The Evolution of System Operation and Transmission Ownership Unbundling

IEA Electricity Security Advisory Panel (ESAP)
January 14, 2015

Richard McMahon
Vice President, Energy Supply and Finance
Edison Electric Institute
The Edison Electric Institute (EEI) is the association that represents all U.S. investor-owned electric companies. Our members provide electricity for 220 million Americans, operate in all 50 states and the District of Columbia, and directly employ more than 500,000 workers.

With more than $85 billion in annual capital expenditures, the electric power industry is responsible for millions of additional jobs. Reliable, affordable, and sustainable electricity powers the economy and enhances the lives of all Americans.

EEI has 70 international electric companies as Affiliate Members, and 250 industry suppliers and related organizations as Associate Members.

Organized in 1933, EEI provides public policy leadership, strategic business intelligence, and essential conferences and forums.
Overview

- Investment is growing across the grid
- The US has a diverse industry structure
- Wholesale market challenges
- The evolving distribution system
- The integrated grid platform
Industry Capital Expenditures

Notes: Total company spending of U.S. Shareholder-Owned Electric Utilities, consolidated at the parent or appropriate holding company. Projections based on publicly available information and extrapolated for companies reporting fewer than three projected years (18% of industry for 2015 and 2016).

Source: EEI Finance Department, company reports, SNL Financial (July 2014)
Projected Functional CapEx

2012P as of August 2012
$94.4 B

2013P as of October 2013
$95.2 B

- Generation: 41% (2012P), 37% (2013P)
- Distribution: 22% (2012P), 21% (2013P)
- Transmission: 15% (2012P), 17% (2013P)
- Gas-Related: 10% (2012P), 12% (2013P)
- Environment: 6% (2012P), 7% (2013P)
- Other: 6% (2012P), 6% (2013P)

Notes: Total company functional spending of U.S. Shareholder-Owned Electric Utilities
Projections based on publicly available information and extrapolated for companies not reporting functional detail (1.6%).

Source: EEI Finance Department, company reports (October 2013)
Drivers of Industry Investment

- Environmental regulations
- Low natural gas prices
- Declining technology costs
- Diversification
- State renewable energy policies
- Financial incentives
- Customer demand
- Economic fundamentals
Generation Fuel Mix Varies By Region

*Includes generation by agricultural waste, landfill gas recovery, municipal solid waste, wood, geothermal, non-wood waste, wind, and solar.

** Includes generation by tires, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.

Sum of components may not add to 100% due to independent rounding.

Current Generation Focus on Renewables and Natural Gas: Capacity Additions and Announcements

Announcements of New Generating Capacity (2013)

Source: EEI; Ventyx Inc., The Velocity Suite. Data as of May 30, 2014
Maintaining Fuel Diversity is Key

Fuel diversity and flexibility are critical

Electric companies rely on many fuels to generate electricity – coal, natural gas, nuclear energy, hydropower and other renewables, and other fuel sources.

Fuel diversity is key to:

- Provide affordable electricity: Respond to fuel price fluctuations
- Maintain reliability and energy security: Respond to extreme events and/or supply constraints
- Improve resiliency: Respond to outages and security threats
- Integrate renewables: Respond to weather and resources variability
- Meet electricity demand: Respond to changing consumption level and patterns

Source: DOE – Energy Information Administration

2013 National Fuel Mix

- Coal: 39.1%
- Natural Gas: 27.4%
- Nuclear: 19.4%
- Hydro: 6.6%
- Renew: 6.2%
- Oil: 0.7%
Cost of Reduced Fuel Diversity

Average wholesale power prices increase 75 %

Average retail power prices increase 25 %

GDP drops nearly $200 billion.

Annual disposable income of a typical household declines about $2,100.

Price impacts would lead to roughly one million fewer jobs.
The RTOs & ISOs (except ERCOT) grew out of FERC Order Nos. 888 & 889 as a way for tight pools to satisfy the requirement to provide non-discriminatory transmission access. RTOs administer their regional wholesale electric market, provide transmission service, and perform transmission planning on a regional basis.
Keys to Realizing Market Structure

Objectives

Reliability
- Sufficient capacity the system can rely on
- Fuel diversity

Economic Sustainability
- Low cost/efficient system
- Reasonable return/sustained investments

Environmental Sustainability
- Achieve carbon targets
- Reduce other pollutants

- Accurate Energy Price Formation
- Fair and Competitive Capacity Market Design
- Compensating Valuable Resource Attributes
If we properly compensate for attributes generators provide in the wholesale market, it would temporarily raise wholesale prices…

However, when low prices induce needed units to shutdown, total energy cost to customers would rise to reflect shortage/cost of new build.

Out-of-market intervention can suppress wholesale power prices and customer energy cost in the short term.

However, it would minimize shutdowns and the need for new builds.
“FERC reforms of competitive wholesale power markets as to market design, tariff rules and grid operator practices are necessary to improve investment signals for existing and new generation resources as well as grid infrastructure consistent with maintaining this grid reliability.” (EEI, NEI, EPSA, April 2014)

- September 2013: FERC’s technical conference on centralized capacity markets. FERC continues to evaluate what steps may be appropriate in light of the more than 1,000 pages of post-conference comments it received.
- April 2014: FERC’s technical conference on the “Polar Vortex”.
- June 2014: FERC launched an initiative to evaluate issues regarding price formation in the energy and ancillary services markets operated by RTOs/ISOs including uplift payments, price mitigation and price caps, scarcity and shortage pricing. 3 technical conferences followed in September October and December 2014.
- November 2014: FERC’s Order initiating a review of how each RTO/ISO is addressing fuel assurance issues. RTOs have 90 days to file reports on the status of their efforts.
Changing Electric Distribution Grid: Centralized to Distributed

Drivers of the evolving distribution grid:
- Growth in DER
- Desire for increased grid resilience/reliability
- Evolving customer needs
- Environmental objectives
Rethinking the Distribution System

- CA, HI, and NY have each embarked on initiatives to redesign the distribution system to accommodate the increased penetration of distributed energy resources, such as PV, energy storage, and electric vehicles.

- The focus is on moving from a centralized model with one-way power flows, to a more distributed model with two-way communications and power flows.

- These states are addressing both technological challenges as well as policy and rate design challenges to ensure the sustainable growth of distributed energy resources.
State visions: Multifaceted and Lengthy

### Illustrative Road Maps to "Utility 2.0" Extend Into the Next Decade

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<td>Distribution Resource Plan</td>
<td>Utilities file plan</td>
<td>PUC approves plan</td>
<td>Integrate DG with T&amp;D grid</td>
<td>Deploy</td>
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<td>Utility of the Future</td>
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**Source:** Moody's Investors Service, regulatory filings

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Source: Moody's, Special Comment: US Utilities: Regulatory Response Looks to Stay Ahead of the Distributed Generation Curve, Nov 6, 2014
AB 32, AB 327, and AB2514 provide for the reshaping of electric utility rates as well as the distribution grid to ensure the sustainable growth of renewable energy and energy storage.

- Successor NEM tariff under development, in conjunction with the creation of a public tool for evaluating the costs and benefits for distributed energy resources.
- CPUC instituted a rulemaking that requires each utility to submit Distributed Resource Plans to the CPUC.
  - Must identify optimal locations for DG deployment
  - Will evaluate existing and future distribution infrastructure and planning procedures with respect to incorporating DER into distribution system planning and operation
  - Will be used to direct future distribution system spending
- Additional initiatives on storage and electric vehicles.
California

## Hawaiian Electric Modern Grid

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<tr>
<th>Benefits</th>
<th>Applications</th>
<th>Description</th>
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<tbody>
<tr>
<td>Lower Electricity Bills</td>
<td>Volt / VAR Optimization</td>
<td>Allows utilities to more accurately control the level of power delivered to the end-consumer.</td>
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<tr>
<td>Expanded Customer Choices</td>
<td>Customer Energy Portal</td>
<td>Allows customers to monitor their bills and usage patterns to reduce energy consumption.</td>
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<td>Prepay</td>
<td>Provides customers the flexibility to pay as they use electricity to avoid deposits and help budget spend.</td>
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<td>Increased Reliability</td>
<td>Advanced Metering Infrastructure</td>
<td>Enables automated billing for customers, reducing meter reading costs, as well as acts as a sensor for outage detection and many other applications.</td>
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<td>Outage Management</td>
<td>Helps utilities find outages on the grid to restore power to customers more quickly.</td>
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<td>Fault Circuit Indicator</td>
<td>Enables devices in the field to be remotely controlled to get an outage fixed more quickly.</td>
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<td>Remote Switching</td>
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<td>Optimal Integration of Distributed Generation</td>
<td>Direct Load Control</td>
<td>Shapes energy demand to ensure the grid can safely manage variable energy sources such as renewable wind or solar.</td>
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<tr>
<td>Reduced CO₂ Emissions</td>
<td>Electric Vehicle Charging</td>
<td>Enables the scheduling of electric vehicle charging.</td>
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*Figure ES-6. The Companies Modern Grid*
Hawaii DG 2.0 – Proposed Infrastructure Changes

- Partnering with solar industry and inverter manufacturers to modify current standards to allow more PV capacity on the grid.
- Fully developed smart grid, increased use of energy storage
- More options for customers, increased monitoring and control, increased reliability
- More community solar and micro-grid options to create a balanced portfolio of solar.
- LNG imports starting in 2017, will help to reduce fuel costs for customers.
New York – Reforming the Energy Vision (REV)

- 6 core policy objectives relating to customer knowledge, market animation, system-wide efficiency, fuels and resource diversity, system reliability and resiliency, and carbon reduction.

- Examining the regulatory reforms needed to shape the roles and responsibilities of the regulated utilities and retail markets, examining the role of the utility as a Distribution System Platform Provider (DSPP).
  - PSC Staff Straw Proposal would transform distribution utilities into network platform providers to facilitate markets.
  - “The DSP function should be served by existing utilities, whose long-term status as DSP providers should be subject to performance reviews;”

- Will lead to regulatory, tariff, market design changes that promote more efficient use of energy, deeper penetration of renewable energy resources, and wider deployment of distributed energy resources.
Evolving State Rate Regulation

Reform net metering policies.
Adopt new approaches to designing rates for DG so that all users of the grid contribute to grid infrastructure.

New Regulatory Policy and Rate Design Are Needed

Is There a Best Rate Approach for DG?

**Straight Fixed/Variable Pricing:** Recovers fixed costs through fixed charges, and variable costs through variable, per kWh, charges.

**Buy/Sell Design:** Two separate transactions: The consumer buys all of his/her power needs from the utility. The utility buys all of the consumer’s DG production.

**Grid payment** - Disaggregated rates, Fixed charge based tariff, Straight fixed/variable pricing
→ Charge for fixed costs separately.

**DG payment** - Feed-In Tariff, Buy-All Sell-All Tariff, Value of Solar Tariff
→ Separate payment for consumption and production.
Evolving Grid Platform

- Regulatory Environment
- New Energy Resources
- Customer Solutions
- Grid Optimization

Evolving Grid Platform

The Edison Foundation
INSTITUTE for ELECTRIC INNOVATION
Thank you!

Richard McMahon
rmcmahon@eei.org