High-DER Grid Modernization Workshop #1: Identifying Operational Needs Panel 3

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350 Bay Area

350 Bay Area is a 501c(3) non-profit organization

- focused on ensuring a sustainable climate and associated environmental and economic justice for all,
- with a reach of over twenty-two thousand people, primarily concentrated in the nine Bay Area counties.

We comment from both an environmental and ratepayer perspective, concerned with economic and environmental impacts of energy policy and planning
meaning that we focus on advancing state goals, including equity, affordability, emissions, and land use.

Our focus today will be on the highlighted items
touching briefly on the other subjects
allowing others to address in more depth

- ***Overview***

  The Role of the Electric Grid in Meeting our Demand for Energy

  (functional roles determine operational needs)

- ***What are the operational needs necessary for the following purposes:***

  1. *efficiently operate a high DER grid,*
  2. *unlock economic opportunities for DERs to provide grid services,*
  3. *limit market power,*
  4. *reduce ratepayer costs,*
  5. *increase equity,*
  6. *support grid resiliency,*
  7. *meet State policy objectives?*

Role of the Electric Grid in Meeting our Demand for Energy

Operation starts at load, working from the bottom up

- To address the operational needs for the distribution system, it is *important to first understand the core function of our electric grid*, which is to distribute power to help (or assist) in meeting our demand for energy, equitably and cost effectively.

- Increasingly, the distribution system is no longer a one-way flow from a substation to loads, but a *multidirectional scalable interaction* between distributed energy resources (DER) and *intermingled* loads.

- At any location we may find loads, generation, storage, communication and control equipment potentially capable of meeting onsite loads and serving nearby loads -- a miniature version of the larger grid.

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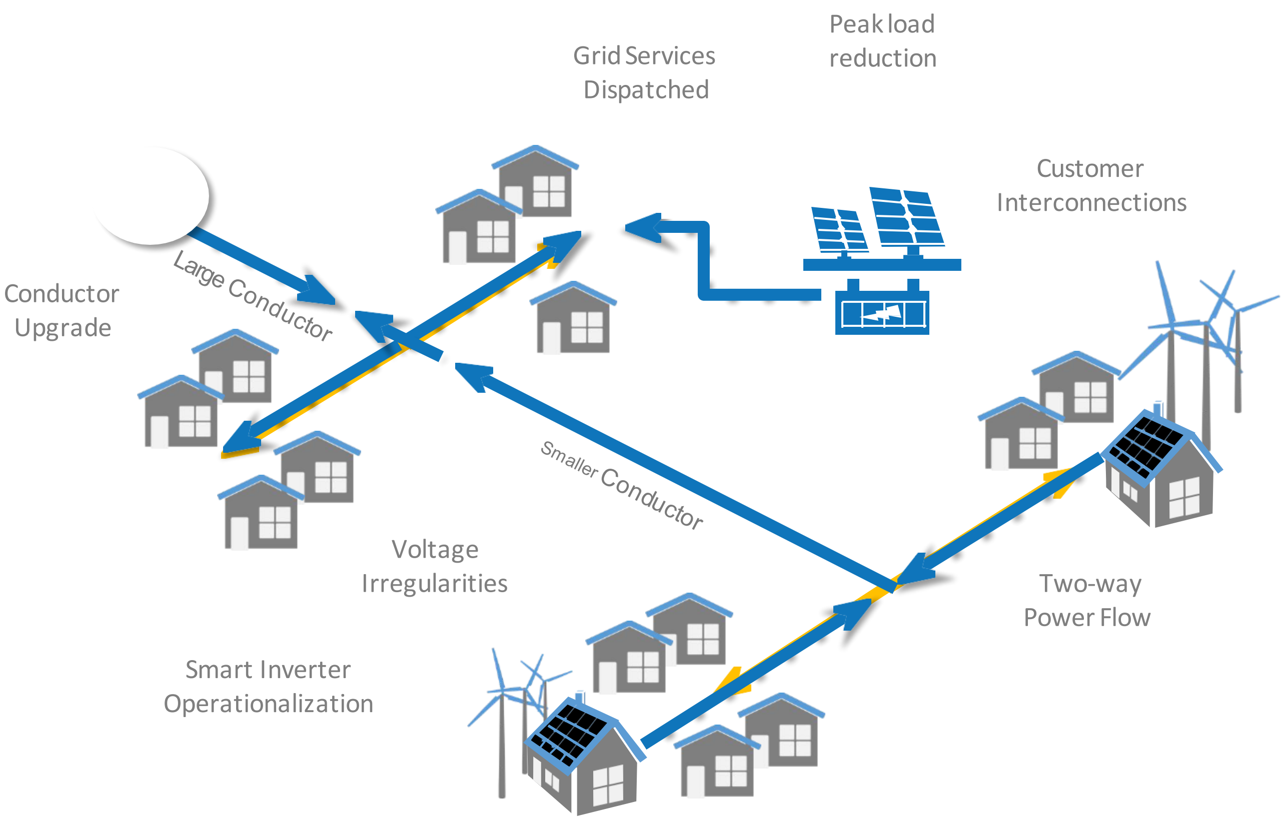
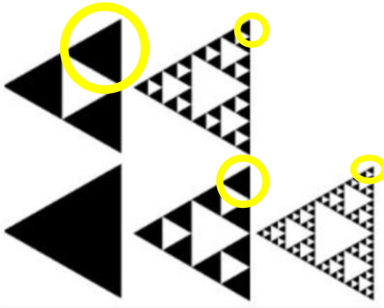
Evolution of the Distribution Grid and DERs

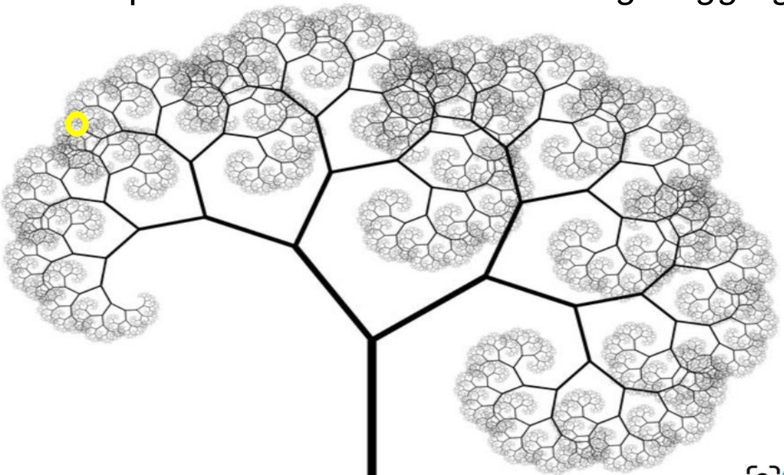


Role of the Electric Grid in Meeting our Demand for Energy

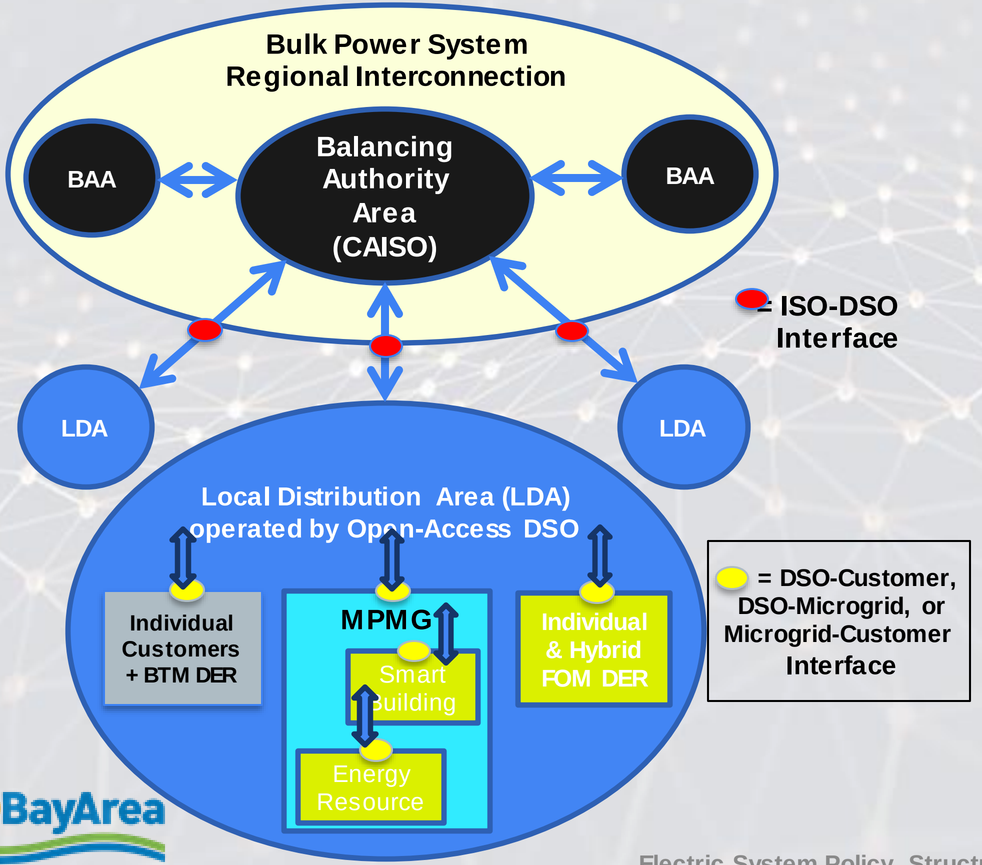
Operation starts at load, working from the bottom up

- The distribution system connects all of this in a *layered architecture* which is *replicated at every junction*, approaching a fractal design, from homes to ISO.
  - This is important - it means that *each layer or node only interacts electrically with the rest at either end of its points of connection*,
  - *Everything* beyond those points *can be treated as a single aggregation*.





Layered Architecture:
Focuses on the interfaces between layers



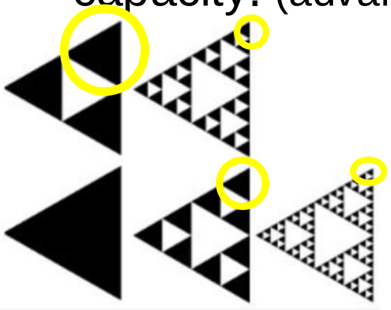
- Main layers are Bulk System; Distribution System; Customer/DER
  - Multi-customer microgrid may exist in between Dist. System & Customers
- Interfaces allow for bi-directional flows
- Each layer needs to manage its interfaces with adjacent layers above & below
- Focus on interfaces

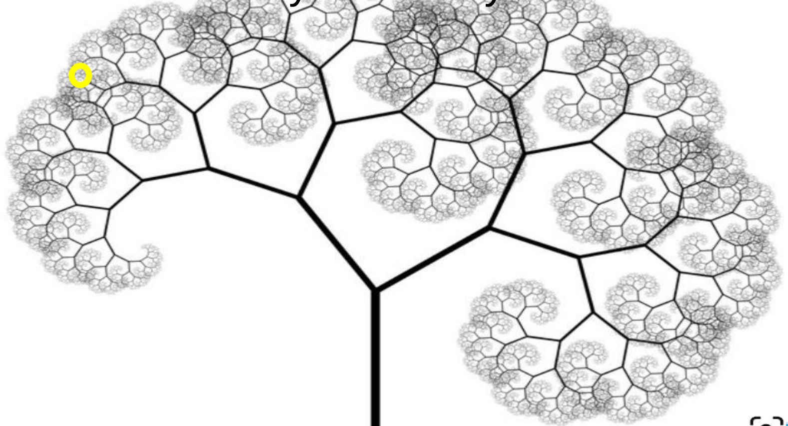
  => *Operator of each layer does* ***not*** *need visibility or control of assets within the layer below*

Role of the Electric Grid in Meeting our Demand for Energy

Operation starts at load, working from the bottom up

- This has the potential to *greatly simplify operation and optimization* because it allows operational data to reflect a single value at each junction.
    - There is no need for a system to process all the details of each component or resource across multiple layers –
- Resources can be *managed locally* to reflect local constraints and available capacity. (advanced functionality is already built in even at the consumer level)





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Role of the Electric Grid in Meeting our Demand for Energy

Operation starts at load, working from the bottom up

This matters because demand is met through resources, and

- *this starts with DER*, because all demand begins *where the load exists*, DER *includes* loads and mitigations, and is the *first* layer in meeting demand and mitigating the impact of loads.
    - DER (BTM *and* FOM) includes EE, DR, DG, ES, EV, and aggregations within buildings or micrograds of all sizes
- **Less load = less demand = less grid capacity costs at each layer**
    - (i.e. less *peak coincident load capacity at the next larger layer*)

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What are the operational needs necessary for the following purposes:

1. *efficiently operate a high DER grid,*
2. *unlock economic opportunities for DERs to provide grid services,*
3. *limit market power,*
4. *reduce ratepayer costs,*
5. *increase equity,*
6. *support grid resiliency,*
7. *meet State policy objectives?*

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1. Efficiently operate a high DER grid

- Efficient operation requires semi-optimal *utilization of all available distributed energy resources*
  - DER: are comprised of all types of EE, DR, DG, ES, EV etc, including buildings and microgrids
  - Semi-optimal: perfection is not required
- Utilization requires having enabling systems in place, i.e. any available means for DER to receive and respond to information with *reasonable* timeliness and *sufficient* certainty
  - Information is not the same as "control". Information can be a signal or data (including tariff-based or "live" pricing, AMI data, local grid conditions, and forecast or reserved capacity needs).
  - Information can be stored or measured at the DER location and/or communicated through any available medium, including internet connection, cellular, wired, or radio signal, or any series of systems
  - *DER may react to data <u>autonomously,</u> or respond to coordinated control signals*
- Coordination of individual DER should include layered aggregation
  - each aggregation seen as a single entity in the next layer.
  - This greatly simplifies operation and offers security over single point failure
- *Efficient* operation means *least <u>net</u> cost*
  - based on cost effectiveness tests including the Societal Cost Test and Avoided Cost Calculator
  - each test has inherent limits

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2. Unlock economic opportunities for DERs to provide grid services

- The Smart Inverter Operationalization Working Group (SIOWG)
  - focused on utilization of *existing* advanced inverter functionalities
  - identified numerous high priority use cases and business cases
  - based on technological readiness, cost, scale, and timeline
- Standard tariffs and contracts are needed
  - designed to *support stacked value uses* of resources
    - Traditional contracts and tariffs often inhibit enrolling and utilizing DER for multiple purposes.
    - Stacked value recognizes any available capacity across all resources in aggregate instead of reserving each resource for a single role and leaving capacity underutilized.
- DSO as the nexus (?)
  - to simplify signaling (layered coordination)
  - *to simplify single point access to revenue streams* (market and utility/tariff)

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4. Reduce Ratepayer Costs
5. Increase Equity (Reduce Inequity)

- **Focus on least <u>net</u> total costs over time, including grid costs**
  - Utilizing cost effectiveness tests, including the Societal Cost Test, plus Avoided Cost Calculator
    - each test has inherent limits, which must be accounted for, including future transmission costs
- <u>Inequitable energy burdens start with costs</u>
  - DER access *and operational utilization* reduces energy burdens
  - $50 Billion cost of unmitigated electrification (EIS phase 1 study)
    - Public Advocates analysis shows *even the simplest mitigation cuts this by half*
      Distribution Grid Electrification Model Findings
  - Up to **$120 Billion in *avoidable* costs** by 2050 through optimization of DER operation compared with the Business-as-usual case (Vibrant Clean Energy study)
    https://www.vibrantcleanenergy.com/wp-content/uploads/2021/07/VCE-CCSA_CA_Report.pdf
  - Up to **$60 Billion in *additional avoided* transmission costs** by 2050 (Clean Coalition analysis of local resource potential) https://clean-coalition.org/policy/transmission-access-charges/#:~:text=We%20know%20our%20solution%20works,encouraging%20more%20clean%20local%20energy
- Savings require easy DER engagement and pricing for energy and services

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6. Support grid resiliency

- The ability to modify demand and utilize local resources to meet both local and system level demand will increase flexibility, strongly supporting resilience and reliability, even to the point of localized islanding.
- Enormous DER capacity in coming decades
  - **15 GW** of BTM rooftop solar today, (*potentially much greater in future years)*
  - FOM distributed generation - *barely tapped potential,* greater than rooftop solar
  - BTM and FOM energy storage
  - Flexible building loads
  - **80+GW** of EV battery deployment by 2030 (= ~**8GW** of DR/flexible demand)
  - Bi-directional V2X potential

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7. Meet State policy objectives

- This requires *all of the above*
- State policy objectives are very large and wide ranging, and ultimately focused on meeting needs at each location.
- The grid is what allows resources to be shared between locations, both locally and system wide.
- Crucially, beyond the grid's operational needs, the policies, programs, and tariffs must avoid barriers to, and appropriately encourage deployment of and utilization of, DER.
  - *We can only utilize these resources to the degree that they are available, and DER are a huge resource.*

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Additional Slides

The High-DER Future Is Both Necessary and Inevitable

Necessary => Today's needs & societal goals require local energy solutions

- Worsening climate disruption, grid vulnerability, energy inequities
- Bulk system & wholesale market are still needed, but not sufficient

Inevitable => DERs keep improving in performance, cost & ease to deploy

- Customers, businesses, and communities see benefits and will deploy

The challenge for policy makers, the industry and all of us =>

- What policies will leverage the use of DER, maximizing the benefits for all while adapting to rapid DER proliferation?

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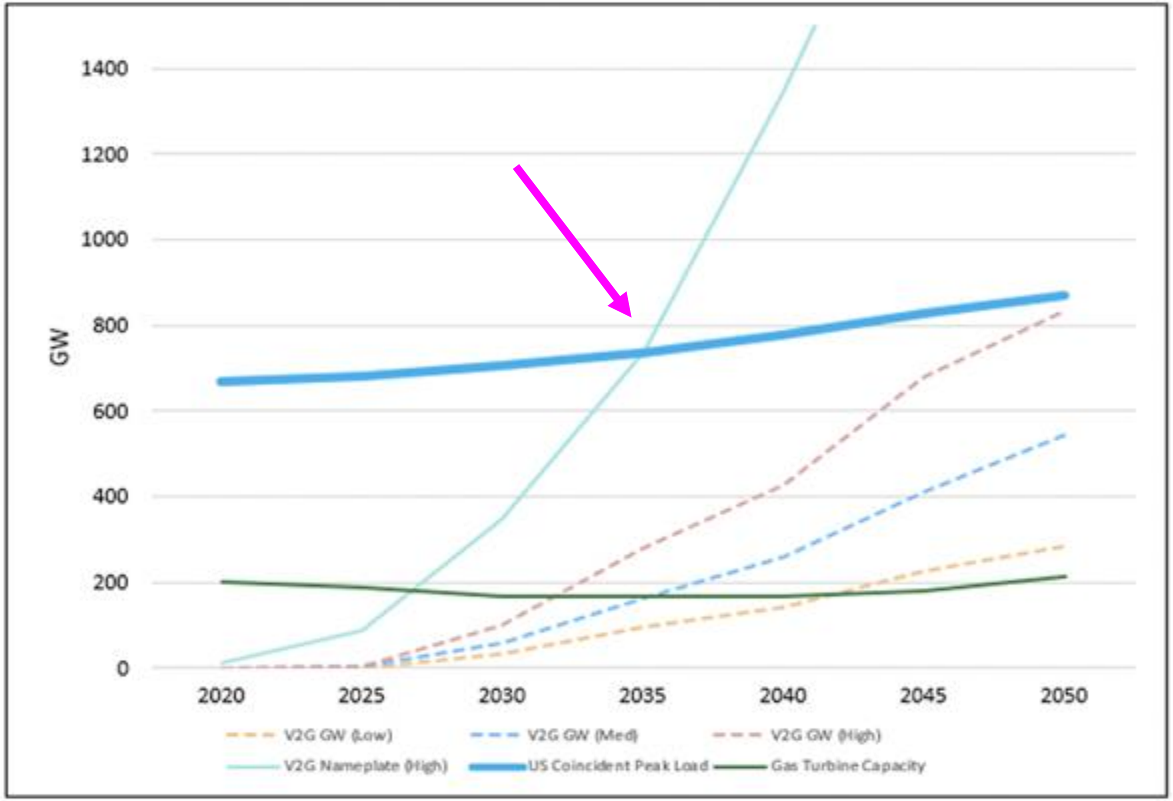
Example:

Total nationwide EV battery capacity will exceed peak US electricity demand in 2035[1]

CEC estimates 8 million EVs in CA by 2030

= Total California EV battery capacity will be greater than all existing CAISO resources



[1] Presented at an October 2022 EPRI Webex. Based on EIA projections of EV populations

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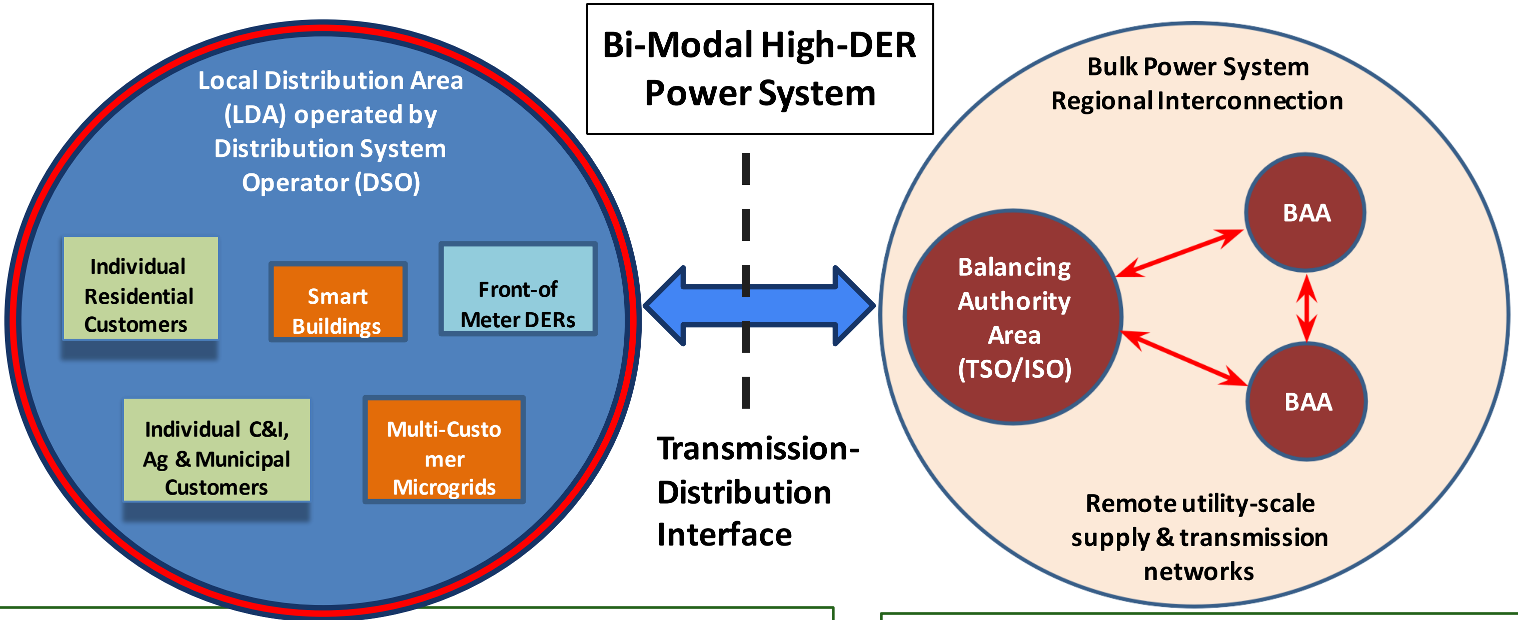
the climate center

The High-DER Future Grid: a participatory distribution network complements the bulk system



- Distribution network connects all network participants: customers, smart buildings, community resources & microgrids
- DSO integrates DER cost-effectively to minimize bulk system impacts
- Local DER can supply a major share of new electrification demand

- Bulk power system moves renewable energy from production areas to load centers
- Supplements local production with regional energy diversity & bulk transactions

Credit: Lorenzo Kristov

Policies for a bottom-up energy transition

Implement bottom-up resource & system planning processes

- Start from local energy needs & priorities, then plan outward in concentric circles — customer premises => block => neighborhood => campus => town/city/county
- Bulk system & wholesale market provide final, residual supply after serving as much demand as possible with locally owned & operated DERs
- Maximize PV + storage systems on the built environment
- Incorporate high-DER scenarios into power system planning

Integrate energy planning into city/county planning

Thank you

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