Regulatory Innovation and the Convergence of Electric Utility Policies: New Business Models and Electricity Market Design

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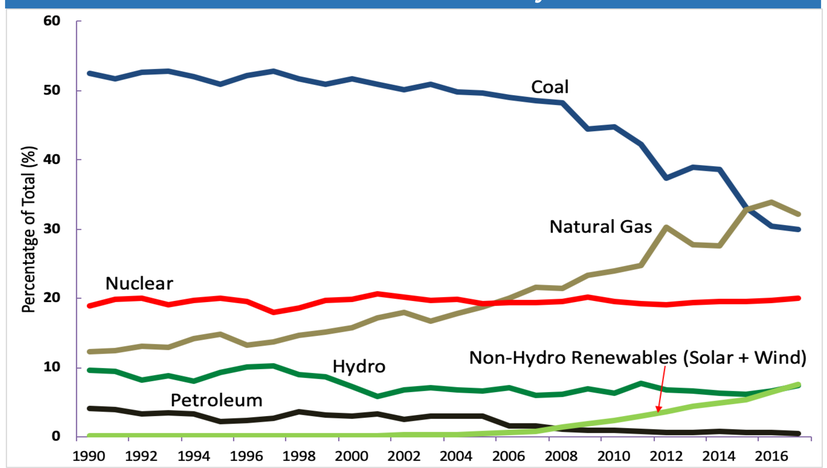
Introduction

Several disruptive trends are driving energy transformation and forcing electric utilities to change their business models. The challenge for utilities is how to transition toward "Utility 4.0" ecosystem: microgrid development, digital and automated, distributed solar, electric market design innovations, smart grid systems, and big data and analytics. Using a multidimensional framework and case studies from United States (i.e., New York's REV,), the U.K.'s RIIO, Germany's Energiewende, and Australia's Electricity Network Transformation Roadmap, this study examines electricity market design and flexibility innovations.

- **Challenges of current utility business model**
  - Falling costs of disturbed energy resources, including solar photovoltaics and wind power.
  - Aging electricity generation fleets
  - Increased investments in smart energy management systems
  - Climate change
  - Funding gap between current investment and projected electricity generation demand
  - Cyber/physical security and data privacy threats on the electric grid systems
  - Positive externalities of shale gas development such as low natural gas prices
  - Ability to provide safe, reliable service without sacrificing environmental health
- **Current regulatory structure is inadequate to handle these disruptive factors.**

Annual Share of Total U.S. Electricity Generation



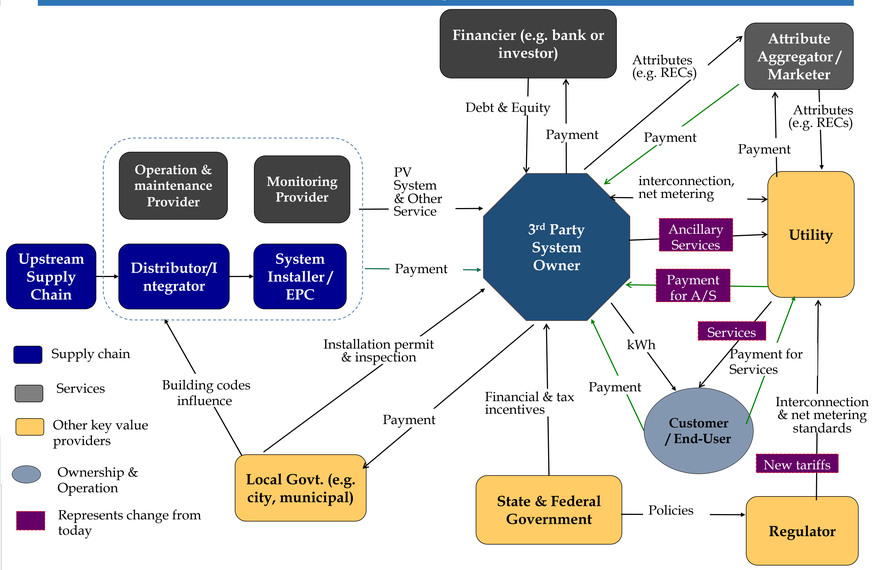
Utility Business Models as Analytical Unit

- The concept of the 'business model' has been successfully applied in evaluating the energy sustainability challenge, including for the Energy Service Company sector (ESCO), investor preference for a given asset class over the other, renewable energy (RE), micro-generation, energy utility evolution, community solar, distributed generation, and energy efficiency programs.
- Typical considerations in business model evaluation include: **Value Proposition**, **Customer Interface**, **Infrastructure**, and **Revenue Model**.

Table 1: Typical Considerations in Business Model Evaluation

Dimension	Description	Application to Conventional Utility
Infrastructure	Depicts the architecture of the company's value creation. It includes assets, know how, and partnerships.	Centralized, prohibitive cost for duplication.
Revenue model	Denotes relationship between costs to produce the value proposition and the revenues that are generated by offering the value proposition to the customers.	Bulk generation of electricity, commodity-focused.
Customer interface	Involves the overall interaction with the customer including customer relationship, customer segments, and distribution channels.	Consumers of electricity, monthly billing, short-term relationships, distant and standardized.
Value proposition	Encompasses added value the business offers for resource providers, project developers, vendors, community served, and other potential partners.	Low cost of electricity at high volume, guaranteed service. "Just and reasonable" prices. Better ROE.

Customer Owned and Utility Controlled Value Network



Framework: Political Components

Function	NY REV Model	UK's Ofgem (RIIO) Model	Germany's Energiewende

Organizational Logic	• 2015 NY State Energy Plan outlines how to enact REV.
	• Integrates three strategic pillars:
	  ○ PSC's REV Docket promotes greater consumer choice in energy use.
	  ○ NYSERDA's Clean Energy Fund provides $5B in new green energy investment over 10 years, starting in 2016.
	  ○ NYPA's programs lead by example.
		• RPI-X@20 Recommendations Consultation proposed 7/26/10.
		• Ofgem's RIIO has 3 pillars:
		  ○ Upfront ex-ante 8-year price control.
		  ○ Option for third parties for deeper engagement.
		  ○ Time limited innovation stimulus open to both utilities and third parties.
			Energiewende is a long-term and evolving process.
			Its principles are documented in the report Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply.

Goal	• Remove market barriers to enable a dynamic clean energy economy at a scale to create opportunities and growth while protecting the environment. • Emphasize customer knowledge, ratepayer contributions, system-wide efficiency, and reliability.	• To encourage energy network companies to contribute to delivery of a sustainable energy sector. Delivery of long-term value to existing and future consumers. • Emphasizes customer satisfaction, reliability and availability.	▪ Energiewende aims to promote renewable energy and energy efficiency growth. ▪ Supports energy sector R&D.

Mandate	• NY State Department of Public Service wrote REV.
	• Public Service Commission is a government agency.
	• PSC authority under Public Service Law, Rules and Regulating of the PSC- 16 NYCRR.
	• Recommended to apply REV gradually: 2 tracks
	  ○ Track 1: examines the role of distribution utilities in promoting EE, load management, DER, consumer control, and wholesale market issues; considers whether distribution utilities should serve as DSPs
	  ○ Track 2: regulatory and ratemaking changes.
		• Ofgem wrote RIIO.
		• Ofgem work with but independent of government.
		• Ofgem's governing body is GEMA (Gas and Electricity Markets Authority), also referred to as The Authority.
		• GEMA's authority is provided under Gas Act 1986, Electricity Act 1989, Utilities Act 2000, Competition Act 1998, Enterprise Act 2002, measures set out in a number of Energy Acts.
		• Applied in 4/13 in TPCR5, GDPCR2 and 4/15 in DPCR6.
			▪ Germany aims to increase the share of renewable energy in electricity generation to 80% by 2050, up from 27.4% in 2014.
			▪ Energiewende creates an efficient and renewable energy sector with a rather decentralized character.

Regulatory focus	• Distribution utilities act as Distributed System Platform (DSP). • DSP's interact between consumers, sellers of products, and NYISO to create a market pricing platform that allows monetization and exchange of resources such as DER, DSM, EE, storage	▪ Transparent, upfront price control framework sets out what outputs network companies need to deliver, upper limit on allowed return, symmetrical incentives, transparent conditions when price control could change.	▪ Key drivers for the Energiewende include climate protection, energy security, industrial development, employment and the phase-out of nuclear power.
Institutional flexibility	• 43 different programs offered in NY Plan	• Reopeners i.e. uncertainty mechanisms • Third parties can appeal to the Competition Commission for price control before they are instituted.	• Promotes stronger market mechanism, flexible and efficient electricity supply, and security of supply.
Complexity of Model	• Transactions take place in a nonlinear manner.	• "Well justified business plans" very involved.	• Differentiated objectives to meet the complex market structure of Germany.
Corporate orientation	• Overarching socio-environmental ideals	• Detailed economic framework.	• Detailed renewable energy, energy efficiency and climate targets.

Application of Political Components

- **Organizational Logic:** REV is a socio-environmental aspiration. RIIO is a standardized rate-making framework.
- **Goal:** Shift to low carbon decentralized generation, multidirectional flow of data, improved customer choice, lower cost of service.
- **Regulatory Focus:** REV alters political structure. RIIO alters economic structure.
- **Institutional Flexibility:** RIIO has three innovation funds outside of the rate-case structure. REV has a network of over tenfold more programs.
- **Complexity:** Exhaustive cost analysis, increased stakeholder involvement, longer term rate cases, large regulatory size of initiatives.

Framework: Economic Components

Function	NY REV Model	UK's Ofgem (RIIO) Model	Australia's Electricity Network Transformation Roadmap
Cost Structure	• DSPs will provide pricing structures. • Efficiency will be treated like part of utility revenue requirement, not a dedicated surcharge. • PSRs and MBEs replace EIMs. • Modified clawback mechanisms to encourage third party interactions. • ESMs tied to performance index. • Scorecards to evaluate non-monetized measurements. • 3-year rate plans (opt in for 5). • Value of DER calculated as LMP+D. • Increased encouragement of TOU rates.	• Three elements of revenue restriction: base revenue, revenue adjustment for rewards/penalties, uncertainty mechanisms. • Rather than set allowed revenues for operating and capital, RIIO combines these into "Totex". • For base revenues, benchmarking analysis of historical costs. • Partially symmetric upfront incentives. • IQI sets the strength of the upfront efficiency incentives according to the differences between utilities forecasts and Ofgem's assessment. • Use return on regulated equity (RORE).	• Four essential elements for a cost-effective integrated grid include: open standards, extended monitoring, advanced planning and feeder hosting analysis, and the mapping and locational valuation of distributed energy resources. • Establish active distribution system operations and markets for technical stability. • Adopts a cost benefit analysis of procuring electricity services through a digital market platform.
Risks	• Market power concerns over distribution utility acting as DSP • Concerns over whether MBEs can replace traditional utility earnings	• Reopeners i.e. uncertainty mechanisms. • Third parties can appeal to the Competition Commission make requests for price control before instituted.	• Detailed power system security analysis to address system stability and security risk. • Align risk allocation and define the regulatory compact
Effects of Reduced Sales	• Combination of financial incentives such as new MBEs, ratemaking adjustments, concrete targets with positive, symmetric, and bidirectional earnings impacts	• Right balance between 8-year price control and reopeners • If efficiency inventive rates are properly set.	• Provides customers with unprecedented choice and control over how and when they consume electricity. • Customer safety net
Scope of Services	• NYSERDA's Clean Energy Fund will provide $5 billion to fill market gaps	• Risk sharing through the symmetric efficiency uncertainty mechanisms. • Provision in the revenue system to cater for rise in demand or volumes of activity.	• Review scope for greater efficiency. • Strong potential for TOTEX.

Stranded Assets	• Each utility submitted a Benefit-Cost-Analysis (BCA)
	• DPS recommends financial incentives such as new MBEs to simplify access to DSP platform and to offset impact of DSP capital by sharing platform costs.
		• 3 part time-limited innovation stimulus.
		  ○ Annual Network Innovation Competition replaces the Low Carbon Network Fund.
		  ○ Network Innovation Allowance funds small scale innovation projects.
			• Optimized asset utilization and provides operational efficiency.
			• Asset financing undertaken efficiently through a well-understood, stable regulatory compact.

Application of Economic Components

- **Cost Structure**
  - Ofgem's price controls are for transmission, gas distribution, and electricity distribution. REV applies to energy sector as whole.
  - Ofgem's price control review process versus NY's transition from energy Efficiency Transition Implementation Plans (ETIPs) to interim action plans to Distribution System Implementation Plans (DSIPs).
- **Risks:** More complex modeling, inclusion of lesser-established parameters.

Conclusion

Identifying key features of the Fourth Industrial Revolution is more central to energy policymakers, utilities and other electricity generators, investors, and regulatory managers today than at any other time in the past. In the absence of rigorous frameworks for utility business model innovation, the search for new business models that complement or substitute technology advances, renewable energy and energy efficiency growth, and changing consumer demands is often ignored. The ongoing relentless pressure on utilities requires leaps into business model innovation that will drive the industry in the coming decade. We classify these business model innovation strategies in New York's REV, the U.K.'s RIIO, Germany's Energiewende, and Australia's Electricity Network Transformation Roadmap into three main categories: (a) industry model innovation i.e., redefining existing industries to serve new markets; (b) revenue model innovation i.e. innovating pricing mechanisms; and (c) enterprise model innovation i.e., enterprise and value chain to deliver added value and competitive advantage.

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