TASC

EXHIBIT C

THE ALLIANCE FOR SOLAR CHOICE

Relevant Values of Solar Distributed Generation and Recommended Definitions and Methodologies

The list below groups costs and benefits based on how most studies treat each. Grid support/ancillary services has its own category since these distributed generation ("DG") attributes can either be a positive or negative value. In addition, the list provides a definition for each element and indicates the best process or methodology to assign a monetary value to each stated value. Rather than include detailed explanations of these processes and methodologies, we provide, where appropriate, references to sources with more complete explanations.

Ancillary Services and Grid Support

Value Category	**Subcategories**	**Definition**	**Methodology / Process**
Ancillary Services and Grid Support	-Ancillary Services -Reactive Supply & Voltage Control -Frequency Regulation -Energy imbalance -Operating Reserves -Scheduling and/or Forecasting -DG System Integration Costs -Technology Synergies	Ancillary services and grid support enable the reliable operation of a grid hosting customer-sited, distributed solar. The value of ancillary services and grid support can be either a positive or negative value when compared with the costs that would otherwise be incurred without distributed solar. Such services include reactive supply, voltage control, frequency regulation, energy imbalance, operating reserves and scheduling/forecasting. TASC believes that the value of "technology synergies", such as advanced inverter technology, or the combination of rooftop solar and energy storage, would also be accounted for here.	Model ancillary services benefit and costs. Regulator's Guidebook at 29-30 and 39-40.[1] Can be a benefit if the utility's ancillary service needs are a function of load. See E3 and Crossborder studies of NEM in California, included in Exhibit AS-1. Easier to quantify in markets where ISOs operate visible ancillary service markets.

[1] Keyes, Jason B., Rábago, Karl R., Regulator's Guidebook: Calculating the Benefits and Costs of Distributed Solar Generation, Interstate Renewable Energy Council, Inc. and Rábago Energy, LLC, October 2013. Available at http://www.irecusa.org/wp-content/uploads/2013/10/IREC_Rabago_Regulators-Guidebook-to-Assessing-Benefits-and-Costs-of-DSG.pdf

Grid-Related Values

Value Category	Subcategories	Definition	Methodology / Process
Avoided Energy Costs	-Avoided Fuel / Purchased Power Costs -Avoided Variable O&M	The cost of energy that would have otherwise been generated to meet customer needs.	Determine future market price of energy over the lifetime of the distributed solar facility. Regulator's Guidebook at 21-22.
Avoided Energy Losses	-Avoided Line Losses	The value of the additional energy generated by central plants that would otherwise be lost due to inherent inefficiencies in delivering energy to the customer via the transmission and distribution system.	Compare total line losses without distributed solar to total line losses with distributed solar. Regulator's Guidebook at 23-24.

Value Category	Subcategories	Definition	Methodology / Process
Avoided Capacity Costs for Generation	-Avoided Power Plant Capital Costs – Customer's Capital Contribution -Avoided Fixed O&M -Avoided Power Plant Decommissioning Costs -Distributed Energy Capacity Value -Avoided Generation Capacity (new generation $) -PV System Orientation	The cost and amount of generation capacity that can be deferred or avoided due to distributed solar. The orientation of a PV system will affect the amount of capacity that distributed solar provides. In turn, the amount of capacity distributed solar provides will directly impact the avoided need for new generation capacity. The value of the avoided need for new generation capacity includes avoided capital costs, avoided fixed O&M, and avoided decommissioning costs.	Determine the capacity value of distributed solar using the Effective Load Carrying Capacity methodology. Regulator's Guidebook at 24-26. Control area operators may have comparable procedures for setting the resource adequacy capacity of distributed solar resources. Determine the capital and O&M costs of the marginal generator that is avoided. Regulator's Guidebook at 24-26.
Avoided and Deferred Capacity Costs for T&D	-Avoided / Delayed Transmission System Investment -Avoided / Delayed Distribution System Investment	The value of the avoided or deferred T&D infrastructure investments due to distributed solar.	Use location-specific data to conduct individualized assessment of distributed solar system value. Regulator's Guidebook at 26-29. Important to consider long-term avoided costs, beyond the utility's near-term T&D plans.

Value Category	**Subcategories**	**Definition**	**Methodology / Process**
Avoided Renewables Costs	-Avoided Renewable Energy and Energy Efficiency Portfolio Standard (REPS) Costs	When customer-sited, distributed solar generation reduces onsite load, a utility does not have to procure as much renewable generation capacity to meet renewable portfolio standards. This reduction in procurement obligations results in cost savings. Customer-owned distributed solar satisfies customer demand to be served with a penetration of renewable generation in excess of the utility's RES requirements, and thus can avoid the costs which the utility would incur to meet such customer preferences through green pricing programs or other initiatives.	Quantify reduction in REPS compliance costs and calculate against market price for the relative compliance instrument. Regulator's Guidebook at 32-35. Customer demand for a higher-than-REPS share of renewables can be valued based on the cost of utility "green pricing" programs which serve the same customer demand. The U.S. Department of Energy maintains a data base of such programs.[2]
Fuel Price Hedge	-Avoided Fuel Hedging Costs	The avoided costs a utility would otherwise incur to guarantee energy fuel costs are fixed.	Compare the cost of a 30-year investment with substantial price uncertainty to one with a fixed price. Regulator's Guidebook at 30.

[2] EERE, U.S. DOE, Green Pricing: Utility Programs by State, http://apps3.eere.energy.gov/greenpower/markets/pricing.shtml?page=1 .

Value Category	Subcategories	Definition	Methodology / Process
Energy Market Impacts	-Avoided Market Price Mitigation (reduction of wholesale market clearing prices for natural gas and electricity)	Distributed solar reduces the demand for fuel to power central station generators and for wholesale power in the wholesale electricity market, reducing wholesale market clearing prices for natural gas and electricity. Reduced demands in these markets lowers prices across the entire market served, providing benefits for the general body of consumers who use these markets.	Estimate the difference between current price projections and hypothetical price projections without the reduction in demand caused by distributed solar. Regulator's Guidebook at 31. Easiest to calculate for regions with deregulated markets and visible market prices. For example, this benefit is regularly included in avoided cost calculations in the U.S. Northeast.[3] These benefits in the natural gas market also have been quantified. [4]

Environmental Values

[3] The market price mitigation benefit of demand-side resources, also called the demand reduction induced price effect (DRIPE), has been estimated at 19-25% of combined energy and capacity prices. Synapse Energy Economics, "Avoided Energy Supply Costs in New England: 2011 Report" (August 11, 2011), at Exhibit 1-1. Available at http://www.synapse-energy.com/Downloads/SynapseReport.2011-07.AESC.AESC-Study-2011.11-014.pdf .

[4] A Lawrence Berkeley National Lab study estimated that the consumer gas bill savings associated with increased amounts of renewable energy and energy efficiency, expressed in terms of $ per MWh of renewable energy, range from $7.50 to $20 per MWh. Wiser, Ryan; Bolinger, Mark; and St. Clair, Matt, "Easing the Natural Gas Crisis: Reducing Natural Gas Prices through Increased Deployment of Renewable Energy and Energy Efficiency" (January 2005), at ix, http://eetd.lbl.gov/sites/all/files/publications/report-lbnl-56756.pdf.

Value Categories	**Subcategories**	**Definition**	**Methodology / Process**
Environmental Benefits	-Water Consumption -Cost of Environmental Compliance	The saving realized from reduced air emission control or allowance costs, including those related to carbon, criteria air pollutants and reduced water use.	To the extent not reflected in the cost of avoided energy, quantify the reduction in carbon, criteria air pollutants, and water use, and calculate using the market price for the appropriate compliance instrument (such as the price of carbon offsets). Regulator's Guidebook at 32-35.

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Societal Values

Value Categories	Subcategories	Definition	Methodology / Process
Health Benefits	-Health Effects (Benefits)	The reduction in societal costs from health risks, including reduced morbidity and mortality, related to air pollution from fossil-fuel production, transportation, and generation.	Quantify reduction in carbon or criteria air pollutants and calculate against estimates of the cost of impacts from such pollution in public health studies. Regulator's Guidebook at 32-35.
Security and Resiliency of the Electric Grid	-Grid Security -Grid / Service Reliability	The benefits to society (*i.e.*, the economy) realized from: (1) The reduction in outages from reduced congestion along the T&D network, (2) The minimization of large-scale outages resulting from a more diverse and dispersed electricity supply, and (3) Back-up power provided by customer-sited DG.	Compare assumed risk of outages and blackouts, assumed cost to strengthen grid to avoid that risk, and assumed ability of DG to strengthen the grid. Regulator's Guidebook at 31. This benefit has been calculated for DG in several Mid-Atlantic states.[5]

[5] Hoff, Norris, and Perez, *The Value of Distributed Solar Electric Generation to New Jersey and Pennsylvania* (November 2012), at Table ES-2, available at http://mseia.net/site/wp-content/uploads/2012/05/MSEIA-Final-Benefits-of-Solar-Report-2012-11-01.pdf.

Value Categories	**Subcategories**	**Definition**	**Methodology / Process**
Avoided Environmental and Safety Costs	-Non-Compliance Environmental Effects	The reduction in costs related to: (1) Fewer land use impacts because customer-sited, distributed solar is installed in the already-built environment; (2) The savings realized from avoided accidents, pollution and economic loss associated with the extraction, transportation, distribution, and processing of fossil fuels; and (3) The reduced compliance costs related to a decrease in the extraction, transportation, distribution and proceeding of fossil fuels.	Difficult to calculate, although the cost of specific accidents can be very large.
Effects on Economic Activity and Employment	-Economic Development and Jobs	The value from the increase in jobs and local economic development related to customer-sited, distributed solar and the resulting increase in welfare and economic productivity of children and working adults from the above health benefits.	Calculate tax enhancement value from derived from DG industry in the state. Regulator's Guidebook at 35.
Visibility Benefits		The increased recreation value and economic activity associated with improved visibility due to emissions reductions from power generation.	Assess using environmental impact analysis methodology.[6]

[6] *See, e.g.*, "The Benefits and Costs of the Clean Air Act from 1990 to 2020", Office of Air and Radiation, U.S. Environmental Protection Agency, p. 18 (March 2011) (available at http://www.epa.gov/oar/sect812/feb11/summaryreport.pdf).