Making Clean Local Energy Accessible Now

How fixing distorted transmission cost allocation will unleash Distributed Energy Resources (DER) and save ratepayers billions

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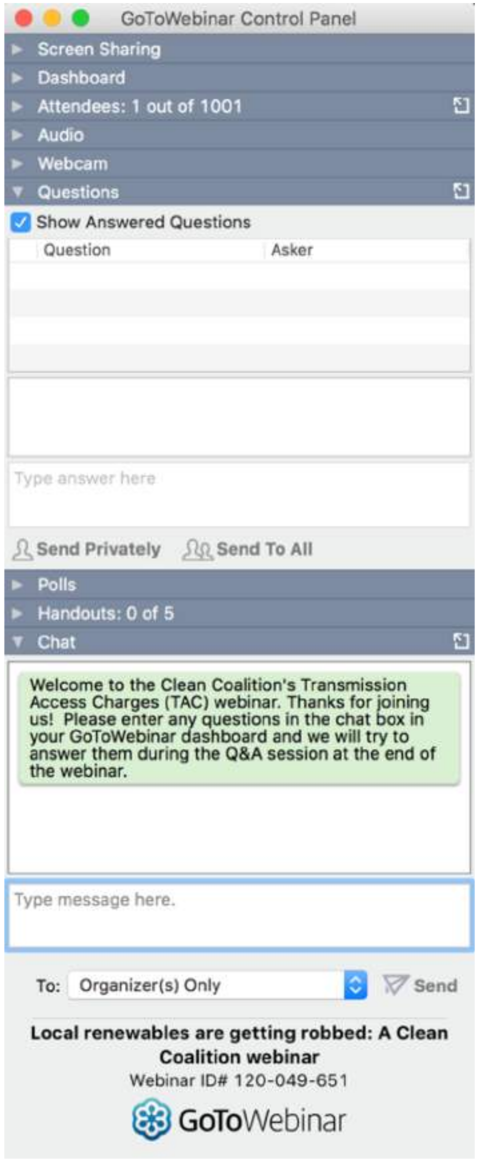

Doug Karpa, J.D. Ph.D.

Policy Director

Dr. Karpa has several years' experience as both a public interest advocate and in private practice working for renewable energy clients on utility scale solar projects.

Ph.D. Ecology and Evolution, Harvard University

J.D., Berkeley Law School (Boalt), U.C. Berkeley

B.S., Biological Sciences, Stanford University

Agenda

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1. **Why you should care about distorted Transmission Access Charges (TAC)**
2. **What TAC are**
3. **Which TAC formula is best**
4. **Why bad rate designs costs ratepayers billions of dollars in unnecessary transmission spending**
5. **How to fix these problems**
6. **Next steps in California**

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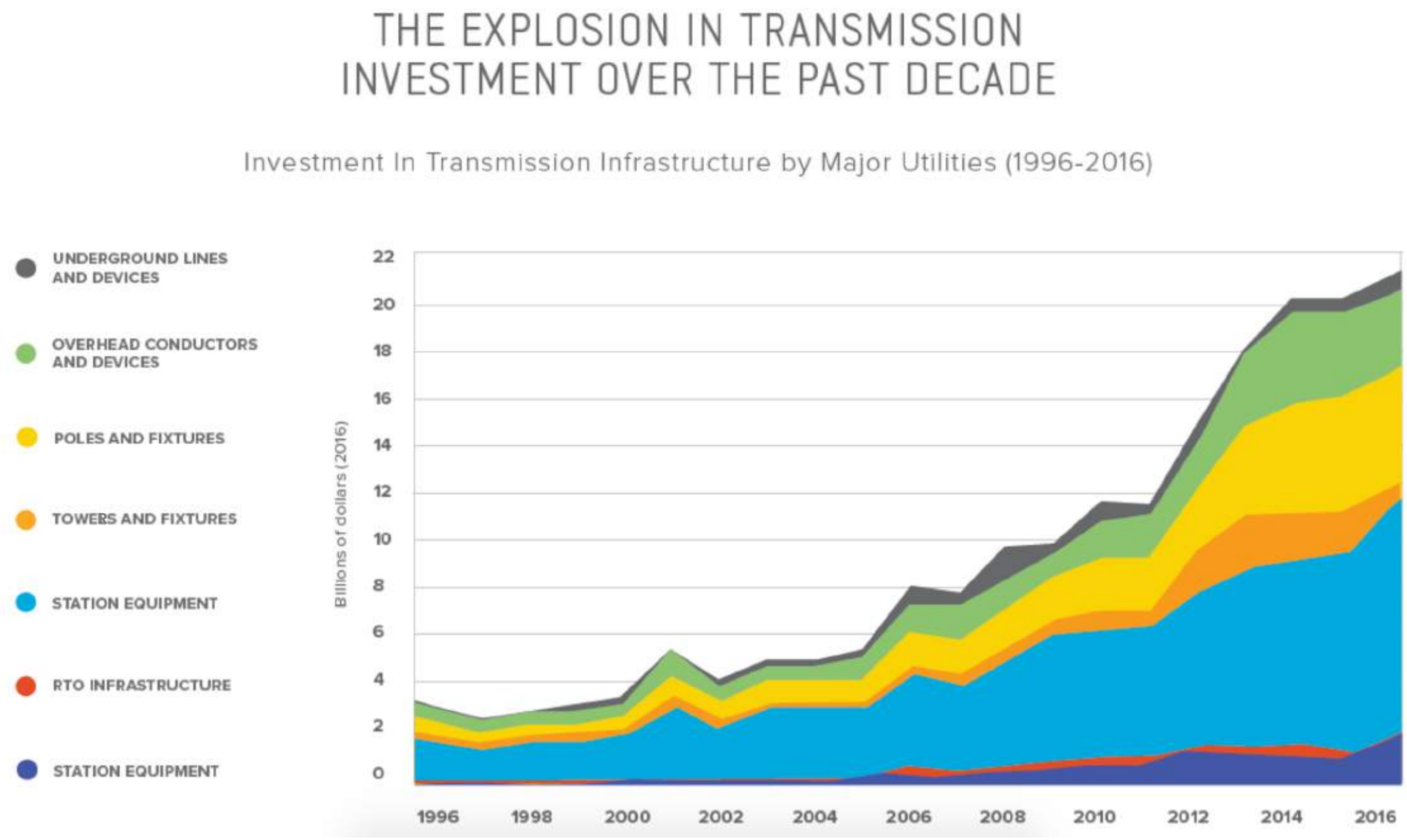
6. Next steps in California

1 - Transmission costs will explode… unless constrained



- Customer load forecast to grow at an accelerated rate in the next decade.[1]
- How fast transmission costs grow depends on **how much load is met with remote transmission-connected resources.**

Graph Source: SunRun, data from the U.S. EIA

[1]*California Energy Commission* California Energy Demand 2018-2030 Revised Forecast

How much of a difference could *rational* Transmission Access Charges make?

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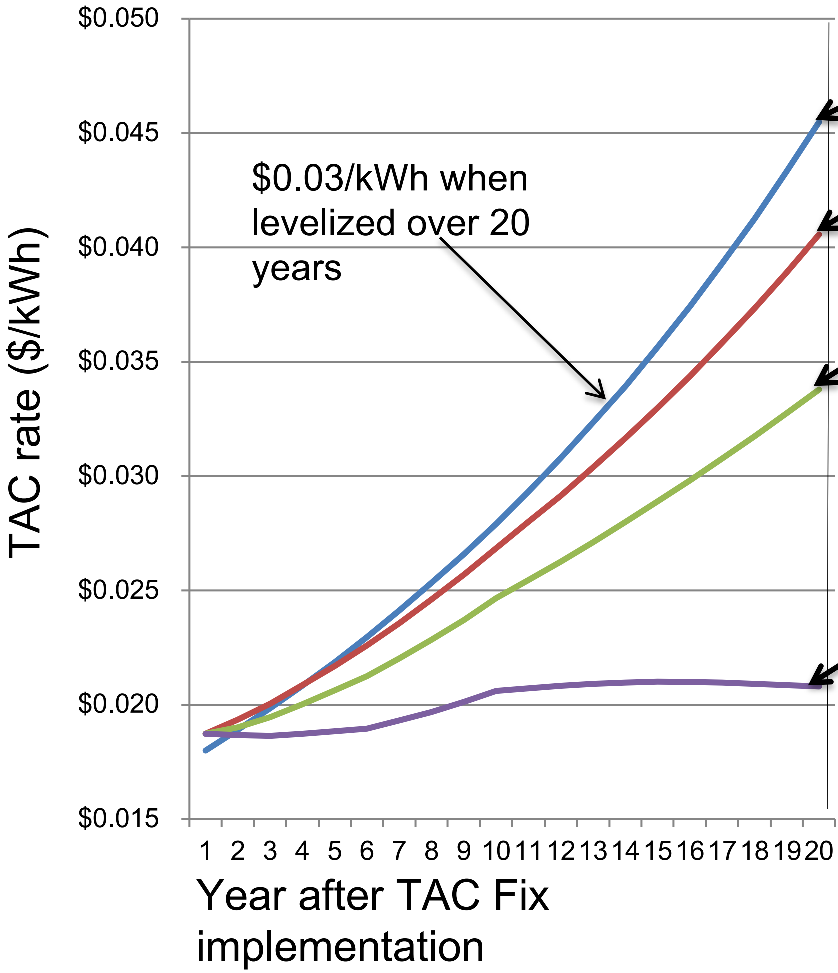
PG&E Total TAC Rate Forecast



TAC savings over 20 years:

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

$23.5 billion TAC savings vs BAU (17.3% local renewables)

$38.5 billion TAC savings vs BAU (22.2% local renewables)

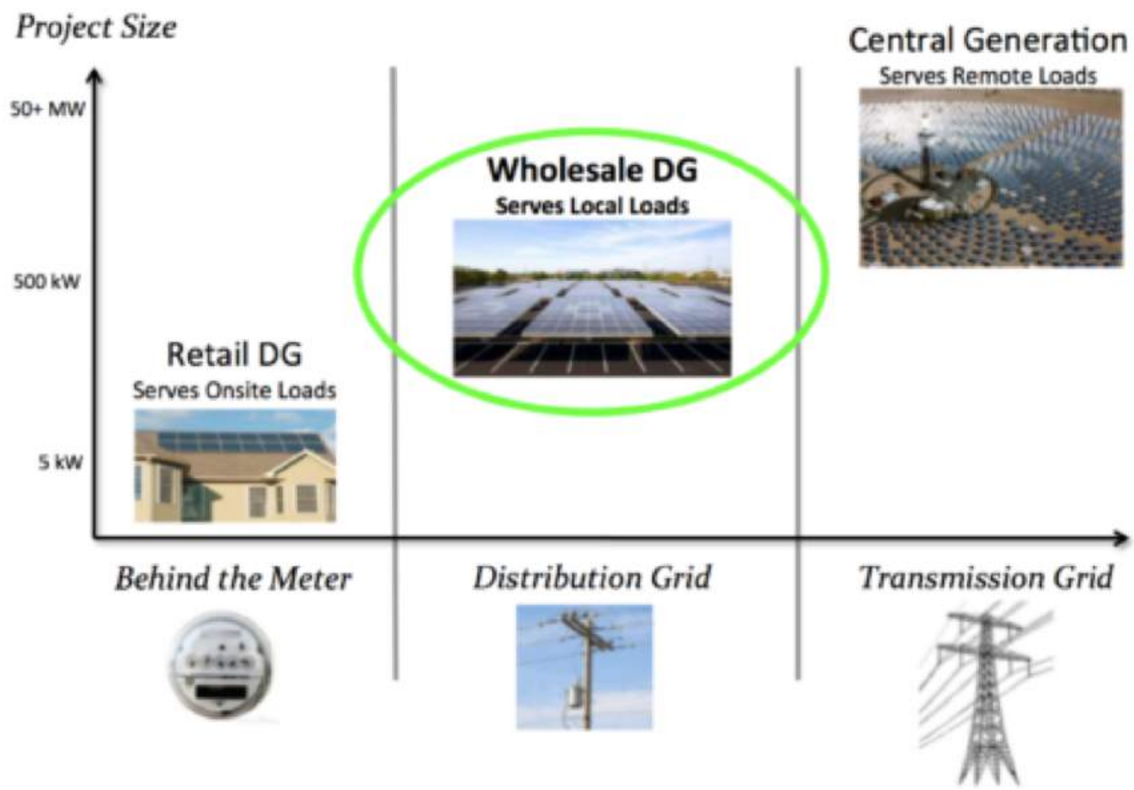
$63.9 billion TAC savings vs BAU (31.5% local renewables =

68.5% transmission connected resources which continue to support TRR for existing transmission

Faster growth of distribution-connected and behind the meter resources = **lower transmission costs**

2- Combating climate change needs *Wholesale Distributed Generation*

Poorly designed transmission charge tariffs impede cost effective renewables and *penalize* Load Serving Entities that reduce their impacts on the grid

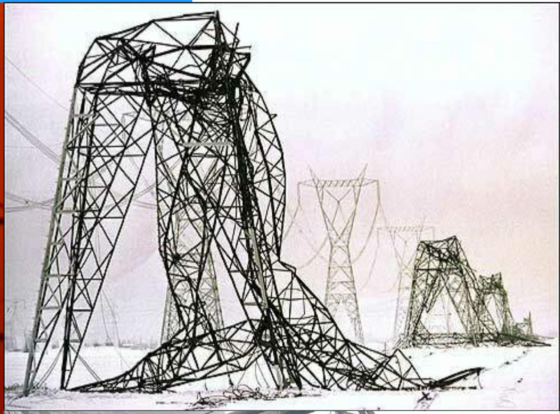


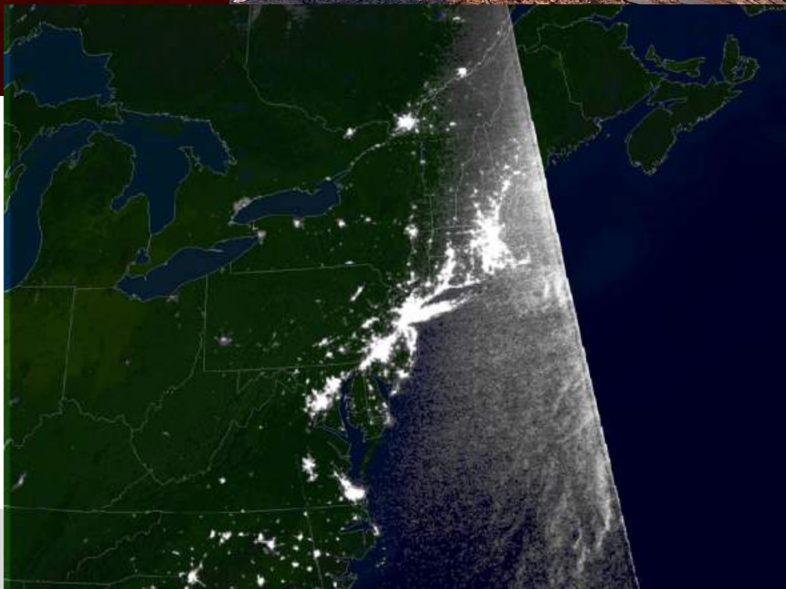
Wholesale Distributed Generation is a **missing piece of the climate change puzzle** in California.

3 - Communities need resilience transmission cannot provide

Ventura and Santa Barbara Thomas Fire 2017

85,000 customers lose power from a "transmission emergency" from "**<u>loss of critical infrastructure</u>**."
Fires grow because of power failure at water pumps.





In an overly transmission-reliant system, losing a single transmission link can **bring the whole grid down.**
In a distributed system, **no single piece can crash the whole grid.**

3 - Communities need resilience transmission cannot provide

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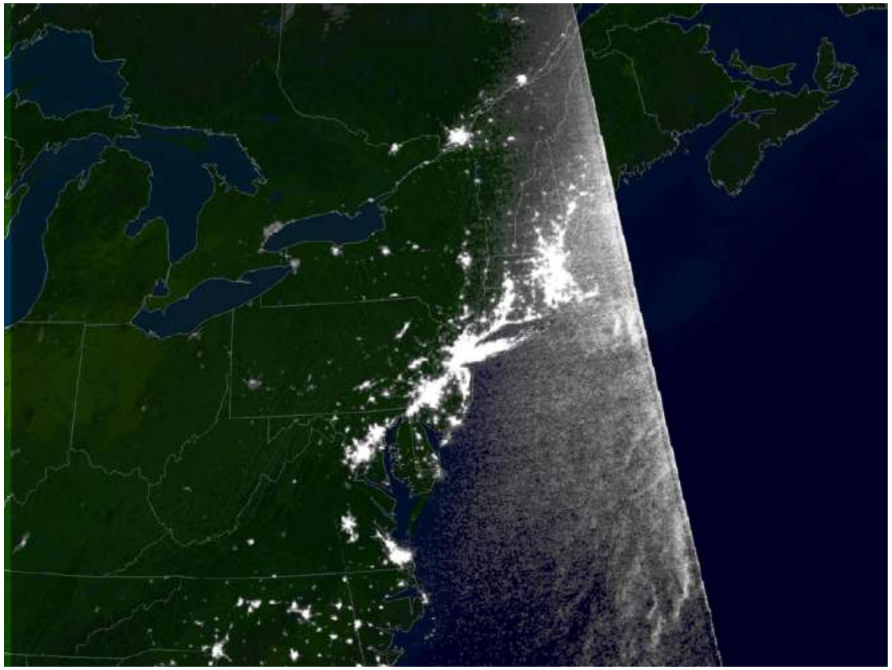

In 2003, a single offline generator and some over grown trees in Akron cuts power to **<u>55 million people.</u>**

This does not happen in a distributed architecture.

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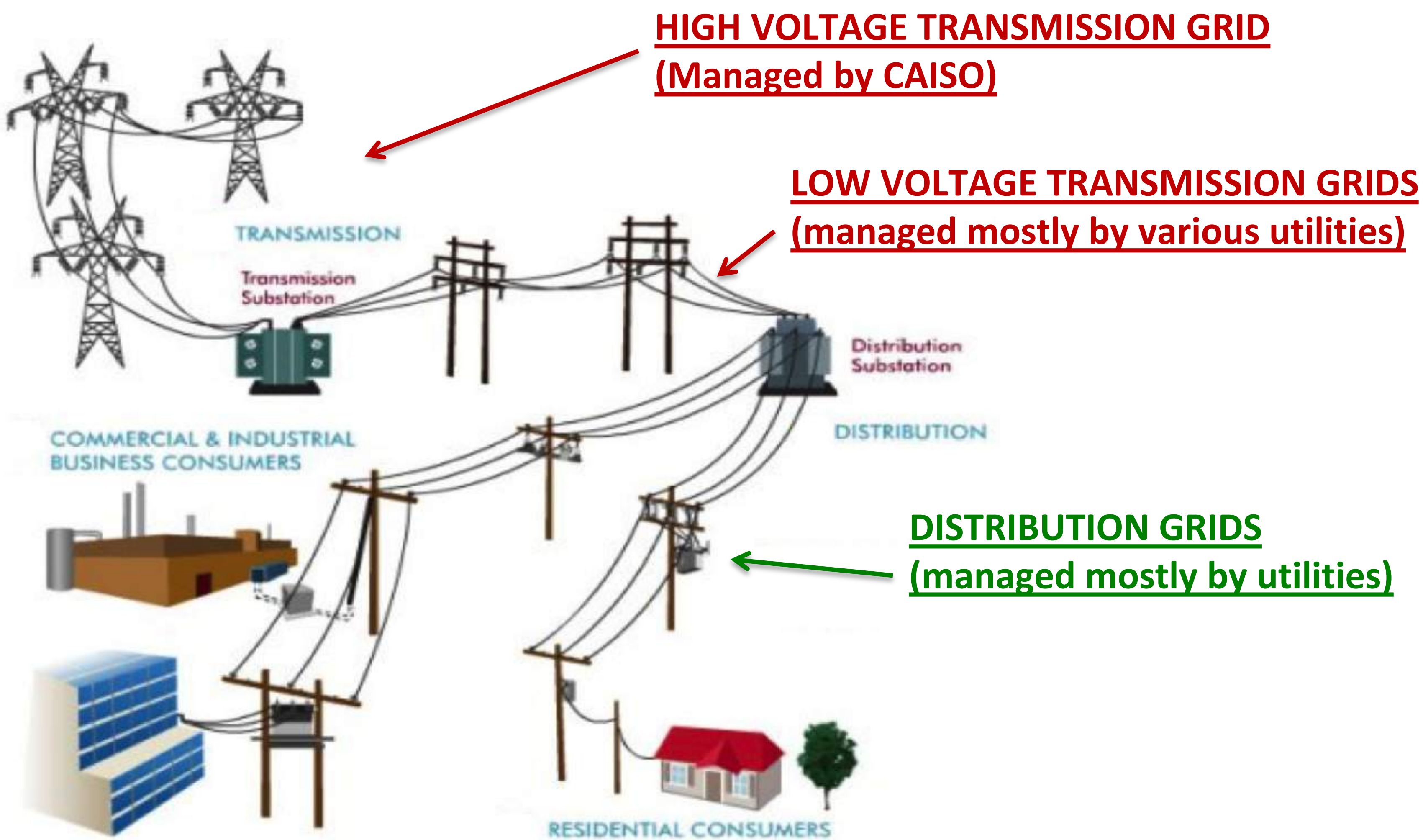
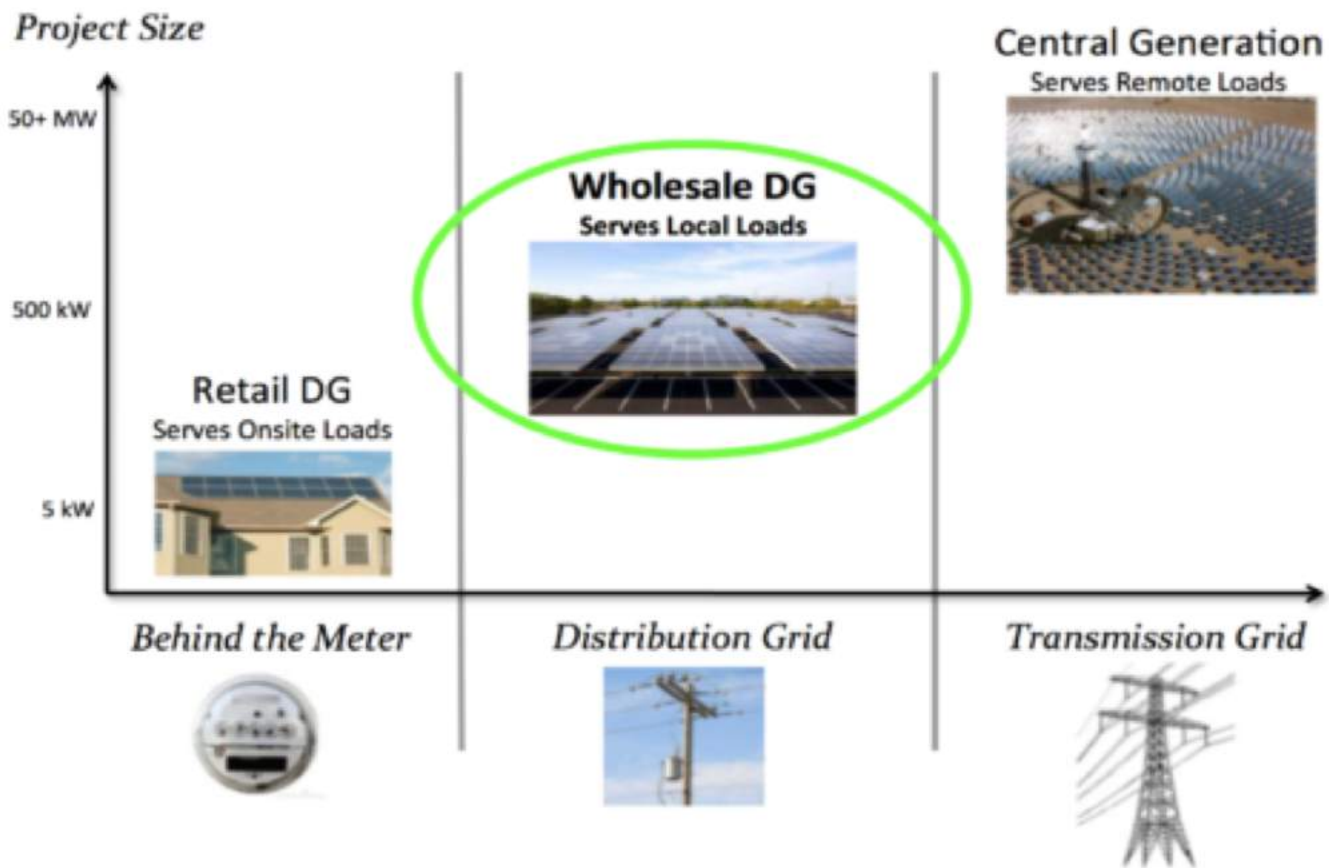
What are TAC?

TAC pays rent to transmission owners for owning the transmission grid



These charges are typically charged based on energy use

Energy comes to customers from three sources



Transmission charges can be charged on three buckets.*

The three energy sources have very different use and impacts on the transmission system

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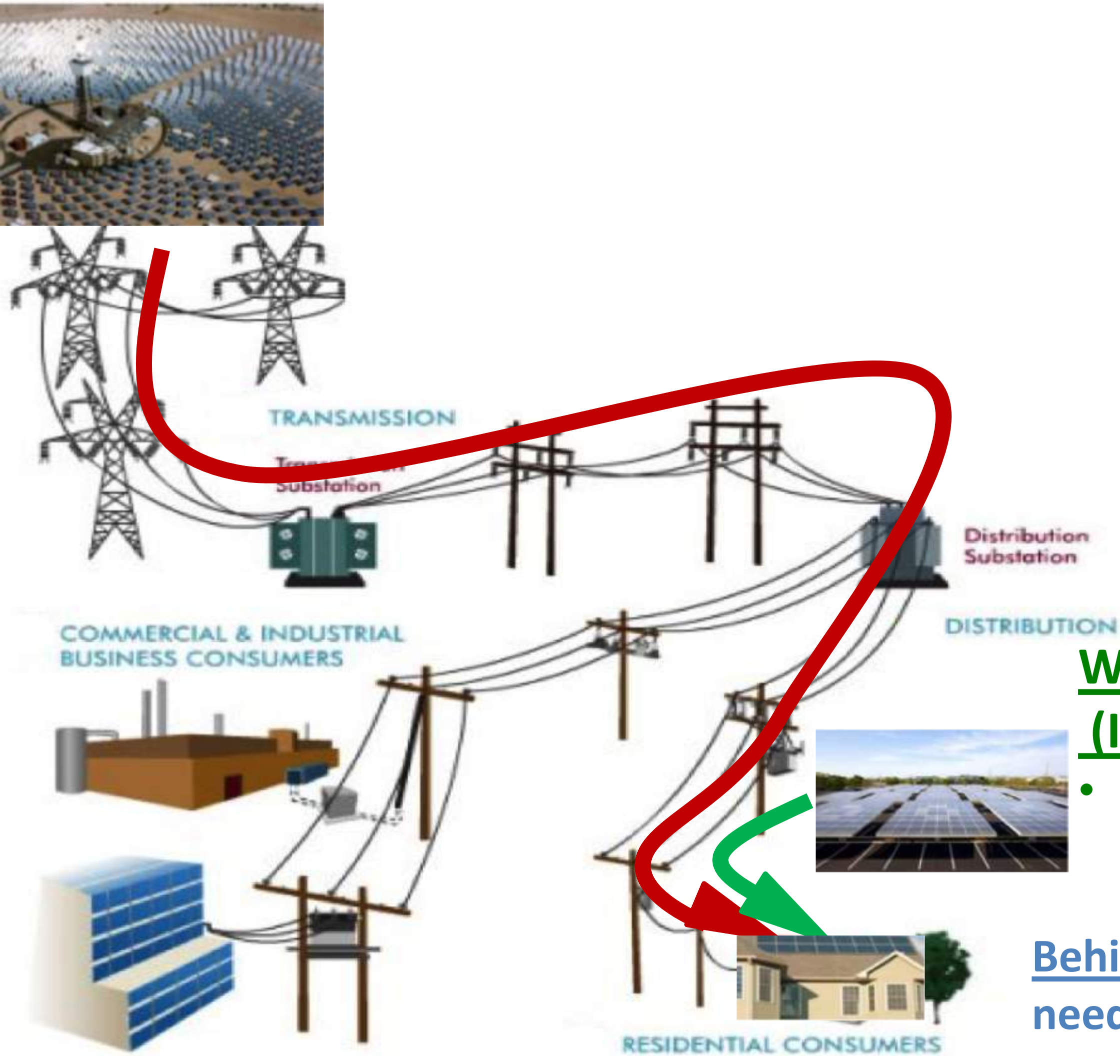
REMOTE generation ("central" generation)

- **Needs hundreds or thousands of miles of the grid to reach customers**



Wholesale DISTIBUTED generation (In Front of the Meter)

- **Needs local wires to reach customers**

Behind the meter retail DG

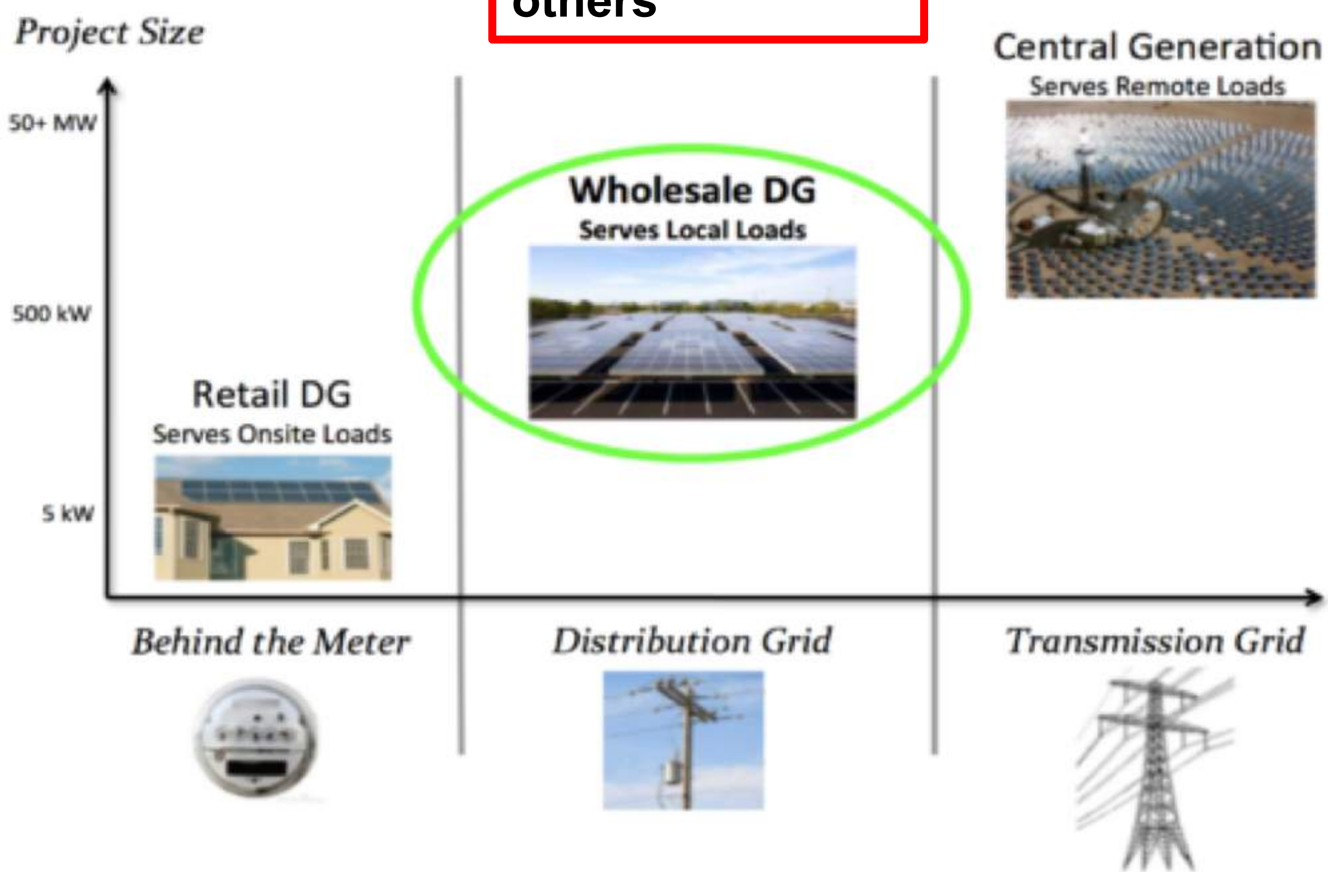
needs no transmission to reach customers

Transmission charges on each bucket should reflect these differences.

No transmission charges

Transmission charges in some places, but not others

Transmission charges



Transmission charges are charged inconsistently across California

Two key measures of transmission use

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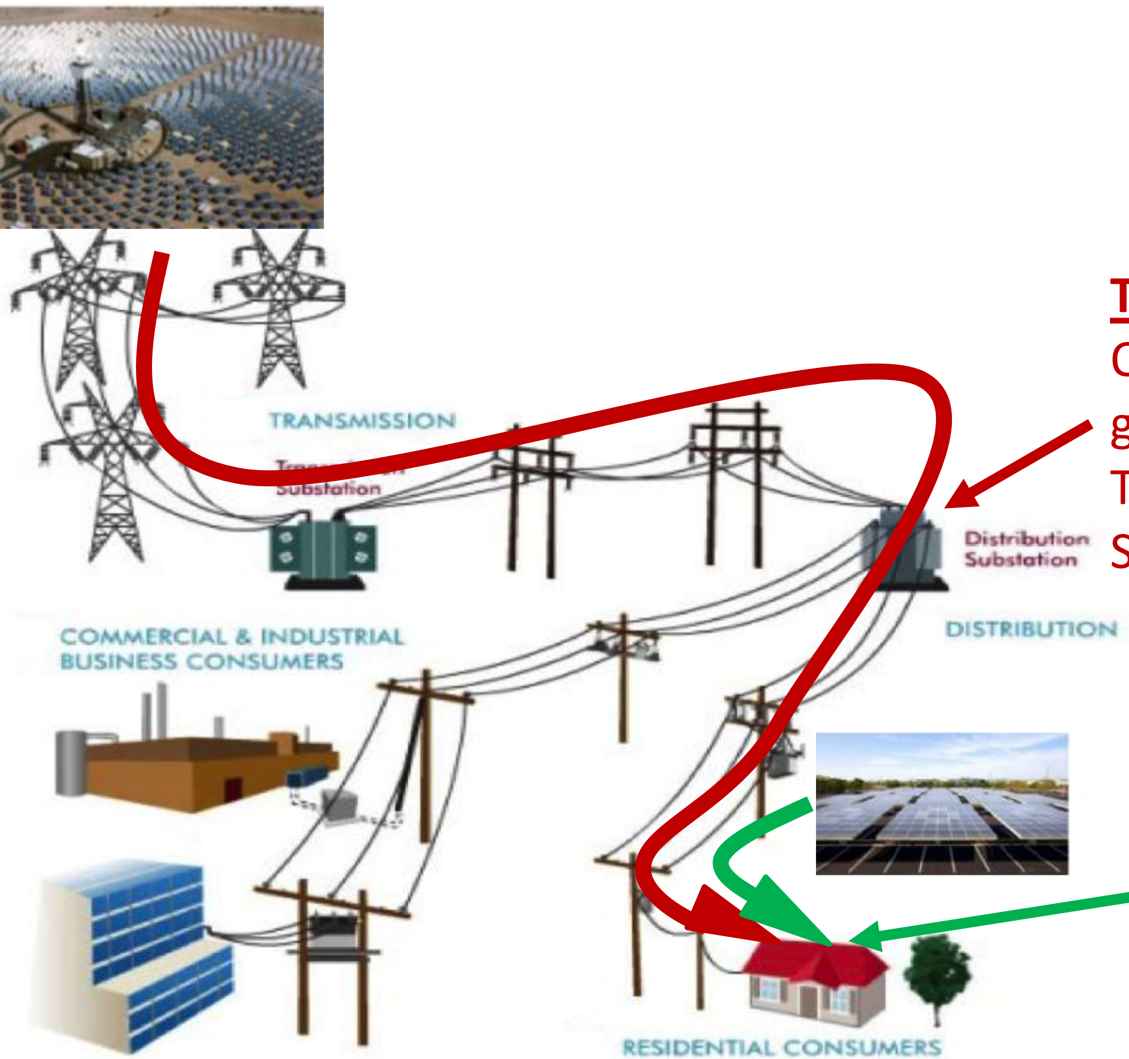

Transmission Energy Downflow
Only energy from remote generation* crosses the Transmission-Distribution Substation

Customer Energy Downflow
Energy crossing the customer meter is a **mix of remote and distributed generation**

How Transmission charges are calculated in California

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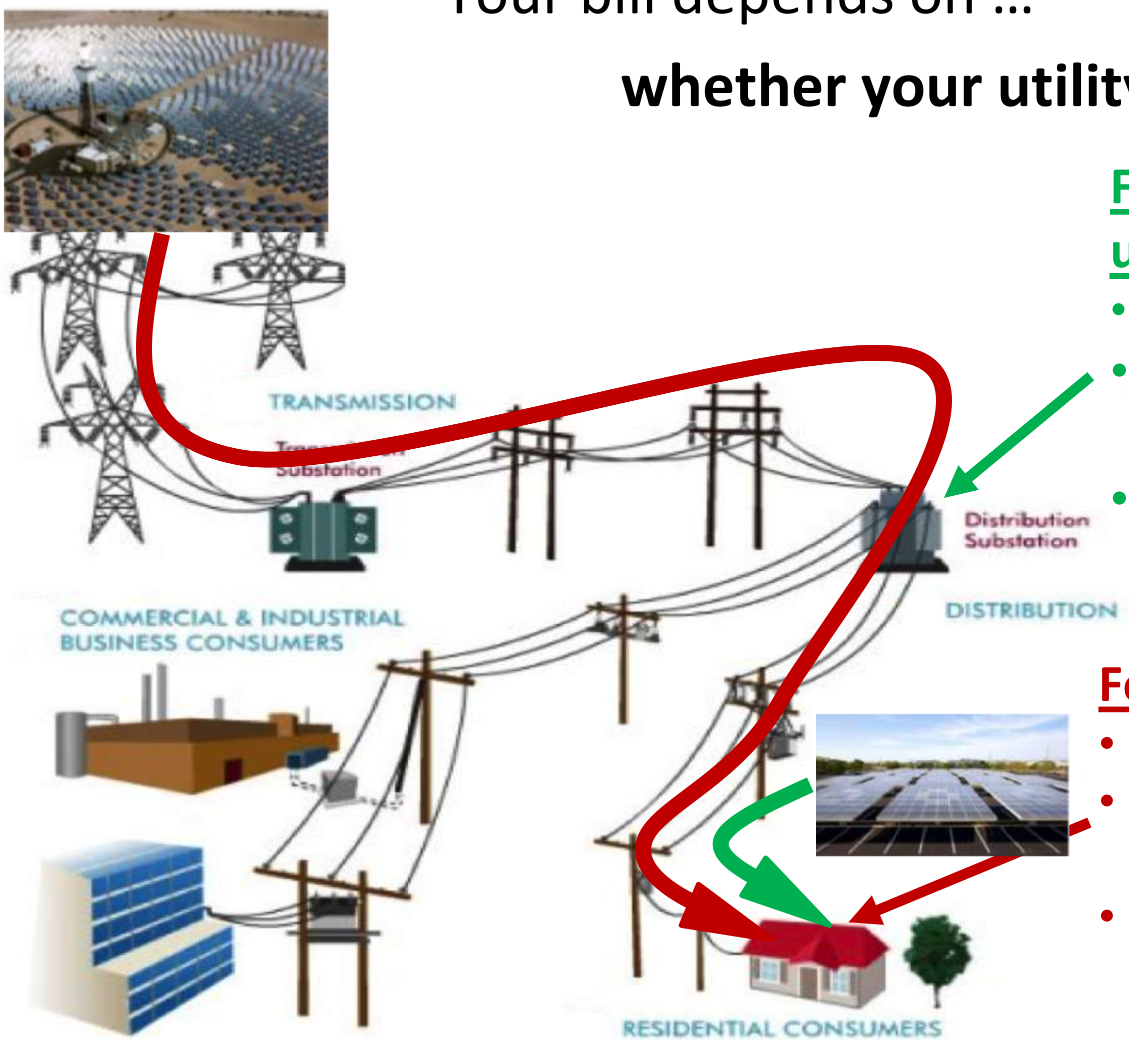
California uses **two different formulas** to charge customers rents:

Your bill depends on …

whether your utility owns the transmission grid.



Formula 1: Bill for transmission use:

- **Non-participating muni utilities***
- **measure transmission use at end of transmission grid**
- **based on transmission energy downflow.**

Formula 2: Bill for all energy:

- **Transmission-owning utilities**
- **Measure transmission use down at the customer meter.**
- **Based on all energy: a mix of transmission use and local energy**

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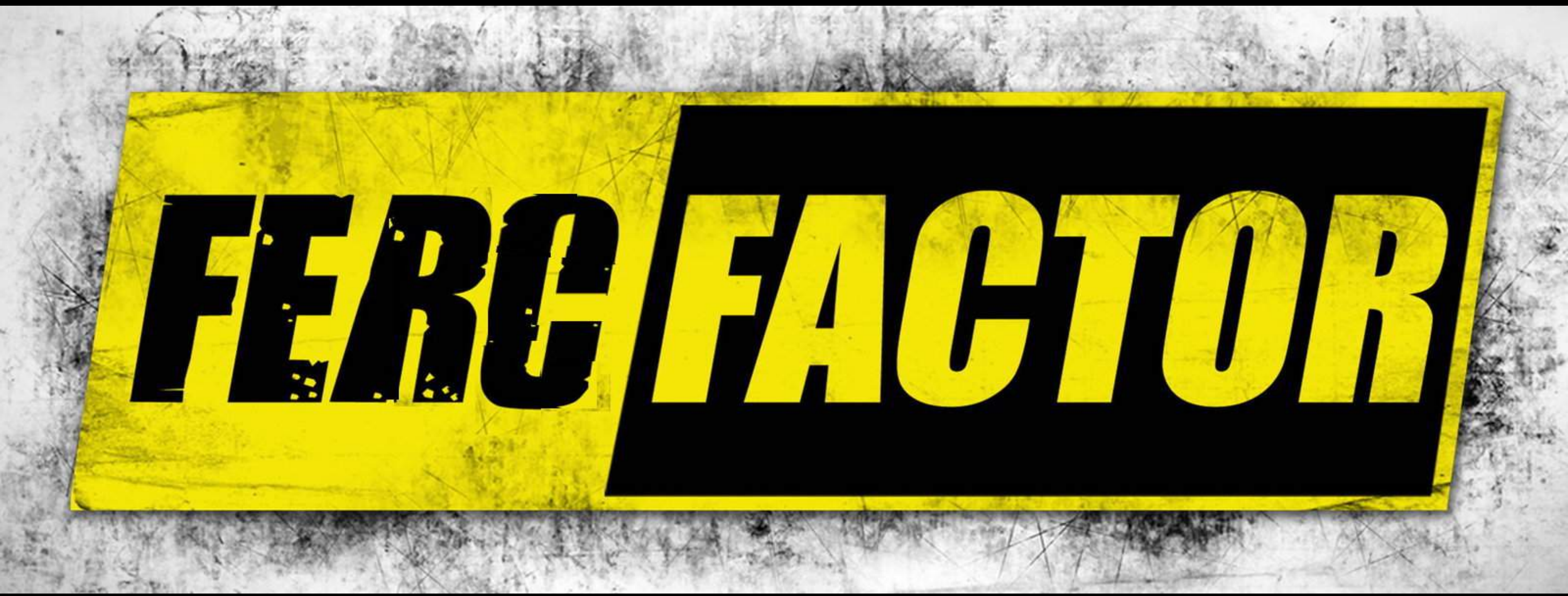
The $63,900,000,000 question*

So, which Formula is better?

***This is how much it costs ratepayers…**

if we choose the wrong formula



Rate designs must meet federal standards established by the Federal Energy Regulatory Commission

FERC ORDER No. 1000/ CAISO standards

1. Historical cost drivers
2. Current beneficiaries and benefits

   FERC "affirmatively require[es] costs of transmission facilities to be allocated to beneficiaries…"

3. Economic distortions:

   "Transmission pricing should promote good decision-making and foster efficient expansion of transmission capacity…" - CAISO

Factor 1: Historical cost drivers

- Does DG displace transmission?
- Which System reflects those savings?

1: Historic Cost Drivers

What drives transmission spending?

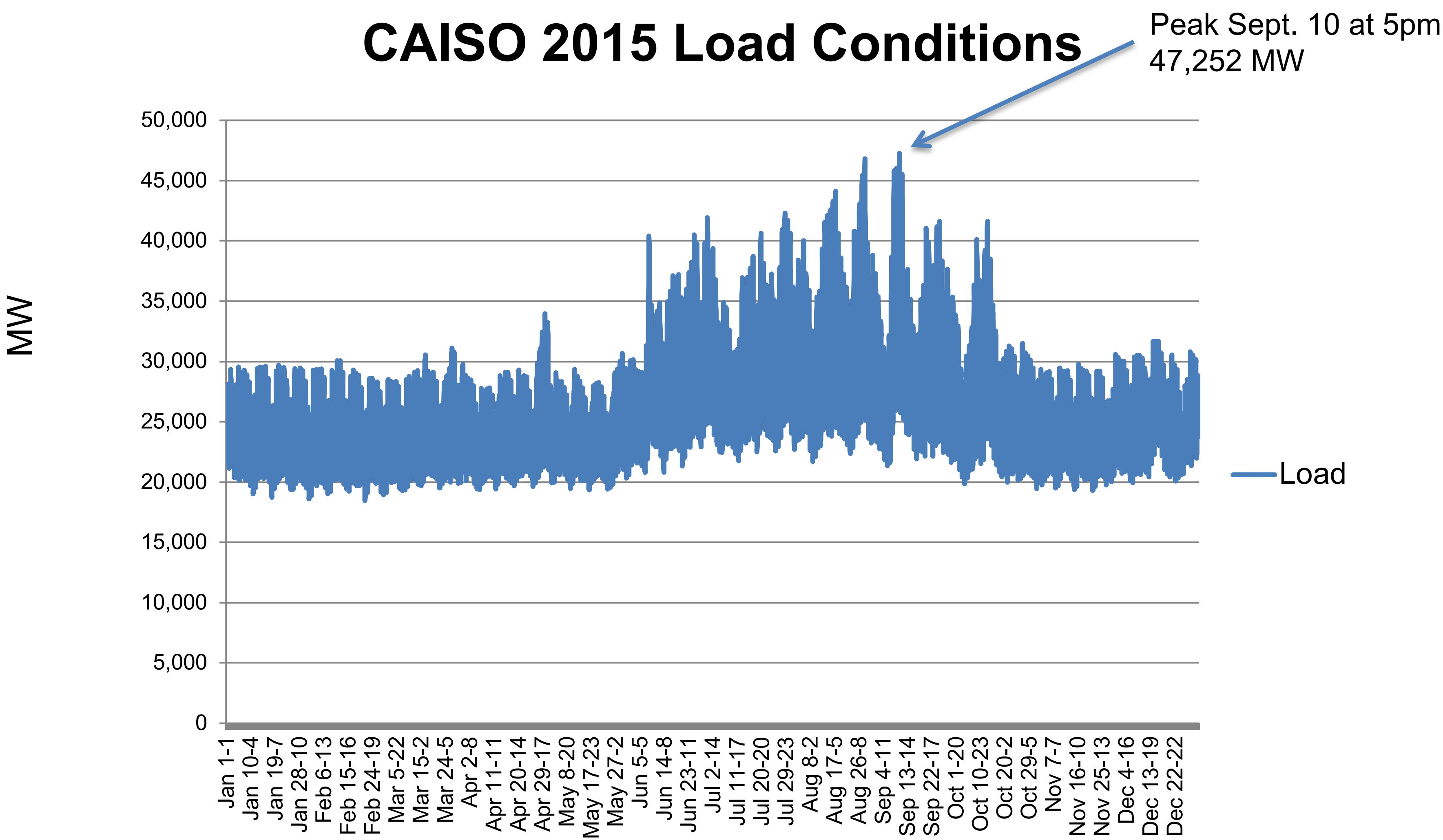
CAISO's Four Drivers of Transmission investment

1. Peak load
2. Policy
3. Economic resource access
4. Reliability

Local energy reduces transmission needs for each driver of transmission spending.

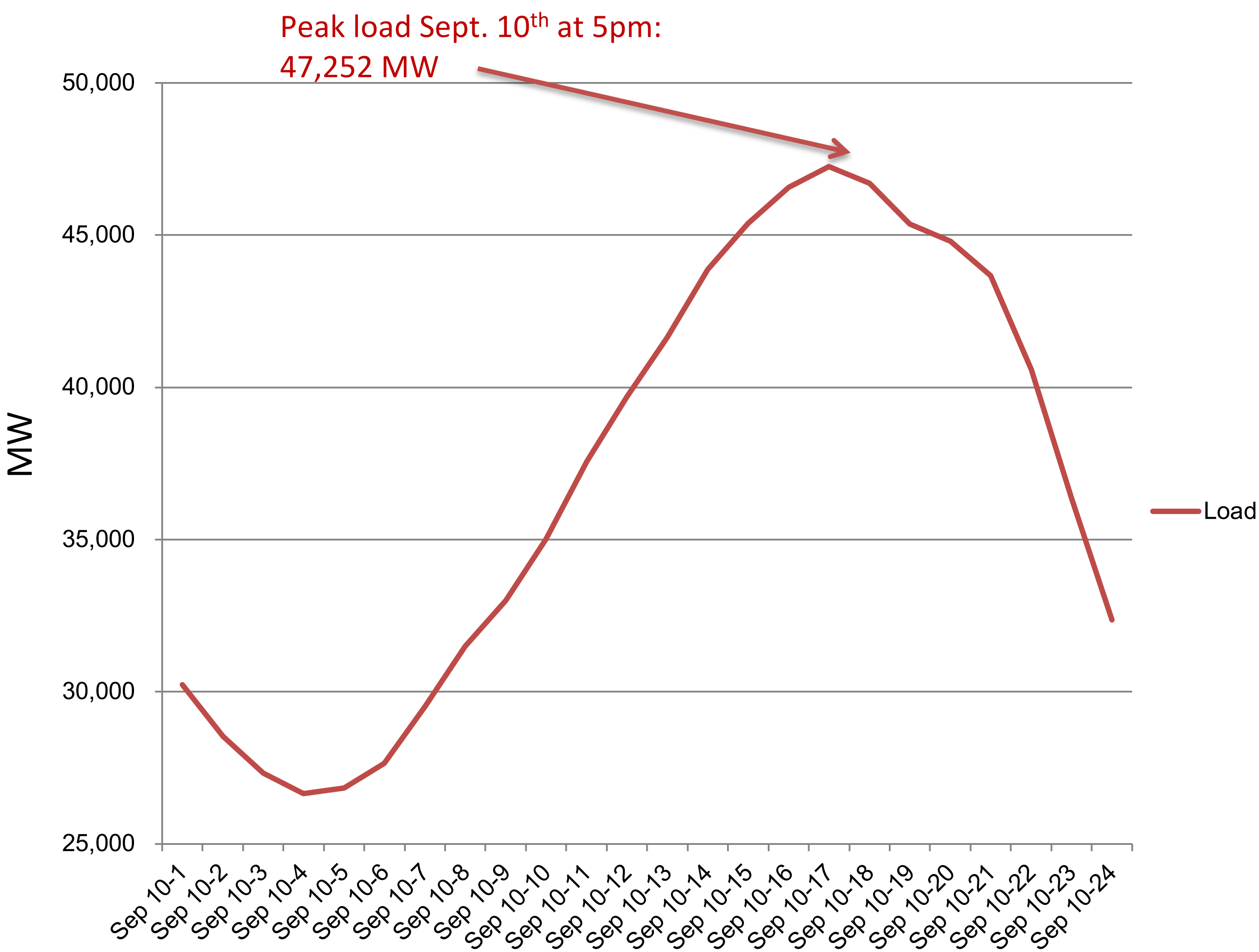
Four Drivers of Transmission investment— 1. Peak Load

Some transmission spending is to meet peak <u>transmission</u> load.



Four Drivers of Transmission investment— 1. Peak Load

What happens if you move generation to the distribution grid?



Four Drivers of Transmission investment— 1. Peak Load

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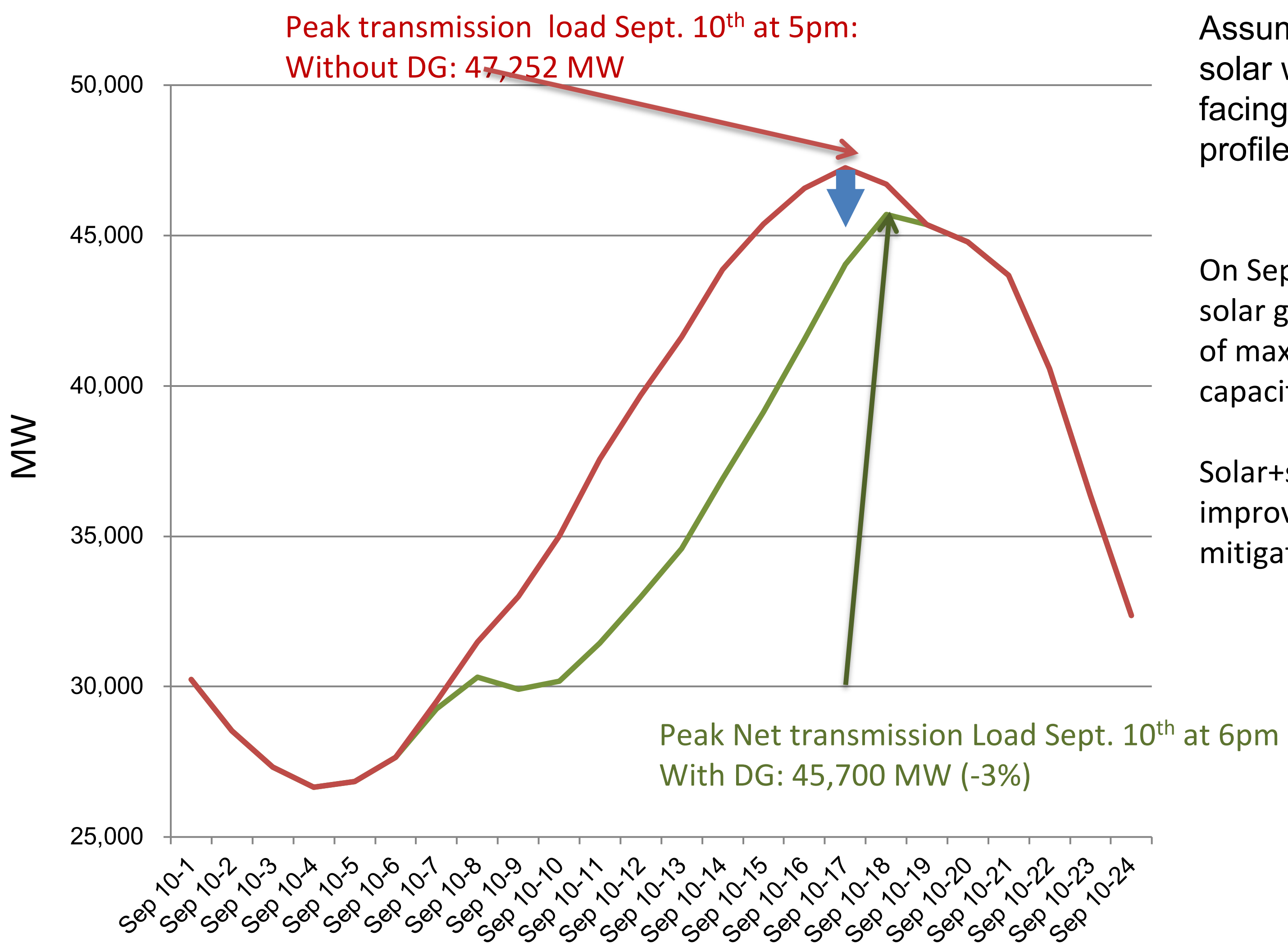
PV DG Production reduces **peak TRANSMISION load**



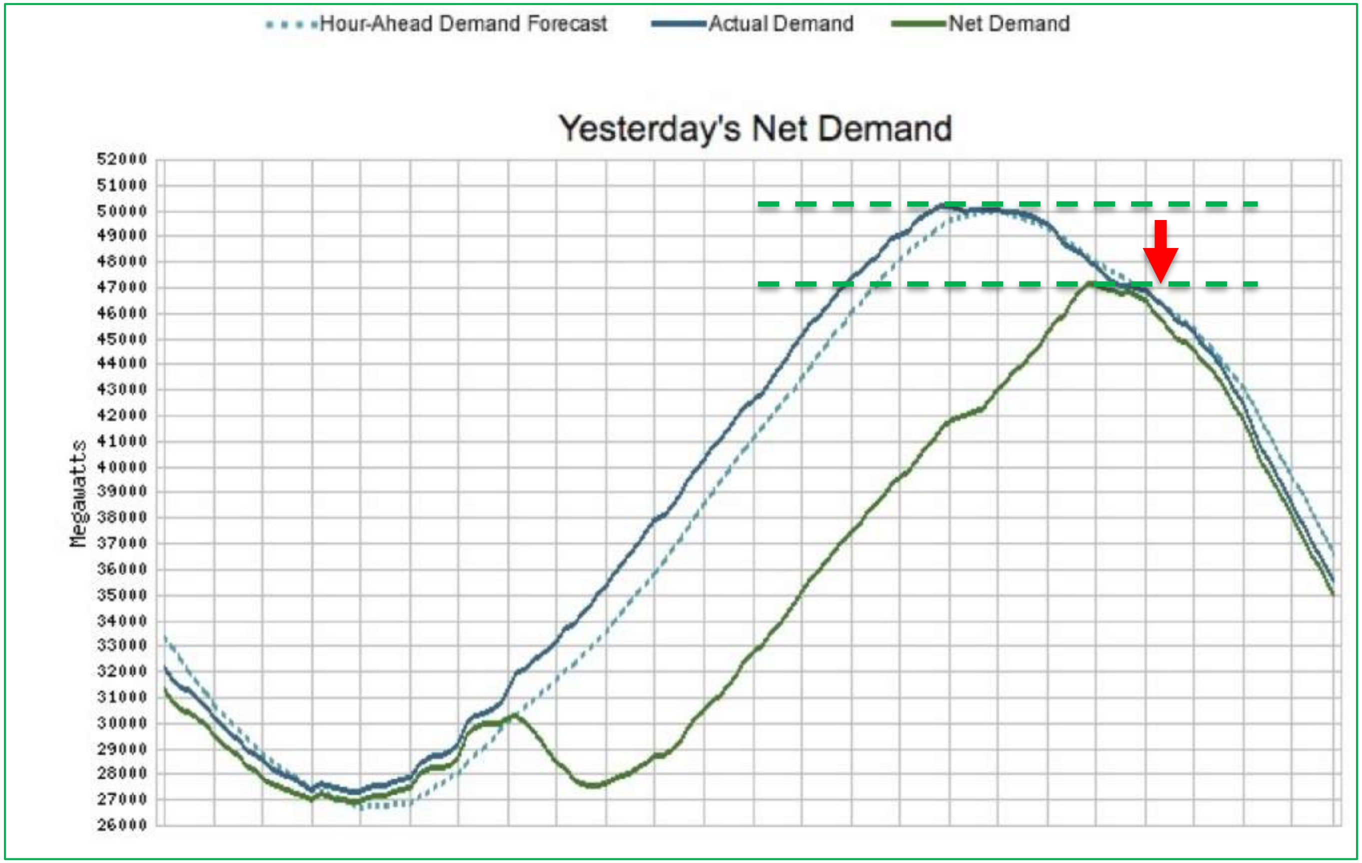
Assumes 10,000 MW solar with a fixed SW-facing Los Angeles profile.

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

Solar+storage would improve this peak mitigation.

Four Drivers of Transmission investment— 1. Peak Load

Sept 1, 2017, CAISO near record peak
Total demand (net DER) and contribution of Transmission level Solar & Wind

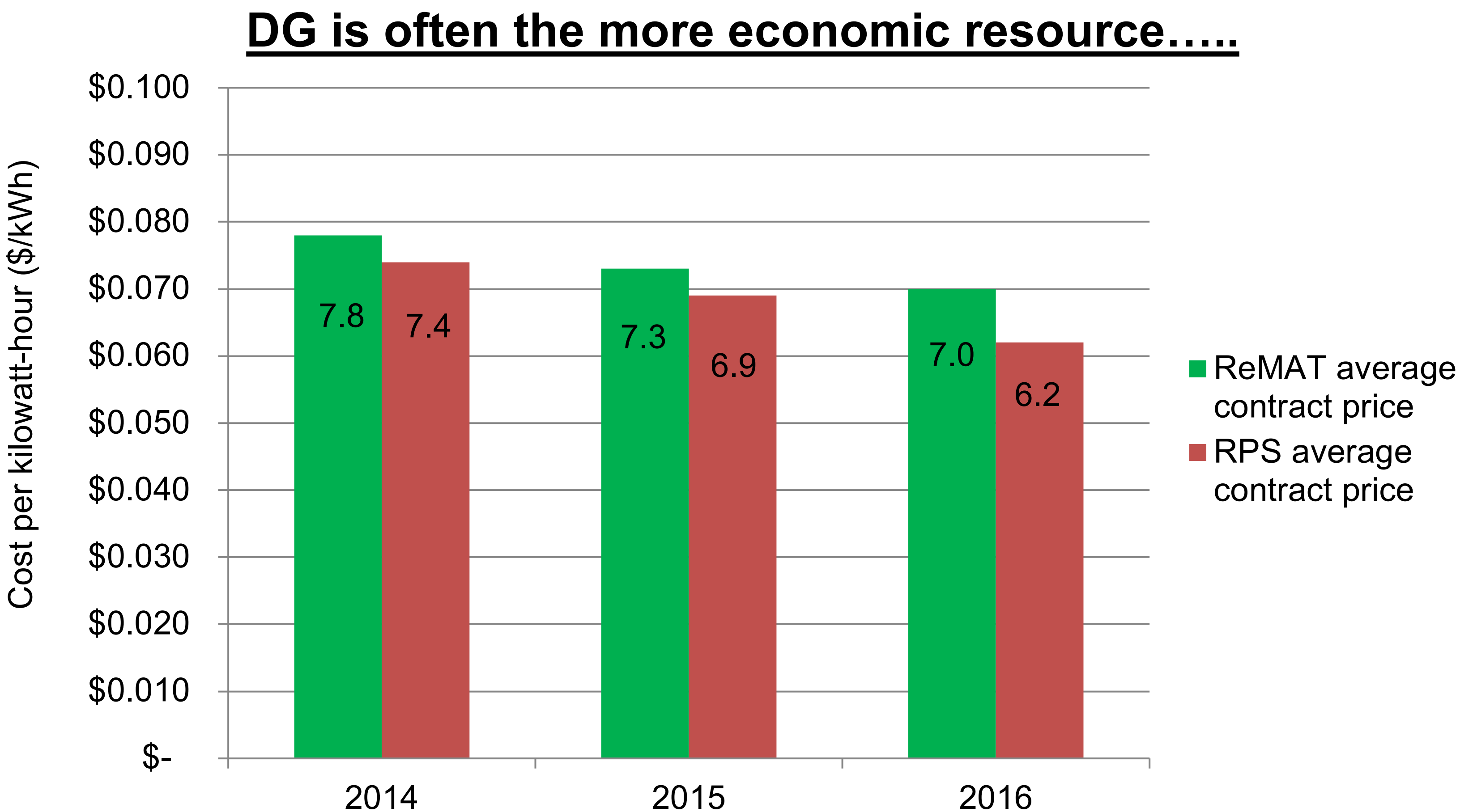


In the real world, DG cut peak TRANSMISSION demand by 6%

Some transmission spending has been to meet renewable goals

- **Aggregated wholesale distributed generation can be Renewable Portfolio Standard (RPS)-eligible resources.**
- **Policy goals are likely to make up a substantial portion of new transmission investment.**
  - Renewable Energy Transmission Initiative (RETI) 2.0 report estimates at least $5 billion in new transmission build will be required to meet the 50% RPS by 2030
  - Operations and maintenance costs increase that cost by 5x → $25b over 50 years
  - Plus financing costs (return on equity)

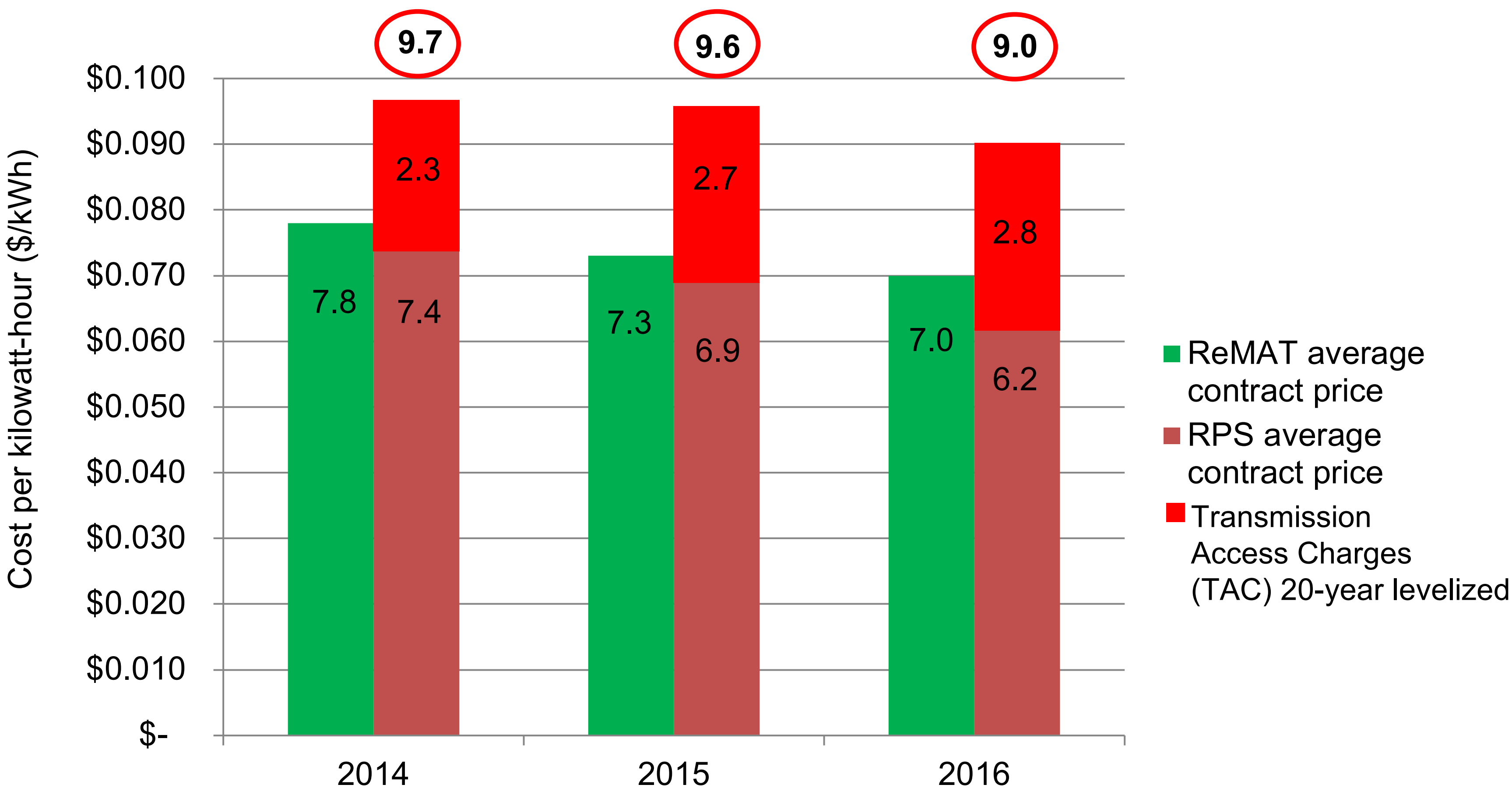
Some transmission spending is to reach cheaper resources



Data sources: 2014-16 RPS via CPUC; 2014-16 Renewable Market Adjusting Tariff (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.

Four Drivers of Transmission investment—3. Economics

…. once the costs of delivery are included



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Four Drivers of Transmission investment—3. Economics

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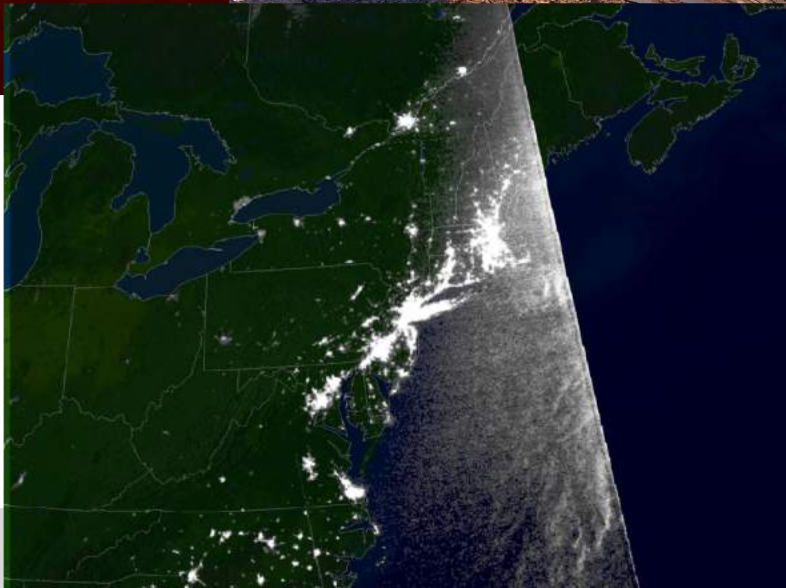
1. **Transmission isn't accessing cheap resources if procurement models misidentify the cheapest resource.**
2. DG reduces peak transmission load locally
   - DG frees up transmission capacity, creating opportunities for more cost-effective delivery of remote energy.
   - DG can reduce congestion and line losses costs.

Four Drivers of Transmission investment—4. Reliability

Some transmission spending is to meet reliability needs.

Ventura and Santa Barbara

Thomas Fire 2017



85,000 customers lose power from a “transmission emergency” from **“<u>loss of critical infrastructure</u>.”**

Fires grow because of power failure at water pumps.

Four Drivers of Transmission — 4. Reliability

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	Solar + Storage Alternative	Moorpark-Pardee Transmission line
Nameplate (MW) (solar)	240	
Additional storage (MWH)	825	
2019 Installed Cost	$487,359,169	$47,000,000
30-year O&M, RoE, and Depreciation Costs	$360,000,000	$175,950,000
Total Cost	**$847,359,169**	**$220,950,000**

This is **NOT** the right comparison!

This is **ALSO NOT** the right comparison!

Four Drivers of Transmission — 4. Reliability

Clean Coalition

DER reduces reliability costs by 80%

	Solar + Storage Alternative	Moorpark-Pardee Transmission line
2019 Installed Cost	$487,359,169	$47,000,000
30-year O&M, return, and depreciation Costs	$360,000,000	$175,950,000
Total Cost	$847,359,169	$220,950,000
Energy Cost (per MWH)	$70	
MWH/ year	384,000	
30 year energy (MWH)	11,520,000	
Total Energy Value	$806,400,000.00	$0.00
Total Ratepayer Cost	**$40,959,169.08**	**$220,950,000.00**

Four Drivers of Transmission investment—4. Reliability

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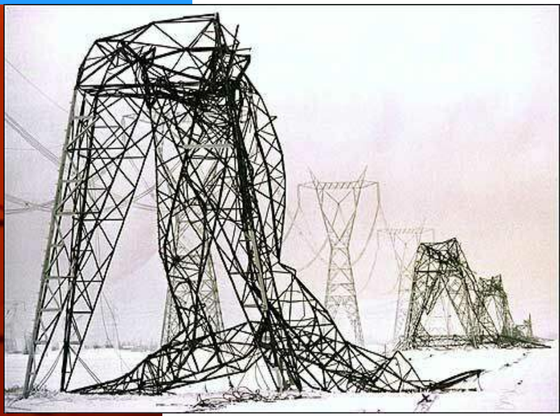
Cui bono?



Factor 1: Historical cost drivers

Does DG displace transmission? YES

- Which formula reflects how DG shapes transmission investment decisions?

1: Historical embedded cost drivers

Which formula better reflects the actual historical cost drivers?

	Transmission-reliant Load Serving Entity	Local Energy-reliant Load Serving Entity
Customer load	50 GWh	50GWh
Load growth	+10 GWh	+10 GWh
Local DG deployment	0	20 GWh
Load "growth"	+10 GWh	-10 GWh
Transmission Load	**60 GWh**	**40 GWh**
Total Transmission load (TED)	100 GWh	
Net Transmission growth	0 GWh	
Total Customer Energy Downflow	120 GWh	
Transmission Planning contribution	60%	40%

For further explanation, see
http://www.caiso.com/Documents/CleanCoalitionComments-ReviewTransmissionAccessChargeStructure-StrawProposal.pdf

FERC FACTOR

1: Historical embedded cost drivers

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Which system better reflects the actual historical cost drivers?

	Transmission-Reliant LSE	Local Energy-Reliant LSE
Customer load	50 GWh	50GWh
Load growth	+10 GWh	+10 GWh
Local DG deployment	0	20 GWh
Load "growth"	+10 GWh	-10 GWh
Transmission Load	**60 GWh**	**40 GWh**
Total Transmission Load	100 GWh	
Total Customer Load	120 GWh	
Transmission Planning contribution	60%	40%
Formula 1 – Transmission Energy Downflow billing	60%	40%
Formula 2 – All Customer Energy Billing	50%	50%
Net mitigation penalty/ subsidy	**17% subsidy**	**25% penalty**

The $63,900,000,000 question

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So, which system is better?

	Formula 1: Transmission energy downflow billing	Formula 2: Customer energy downflow billing
Aligned with Cost Drivers?		
Beneficiaries?		
Economic market distortions?		

2: Current beneficiaries

Without allocating costs to those who are actually using the transmission grid, "cost allocation methods … may fail to account for the benefits associated with new transmission facilities and, thus, result in rates that are not just and reasonable or are unduly discriminatory or preferential."

-FERC Order No. 1000

FERC FACTOR

2: Current beneficiaries

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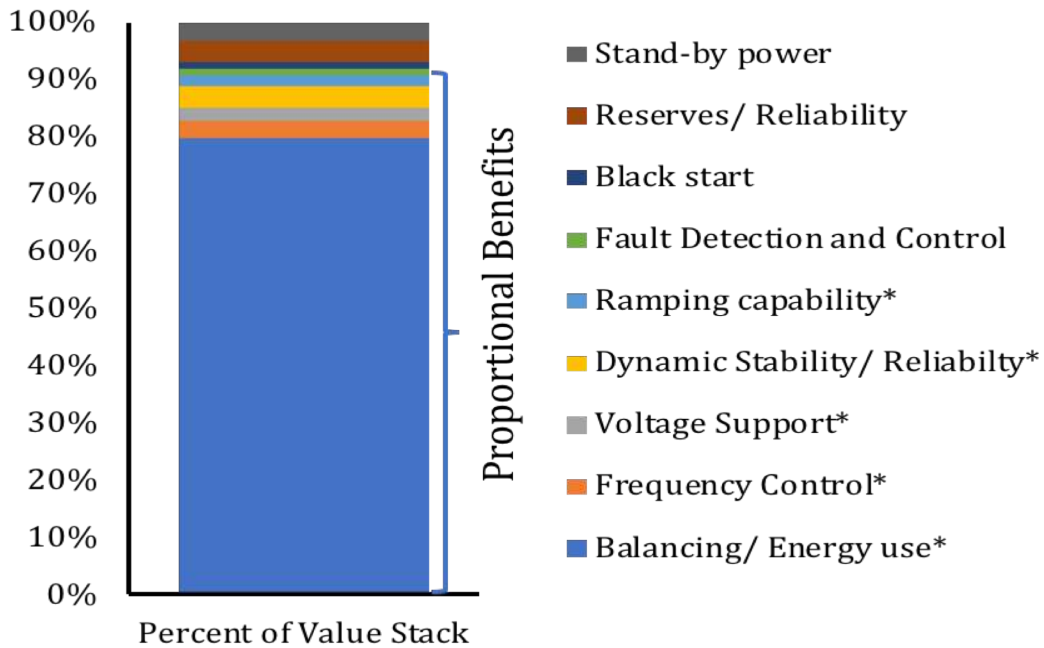
A few years later, both LSEs have seen growth of 10GWH
One LSE mitigates that growth, the other does not….

	Transmission-Reliant LSE	Local Energy-Reliant LSE
Customer load, a year later	70 GWh	70GWh
Load DG energy	0	30
Transmission sourced energy	70 GWh	40 GWh
Transmission Load	**70 GWh**	**40 GWh**
Total Transmission Load	110 GWh	
Net Transmission growth	10 GWh	
Total Customer Load	140 GWh	
Relative transmission use	64%	36%
Formula 1: Transmission use billing	64%	36%
Formula 2: All Energy Billing	50%	50%
Net mitigation penalty/ subsidy	**22% subsidy**	**38% penalty**

The energy system provides other services



- These services are not transmission-specific services.
- Unjust and reasonable to charge LSE customers the same charge if they are not getting these services from transmission to the same degree

The $63,900,000,000 question

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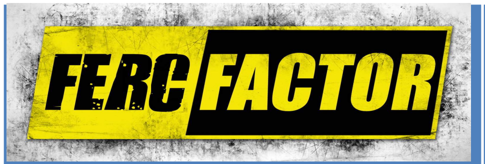
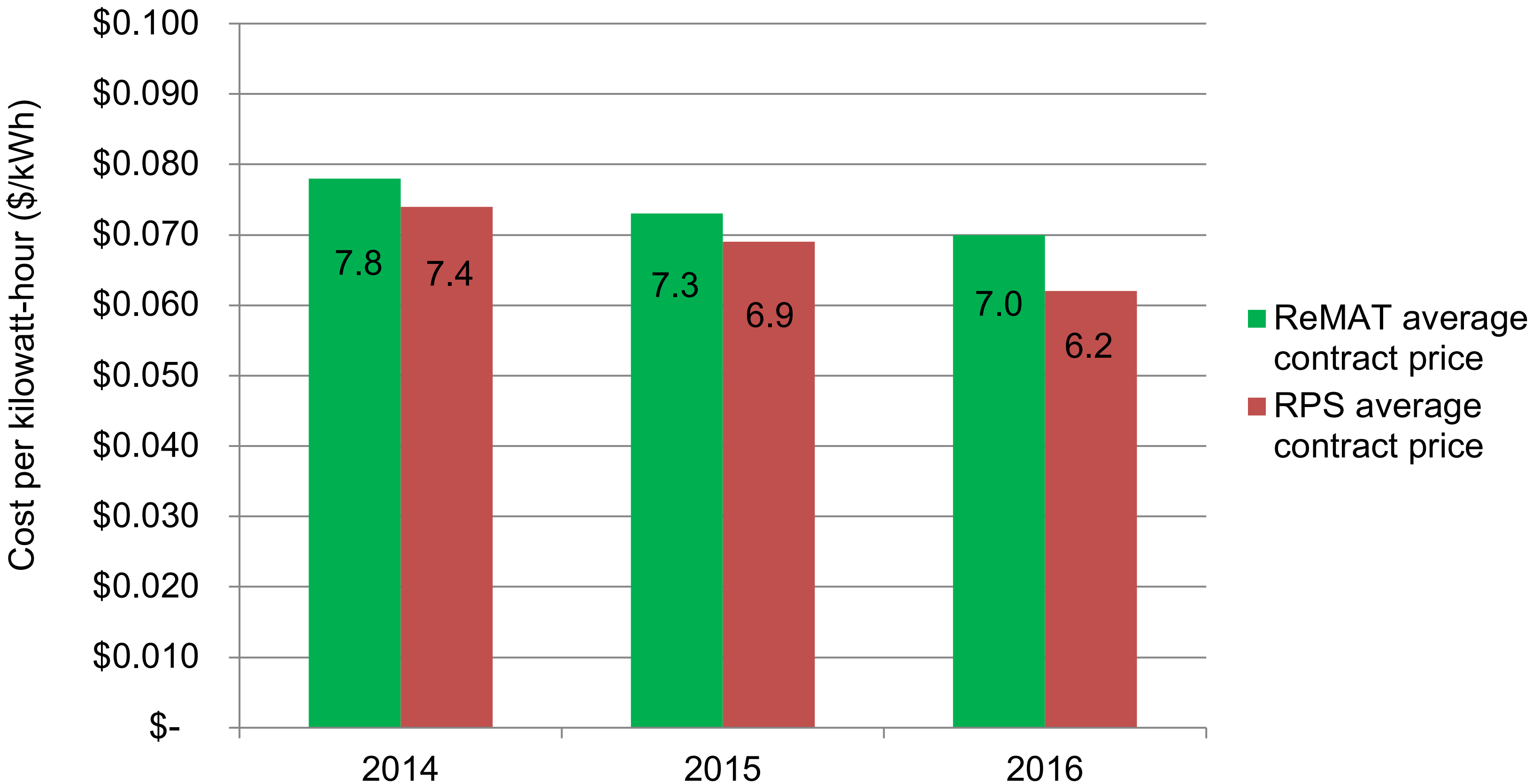
	Formula 1: Transmission energy downflow billing	Formula 2: Customer Energy Downflow billing
Aligned with Cost Drivers?		
Beneficiaries		
Economic market distortions		

DG is often the more economic resource…..



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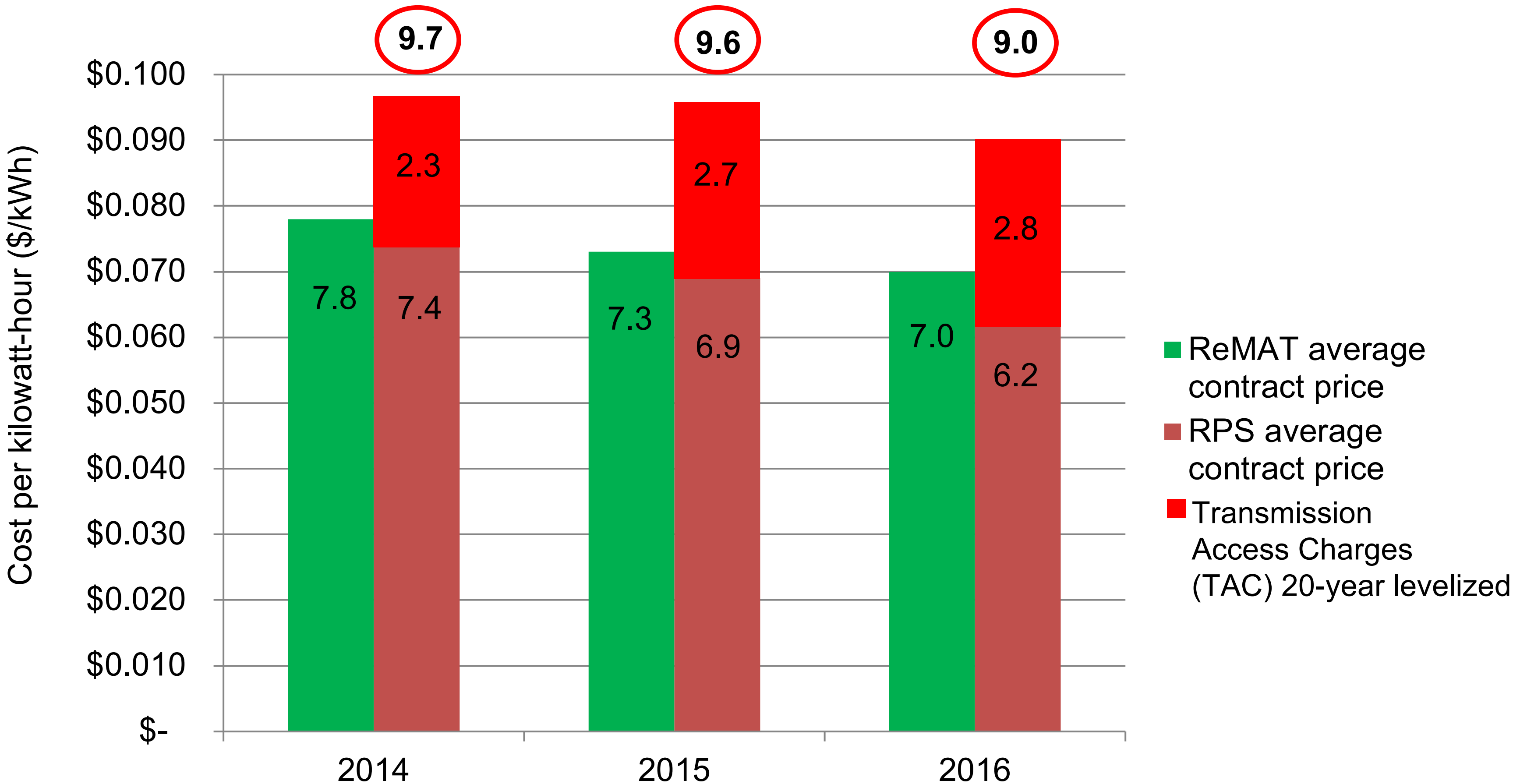
…. once the costs of delivery are included



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3: Market distortions & perverse incentives

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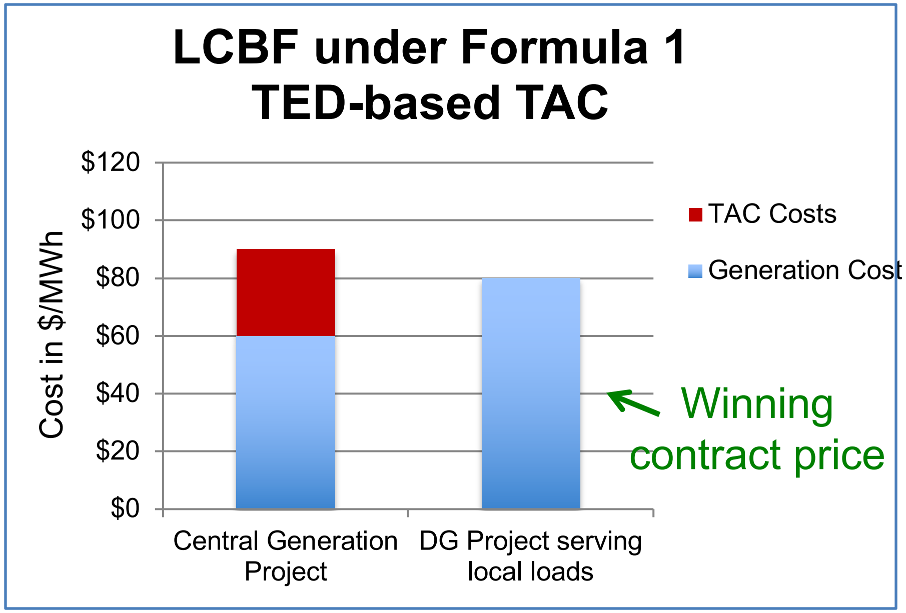
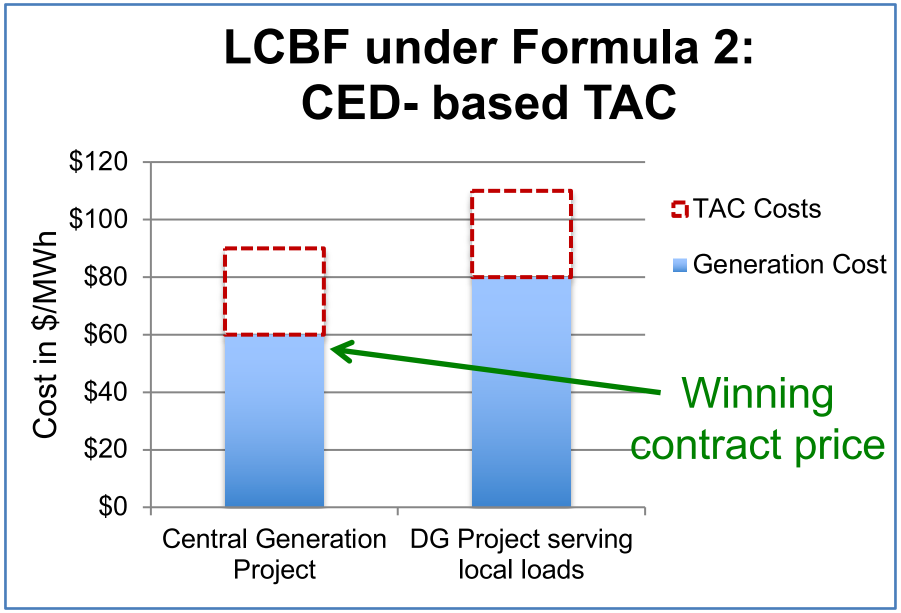
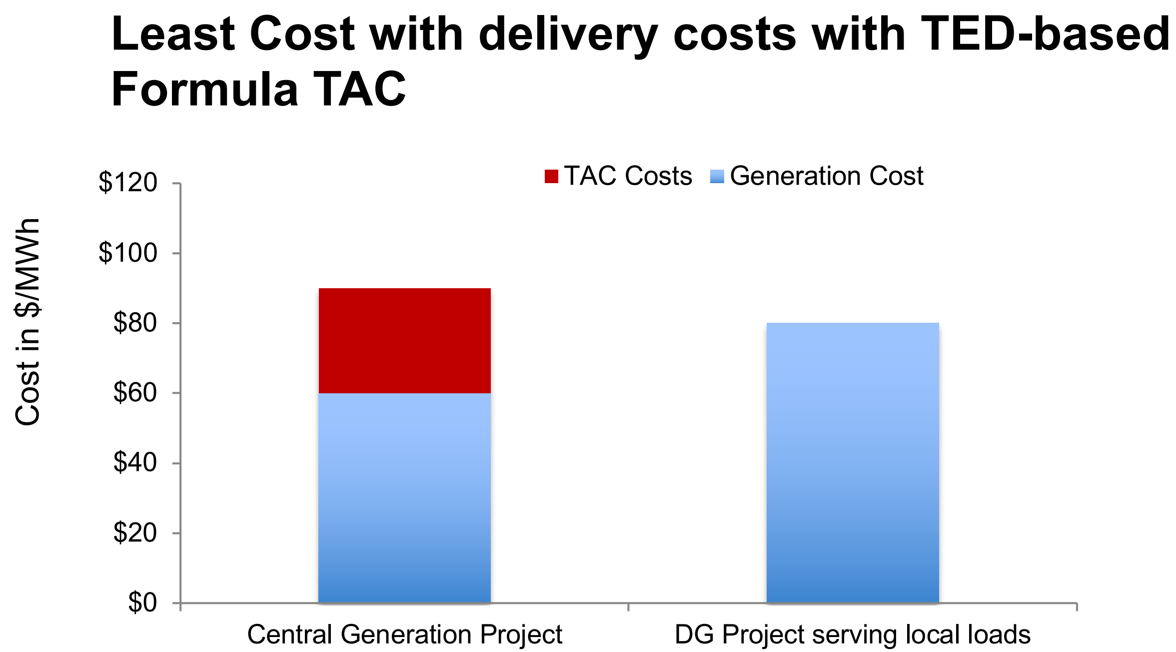




- Transmission Energy Downflow (TED)-based TAC will allow the costs of the transmission delivery system to be incorporated into procurement decisions.
- Where local energy is cheaper, including delivery, these will be procured
- Where transmission-sourced energy is cheaper, including delivery these will be procured

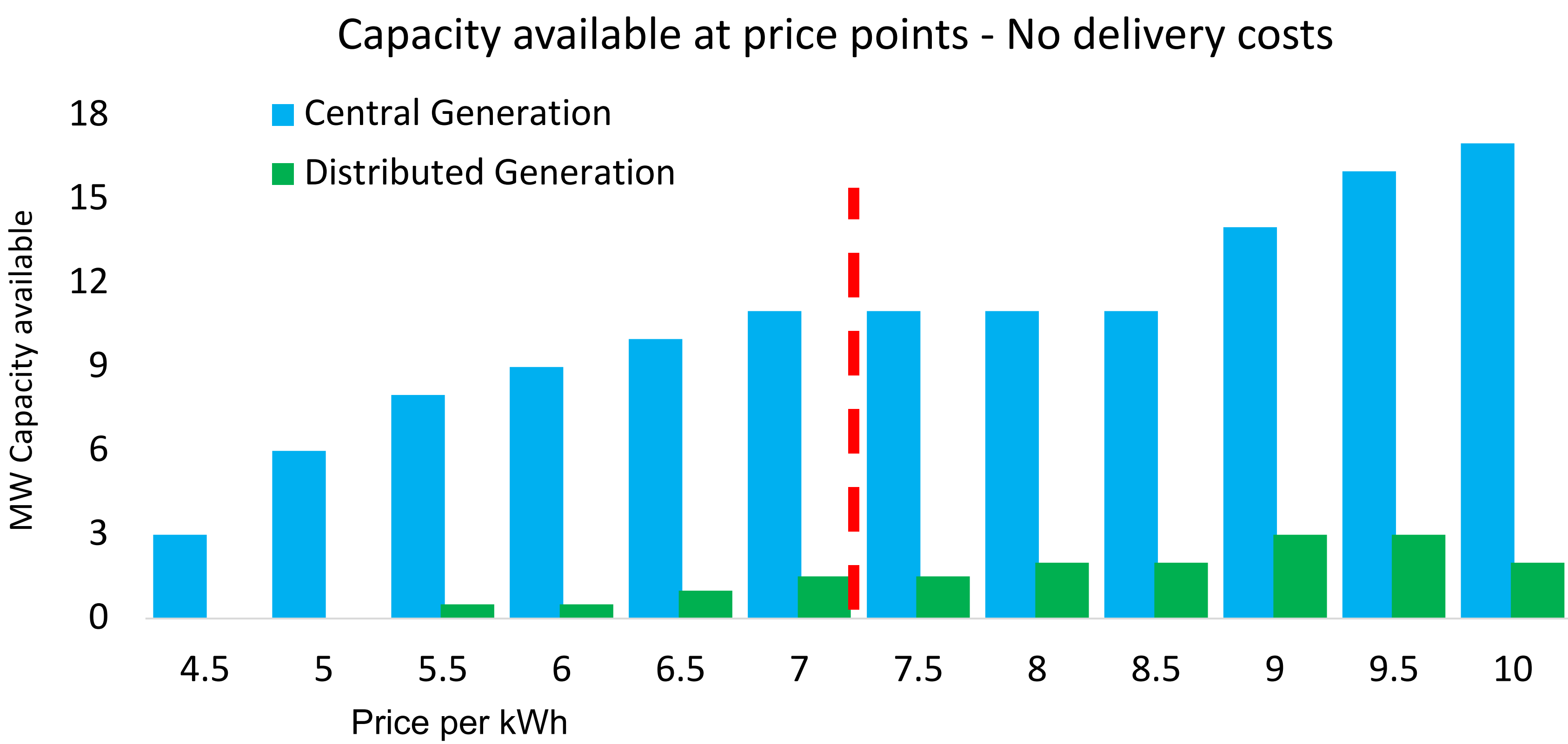
3: Market distortions & perverse incentives



- Procurement costs include both costs of generation and delivery.
- Existing LCBF methodologies can incorporate this cost information without additional regulatory changes.

Hypothetical 50 MW procurement

- System 2: CED-based TAC, delivery costs ignored



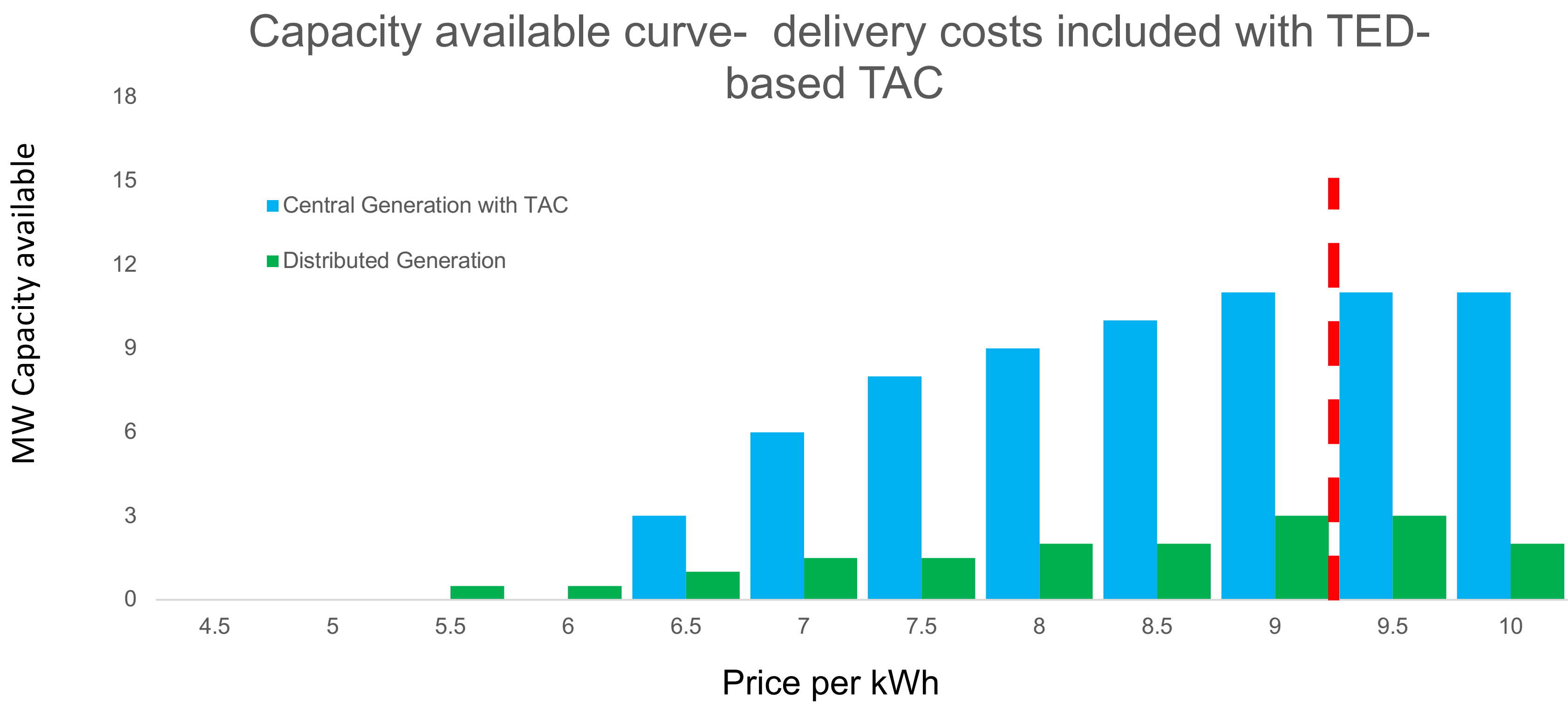
50 MW capacity procured:

47 MW central Generation, 3 MW Distributed

@7 cents per kWh or lower (+2 cents/ kWh TAC)

Hypothetical 50 MW procurement

- System 1: TED-based TAC, delivery costs included
- Same bids +2 cents/kWh charge for transmission sourced offers



50 MW capacity procured:

42.5 MW central Generation, 7 MW Distributed

@9 cents per kWh or lower (+no additional TAC added)

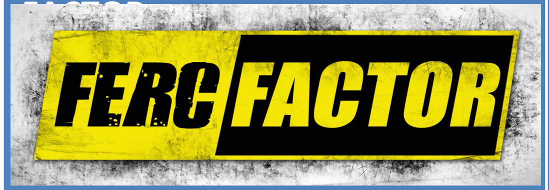
Which formula delivers the lowest overall costs?

	Transmission – sourced	Distribution grid- sourced	Average price per kWh including TAC
Formula 1: TED-Based TAC	42.5 MW	7.5 MW	**$0.0781**
Formula 2: All-energy TAC	47 MW	3 MW	**$0.08125**

TED-Based TAC

Results in more DG winning procurement contracts
Results in lower overall costs to ratepayers
How much more DG results depends on the overall distribution of bids.

The $63,900,000,000 question

	System 1: Transmission use billing	System 2: All energy billing
Aligned with Cost Drivers?		
Beneficiaries		
Economic market distortions		

Formula 1: TED – based TAC

wins on all three factors

So what?

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Transmission costs will explode… unless constrained

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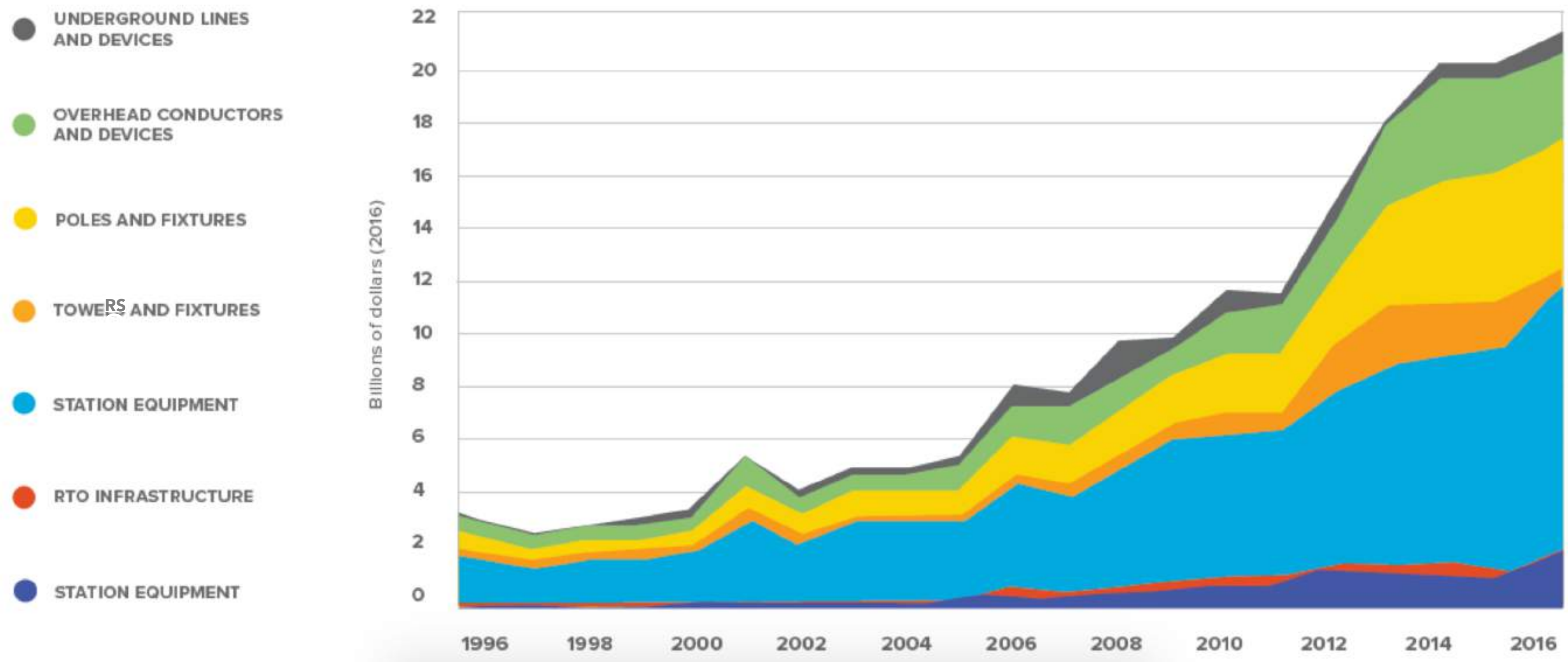
THE EXPLOSION IN TRANSMISSION INVESTMENT OVER THE PAST DECADE

Investment In Transmission Infrastructure by Major Utilities (1996-2016)

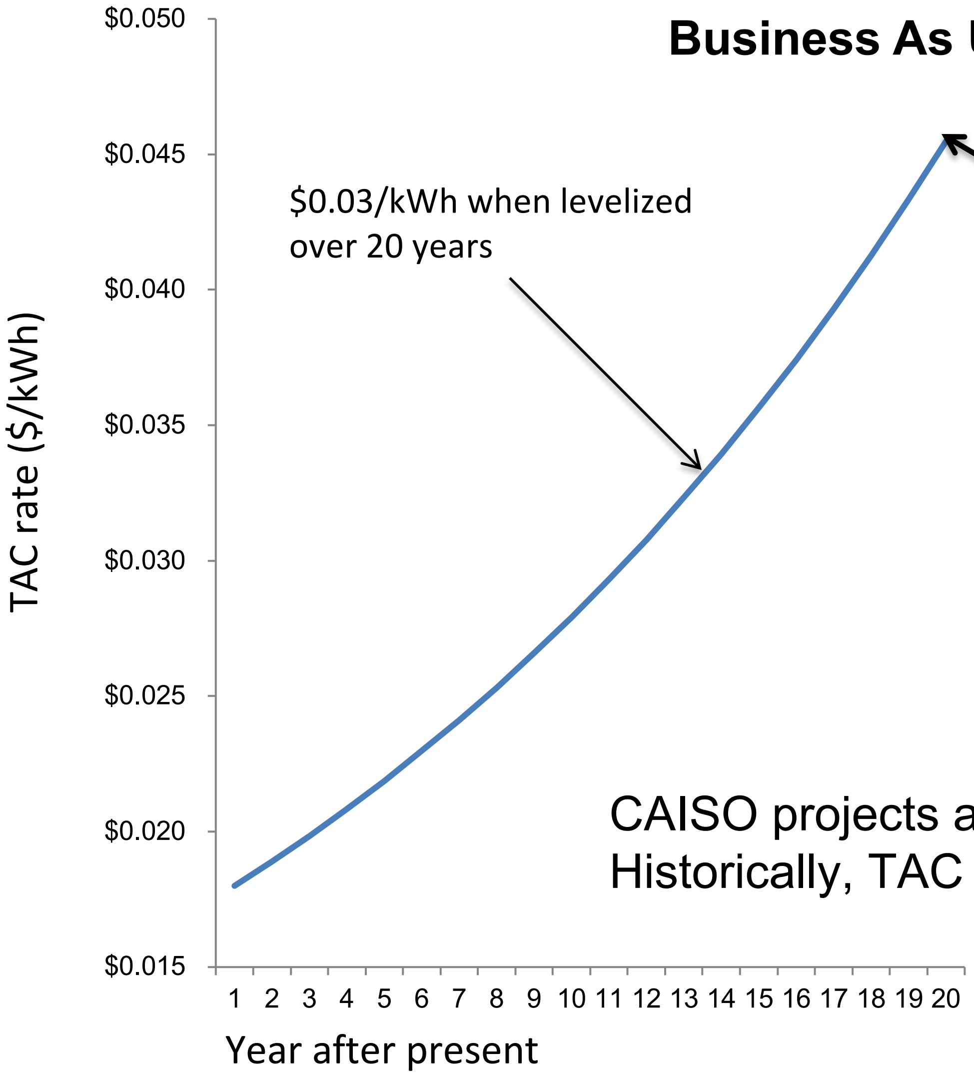


Source: SunRun, data from the U.S. EIA

Impacts of TED-based TAC on TAC growth rate

Forecasted PG&E Total TAC Rate

Business As Usual (BAU)



BAU
(Current baseline trends would result in 12.4% of load met by local renewables after 20 years)

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.

CAISO projects a 5% real growth rate in TAC
Historically, TAC rates have grown between 9% and 11%

Clean Coalition

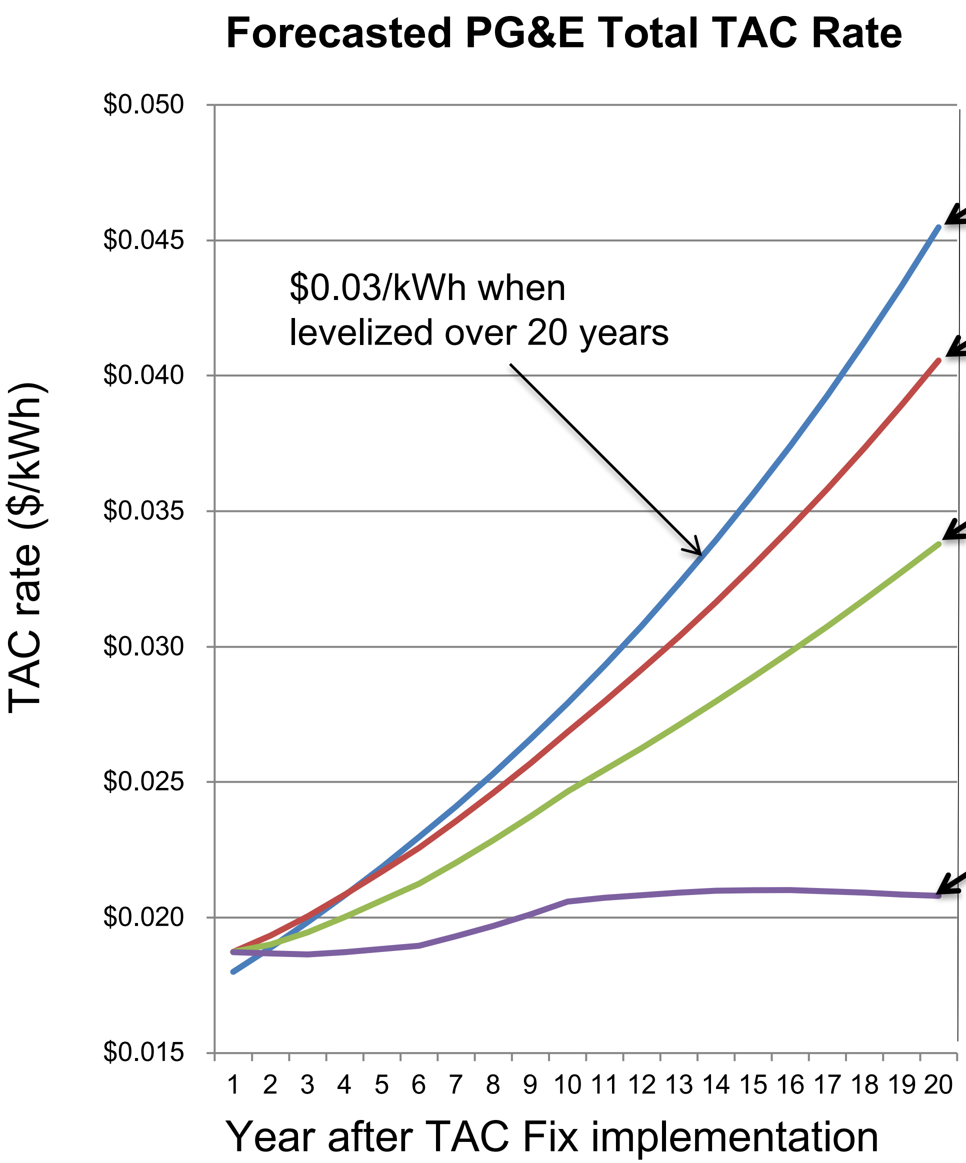
DER reduces existing and future transmission costs

DER deployment can reduce the need for future transmission grid investment.

- Growth of local solar puts plans for $115 million transmission project on hold, 12/2016, Fresno Bee:
- $192 million in PG&E transmission projects cancelled due to energy efficiency and local solar, 5/2016, Greentech Media:
- Efficiency, DERs saving $2.6B in avoided transmission costs, CAISO says, 3/2018, Utility Dive

How much transmission spending could accelerated DG growth avoid?

Clean Coalition



TAC savings over 20 years:

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

$23.5 billion TAC savings vs BAU (17.3% local renewables)

$38.5 billion TAC savings vs BAU (22.2% local renewables)

$63.9 billion TAC savings vs BAU (31.5% local renewables =

68.5% transmission connected resources which continue to support TRR for existing transmission

Hunters Point Economic Benefits from 50 MW DER

$200M in private investment + Operations & Maintenance over 20 years local economic benefits:

Photo courtesy of GRID Alternatives

Economic Benefits

$200M: Added regional economic stimulation

$100M: Added local wages, near-term plus annual

1,270 Job-Years: New near-term regional employment

520 Job-Years: New ongoing regional employment

$10M: Site leasing income for property owners

$5.8M: Added construction-related state sales taxes

Source: NREL JEDI calculator. Based on average installed cost of $2.75/W(dc) before taxes & incentives using PG&E rates/region.

Agenda

1. Why you should care about distorted Transmission Access Charges (TAC)
2. What TAC are
3. Which TAC formula is best
4. Why bad rate designs costs ratepayers billions of dollars in unnecessary transmission spending
5. **How to fix these problems**
6. Next steps in California

Answering the $63,900,000,000 question

	System 1: Transmission use billing	System 2: All energy billing
Aligned with Cost Drivers?		
Beneficiaries		
Economic market distortions		

Use the winning Formula 1:
<u>TED – based TAC</u>

The Clean Coalition Proposal, part 1:

Clean Coalition

Step 1: Use Formula 1: TED-Based TAC:

Recover the costs of the high voltage (HV) transmission grid with

-a fee

-on energy crossing **the transmission grid**.

HV Transmission Revenue Requirement:

money to be recovered to pay for the transmission grid

T-D TED: the energy flowing across the transmission grid

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

The Clean Coalition Proposal

Clean Coalition

- This proposal involves:
  - No change in the TRR reporting process
  - No change in TRR
  - No change in operations
  - No change in TAC formula*

- Only a change in *where* energy is measured

*Additional features such as demand charges can be added, provided they are based on TED.

Use the winning
Formula 1: <u>TED – based TAC</u>

- Formula 1 TED-based TAC wins based on Rate Design considerations alone, regardless of impacts on procurement.
- Formula 1 TED-based TAC also wins if the change can shape procurement

Clean Coalition

Realizing the $64 billion savings requires price signals to reach procurement departments.

Non-PTO Municipal Utilities already TED.

Investor Owned Utilities' Least-Cost-Best-Fit automatically incorporates price signals if TAC formula changes

Community Choice Aggregators see no price signal of any kind.

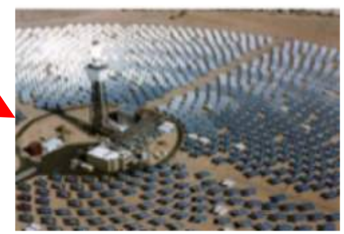
This is a problem

Understanding TAC Billing

Step 1: Load Serving Entities procure energy for their customers

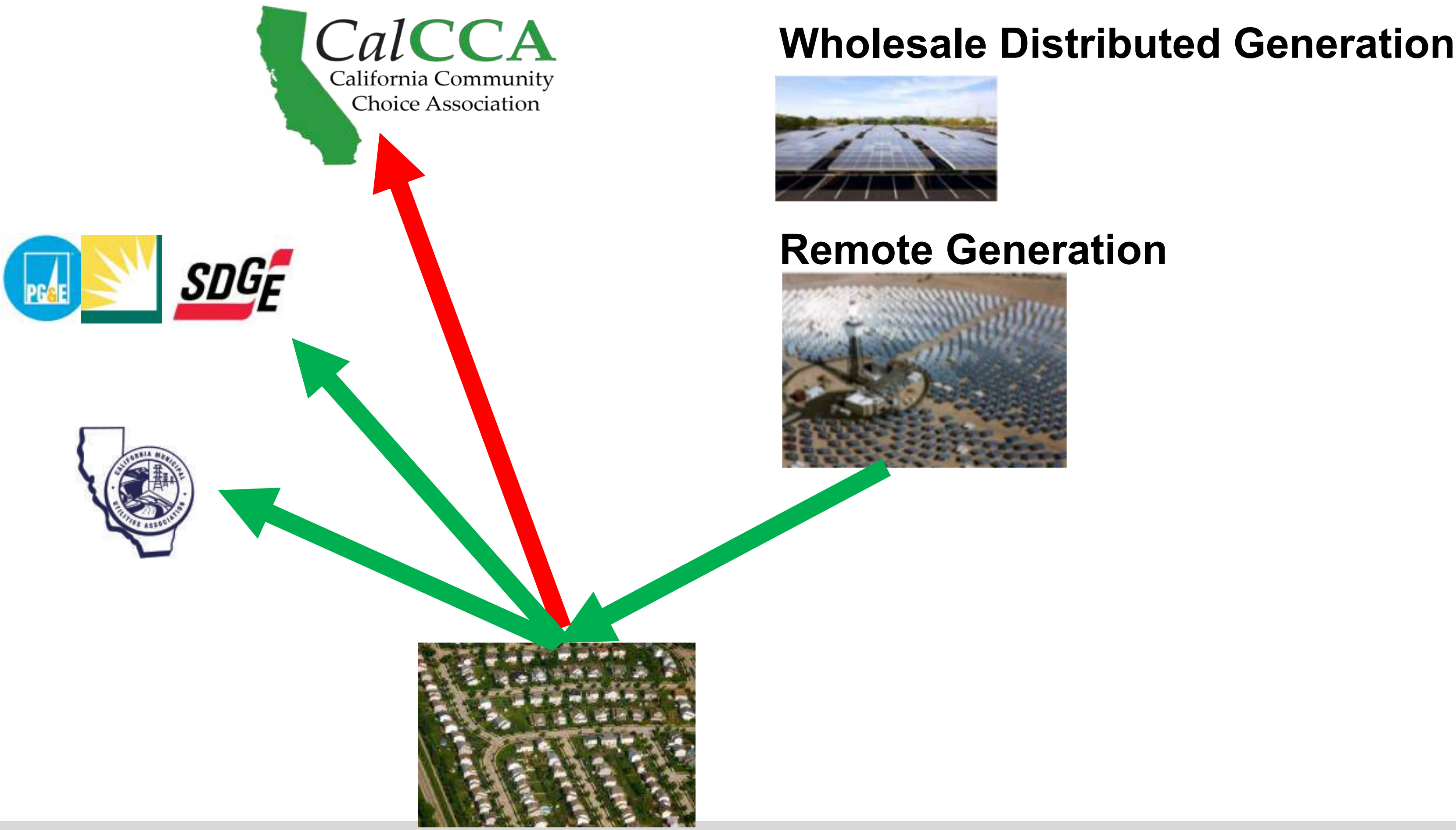
Wholesale Distributed Generation

Remote Generation



Understanding TAC Billing

Step 2: CAISO and investor-owned utilities (IOU) bill ONLY IOUs and Municipals for TAC CCAs never see any bills for TAC



Understanding TAC Billing

Problem:

1. CCAs never see the bill for transmission, so they can procure remote resources without regard to the transmission costs.
2. This drives up transmission costs for ALL ratepayers.
3. Without a price signal, CCAs create demand for transmission that is paid for by someone else.

This is a market distortion inherent in California's TAC rate design.

Agenda

1. Why you should care about distorted Transmission Access Charges (TAC)
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6. **Next steps in California**

Two potential Solutions (from many)

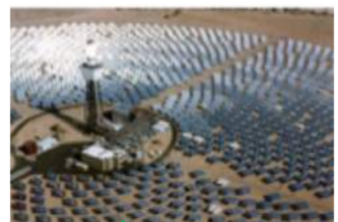
Solution 1: bill CCAs for their share of TAC

CalCCA
California Community Choice Association

PG&E SDGE

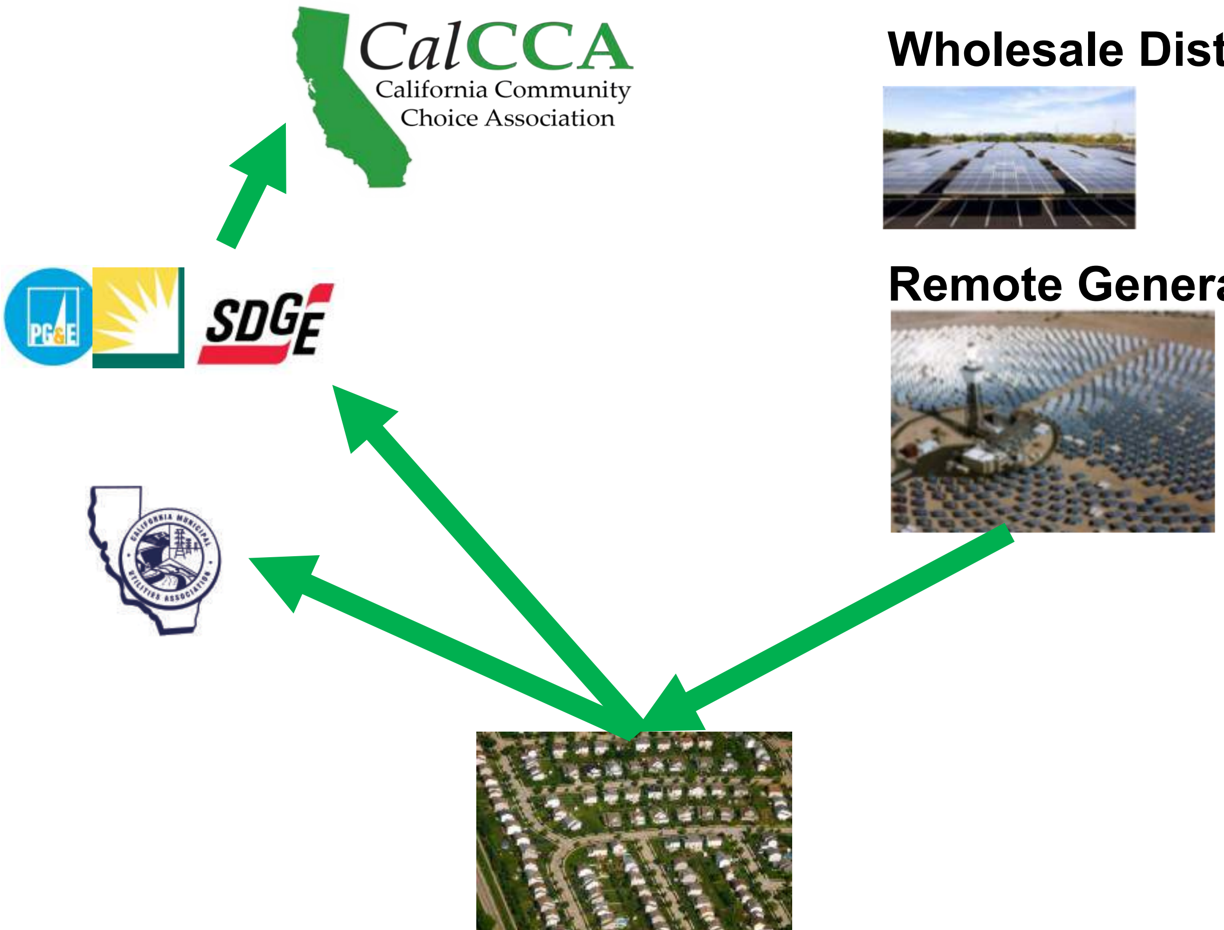
Wholesale Distributed Generation

Remote Generation



Two potential Solutions (from many)

<u>Solution 2: IOUs credit CCAs for their WDG procurement</u>



Clean Coalition proposal for next steps

Clean Coalition proposal for SB 692 (Allen)"bill concept"*

1. California recognizes that DER play a key role in cost-effectively meeting climate goals and restraining the growth of transmission costs.
2. California policy to have procurement include the costs of delivery
3. A joint CPUC/CAISO/IOU/CCA stakeholder process to develop a consensus solution.
4. If that fails, implement TED-based TAC and LSE TAC billing

Not final, not yet formally analyzed or approved!

Me, out on a limb

What you can do

1. Give us better ideas!
2. Support SB 692 (Allen) as it moves forward.
3. Talk to your IOU, CCA, CAISO, and CPUC to spur a solution!

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
- TeMix — Transactive Energy Services
- TerraVerde Renewable Partners
- Voltaic Capital Markets LLC
- Yaskawa Solectria Solar
- Solar Engineering Consultants

Clean Coalition

Questions?

Additional Information:

visit www.clean-coalition.org/tac

or email doug@clean-coalition.org

DER provide essential reliability services.

- Energy storage can provide frequency and voltage stability services under varying real load conditions. [1, 2]
  - Solar+Storage can provide real power
  - Automated DR can manage load profiles
  - Advanced inverters can provide reactive power for voltage support if needed.
  - DERs also provide resiliency by adding diversity to the generation portfolio.

1 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.
2 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.