THE VALUE OF DISTRIBUTED SOLAR GENERATION

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Costs and Benefits Included in Recent Studies

- The cost to the customer of purchasing or leasing a solar system, its installation, and O&M
- The cost (including administrative costs) to the utility of any DSG incentive paid
- The cost to the utility of integrating DSG
- Utility revenue cost – resulting from a fall in demand for central station generation
- Avoided energy generation or fuel costs
- Avoided generation capacity costs
- Energy line loss savings
- Avoided regional and in-state transmission capacity costs
- Avoided regional and in-state distribution capacity costs
- Fuel/natural gas price hedging benefit – attributed to DSG associated with a reduced need to mitigate price volatility risks associated with wholesale energy and/or natural gas prices
- Market price reduction – associated with a reduction in wholesale energy and/or natural gas prices resulting from a utility's reduced demand for electricity as a consequence of more DSG, and its potential dampening effect on energy prices
- Environmental emissions and air pollutants value
- System reliability and resilience – attributed to the characteristics of DSG as a back-up power source to overcome outages, a potential diversifier of a utility's generation portfolio, and/or its impacts on ancillary grid services
- Water usage
- Land impacts
- Economic development benefits
- Disaster recovery benefits – associated with the continued availability of electricity in weather-related emergencies
- Avoided renewables (RPS or RES) benefit
- O&M cost savings – generally counted as part of the avoided fuel cost and avoided generation capacity cost categories though could be in excess of these
- Long term societal value – attributed to the magnitude of all the benefits listed if the economic life of a DSG system extends beyond the number of years originally assumed in the assessment

7 Core Cost and Benefit Categories

- Utility DSG Costs - DSG Incentive Program and System Integration Costs; Utility Revenue Losses
- Energy Generation Savings
- Generation Capacity Savings
- Transmission Capacity Savings
- Distribution Capacity Savings
- Environmental Benefits
- Economic Development Benefits

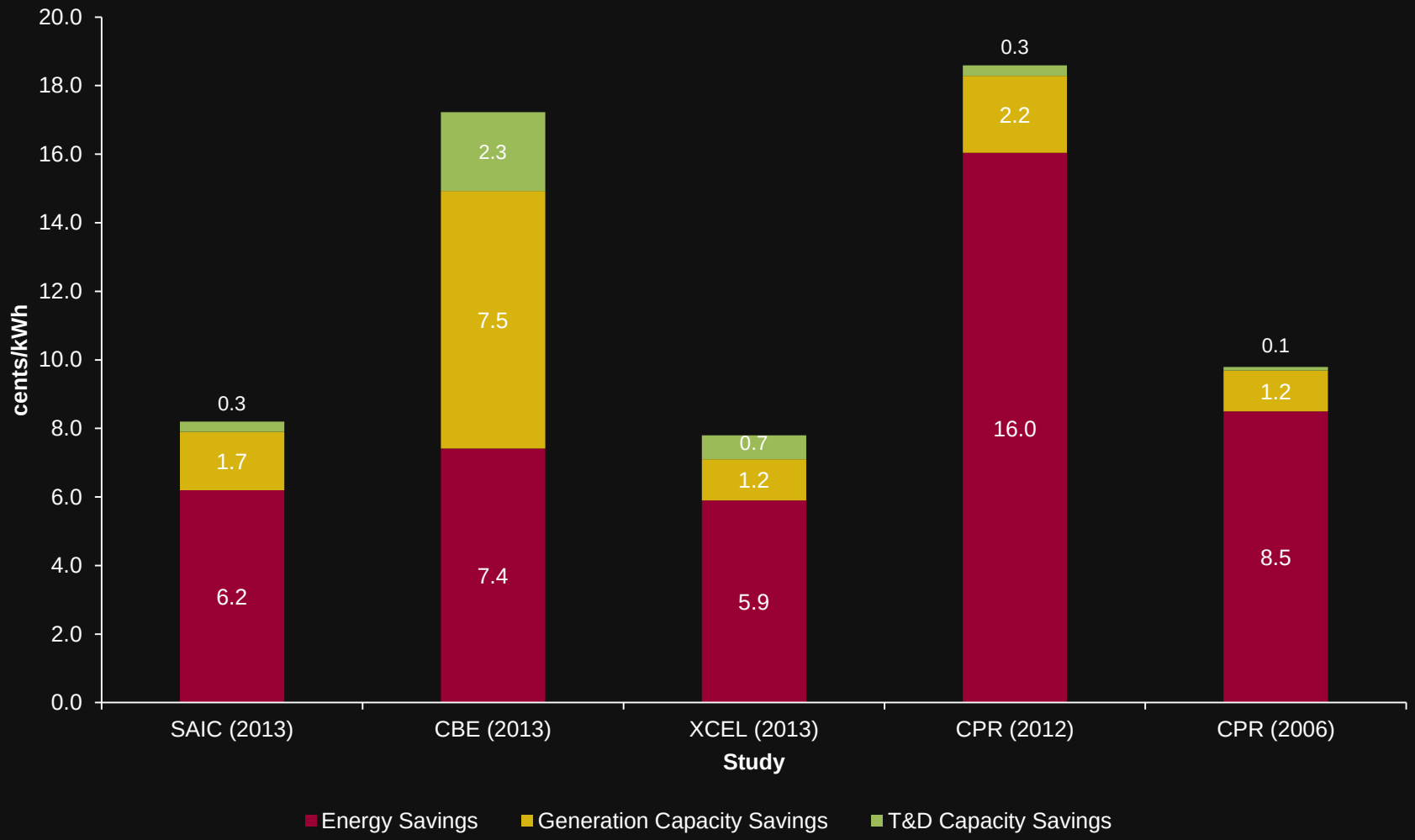
7 Categories of DSG C&Bs

	DSG Program Costs and Revenue	Energy Generation	Generation Capacity	Transmission Capacity	Distribution Capacity	Environmental	Economic Development
DSG system costs including O&M	X						
Utility incentive and program admin costs	X						
DSG solar integration costs	X		X	X	X		
Utility revenue impact	X						
Avoided energy generation costs		X					
Avoided generation capacity costs			X				
The potential for energy loss savings		X	X	X	X		
Avoided region/instate transmission capacity				X			
Avoided regional/instate distribution capacity					X		
Fuel/natural gas price hedging benefit		X					
Market price reduction		X					
Emissions and air pollutants value						X	
System reliability and resilience			X	X	X		
Water usage		X				X	
Land impacts						X	
Economic development benefits							X
Avoided renewables benefit		X	X	X	X		
O&M cost savings		X					
Long term societal value		X	X	X	X	X	X

Ratepayers and Society

	Relevant DSG Categories of Value
Ratepayers (DSG and non-DSG)	Utility DSG Costs Energy Generation Generation Capacity Transmission Capacity Distribution Capacity
Society	Environment Economic Development

Comparison of Recent Valuations



Scale of DSG Penetration

- Low levels of solar penetration (particularly in the short run) will have a negligible effect in terms of system capacity benefits
- Benefits only accrue with large-scale DSG penetration
- Simply grossing up the analyzed effects of small-scale DSG systems fails to take into account the way in which a utility's generation and its T&D system will mutate over time to accommodate the DSG
- Justifies a "lumpy" approach in valuing solar deployment modeling large penetrations to quantify the value of DSG

Average versus Marginal Valuations of Costs and Benefits

- C*osts* - each kWh of distributed solar fed back into the utility system is valued at the tariff applicable to consumption for the consumer - Essentially, this is an *average* valuation since the tariff is set through volumetric pricing

- B*enefits* of each kWh of DSG fed back into the utility system are generally assessed at their *marginal* value

- Small-scale DSG additions can potentially offer relatively larger benefits when the level of penetration is low by significantly reducing peak load

- Large-scale additions with already high levels of solar penetration do not bestow the same high marginal benefits – that is, DSG suffers from significant diminishing marginal benefits (with declining utility marginal costs)

- Any appraisal of DSG that considers small-scale additions and values them using utility marginal costs and then grosses up the effects for high penetrations is therefore subject to upward bias

Lessons for “Good” Valuations

- Make stakeholder perspective clear
- Use an appropriate mix of DSG systems appropriate to the location considered
- Make good input assumptions – NG prices
- Use robust methods of forecasting of the degree of solar penetration over timescale
- Care grossing up small-scale additions and valuations using utility marginal costs
- Measure T&D and capacity benefits using a cost-based engineering (planning) approach on a year-by-year (and cumulative) basis
- Examine the benefits of reductions in fuel usage, variable O&M and T&D line losses with a generation dispatch simulation tool - ProSym or PROMOD

Some Musings

- Objective is to reduce emissions – increase renewables (solar)
- NEMs or FITs have complex problems
- If the private benefits of solar are as great as calculated by some, why are there still utilities?
- Why not use carbon taxes and let people and markets adapt?

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