

Clean Coalition

Making Clean Local Energy Accessible Now

The Distribution System Operator (DSO) Future

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The fastest path to the
renewables-driven DER future

What are the
roadblocks and problems
to getting to a
high distributed energy resource (DER)
future?



What is slowing us down?

What are the problems we will need to solve?

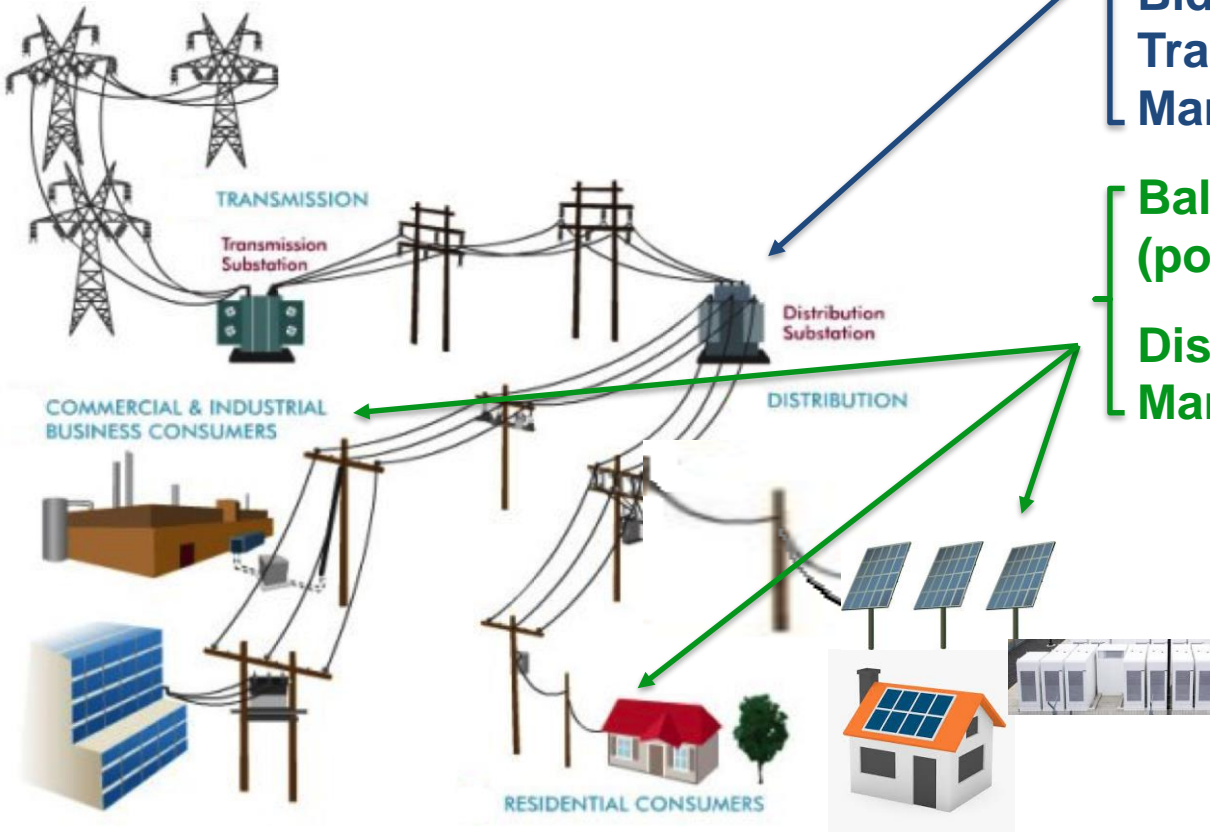
1. Improve reliability and simplify grid operations
2. Eliminate market distortions
3. Save ratepayers money
4. Capture the value stack for DER



The Distribution System Operator (DSO): A dedicated operator of the distribution grid

The DSO manages

**Centralized
Generation**



- Interactions with the Transmission Grid
- Bidding of energy services into Transmission-level Wholesale Markets
- Balancing within Distribution grid (power, voltage, frequency)
- Distribution-level Energy Services Markets

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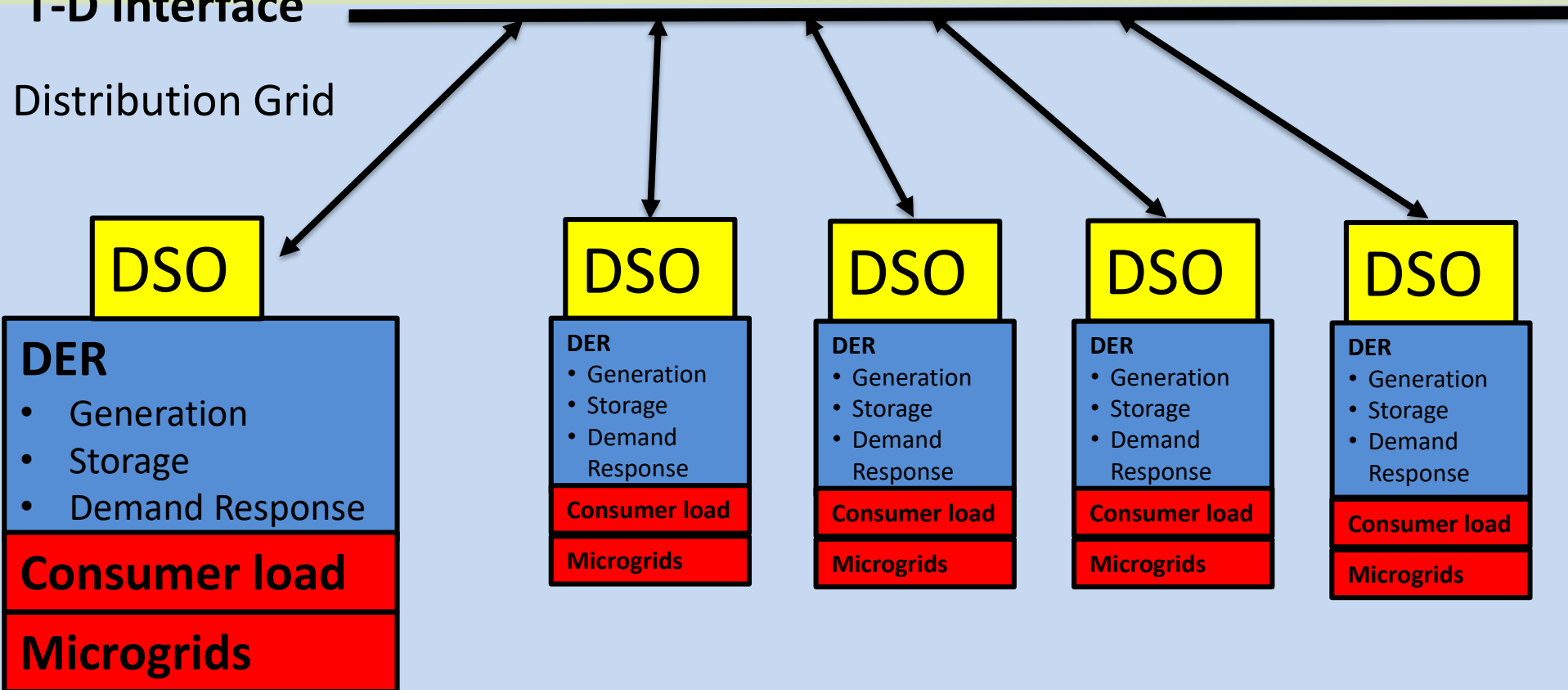
The DSO Grid Model

Transmission Grid

Transmission System Operator

T-D Interface

Distribution Grid



Step 1:

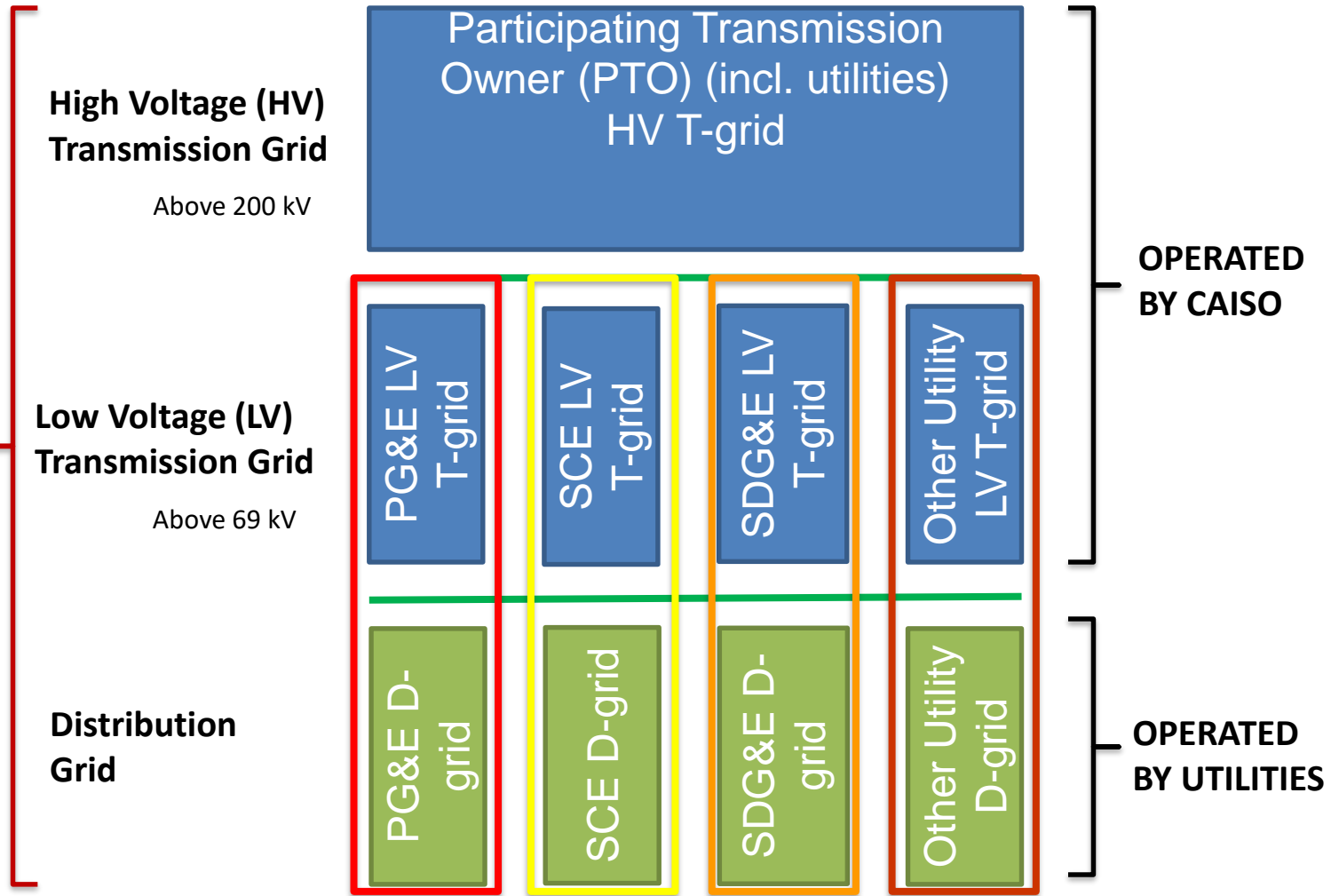
Separate transmission from distribution

Split existing utilities from transmission assets with a
bright line separation
between transmission and distribution businesses.

There is no (big) step 2

Transmission & Distribution Facilities

UTILITIES OWN TRANSMISSION & DISTRIBUTION



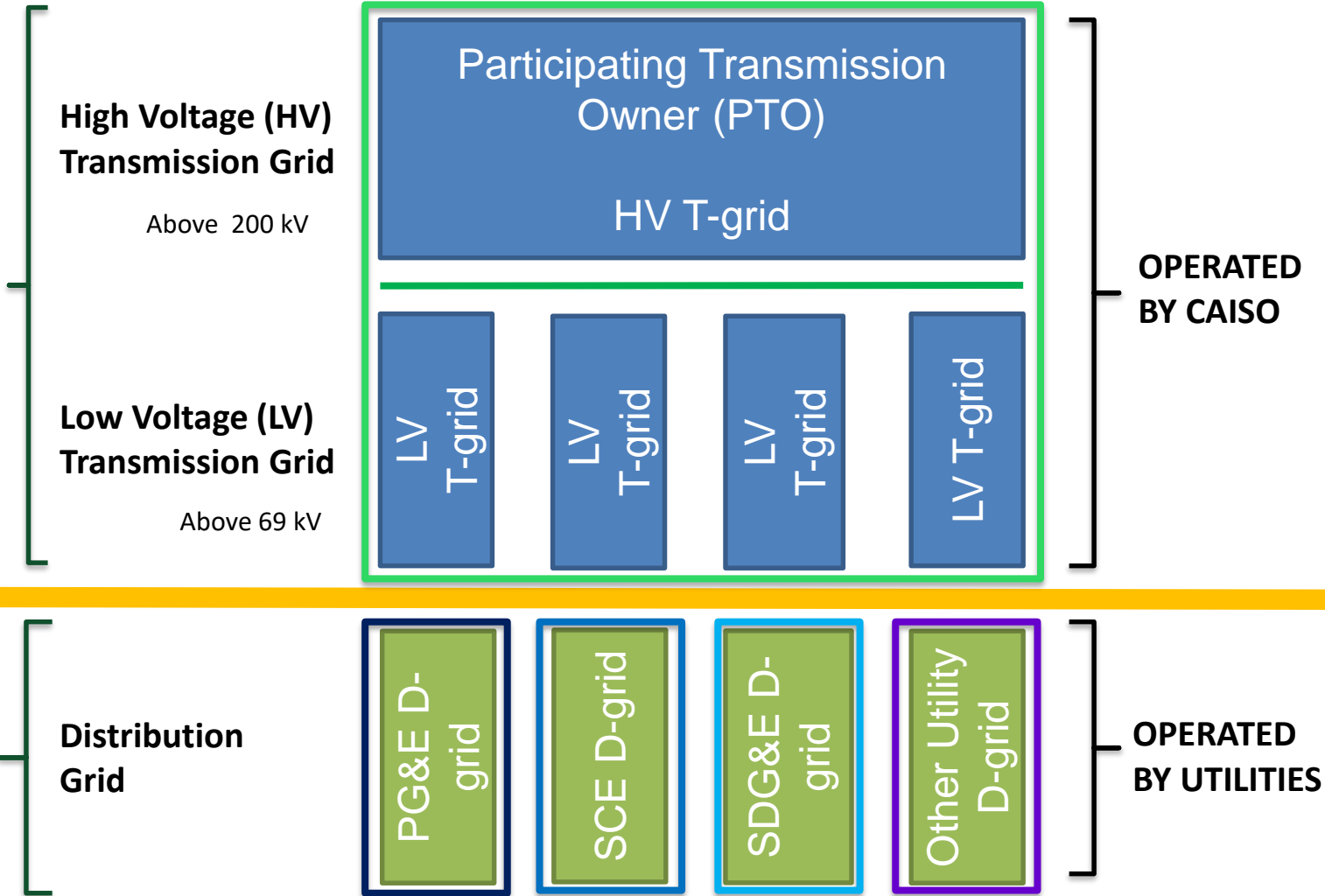
Clean Coalition Proposal: Restructuring to improve competition and innovation



Transmission & Distribution Facilities

Only Participating Transmission Owners
own transmission assets

BRIGHT LINE
↓



Utilities
own & operate distribution only

One weird trick to reform your energy grid

Only the ownership and maintenance of transmission assets changes

Grid Segment	Current Market Structure		DSO Restructuring	
	Owned/ Revenue	Operated	Owned/ Revenue	Operated
High Voltage (HV) Transmission Grid (above 200kV)	Participating Transmission Owners, Utilities	CAISO	Participating Transmission Owners	CAISO
Low Voltage (LV) Transmission Grid (above 69 kV)	Utilities	CAISO	Participating Transmission Owners	CAISO
Distribution Grid	Utilities	Utilities	Utilities	Utilities
Transmission Markets		TSO		TSO
Distribution Markets		(none)		DSO

Why would anyone do this?

1. Improve reliability and simplify grid operations
2. Eliminate market distortions
3. Save ratepayers money
4. Accelerate the penetration of DER

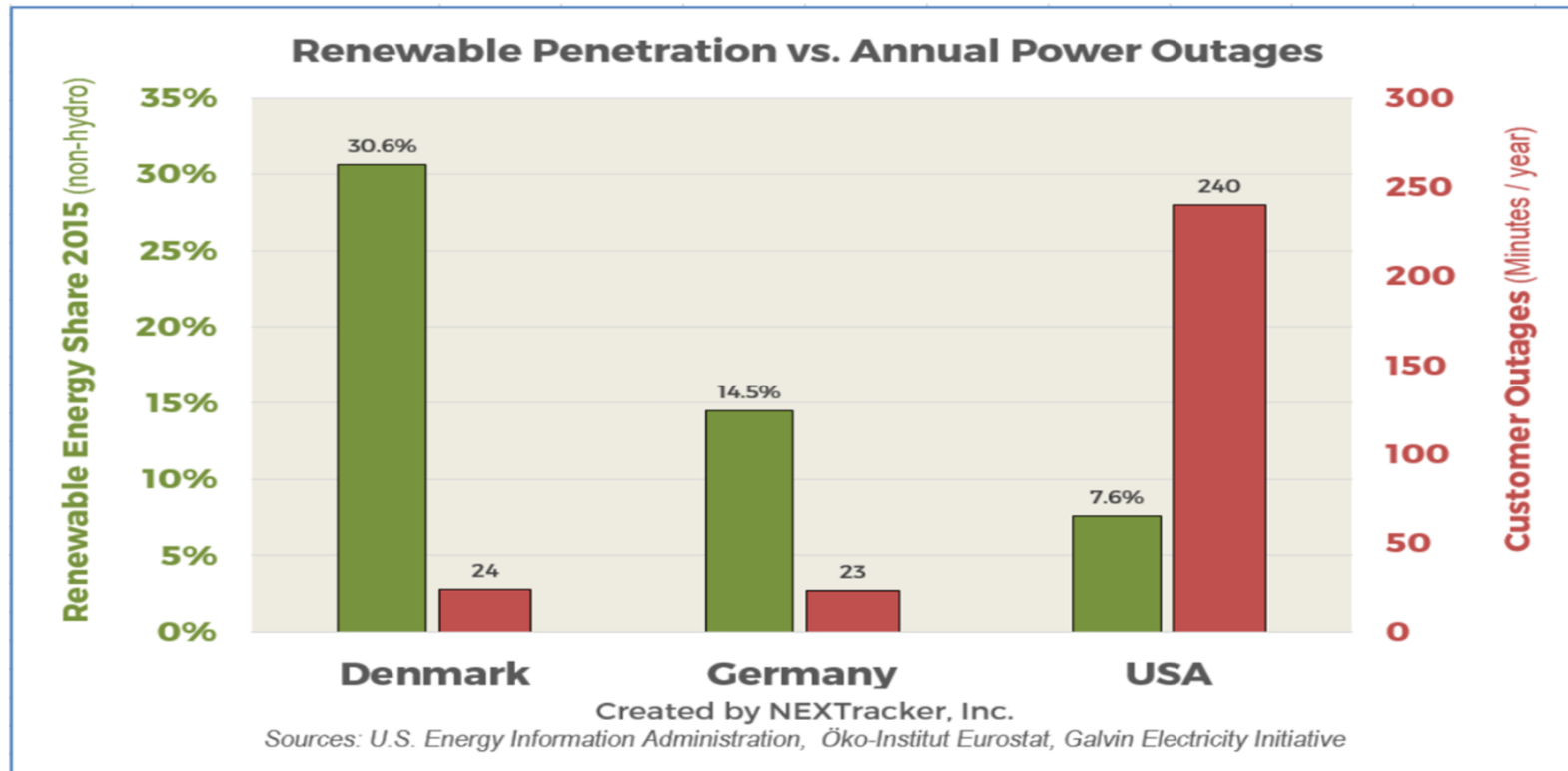


1. GRID RELIABILITY

- ▶ DSOs can provide **critical distribution grid management** to ensure both transmission and distribution grids remain reliable in a high DER world.
- ▶ DSOs can greatly simplify grid operations

DSOs solve four emerging problems: 1. GRID RELIABILITY

High renewable penetration correlates with HIGH reliability



Daniel Shugar, <https://www.linkedin.com/pulse/response-rick-perry-regarding-renewables-grid-stability-daniel-shugar>, April 27, 2017
David Hochschild, CEC, David Owen, CAISO, **Renewable energy no threat to electric grid, as Trump aides claim**, S.F. Chronicle, June 16, 2017

DSOs solve four emerging problems:

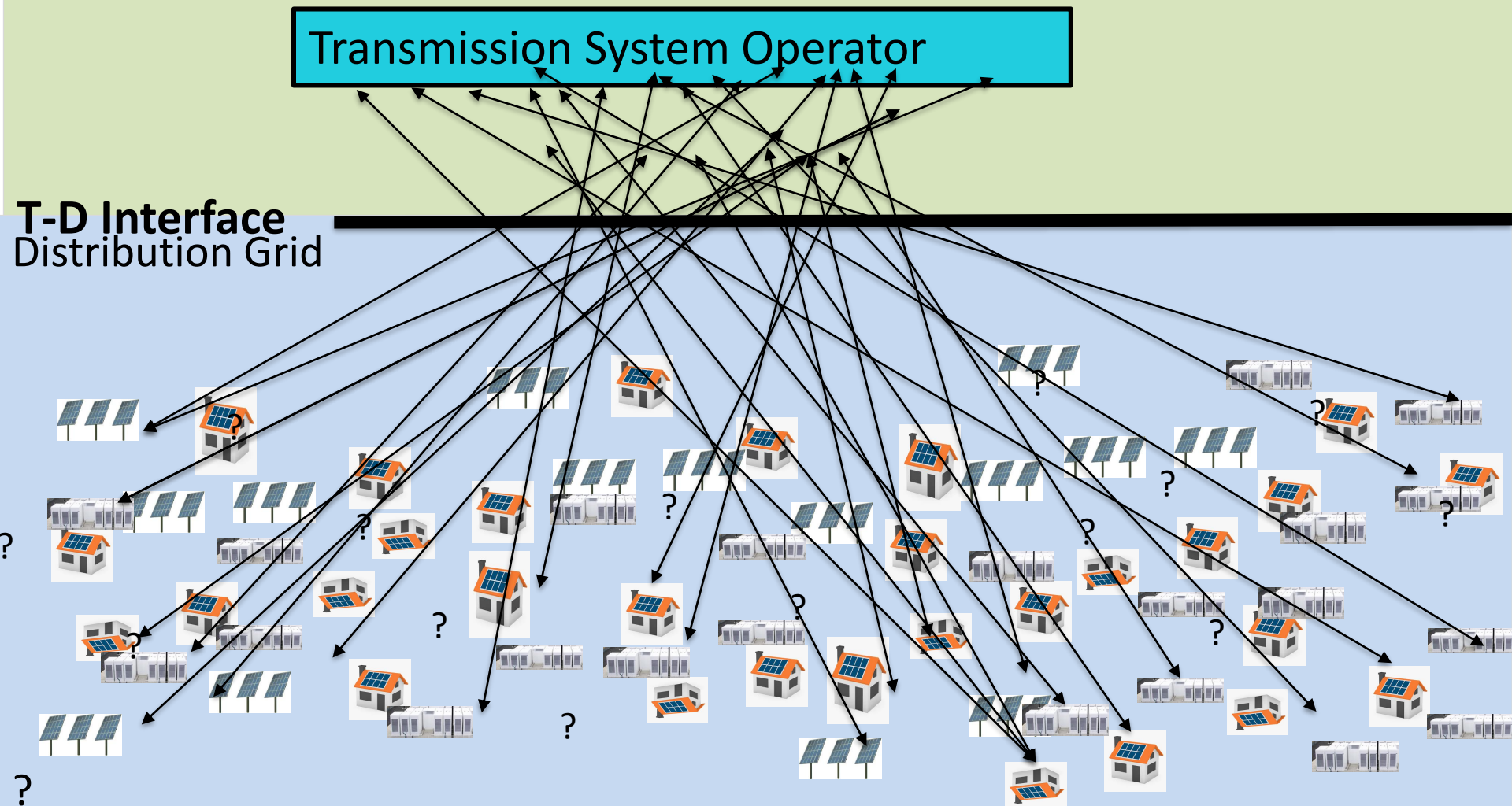
1. GRID RELIABILITY

Transmission Grid

The TSO's Nightmare

Transmission System Operator

T-D Interface
Distribution Grid



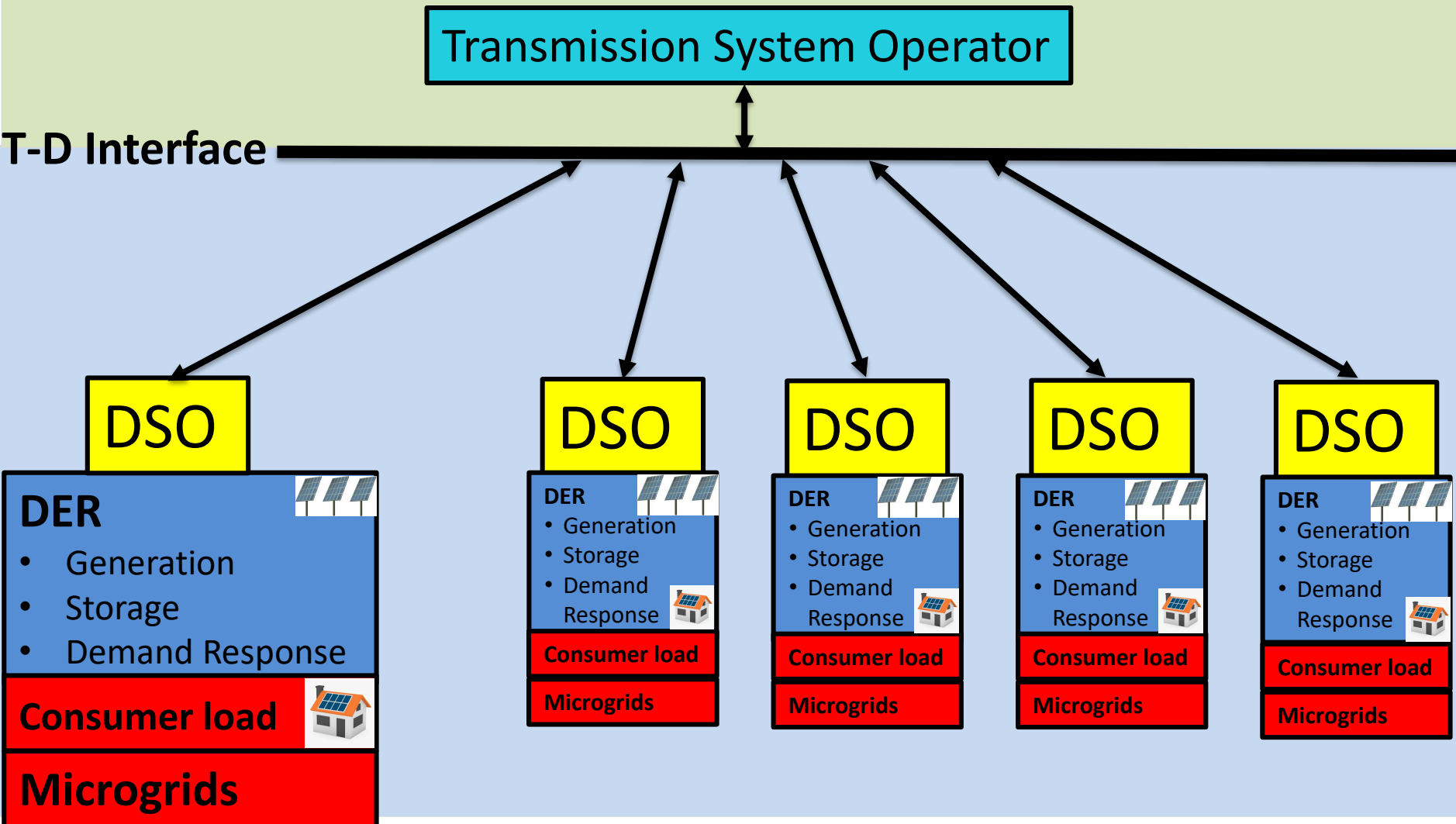
DSOs solve four emerging problems:
1. GRID RELIABILITY



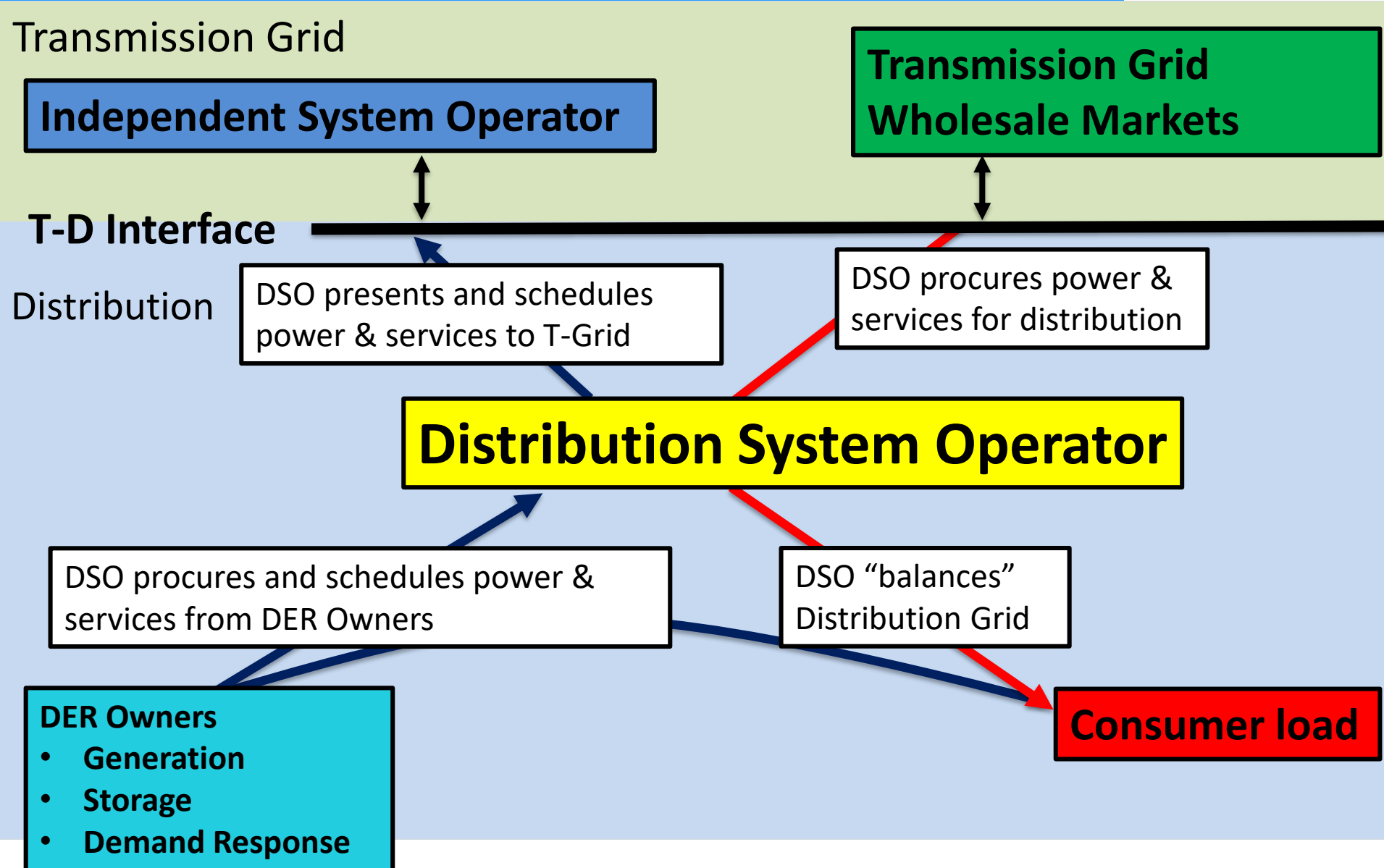
DSOs solve four emerging problems:

1. GRID RELIABILITY

DSOs present aggregate generation and load to TSO



DSOs solve four emerging problems: 1. GRID RELIABILITY



Key DSO functions 1 and 2

- **First function of DSO: Reliability**
 - Maintain distribution grid reliability
 - Implement advanced distribution management functions
 - DERMS
 - T-D- Interface transactions
- **Second function of DSO: Scheduling coordinator**
 - Scheduling coordinator for distribution grid
 - Scheduling coordinator to the T-D interface for transmission grid.

Advanced distribution functionality can make both distribution and transmission more reliable and efficient.

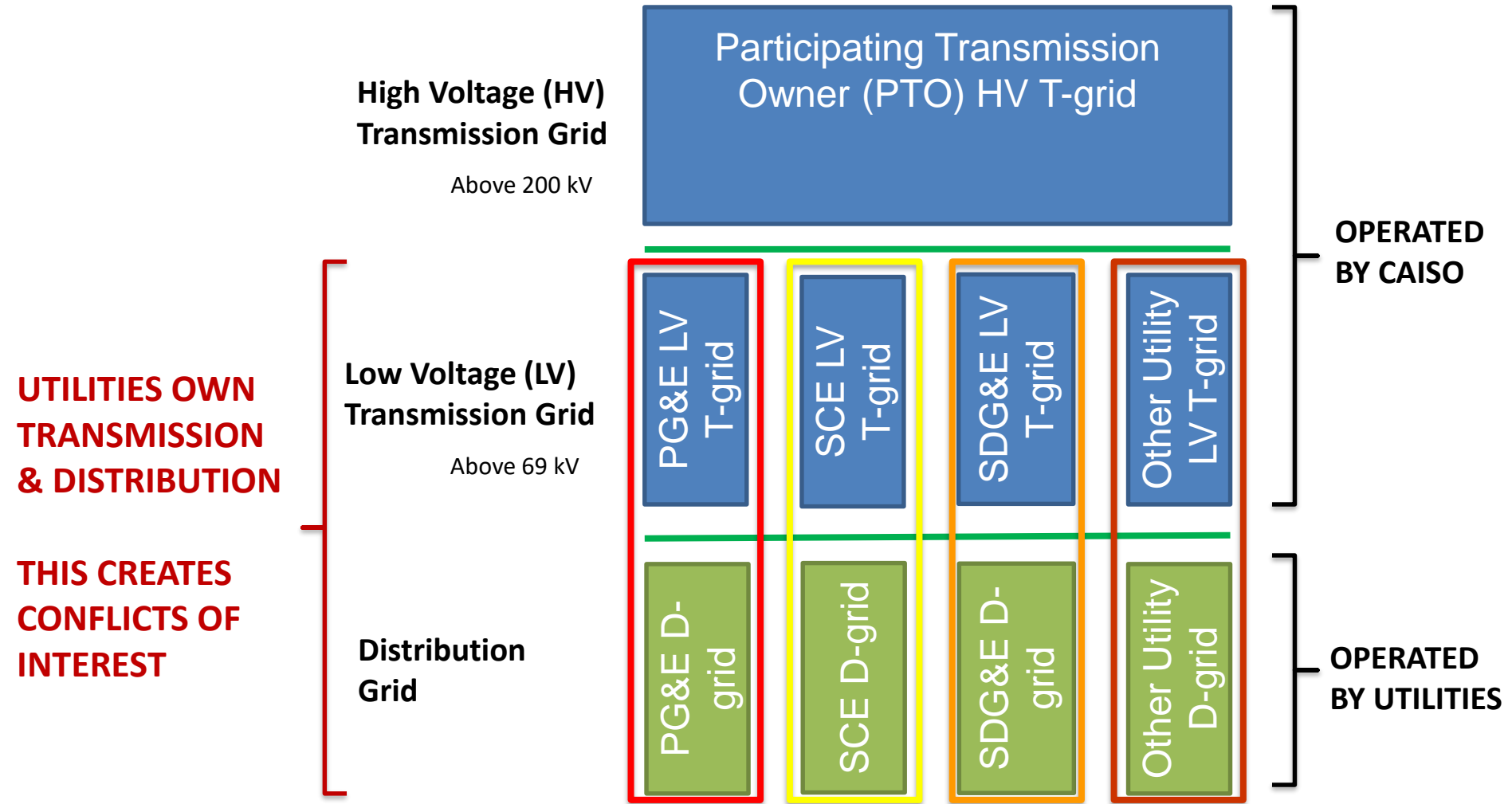
2. Eliminate market distortions & conflicts of interest

- ▶ DSO market structures can ensure **cost effective resources procurement**.
- ▶ Current market structures distort procurement incentives and prices in favor of remote resources.
- ▶ Conflicts of interest mean distribution level services are underdeveloped.



2. Eliminate market distortion & conflicts of interest

California's electricity grid market structure TODAY



DSOs solve four emerging problems:

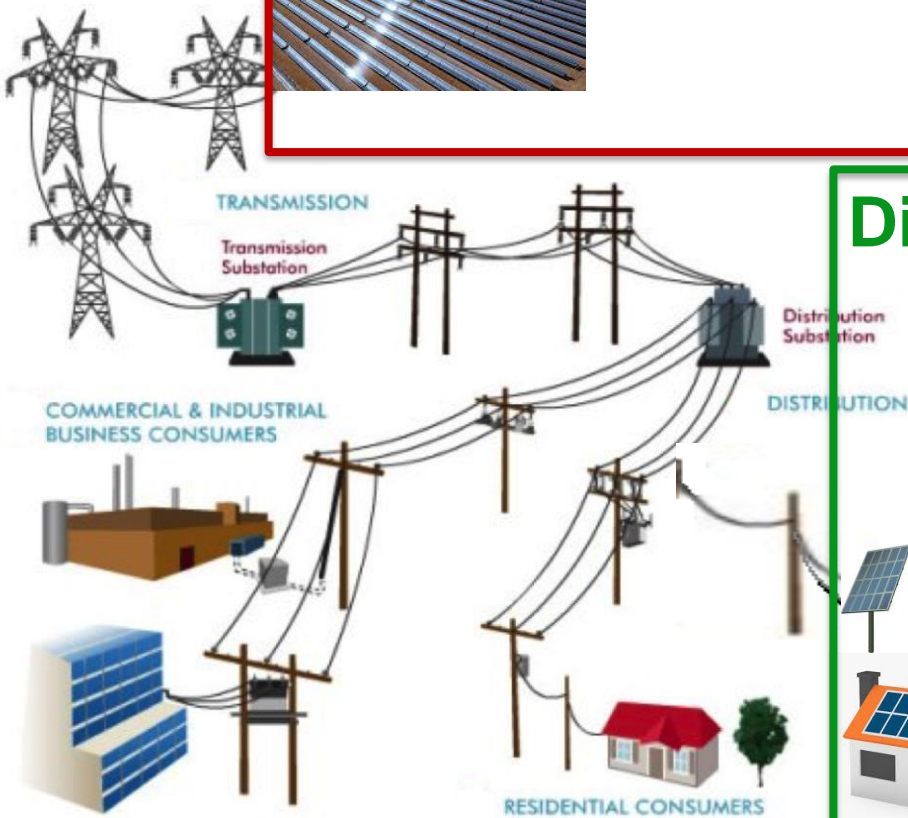
2. Eliminate market distortion & conflicts of interest

Remote Generation



Utilities get paid for:

- ▶ Power and services delivered.
- ▶ **Transmission charges for profits on existing assets**
- ▶ **Guaranteed profits on new required transmission**



Distributed Energy Resources

Utilities get paid for:

- ▶ Power delivered.
- ▶ **Transmission access charges***

Utilities don't get paid for:

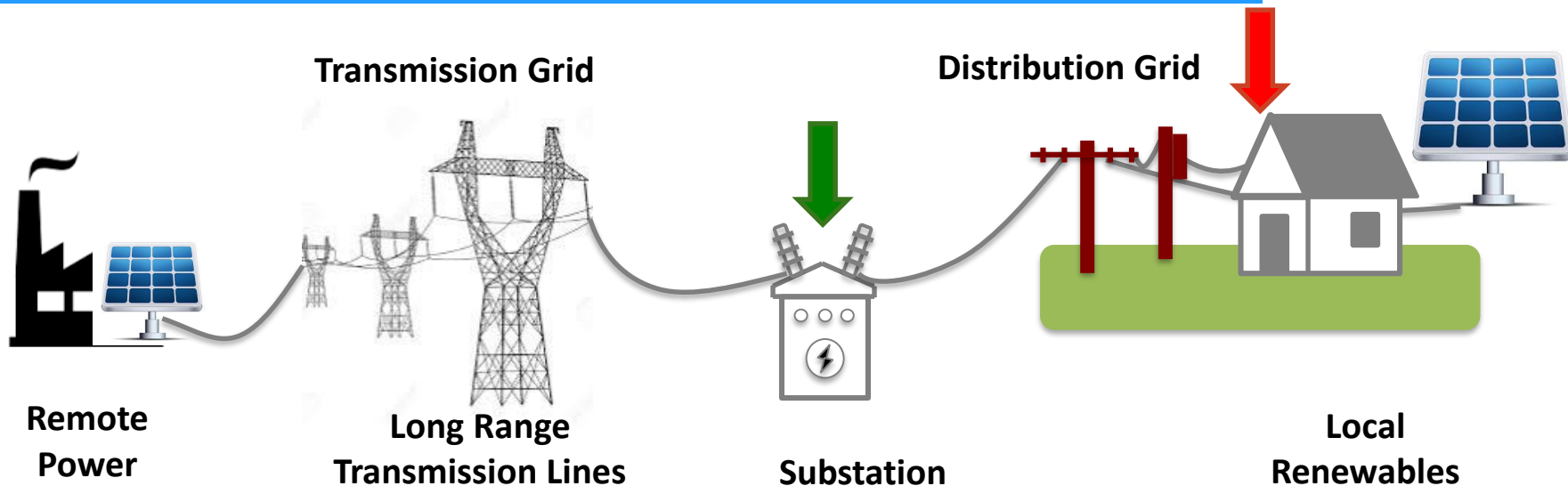
- ▶ **Guaranteed profits on new required transmission**



*The Clean Coalition is sponsoring SB 692.

Transmission Access Charges (TAC) Campaign

2. Eliminate market distortion & conflicts of interest



Problem: Local DER pay transmission charges, even though they don't use transmission and don't induce investment

Solution:

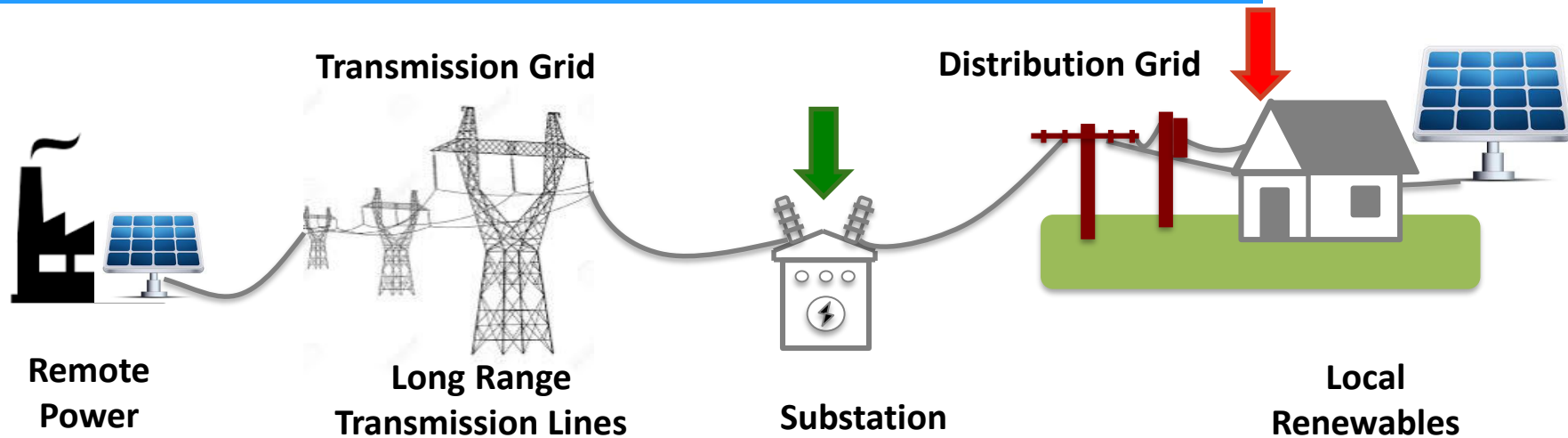
Meter transmission at substation downflow so that local energy is not subject to transmission fees

- Increases the value of local energy
- Makes local renewables more competitive in procurement
- Saves ratepayers by avoiding new transmission investment

→ SB 692, participation in CAISO stakeholder initiatives

Transmission Access Charges (TAC) Campaign:

2. Eliminate market distortions & conflicts of interest



SB 692(Allen)

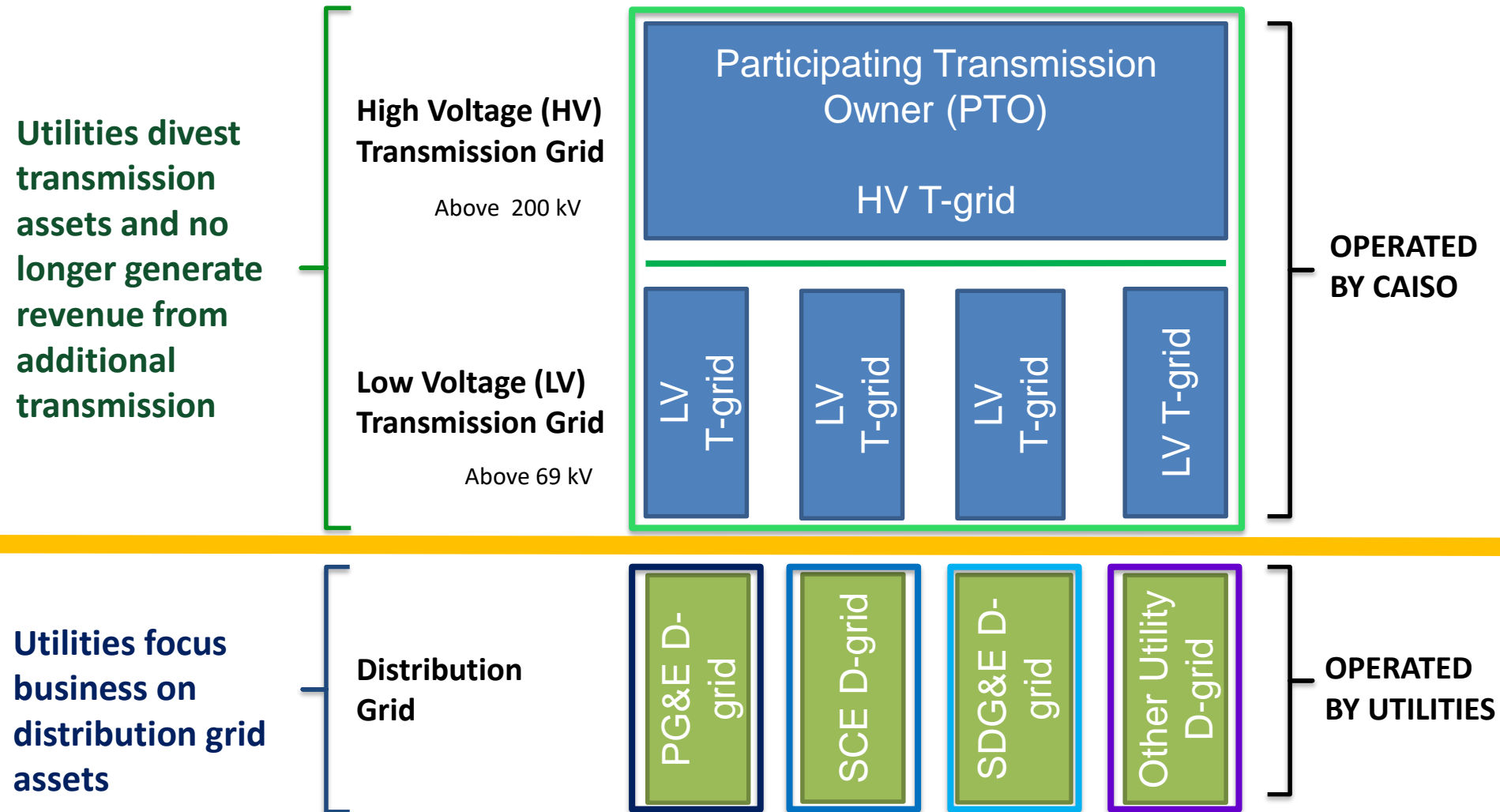
Eliminate the Transmission Access Charge Distortion

- ▶ **Problem:** Local DER pay transmission charges, even though they don't use transmission and don't induce investment.
- ▶ **Solution:** Meter transmission at substation downflow so that local energy is not subject to transmission fees
 - ▶ Makes DER more competitive in procurement (\$0.027 per kWh)
 - ▶ Saves ratepayers by avoiding new transmission investment

DSOs solve four emerging problems:

2. Eliminate market distortion & conflicts of interest

Transmission & Distribution Facilities



DSOs solve four emerging problems:

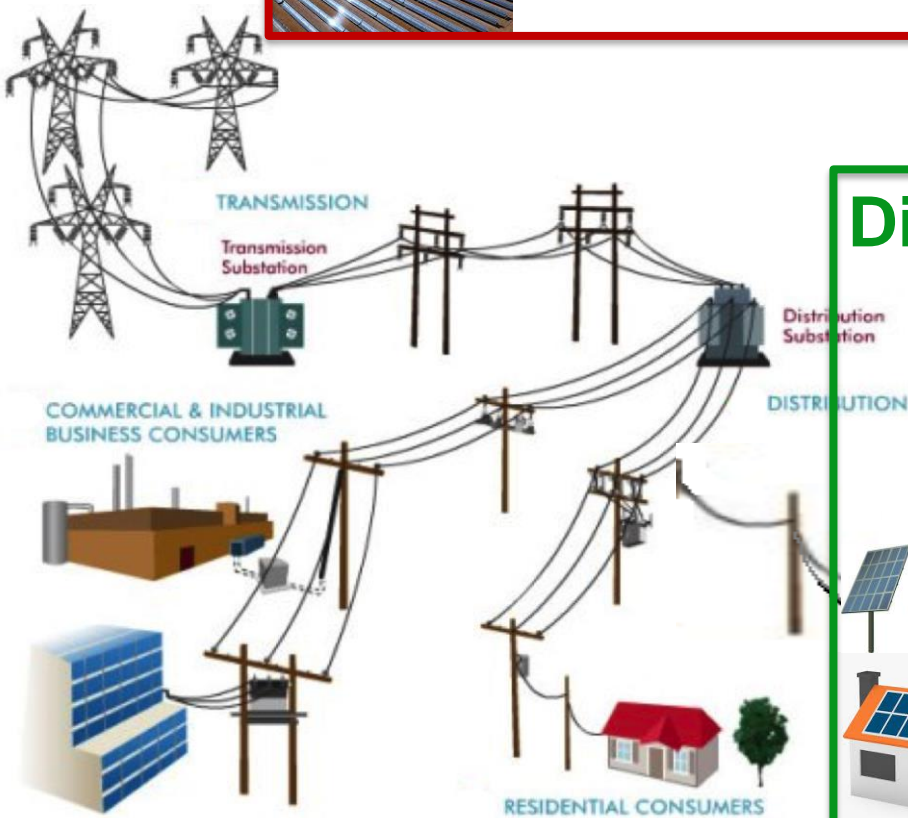
2. Eliminate market distortion & conflicts of interest

Remote Generation



Utilities get paid on:

- **Power and services delivered.**
- **Transmission charges for existing and new assets.**



Distributed Energy Resources

Utilities get paid on:

- **Power and services delivered.**
- **Distribution services**
- **Indifferent to profits on avoided transmission**
- ***Avoid transmission access charges by 2018****



*The Clean Coalition is sponsoring SB 692.

Key DSO functions 3

▶ Third function of DSO:

- ▶ Procure cost effective mix of distributed and remote resources.
- ▶ Act as fierce DER competitor in energy markets.

Decoupling profits for transmission from procurement removes market distortion and conflict of interest.

Ratepayers only pay for new and existing transmission on remote generation using transmission assets.

3. Plan better investment and develop distribution level services.

- ▶ DSOs will have a strong incentive to **avoid excess transmission investment.**
- ▶ DSOs will have strong incentives to develop distribution level service.

DSOs solve four emerging problems: *an* *alition*

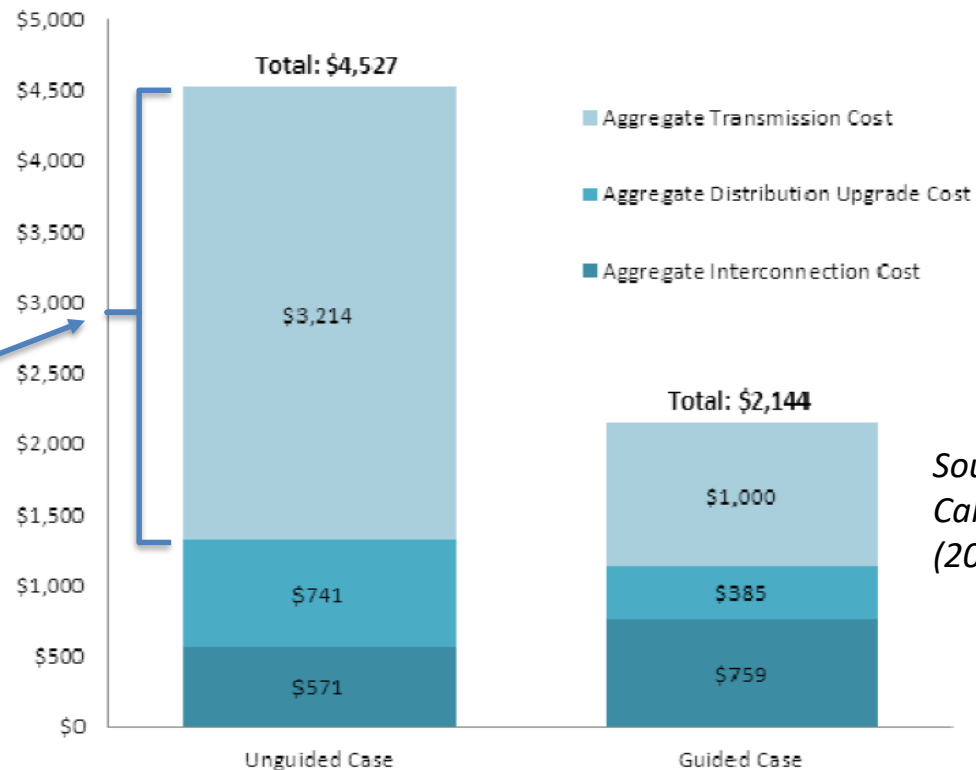
3. Save ratepayers money by smarter investment

Unplanned DER siting adds hundreds of millions to utility profits

- ▶ Southern California Edison found that planned siting of ~4 GW of local renewables would reduce SCE's upgrade costs by over \$2.2 billion

Large new transmission needs increase:

- ▶ Rate base
- ▶ Guaranteed profits



Source: Southern California Edison (2012)

Transmission is borne by ratepayers. DER interconnection borne by developer.

3. Save ratepayers money by smarter investment

Key DSO function 4

- ▶ Fourth function of DSO:
 - ▶ DSOs can run distribution grids more efficiently
 - ▶ Avoid transmission costs with distribution planning
 - ▶ DSOs have incentives to develop management systems for optimal visibility and scheduling.

Ratepayers would save from optimized investment and services scheduling.

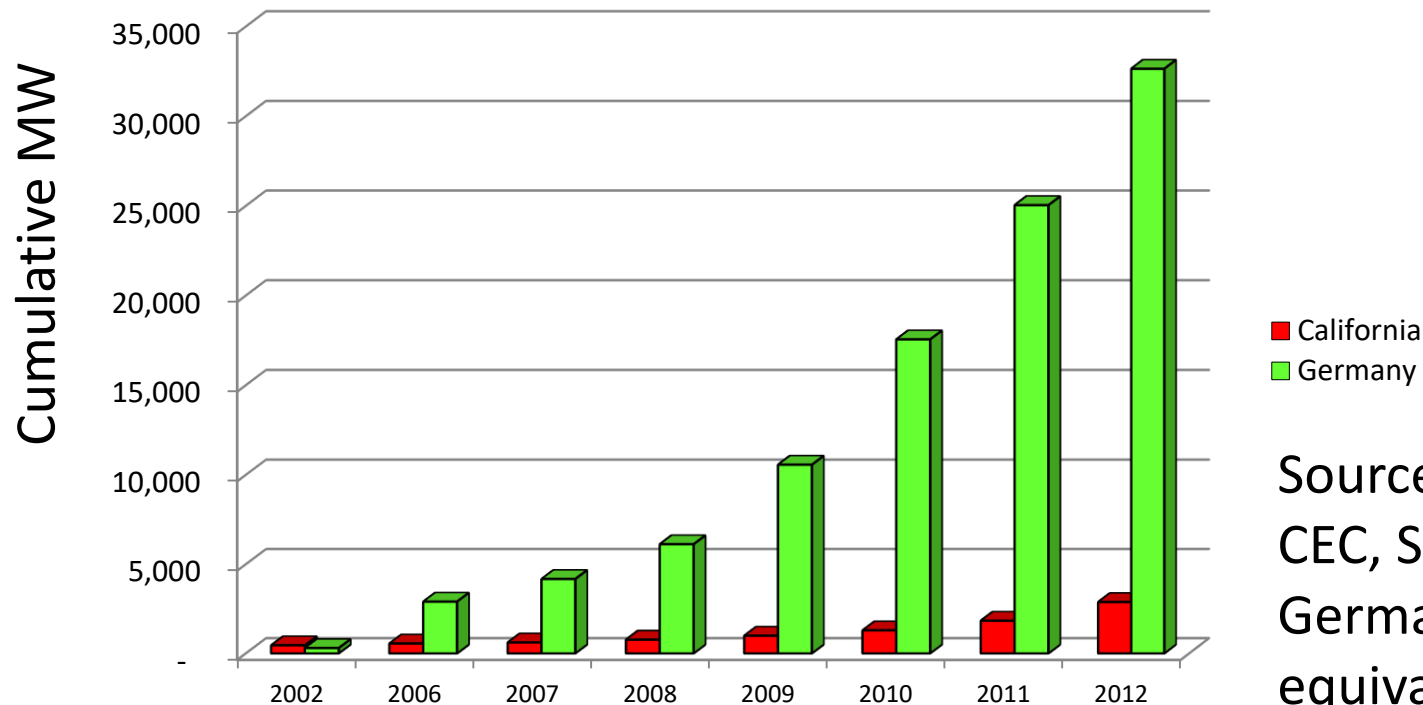
4. Accelerate deployment of DER

- ▶ DSOs can facilitate energy services markets to capture of full value stack for DER.
- ▶ DSOs would remove market distortions against DER.
- ▶ DSO have incentives to promote and develop DER supportive services.

DSOs solve four emerging problems: 4. Accelerate deployment of DER

California is failing to lead in distributed renewables

Cumulative deployed solar capacity deployed



As of 2017, Germany deployed more than twice as much solar as California despite California's 70% better solar resource, mostly as DER.

DSOs solve four emerging problems:

4. Accelerate deployment of DER

Why don't we have more DER?

DER provides a host of key benefits.

Grid management

- ▶ Local Capacity
- ▶ Frequency response
- ▶ Voltage management
- ▶ Avoid distribution grid upgrades
- ▶ Avoid transmission grid upgrade

Markets

- ▶ Saves money
- ▶ Greater market efficiency
- ▶ Diversity of energy services

Environmental benefits

- ▶ Protect habitat
- ▶ Reduce GHG emissions
- ▶ Reduce air pollution

Community benefits

- ▶ Provide local jobs
- ▶ Alleviate community health load
- ▶ Address environmental justice and inequity.

Why don't we have more DER?

California needs mature markets to capture the full value of DER to incentivize deployment.

DER only has limited capacity to recover its full value:

Marketable

- ▶ Power
- ▶ Frequency response
- ▶ Capacity

Markets in development

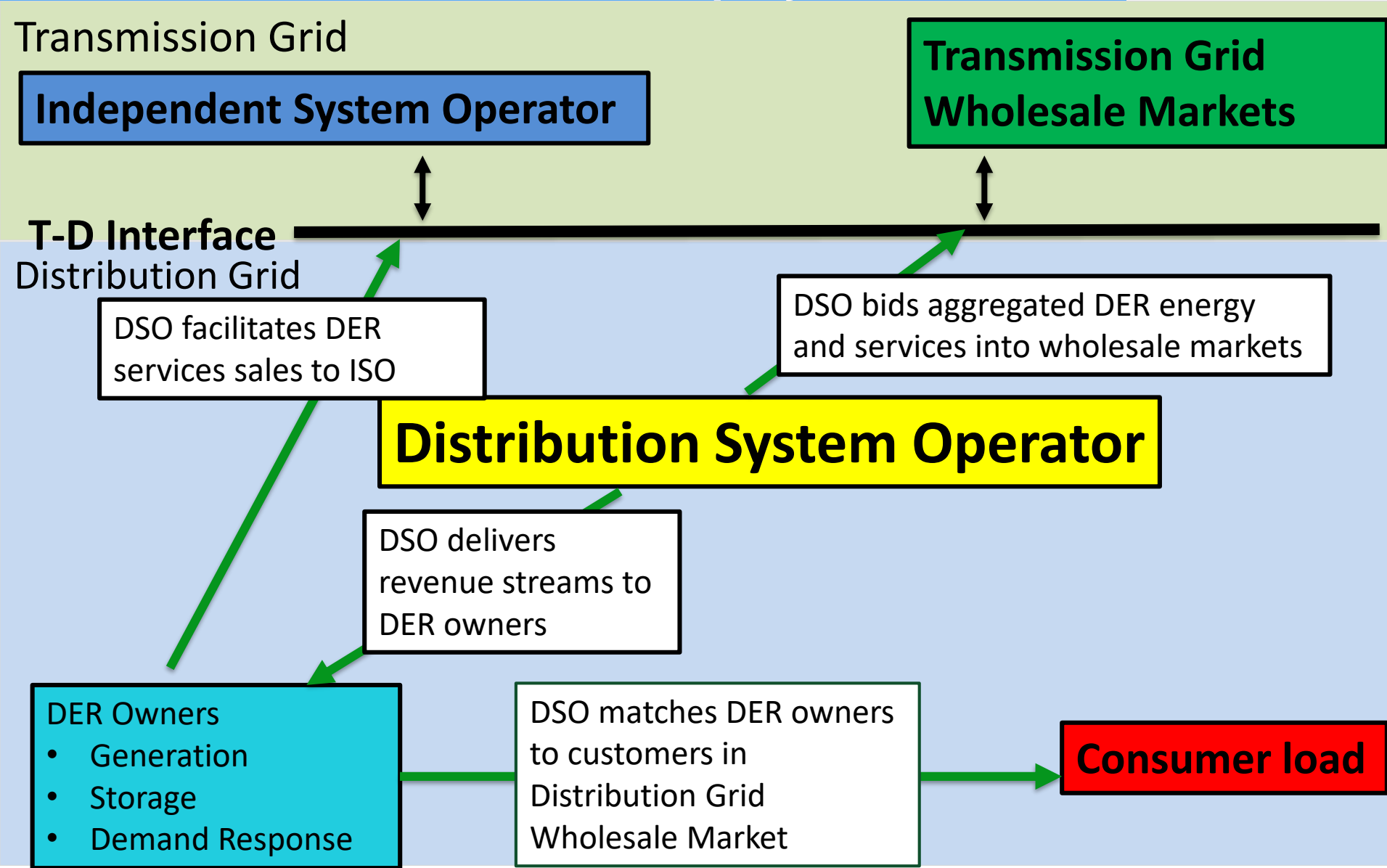
- ▶ Demand response

Markets missing

- ▶ Voltage management
- ▶ Reliability services
- ▶ Distribution deferral
- ▶ Customer services
- ▶ Resiliency
- ▶ Avoided Transmission infrastructure
- ▶ Community benefits, pollution reduction

DSOs solve four emerging problems:

4. Accelerate deployment of DER



Key DSO functions 5

- ▶ Fifth function of DSO:
 - ▶ DSOs sell DER services to ISO at the T-D interface
 - ▶ DSO bids aggregate services to wholesale markets at the T-D interface.
 - ▶ DSOs facilitate distribution level wholesale markets to match DER services to customers.

DER owners capture a much broader range of values from coordination of various markets.

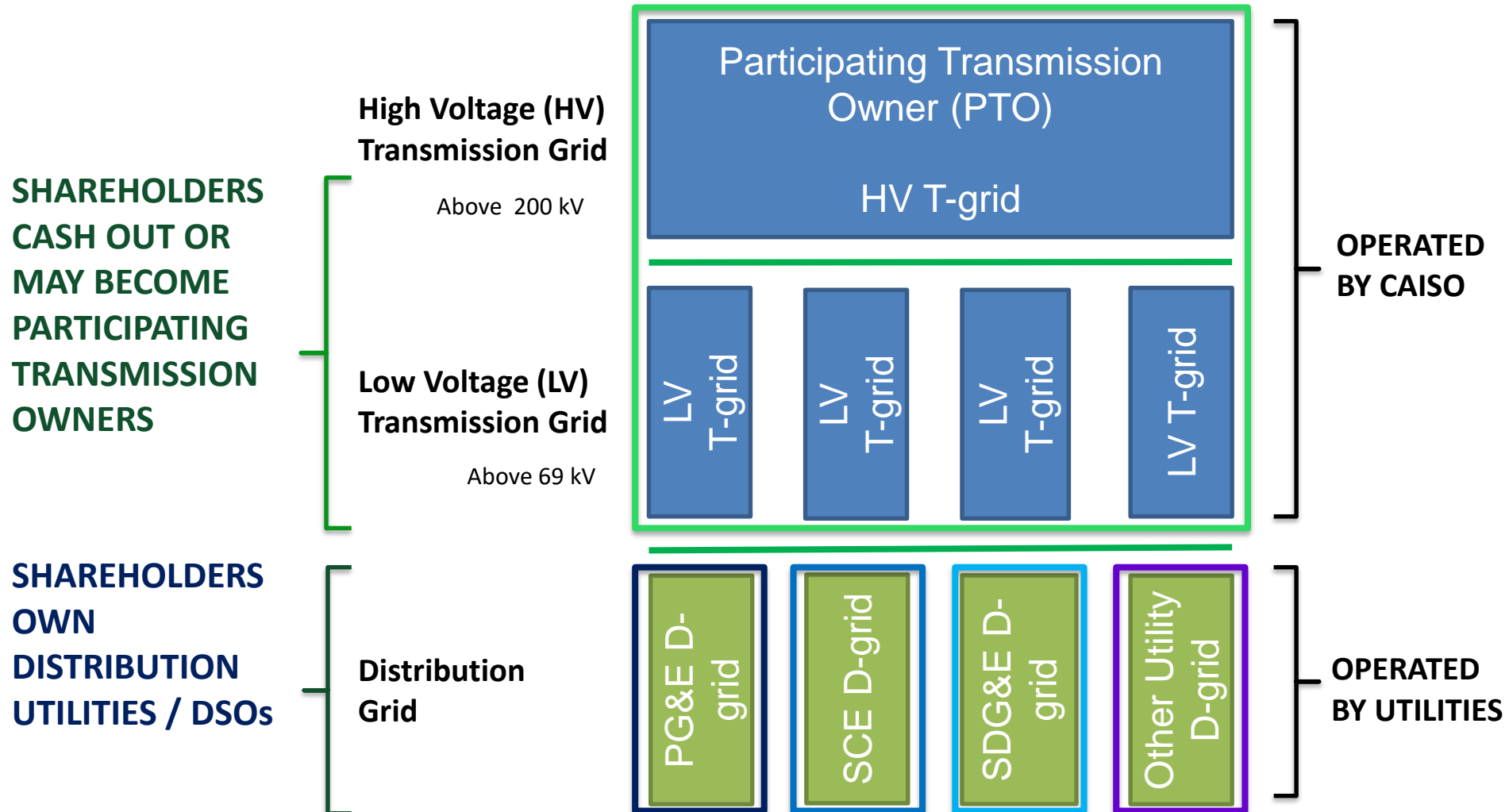
The Clean Coalition Plan Step 1: Separate transmission from distribution

*Split existing utilities from transmission assets with a **bright line** between transmission and distribution businesses.*

There is no (big) step 2

DSOs solve five emerging problems: 5. Create new opportunities

Transmission & Distribution Facilities



Restructuring drives better alignment of shareholder value with ratepayer value for cost effective energy.

- ▶ Shareholders hold DSO assets and transmission assets/cash.
- ▶ Diversified value streams come from providing a range of new distribution services.
- ▶ Value comes from more efficient services.
- ▶ Transmission business no longer cannibalizes distribution business.

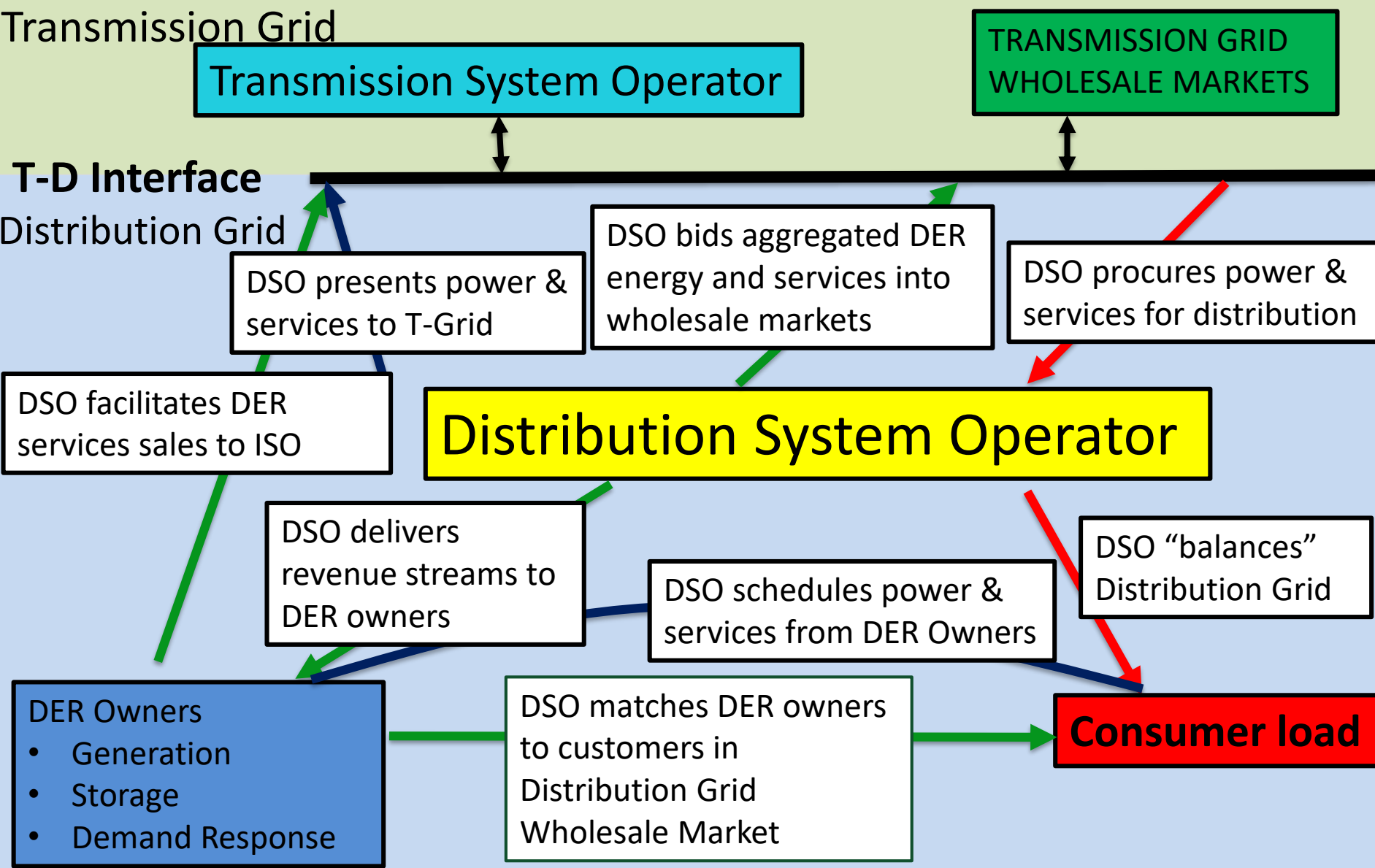
The Clean Coalition Plan makes three changes:

- ▀ Improves operation of the distribution grid
- ▀ Fosters creation of distribution energy services markets
- ▀ Adjusts ownership of transmission assets to remove conflicts of interest

Five Key DSO functions

- **First Function: Maintain distribution grid reliability**
- **Second function: Scheduling coordinator**
- **Third function: Procure cost effective mix of distributed and remote resources as fierce DER competitor in energy markets.**
- **Fourth function: Run distribution grids with advanced functionality and planning.**
- **Fifth function: Facilitate distribution wholesale markets and bidding to transmission grid markets.**

Clean Coalition Proposal: Restructuring to drive competition and innovation



DSOs can benefit...

✔ Ratepayers:

- ✔ Cost effective procurement
- ✔ Avoided investment

✔ DER owners and developers:

- ✔ Capture the full stack of DER value in a much larger market.
- ✔ Remove market distortions favoring remote generation.

✔ Distribution utilities:

- ✔ DSOs can expand the range of services utility business provide.

✔ TSOs:

- ✔ Simplifying transmission grid operation through management T-D interface
- ✔ Presentation of aggregate services at T-D interface

✔ Local Communities:

- ✔ Local renewables reduce pollution, improve resiliency, and provide local jobs.

✔ Society: Local renewables reduces GHG emissions and habitat loss.

A very brief history:

1990s

- AB 1890 (1997)
 - Utilities divested generation assets
 - Transmission System Operator (CAISO) established

Today:

- DSO Restructuring
 - Utilities divest TRANSMISSION assets
 - DISTRIBUTION System Operators (DSOs) established

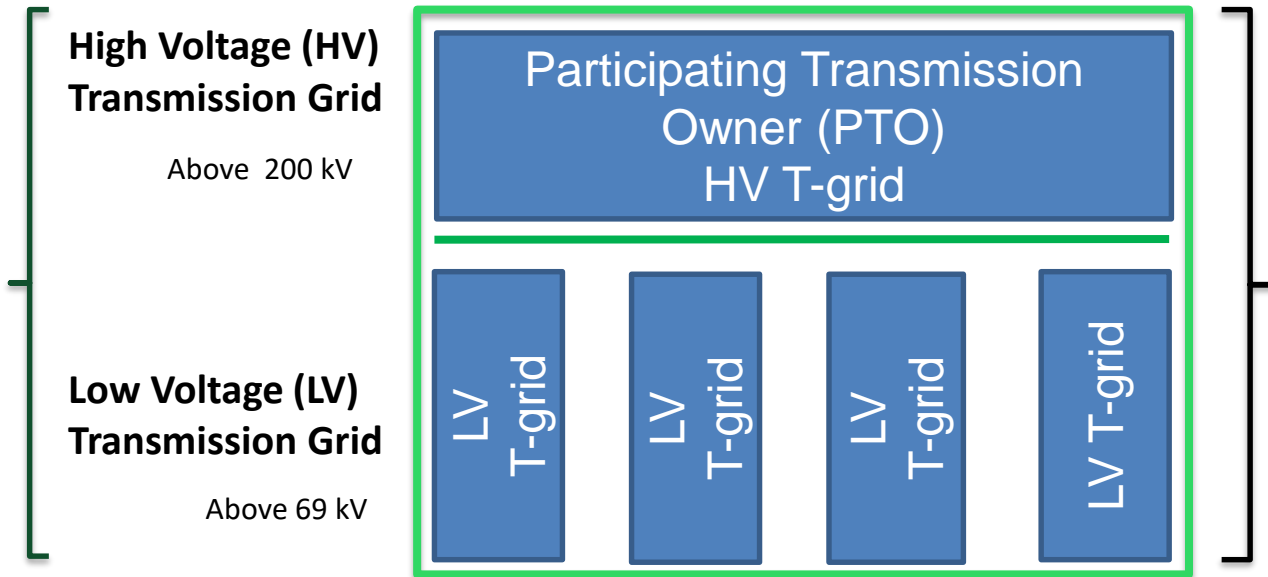
Clean Coalition Proposal: Restructuring to improve competition and innovation

**Wholesale
Generators**



**Owned by
Participating
Transmission
Owners**

BRIGHT LINE
↓

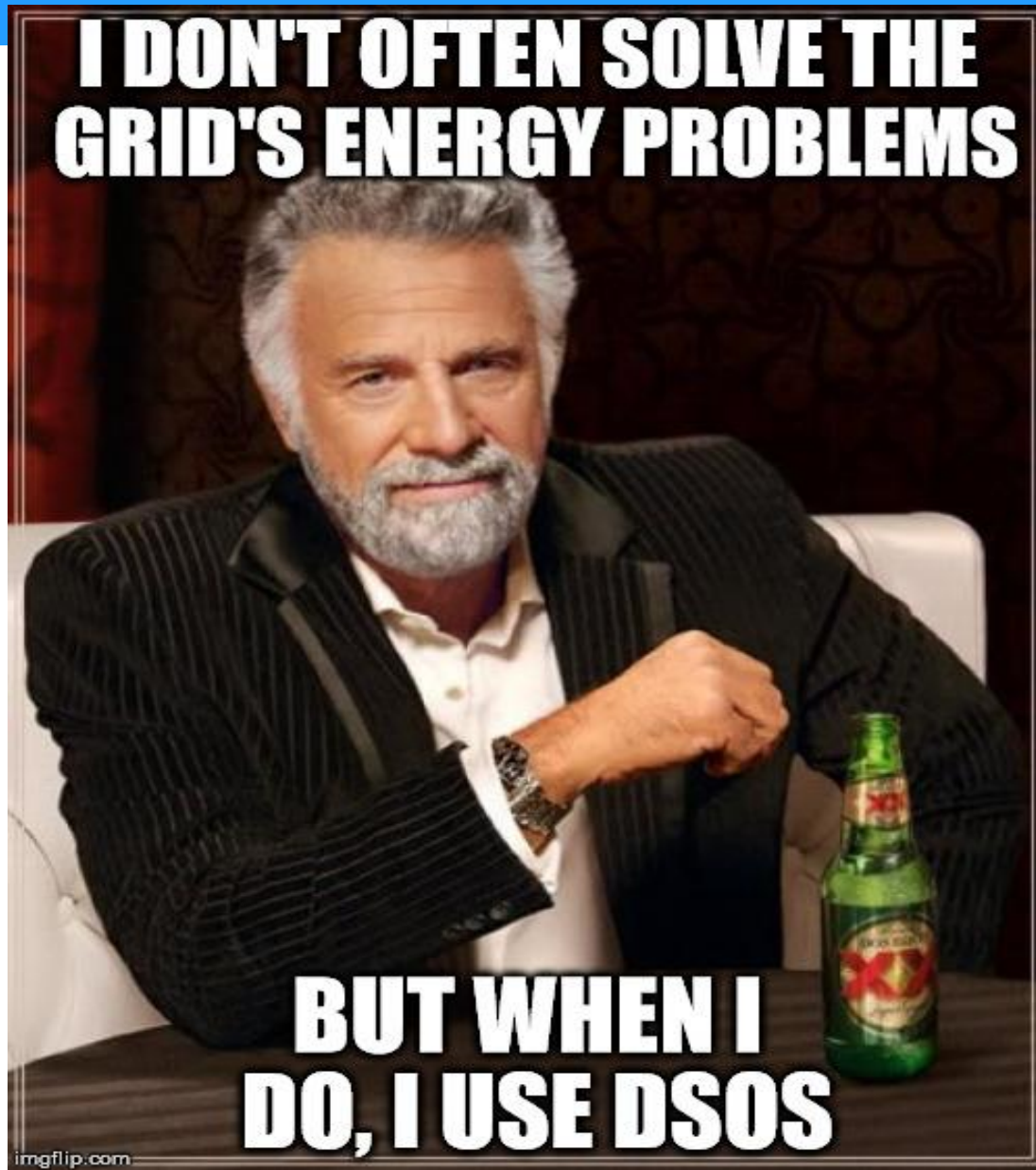


**OPERATED
BY CAISO**

**DSO owns and
operates
distribution
grid**



**OPERATED
BY UTILITIES**



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