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Making Clean Local Energy Accessible Now

GTSR Project Costs & Benefits

Net Benefits Assessment
Distribution & Transmission

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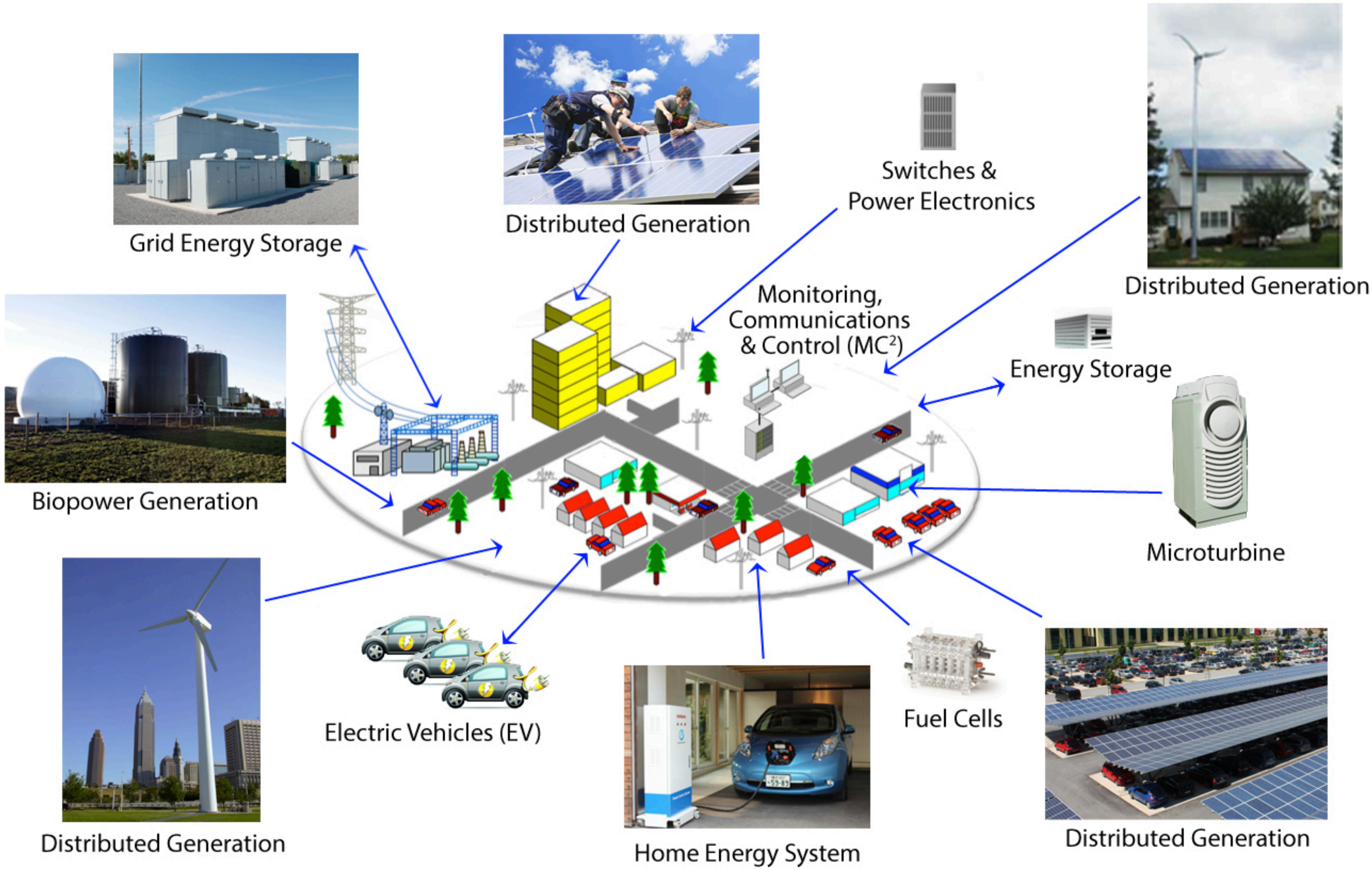
Distributed energy resources (DER)



California Distribution Resources Plan (DRP)

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Proceeding overview

California Distribution Resources Planning (DRP), CPUC Rulemaking 14-08-013

- AB 327 enacted Pub. Util. Code §769, requires IOUs to identify optimal locations for the deployment of distributed resources and potential for net benefits.
- Emphasis is on the how "optimal locations" are defined
  - » Relative to grid benefits and net ratepayer value
  - » Emphasizing aggregate value of a portfolio
  - » Ability to model impacts and value
- Distribution Resource Planning = Giving a location to DER value

Regulatory Activity

- Rulemaking instituted in August 2014
- Final Guidance issued February 2015
- Biennial process
- Parties collaborating in informal 'More Than Smart' Working Group
- IOUs issued initial Distribution Resources Plans July 1, 2015 including Locational Net Benefits Methodology
- Commission anticipated to approve initial plans March 2016
- Implement initial DRP in one Distribution Planning Area per utility in 2016

Distribution Resources Plan (DRP)

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Requirements per CA Public Utilities Code Sec. 769 – from AB 327 (2013)

Identify **optimal locations** for the deployment of Distributed Energy Resources (DERs)

DERs include distributed renewable generation, energy efficiency, energy storage, electric vehicles, and demand response

Evaluate **locational benefits and costs** of DERs based on reductions or increases in local generation capacity needs, avoided or increased investments in distribution infrastructure, safety benefits, reliability benefits, and any other savings DERs provide to the grid or costs to ratepayers

Propose or identify standard tariffs, contracts, or other mechanisms for deployment of cost-effective DERs that satisfy distribution planning objectives

Propose cost-effective methods of effectively coordinating existing commission-approved programs, incentives, and tariffs to maximize the locational benefits and minimize the incremental costs of DERs

Identify additional utility spending necessary to integrate cost-effective DERs into distribution planning

Identify barriers to the deployment of DERs, including, but not limited to, safety standards related to technology or operation of the distribution circuit in a manner that ensures reliable service

Distribution Resources Plan

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Emphasis is on the how "optimal locations" are defined

Optimal Location Benefit Analysis Requirements:

- Unified IOU Locational Net Benefits methodology
- Utilize E3's Distributed Energy Resources Avoided Cost Model (DERAC)
- But, Current DERAC model has "system level" values that need to be modified/replaced with relevant locational specific values.

#	**Minimum Value Components to include in Locational Net Benefit Methodology**
1	Avoided Sub-Transmission, Substation and Feeder Capital and Operating Expenditures
2	Avoided Distribution Voltage and Power Quality Capital and Operating Expenditures
3	Avoided Distribution Reliability and Resiliency Capital and Operating Expenditures
4	Avoided Transmission Capital and Operating Expenditures
5	Avoided Flexible Resource Adequacy (RA) Procurement
6	Avoided Renewables Integration Costs
7	Any societal avoided costs which can be clearly linked to the deployment of DERs
8	Any avoided public safety costs which can be clearly linked to the deployment of DERs

DRP Components

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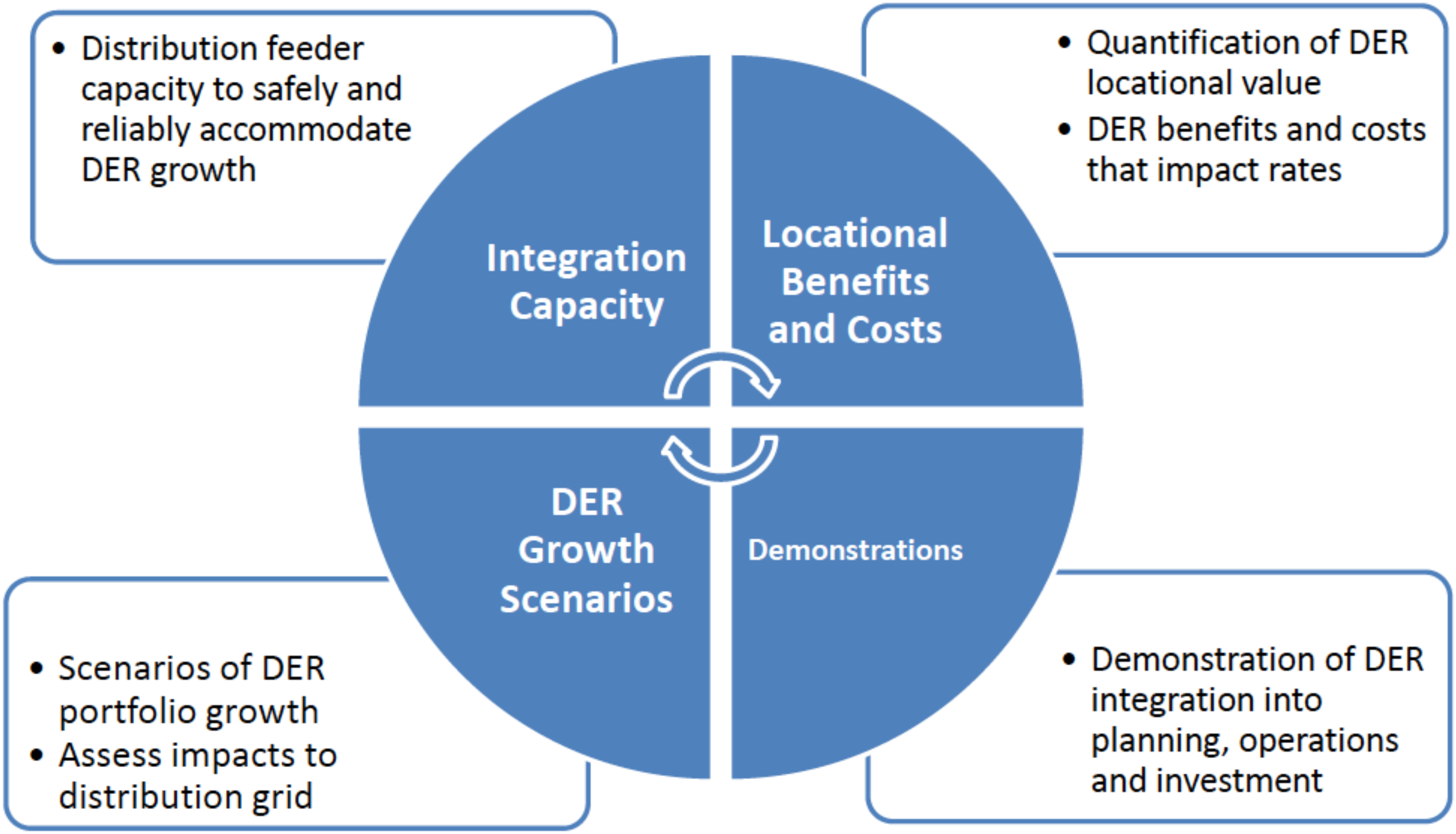

Evolution of DRP Optimal Location Benefits Analysis

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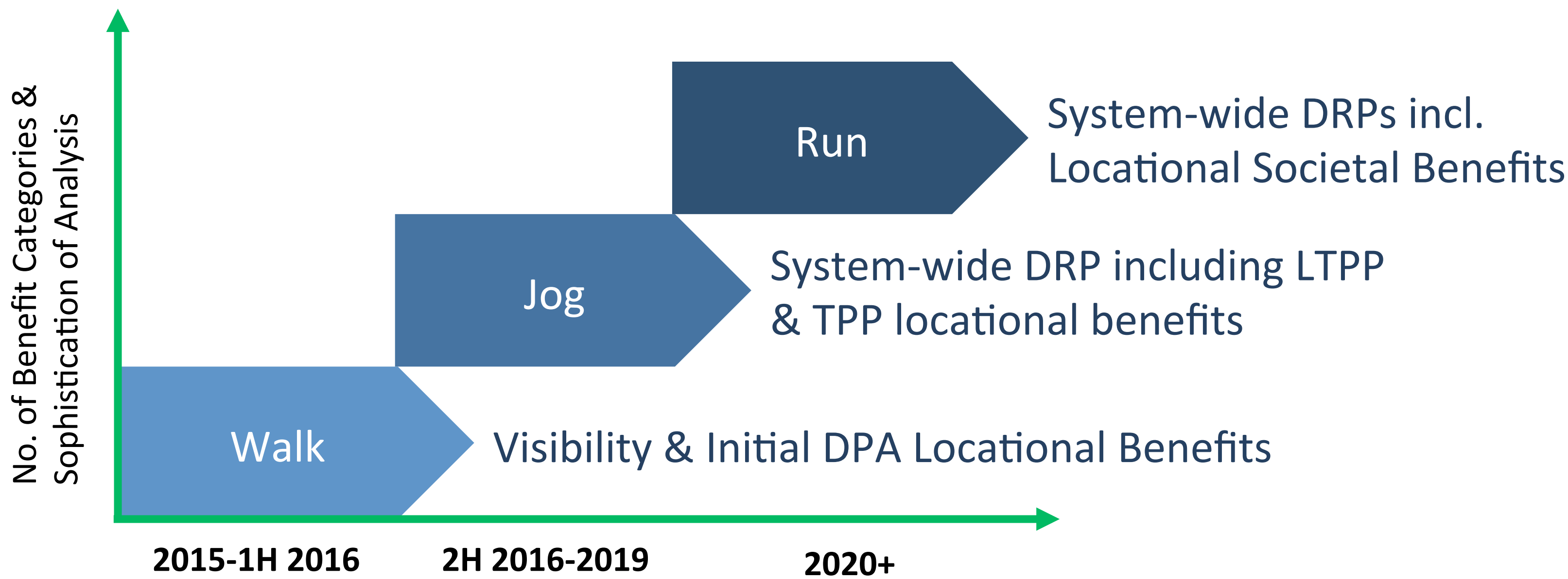
- 2016-17 Evaluate current grid capacity for DER
- 2018-19 Identify optimal locations and DER portfolios
- 2018+ Define DER procurement; 3rd party grids



Stages of DRP Optimal Location Implementation

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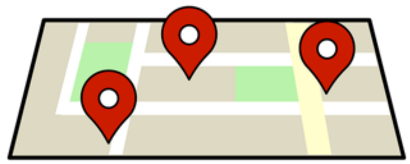
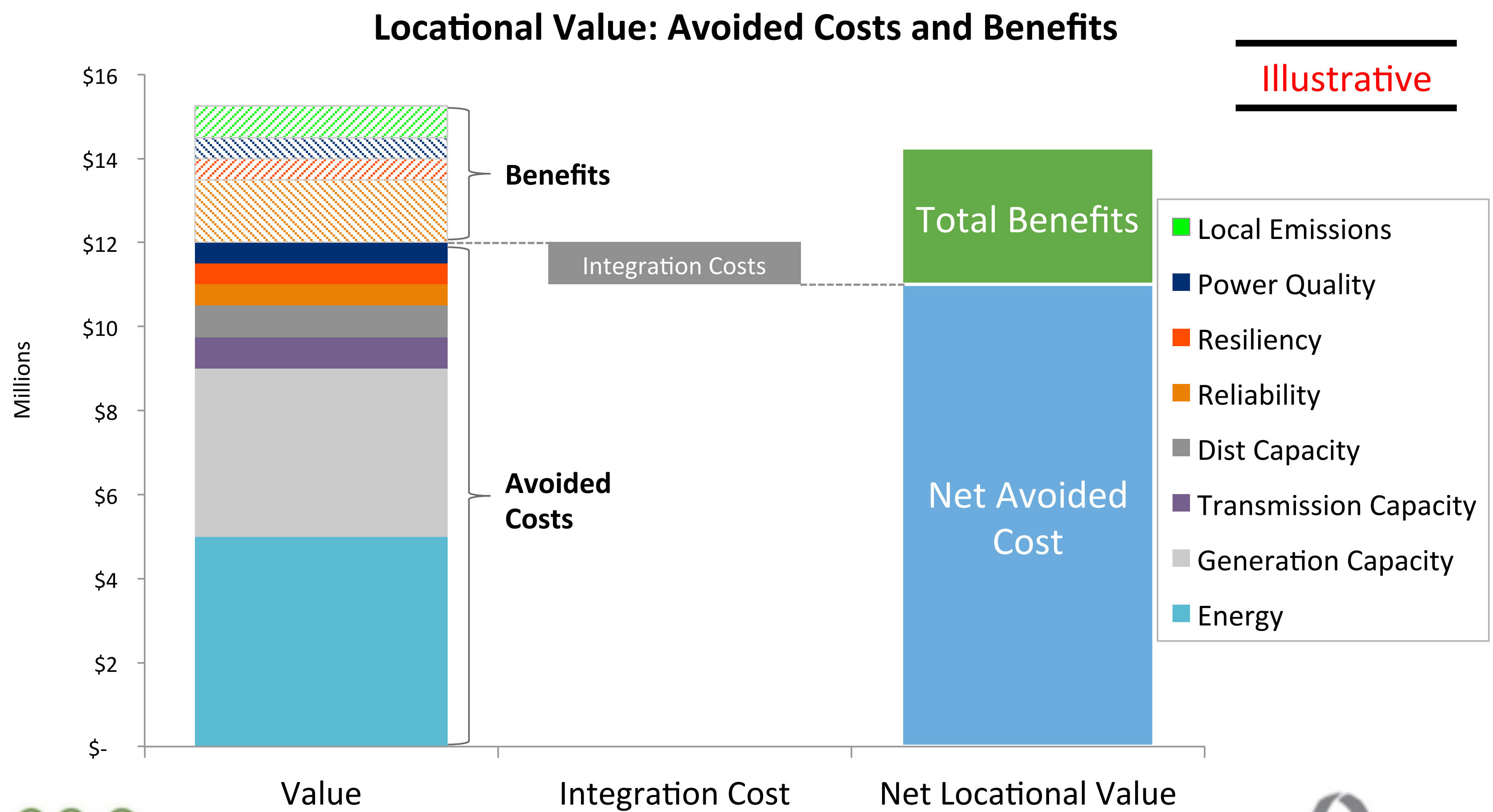


Analysis & Planning	Grid Modeling & Optimization	Distribution Resource Plan Design	Distributed Energy Resource Deployment
Full cost and value accounting for DER	Siting analysis; Power-flow modeling; DER optimization	Design and approval	Implementation; procurement and interconnection programs

Value Analysis: Avoided Costs and Benefits



Note: Analysis excludes some avoided costs/benefits that do not have a locational dimension. Therefor analysis is not intended to estimate full stack of avoided costs and benefits associated with DER

MTS DER Value Components (1 of 2)

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Objective is to define a mutually exclusive and collectively exhaustive (MECE) list irrespective of whether these could be valued or monetized today, or if the value is part of CA utility revenue requirements. Value components reflect NEM 2.0 and MTS discussion on potential DER value for Customers, Society, Bulk Power system & Distribution with a focus on locational value.

	Value Component	Definition
Wholesale	WECC Bulk Power System Benefits	Regional BPS benefits not reflected in System Energy Price or LMP
	CA System Energy Price (NEM 2.0)	Estimate of CA marginal wholesale system-wide value of energy
	Wholesale Energy	Reduced quantity of energy produced based on net load
	Resource Adequacy (NEM 2.0 modified)	Reduction in capacity required to meet Local RA and/or System RA reflecting changes in net load and/or local generation
	Flexible Capacity	Reduced need for resources for system balancing
	Wholesale Ancillary Services (NEM 2.0)	Reduced system operational requirements for electricity grid reliability including all existing and future CAISO ancillary services
	RPS Generation & Interconnection Costs (NEM 2.0)	Reduced RPS energy prices, integration costs, quantities of energy & capacity
	Transmission Capacity	Reduced need for system & local area transmission capacity
	Generation/DER Deliverability	Increased ability for generation and DER to deliver energy and other services into the wholesale market
	Transmission Congestion + Losses (NEM 2.0 modified)	Avoided locational transmission losses and congestion as determined by the difference between system marginal price and LMP nodal prices
	Wholesale Market Charges	LSE specific reduced wholesale market & transmission access charges

MTS DER Value Components (2 of 2)

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	Value Component	Definition
Distribution	Subtransmission, Substation & Feeder Capacity (NEM 2.0 modified)	Reduced need for local distribution system upgrades
	Distribution Losses (NEM 2.0)	Value of energy due to losses between wholesale transaction and distribution points of delivery
	Distribution Power Quality	Improved steady-state (generally >60 sec) voltage, voltage limit violation relief, reduced voltage variability, compensating reactive power
	Distribution Reliability + Resiliency+ Security	Reduced frequency and duration of outages & ability to withstand and recover from external natural, physical and cyber threats
	Distribution Safety	Improved public safety and reduced potential for property damage
Customer & Societal	Customer Choice	Customer & societal value from robust market for customer alternatives
	CO2 Emissions (NEM 2.0 modified)	Reductions in federal and/or state carbon dioxide emissions (CO2) based on cap-and-trade allowance revenue or cost savings or compliance costs
	Criteria Pollutants	Reduction in local emissions in specific census tracts utilizing tools like CalEnviroScreen. Reduction in health costs associated with GHG emissions
	Energy Security	Reduced risks derived from greater supply diversity
	Water Use	Synergies between DER and water management (electric-water nexus)
	Land Use	Environmental benefits & avoided property value decreases from DER deployment instead of large generation projects
	Economic Impact	State and/ or local net economic impact (e.g., jobs, investment, GDP, tax income)

NEM 2.0 values drawn from E3 identified avoided cost components in
"Overview of Public Tool to Evaluate Successor Tariff/Contract Options", Dec. 16, 2014

E3 NEM Framework vs. DRP Framework

E3 NEM 2.0 Framework	Proposed DRP Framework	Included in DRPs?	Methodology Improvement Expected
Capital costs	--	Not relevant to Locational Value Analysis	
Customer Bill Savings	--	Not relevant to Locational Value Analysis	
Utility Avoided Costs			
Generation	Energy + Congestion	Yes	Value at LMP (Pnode); include congestion
A/S	Ancillary services	Not relevant to Locational Value Analysis	
RPS	RPS	Not relevant to Locational Value Analysis	
Losses	Losses	Yes; include in Energy component	More locational granularity
CO2	CO2 Emissions	Not relevant to Locational Value Analysis	
System Capacity	System Capacity	Yes	Include local capacity values
Subtransmission Capacity	Transmission Capacity	Yes	Specific utility costs; more granularity
Distribution Capacity	Distribution Capacity	Yes	Specific utility costs; more granularity
	Power Quality – AC	Yes	Specific utility costs; more granularity
	Reliability – AC	Yes	Specific utility costs; more granularity
	Resiliency – AC	Yes	Specific utility costs; more granularity
State/Federal Incentives	--	Not relevant to Locational Value Analysis	
Integration Costs	Integration costs	Yes	Specific utility costs; more granularity
Program Costs	--	Not relevant to Locational Value Analysis	
Criteria Pollutants	Local Emissions	Yes	More granularity
Societal Cost of Carbon	--	Not relevant to Locational Value Analysis	
Energy Security	--	Not relevant to Locational Value Analysis	
RPS Benefit	--	Not relevant to Locational Value Analysis	
RPS Externalities	--	Not relevant to Locational Value Analysis	
Market Price Effect	--	Not relevant to Locational Value Analysis	
Water Usage Benefits	--	Not relevant to Locational Value Analysis	
Other	Power Quality – Benefits	Yes	Introduce methodology
	Reliability – Benefits	Yes	Introduce me
	Resiliency – Benefits	Yes	Introduce me

Regulatory Interactions

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Distribution Resources Plans require coordination with ISO transmission planning schedules and Energy Commission forecasts.

The DRP also overlap with many other proceedings within the CPUC. A partial list:

- Long Term Procurement Planning(R.13-12-010)
- Resource Adequacy (R.14-10-010)
- Joint Reliability Planning (R.14-02-001)
- Rule 21 Interconnection (R.11-09-011)
- Renewable Portfolio Standard (R.11-05-005)
- Alternative Fueled Vehicles (R.13-11-007)
- Demand Response (R.13-09-011)
- Distributed Generation (R.12-11-005)
- Energy Efficiency (R.13-11-005)
- Energy Storage/Storage Roadmap (R.10-12-007)
- Integrated Demand-Side Management (R.14-10-003)
- Net Energy Metering Successor Tariff (R.14-07-002)
- Smart Grid (R.08-12-009)
- Residential Rate Reform (R.12-06-013)

Hunters Point Reasonable DG Potential = 58 MW, Over 25% Total Energy

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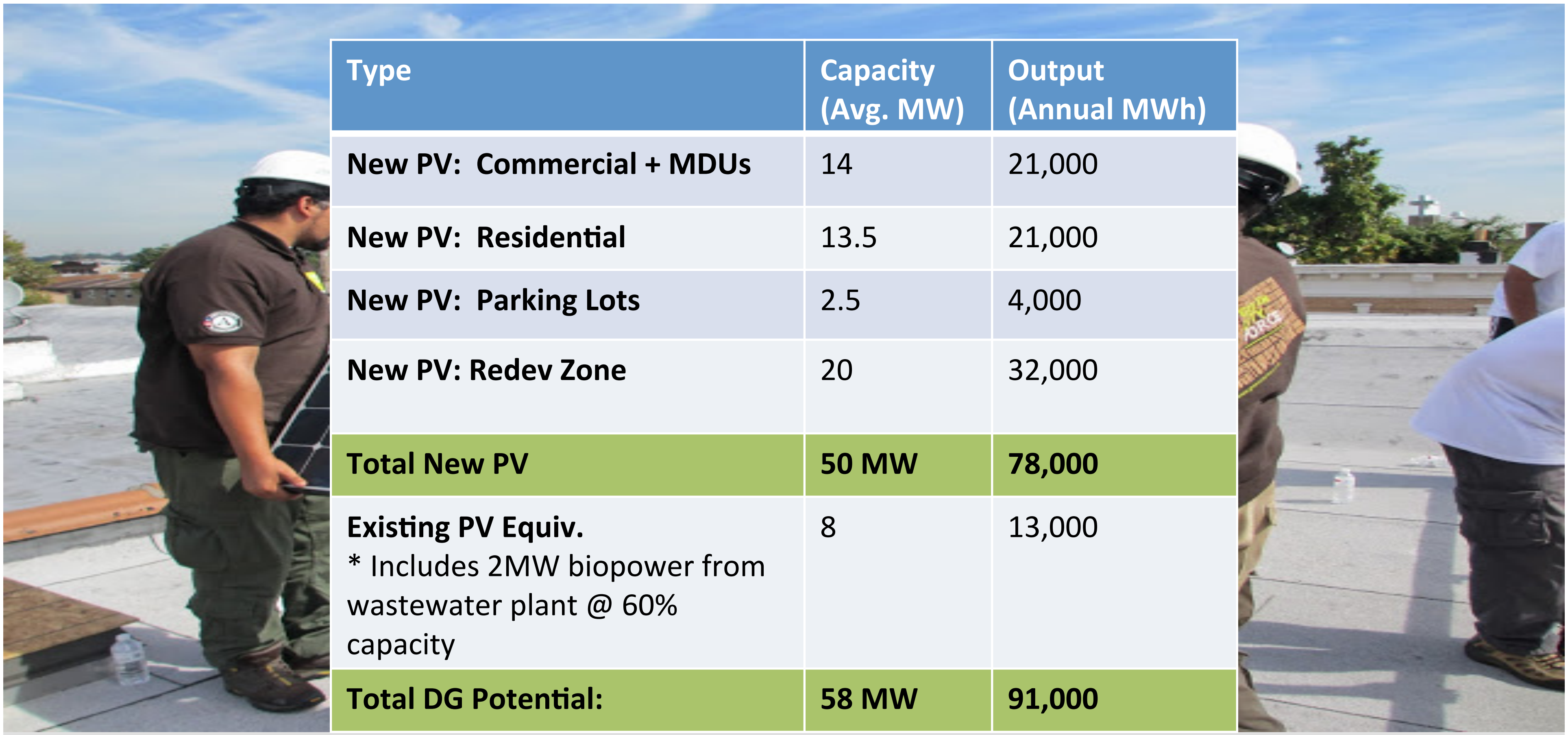
DG Potential: **Over 25% of Total Load (320,000 MWh)**

- **New PV in Bayview** = 30 MW, or 46,000 MWh
- **New PV in HP Redev Zone** = 20 MW, or 32,000 MWh
- **Existing DG** = 8 MW (PV equivalent), or 13,000 MWh



Type	Capacity (Avg. MW)	Output (Annual MWh)
New PV: Commercial + MDUs	14	21,000
New PV: Residential	13.5	21,000
New PV: Parking Lots	2.5	4,000
New PV: Redev Zone	20	32,000
Total New PV	**50 MW**	**78,000**
Existing PV Equiv. * Includes 2MW biopower from wastewater plant @ 60% capacity	8	13,000
Total DG Potential:	**58 MW**	**91,000**

Hunters Point Solar LCOE is less than CCNG

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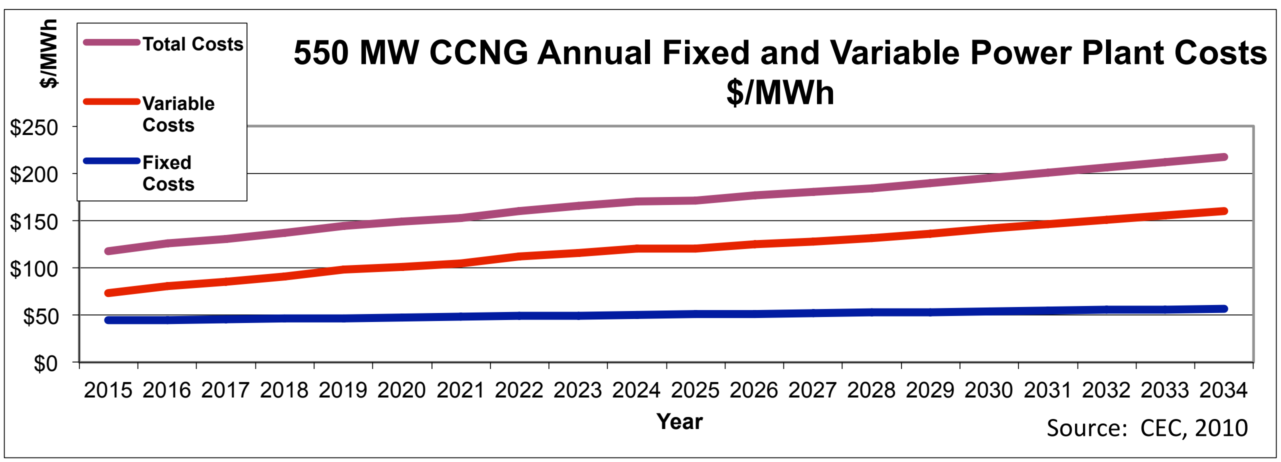
500 kW Solar achieves lower LCOE than new natural gas generation – Hunters Point average expected commercial size = 650 kW

SOLAR

System size (example only)	Installed cost $/W(ac)	Initial output kWh(ac)/kW(ac)-yr	20 year fixed PPA price	LCOE
1 MW ground	$3.50/W	2,305	15.35¢/kWh	13.00¢/kWh
1 MW roof	$2.85/W	1,823	16.36¢/kWh	13.86¢/kWh
500 kW roof	**$3.15/W**	1,823	**17.65**¢/kWh	**14.95¢/kWh**
100 kW roof	$3.50 /W	1,823	19.03¢/kWh	16.12¢/kWh
50 kW roof	$3.75/W	1,823	20.38¢/kWh	17.26¢/kWh
5 kW roof	$4.60/W	1,823	24.37¢/kWh	20.64¢/kWh

NATURAL GAS



Busbar wholesale cost from plant
2015: $11.7 ¢/kWh
2024: $17.1 ¢/kWh
2034: $21.7 ¢/kWh

LCEO: $15.4 ¢/kWh

Hunters Point DG Benefits: 50 MW New PV = 25% Total Energy

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50 MW Total = Existing Structures @ 30 MW + Redev Zone @ 20 MW

Example: 180 Napolean St.
- PV Sq. Ft = 47,600
- System size = 714 kW

Commercial: 18 MW

Example: 1485 Bay Shore
- PV Sq. Ft = 37,800
- System size = 567 kW

Parking Lots: 2 MW

Example: 50 avg. rooftops
- Avg. PV Sq. Ft = 343
- Avg. system size = 5 kW

Residential & MDU: 10 MW

Benefits from 50 MW New PV Over 20 Years

Energy

Cost Parity: Solar vs. NG, LCOE
$260M: Spent locally vs. remote
$80M: Avoided transmission costs
$30M: Avoided power interruptions

Economic

$200M: New regional impact
$100M: Added local wages
1,700 Job-Years: New near-term and ongoing employment
$10M: Site leasing income

Environmental

78M lbs.: Annual reductions in GHG emissions
15M Gallons: Annual water savings
375: Acres of land preserved

Wholesale DG is the missing segment

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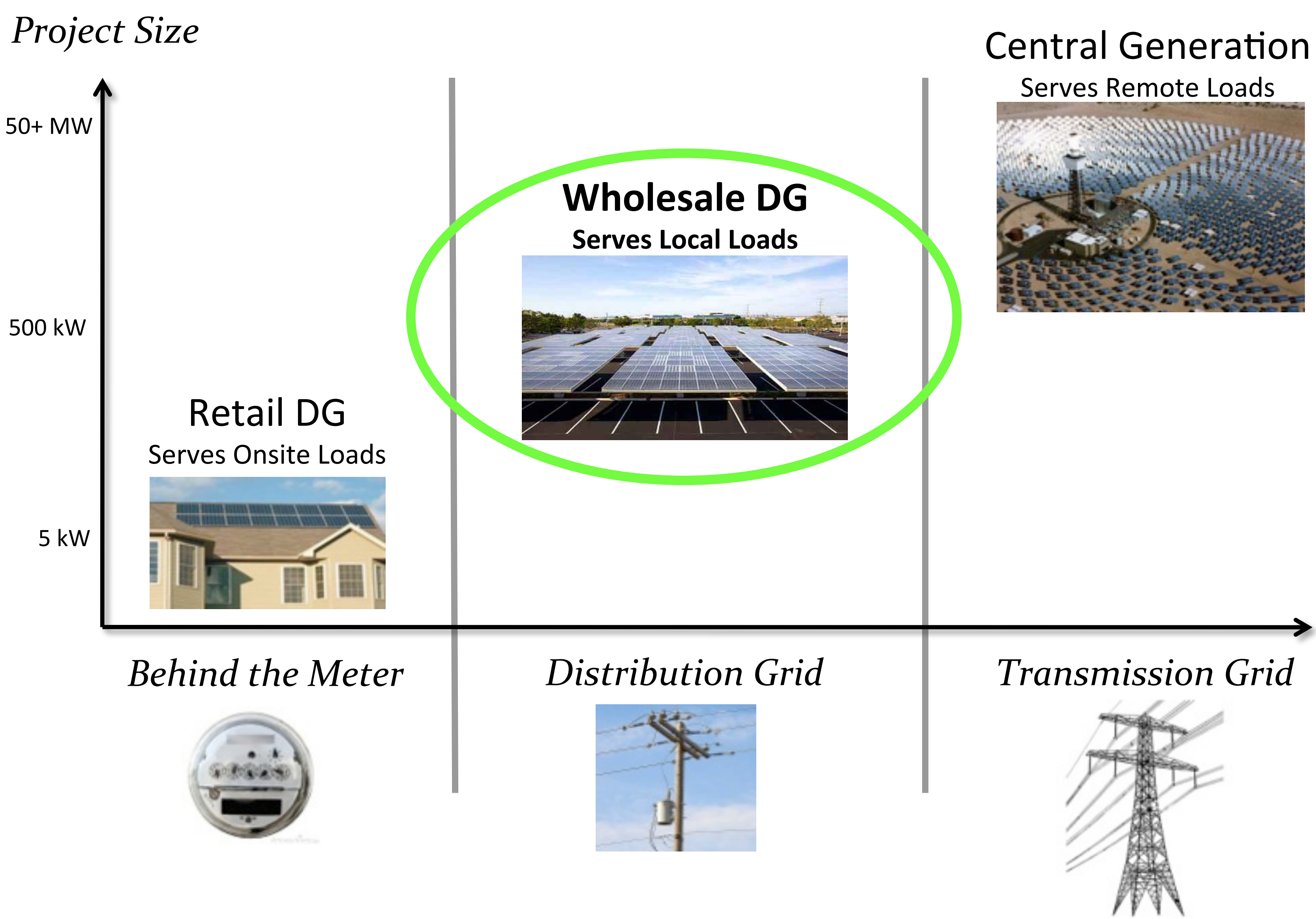

Preferred Distributed Generation Siting Value

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SCE Share of 12,000 MW Goal

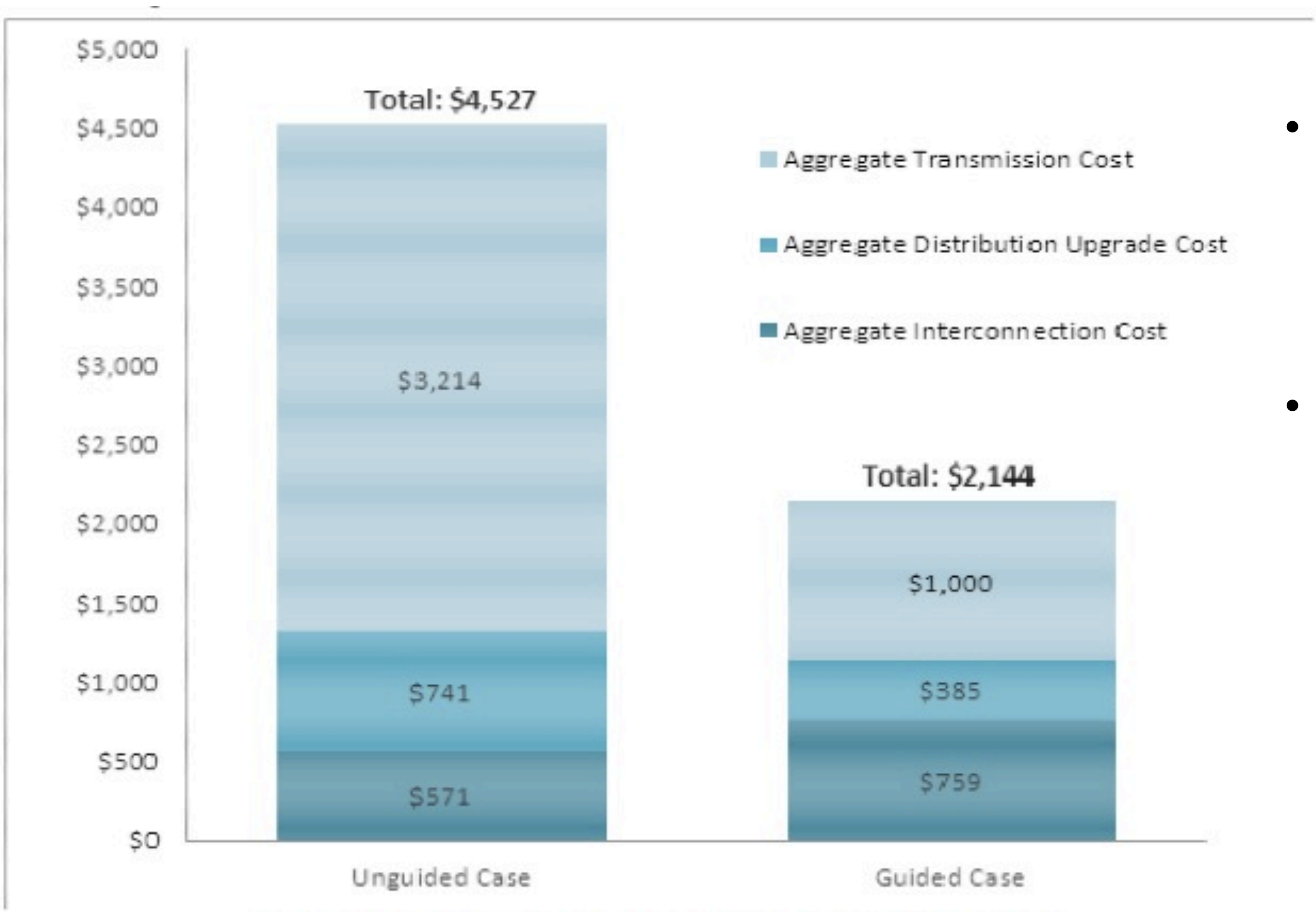

Figure 8: Total SCE System Costs of LER Proposal (Million USD)

Guided Siting Saves Ratepayers 50%

- **Locational value** methodology should include transmission costs.
- **Interconnection** policies should favor high value locations, and reduce cost uncertainty for developers.

Source: SCE Report May 2012

Shift transmission investments to distribution

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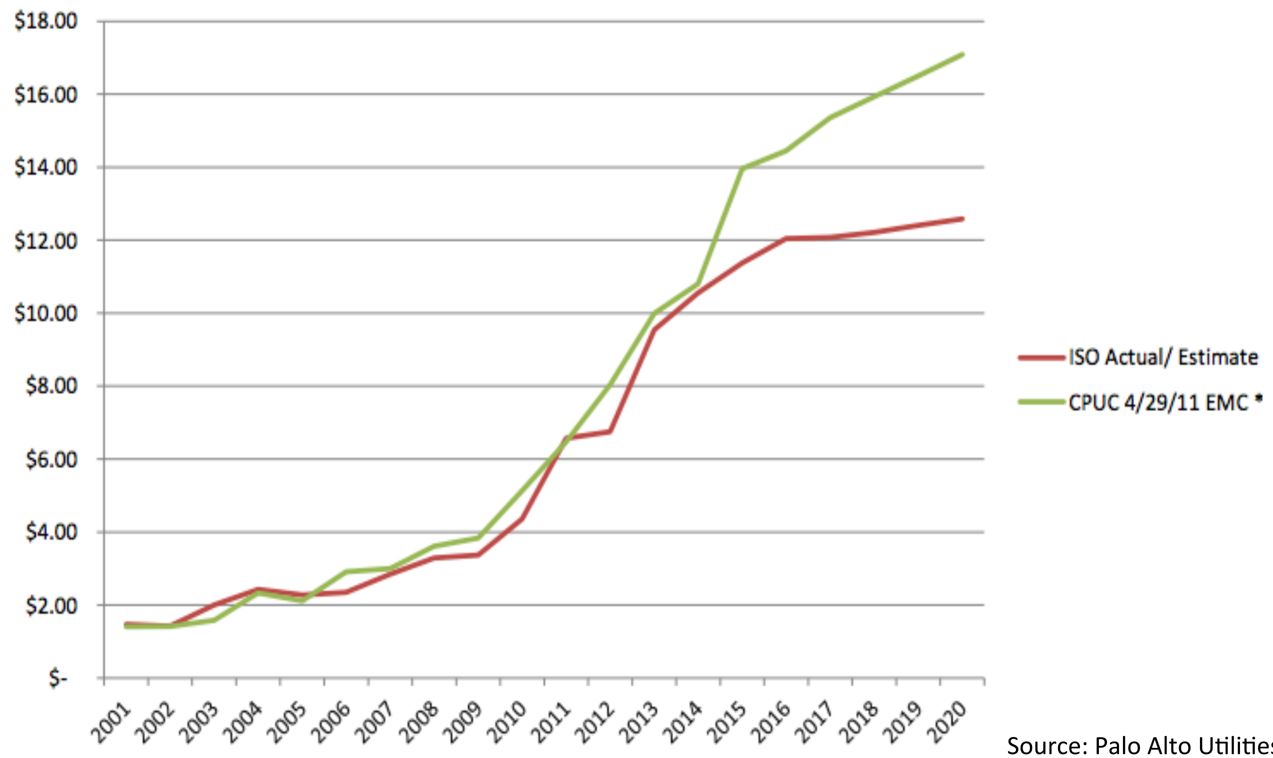
- Under a business as usual scenario, new incremental transmission investments will reach **$80 billion** over the next 20 years, imposed on California ratepayers
- Levelized over 20 years, this approaches **3 cents/kWh** – or roughly 25% of the wholesale cost of electricity, or 33% of the energy price of centralized solar
- Avoiding half of these charges, for example, would **free up roughly $40 billion** for modernizing the distribution grid, including local renewables, storage, etc.

Historical and Projected High Voltage Transmission Access Charges ($/MWh).

Does not include Low Voltage Transmission Access Charges.



Source: Palo Alto Utilities

Introduction to TAC

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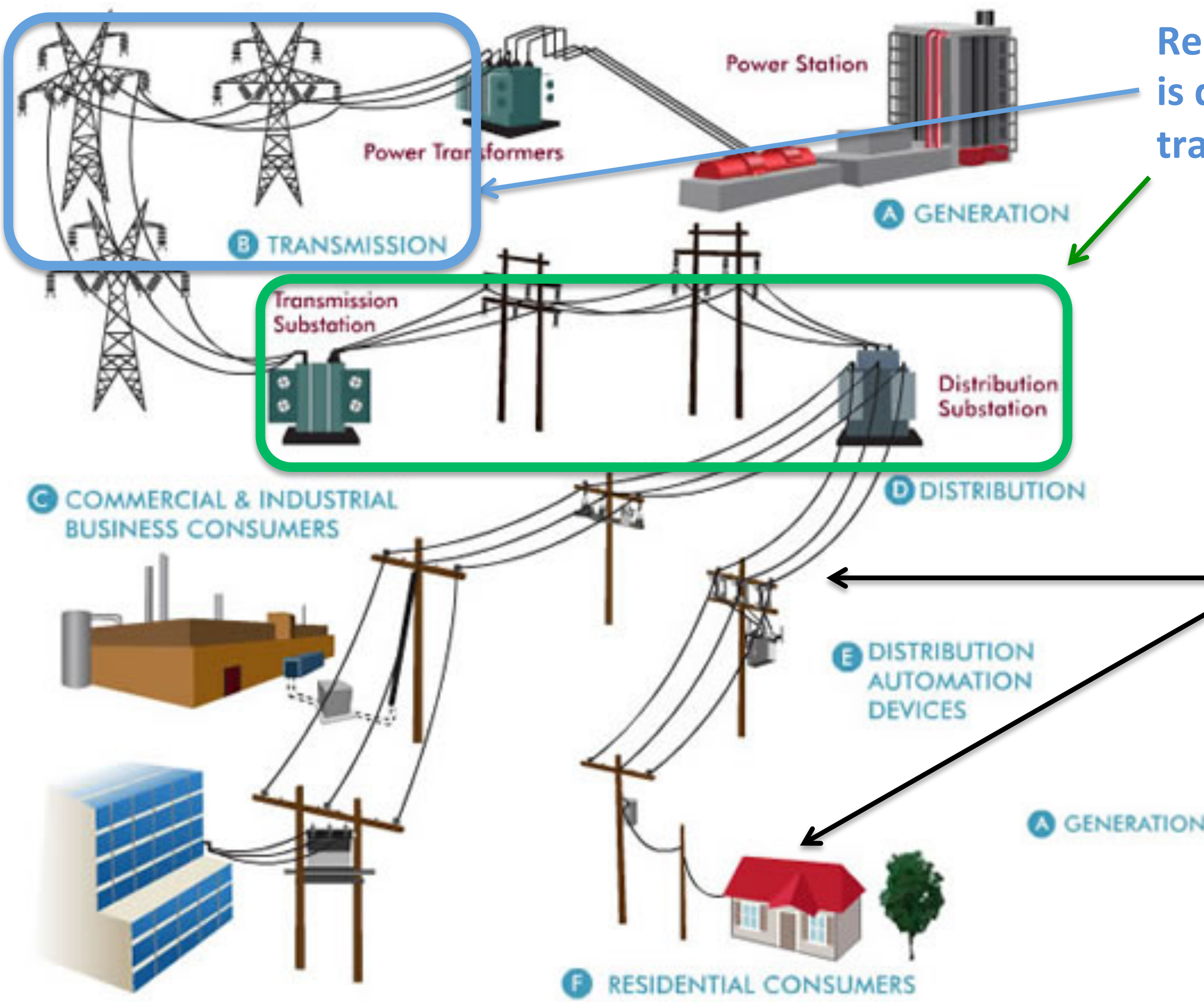

Remote generation is delivered via transmission

Distributed generation connects close to loads

TAC Should Be Based on Cost Causation

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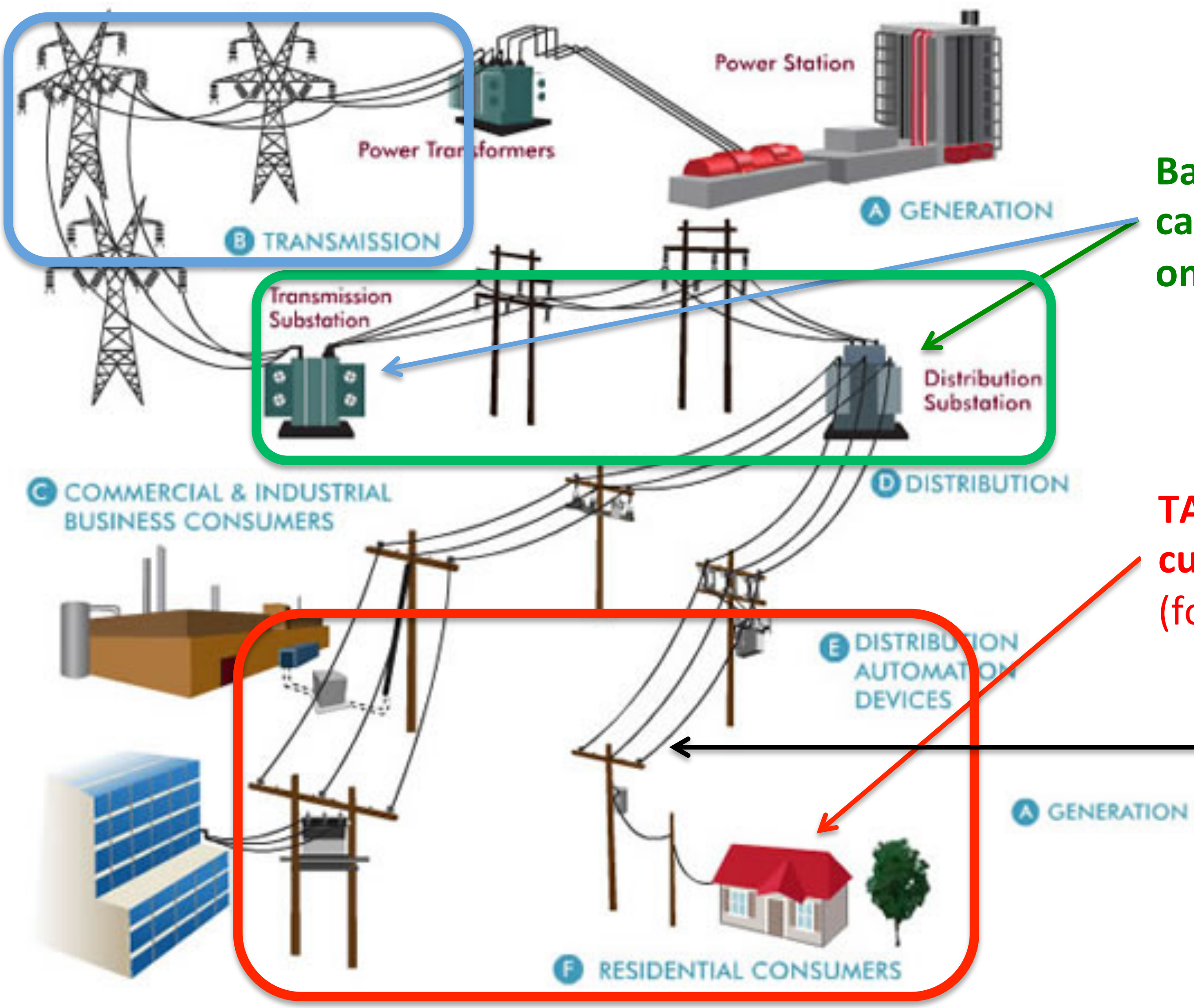

Based on cost causation, assess TAC on transmission load

TAC now assessed on customer load
(for PTO utilities)

Distributed generation connects here

TAC Market Distortion is Significant Issue

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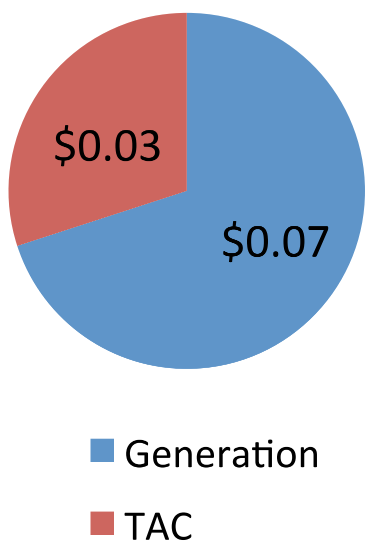
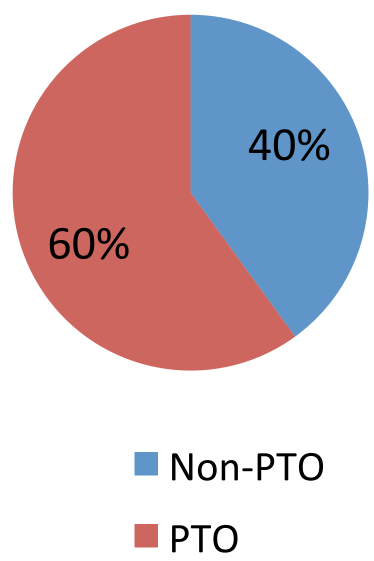
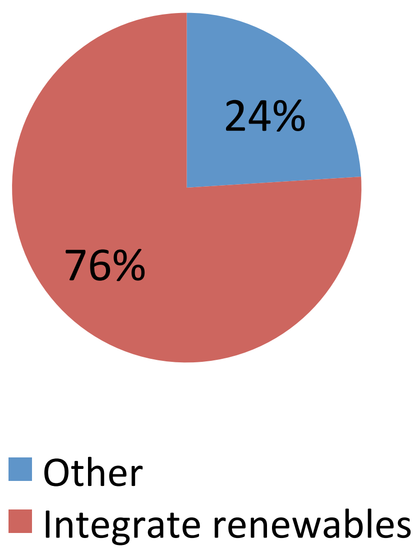
TAC a Third Of WDG Price ($/kWh)



Most CA Electricity Customers Face Market Distortion



Most Transmission Spend Through 2023 for Renewables



TAC Market Distortion Threatens $80 Billion Benefit

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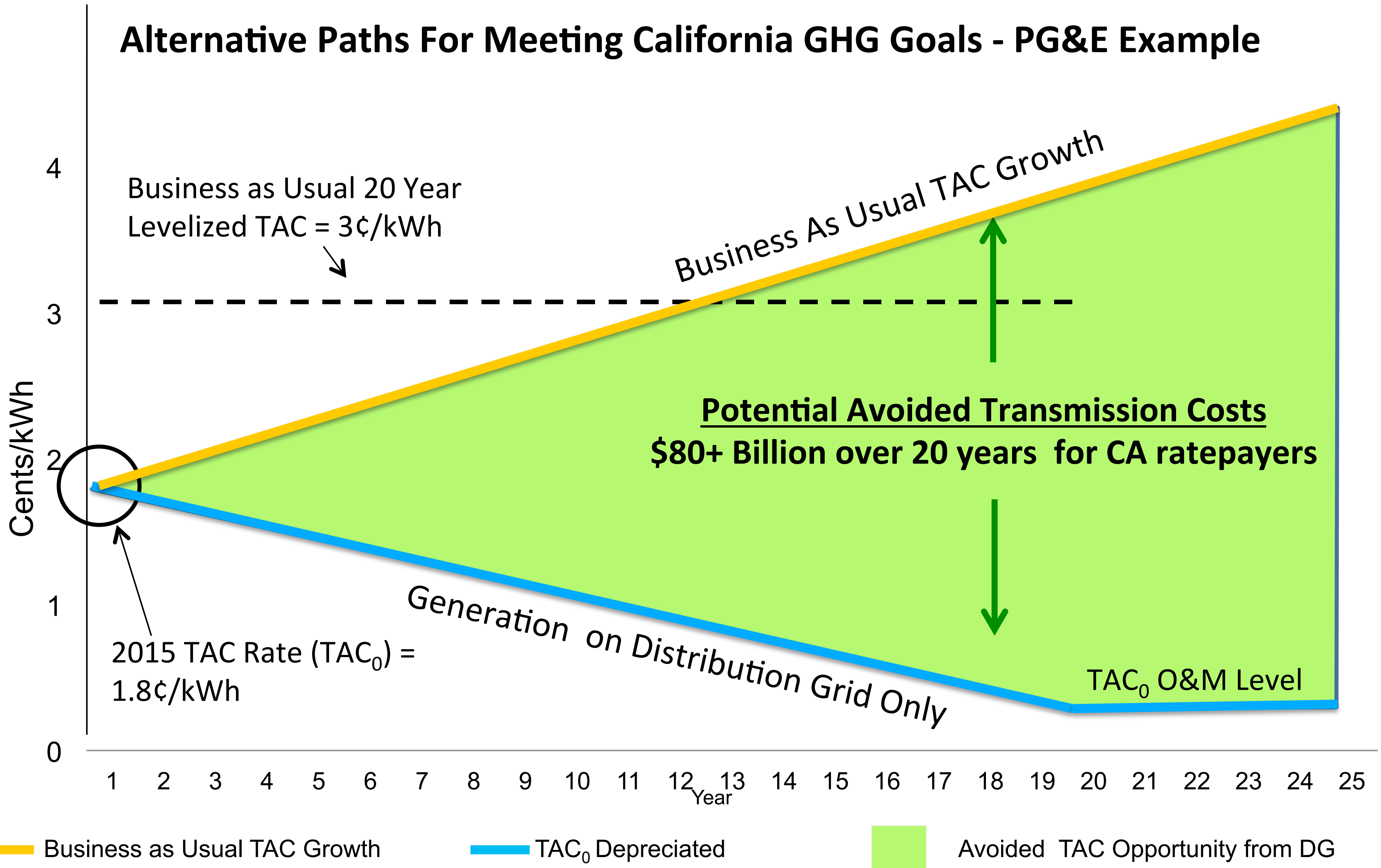

WDG: TAC Double-Charges for Grid Usage

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