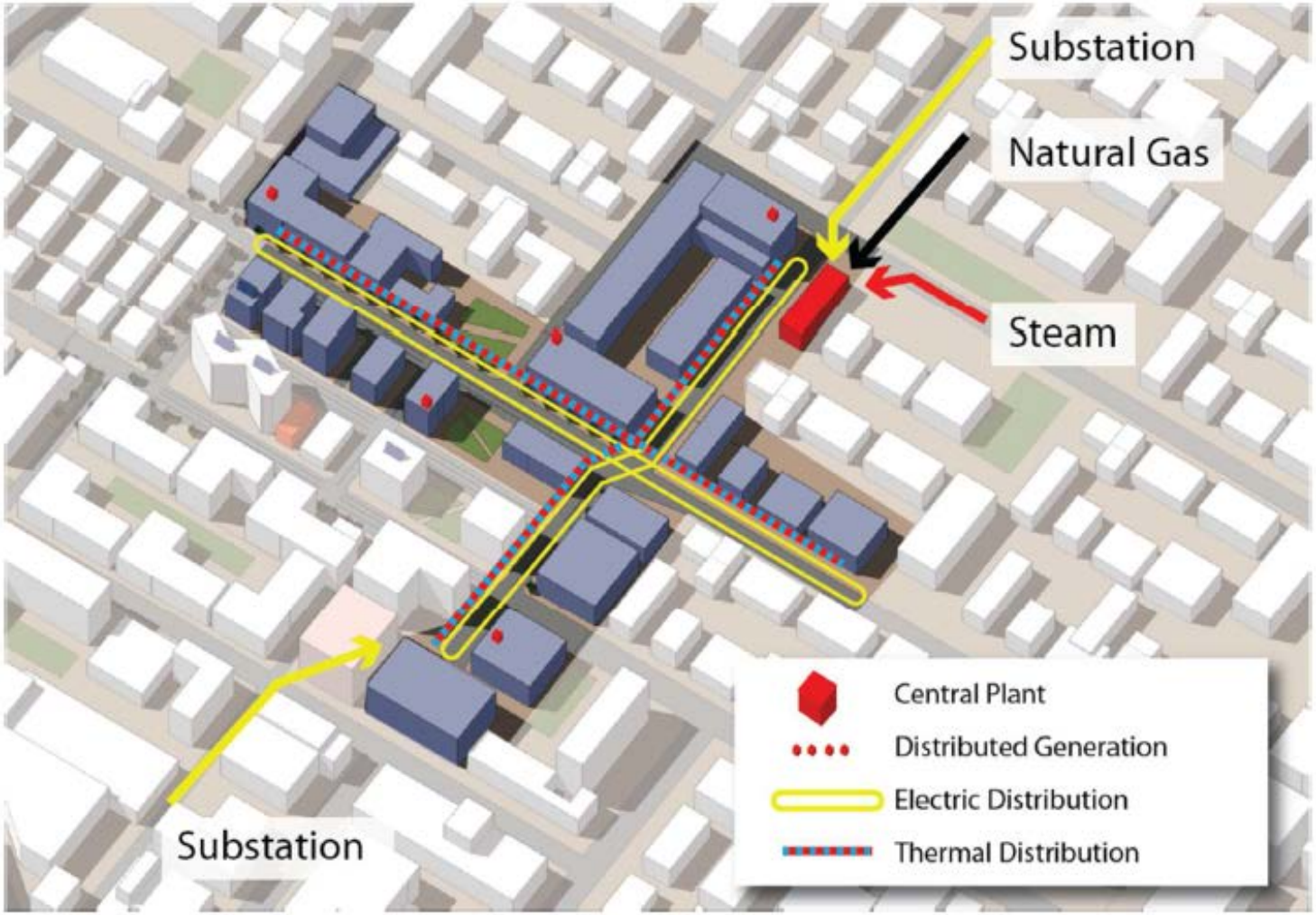
ENERGY

DC MEDSIS

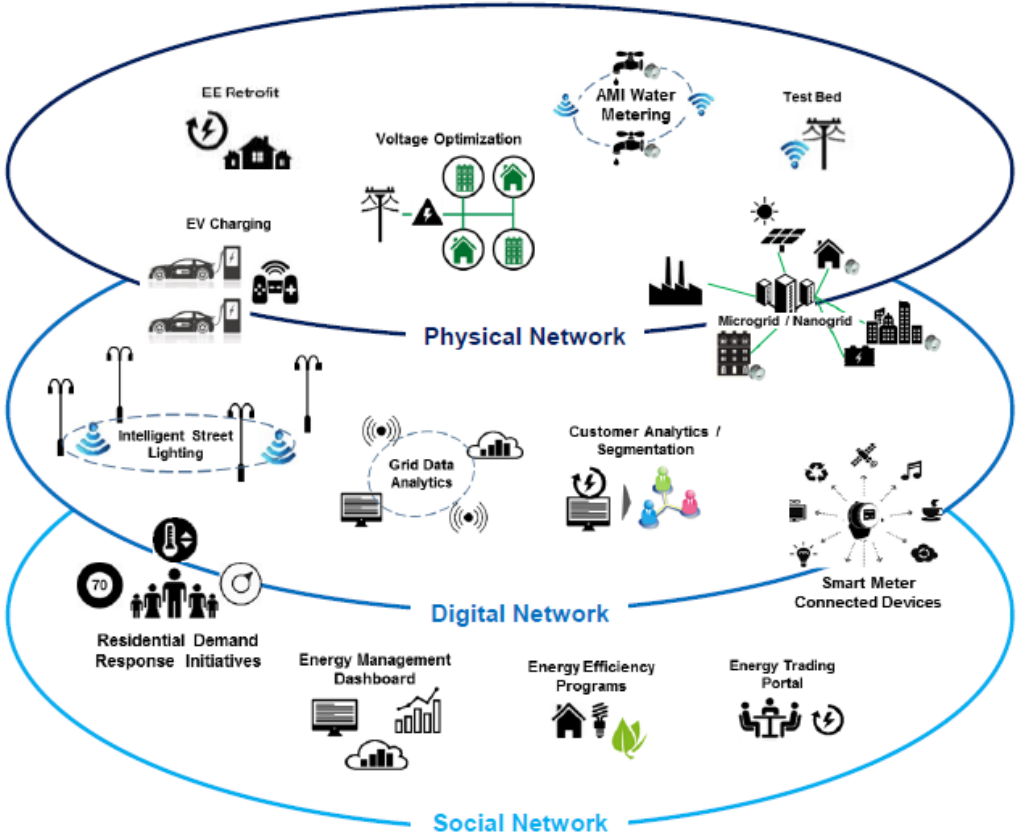
Modernizing the Energy Delivery System for Increased Sustainability

FC No. 1130

Jorge A. Camacho, P.E.
Chief, Office of Infrastructure and System Planning
Public Service Commission of the District of Columbia
1325 G Street N.W., Suite 800, Washington, D.C. 20005
jcamacho@psc.dc.gov | 202-626-5108 Office
www.dcpsc.org


Substation
Natural Gas
Steam
Substation
Central Plant
Distributed Generation
Electric Distribution
Thermal Distribution

Why Is the Current Energy Model being reconsidered?



THE WASHINGTON POST · WEDNESDAY, DECEMBER 16, 2015

storage business

The energy-storage business is definitely moving to a new level this year," said John Zahurancik, president of AES Energy Storage. Zahurancik said that the big buy of batteries is a "vote of confidence" in the business, which drew dramatic attention earlier this year when Tesla Motors announced a home battery product dubbed the "Powerwall."

But for now, the biggest business for batteries isn't in the

ss is "definitely moving this year."

of AES Energy Storage

home, where they can serve a backup role in the event of an outage or pair with a rooftop solar system; it's on the grid, where there is a constant need to be able to manage shifting electricity demand at different times of the day. Batteries that can switch on automatically at key moments can provide a major grid service, which is why demand is increasing.

Thus, AES is, in effect, packaging lots of batteries, provided by LG Chem, into large systems that large power companies can purchase and install or integrate into the grid wherever they need new capacity. AES advertises its batteries as the "complete alternative" to "peaking power plants."

"The projects are generally getting bigger, they're getting longer in duration, and they're happening in more markets around the world," Zahurancik said.

Peter Gibson, director of sales for energy-storage systems with LG Chem, said: "We're very bullish about the outlook for storage. It's in a relatively early stage, but there are an increasing number of successful commercial projects which are in operation today. We're well past the stage of doing pilot demonstrations."

According to AES, deployments of large batteries on the grid will reduce greenhouse-gas emissions in several ways.

In some cases they can supplant the need for "peaker" plants, natural-gas plants that can ramp up fast when there is high demand but tend to have considerable emissions. Batteries can ramp up fast, too, but without the emissions.

There's also a climate benefit if batteries help power plants so "run at more steady rates of output, so they don't have to ramp up or ramp down as much," AES said in a statement.

chris.mooney@washpost.com

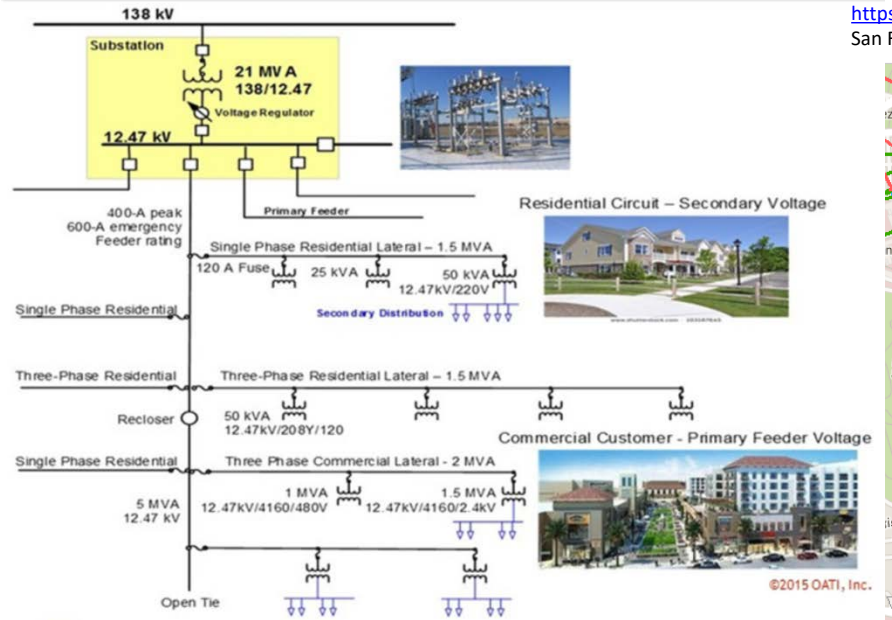
stored and used later, including at night.

Energy company AES, based in Arlington, Va., has announced a large deal in the battery space. It is gaining access to 1 gigawatt-hour's worth of lithium-ion bat-

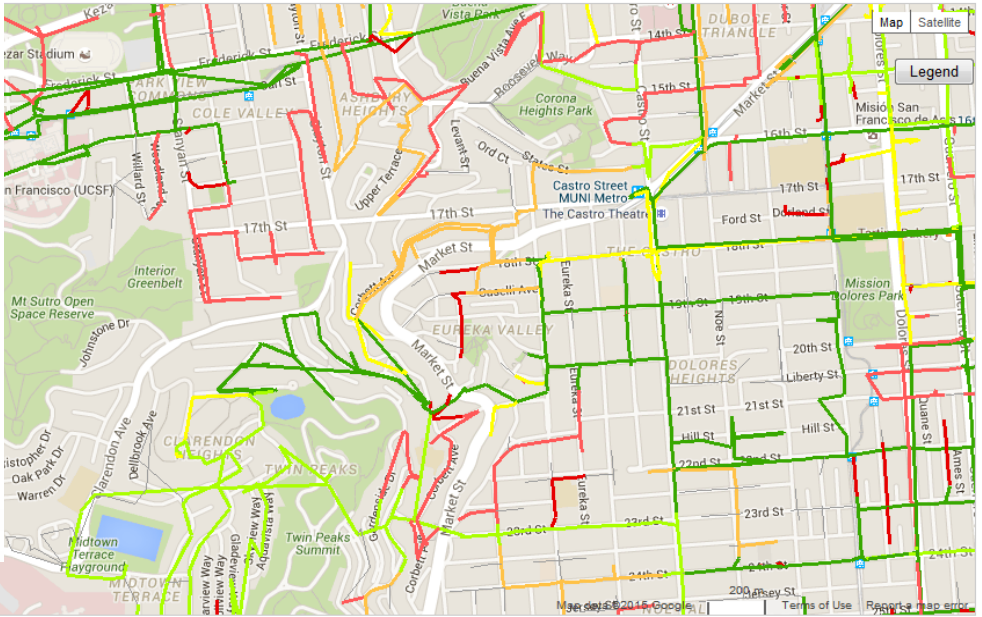
Either way, that's a large amount of battery power. For comparison, GTM Research recently forecast that the United States will deploy a record 192 megawatts of energy storage in 2015.

- Customer Expectations
- Clean Energy Mandates
- Technological Innovation Cost Reductions
- System Reliability Issues

The distribution wires have been the domain of the electric utility.
Non-Utility stakeholders are requiring access to these wires -> physically and visually.
How to enable DER penetration while still maintaining system reliability?



https://www.pge.com/b2b/energysupply/wholesaleelectricsuppliersolicitation/PVRFO/PVRAMMap/index.shtml
San Francisco, CA

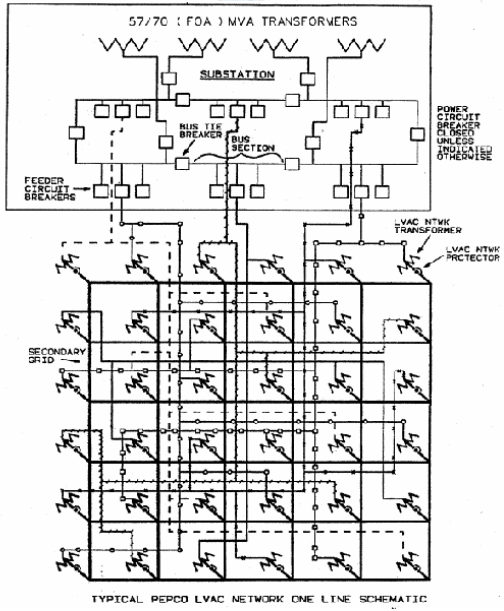


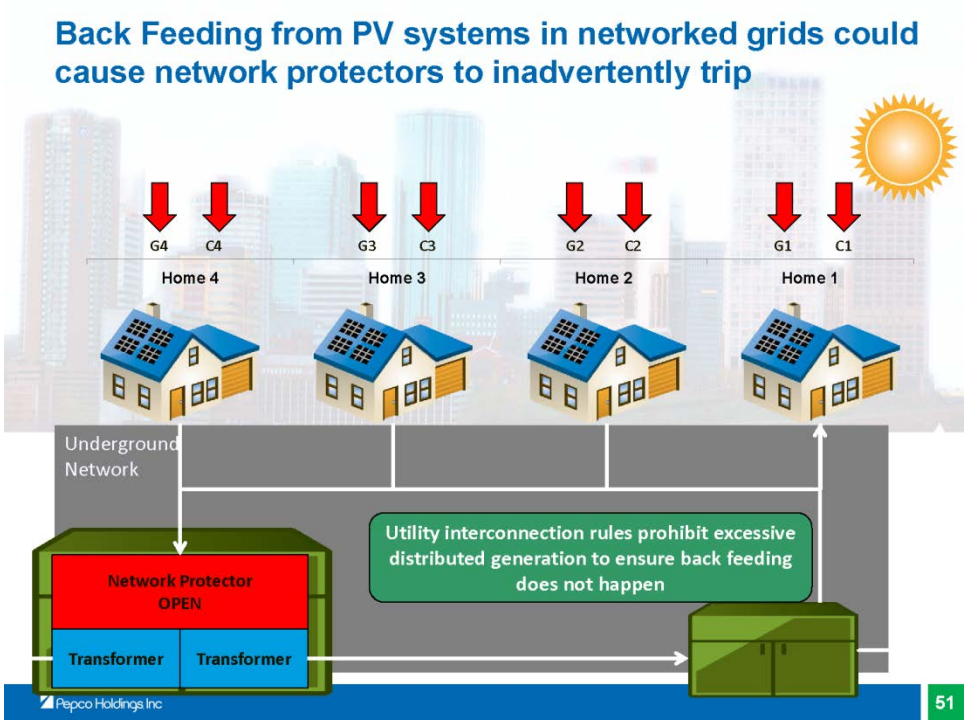
map width: 2.21 miles, map height: 1.26 miles

Enter Address
Go

- Distribution Lines
- Substations
- Transmission Lines

LVAC Networks



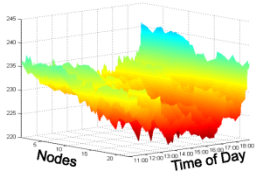


Pepco has ~ 3700 network transformers in the District

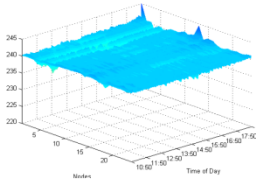
Primarily located within the CBD to support the high-density commercial loads

However, technology exists to overcome these technical challenges in the LVAC network and potential voltage violations on radial feeders.

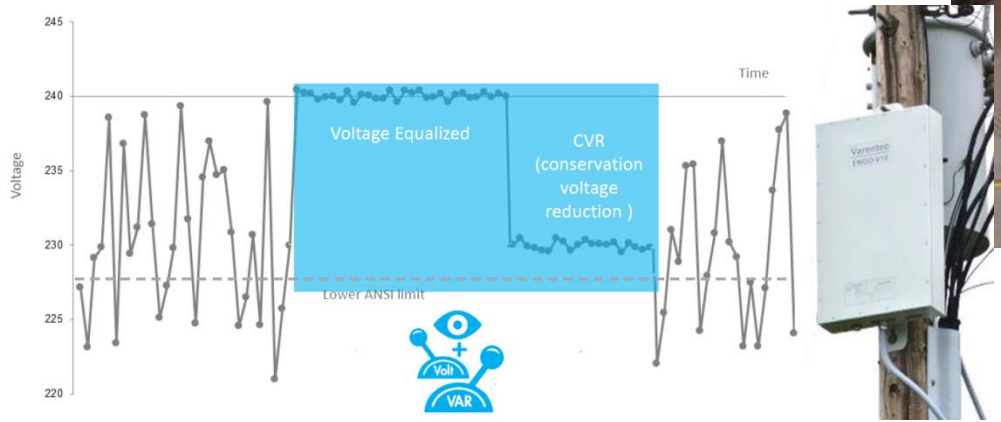
1. **A new concept of "Grid-Side Energy Efficiency"**
   - Dramatic reduction in technical losses
   - Life extension for all existing Distribution operating assets
   - Reactive power managed at the Distribution level
   - Reduced required capital investments in generation, transmission and distribution and avoiding construction of new assets (permitting and community acceptance issues)
2. **Enables ≈ 5% active control of feeder level demand and energy use**
   - Enables grid-side demand reduction and energy savings *without affecting Consumer Quality of Service*
   - Conservation Voltage Reduction can benefit both consumers and utilities
   - CO_2 emission reduction and Clean Power Plan compliance
   - Reduced consumer electricity bill
3. **Increase PV hosting capacity**
   - Can increase PV penetration to >50% while maintaining *all Volt-VAR control benefits*



Grid Edge Control



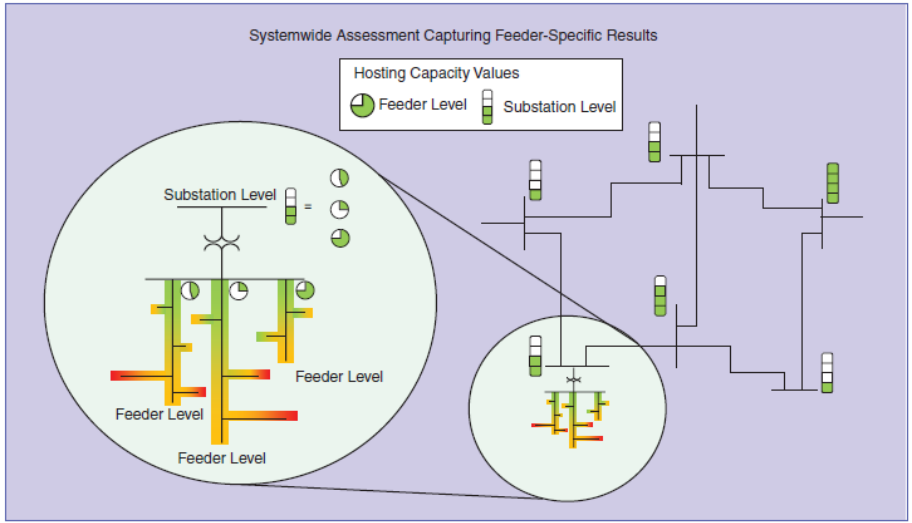
Retrofitted conEdison network protectors (2-Way Communication Relays)



A Delicate Balancing Act

Craft a Win-Win proposition between the Utilities and 3rd Party Developers

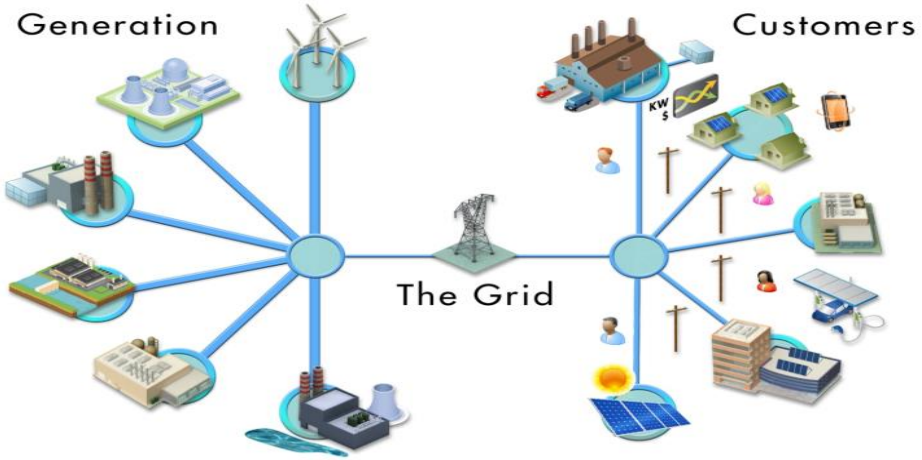
High Level Goals:
Increased Efficiency, Interactivity, Reliability, and Cost Effectiveness



Collaboration

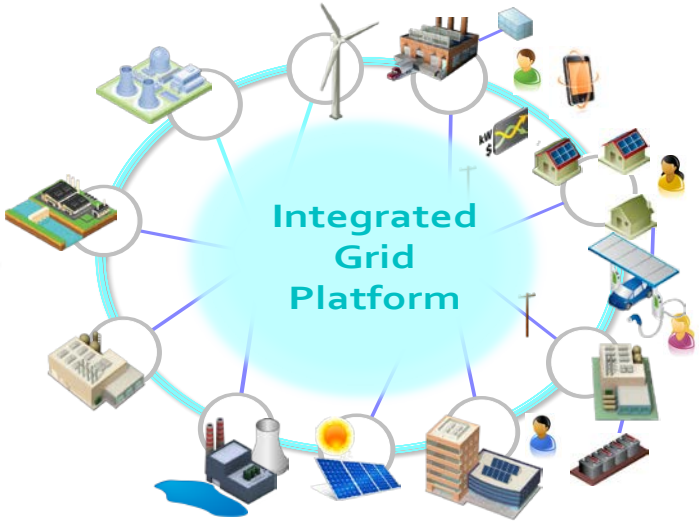
How to Adapt:
Utilities -> provider of different products and services

Today



Load-Serving World

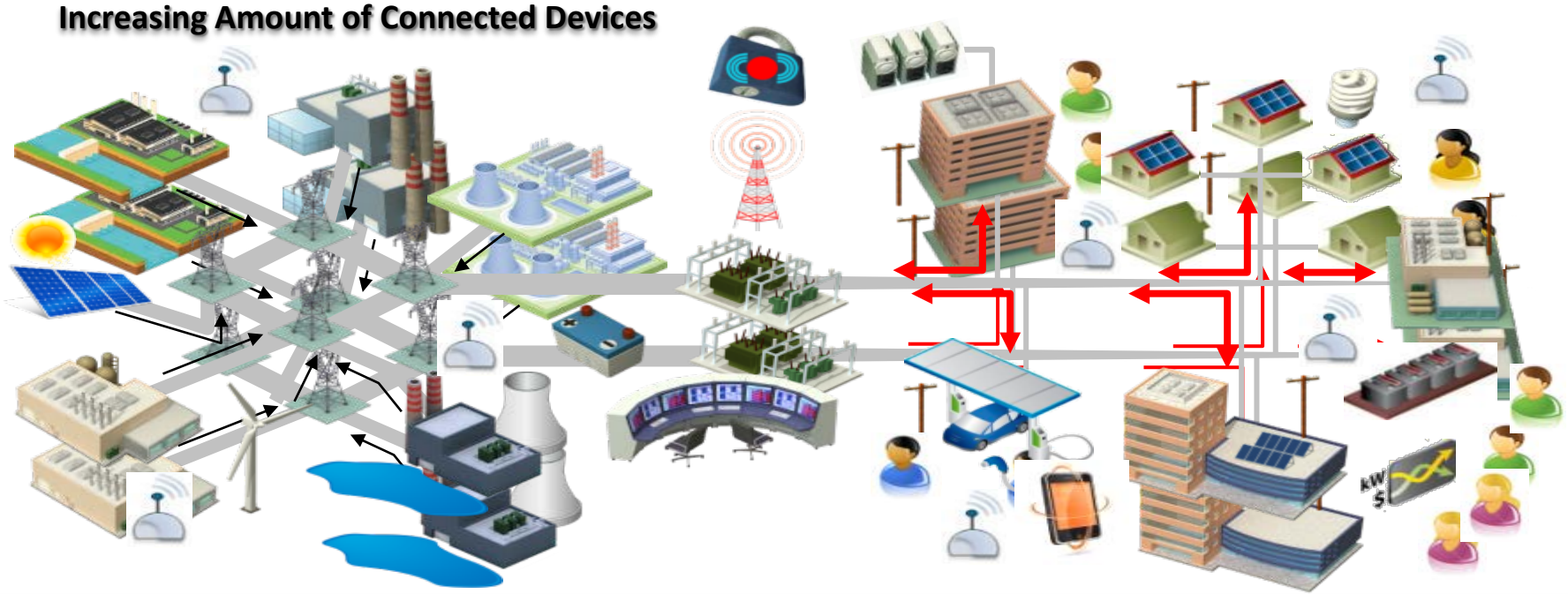
Future



Service-Based World

Source: EPRI

How the Grid is Transforming



Communications and Software are Key Enablers

No need to start from scratch, almost 100% AMI penetration in DC, and ~ 13MW of PV Solar.

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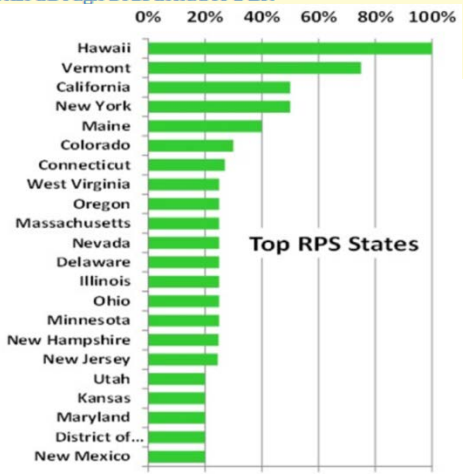
- NEW YORK IOUs: Full AMI necessary for DSP success
- Former IBM Watson exec becomes 'CDO' at GE's Current
- NYISO strategic plan through 2021 includes DER
- Ceiva Energy wir
- CUOMO: NY Gre
- NAVIGANT: Fast



Active Interconnections in the District of Columbia for Solar Photovoltaic Systems

Nameplate Capacity	2015 Y-T-D		2006 – 2014 Total	
	kW AC Inverter Rating	No. of Active Systems	kW AC Inverter Rating	No. of Active Systems
Level 1 10 kW or less and inverter based	1,861 kW	454	5,925 kW	1,467
Level 2 2 MW or less radial distribution circuit or spot network serving one customer	616 kW	15	4,209 kW	81
Level 3 50 kW or less (area network) 10 MW or less (radial distribution circuit)	0 kW	0	0	0
Level 4 less than 10 MW and not level 1, 2, or 3	0 kW	0	90 kW	4
Total	**2,477 kW 2.5 MW**	**469**	**10,244 kW 10.2 MW**	**1,552**

Evolving Distribution Grid
Public Policy Issues

The public policy issues relating to the evolving distribution grid

- What planning process should be employed for the evolving grid?
- How should the grid be designed and constructed?
- How and by whom should the grid be operated?
- How and by whom should the grid DER marketplace be designed and managed? What services behind the meter can be provided and by whom?
- How to define and quantify locational avoided costs that would be realized under DER integration scenarios?

Planning Process Issues

- **What should be the role and function of the utility in the planning process?**
  - As contrasted with existing practice?
- **How should the interests of the multiple stakeholders that will use the grid be represented in the planning process**?
  - Should planning now be a collaborative process involving all stakeholders?
  - How should the final planning decisions be made for the new grid?
- **How should the order and priority of investments (e.g., physical plant, communications, remote sensing, etc.) in the new grid be determined?**
- **Who should bear the financial risks associated with:**
  - Any failure of the new planning process to meet the needs of the DER customer?
  - Premature obsolescence of existing distribution plant facilities?

Design and Construction Issues

- **What should be the role of the utility in the design and construction process?**
  - Should the design and construction of the new grid be outsourced?
- **What should be the functional capabilities of the new grid?**
  - How should those capabilities be determined?
- **Role of microgrids to enhance reliability and facilitate DER integration?**
  - Should utilities be allowed to own and/or operate microgrids?
- **Role of third-parties to:**
  - Own and operate microgrids that serve multiple customers across property lines?
  - Operate commercial multi-customer, multi-property microgrids?

Operation of Grid Issues

- **Should the utility or an independent entity be designated as the Distribution System Operator (DSO) for the new grid?**
  - Would an independent entity provide greater value to the customer?
- **DSO need to exercise control over all assets connected to the grid for reliability purposes?**
  - Will the DSO be able to override operations by all third-parties connected to the grid?
- **How would the DSO be able to ensure that it has sufficient assets under its control to balance supply and demand on the system?**
- **What are the performance metrics for the DSO?**

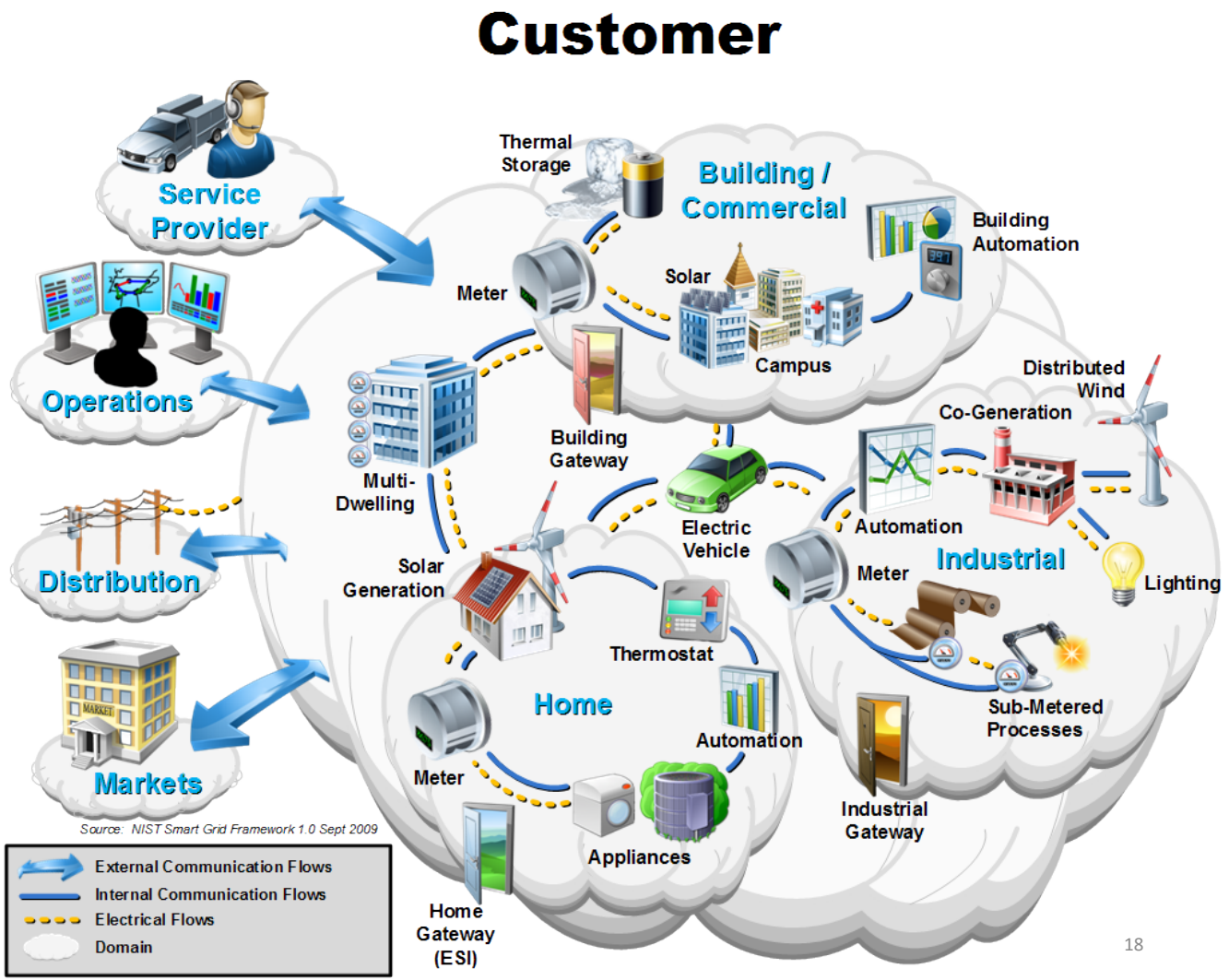
DER Market Facilitation

- **Should the utility or an independent entity be given the responsibility for establishing and operating a market for DER products and services?**
- **Should a utility that functions as a DSO also be allowed to participate in the DER marketplace?**
  - If so, under what rules of conduct?
  - Through an affiliate?
- **How should prices in the DER products and services market be determined?**
  - Regulated or market-based?
- **What access to both customer and operational data should be provided to DER market participants?**
- **Can a utility become a full service energy provider in its service territory?**

Some Observations

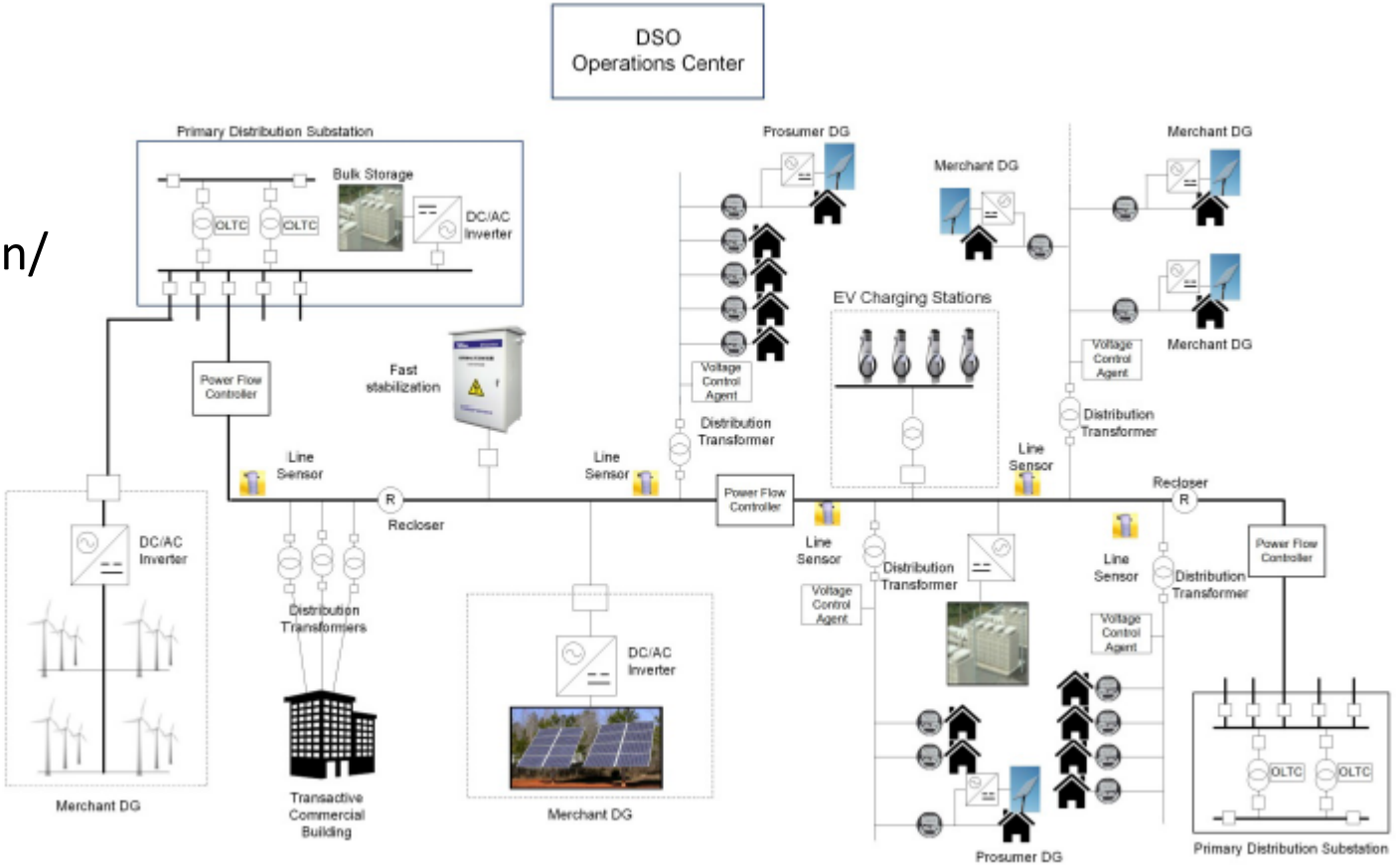
- Customers want choice
- Customers support green technologies particularly solar
- Customers want independence
- Customers want more control over their energy bills; they want to better manage energy usage
- Some customers think utilities oppose renewables especially rooftop solar
- Some customers think utilities break barriers to customer choice
- Some customers do not think utilities are innovative or support new technologies
- Some customers think utilities are slow to act

Regulator is to ensure that the optimization of the energy delivery is in the public interest.



Potential Structures

Ownership/Operation/
Maintenance
Dispatch Rules
Oversight:
Utility DSO
3rd Party DSO



Source: DOE

A simplified Distribution System Operator (DSO) Structure

DSO to ISO/RTO

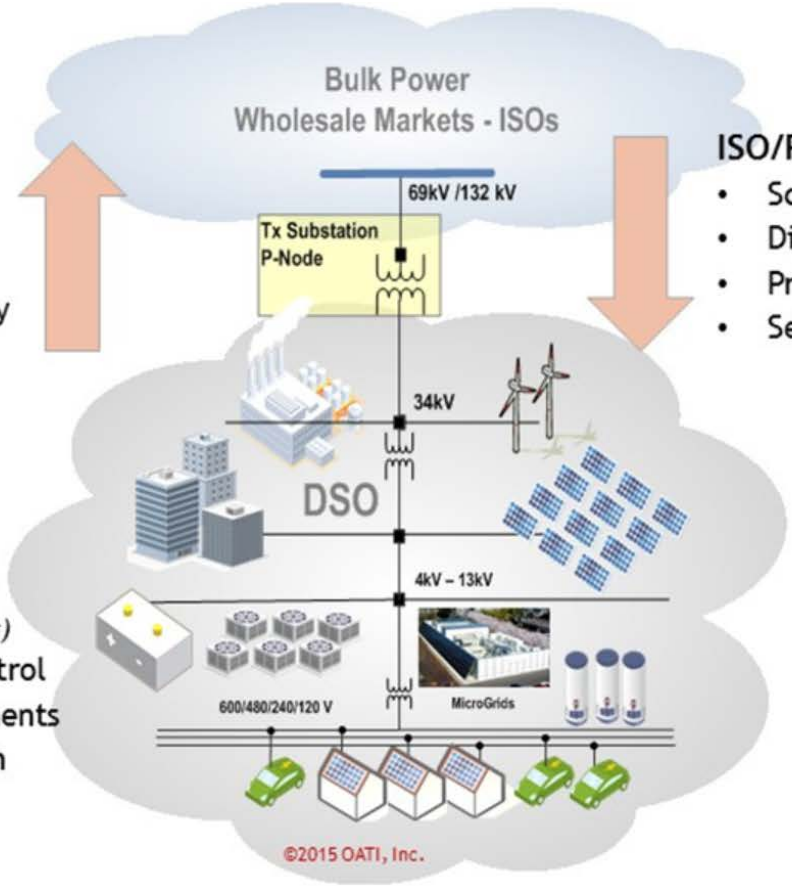
- Forecast Net Load and Dispatchable Products
- Schedules and Bids
- Metering and Telemetry

ISO/RTO to DSO

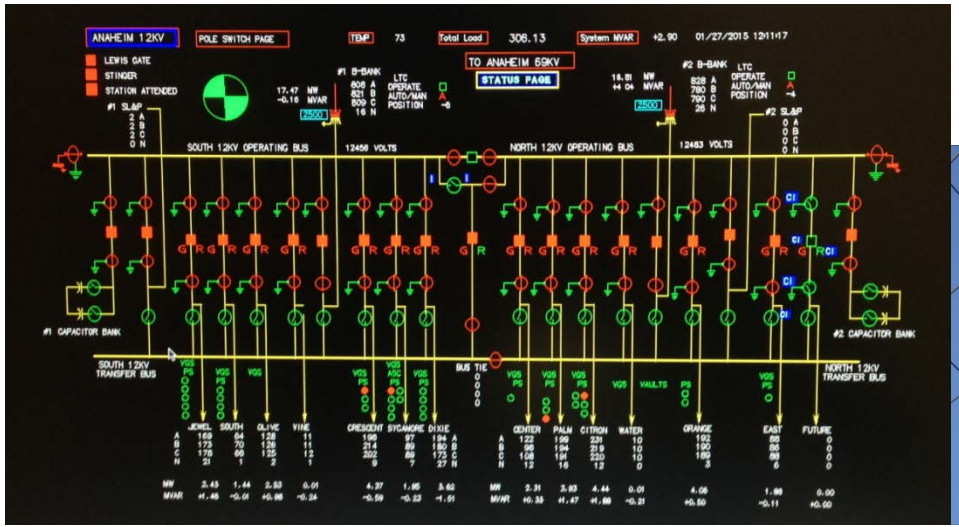
- Schedules
- Dispatch Instructions
- Prices
- Settlements

DSO Functions

- Distribution Planning
- Distribution Reliability
- Operations Scheduling
  - *Forecasting (Load, DR, DER)*
  - *Scheduling (DR, DER, Market)*
- Dispatch and Real-Time Control
- Retail Metering and Settlements
- Retail Market Administration

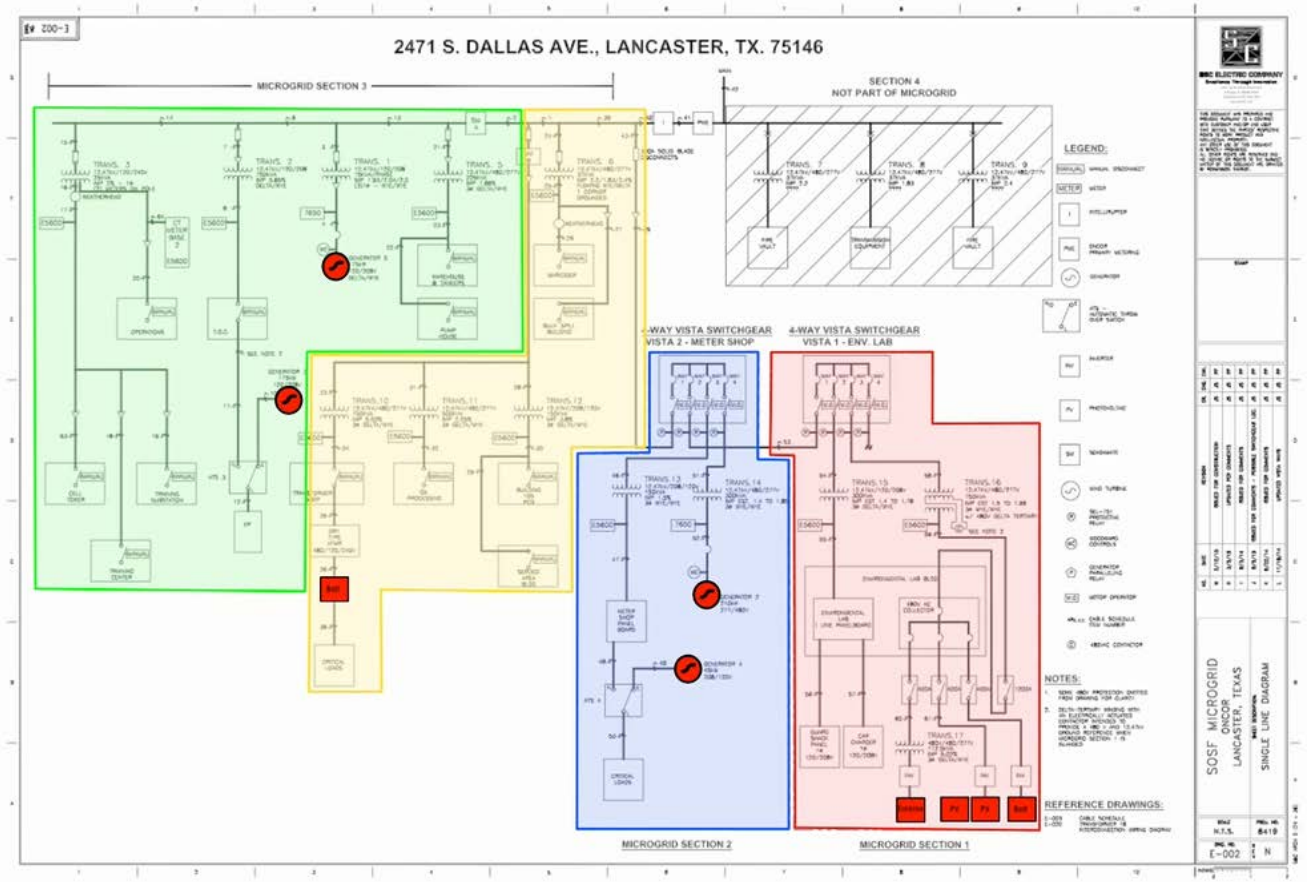


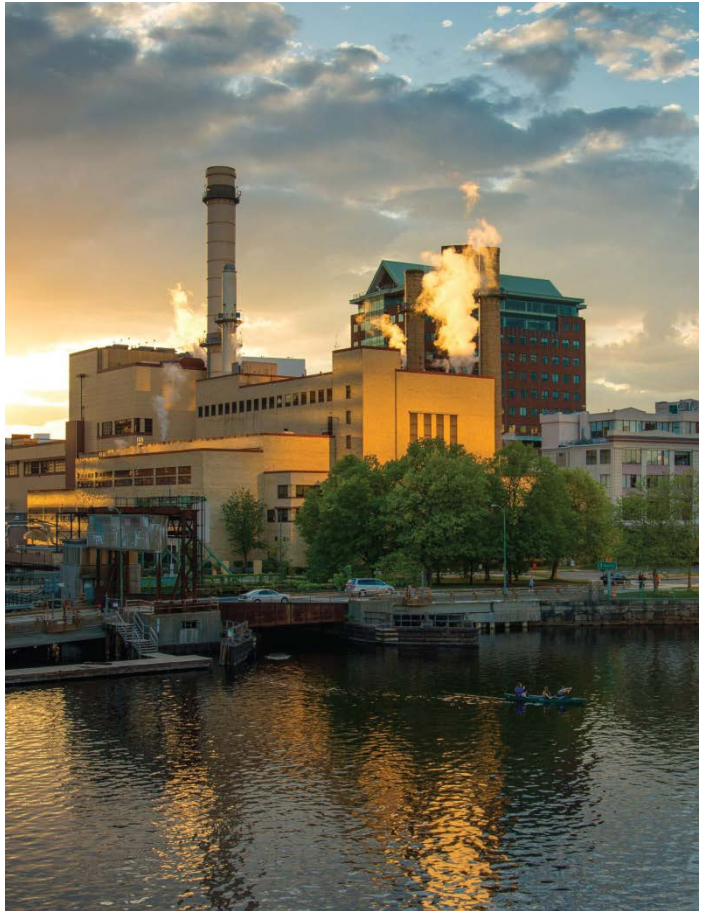
Compensation Efficiency
Interconnection
Ancillary Services @Distribution
IEEE1547, UL1741



Emerging Concerns with Microgrids

- Who should develop, own and operate microgrids in restructured states?
- Treated as IPPs?
- As utility-rate based investment?
- As renewable energy or energy efficiency?
- As premium service?
- Adjunct to macrogrid?





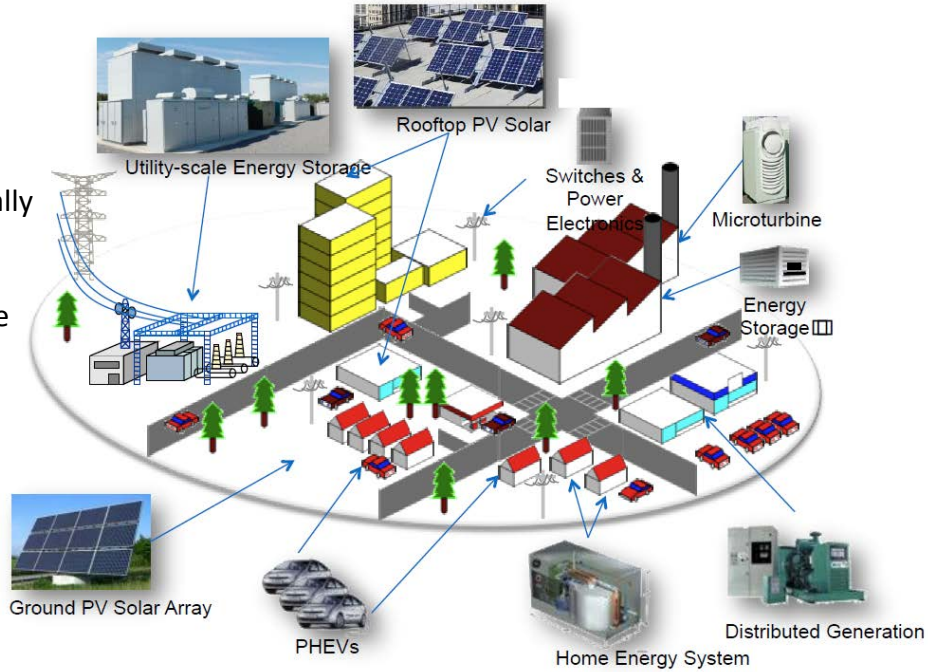
Kendall Cogeneration Station – District Energy Boston, Cambridge

Crossing the public right-of-way
Wheeling Arrangements, Remote (Virtual) Net Metering?

Making a potential case for Microgrid deployment

Barriers

- Obligation to Serve
- Ability to balance generation, storage and load to maintain reliable operations when disconnected from the grid
- Safety, Reliability Oversight
- Wholesale FERC Regulation -> Any exported electrons will sink locally
- Risk Aversion Utilities
- Exclusive Franchising
- Attracting Third-Party Investment, it may not make economic sense
- It may make more sense for generation to sell into RTO -> sustainable business model
- Less distribution wires, less revenue to distribution utility, what's the ratebase?
- CHP Air -> Air+Noise Permitting



Benefits

- Increased Efficiency -> Lower GHG
- Increased reliability to microgrid participants and possibly increased resiliency to surrounding areas (community stewardship), local balancing
- Deferment or elimination of utility capex to address Load Growth and Power Quality (reliability)
- Fast-Acting ancillary services to the distribution system
- Security advantages of distributed generation (less vulnerable than centralized generation)
- Total Cost of Energy decrease
- Energy infrastructure expenditure decisions possibly made closer to the customer

MEDSIS Initiative -> What's Next? – Tentative

1. Informational Workshops – 2015

   Final Informational Workshop: February 12, 2016 @DCPSC -> Become a collaborator.
   http://www.dcpsc.org/esr/FC1130_IncreasedSustainability.asp
2. Roadmap, Long Term and Short Term Goals – 1st Q 2016
3. Creation of Working Groups – 2016

   Technologies, Policies, and Sustainable Business Models
4. Possible Spinoffs into other proceedings that could seek rulemaking – 2016-2017