The GAP Process:
A Streamlined Economic Analysis for Procurement and Pricing of Community Solar

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Community Solar Value Project

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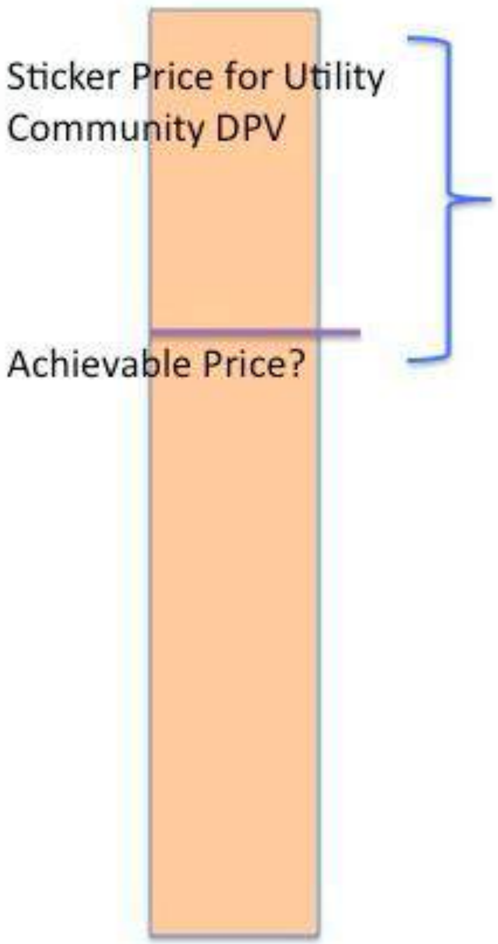
Introduction

Utility-led community solar programs often struggle with the economics of community-scale solar and the need for pricing that is both cost-based and competitive. While policymakers work to address fundamental changes to utility rate-design policies, program designers still need an internal process to help advance solar projects and programs today.

CSVP has worked with its advisory Forum to address this need. Its GAP process objectives include

1. Basing the analysis on a program narrative, which concisely describes all the benefits of the procurement and the program;
2. Utilizing the analytic processes as a tool for decision-making, and not as an end in itself;
3. Encouraging the introduction of customized solar design elements that add strategic net value;
4. Including a rigorous solar- benefits analysis, narrowly focused on achieving the GAP pricing goal;
5. Adapting familiar rate-design strategies for pricing the offer.

What is the GAP?



The GAP analysis is named for need to fill the gap between the baseline “sticker price” on a solar procurement and the net value that the utility can accept, in order to achieve competitive pricing on the program offer.

The GAP analysis is a process to “Get A Price” that reflects strategic DER value, but conforms closely enough to utility norms that it can be achieved and accepted by decision-makers in a relatively short time.

Methodology for the Study

The GAP analytic process evolved through a series of modeling exercises, supplemented by reviews from CSVP Utility Forum participants, led by Sacramento Municipal Utility District (SMUD) and the Platte River Power Authority. Models completed for these utilities were transformed into generic scenarios that preserved some situational characteristics, while replacing others to increase model replicability. The GAP process continues to evolve, thanks in part to additional peer reviewers:

•Technical Assistance supported by Solar Market Pathways program, with Bryan Palmintier, senior engineer at NREL (2015 and 2017)

•Presentation and discussion at the National Solar Conference 2016

•Presentation and discussion at Solar Market Pathways Leadership Workshop, including advisors from the Regulatory Assistance Project

•Feedback from presentations at various utilities, workshops and a CSVP webinar in July 2017

Key Findings from the GAP Process Study

1) Community-scale PV in distributed applications can compete on ***price*** and ***value*** with utility-scale and customer-sited PV systems
2) A ***streamlined analysis approach*** can provide accurate information to guide the design of community solar (CS) projects and programs. This approach maintains a focus on decision criteria. It avoids falling prey to "analysis paralysis," and it minimizes risks of prolonged internal debate
3) The GAP process can help utilities develop **cost-based pricing** for their CS program
4) A ***fleet approach***[1] to growing the CS portfolio can provide ***additional benefits*** by bundling projects within a longer term procurement and by achieving the technical benefits of geographically dispersed PV projects
5) The ***GAP analysis*** identifies distributed PV benefits that can be monetized by the utility, and the these cost savings can be reflected in an ***adjusted PPA Price*** or reflected in other, acceptable rate-making strategies.

Basis for the GAP Analytic Process

- One metric often used in evaluating resource acquisition decisions is the Levelized Cost of Energy (LCOE)
- LCOE is defined as the net present value (NPV) of project costs divided by the NPV of kWh output evaluated over the project life
- Traditionally, since most electricity resources were procured from central station projects on the transmission grid, only the NPV of project *costs* were compared
- When considering DERs, it is important to evaluate the *net* LCOE, which also incorporates incremental *benefits* of distributed PV on a levelized basis, i.e., the LBOE
- Even without including every possible benefit, the *net LCOE* analysis provides a more valid comparison of DPV resources

Equations

CSVP defines the LBOE categories as falling into four areas:

- Generation
- Transmission
- Distribution
- Societal

The equations for calculating the net LCOE are:

- $LCOE_{DPV\ NET} = LCOE_{DPV\ GROSS} - LBOE_{DPV}$
- Where,

↖PPA Price ↖DPV Benefits

$LBOE_{DPV} = LBOE_{GENERATION} + LBOE_{TRANSMISSION} + LBOE_{DISTRIBUTION} + LBOE_{SOCIETAL}$

Once the $LCOE_{DPV\ NET}$ is calculated, the utility's non-bypassable wires charge may be included, as usual, for bottom-line CS program pricing.

While some alteration of the wires charge may be warranted, most utilities find that very difficult to achieve. Modifications to support better pricing may be presented as an Adjusted PPA Price or Gross PPA Price + credit.

DPV Value Streams / Screening and Analysis

To identify appropriate value streams for assessment, the first step is to collect data specific to the utility designing the CS program. This is accomplished with a *data collection form*. Some utility data should be readily available. Regarding solar value, the process encourages utility staff to provide *ranges of values* for DPV benefit categories that may be difficult to quantify.

For different regional scenarios in this study, the DPV values were based on available data from participating utilities. Then, ranges were estimated for data not readily available, utilizing the best data available for the region or for utilities with similar characteristics. A sample utility data request is illustrated below, and on the following slides:

DPV Value Streams / Screening and Analysis

DATA VARIABLE	DESCRIPTION	UNITS	VALUE USED IN THIS ANALYSIS	ESTIMATED VALUE AT LOW END OF RANGE	ESTIMATED VALUE AT HIGH END OF RANGE
GENERATION SYSTEM LEVEL					
• Avoided wholesale energy and capacity purchases during PV production hours for a conventional fixed tilt mount (33.5°) PV system	• For this analysis, a proxy was used assuming the avoided generation was a natural gas combined cycle turbine. As per the EIA, the expected levelized avoided cost of energy for a PV project is $0.052/kWh	$/MWh	$0.052/kWh	$0.045/kWh	$0.09/kWh
• New generation capacity deferral or avoidance	• The value of new planned generation ($/MW) or PPAs ($/MWh) from non-solar resources deferred or avoided from DPV.	$/MW-year or $/MWh	Not Used	$0.005/kWh	$0.11/kWh
TRANSMISSION SYSTEM LEVEL					
• Avoided transmission line losses	• The line losses on the transmission system that are avoided as a result of DPV. If data is not available for real-time PV output, then system averages may be used.	%	3%	2%	4%
• Avoided transmission charges	• Avoided transmission access charges	$/MWh	$0.01/kWh	$0.018/kWh	$0.03/kWh
• Avoided ancillary service costs	• The value of avoided ancillary service costs during the periods of PV generation. If data is not available for real-time PV output, then system averages may be used.	$/MWh	Not Used	-$0.000005/MWh	$0.000015/MWh

Sample Data Request Checklist (cont.)

DATA VARIABLE	DESCRIPTION	UNITS	VALUE USED IN THIS ANALYSIS	ESTIMATED VALUE AT LOW END OF RANGE	ESTIMATED VALUE AT HIGH END OF RANGE
DISTRIBUTION SYSTEM LEVEL					
• Avoided distribution line losses	• The real-time line losses on the distribution system level that are avoided as a result of distributed PV generation.	%	6.3%	1.5%	6.3%
• Ancillary service value	• The value of ancillary services provided by distributed PV, including but not limited to: • frequency and regulation support • reactive power • voltage support • spinning reserves	$/MWh-year	Not Used	N/A	N/A
• Improved capacity utilization, and potentially deferred or avoided equipment upgrades and/or O&M	• The value of improved capacity utilization and deferred/avoided equipment upgrades and/or O&M	$/MW-year (cite applicable years)	Not Used	$0.0/kWh	$0.07/kWh
• Grid resiliency • Reliability • Disaster recovery • Micro-grid capability	• The value of distributed PV resources in providing grid resiliency, reliability, and disaster recovery related services	$/MWh or $/MW-year	$0.01/kWh	$0.01/kWh	$0.023/kWh

Sample Data Request Checklist (cont.)

DATA VARIABLE	DESCRIPTION	UNITS	VALUE USED IN THIS ANALYSIS	ESTIMATED VALUE AT LOW END OF RANGE	ESTIMATED VALUE AT HIGH END OF RANGE
SOCIETAL BENEFITS					
• Avoided CO_2 emissions • Other avoided emissions • Avoided water consumption • Regulatory compliance (i.e., RPS, IRP, S-REC)	• These potential benefits are aggregated to capture any potential societal benefits that are directly monetized by the utility, or are anticipated to be directly monetized within the 30-year analysis period.	$/MWh	Not Used	$0.001/kWh	$0.04/kWh
UTILITY STRATEGIC VALUE BENEFITS					
• Economic development; sustainability targets • Grid modernization and electrification • Additional risk-management values • Customer service, including equity	• As these utility strategic value benefits are difficult to quantify and/or monetize, please provide brief written summaries on how these values positively impact the utility, its goals, and its overall mission as applicable.	Qualitative Discussion	Not Used		
• Customer retention / competitiveness value	• The customer retention value is the value that distributed community solar PV resources has in terms of keeping the customer and not losing them (and their revenues) to a third party PV provider.	$/MWh	Not Used		

How Does the GAP Analysis Differ from VOS?

The GAP Analysis focuses on high-value DPV benefits that are both appropriate to the particular utility/situation, and *sufficient to meet target costs*. In discussion with utility staff, the analyst prioritizes benefits, in order to test those that are most likely to yield significant value and to be acceptable to utility decision-makers. Where data is unclear or values are contentious, the GAP analysis may use a conservative value that stakeholders can agree upon without delay. By contrast, a VOS analysis aims to count *all applicable solar benefits* and to work through regulatory channels to set the full net value of DPV.

By focusing on the minimum DPV benefits required to meet the cost and pricing target, fewer values become contentious, and the work environment can be more collaborative. This is not a critique of VOS, except that the more streamlined GAP approach is well-suited to internal program-design and decision-making, whereas VOS is primarily a policy instrument.

Universe of Categories for GAP Benefit Analysis

- Avoided transmission losses
- Avoided transmission ancillary services
- Reduced distribution line losses
- Distribution ancillary services
- Improved distribution capacity utilization; may avoid/defer upgrades

- Avoided costs of conventional wholesale power**
- Avoided/deferred conventional generation capacity investment**
- Fuel price hedging**

- Reduce GHG and other emissions**
- Reduce water use**
- Conserve ag land, sensitive land
- Meet local sustainability goals
- Other compliance values**

- Potential DR companion measures
- Potential customer-side storage
- Potential added project-design values, e.g., shading

- Solar geographic diversity benefits, risk management
- Potential resilience benefits
- Solar siting, design & operational flexibility to capture strategic benefits

** Also available to centralized PV projects

Benefits Selected for Each Scenario Vary

For each scenario, additional benefits could be included, but those indicated provide the LBOE values that would be most readily quantified and accepted by utility staff.

DPV Benefit	Central California	Desert Southwest	Rocky Mountain
Avoided Transmission Costs	✔	✔	✔
Strategic DPV Design	✔	✔	✔
Customer Retention Value	✔		
Avoided Transmission Losses		✔	✔
Avoided Distribution Losses		✔	
Grid Resilience and Reliability		✔	
Coincident Demand Reduction			✔
Distribution Upgrade Deferral			✔

High-Value Design Solutions

For this study, the CSVP analyst also applied innovation to maximize the benefits available. CSVP has additional resources available on high-value DPV. Depending on the situation, these may include:

- Strategic Site Characteristics
- Fleet Siting to Take Advantage of Geographic Diversity of Multiple Projects
- Single-Axis Tracking Mount
- Optimized Orientation and Tilt Angle of Fixed-Tilt Mount or Carport
- Matching Cell Types to Geographic / Site Conditions
- Use of Smart Inverters
- Use of Storage or DR Companion Measures
- Supplemental Technology Strategies (EV Charging)
- Financing and Business Model Strategies
- Programmatic Strategies

A Simplified Analysis Approach with Robust Modeling Behind It

The GAP analysis is a streamlined approach to DPV valuation, but it is also a robust model. The image below shows the detail and complexity behind the simplified formulas used to calculate net value. There are four categories of analysis: Impacts, Costs, Benefits, and Metrics. The first step in the analysis process is to document the assumptions, based on the utility data request results, and then to input them into this modeling tool. A sample Assumption Table from the evaluation tool is presented below:

PROJECT DESCRIPTION 1(a): MW$_{AC}$ Community Solar Solar Photovoltaic Plant/Single Axis Tracking/Wholesale PPA

ASSUMPTIONS			Source								
Discount Rate	4.5	%	Assumption								
PV System Size	1	MW	Assumption								
Turn-key Plant Capital Cost	1,750,000	$/MW	Estimated based on current industry costs								
Power Purchase Agreement Price	65.00	$/MWh	Estimated based on current industry costs								
Annual Degradation	0.50	%	NREL System Advisor Model default								
Annual Energy Yield	1,719	MWh/MW	NREL System Advisor Model								
Annual Capacity Reduction Credit	3.07	MW of Capacity Credit/M	Calculated from SAM output								
Avoided Transmission Line Loss Factor	1.82	%	Utility Data Request								
Transmission Access Charge	10.00	$/MWh	Conservative Estimate Reduced From EIA Value								
Blended Cost of Avoided Wholesale Energy Purchases	35.00	$/MWh	Utility Data Request								
Value of Capacity Credit	3,960	$/MW	Per PURPA Tariff								
Program Start-up Costs ([illegible])	[illegible]	$/MW	Estimated based on literature review								
Annual Program Administration Costs	2,500	$/MW	Estimated based on literature review								
Customer Subscriber Retail Rate (not including customer surcharge)	65.50	$/MWh	Wholesale PPA Rate + Solar Premium								
Deferrel Value (50% of Fleet captures value)	37,500	$/MW	Based on $1M deferral at 7.5% interest								
Residential Customer Retail Rate (Energy Cost Only)	55.44	$/MWh	Utility Data Request								
Residential Customer Retail Energy Escalation Rate	2.50	%	Utility Data Request								
Residential Customer Retail Rate Forward Schedule	$55.44	$56.83	$58.25	$59.70	$61.20	$62.73	$64.29	$65.90	$67.55	$69.24	
Forward Tranmission Access Charge Schedule	0.99	1.03	1.07	1.11	1.17	1.24	1.29	1.33	1.35	1.38	
Forward TAC ($/MWh)	9.85	10.34	10.68	11.08	11.74	12.37	12.91	13.28	13.50	13.78	

* Note that the above data and assumptions are for illustrative purposes only.

Evaluation of Community Solar Impacts

The first step in the quantification of net benefits of a CS program is to calculate the impacts of the community solar fleet. This is determined by using solar production modeling software (such as SAM or PVsyst) to calculate the hourly and annual generation output for each year of the analysis period. Most of the impacts associated with DPV benefits are derived from the hourly and annual data sets generated by the solar modeling, including for example, the avoided annual wholesale energy and capacity purchases and avoided line losses attributable to a fleet of CS projects. A sample of the Impacts section of the evaluation tool is provided below:

IMPACTS	1	2	3	4	5	6	7	8	9	10
Annual Energy Production (MWh)	1,719	1,710	1,702	1,693	1,685	1,676	1,668	1,660	1,651	1,643
Annual Aggregated Capacity Reduction Value (MW)	3.07	3.05	3.04	3.02	3.01	2.99	2.98	2.96	2.95	2.93
Annual Avoided Line Losses (MWh)	31	31	31	31	31	31	30	30	30	30

*- Note that the above data and assumptions are for illustrative purposes only

Evaluation of Community Solar Costs

The second step in the quantification of net value for a CS program is to calculate the costs associated with implementation of the community solar program. These include the costs of the solar energy or PV projects (i.e., the power purchase agreement cost, or the capital and annual O&M costs), the costs to implement and manage the program, and the lost retail revenues attributable to the portion of the bill that the customer is no longer paying (i.e., the commodity cost of energy on their monthly utility bill). These annual values for each cost category are then summed to indicate the annual costs of the CS program, which are used in calculating the program metrics later in the analysis. A sample of a portion of the Costs section of the evaluation tool is provided below:

COSTS	1	2	3	4	5	6	7	8	9	10
Annual PPA Costs	$111,735	$111,176	$110,620	$110,067	$109,517	$108,969	$108,425	$107,882	$107,343	$106,806
Lost Retail Revenues	$95,301	$97,195	$99,127	$101,097	$103,107	$105,156	$107,246	$109,377	$111,551	$113,768
Program Administration Costs	$20,000	$2,500	$2,553	$2,607	$2,662	$2,719	$2,776	$2,835	$2,895	$2,957
Annual Costs	**$227,036**	**$210,872**	**$212,301**	**$213,772**	**$215,286**	**$216,844**	**$218,447**	**$220,095**	**$221,790**	**$223,532**

*- Note that the above data and assumptions are for illustrative purposes only

Evaluation of Community Solar Benefits

The third step in the quantification of net value for a CS program is to calculate the benefits associated with implementation of the community solar program. These may include a variety of of DPV-related benefits, as identified in the data request and initial screening assessment. Typical benefits may include avoided wholesale energy and capacity purchases, avoided transmission access charges, T&D line losses, and CS program subscriber revenues. Other benefits would be calculated on a measure specific basis such as for distribution deferral upgrades, deferred generation capacity additions, provision of grid services, and/or compliance value for example. These individual benefit values are used in calculating the LBOE of specific DPV benefits; in addition, summing these values to determine the annual benefits are used in the determination of overall program metrics later in the analysis. A sample of a portion of the Benefits section of the evaluation tool is provided below:

BENEFITS	1	2	3	4	5	6	7	8	9	10
Avoided Wholesale Energy Purchases	$60,165	$61,361	$62,580	$63,824	$65,093	$66,386	$67,706	$69,051	$70,424	$71,823
Coincident Demand Reduction Credit	$12,149	$12,390	$12,637	$12,888	$13,144	$13,405	$13,672	$13,943	$14,221	$14,503
Avoided Transmission Access Charges	$16,940	$17,678	$18,174	$18,770	$19,782	$20,740	$21,537	$22,039	$22,298	$22,647
Avoided Line Loss Value	$308	$322	$331	$342	$360	$377	$392	$401	$406	$412
Distribution Upgrade Deferral Value	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500			
Customer Subscriber Revenues	$112,595	$112,032	$111,471	$110,914	$110,359	$109,808	$109,259	$108,712	$108,169	$107,628
Annual Benefits	**$239,657**	**$241,283**	**$242,693**	**$244,237**	**$246,238**	**$248,216**	**$250,065**	**$214,148**	**$215,517**	**$217,014**

*- Note that the above data and assumptions are for illustrative purposes only

Quantification of Program Metrics

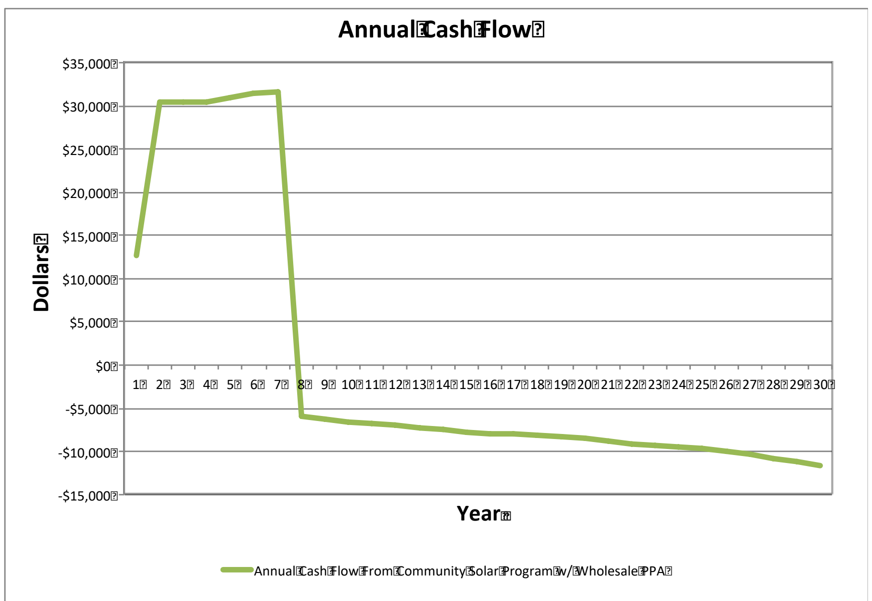
The final step in the quantification of overall and net value for a CS program is to calculate the economic metrics associated with the program as a whole, as well as the individual LBOEs of the DPV values. The CSVP used a proprietary version of the SAM model (NREL) for its analysis. Readers may customize that free resource for their own use, or contact the authors for further support. The CSVP approach quantifies the LBOE of DPV benefits individually and in aggregate to feed into the overall program value analyses, as well as to support the pricing analysis as the final step of the program analysis process. Sample output below:

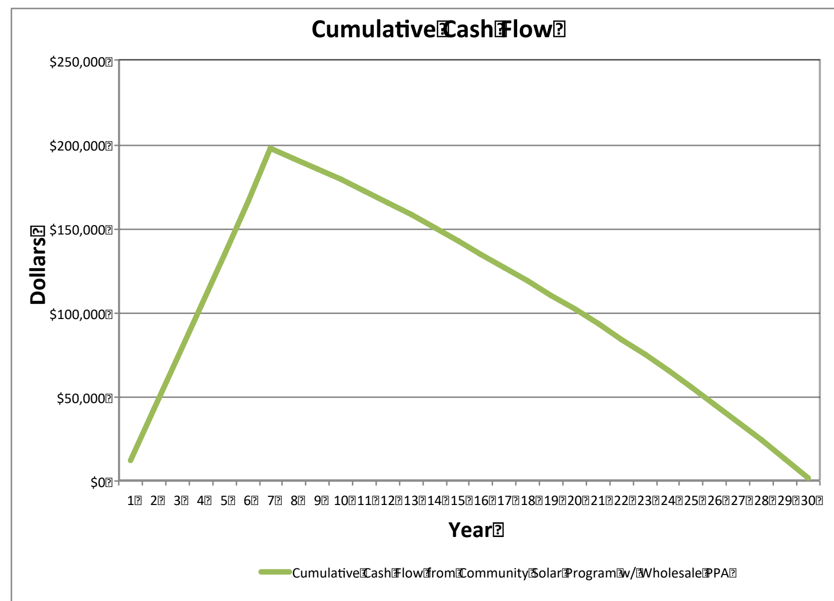
ECONOMIC METRICS		
Value of Lifecycle Cash Flow	$1,798	
NPV of Lifecycle Cash Flow	$87,165	
Average Annual Cash Flow	$60	/year
Years to Cash Flow Positive	1	year
NPV of Costs	$1,540,768	
NPV of MWh	23,704	MWh
Levelized Cost of Energy	$65.00	/MWh
Internal Rate of Return	0.36%	
Benefit-Cost Ratio	1.00	
NPV of Coincident Demand Reduction Credit	$250,543	
LBOE of Coincident Demand Reduction Credit	$11	/MWh
NPV Avoided Tranmission Access Charges	$381,239	
LBOE of Transmission Access Charges	$16	/MWh
NPV of Transmission Line Loss Value	$6,939	
LBOE of Transmission Line Loss Value	$0.29	/MWh
NPV of Distribution Upgrade Deferral Value	$220,976	
LBOE of Distribution Upgrade Deferral Value	$9	/MWh
LBOE OF DISTRIBUTION VALUES	$36	/MWh

Note that the above data and assumptions are for illustrative purposes only. They are based on a one generic case. Customization per utility/project Is required.

Quantification of Program Metrics (cont.)

Based on the generic case above, these graphics depict the annual and cumulative cash flows associated with the CS program and its various DPV cost and benefit attributes. It is useful to view these two metrics in a graphic format, to see the variations in cash flows over time. Gaining an understanding of program cash flows also aids in program design efforts to insure that any required costs in “out years” are properly budgeted for in the program planning stage. See examples below.





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Generic GAP Analysis Calculation

PV PPA Price ($LCOE_{GROSS}$)	$0.075

Baseline Cost ↗

DPV Value Category (LBOE)	Value ($/kWh)
DPV Benefit Category #1	$0.010
DPV Benefit Category #2	$0.005
DPV Benefit Category #3	$0.005
TOTAL OF DPV BENEFITS ($LBOE_{GROSS}$)	**$0.020**

Aggregated DPV Benefits ↗

PPA Price Adjustment Calculation	Value ($/kWh)
Baseline PPA Price ($LCOE_{GROSS}$)	$0.075
Aggregated DPV Benefits ($LBOE_{GROSS}$)	$0.020
Adjusted PPA Price ($LCOE_{NET}$)	**$0.055**

Cost Minus Benefits ↗

Program Price Offering Calculation	Value ($/kWh)
Adjusted PPA Price	$0.055
Non-Bypassable Wires Charge	$0.045
Community Solar Program Price	**$0.10**

Indicative Pricing Estimate ↗

Overview of Regional Cases

- The CSVP team modeled three cases to demonstrate value and pricing approaches for utility-driven CS fleets in different regions of the country
- These models illustrate the **technical and economic impacts** of various solar fleet configurations, and help assess DPV values in regions with varying solar resources and varying DER benefits
- The analyses were also designed to answer specific questions for CS project and program designs:
  - Central California: **Central PV Versus Distributed PV**
  - Desert Southwest: **Value of Solar Carports**
  - Rocky Mountain: **Program Pricing**

The Central California Scenario

For this Case:

- A municipal utility in California's Central Valley
- 20-MW Central PV project + 6 MW of DPV projects
- Tariff-based program
- Seeking balance between NEM based and utility-provided ; manage pace of the shift to third-party providers of NEM-based PV systems
- CS program interested in looking at a fleet approach to pricing, incorporating both CPV and DPV resources
- DPV benefit categories focused for this scenario were:
  - Avoided Transmission Access Charges (due to high costs in California)
  - Strategic PV Design (incorporate tracking and carports to maximize summer energy production and optimize the offset of higher avoided costs during the summer months)
  - Customer Retention (calculate the utiltiy/system value of the customer's choice to join a community-solar program, instead of rooftop NEM)

The Central California Scenario: DPV & Fleet Analyses

6 MW DPV Alone

DPV Value Category	Value (kWh)
LCOE of DPV (PPA Price)	**$0.075**
Avoided Transmission	$0.010
Strategic DPV Design	$0.006
Customer Retention	$0.012
Adjusted PPA Price	**$0.047**

26 MW Fleet
(20 MW Central + 6 DPV)
Analysis Results

Price Category	Value (kWh)
LCOE of CPV (PPA Price)	$0.050
LCOE of DPV w/o Benefits (PPA Price)	$0.075
LCOE of 26 MW Fleet w/o DPV Benefits	$0.055
LCOE of 26 MW Fleet w/ DPV Benefits	**$0.049**

By combining a centralized green power product with a DPV community solar product, the utility builds a stronger, diverse and affordable portfolio.

Customer-facing pricing for the fleet-based community solar program

Price Category	Value (kWh)
LCOE of CS PV Fleet	$0.049
Non-Bypassable Wires Charge	$0.050
Community Solar Program Price Offering	**$0.099**

For this case, it was assumed the program could not move forward for timely implementation, unless the utility imposed the wires charge.
Yet, the *net LCOE* + wires charge for the fleet-based offer adds up to a competitive price. In fact, the solar developer would not offer this net LCOE price. Thus, the net LCOE shown here would not represent a full pass-through, but rather, pass-through of an "adjusted PPA" price.

The Desert Southwest Scenario

For This Case:

- A utility with a large service area in the Desert Southwest
- 5-MW CS fleet, entirely of solar carports
  - Strategically located on the grid to optimize resiliency and reliability, as well as line loss reductions over 6%
  - Demonstrated strategic design benefits of a flat mount system optimized for summer production
- PPA price of the 5-MW DPV canopy fleet: $0.103/kWh
- Utility-led, tariff-based CS program w/ full wires charges

The Desert Southwest Scenario

DPV benefit categories for this scenario:

- Avoided Transmission Access Charges (reflecting high costs in the region)
- Strategic PV Design (incorporating flat-mount PV carports to maximize summer energy production and optimize the offset of higher avoided costs during the summer months; also lowers siting and construction costs)
- Avoided T&D losses (primarily distribution, due to the documented high line loss values for the periods of PV production in the region)
- Grid Resiliency (due to the critical importance and high value of maintaining grid reliability and security in the region, especially during summer heat waves)

This case was modeled on published data, without up-front input from the utility, but with feedback from CSVP Utility Forum members. It illustrates use of current U.S. EIA data on both transmission values and line losses that occur during summer days, when the PV is generating. This analysis, unlike standard approaches, recognized that the analysis should focus on hours of PV generation.

The Desert Southwest Scenario: DPV & Pricing Analyses

5 MW DPV Analysis Results

DPV Value Category	Value (kWh)
LCOE of DPV (PPA Price)	**$0.103**
Avoided Transmission Costs	$0.010
Strategic DPV Design	$0.005
Avoided T&D Losses	$0.005
Grid Resilience & Reliability	$0.010
Adjusted PPA Price	**$0.073**

CS Program Price Analysis Results

Price Category	Value (kWh)
LCOE of CS PV Canopy Fleet	$0.073
Non-Bypassable Wires Charge	$0.031
Community Solar Program Price Offering	**$0.104**

The scenario also assumes an adjusted-PPA pricing strategy.

The Rocky Mountain Scenario

For This Case:

•A public power utility with a JAA power supplier in the Rocky Mountain West

•Very low avoided wholesale power-purchase cost

•A 5-MW CS fleet of fixed-tilt PV systems strategically located to capture distribution upgrade deferral benefits

•Estimated PPA price of the 5-MW DPV fleet: $0.065/kWh

•Utility-led, tariff-based CS program w/ full wires charges

•Analyzed a modified approach to the “adjusted PPA” pricing methodology to recover all program costs and lost revenues

Because of the very low avoided wholesale power-purchase cost, this analysis looked at more benefits. Alternatively, the GAP could be filled with high-value companion measures or a slight premium.

The Rocky Mountain Scenario

The DPV benefit categories focused on for this scenario were:

- Avoided Transmission Access Charges (due to the relatively high costs in the region)
- Strategic PV Design (incorporate PV tracking systems to "test" the ability to capture additional value of higher avoided energy costs in the summer and shoulder periods*)
- Avoided Transmission Losses (as the utility owned its own transmission assets)
- Coincident Demand Reduction (value based on assuming an anchor CS customer and including utility incentive for customer-sited generation assets)
- Distribution Upgrade Deferral (using GAP methodology for calculating distribution system deferral value, by discounting the standard estimated value, to address engineering skepticism of this high-value strategy)

* A striking finding of this case analysis was that single axis tracking (SAT) is at about parity with fixed-tilt, and though the savings, given current rate structures and costs, were not dramatic, the flexibility of the SAT design a risk mitigation strategy.

The Rocky Mountain West Scenario: DPV & Pricing Analyses

5 MW DPV Analysis Results

DPV Value Category	Value (kWh)
LCOE of DPV (PPA Price)	**$0.065**
Avoided Transmission Costs	$0.016
Strategic DPV Design*	$0.000
Avoided Transmission Losses	$0.0003
Coincident Demand Reduction	$0.011
Distribution Upgrade Deferral	$0.009
Adjusted PPA Price	**$0.029**

CS Program Price Analysis Results

Price Category	Value (kWh)
Baseline "Break-Even" Price for All Program Costs	$0.065
Non-Bypassable Wires Charge	$0.046
Community Solar Program Price Offering	**$0.111**

*SAT for risk management; see above.

Summary of Findings

- The GAP streamlined methodology and approach for CS Valuation and Program Pricing offers a flexible approach that is easily adapted to different:
  - CS program designs
  - PV system types
  - Utility situations
  - Solar-Plus companion technologies (i.e., storage and demand response)
  - Alternative pricing structures
- Critical to conduct preliminary program planning, to identify key characteristics desired for the program, areas of high value DPV benefits, and to answer important questions for the project
- A GAP approach that is streamlined and conservative, yet rigorous in its analytics, can be an effective tool in garnering management support for a CS program, and for distributed PV in general.
- Contact info@communitysolarvalueproject.com or the authors for an expanded report on each scenario and for more information on GAP process facilitation.

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The CSVP acknowledges the contributions of various utilities to this effort. Details and updates are available at the CSVP website, http://www.communitysolarvalueproject.com. The authors underscore that the case described is, as intended, a hypothetical, and does not represent specific utility programs or policies.