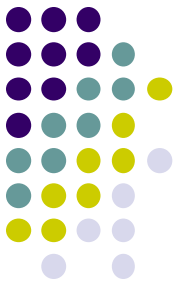
# SCE Evaluation – Solar PV Project

## Evaluation Framework

- The customer has an operating IC engine generation rated at 1,430 kW (GFID 2572), (2 x 715 kW) and has a “standby” level of 1,430 kW. These generators are configured to operate in an inadvertent export mode.
- The facility native load basis selected was for the period January – December 2013. During this period, 1,430 kW IC engine generators were operating, and the residual electricity was purchased from ESP, and delivered by SCE under the TOU-8-B-Standby tariff prices.
- Solar PV project outputs were simulated using NREL solar PV model, and the impact of IC engine generator outputs were considered



# SCE Evaluation – Solar PV Project



## Evaluation Basis - Technical

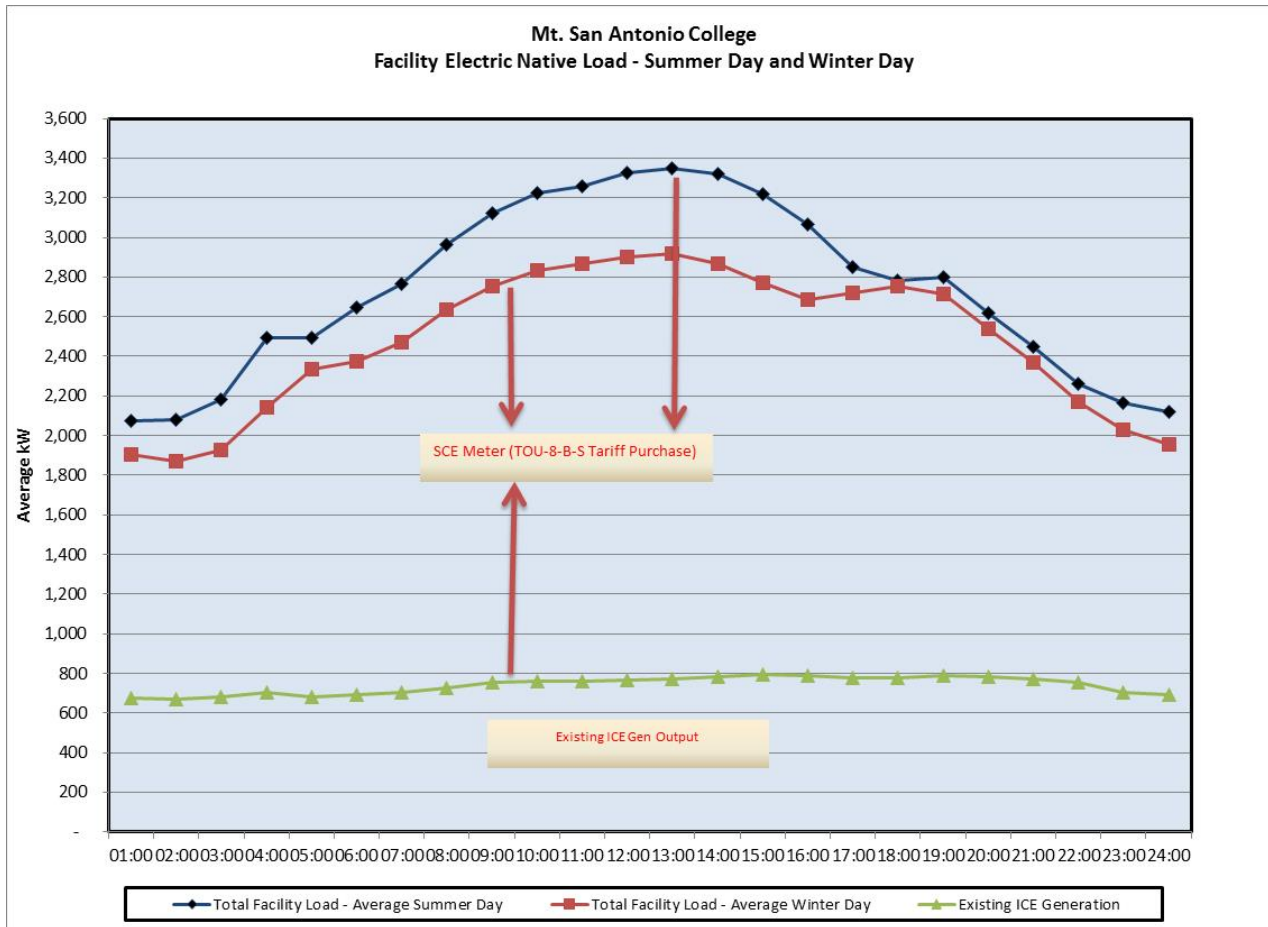
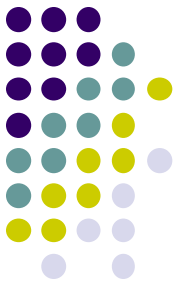
### Technical/Modeling Basis

- Hour-by-Hour electric loads (SCE TOU-8 meter data) for the facility (Based on Jan-Dec 2013 load) - SA # 000-2091-22.
- Hour-by-hour generator output meter data from existing 1,430 kW IC engine generators (Jan – Dec 2013); i.e. Net Generator Output Meter (NGOM) data.
- Hour-by-hour adjusted facility loads (SCE TOU-8 Meter + NGOM) to be served by solar PV project, existing IC engine generators, and residual electricity purchase from ESP/SCE.

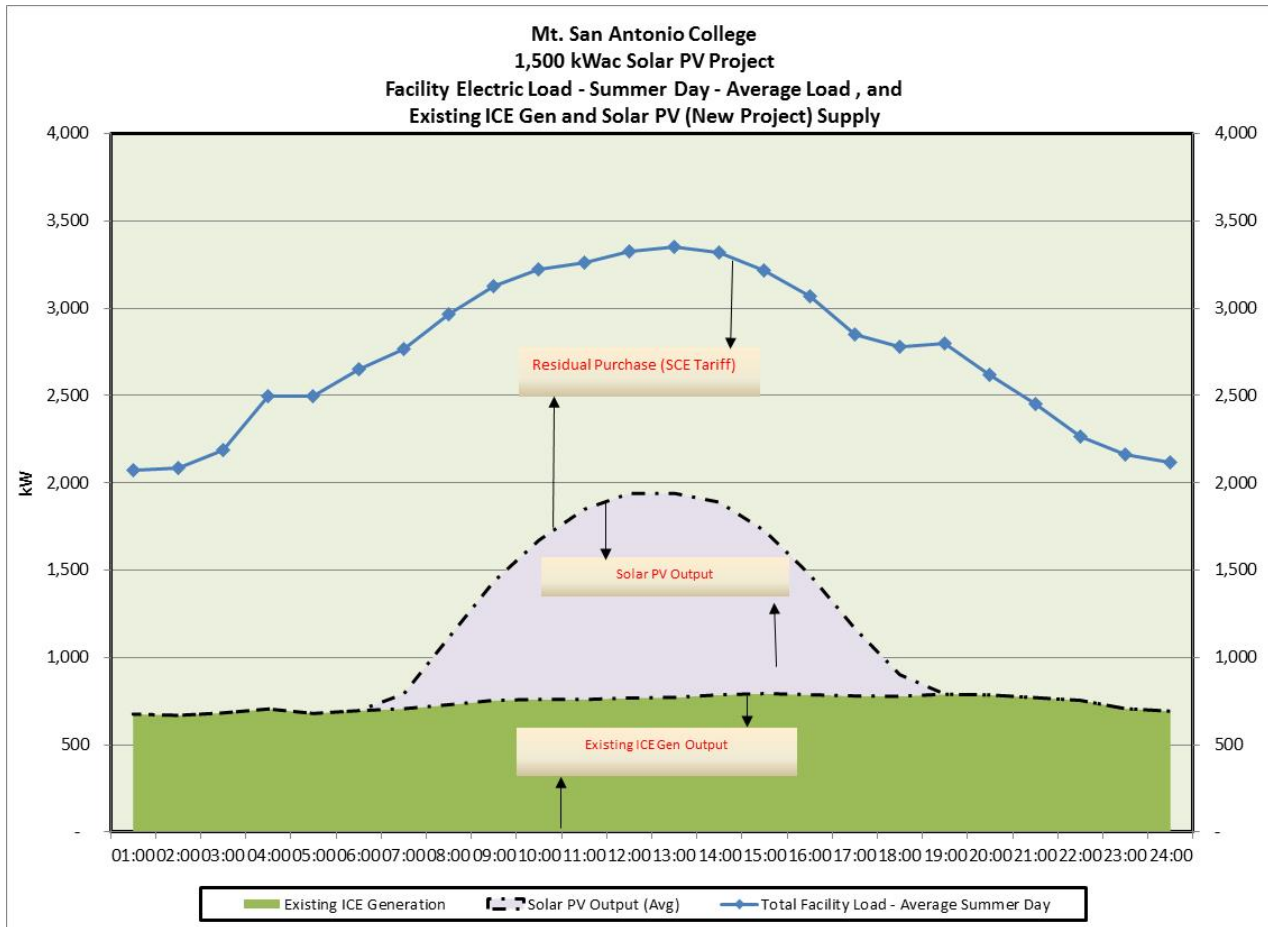
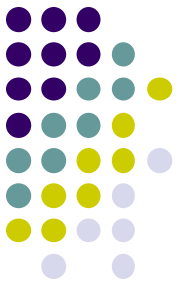
### *Solar PV Power Generation*

- The Solar PV output was modeled using NREL solar insolation data.

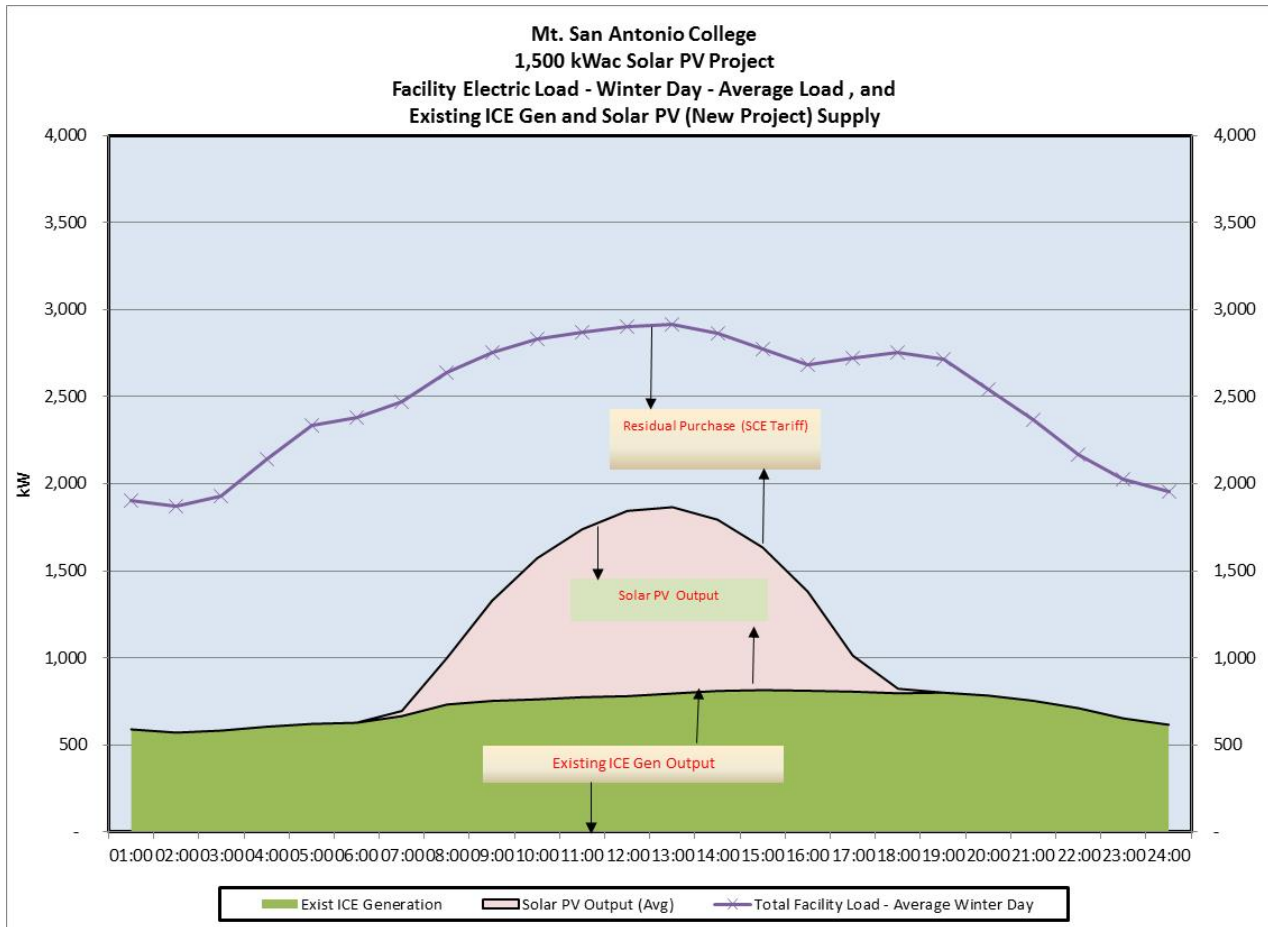
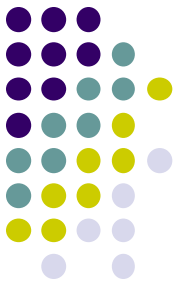
# SCE Evaluation – Solar PV Project Simulation Modeling Results



# SCE Evaluation – Solar PV Project Simulation Modeling Results

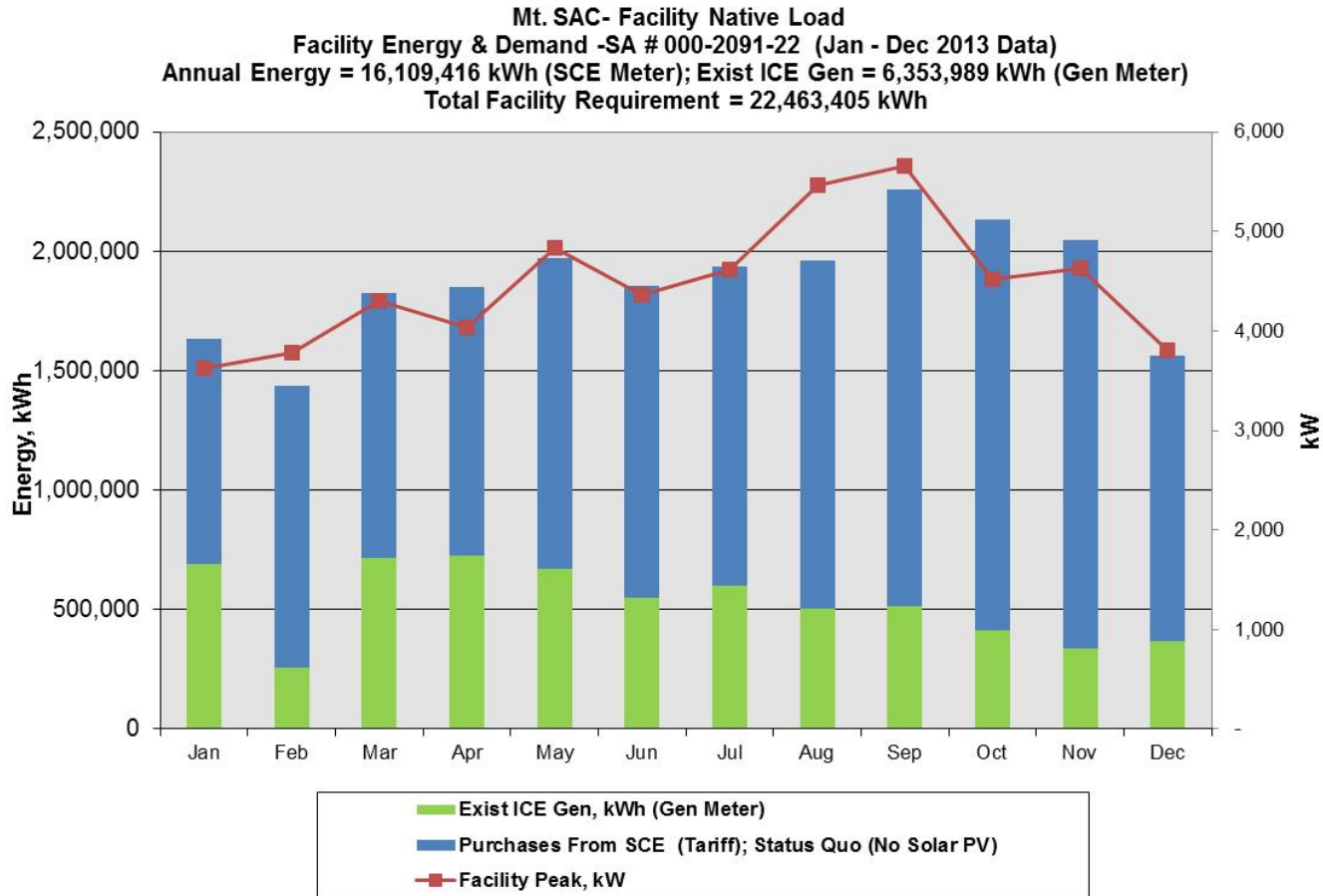
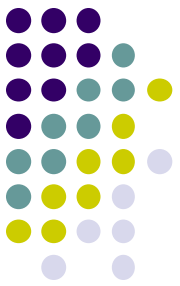


# SCE Evaluation – Solar PV Project Simulation Modeling Results

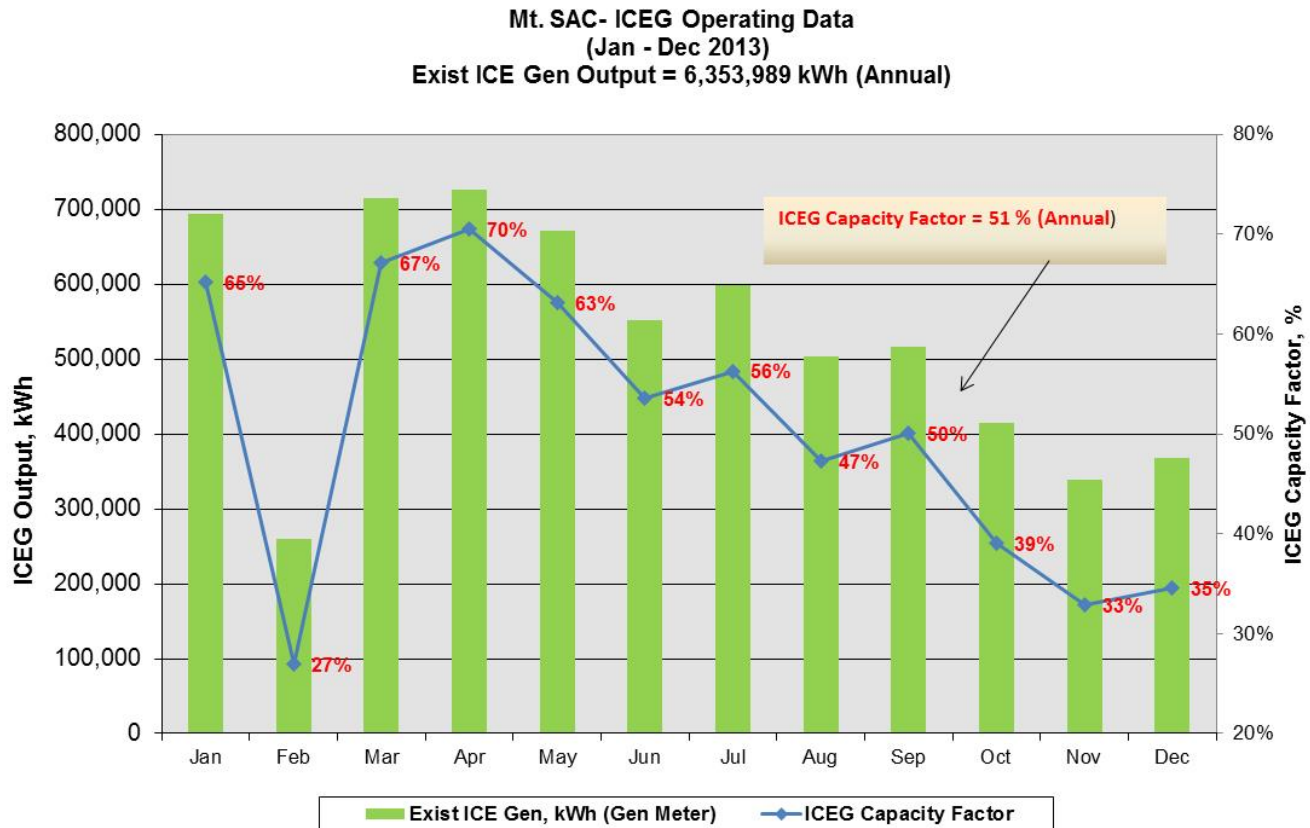
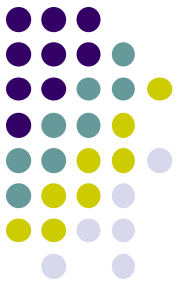




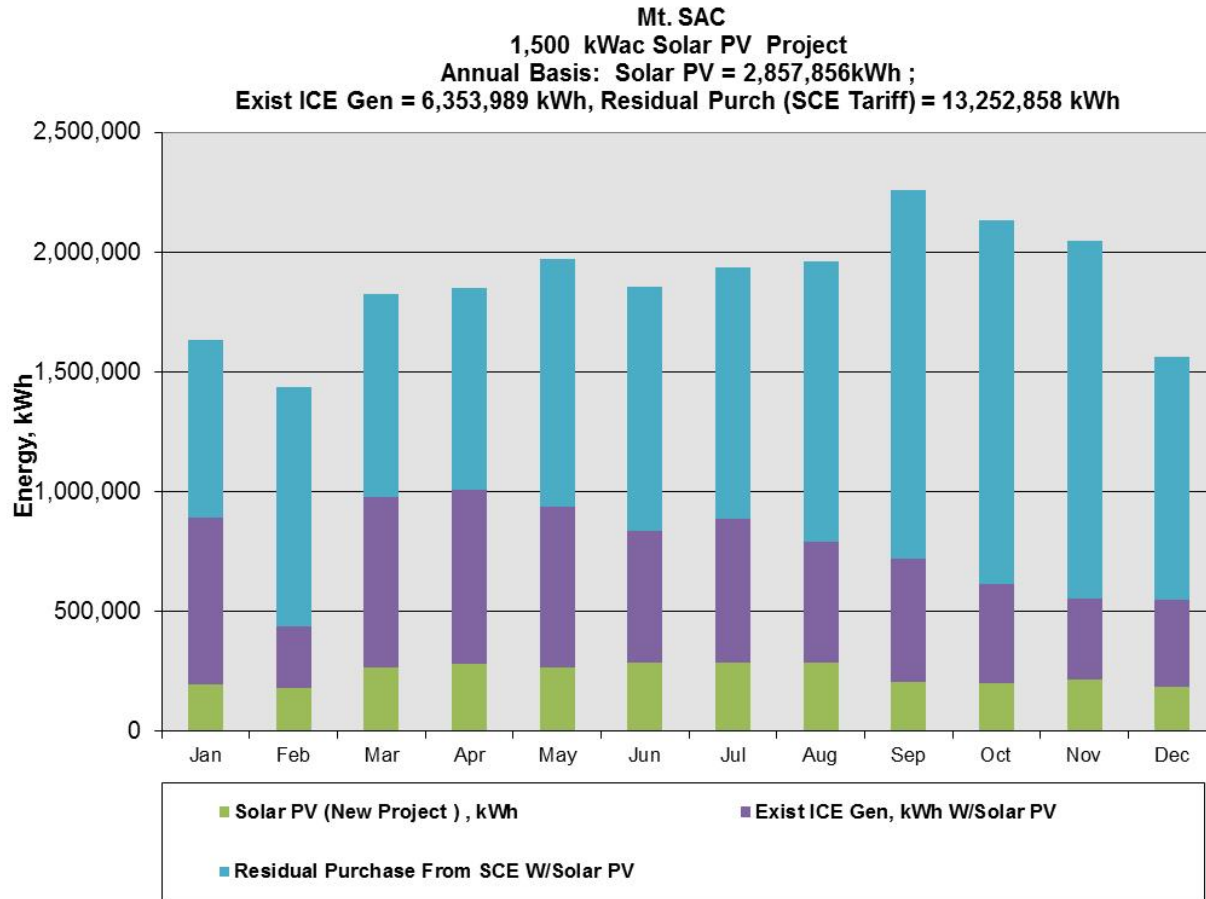
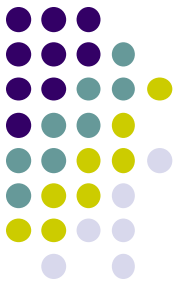
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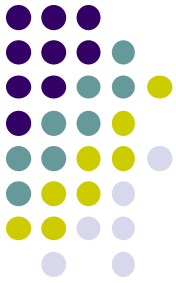
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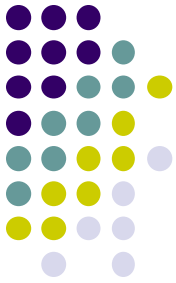


# SCE Evaluation – Solar PV Project Simulation Modeling Results



<b>*** Simulation Results *****</b>				
<b>1,765 kWdc/1,500 kWac Ground Mount Solar PV Project</b>	<b>SCE STUDY</b>	<b>SCE STUDY</b>	<b>SCE STUDY</b>	<b>P2S Engineering</b>
	<b>8- Winter Months</b>	<b>4- Summ Months</b>	<b>ANNUAL -YEAR 1</b>	<b>ANNUAL -YEAR 1</b>
			<b>Total</b>	<b>Total</b>
	<b>SCE Meter (No Solar PV)</b>			
<b>ENERGY (KWh); SCE TOU-8 Meter</b>				
On-Peak	-	1,452,136	1,452,136	No Info
Mid-Peak	4,785,552	1,770,264	6,555,816	No Info
Off-Peak	5,486,456	2,615,008	8,101,464	No Info
<b>Total</b>	<b>10,272,008</b>	<b>5,837,408</b>	<b>16,109,416</b>	<b>No Info</b>
	<b>SCE Meter (No Solar PV)</b>			
<b>Demand, kW, SCE TOU-8 Meter</b>				
On-Peak	-	4,944		No Info
Mid-Peak	3,936	4,864		No Info
Off-Peak	3,632	3,640		No Info
<b>MAX</b>	<b>3,936</b>	<b>4,944</b>		<b>No Info</b>
	<b>ICE Gen Production (Existing)</b>			
<b>ICE Gen Output (Existing)</b>				
On-Peak	-	428,035	428,035	No Info
Mid-Peak	1,994,095	635,749	2,629,844	No Info
Off-Peak	2,190,958	1,105,152	3,296,110	No Info
<b>Total ==&gt;</b>	<b>4,185,053</b>	<b>2,168,936</b>	<b>6,353,989</b>	<b>No Info</b>
	<b>Facility Native Load</b>			
<b>Total Facility Energy Requirement, kWh</b>				
On-Peak	-	1,880,171	1,880,171	No Info
Mid-Peak	6,779,647	2,406,013	9,185,660	No Info
Off-Peak	7,677,414	3,720,160	11,397,574	No Info
<b>Total ==&gt;</b>	<b>14,457,061</b>	<b>8,006,344</b>	<b>22,463,405</b>	
	<b>Facility Native Load</b>			
<b>Demand, kW,</b>				
On-Peak	0	5,660		
Mid-Peak	4834	5,581		
Off-Peak	4355	4,363		
<b>MAX</b>	<b>4,834</b>	<b>5,660</b>		

# SCE Evaluation – Solar PV Project Simulation Modeling Results

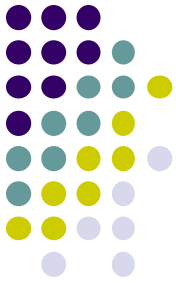


*** Simulation Results *****				
1,765 kWdc/1,500 kWac Ground Mount Solar PV Project	SCE STUDY 8- Winter Months	SCE STUDY 4- Summ Months	SCE STUDY ANNUAL -YEAR 1 Total	P2S Engineering ANNUAL -YEAR 1 Total
<b>Solar PV Output, kWh</b>	<b>Solar PV Estimate Output (New Project)</b>			
On-Peak	-	514,049	514,049	No Info
Mid-Peak	1,254,650	215,369	1,470,019	No Info
Off-Peak	539,211	334,577	873,789	No Info
<b>Total ==&gt;</b>	<b>1,793,861</b>	<b>1,063,996</b>	<b>2,857,856</b>	<b>2,801,290</b>
<b>Solar PV # 1 kW Output</b>	<b>1,500 kWac</b>			<b>1,500 kWac</b>
	<b>Post- Solar PV Project Tariff Basis</b>			
	<b>ICE Gen Operating</b>			
<b>Post-Solar PV SCE Tariff Basis</b>				
On-Peak	-	938,087	938,087	No Info
Mid-Peak	3,606,392	1,554,895	5,161,287	No Info
Off-Peak	4,873,053	2,280,431	7,153,484	No Info
<b>Total</b>	<b>8,479,445</b>	<b>4,773,412</b>	<b>13,252,858</b>	<b>No Info</b>
	<b>Post- Solar PV Project Tariff Basis</b>			
	<b>ICE Gen Operating</b>			
<b>Post-Solar PV SCE Tariff Basis</b>				
<b>Demand, kW</b>				
On-Peak	0	4,473		No Info
Mid-Peak	3,887	4,515		No Info
Off-Peak	3,632	3,640		No Info
<b>Max kW</b>	<b>3,887</b>	<b>4,515</b>		<b>No Info</b>
<b>ICE Gen Output (Existing)</b>	<b>ICE Gen Production W/O Solar PV (New Proj)</b>			
On-Peak	0	428,035	428,035	No Info
Mid-Peak	1,994,095	635,749	2,629,844	No Info
Off-Peak	2,190,958	1,105,152	3,296,110	No Info
<b>Total (1) ==&gt;</b>	<b>4,185,053</b>	<b>2,168,936</b>	<b>6,353,989</b>	<b>No Info</b>
<b>ICE Gen Output (Existing)</b>	<b>ICE Gen Production W/Solar PV (New Proj)</b>			
On-Peak	-	428,035	428,035	No Info
Mid-Peak	1,994,095	635,749	2,629,844	No Info
Off-Peak	2,190,958	1,105,152	3,296,110	No Info
<b>Total (2) ==&gt;</b>	<b>4,185,053</b>	<b>2,168,936</b>	<b>6,353,989</b>	<b>No Info</b>
	<b>ICE Gen Impact W/Solar PV (New Proj)</b>			
<b>ICE Gen Impact, kWh (Due to Solar PV Project)</b>	-	-	-	No Info



## SCE Evaluation – Solar PV Project Economic/Financial-Assumptions & Bases

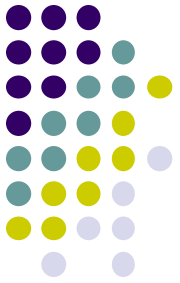
	<b><u>Solar PV Economics Evaluation Basis</u></b> <b><u>(Ground Mounted Solar PV)</u></b>
SCE Tariff Basis DA/ESP Electricity Price	2-50 kV (Primary Voltage), Effective April 1, 2014 \$0.06/kWh (Source: Mt. SAC)
	Pre-Solar: TOU-8-B-S (Standby); Current Standby Capacity = 1,430 kW Post-Solar: TOU-8-B-S (Standby) ; New Standby Capacity = 2,619 kW <u>Note:</u> Standby customers <u>are not</u> eligible for Option A tariff. Solar PV > 1 MW does not qualify under Net Energy Metering (NEM), and is subject to “Standby” and Departing Load (DL) tariffs. NEM generators are exempt.
SCE Electricity Price Projection (ESP/SCE) Yr. 2014- Yr. 2033 (20 Years)	SCE Study: Escalation Factors were derived from CEC Electricity Rate Outlook (2005-2016) – Published June 2007. CEC Escalation Trajectory applied to SCE Tariff Rates (~ 3 % per year). 3 %/year After 2017
SCE Tariff – Departing Load (DL) Charges	Certain components Exempt to solar kWh up to 1 MW. PCIA, CTC ,and CDWRB apply to all Solar kWh > 1 MW. NDC and PPPC apply to all Solar kWh.
Tax & Depreciation Benefits – Solar Investments	Not Applicable – Non Tax Entity
Evaluation Period	20 Years
Cash Flow Discount Rate	5 % (Assumption)
CSI – PBI Incentive (MW Step 9B) (Government/Non-Profit) Solar PV Power Degradation	\$0.114/kWh – <u>Applies to Solar PV Energy Output up to 1 MW</u> – Applicable for first 5 years. PBI incentive \$ is tied to Solar PV Performance. SCE Study: Solar PV module degradation resulting in lower kWh output was considered. <u>0.5 % power output</u> degradation was included.
Solar PV Project Capital Cost Solar PV Maintenance Cost Solar PV Asset Insurance Solar PV Inverter Replacement Grid Interconnection Cost (SCE Added Facilities Basis); (SCE Rule 21)	<u>\$5.0 Million; BASE CASE (\$3,333/kWac)</u> – P2S Engineering’s Estimated Capital Cost 0.5 cent/kWh ; escalated @ 3% 0.25 % of Capital Replacement year: 12 Not Considered. The cost estimate can only be done after the project interconnection design is submitted with Rule 21 application.



# SCE Evaluation – Solar PV Project Economic/Financial – Tariff Cost

Mt. San Antonio College				Mt. San Antonio College			
TOU-8-B-S (2-50 kV), April 1 2014				TOU-8-B-S (2-50 kV), April 1 2014			
Pre- Solar PV ESP/Tariff Basis Cost				Post- Solar PV ESP/Tariff Basis Cost			
SCE Standby Capacity	1,430 kW			SCE Standby Capacity	2,619 kW		
	8 Wint Mo	4- Summ Mo	Annual		8 Wint Mo	4- Summ Mo	Annual
Generation (DA/ESP) Chg	\$616,320	\$350,244	\$966,565	Generation (DA/ESP) Chg	\$ 508,767	\$ 286,405	\$ 795,171
*** Power Delivery -SCE Tariff ****				*** Power Delivery -SCE Tariff ****			
Energy Chg	\$185,553	\$110,141	\$295,693	Energy Chg	\$153,105	\$90,110	\$243,216
Demand Chg (Summ On-Pk/Mid-Pk)	\$0	\$0	\$0	Demand Chg (Summ On-Pk/Mid-Pk)	\$0	\$0	\$0
Excess Fac Related Demand (FRD) Chg	\$217,366	\$168,801	\$386,167	Excess Fac Related Demand (FRD) Chg	\$57,656	\$65,917	\$123,573
Customer Chg	\$2,574	\$1,287	\$3,860	Customer Chg	\$2,574	\$1,287	\$3,860
Sch "S" Cap Reservation Chg	\$ 84,542	\$ 42,271	\$ 126,812	Sch "S" Cap Reservation Chg; Exempt	\$154,831	\$77,415	\$232,246
Sch "S" Backup Demand Chg (Summ On-Pk/Mid-Pk)	\$ -	\$ -	\$ -	Sch "S" Backup Demand Chg (Summ On-Pk/Mid-Pk); Exempt	\$0	\$0	\$0
TOU-8-B-S (Standby) Tariff Cost (Pwr Delivery)	\$ 490,034	\$ 322,499	\$ 812,533	TOU-8-B-S (Standby) Tariff Cost (Pwr Delivery)	\$ 368,166	\$ 234,729	\$ 602,895
Departing Load Charge (DL-NBC/CGDL-CRS Tariffs); ICE Gen	\$65,747	\$34,074	\$99,821	Departing Load Charge (DL-NBC/CGDL-CRS Tariffs); ICEGen	\$65,747	\$34,074	\$99,821
SCE Tariff Cost (DA-CRS)	\$88,339	\$50,202	\$138,541	Departing Load Charge (DL-NBC/CGDL-CRS Tariffs); Solar PV > 1 MW	\$20,408	\$12,105	\$32,513
<b>Total SCE Tariff Cost (Pwr Delivery)</b>	<b>\$ 644,120</b>	<b>\$ 406,775</b>	<b>\$ 1,050,895</b>	<b>Total SCE Tariff Cost (Pwr Delivery)</b>	<b>\$ 527,244</b>	<b>\$ 321,959</b>	<b>\$ 849,204</b>
<b>Total Cost (ESP + SCE Tariffs)</b>	<b>\$ 1,260,441</b>	<b>\$ 757,019</b>	<b>\$ 2,017,460</b>	<b>Total Cost (ESP + SCE Tariffs)</b>	<b>\$ 1,036,011</b>	<b>\$ 608,364</b>	<b>\$ 1,644,375</b>
Cents/kWh	12.27	12.97	12.52	Cents/kWh	12.22	12.74	12.41
kWh Basis ==>	10,273,306	5,837,408	16,110,714	kWh Basis ==>	8,479,445	4,773,412	13,252,858
				Solar PV kWh Supply	1,793,861	1,063,996	2,857,856

Tariff Cost Savings From Solar PV Project  
 (Displaced Power Value) = \$2,017,460 - \$1,644,375 = \$373,085  
 Solar PV kWh Supply to Facility = 2,857,856 kWh  
 \$373,085 / 2,857,856 kWh = 13.05 cents/kWh



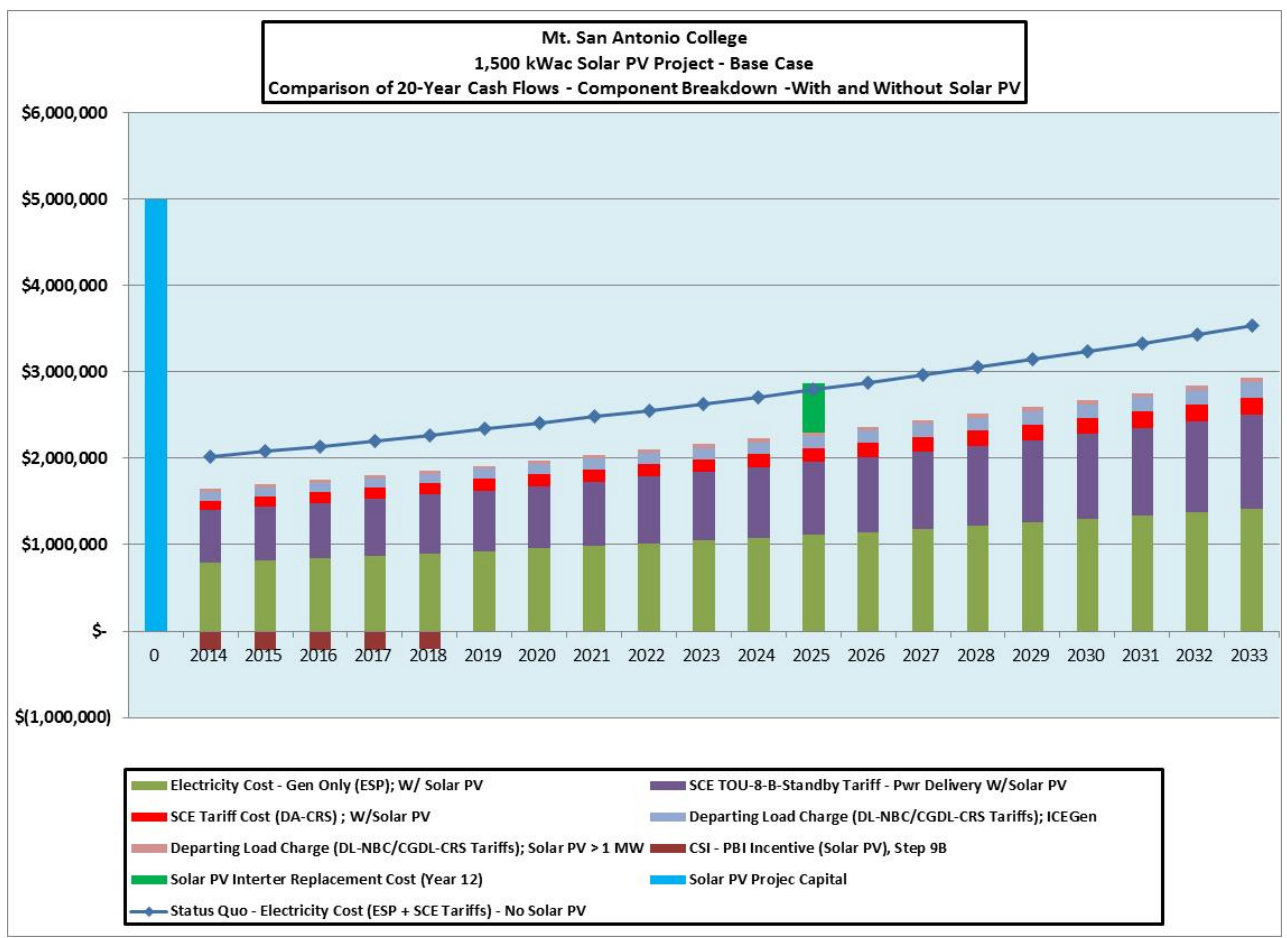
# SCE Evaluation – Solar PV Project Economic/Financial-Cost/Savings First Five (5) Years – Details - Base Case

PERIOD	1	2	3	4	5
YEAR	2014	2015	2016	2017	2018
<b>Cash Flows -Status Quo (No Solar PV Project)</b>					
Electricity Cost - Gen Only (ESP); W/O Solar PV	\$ 966,565	\$ 995,562	\$ 1,025,429	\$ 1,056,192	\$ 1,087,877
SCE TOU-8-B-Standby Tariff - Pwr Delivery W/O Solar PV	\$ 812,533	\$ 836,909	\$ 862,016	\$ 887,877	\$ 914,513
SCE Tariff Cost (DA-CRS) ; W/O Solar PV	\$ 138,541	\$ 142,697	\$ 146,978	\$ 151,387	\$ 155,929
Departing Load Charge (DL-NBC/CGDL-CRS Tariffs); ICEGen	\$ 99,821	\$ 102,816	\$ 105,900	\$ 109,077	\$ 112,350
<b>Total Electricity Cost -No Solar PV (A)</b>	<b>\$ 2,017,460</b>	<b>\$ 2,077,984</b>	<b>\$ 2,140,323</b>	<b>\$ 2,204,533</b>	<b>\$ 2,270,669</b>
<b>Cash Flows - W/Solar PV Project</b>					
Solar PV Maintenance Cost	\$ 14,289	\$ 14,656	\$ 15,032	\$ 15,417	\$ 15,812
Solar PV Insurance Cost	\$ 12,500	\$ 12,750	\$ 13,005	\$ 13,265	\$ 13,530
SCE Added Fac Cost (Grid Interconnection)	\$ -	\$ -	\$ -	\$ -	\$ -
Electricity Cost - Gen Only (ESP); W/ Solar PV	\$ 795,171	\$ 819,910	\$ 845,412	\$ 871,702	\$ 898,803
SCE TOU-8-B-Standby Tariff - Pwr Delivery W/Solar PV	\$ 602,895	\$ 621,651	\$ 640,987	\$ 660,920	\$ 681,468
SCE Tariff Cost (DA-CRS) ; W/Solar PV	\$ 113,975	\$ 117,520	\$ 121,176	\$ 124,944	\$ 128,829
Solar PV Excess Gen Net Metering Credit (NEM)	\$ -	\$ -	\$ -	\$ -	\$ -
Departing Load Charge (DL-NBC/CGDL-CRS Tariffs); ICEGen	\$ 99,821	\$ 102,816	\$ 105,900	\$ 109,077	\$ 112,350
Departing Load Charge (DL-NBC/CGDL-CRS Tariffs); Solar PV > 1 MW	\$ 32,513	\$ 33,321	\$ 34,149	\$ 34,997	\$ 35,867
CSI - PBI Incentive (Solar PV), Step 9B	\$ (217,197)	\$ (216,111)	\$ (215,031)	\$ (213,955)	\$ (212,886)
Solar PV Interter Replacement Cost (Year 12)	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total Costs W/Solar PV (B)</b>	<b>\$ 1,453,967</b>	<b>\$ 1,506,513</b>	<b>\$ 1,560,630</b>	<b>\$ 1,616,367</b>	<b>\$ 1,673,774</b>
<b>Solar Project Savings; (A) - (B)</b>	<b>\$ 563,493</b>	<b>\$ 571,471</b>	<b>\$ 579,693</b>	<b>\$ 588,166</b>	<b>\$ 596,895</b>

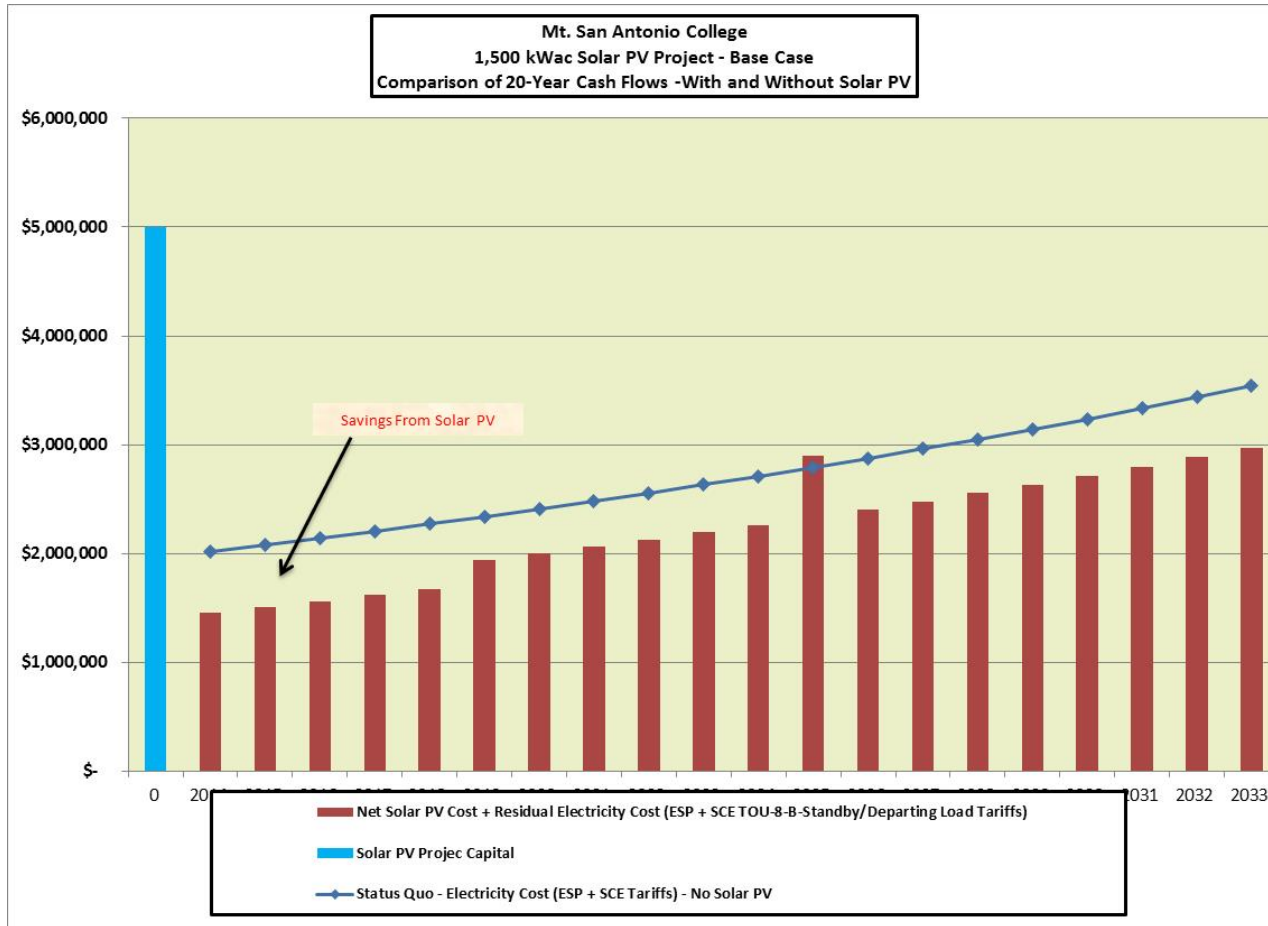
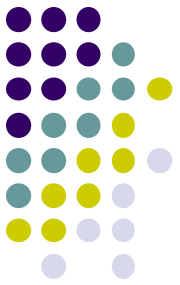




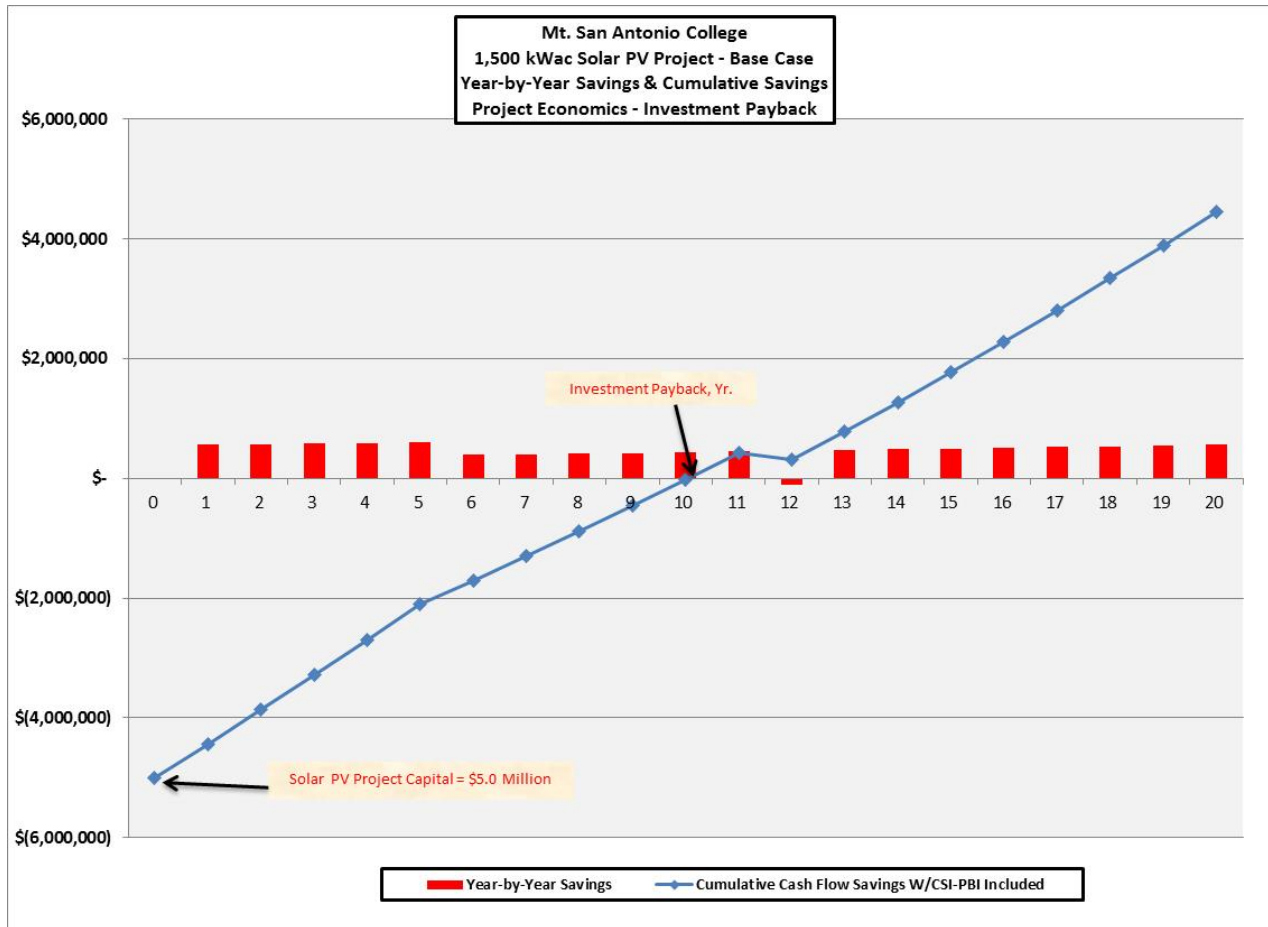
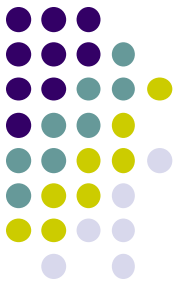
# SCE Evaluation – Solar PV Project Economic/Financial Cash Flows – Base Case



# SCE Evaluation – Solar PV Project Economic/Financial- Cash Flows - Base Case



# SCE Evaluation – Solar PV Project Economic/Financial Cash Flows – Base Case

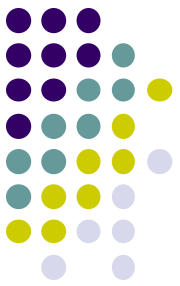


## SCE Evaluation – Solar PV Project Economic/Financial - Summary



SOLAR PV PROJECT ECONOMICS - SUMMARY 1,765 kWdc/1,500 kWac Ground Mount Solar PV Project	BASE CASE	Alt Case 1 Tariff Escalation	Alt Case 2 Capital Sensitivity
		Sensitivity	15 % HIGHER Than BASE
	Direct Access	Direct Access	Direct Access
	Pre -Solar: TOU-8-B-S	Pre -Solar: TOU-8-B-S	Pre -Solar: TOU-8-B-S
	Post -Solar: TOU-8-B-S	Post -Solar: TOU-8-B-S	Post -Solar: TOU-8-B-S
	SCE Study	SCE Study	SCE Study
Solar PV Project Capital Cost	\$ 5,000,000	\$ 5,000,000	\$ 5,750,000
\$/KWac Basis ==>	\$ 3,333	\$ 3,333	\$ 3,833
ESP/SCE Tariff Escalation Rate, %	3.0%	4.0%	3.0%
DA/ESP Electricity Cost (First Yr.); Cents/kWh	6.00	6.00	6.00
SCE Tariff Electricity Cost (First Yr.); Cents/kWh	6.52	6.52	6.52
Evaluation Period, Years	20	20	20
Cash Flow Discount Rate	6.0%	6.0%	6.0%
<b>***** Results : Solar PV Project Economics *****</b>			
<b>***** Non-Tax Entity Basis *****</b>			
20-Yr NPV - Solar PV Project Savings	\$ 480,477	\$ 909,027	\$ (250,803)
Solar PV Project IRR, %	7.29%	8.29%	5.40%
Solar PV Investment Payback, Years	10.00	9.50	13.0
20-Yr Cumulative Project Savings (Project Capital Cost Included)	\$ 4,457,818	\$ 5,486,223	\$ 3,662,261
20-Yr Cumulative Project Savings (Project Capital Cost <u>Not</u> Included)	\$ 9,457,818	\$ 10,486,223	\$ 9,412,261

## SCE Evaluation – Solar PV Project Evaluation Summary



- Based on native load for the facility, and simulation studies, it appears that the proposed solar PV project would supply (or offset) ~ 18 % of the current electricity purchases (~ 2.85 million kWh), and the remaining ~ 82 % (~13.25 million kWh), would need to be purchased from ESP/SCE under the ESP/TOU-8-B-S tariff prices. The facility native load electricity requirement is ~ 22.4 million kWh/year.
- Solar PV production would not impact the existing ICE generator production. If the Solar PV project were to be installed, and operated, then ICE generator could continue at current operating levels (~ 6.35 million kWh annual). In 2013, ICEGs had operated at ~ 51 % capacity factor (annual)- see page 10. It is unclear whether there are any operating constraints that preclude ICEGs from operating at higher capacity factors.
- Based on simulation studies, it appears that there would be no excess electricity generation from the proposed Solar PV.
- The total CSI payment under MW step 9b (\$0.114/kWh; non-profit/government entities) is estimated to be \$1.075 Million over first 5 year period for up to 1 MW solar PV capacity. This equates to ~ 21 % of the total estimated installed cost of the solar PV project (i.e., 21 % subsidy).
- The project shows positive Net Present Value (NPV) savings (@ 6 % cash flow discount rate), and ~ 7 % Internal Rate of Return (IRR); and ~ 10 year investment pay back. The project economic evaluation considered CSI-PBI incentive up to 1 MW solar PV capacity.
- The project is sensitive to capital cost and electricity price. 15 % increase in capital cost (i.e., \$5.75 Million) would result in negative NPV (see page 20); and break-even ESP electricity price is estimated to be ~4.7 cents/kWh (i.e. 4.7 cents/kWh ESP electricity price would produce “0” NPV under “base case” assumptions).