
Grid Modernization

The Distribution System as a Platform Technology

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Overview of My Talk

- This talk will investigate the drivers of change, and discuss the state of play within NYS.
- We'll start with a discussion on NYS electricity markets...
- then discuss general concepts of networked markets and 'platforms' they utilize...
- And finally discuss the path forward and speculate some....

Reforming the Energy Vision: REV



Reforming the Energy Vision **REV**



What is REV?

The twentieth-century power system is unsustainable, both environmentally and economically. Rising energy bills, more frequent extreme weather, and the environmental imperative to reduce carbon emissions require us to reinvent how we produce, deliver, and consume energy. Meanwhile, increasingly affordable clean energy technologies such as the rapidly declining costs of solar electric (also referred to as solar PV) and other clean distributed generation alternatives, offer the opportunity to address our energy challenges in innovative ways, creating new jobs, promoting economic development, and improving value for customers. REV unlocks clean energy markets to capture these opportunities, building a brighter future for New York.

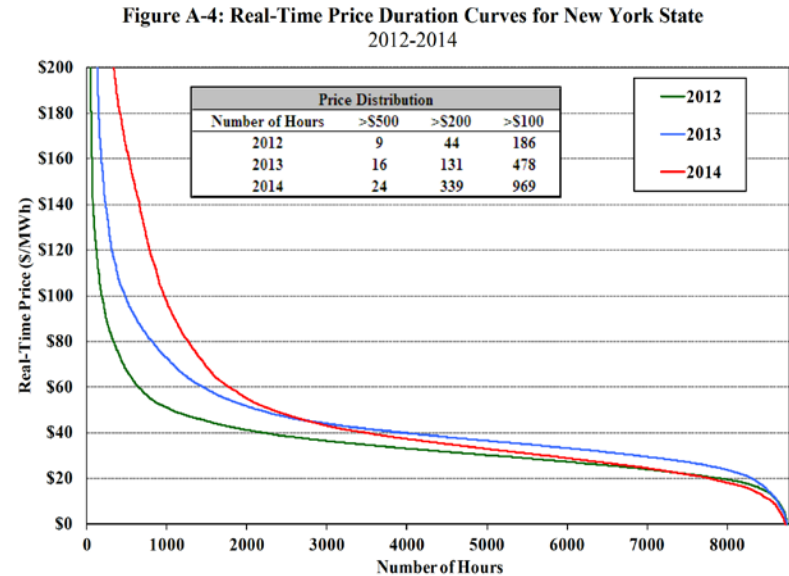
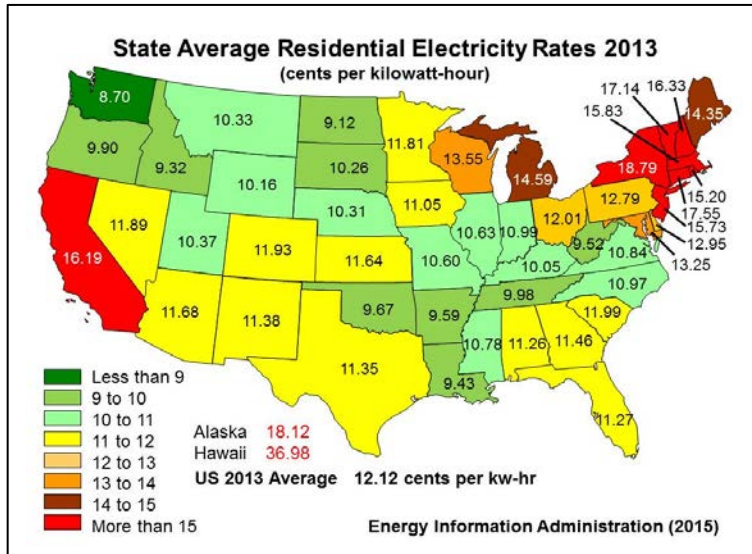
to encourage the cleanest, most advanced, and efficient power system operation. State programs supporting clean energy are being redesigned to accelerate market growth and unlock private investment. And under REV, New York is deploying innovative energy solutions across State-owned buildings, university campuses, and State vehicle fleets.

The outcome of REV will be a dynamic clean energy economy that empowers communities and customers – across all income levels, geographies, and demographics – to take control of their energy use, driving local economic growth and revitalization, improving the resiliency of our energy system, and protecting our environment.

To ensure we achieve these ambitious goals, New York State has enacted a Clean Energy Standard, legally mandating that renewable sources will provide 50% of the State's electricity by 2030. The transformative effects of REV ensure this mandate will be achieved through the fastest, most cost-effective means.

The clean energy opportunity is now. In New York, we're seizing it.

Situation: NYS electricity costs are the highest in the continental US



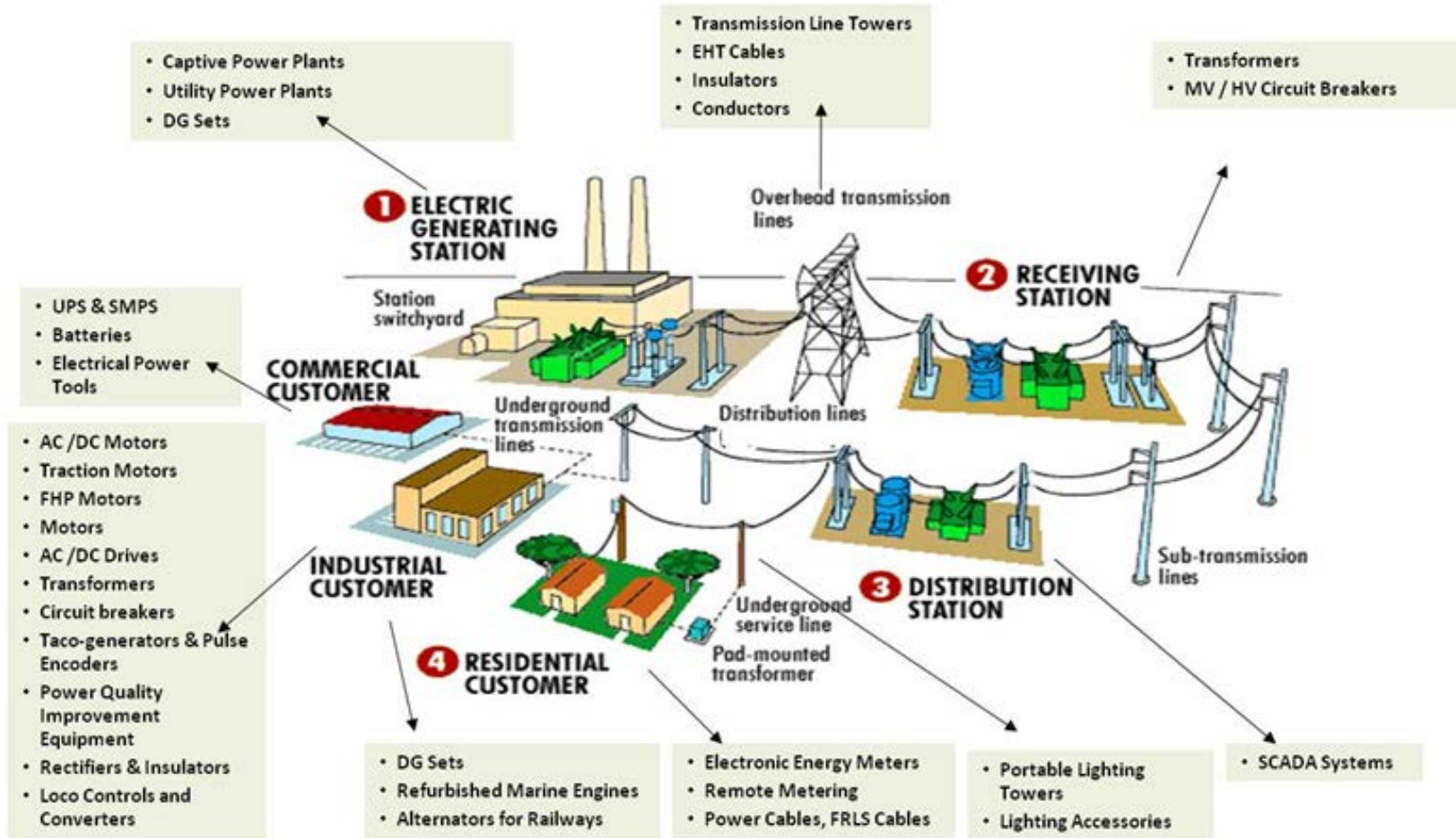
- Peak demand growing faster than base, resulting in an increasingly inefficient electricity market

Flattening the 100 hours of peak load = \$1.5B for consumers

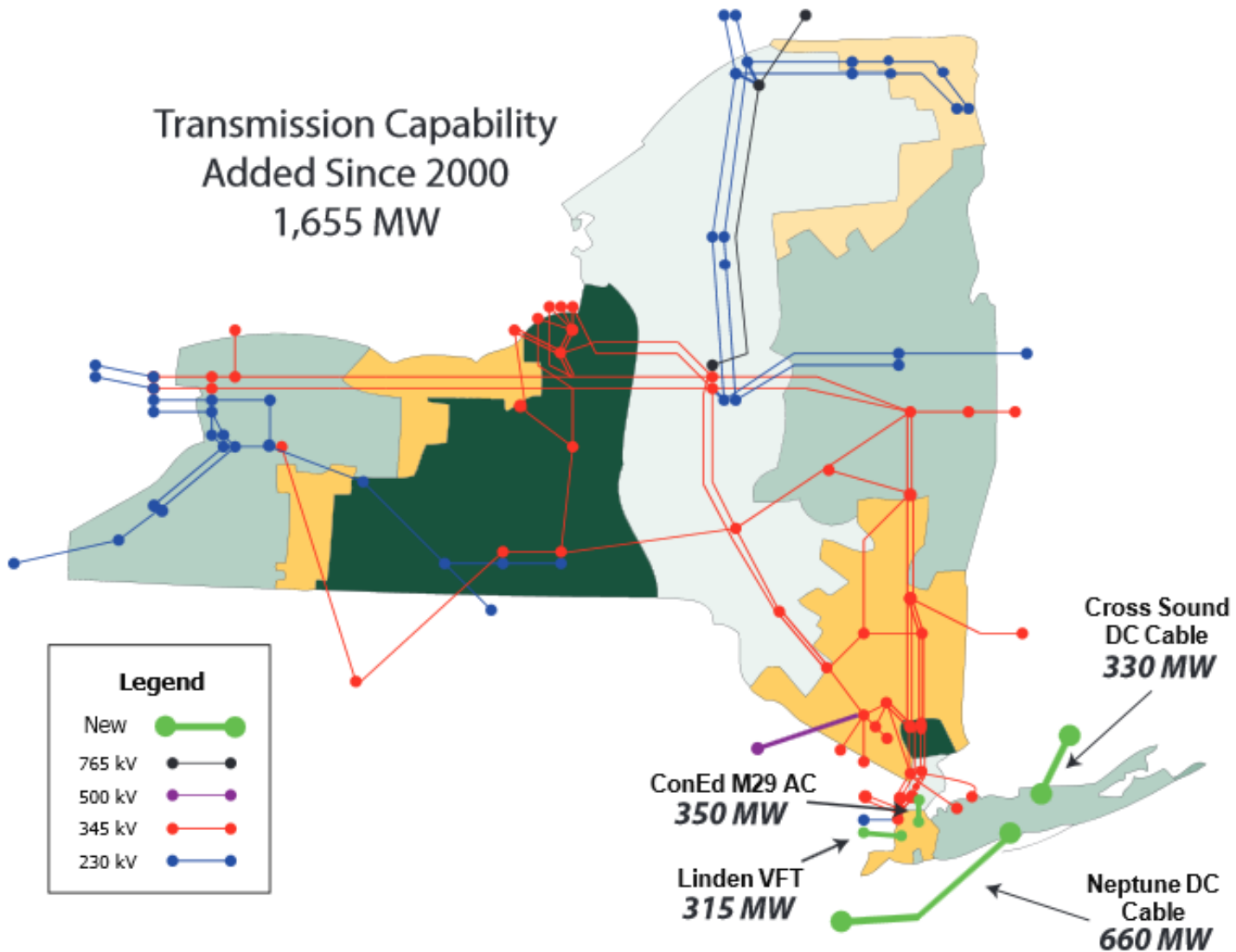
- A key issue for improving efficiency is creating a more efficient distribution system

The LIPA system has a utilization rate of about 40%

Electricity Generation, Transmission, and Distribution

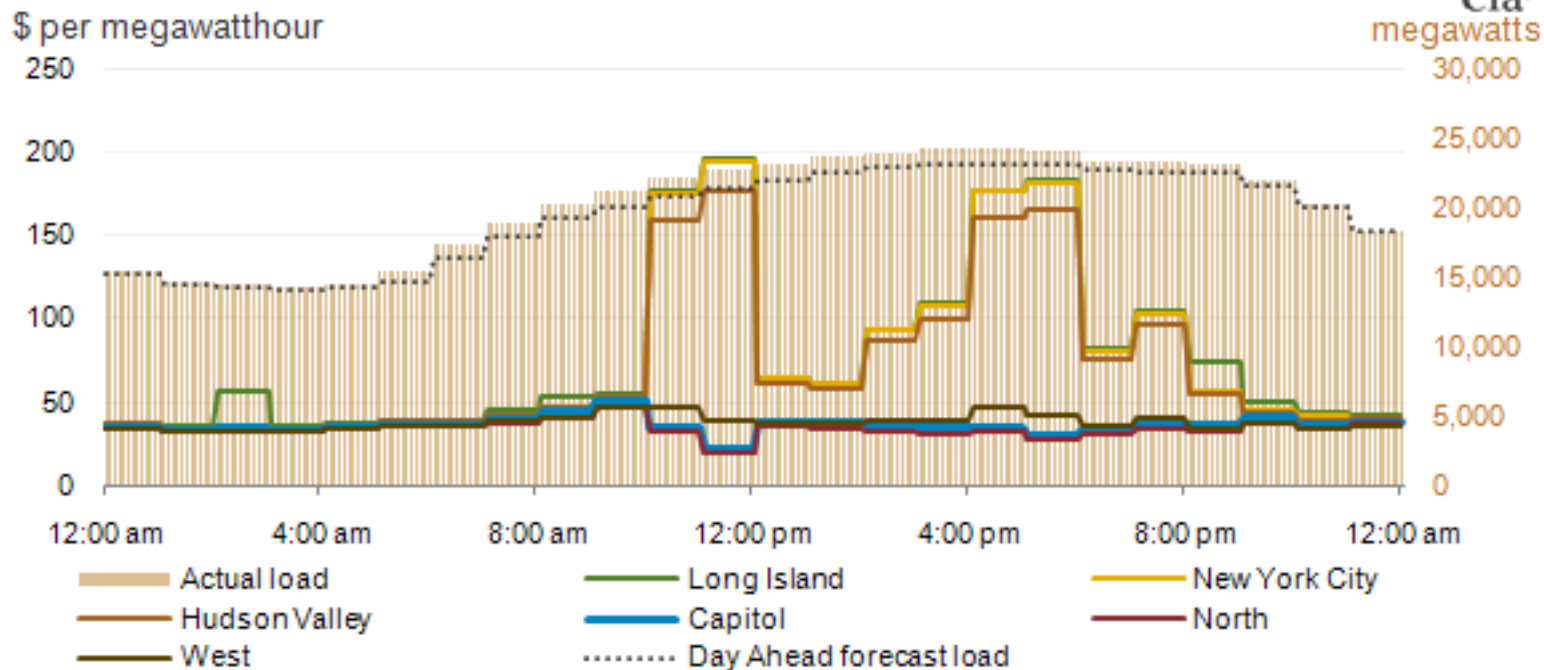


New York's Transmission System

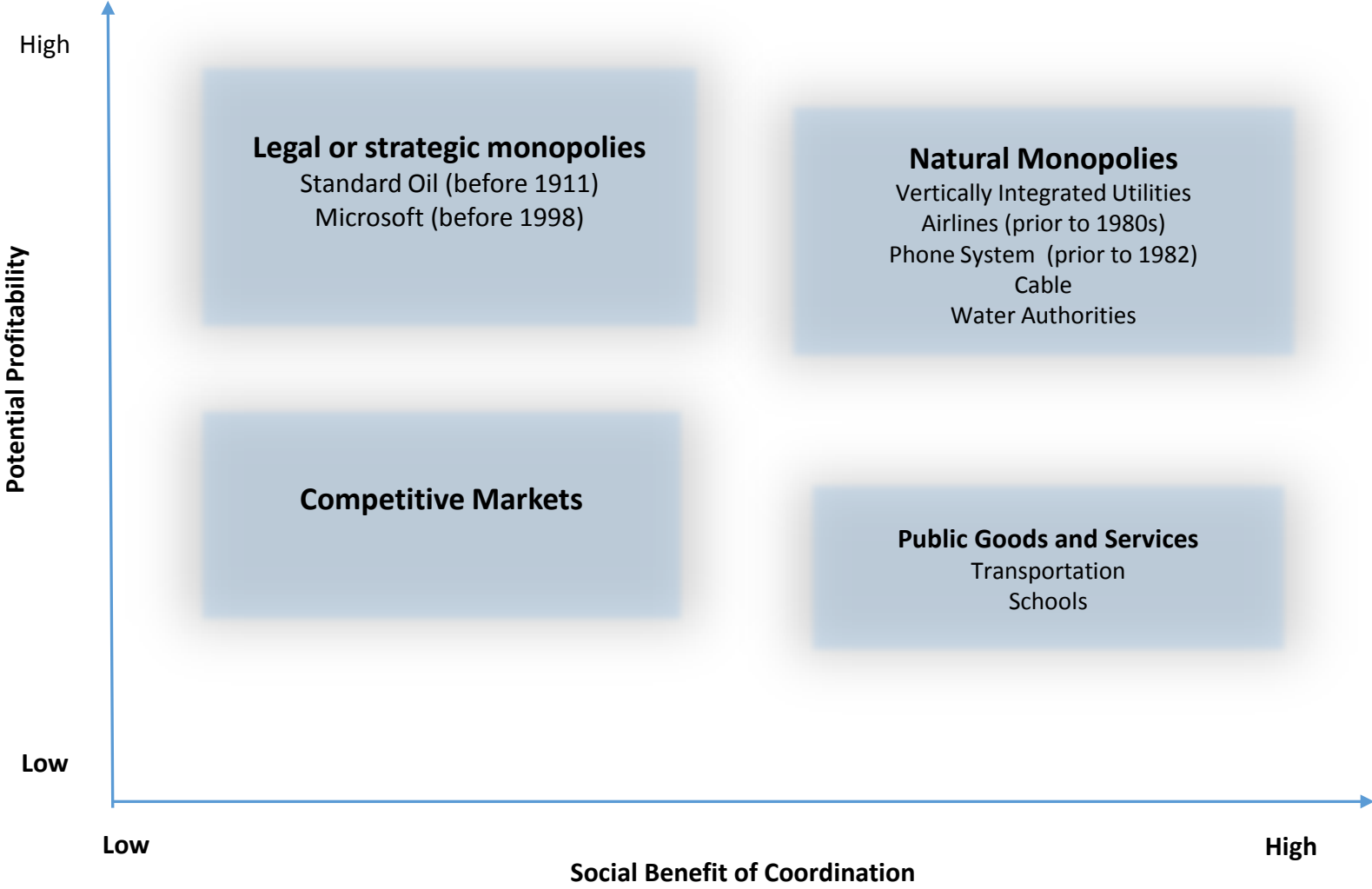


New York Bulk Power Market

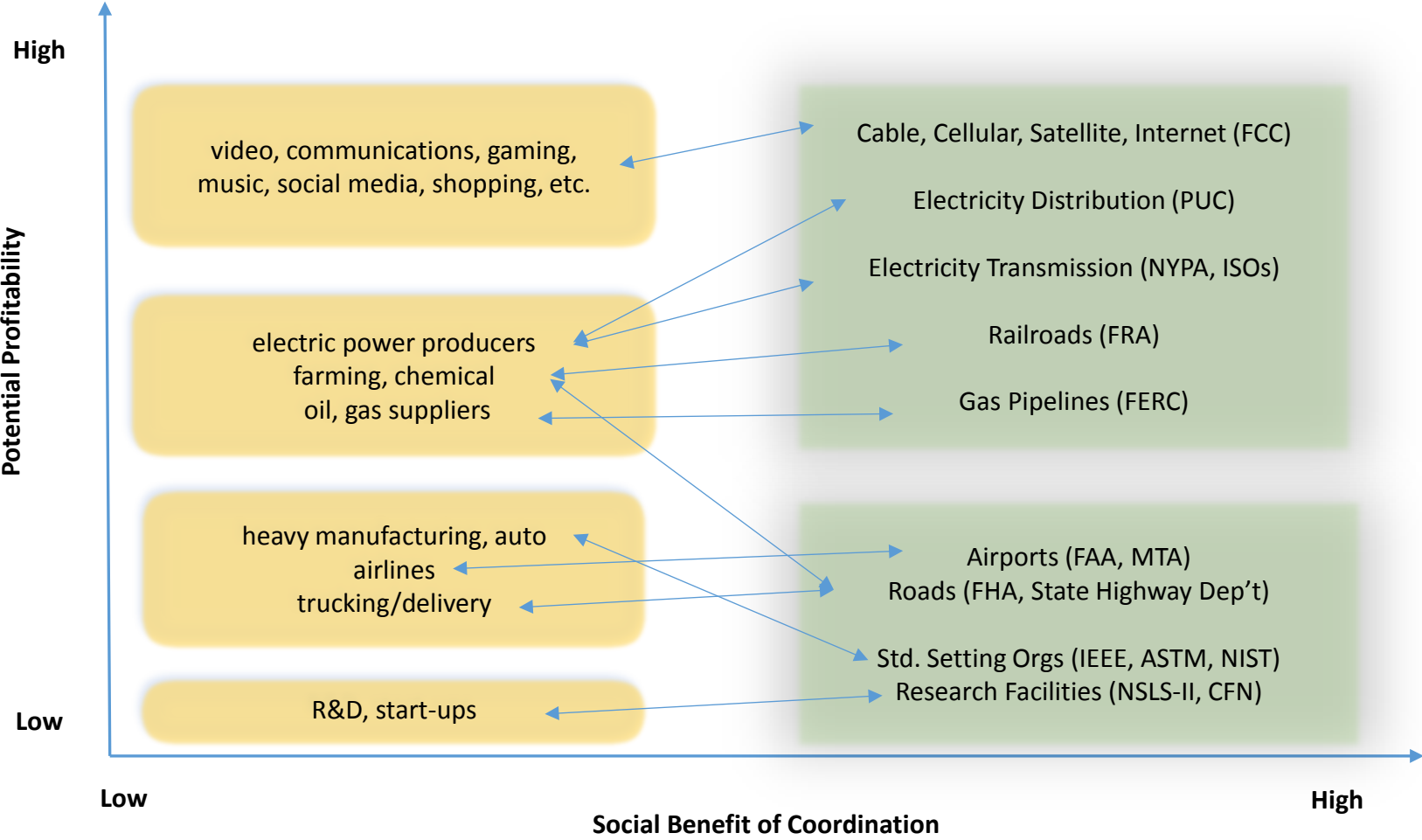
Real-time prices and actual load for New York ISO: Sept 12, 2011



Structure of Firms and Markets (notional)



Coordinated, networked, and regulated infrastructures are platforms for businesses/services/markets for many sectors of the economy



There are "disruptive" trends in the electricity sector which are eroding the natural monopoly of the distribution utility

- Ever increasing connectivity/networking of energy systems
 - enabling improved state estimation, more coordination, more facile operations
- Falling costs of distributed generation (PV, wind, etc.) and other distributed energy resources (DER) while electric rates are rising
 - In ~20 years, prices are likely to reach cost parity with conventional generation
- Gov't actions are aimed at commercialization and deployment of new DER and DSM technologies
 - NYS/federal programs for development and commercialization of DER/DSM
 - Programs aimed at lowering the cost and reducing the time for deployment
 - Programs aimed at enabling demand response (100% AMI in ConEd Territory)
 - Policies to reduce GHG emission, and increasing resilience

Numerous studies predict DER cost-parity with 10-30 years (Example: solar + energy storage)

FIGURE 1: OFF-GRID VS. UTILITY PRICE PROJECTIONS
COMMERCIAL - BASE CASE
[Y-AXIS 2012\$/kWh]

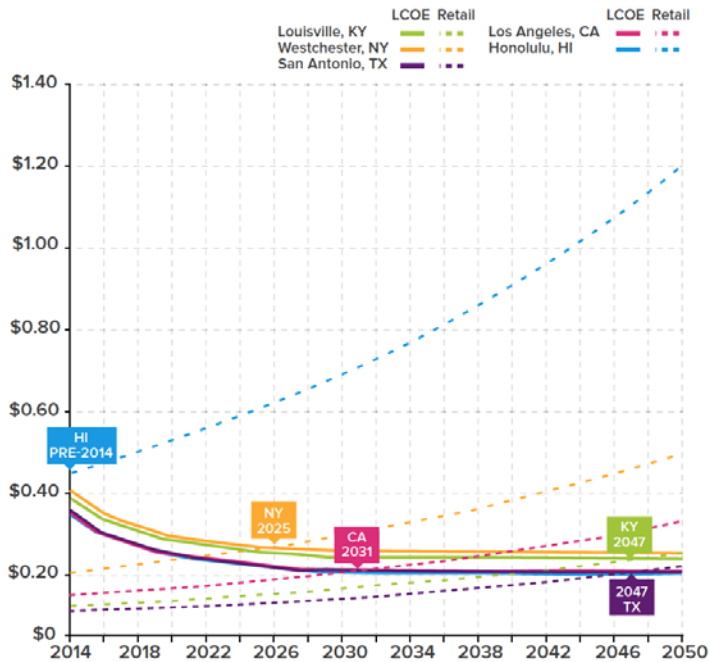
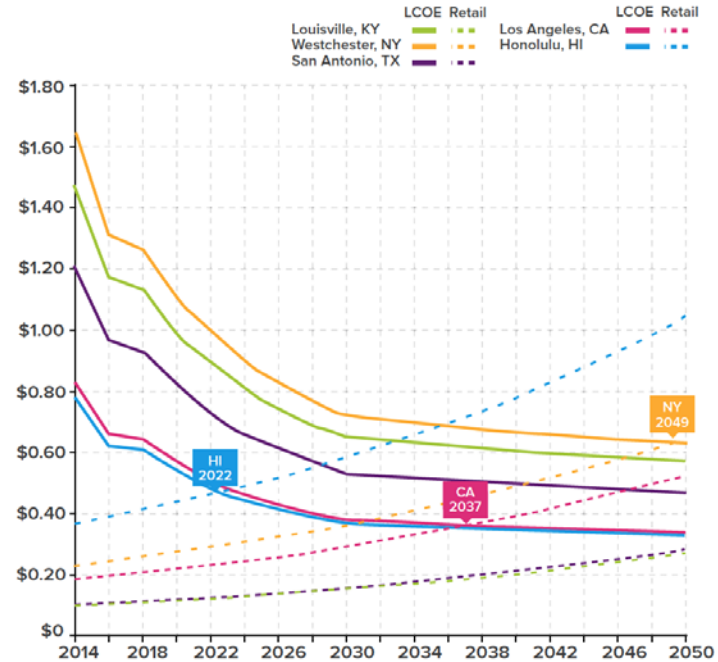


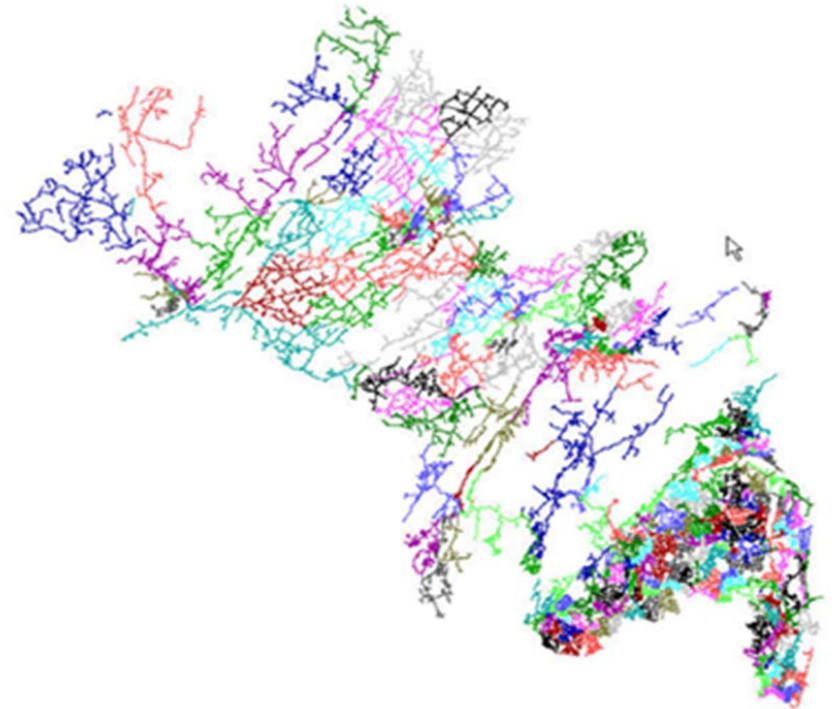
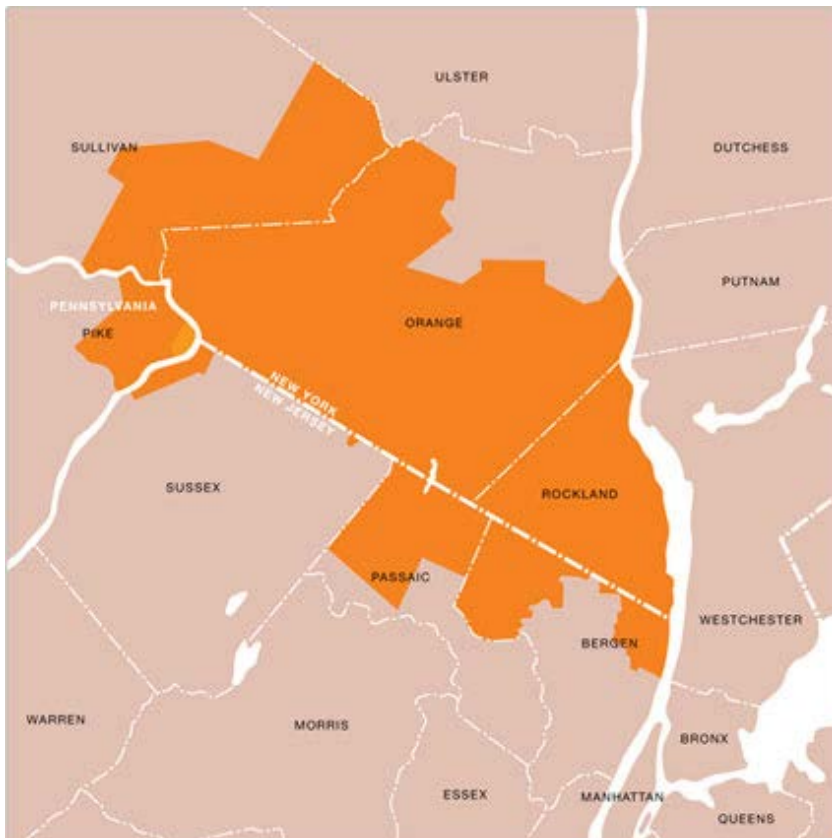
FIGURE 2: OFF-GRID VS. UTILITY PRICE PROJECTIONS
RESIDENTIAL - BASE CASE
[Y-AXIS 2012\$/kWh]



NYS is creating the “Distribution System Platform”

NYS will transform today’s utility distribution system into a platform technology for markets at the distribution layer

Primary products to be traded: real power, reactive power, reserves



The Distribution System Platform (I)

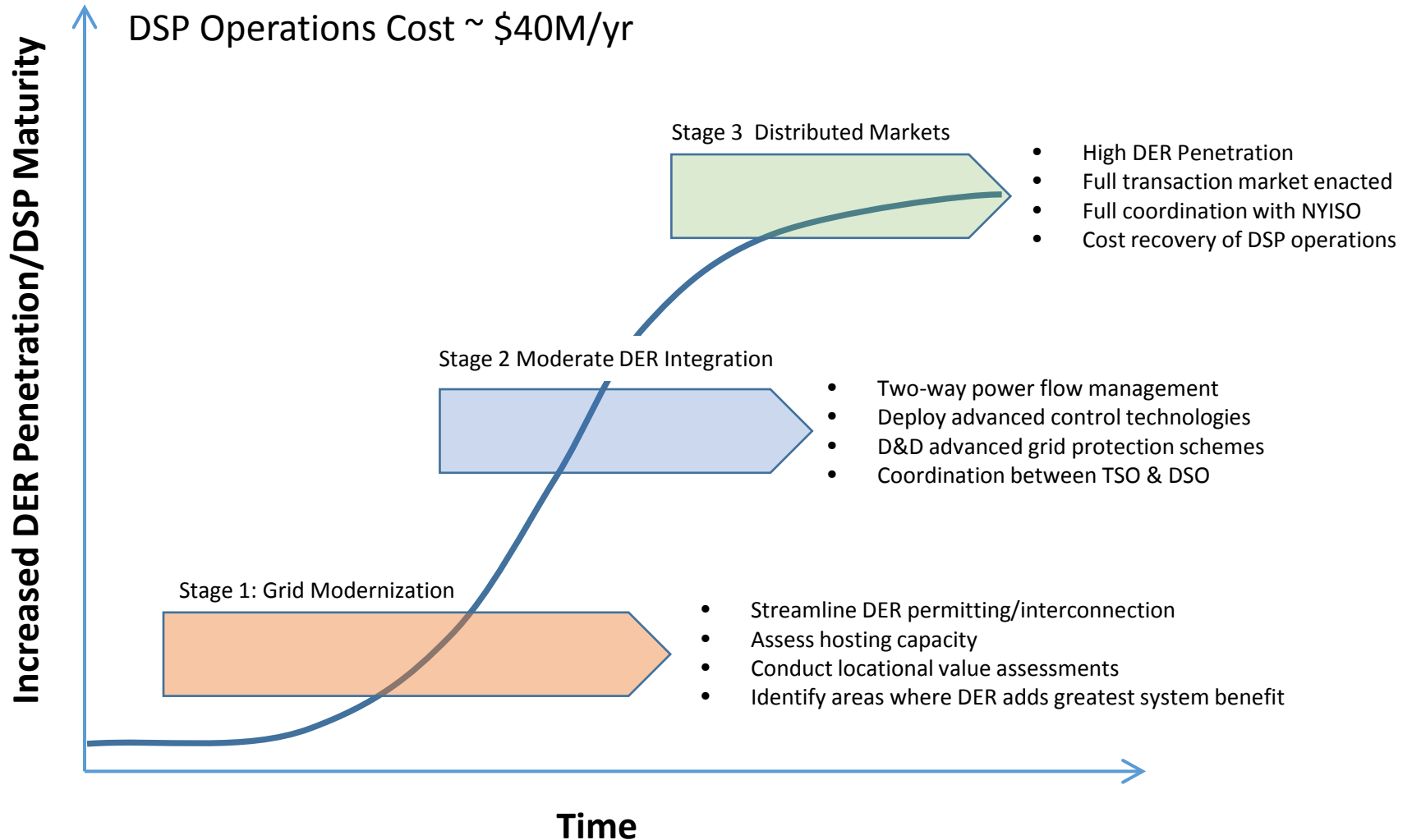
- With the DSP, DER will provide three main products:
Real energy, reactive power, reserves
- Value propositions
 - DSP markets could deliver total lower costs to consumers over BAU
 - Models estimate as much as 5% in peak summer for real power
 - Cost of reactive power charged to consumers as much as 25% lower
 - TOD pricing for flexible customers saves ~10% - 15%
 - Improving system performance
 - Increase system utilization
 - Align DER locational adoption with local system needs (avoid capacity upgrades)
 - Implement new technologies (inverter-based), enable volt-var control at lower cost
 - Support for new combinations of products and services
 - Support for transactions among participants, creating new combinations of offerings
 - ESOCs, aggregators, service suppliers able to come together to bundle and market DER resources – “network effect”

The Distributed System Platform (II)

- Utilities will operate the physical platform
 - Plan and operate their systems (wires and poles)
 - Utilities will not own generation, DER resources (to first order)
 - Regulation moves from cost of service model to performance based regulation
 - Co-owners of a single, state-wide digital platform to enable market transactions (?)
- Electricity marketplace – similar to ISO markets
 - Forward market for electric “products” (advance, up to closure of day ahead)
 - Bids and offers transparent, visible to all (not entities making bids/offers)
 - Location and time-based bids bilaterally matched
 - Separate clearing market
 - Resolves differences between scheduled supply and actual consumption
 - Real-time load-flow calcs, LMP, etc.
- Not clear who will operate the financial marketplace.
 - Concern about utility conflicts of interest as system and marketplace operators

The Distributed System Platform Evolution

DSP Development Cost ~ \$100M
DSP Operations Cost ~ \$40M/yr



Implications?

- New Platforms can bring entirely new levels of value to consumers
- New modes of service for consumers
 - Whole home energy systems, smart appliances, smart meters...
 - PV, storage, fuel cells, etc. etc.
 - ESCOs that provide thermal services (instead of HVAC systems)?
- New ways for consumers to manage their energy bills
 - Participate in markets?
 - Demand managemet
 - Reactive power? Real power? Reserves?
- New business models for utilities
 - % per transaction vs. reimbursement for cost of service
 - Note: ebay charges ~ 9%/transaction, Open Table ~ 2%

Situation: NYS electricity costs are the highest in the continental US

Figure A-12: Load Duration Curves for New York State
2012 – 2014

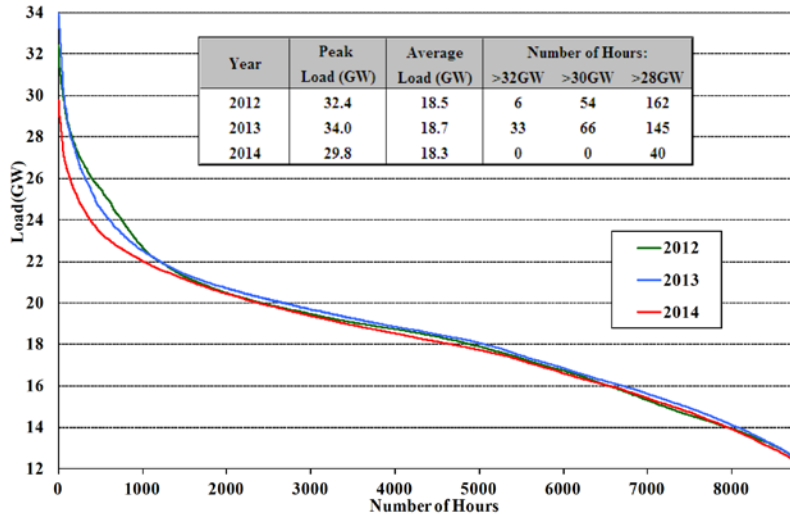
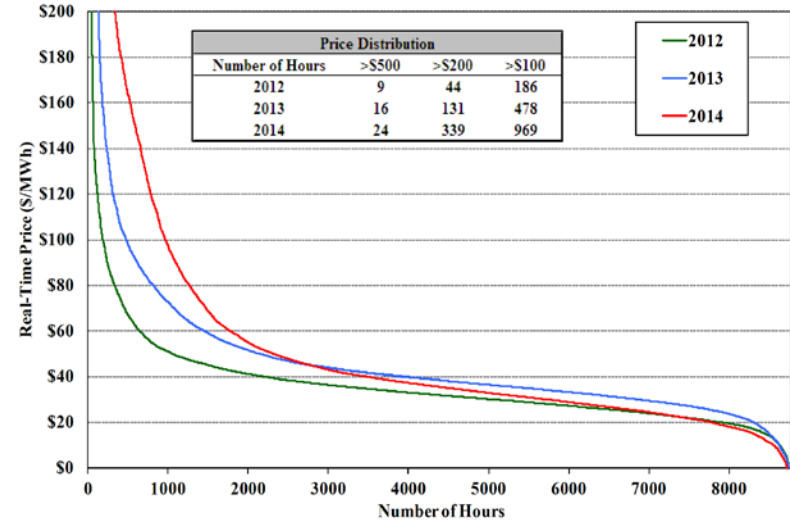


Figure A-4: Real-Time Price Duration Curves for New York State
2012-2014



- Peak demand growing faster than base-load, resulting in an increasingly inefficient electricity market
 - **Flattening the 100 hours of peak load = \$1.5B**
 - **The LIPA system has a utilization rate of about 40%**
- A key issue for improving efficiency is creating more “elasticity” in demand