Clean Coalition

Making Clean Local Energy Accessible Now

Transmission Access Charges (TAC) Structure

Use Transmission Energy Downflow (TED) as the TAC Billing Determinant

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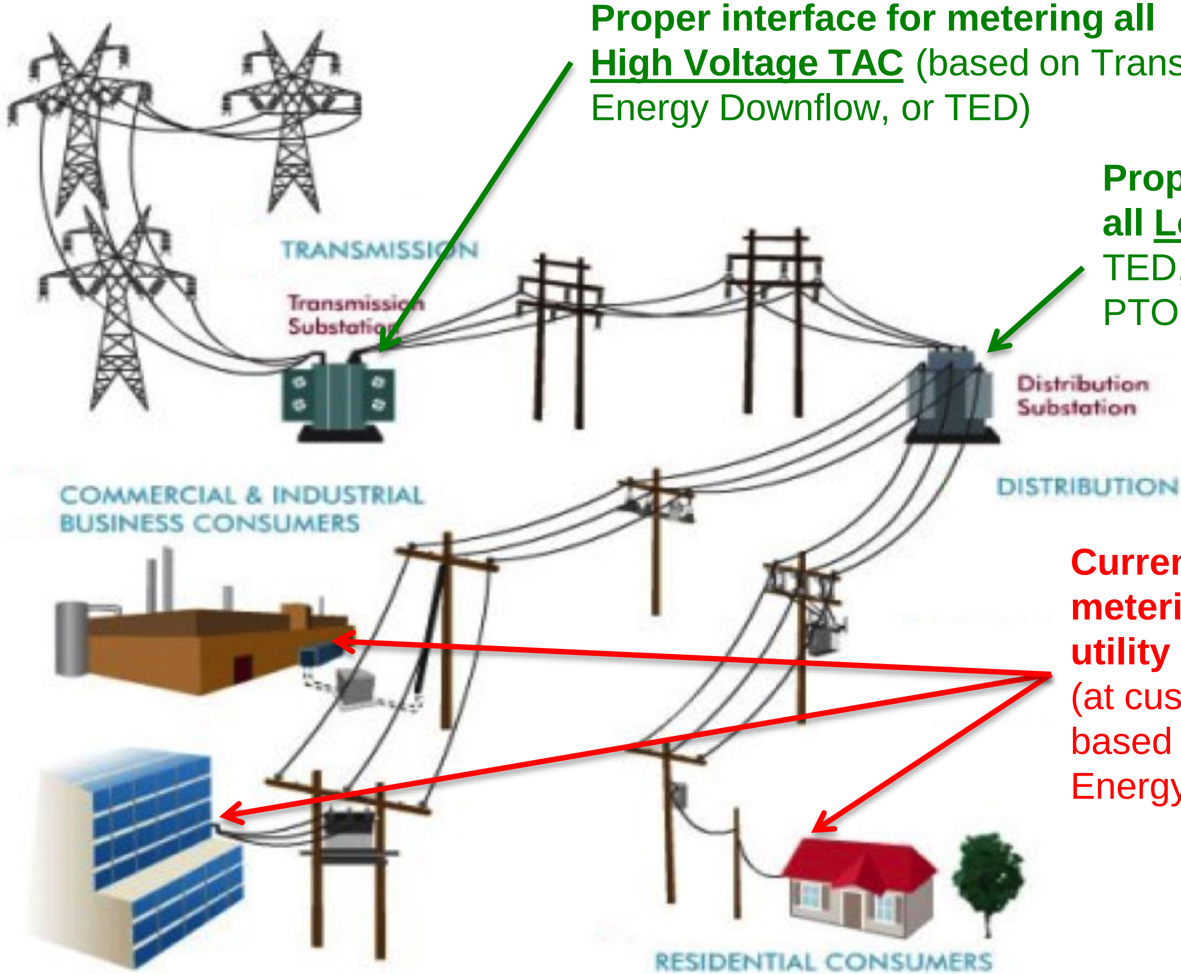
Use Transmission Energy Downflow (TED) as the TAC Billing Determinant

Clean Coalition Proposal: measure transmission usage at the TED

Measure usage at the Transmission Energy Downflow (TED), regardless of underlying TAC structure

Proper interface for metering all <u>High Voltage TAC</u> (based on Transmission Energy Downflow, or TED)

Proper interface for metering all <u>Low Voltage TAC</u> (based on TED, as is already done in non-PTO utility service territories)



Current interface for metering TAC in PTO utility service territories (at customer meters based on Customer Energy Downflow)

Key TAC definitions

- **Transmission Access Charges (TAC)**
  - **Volumetric fees** for using the CAISO-controlled transmission grid
  - Low Voltage (LV) and High Voltage (HV) TAC
- **Transmission Energy Downflow (TED)**
  - **Metered energy flow** from higher to lower voltages **across defined transmission interfaces**
    - Two points: HV-to-LV substations (HV TED) and LV-to-Distribution substations (LV TED)
  - Correct TAC metering basis
- **Customer Energy Downflow (CED)**
  - **Metered energy flow** measured across customer meters (a.k.a. end-use customer metered load)
  - Incorrect TAC metering basis
- **Participating Transmission Owner (PTO)**
  - Entity that **owns part** of the CAISO-controlled transmission grid
  - **TAC correction needed** in PTO utility service territories
  - Non-PTO utilities already use TED

Key TAC definitions

- **Distributed Generation (DG) Output**
  - **Energy** produced and consumed **on the distribution grid**
  - Includes energy produced by wholesale distributed generation and distributed energy resources (DER) as well as net energy metering (NEM) exports

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Use TED as the TAC billing determinant

1. **PROBLEM**: CED TAC basis
   a. distorts cost allocation
   b. distorts the market
   c. costs ratepayers money
2. **PRINCIPLES**
   a. More accurate measurement of transmission usage
   b. Cost allocation principles support it
3. **IMPACTS**
   a. Reduces market distortion on Distributed Energy Resources (DER)
   b. Reduces all 4 drivers of transmission investment
   c. Results major ratepayer savings in avoided transmission investment
4. **CONCLUSION**

1. Problem: Where to measure transmission usage

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The Problem:

Customer Energy Downflow (CED) basis

a. distorts the TAC cost allocation
b. distorts energy markets
c. costs ratepayers money.

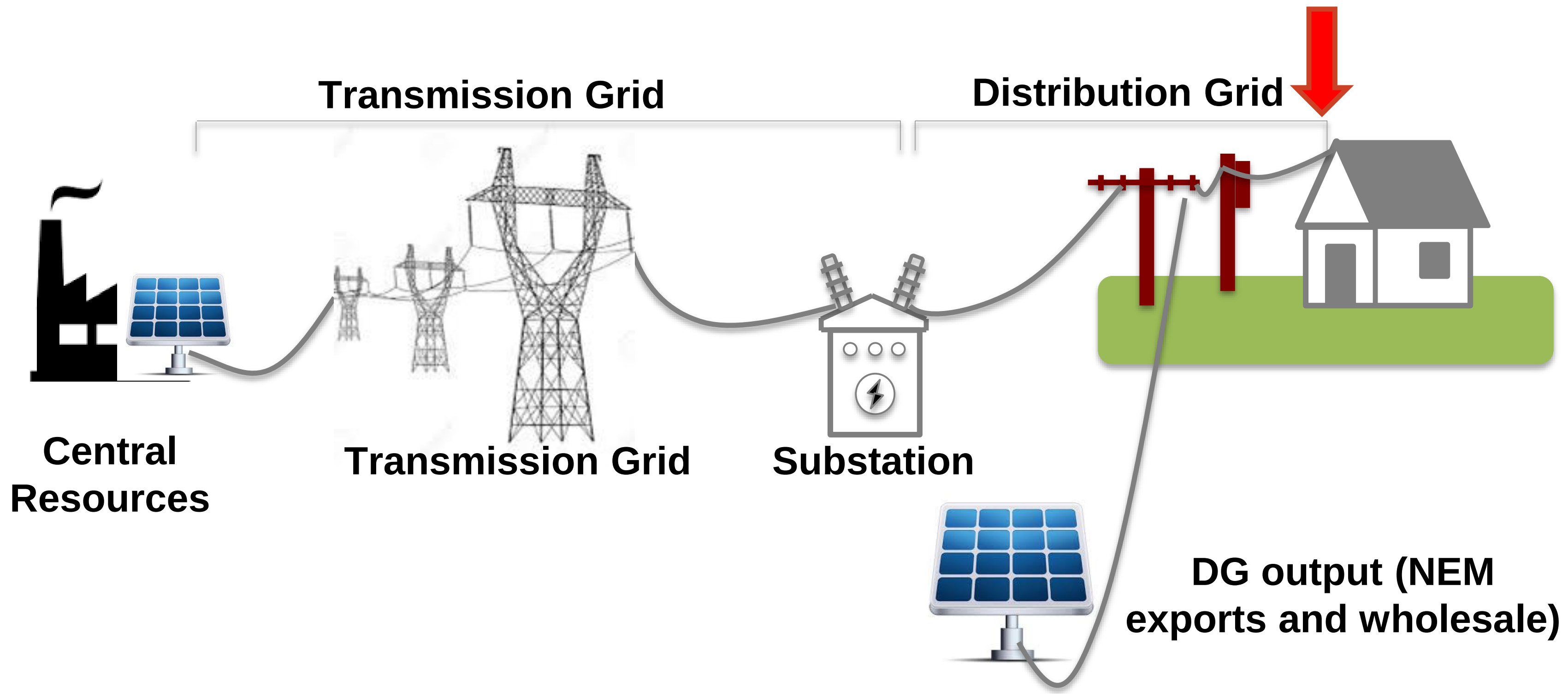
1. Problem: Where to measure transmission usage

This initiative addresses it through two questions.

- ***Where* to measure transmission usage**
  Customer energy downflow or transmission energy downflow (TED)

- ***How* to calculate transmission charges**
  Volumetric? Demand Charges? Flat fee?

1a. TED is a more accurate measure of transmission usage



Problem with CED: DG output is subject to transmission fees and does not travel via transmission lines (except backfeeding).

This disadvantages DER in procurement decisions and subsidizes remote generation.

1a. TED is a more accurate measure of transmission usage

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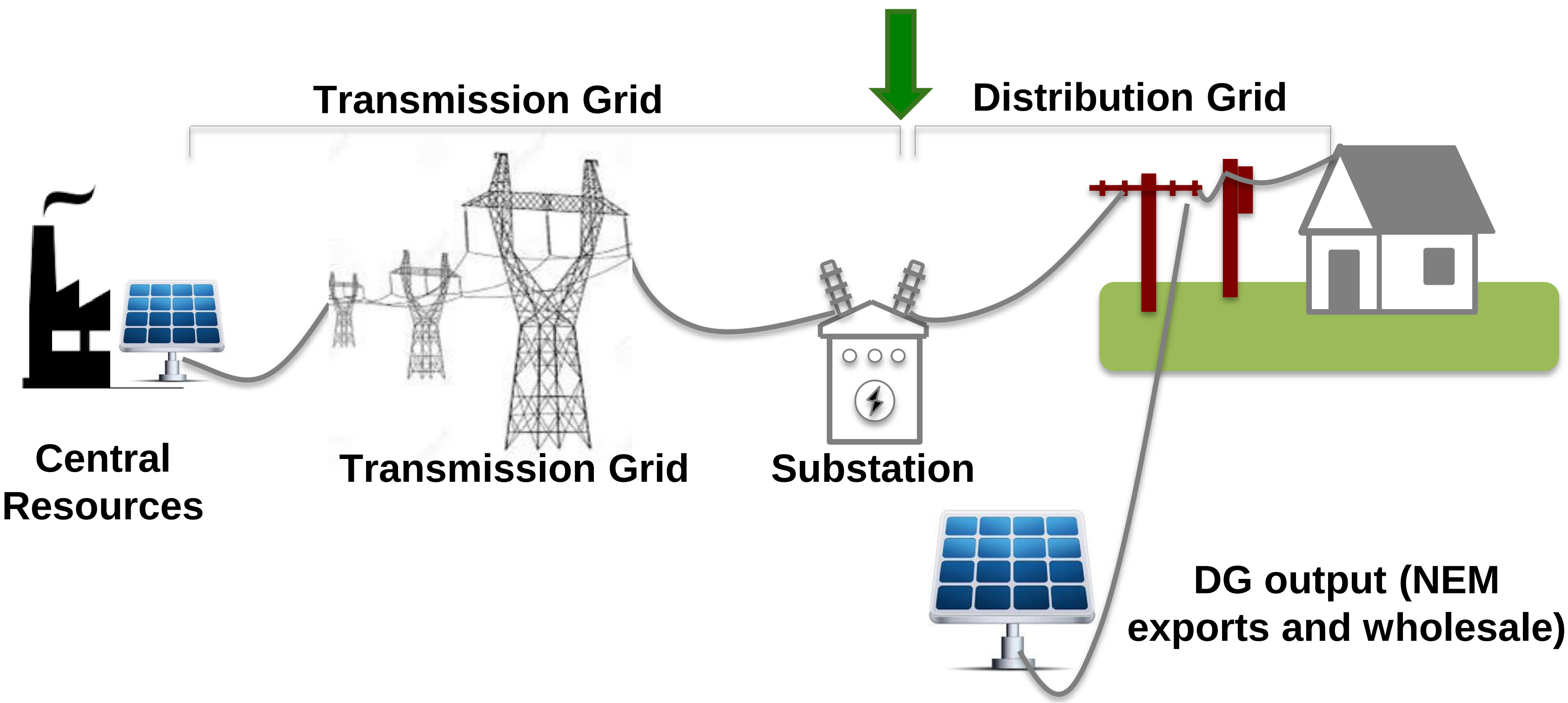
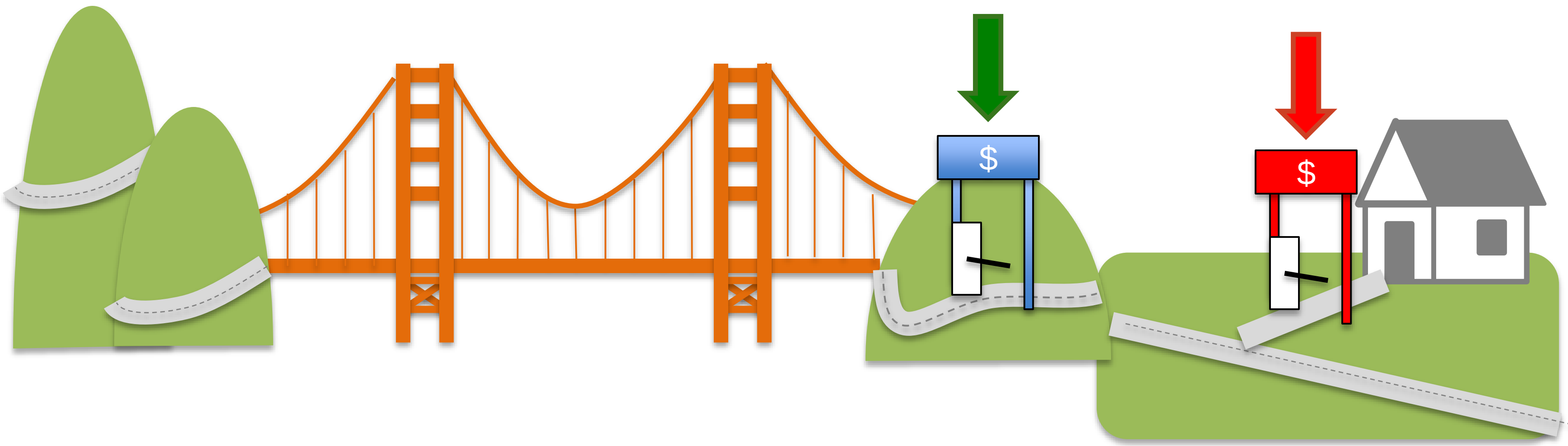


Problem with CED: DG output is subject to transmission fees and does not travel via transmission lines (except backfeeding).

This disadvantages DER in procurement decisions and subsidizes remote generation.

1a. TED is a more accurate measure of transmission usage – Analogy of the Golden Gate Bridge Toll



Assessing transmission fees on all metered electricity is like paying the Golden Gate Bridge toll every time you pull into your driveway, rather than paying the toll when you cross the bridge.

This system would distort the true cost of the bridge and driving in general by disconnecting use of the bridge from paying the toll. Similarly, the misalignment of transmission fees distort the true cost of transmission and distributed generation.

1b. CED methodology distorts the energy market

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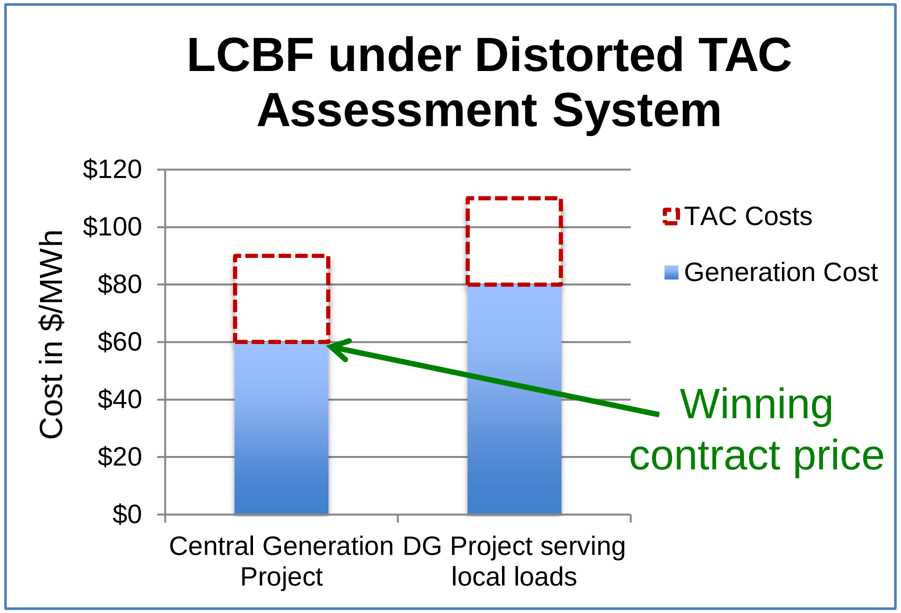

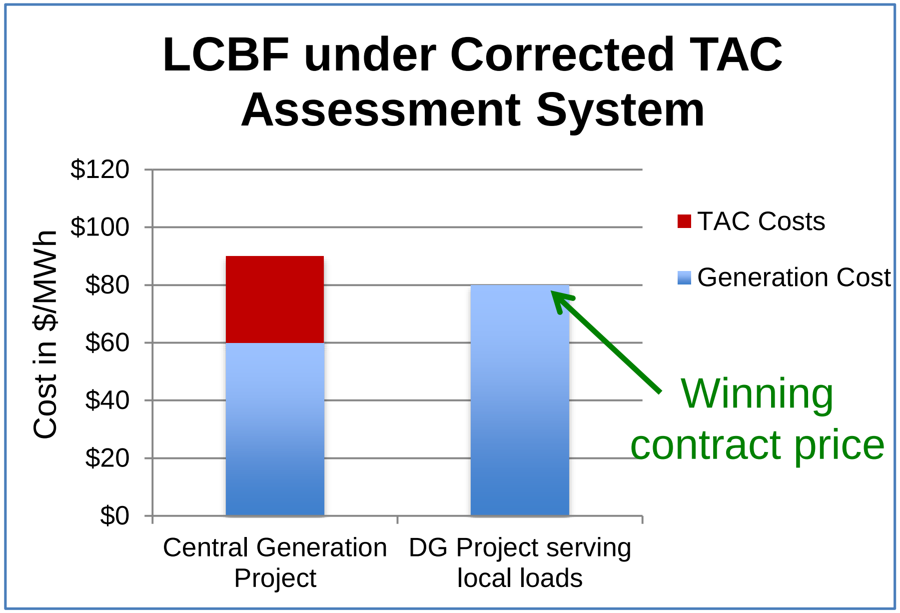

- Current TAC assessment artificially increases the cost of DER.
- Fixing the TAC market distortion reflects the true delivery.
- Over time, more distributed generation will be built, decreasing transmission investments and overall system costs

1c. Result in avoided transmission investment and major ratepayer savings

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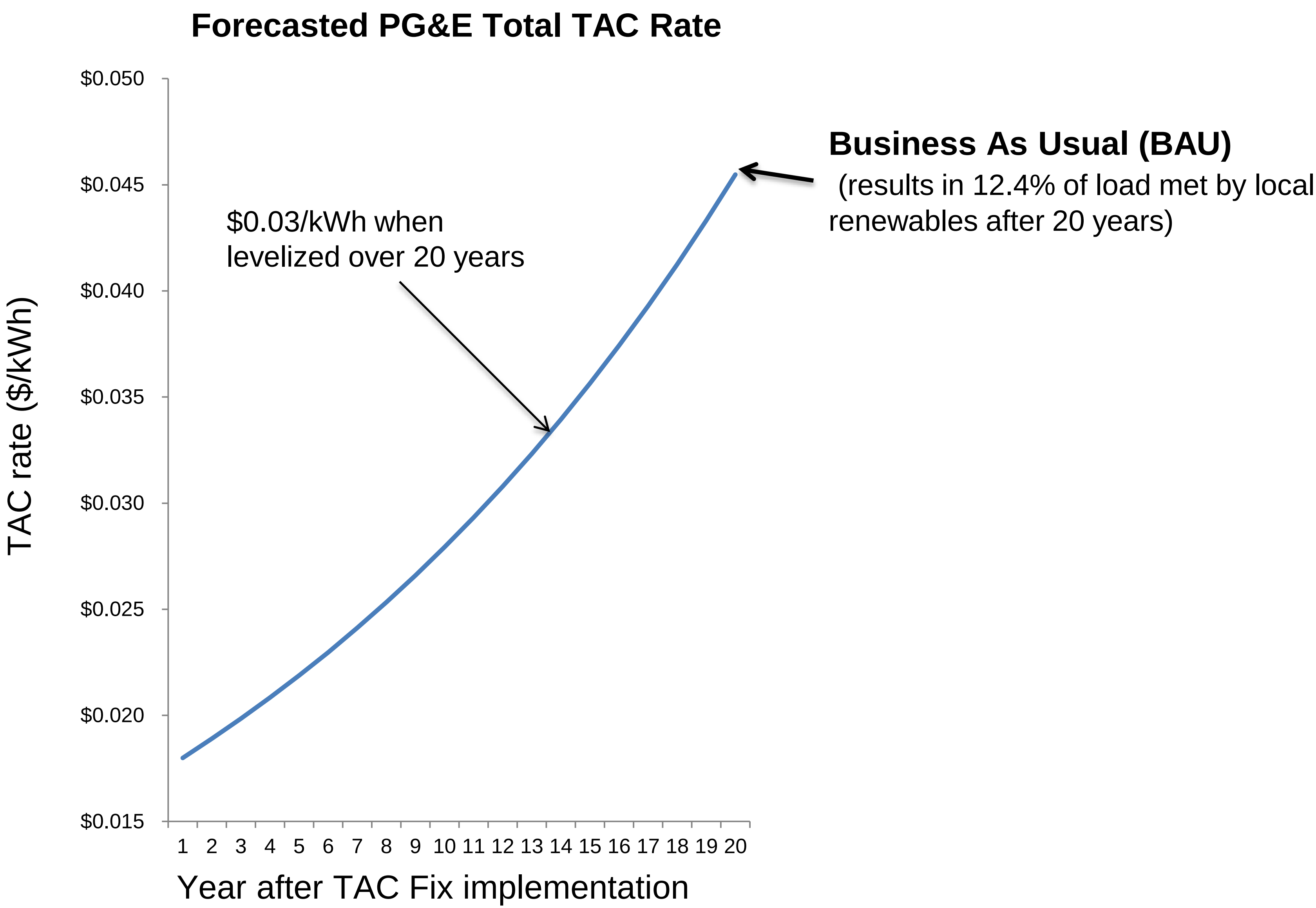
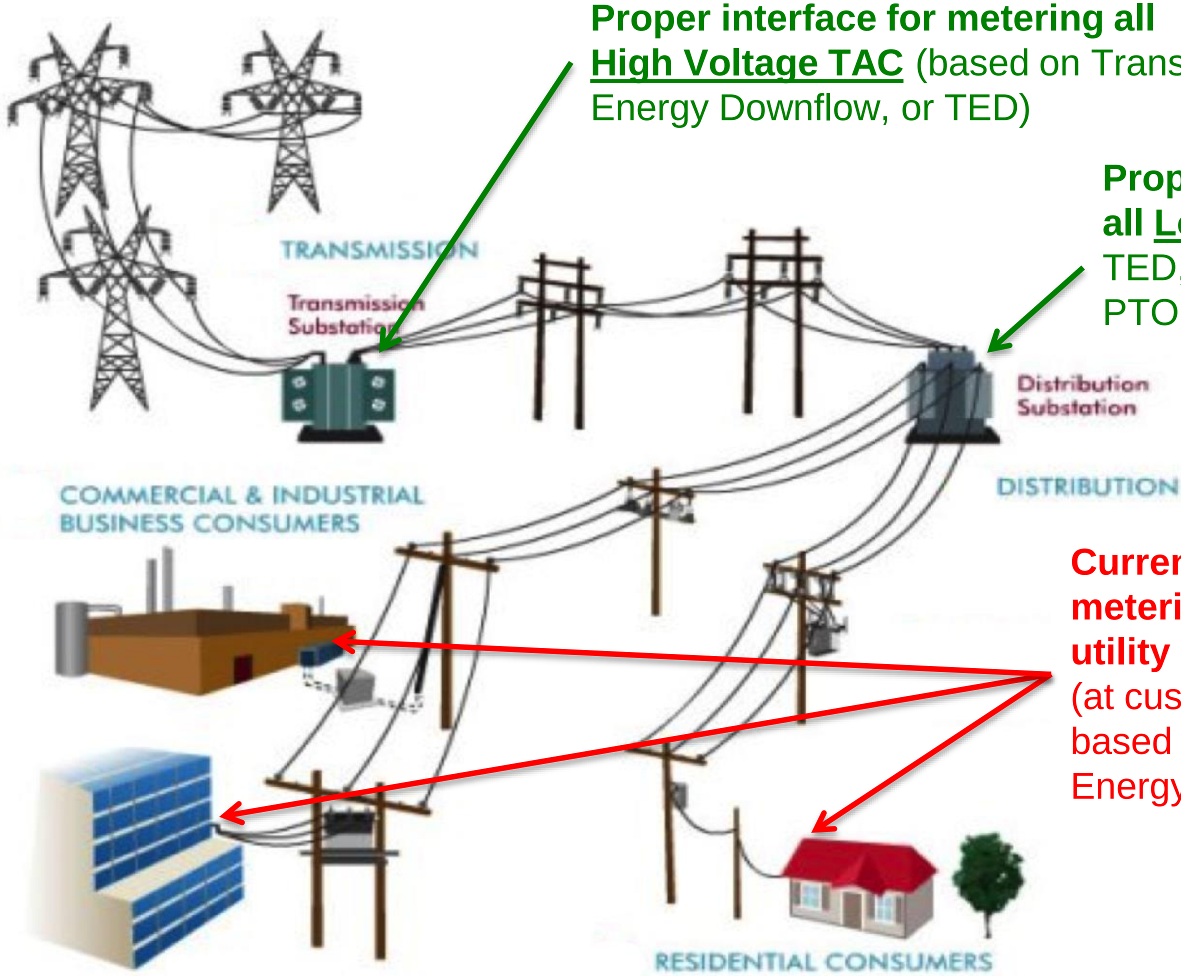


2. Clean Coalition Proposal: measure transmission usage at the TED

Clean Coalition

Measure usage at the Transmission Energy Downflow (TED), regardless of underlying TAC structure.



Proper interface for metering all <u>High Voltage TAC</u> (based on Transmission Energy Downflow, or TED)

Proper interface for metering all <u>Low Voltage TAC</u> (based on TED, as is already done in non-PTO utility service territories)

Current interface for metering TAC in PTO utility service territories (at customer meters based on Customer Energy Downflow)

2. Clean Coalition Proposal: Change where usage is measured to TED

$$\text{HV TAC Rate} = \frac{\text{Annual HV Transmission Revenue Requirement (costs associated with facilities operating >200kV)}}{\text{HV TED}}$$

2. Clean Coalition Proposal: Change where usage is measured to TED

Advantages of the TED:

- Consistent, unbiased, and technology-neutral
- More accurate measurement of HV transmission usage
- Cost allocation principles support it
- Better reflects DER contributions to reducing future transmission investments
- Reduces distortion on market for DG output and DER
- Results in significant ratepayer savings

2a. TED is a more accurate measure of transmission usage – Allocating TAC liability between LSEs

Allocate TAC liability according to each LSE’s proportional share of TED

*LSE TAC liability = TAC rate * LSE share of TED*

LSE share of TED = LSE CED – (LSE LV and DG output)

This can be done as long as the UDC knows the **HV TAC rate** and each **LSE’s DG output**.

2a. TED is a more accurate measure of transmission usage

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The current TAC methodology results in inconsistency between customers.

→ **Non-PTO utilities** pay TAC based on TED

- Customers benefit from avoided transmission charges
- See better market conditions for DG and other DER

→ **PTO utilities** pay TAC based on CED

- Customers are disadvantaged by a PTO utility’s conflicting interests in additional transmission investment and cost-effective energy
- All customers are disadvantaged by unnecessary transmission investments

2c. TED is a consistent measurement of transmission usage

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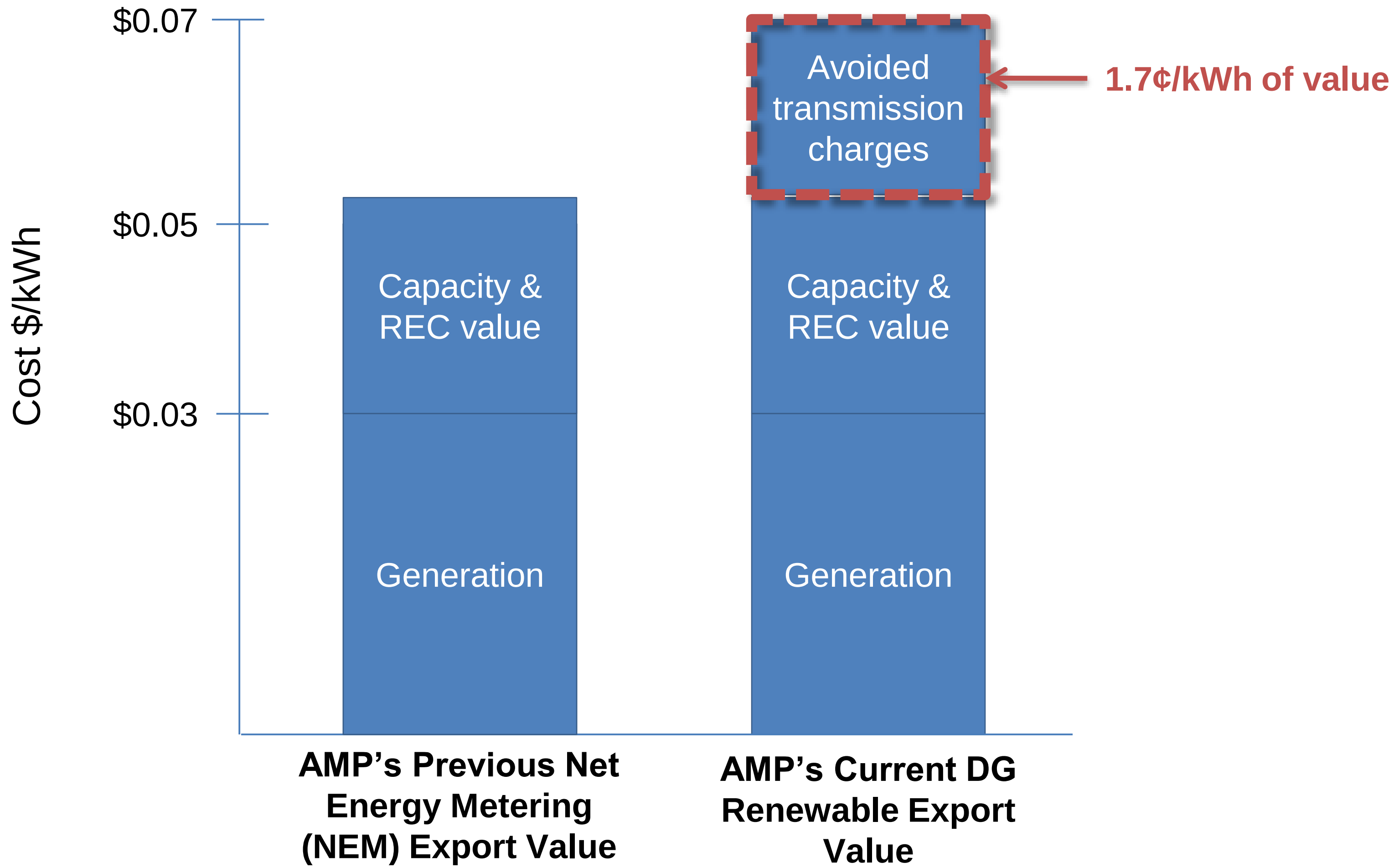
Alameda Municipal Power (AMP) released their plan to credit their customers with DG resources for avoided transmission charges, meaning participating customers will see higher payouts for their exported energy.



2b. Cost Allocation Principles Support TED

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FERC Principles require that transmission pricing:

1. ✓ Must meet the traditional revenue requirement
2. ✓ Must reflect comparability
3. ✓ Should promote economic efficiency
4. ✓ Should promote fairness
5. ✓ Should be practical

Courts and FERC require cost responsibility to track cost causation.

3. IMPACTS of Using a TED Billing Determinant

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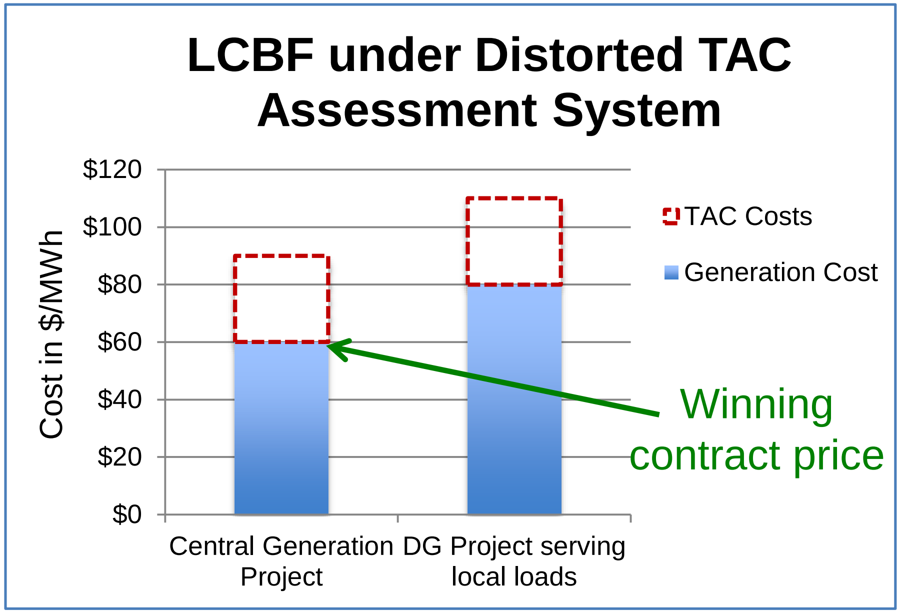
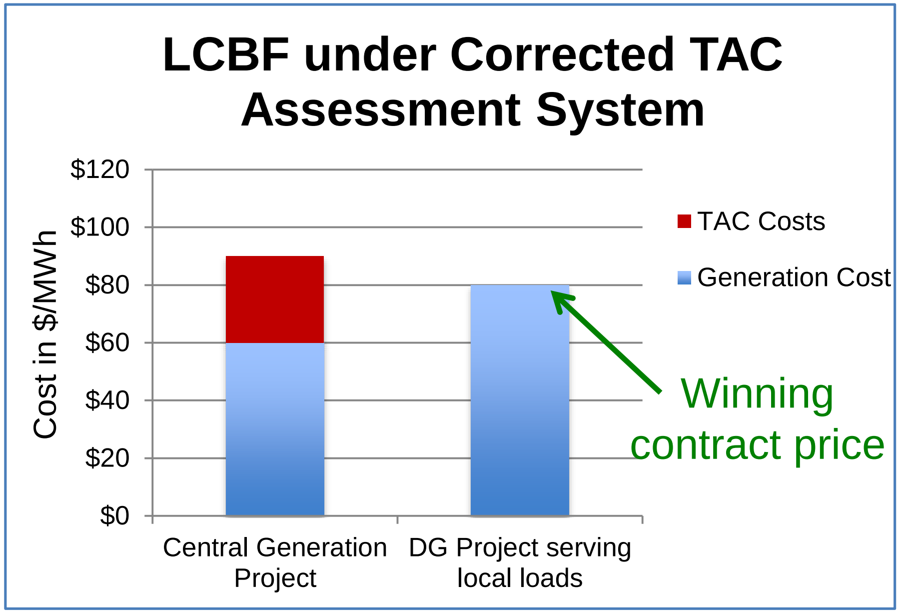
Using a TED billing determinant would produce the following impacts:

a. Reduce the distortion on DER and create a market signal for resources that avoid the transmission grid
b. DER reduces all 4 drivers of transmission investment
c. Result in avoided transmission investment and major ratepayer savings

3a. The TED methodology would reduce the TAC market distortion on DER

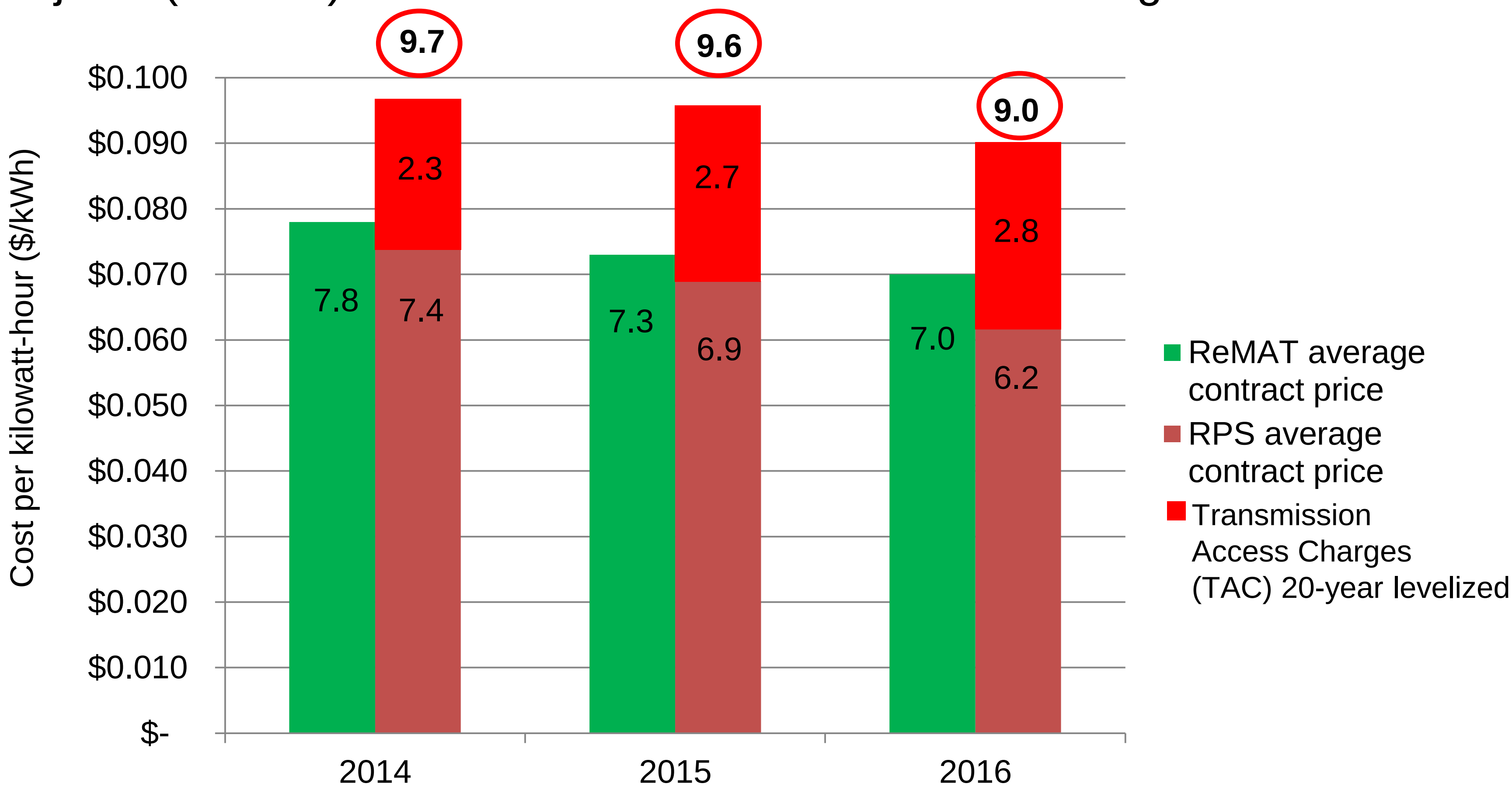




- Current TAC assessment artificially increases the cost of distributed energy resources
- Fixing the TAC market distortion reflects the true delivery costs of distributed and central generation
- Over time, more distributed generation will be built, decreasing the need for transmission investments, and decreasing overall system costs

3a. The TED methodology would reduce the TAC market distortion on DER

DER projects are currently the most cost effective RPS-eligible projects when avoided transmission costs are considered. Considering TAC, ReMAT projects (<3 MW) are more cost effective than the average RPS resource.



Data sources: 2014-16 RPS via CPUC; 2014-16 ReMAT via PG&E, SCE ReMAT web sites.

NOTE: 2017 SCE ReMAT contracted price was 4.5c/kWh as of May. The most recent offer price was 4.1c/kWh.

3b. Result in avoided transmission investment and major ratepayer savings

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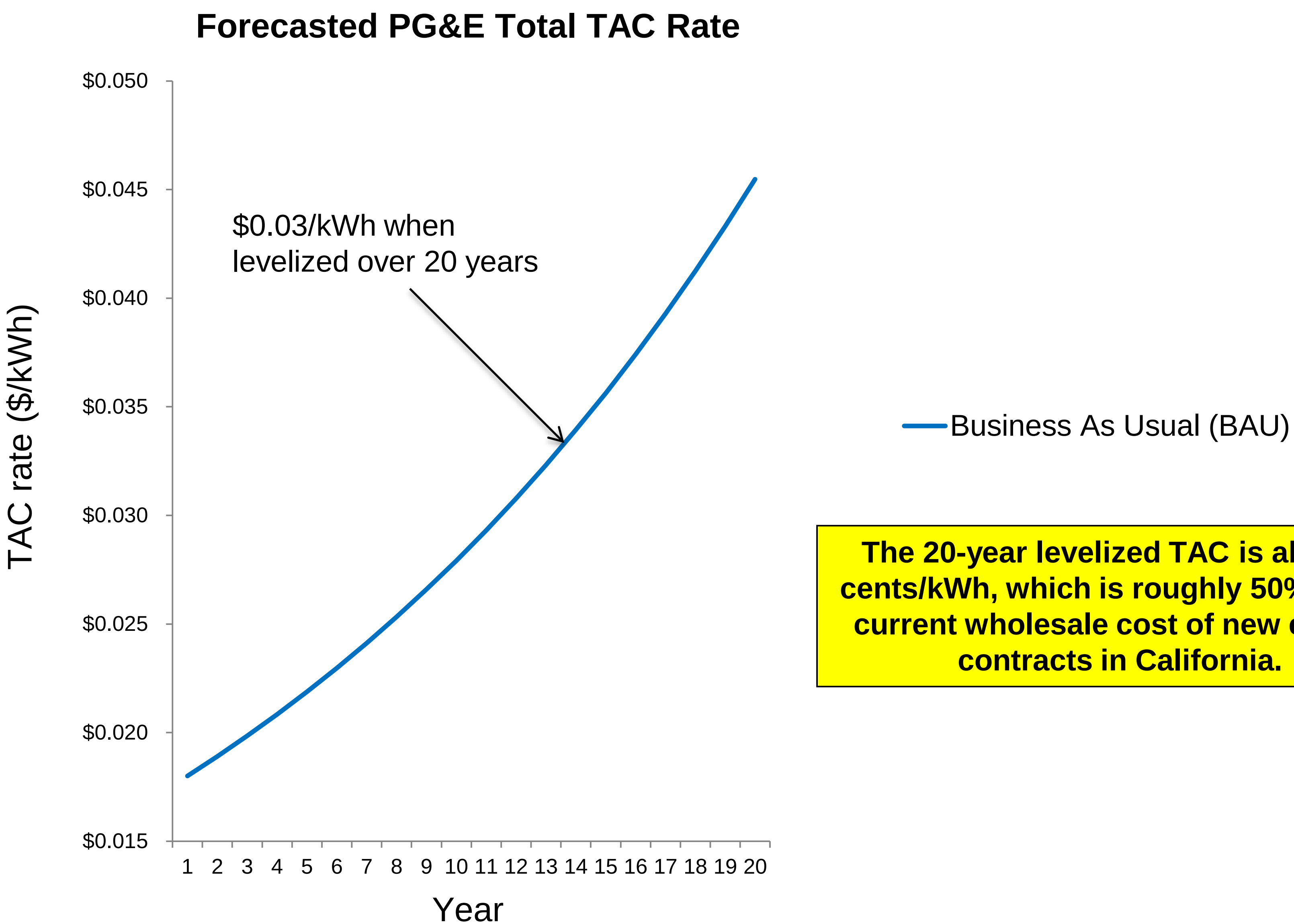

The 20-year levelized TAC is about 3 cents/kWh, which is roughly 50% of the current wholesale cost of new energy contracts in California.

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DER reduces existing and future transmission costs

DER reduce the stress on the transmission grid and reduce the need for future transmission grid investment. It has already caused existing transmission spend to be lower than it otherwise would be.

- 12/2016, Fresno Bee: Growth of local solar puts plans for $115 million transmission project on hold
- 5/2016, Greentech Media: $192 million in PG&E transmission projects cancelled due to energy efficiency and local solar

O &M and return on equity can increase these costs five-fold

3c. DER reduces all 4 drivers of transmission investment

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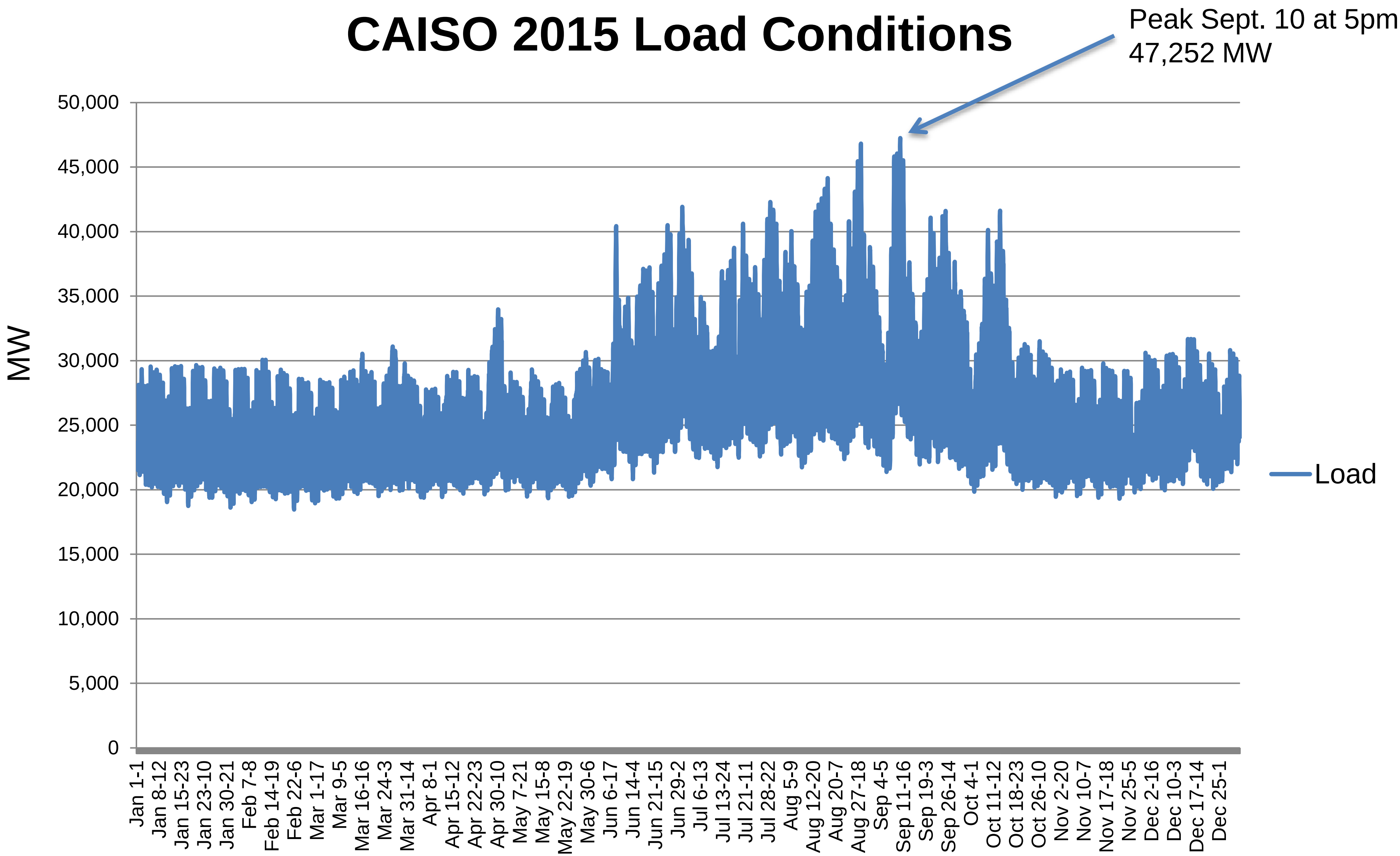
The Issue Paper identified 4 main drivers of transmission investment, and DER can address needs for each driver.

1. Peak load
2. Policy
3. Economics
4. Reliability

3c. DER reduces all 4 drivers of transmission investment—Peak Load



3c. DER reduces all 4 drivers of transmission investment—Peak Load

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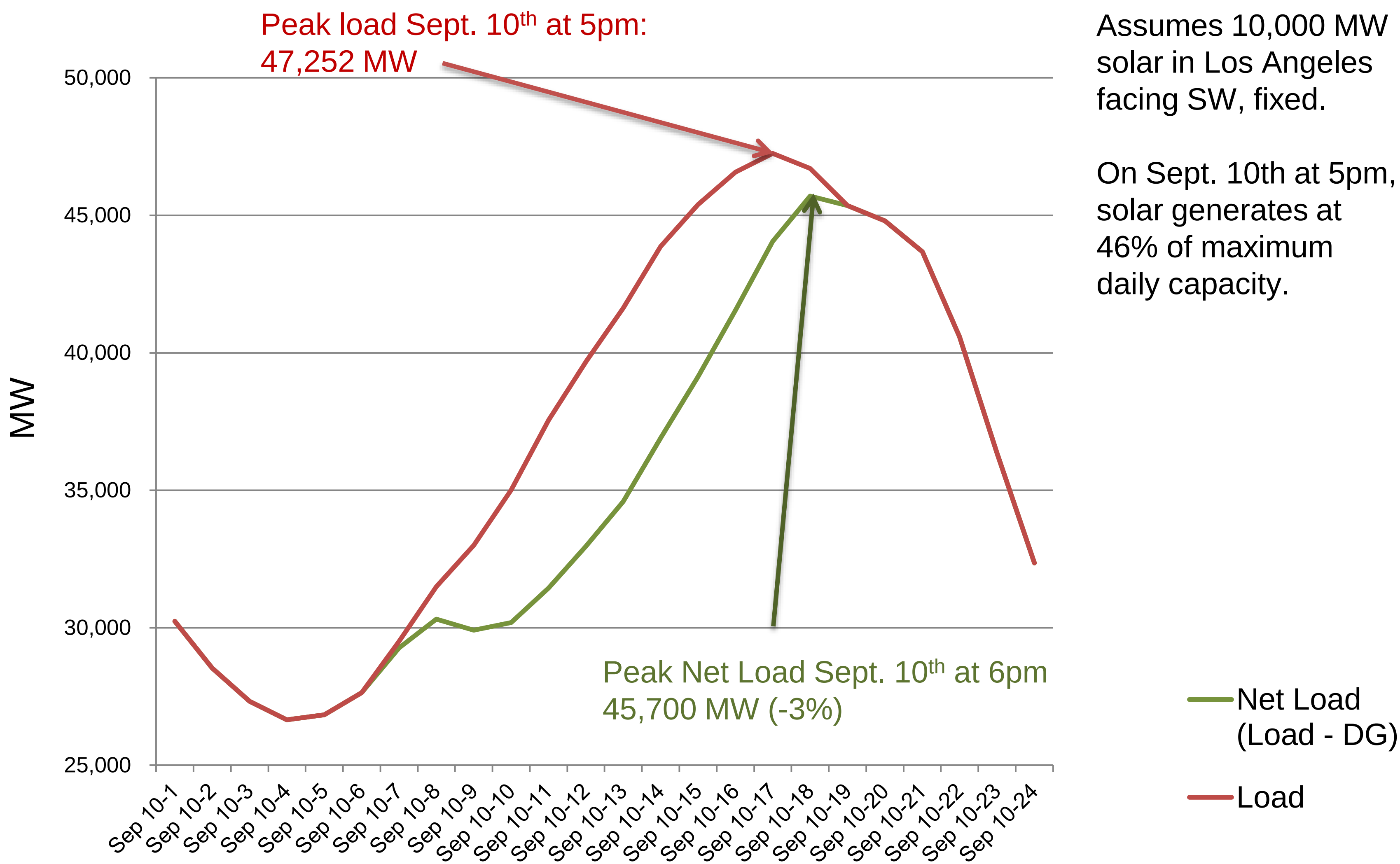
Example DG production during peak load conditions



Assumes 10,000 MW solar in Los Angeles facing SW, fixed.

On Sept. 10th at 5pm, solar generates at 46% of maximum daily capacity.

3c. DER reduces all 4 drivers of transmission investment—Policy Goals

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- Policy goals are likely to make up a substantial portion of new transmission investment.
  - RETI 2.0 report estimates at least $5 billion in new transmission build will be required to meet the 50% RPS by 2030
  - O&M costs increase that cost by 5x → $25b over 50 years
  - Plus financing costs (return on equity)

- DG reduces this second key driver of transmission investments:
  - Wholesale distributed generation and aggregated DG are RPS-eligible resources.

3c. DER reduces all 4 drivers of transmission investment—Economic Drivers

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- DG frees up transmission capacity, creating opportunities for more cost-effective delivery of remote energy
- DG profiles and location can reduce the marginal costs of energy by reducing congestion and line losses

3c. DER reduces all 4 drivers of transmission investment—Reliability

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DER can provide reliability services traditionally offered by transmission-dependent resources.

- Energy storage can provide frequency and voltage stability services under varying real load conditions.[1]
- DERs also provide resiliency by adding diversity to the generation portfolio.
- 2017 NREL study concluded that solar PV generation plants can provide essential reliability services.[2]
  - *Essential reliability services during periods of oversupply,*
  - *Voltage support when the plant's output is near zero,*
  - *Fast frequency response (inertia response time frame), and*
  - *Frequency response for low as well as high frequency events.*

1 Khalsa, Amrit S., and Surya Baktiono. *CERTS Microgrid Test Bed Battery Energy Storage System Report: Phase 1., 2016*, available at https://certs.lbl.gov/sites/all/files/aep-battery-energy-storage-system-report-phase1.pdf.
2 C. Loutan et al., *Demonstration of Essential Reliability Services by a 300-MW Solar Photovoltaic Power Plant* (March 2017), available at https://www.nrel.gov/docs/fy17osti/67799.pdf.

3b. Result in avoided transmission investment and major ratepayer savings

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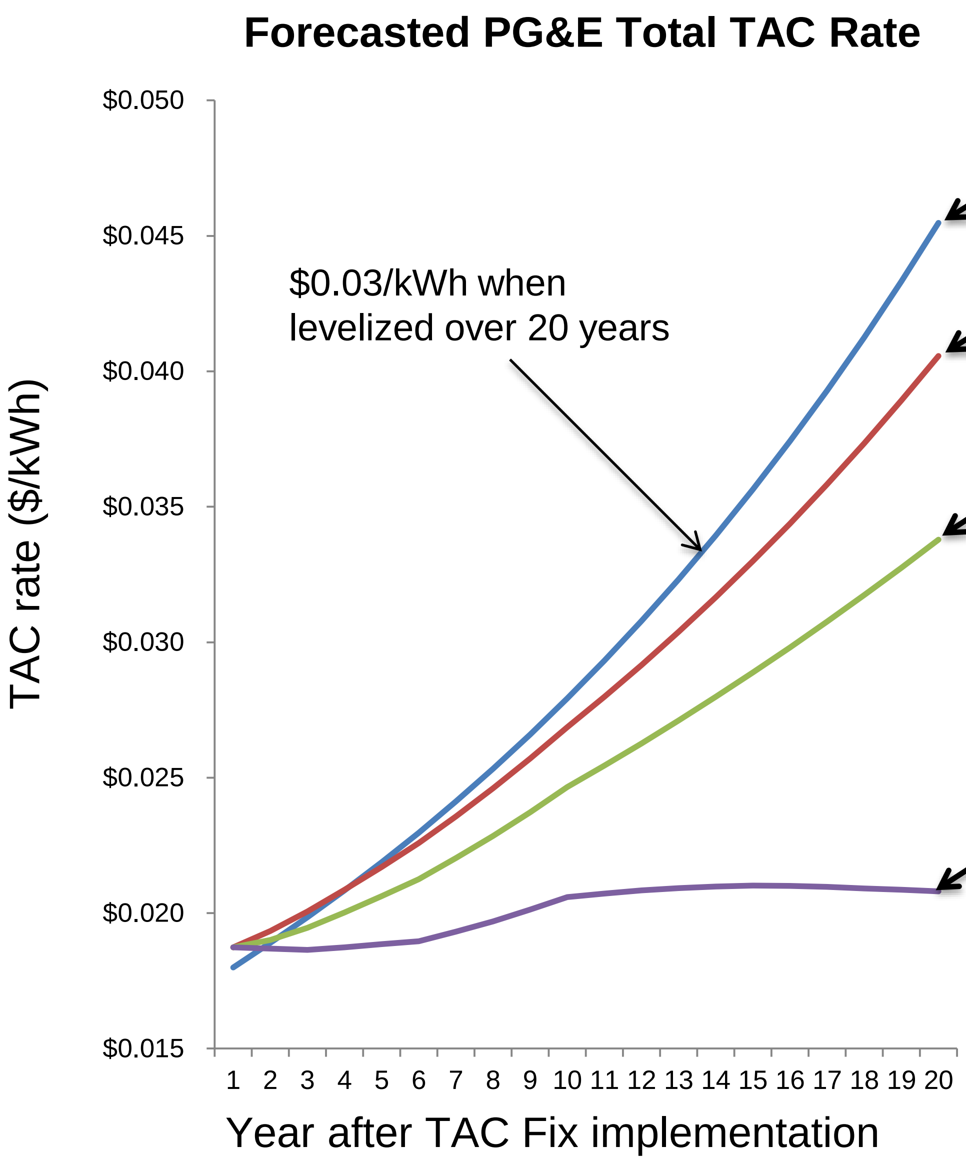


20 year TAC savings compared to BAU:

BAU (results in 12.4% of load met by local renewables after 20 years)

1.5x DG: $23.5 billion TAC savings (17.3% local renewables)

2x DG: $38.5 billion TAC savings (22.2% local renewables)

3x DG: $63.9 billion TAC savings (31.5% local renewables)

Ratepayer avoided TAC costs over 20-year period in the 1.5x, 2x, and 3x BAU DG scenarios.

Use TED as the TAC billing determinant

Consistent, unbiased, and technology-neutral

PRINCIPLES

a. More accurate measurement of transmission usage
b. Cost allocation principles support it

IMPACTS

a. Reduces distortion on DER and creates market signal for resources that avoid the transmission grid
b. DER reduces all 4 drivers of transmission investment
c. Drives major ratepayer savings through avoided transmission investment

The TAC Fix is backed by a broad range of organizations

Clean Coalition

SolarCity
CALSEIA California Solar Energy Industries Association
Sierra Club California
Vote Solar
sunrun
Center for Biological Diversity Because life is good.
350 Bay Area
Solar Land Partners
Lean Energy US Local Energy Aggregation Network
Center for Sustainable Energy
Sustainable Economies Law Center
UCLA Luskin School of Public Affairs Luskin Center for Innovation
Enphase
the Energy Coalition Generating Capital for Communities Through Energy
Efficient
Appraccel
BBL Solar Design & Consulting
California Alliance for Community Energy
Californians for Energy Choice
California Consumers Alliance
Carbon Free Mountain View
Carbon-Free Palo Alto Advocates of carbon-free energy for Palo Alto, California
Berkeley Climate Action Coalition
CivicSolar
Commercial Solar Design
Community Choice Partners Securing your community's energy future
Community Environmental Council
Community Renewable Solutions LLC Reducing emissions. Saving money.
DGC Dynamic Grid Council
Earthwise Energy
East Bay Clean Power Alliance
eMotorWerks Smart [Grid] EV Charging
Energy and Policy Institute
Environment California Clean air. Clean water. Open spaces.
Fossil Free California
Foundation Windpower
Green Lynx, LLC Environmentally Sound Solutions
ILSR Institute for Local Self-Reliance
ImMODO Energy Services Corporation
Integrated Resources Network
JTN Energy LLC
JKB Energy Capturing the power of nature
Local Clean Energy Alliance
Local Power.
McCalmont Engineering
Menlo Spark
Microgrid Media
Mirasol Development LLC
mrc Microgrid Resources Coalition
nectarsolar
Nutter Consulting
The Offset Project
Pacific Environment
panel the planet
Photon Power Solar. Everywhere.
Preserve Wild Santee
Pristine Sun
Promise Energy
Récolte Energy www.recolteenergy.com
REP Energy
San Diego Energy District
SimplySolar
SkyCentrics
SLO Clean Energy Your power to choose
Solagra Solar + Agriculture + Water Solutions
Solar Electric Solutions
Soltage Renewable Energy Provider
Sustainable Silicon Valley
Sustaenable
TeMix Transactive Energy Services
TerraVerde Renewable Partners
Voltaic Capital Markets LLC
Yaskawa Solectria Solar
Solar Engineering Consultants

Use
Transmission Energy Downflow (TED)
as the TAC Billing Determinant

For more information on the TAC Campaign,

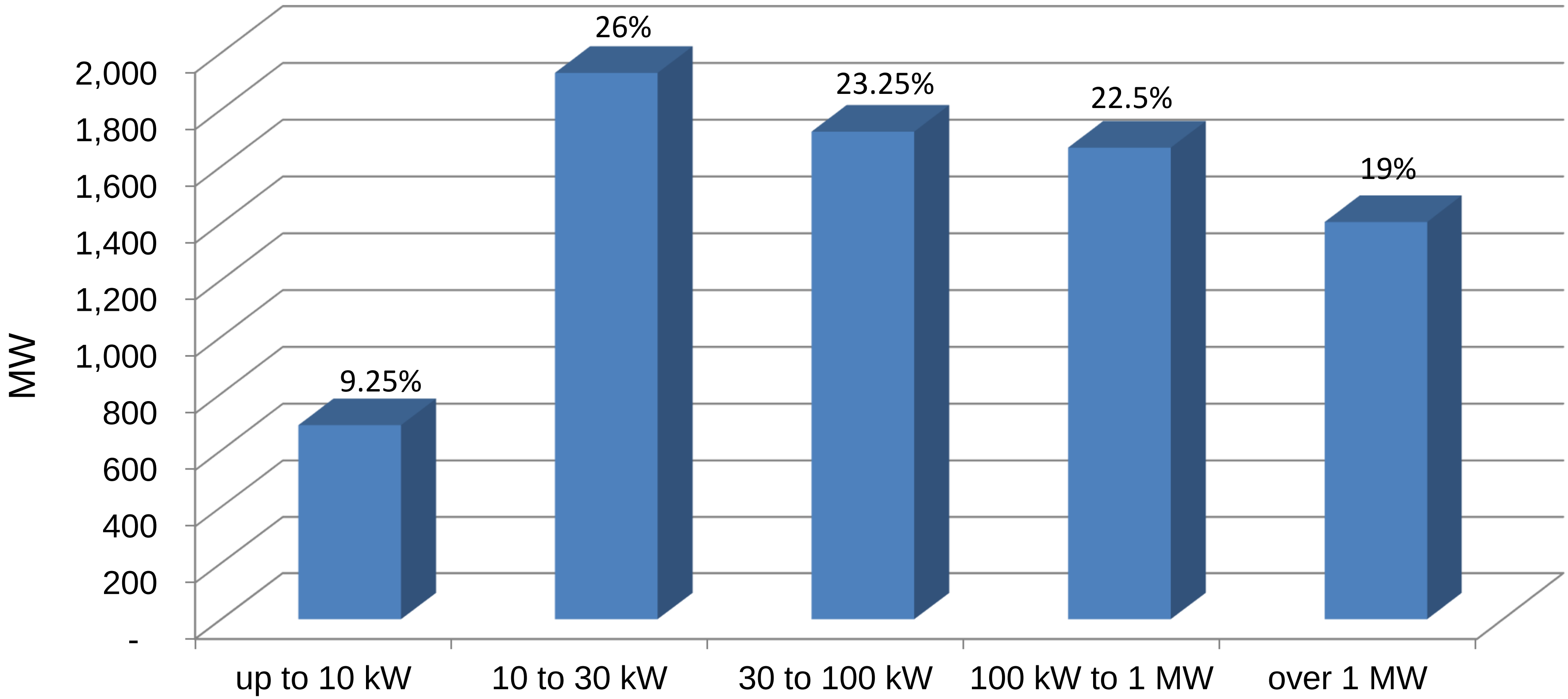
visit www.clean-coalition.org/tac or

email doug@clean-coalition.org

BACKUP

German solar is mostly local (on rooftops)

German Solar Capacity Installed through 2012



Source: Paul Gipe, March 2011

Germany's solar deployments are almost entirely sub-2 MW projects on built-environments and interconnected to the distribution grid (not behind-the-meter)

German rooftop solar is 4 to 6 cents/kWh today

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Project Size	Euros/kWh	USD/kWh	California Effective Rate $/kWh
Under 10 kW	0.1270	0.1359	0.0628
10 kW to 40 kW	0.1236	0.1323	0.0611
40.1 kW to 750 kW	0.1109	0.1187	0.0548
Other projects up to 750 kW*	0.0891	0.0953	0.0440

- Conversion rate for Euros to Dollars is €1:$1.07
- California's effective rate is reduced 40% due to tax incentives and then an additional 33% due to the superior solar resource

Replicating German scale and efficiencies would yield rooftop solar today at only between 4 and 6 cents/kWh to California ratepayers

* For projects that are not sited on residential structures or sound barriers.

Allocating TAC between multiple LSEs on the same distribution grid

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Problem: When multiple LSEs are served on the same distribution grid, how can a utility distribution company (UDC) fairly apportion a TED-based TAC liability?

Goal: Allocate TAC liability according to each LSE's proportional share of TED

*LSE TAC liability = TAC rate * LSE share of TED*

LSE share of TED = LSE CED – (LSE LV and DG output)

This can be done as long as the UDC knows the **HV TAC rate** and each **LSE's DG output**.

Allocating TAC between multiple LSEs on the same distribution grid: Overcollect + Refund Method

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1. CAISO files the annual HV TAC rate with FERC and assigns costs to utilities based on their TED.

   HV TAC rate = (HV TRR)/(HV TED)

2. Each LSE can identify their LV and DG output using information available to their scheduling coordinator.

   LSE LV and DG output = LV output + WDG output + NEM metered exports

   (available from scheduling coordinators reporting to UDC)

3. The UDC that serve multiple LSEs would apply the HV TAC rate to each kilowatt-hour of <u>CED</u> and collected from customers.

   *HV TAC rate * LSE total CED = LSE TAC liability + overcollection*

4. The UDC would refund the excess fees to each LSE in proportion to their LV and DG output.

   *LSE Refund = HV TAC rate * LSE LV and DG output*

   (will match the overcollected amount from each LSE)

Allocating TAC between multiple LSEs on the same distribution grid: Proportional Collection Method

1. CAISO files the annual HV TAC rate with FERC and assigns costs to utilities based on their TED.

HV TAC rate = (HV TRR)/(HV TED)

2. Each LSE can identify their LV and DG output using information available to their scheduling coordinator.

LSE LV and DG output = LV output + WDG output + NEM metered exports
(available from scheduling coordinators reporting to UDC)

3. The UDC identify an LSE-specific TAC rate based on the LSE's share of TED. This LSE-specific TAC rate would be applied to each customer's CED and collected.

LSE-specific TAC rate = (LSE TAC Liability)/LSE CED

CAISO's current transmission market structure

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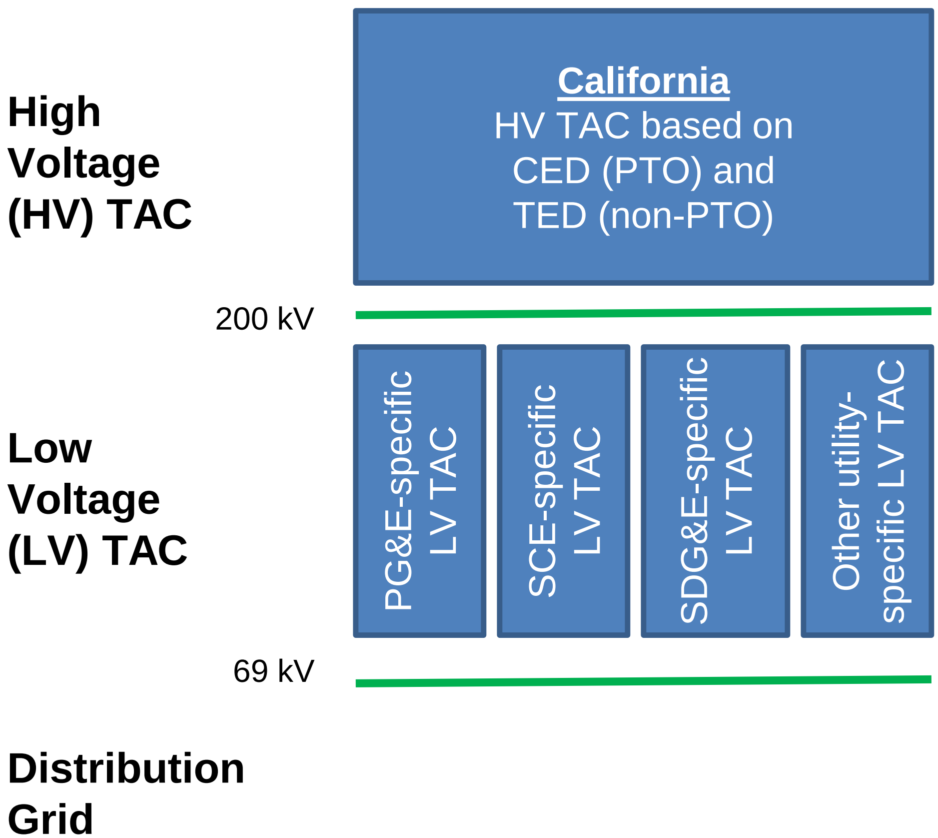
CAISO Transmission Facilities



The HV-LV firewall protects each utility service territory in CAISO from LV transmission investments that serve other utility service territories.

Cost effect example: immediate

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2016 Scenario	IOU	CCA	ESP	Total	Notes
LSE Customer Energy Downflow (CED, in GWh)	70	30	10	110	*Current TAC wholesale billing determinant*
% of Total CED	64%	27%	9%	100%	*Share of total TAC basis (now)*
TRR (in thousands)	NA	NA	NA	$1,650	*Total Transmission Revenue Required*
TAC Rate per kWh (now)	$0.0150	$0.0150	$0.0150	$0.0150	*TRR/CED*
TAC payment (in thousands)	$1,050	$450	$150	$1,650	*TAC Rate x CED*
DG output (GWh)	2.8	1.2	0	4	*4% is the highest current % of DG in any PTO utility service territory*
Share of LSE CED served by DG	4%	4%	0%	4%	
TED (GWh)	67.2	28.8	10	106	*Proposed TAC basis*
% of TED	63.4%	27.2%	9.4%	100%	*Share of total TAC basis (proposed)*
TRR (in thousands)	NA	NA	NA	$1,650	*Remains unchanged*
TED-based TAC Rate (per kWh)	$0.0157	$0.0157	$0.0157	$0.0157	*TRR/TED*
TED-based TAC payments (in thousands)	**$1,046 (-$4)**	**$448 (-$2)**	**$156 (+$6)**	**$1,650**	*New TAC Rate x TED*

Cost effect example: long term (2 x BAU DG Scenario)

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2036 Scenario	IOU	CCA	ESP	Total	Notes
LSE Customer Energy Downflow (CED; in GWh)	70	30	10	110	Current CED and TAC basis
% of Total CED	64%	27%	9%	100%	Share of total TAC basis (now)
TRR (projected 2035, in thousands)	NA	NA	NA	$5,740	Total Transmission Revenue Requirement
TAC Rate per kWh (projected 2035)	$0.052	$0.052	$0.052	$0.052	TRR/CED
TAC payment (in thousands)	$3,653	$1,565	$522	$5,740	TAC Rate x CED
DG output (GWh)	8.00	12.00	0.00	20.00	18% energy sourced below T-D interface
Share of total LSE CED served by DG	11%	40%	0%	18%	*Increased to 2 x BAU case*
TED (GWh)	62.00	18.00	10.00	90.00	Proposed TAC basis
% of TED	68.9%	20.0%	11.1%	100.0%	Share of total TAC basis (proposed)
TRR (in thousands)	NA	NA	NA	$4,470	Reduced (due to deferred need for new capacity)
TED-based TAC Rate per kWh (projected 2035)	$0.0497	$0.0497	$0.0497	$0.0497	TRR/TED; TRR is reduced to DG meeting share of load growth
TED-based TAC payments (in thousands) Savings	**$3,079 (-$573)**	**$894 (-$671)**	**$497 (-$25)**	**$4,470**	New TAC Rate x TED (and change from business-as-usual)

The TED methodology would reduce the TAC market distortion on DER

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Marin Clean Energy (MCE) 2016 service offerings

PG&E (Opt Out)	MCE Light Green	MCE Deep Green	MCE Local Sol
30% renewable energy**	52% renewable energy**	100% renewable energy**	100% locally-produced solar
$47.53 PG&E Electric Delivery	$47.53 PG&E Electric Delivery	$47.53 PG&E Electric Delivery	$47.53 PG&E Electric Delivery
$44.84 Electric Generation	$33.34 Electric Generation	$37.97 Electric Generation	$65.75 Electric Generation
– Additional PG&E Fees	$11.04 Additional PG&E Fees	$11.04 Additional PG&E Fees	$11.04 Additional PG&E Fees
$92.37 avg. total cost	$91.91 avg. total cost	$96.54 avg. total cost	$124.32 avg. total cost
OPT FOR 30% RENEWABLE	ENROLL IN 52% RENEWABLE	ENROLL IN 100% RENEWABLE	ENROLL IN 100% LOCAL SOLAR

- MCE defines local as “located in an MCE member community”
- Based on a typical usage of 463 kWh at current PG&E rates and MCE rates effective September 1, 2016 under the Res-1/E-1 rate schedule. Actual differences may vary depending on usage, rate schedule, and other factors. Estimate is an average of seasonal rates.

The TED methodology would reduce the TAC market distortion on DER

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Potential Marin Clean Energy savings for 100% local solar