

Managing the Transition to a Distributed Utility Model

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+ Important Macro Electric Industry Trends

- Historically low energy sales growth & retail price pressures.
- New environmental initiatives affecting fossil generation
- Dramatic expansion of distributed generation led by solar PV
- Sustainably low natural gas prices
- Advanced technology that provides new customer services
- Demand for increasing grid resiliency
- Increasing cyber security threat
- Need for significant investment in new electric infrastructure





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+ Key Drivers for Transformation of the Utility Sector

Supply-driven, hierarchical electric industry structure is being replaced with a bi-directional, network-interactive architecture

- Transformative Technologies
 - "Internet of Things": sensors and actuators linked through wired and wireless networks
 - Information networks provide critical support to electrical: real-time awareness of the grid, sensor-driven decision analytics, insight to customer preferences and behavior
- Transition towards smart cities, communities and customers
 - Consumer psychology shifting towards smartphone enabled energy management products
 - Community solar, micro grids to improve security and resiliency
 - Smart water, transportation, natural gas coordinated with smart electricity

- Structural decoupling of GDP and electric load growth
- DG, DR, and energy efficiency contributing to low growth
- Utility-administered EE growing at 10% per year, DR programs at 20% per year
 - DG adoption (PV, CHP) enabled by net metering
- Dislocations in wholesale market due to renewable penetration and low natural gas prices

For many utilities earnings growth has been supported by rate increases rather than through increased demand



DER is playing a growing role in US electricity supply...

Share of "customer wallet" - one client's view



Observations

Demand erosion for central station generation over time...

- DER gains share of additions over next decade (~50% to ~90%)
- Absolute growth in DER over 9%
- Diesel and gas reciprocating engines are dominant forms; Solar PV grows from 5% to 20%

Increasing dis-intermediation of customers from utilities

- Reduced demand
- Aggressive non-utility players offering an array of behind the meter products and services
- ...but opportunity for utility investment New business models to drive growth

Distributed Generation includes: Boiler / steam turbines, Combined cycle, Combustion turbines, fuel cells, NG gensets, microturbines, solar PV, storage and NG reciprocating engines

Source: EIA, KEMA, SEIA, Lawrence Berkeley National Lab, NETL, Lazard, ICF, EGSA, EP analysis

... with solar PV's growth receiving the greatest attention





Observations

- Strong early growth (CAGR 2005-09 = 37%) attributable to rebates
- Accelerated recent growth (CAGR 2010-14 = 49%) due to price decrease spurred by PV oversupply
- Commercial sector had its first decline in 2014, but growth appears to have resumed in 2015
- ITC extension through 2020 creates foundation for sustained growth

Drivers of future growth

- Clean Power Plan (CPP) implementation?
- Continued regulatory reforms to drive DER vs. overturning net metering

Cost improvements

Source: SEIA / GTM Research Solar Market Insight (Q2 2015), EP analysis

But DER is not just – or even primarily – about PV



Note: 2014 – 2023 are projected (P) values Source: Power Systems Research, SEIA, EGSA, Navigant, Enovation Partners

Upward pressure on rates and the take-off in DER is leading many regions to explore alternative utility business models

Continuum of Proposals for Reform – Illustrative Positions



+ Clean Power Plan (CPP)

- Final rulemaking issued by EPA in November 2015
 - Goal: Over 30% carbon emissions reduction in the power sector by 2030
- SCOTUS has stayed implementation
 - Recent argument on appeal by the DC Circuit
 - Ultimate 2017 adjudication by the SCOTUS
- State based implementation through SIP
 - Reducing coal generation is key target
- Potential compliance options:
 - New CCGT
 - New utility scale wind/solar
 - Energy efficiency
 - Distributed Generation?

- Potential Impacts
 - 50 GW of additional coal retirements
 - Need for major transmission upgrades/investment
 - Market driver for RE growth
 - Utility scale and DG
 - Significant increases in wholesale costs: 10-30%
- Important Take-aways
 - Rule implementation will drive up wholesale power prices
 - Potential for increasing resistance to rate increases from new utility T&D investments

Driving the Transition to a New Distributed Utility Business Model



Meeting the Challenges through a New Utility Business Model



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Proposition: Reform of the utility business model can address policy, customer and shareholder needs

The Challenge

- Low to negative load growth, imposes a practical limit on rate base T&D growth opportunities
- Upside pressure on customer costs will accelerate uncontrolled DER growth and an adverse political reaction
- Sustainably low natural gas prices supports increased penetration of onsite gas generation further eroding utility customer base, particularly in the C&I sector
- Most distribution utilities barred from owning generation; even behind the meter.
- Momentum is growing for utility regulatory reform
 - Such reform may well be adverse to utility shareholders

The Opportunity

 Lever increasing interest in carbon emissions reduction to obtain state support for a behind the meter initiative that supports the creation of a highly functional/advanced Distribution Management System (DMS) and enables Behind the Meter (BTM) Products and Services

Momentum is Growing for Utility Regulatory Reform



NEW YORK "REV"- Reforming the Energy Vison TWO "TRACKS" GUIDING THE DEVELOPMENT OF A NEW REGULATORY POLICY

Track 1 – Focused developing the *Distribution System Platform* ("DSP") model; addresses the roles different entities will play, wholesale market impacts, customer engagement, etc. Track 2 – Regulatory changes and ratemaking issues that must be considered in order to transition to a new mode of interaction with energy in New York.

Track 1 – Distributed System Platform

- 1. REV outcomes, measurements, and policy goals alignment
- 2. DER ownership models
- 3. DSP Identity
- 4. Establishing a framework for measuring benefits and costs ("BCA Framework")
- 5. Transition for existing clean energy programs
- 6. Enhanced services (from utilities and/or third parties)
- 7. Data Access (protection, privacy, market facilitation)
- 8. Other issues of interest to parties

Track 2– Regulatory Issues

- 1. Outcomes-based ratemaking
 - Metrics and benchmarking
 - Incentives, disincentives, symmetry
 - Neutralizing utility CapEx bias
- 2. Long-term rate plans
 - Cost recovery, equity returns
 - Encouraging optimal investment
 - "Reopeners" (per performance)
 - Outputs vs. inputs (consideration of RIIO design elements)
- 3. Rate design
 - Internalizing externalities in rates
 - Pricing innovative services
 - New rate designs (e.g., standby rates)

State	Docket(s)	Key Elements
CA	R-12-11-005 R-12-06-13 R-11-09-011 R-14-08-013	 Renewable distributed generation programs Residential rate re-design investigation Interconnection of distributed generation resources Development of comprehensive distribution resource plans
MA	DPU 12-76 DPU 14-04	 Modernization of the electric grid (filing of utility plans in 2015) Policy framework for the implementation of time varying rates for basic electric utility service (implementation to follow after GMPs)
MN	E-999/M-14-65	 Legislation passed in 2013 requires the Department of Commerce to establish a Value of Solar (VOS) Tariff Methodology MN PSC approved the VOS Tariff Methodology on April 1, 2014 (utilities are not required to file a VOS tariff as per the legislation)
HI	2014-0192 2013-0141	 Comprehensive energy policies and guidelines Investigation into DER pricing and tariff policies Investigation into the continued use of decoupling mechanisms
AZ	Various	 Utility pricing for customers with solar installations (APS and TEP) New metering, increased monthly fixed charges, utility-owned solar programs for residential customers, monthly roof leasing fees. Rate design with a demand charge for solar customers (SRP)

Dynamics of a Distributed Utility Business Model (DUBM)



- Unbundled Central Station Generation, Transmission and Distribution
 - But...downsized infrastructure and investment overtime as DERS supplant central station generation
- Cost of service investment in transmission (FERC) and distribution
 - But...reduced investment opportunities overtime as focus shifts to DERS
- Current distribution investment focuses on resiliency and reliability support
 - Important investment but puts upside pressure on customer costs
- Non-utility provides offer a wide range of commodity and electric related services:
 - Customers are increasingly "dis-intermediated" from utilities

Investment by distribution utilities is downsized over time, eroding the ability of Discos to maintain historic EPS growth and therefore equity valuations

+ Potential Impacts of DUBM Adoption

Assertion: The shift to a DUM will adversely impact the financial performance of distribution utilities

- Deterioration in earnings quality as utility capital is deployed away from regulated investors to non-utility competitors
- Earnings erosion over time as opportunities for regulated utility investment decline and capital shifts to competitive sectors, with uncertain risk adjusted ROCI
- Utility shareholder composition will need to conform to the any new shareholder value proposition

For the most part, advocacy groups are indifferent to the impact of regulatory reforms on utility shareholder value

Utilities have the opportunity to define a new business model for themselves

The Opportunity

- Enhance customer experience/affinity by offering customized energy services
- Provide investors with sustained, low risk opportunity for growth and income
- Leverage new technology to improve reliability, lower cost, promote sustainability

Rationale	Enablers
 Respond to changing customer need for – Reliability/power quality and cyber security across customer classes – Autonomy / control/ choice – Environmental sustainability/footpr • Achieve policy goals cost effectively 	 New regulatory compact DER ownership by utility Differentiated/TOU rates reflecting cost to serve and diverse customer preferences PBR to reward utility for superior
- GHG abatement (CPP)	performance
 Fitysical/cyber security Leverage rapidly evolving technology Mobile apps DER, IOT, advanced energy manage EV, etc. 	 New utility capabilities DER/DERMS technology Customer insight ment, – Mobile apps Distributed System Platform (DSP) - OT.

IT, advanced analytics, asset

management, etc.

Managing the Transition: Key Elements

- Regulatory Reform
 - SmartRates
 - PBR
 - Decoupling
- Utility investment in creating a distributed system platform (DSP)
 - Drives sustained rate base investment in OT/IT, engineered equipment, analytics to manage distributed grid infrastructure
 - Creates competencies to develop and deliver DGI solutions
- Creating the organization design, financing, business processes and technology platforms to provide tailored behind the meter energy solutions to customers

+ Proposed Approach

- Develop and implement a comprehensive strategy incorporating regulatory, technology and commercial initiatives
- Proactively engage state regulators and key constituencies to implement DUBM transition plans that grow shareholder value

Ensure operational effectiveness:

- Efficiency, productivity, outsourcing, pruning, streamlining, merging
- Improve planning, analytics, risk assessment, and decision making

Promote technology innovation, grow earnings and enhance credit quality

- Evolve strategic initiatives and shape reform proceedings
- Engage, educate -- customers and other stakeholders

Establish sustainable cost recovery for new infrastructure

- Align and support customer preferences (renewables, DER, choice)
- Protect, renew, and invest prudently and proactively
- Grow capabilities: R&D, partnerships and alliances

Create new opportunities for investment to drive/support earnings growth

+ Two Vehicles for Distributed Grid Investment

- Build the Distributed System Platform (DSP) that can seamlessly manage an increasing array of behind the meter Distributed Grid Infrastructure (DGI)
 - Hard infrastructure
 - Operational Technologies
 - Distribution and Asset Management Systems
 - Cloud based
 - Customer Information and Financial Settlement Systems
 - Analytics
 - Other IT
- Create the organizational capability to originate, develop, execute and manage DGI that provides interoperability with the distribution grid. Recover costs through a cost of service regulatory construct
 - Engineered equipment (micro grids, energy storage, CHP, DG)
 - Operational technologies
 - Analytics
 - Asset management

+ "Rate base" Investment Recovery

- Principles:
 - Investment in the DSP recovered through conventional distribution rate base
 - The benefit of DSP investment inures to all distribution customers
 - DGI can provide benefits to the distribution grid as well as the basis for tailored energy solutions for customers (C&I)
 - Distribution grid benefits are recovered through the distribution rate base
 - Other customer benefits recovered through a new "Customer Rate Base"
- Risk Adjusted ROE Established by State Regulation
 - Potential for spread between ROE for investment in distribution grid and customer solutions

+ Utility Strategy Roadmap

- Develop an integrated regulatory, technology and commercial framework to support a integrated strategy initiative
- Key Components:
 - Determine potential for distributed solar DG in PPL's service territory
 - Estimate generation and carbon reductions based upon average PJM generation portfolio carbon profile
 - Establish potential for DG/DGI for CPP compliance
 - Establish first level distribution system impacts
 - Determine potential capital investment flows over time and integrate with present investment program to examine earnings impacts
 - Engage state political leadership including PADEP, PUC and other key constituencies

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A Well Developed Regulatory Construct is essential to guide an orderly transition

Key questions

- Business roles and responsibilities of an electric utility
 - Obligation to serve
- Allowable infrastructure investments and adoption of new technologies
- Establishment of financial expectations (revenues, net income, ROE) and the ability to achieve those metrics
- Degree of participation in new and evolving markets
- Interactions/transactions with customers
- Pricing of existing and new services
- Accommodation of societal objectives

+ Smart Rates create a level Playing field



- Fully unbundled seasonal and time-ofuse (TOU) rates with additional options such as Critical Peak Prices (CPP)
- Charges based on costs for each rate component
- Rates use Customer, Demand, and Energy (CDE) elements
- Rates are differentiated by voltage level of service
- Customers pay for the services that they elect
- Foundation for customers to choose the level reliability, convenience, cost, power quality and environmental footprint that they would like
- Creates transparency across customer classes

+ Structural Elements: Regulatory Framework

Build-upon the existing regulatory construct

- Reaffirm the regulatory compact
 - Universal service/obligation to serve
 - Confirm recovery on existing rate base at approved ROE
 - Enhance certainty of earnings and growth
 - Decouple earnings from KWh sales
 - Level playing field across all customer classes
 - Identify and quantify cross subsidization
 - Unbundle rates ("SmartRates") to provide transparency and customer choice

- Answer the policy question how does the state wish to internalize positive/negative externalities
- "Extend the Franchise" Behind the Meter for underserved customers (Low Income)
 - Solar DG
 - Energy efficiency and load management
- Provide for earnings upside through performance based rate making
- Manage revenue requirements through non-conventional financing structures
 - Structured leverage lease financing to reduce up-front revenue requirements

+ Technology Framework

- Key Elements:
 - Distributed System Platform (DSP)
 - Seamless interoperability between the distribution grid and distributed grid infrastructure (DGI) and RTO
 - Extracts maximum value from the DGI: ancillary services, capacity and commodity
 - Develop methodology to quantify benefits in nonorganized power markets
 - Distributed Grid Infrastructure: Micro grids, energy storage, CHP and solar PV (DG)
 - Allows tailored solutions to satisfy customer criteria for resiliency/ reliability, power quality, environmental footprint and cyber security
 - Initial focus on C&I customers to build technology platforms and core competencies including commercial models

- DSP and DGI technology framework
 - Develop DSP and DGI foundational criteria
 - Scope to include engineered equipment, OT, IT, analytics, cyber security and asset management
 - Identify the respective roles of AMI/DA and micro grid controllers
- Build upon existing technology position and perform a "gap" analysis to reconcile against the DSP technology framework
 - Regulated and commercial businesses
- DGI reference design(s) including technology selections
 - Budget cost estimate and operational performance profile
- Modeling methodologies to assess DEI penetration/associated distribution grid impacts and carbon reductions

+ Commercial Framework

- Identify a target menu of core behind the meter customer products and services
 - Load management including DR and EE
 - Cloud based platform
 - Resiliency/reliability
 - Environmental management
 - Energy cost management
- Identify potential benefit streams associated with DGI (Benefits Streams)
 - Regulated
 - Organized markets (based upon RTO tariffs and market design)
- Develop methodology for quantifying benefits streams
 - Including basis for distribution capital and operating cost recovery
 - Integrate into SmartRates

- Develop potential financing structures for customer cost recovery
 - Conventional revenue requirements model
 - Leverage lease and other forms of project financing
- Identify potential customer commercial constructs
 - Customer leases and
 - Equipment purchases
 - Fixed and variable energy charges
- Develop model for customer capture and solutions implementation
 - Fully integrated into regulated business
 - Hybrid construct with commercial business
 - Commercial offering

Post November: Can we think about major federal energy initiatives

- Prospects for a Clinton Administration
 - Scenarios
 - Potential Initiatives



Michael Schwartz – Dr. Schwartz an innovative and seasoned energy executive with 35 years of experience across the energy industry including the management of asset based energy businesses, investment strategies, commercial structuring, project financing, technology commercialization, energy and environmental policy, government relations and project development. From 2013 to 2015 he created and managed Black & Veatch's strategic business advisory practice. Prior to Black &Veatch, he was SVP Policy, Strategy and Strategic Initiatives at Duke Energy and Visiting Professor in Energy and the Environment at Princeton University. He serves on the boards of advisors of the Micro-grid Resources Coalition and CarbonLight House. He earned PhD and MS degrees in chemical engineering from Princeton University and BS and MS degrees in chemical engineering from the Polytechnic Institute of NYU.

Phone: (412) 527-4566

e:mail:michaelschwartz@newwaveecp.com