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Utility 2.0: The Reforming the Energy Vision (REV) and RIIO Utility Business Models

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ABSTRACT

A powerful confluence of architectural, technological, and socio-economic forces is transforming the U.S. electricity market. These trends and developments are placing tremendous pressure on utilities triggering changes in electricity production, transmission, and consumption. Increased democratized choice over energy usage, for instance, is empowering consumers to take key actions such as peak shaving, flexible loading, and installation of grid automation and intelligence solutions. A key step to achieving full benefits of these programs is repurposed Utility 2.0 concepts: the distributed grid, innovations in electric market design, real-time automated monitoring and verification, deployment of microgrids, increased uptake of 'smart meters and smarter' grids, and investment in data analytics in order to incentivize efficient market design and flexibility. Using a seven-part multi-dimensional framework, this paper examines the role of infrastructure network, revenue models, customer interface, business model resilience, organizational logic and mandate, risk management, and value proposition in improving communication with consumers and operational boundary of utilities in the new utility business model regime. The paper also assesses two prominent utility business models, the New York's Reforming the Energy Vision (REV) and Great Britain's 'Revenue = Incentives + Innovation + Outputs" (RIIO) legislation in order to illustrate potential changes that await the energy utility actors. We conclude that positioning the 'business model' as the unit for analysis provides a robust and multi-dimensional tool for evaluating the suitability of new proposals for electric utilities and energy governance.

Keywords: Utility 2.0, Utility business model, Multi-dimensional analysis, Reforming the Energy Vision, RIIO

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1.0. INTRODUCTION

Key disruptive challenges are expected to provoke momentous redesign in modern electricity infrastructures and destabilization of the century-old dominance of the government regulated, vertically integrated monopoly business model that is the energy utility. The disruption was initiated in the 1990s when, under the guise of deregulation, competition, innovation, and consumer involvement was introduced in the supply-oriented architecture (Philipson & Willis, 1999). The dominance of the traditional utility business model – what can be called 'Utility 1.0' – has since additionally been confronted with a confluence of architectural, technological, social, and economic developments that will likely accelerate the emergence of 'Utility 2.0' business models:

a) Distributed renewable energy sources, like solar energy, have become increasingly cost-competitive (Feldman, et al., 2015);
b) State-wide demand side management (DSM) and energy efficiency (EE) policy schemes are progressively more aggressive (Barbose, Goldman, Hoffman, & Billingsley, 2013; Palmer, Grausz, Beasley, & Brennan, 2013);
c) Energy demand growth patterns have reversed and are now flat to declining (Nadel & Young, 2014);
d) Rapidly advancing "intelligent efficiency" technology options capable of unlocking device-level measurement and control at large-scale are now available (Rogers, Carley, Deo, & Grossberg, 2015);
e) Existing infrastructural deficiencies – the American Society of Civil Engineers (ASCE) gave the US energy sector a D+ rating (ASCE, 2013). For instance, according

to the Edison Foundation, national level costs over 2010-2030 are estimated at $582 billion in nominal terms (Edison Foundation, 2008). Similarly, the New York Department of Public Services estimates state-wide investments of $30 billion over a ten-year timeframe (NYPSC, 2014);

f) Federal pressure in the form of the requirements set by policy efforts such as the Clean Power Plan (CPP) will drive substantial change (DOE, 2015);
g) Global coercion to transition to climate change appropriate development pathways, particularly with the signing of the December 2015 Paris Climate Agreement;
h) Lagging capital investment in transmission and distribution infrastructure (Jacobsson & Jacobsson, 2012);
i) Security threats from extreme weather as well as from cyber and physical terrorism (Ward, 2013); and
j) Another risk faced by the conventional utility is that its asset base is prone to 'stranding' – rapid depreciation of the asset base and its revenue generation potential. The limitations imposed by the notion of a climate change 'budget' for instance, which places much of the available fossil fuel resources as 'unburnable', threaten the long-term viability of the asset base (i.e. energy generation facilities that rely on fossil-fuel resources) (Jakob & Hilaire, 2015).

The compounding pressures levied by these disruptive challenges has led some to argue the incompatibility of the 20th century business model (constructed around sales growth and asset base expansion) with 21st century demands. Captured under the concept of the "death spiral", this position argues that the 20th century business model will make itself increasingly un-competitive as its efforts to combat the aforementioned challenges will divide increasing operational costs across a decreasing customer base (Costello & Hemphill, 2014). Indeed, the recalcitrant position of several utilities, such as in Arizona and Georgia, has set the stage for conflict of this kind (Hess, 2015).

As a result, the challenge overall has been posited as one requiring fundamental change to a new sustainable business model that can cope with the observed and expected disruptions – in short, this challenge has been determined to be an evolution to a "Utility 2.0" (Energy Future Coalition, 2013). Utility 2.0 characteristics will need to be such as to motivate – indeed, thrive within – a sustainable economy encouraging the minimization of consumption (or, at least, adheres to strict limitations on the consumption of water, energy, materials, etc.) while maximizing and prioritizing societal and environmental benefit over the sole purpose of economic growth (Jackson, 2009).

However, the specifics of what would constitute a 'Utility 2.0' remain largely unclear. For instance, strategies of "defection" from traditional utility-customer relationships (where new technologies, particularly solar and storage, deliver "utility in a box" functionality, thus forcing an optional character on further interaction with traditional utilities) (Rocky Mountain Institute, 2014) compete with proposals that retain a much larger importance to centralized generation, transmission and distribution capability (Kind, 2013) or heterogeneous "system of systems" ideas (Ruth & Kroposki, 2014). Efforts to situate such competing proposals have focused on the identification of possible trajectories, aligning the models across dimensions such as profit motivation and profit achievement (Satchwell & Cappers, 2015) or the speed of change and extent of change (Zinaman, et al., 2015). Possible trajectories within such a two-dimensional landscape can take on an adaptive, evolutionary, reconstructive, or revolutionary trait (Zinaman, et al., 2015).

Here, a case study analysis of the business models of two prominent proposals is developed to illustrate the potential changes that await the energy utility actors. First, fundamental change to the existing regulatory model has been put forth in New York through their "Reforming the Energy Vision" (REV) initiative. Critically, REV realigns the role of regulated utilities in terms of the ownership, management, and operation of electric delivery systems. Increased adoption of the portfolio of disruptive technologies is expected under this model. Second, the electric and gas regulator of Great Britain, OFGEM, is currently implementing its own original "Utility 2.0" concept via the "Revenue = Incentives + Innovation + Outputs" legislation (RIIO).

Using a comparative business model analysis, a detailed overview of the characteristics, focus, structure, approach, etc. of the two proposals forms the core of this paper. To do so, the paper is structured as follows: Section 2 highlights the importance of the 'business model' as a unit for analysis and its application in the energy and utility sector. Noting some possible deficiencies with limited approaches, this Section introduces and describes the methodological and analytical framework with which Utility 2.0 business model candidates can be compared and evaluated; Section 3 applies the common methodological and analytical framework to the two selected case studies in the United States and Great Britain. This section includes a description of the two models and a brief overview of their origin; Section 4 outlines the lessons learned with the framework and offers direction on its future application for additional Utility 2.0 candidates; Section 5 concludes.

2.0. PLACING THE 'BUSINESS MODEL' AS AN ANALYTICAL UNIT IN THE EVALUATION OF 'UTILITY 2.0' CANDIDATES

Positioning the 'business model' as the unit for analysis has become a common practice in the evaluation of proposals to address the energy sustainability and climate change challenge. For example, business model unit analysis was central in the following research efforts:

a) energy service company (ESCO) model analysis revealed customer-side information gaps and suggests customer interface improvements to advance ESCO success (Pätäri & Sinkkonen, 2014);
b) explorative analysis of generic business model showed investor preference for "customer intimacy" business models over lowest-cost or best technology models (Loock, 2012);
c) regulatory reform of the distribution of renewable energy benefits needs to be in accordance with, or drive the change of, existing utility business models in order to retain and achieve nation-wide objectives for further distributed energy deployment (Barbose, et al., 2016);
d) the role of external politico-institutional and socio-institutional dynamics in the formation and success of business model options is as a co-authoring agent in addition to internal decision-making (Provance, Donnelly, & Carayannis, 2011);

e) identification and analysis of 'community solar' business models as an alternative deployment strategy for solar energy that could mitigate or circumvent current concerns of negative impacts of distributed photovoltaic deployment for utility revenues and equity distributions of subsidies (Funkhouser, Blackburn, Magee, & Rai, 2015); or

f) the proliferation of demand-side management models and options in terms of transaction characteristics, renewable energy correlation, and load control shows demand response diversification but energy efficiency complexity (Behrangrad, 2015).

Important dimensions in business model evaluation are the model's main value proposition, its customer interface, infrastructure, and revenue approach (Chesbrough & Rosenbloom, 2002; Chesbrough H. , 2007; Kindström, 2010; Richter, 2012; Pätäri & Sinkkonen, 2014; Hamel, 2000). Broad categorizations of business models can be extracted from applying the concept as an analytical unit along these lines. A first categorization, for instance, is made by Richter as he separates utility-side business models from customer-side business models, each with their own distinctive characteristics (Richter, 2012). A customer-side business model, for instance, delivers value through customization and a services based approach, interacts with customers through a close long-term relationship and customer involvement in decision-making, and deploys many small-scale assets close to the point of use. In contrast, utility-side business models, create value through bulk generation of electricity, are commodity-focused rather than services-focused, deploy a small number of large-scale, centralized, assets, and focus on economies of scale and guaranteed rates of return.

However, multiple, ambiguous definitions with confusing and overlapping terminology are in use for the concept of the 'business model' (Chesbrough & Rosenbloom, 2002; Pätäri & Sinkkonen, 2014, p. 266). In addition, evolution within the energy utility sector is not limited to the broad categorization provided above as conventional utilities both contest and co-opt elements of the 21st century model. For instance, Hess observes how conventional energy utilities pursue strategies of conflict and disruption in the face of emerging distributed renewable energy generation (Hess, 2015) while Funkhouser et al. illustrate strategies of cooptation in an effort to retain customers and mitigate revenue impacts (Funkhouser, Blackburn, Magee, & Rai, 2015).

A critical challenge in the analysis of Utility 2.0 candidates, therefore, is to construct a comprehensive analytical framework capable of comparing business model options across the entirety of the energy utility spectrum. The pitfall of ambiguous definitions and overlapping terminology needs to be avoided in such a framework. Table 1 offers a multi-dimensional analytical framework that tries to deliver on such a set of definitions and characteristics that can be positioned in the evaluation of Utility 2.0 candidates. The framework defines the four dimensions introduced above and offers three additional dimensions.

The dimensions were selected based on a literature review that extends beyond business model innovation in the energy sector (see the discussion above). In particular, the dimensions account for the increasing focus on performance-based utility operation and the relationship dynamics that accompany such a shift (Kushler, Yokr, & Witte, 2006; Nowak, Baatz, Gilleo, Kushler, Molina, & York, 2015; Selviaridis & Wynstra, 2014) and the apparent requirement to move to a servitization system as mandated by the sustainability and climate change challenge (Carley, 2012; Steinberger, van Niel, & Bourg, 2009; Barnett, Parry, Saad, Newnes, & Goh, 2013).

Table 1: Application of dimensions of business model to conventional energy utility

Dimension	Definition	Application to conventional utility
Infrastructure	Depicts the architecture of the company's value creation. It includes assets, know how, and partnerships.	Centralized, large-scale, production. Long-distance transmission and distribution. Prohibitive cost for duplication,
Revenue model	Denotes the 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 values the business offers for resource providers, project developers, technology vendors, community served, and other potential partners.	Low cost of electricity at high volume, guaranteed service. "Just and reasonable" prices. Shareholder return

Organizational logic and mandate	The channel of authority for the utility to carry out a policy or course of action. This authority can be granted through a variety of channels (regulation, community-based management) and by a variety of actors (e.g., government, local community, shareholders).	Regulatory compact Stockholders
Business model resilience	The utility's capacity to change course in the face of potential existential business model risks. This capacity is influenced by the flexibility and complexity of both the business model but also the infrastructure it operates.	Limited flexibility: maintains complex system of interconnections and generation capabilities with second-to-second management across (state) borders.
Potential existential business model risks and risk management	Vulnerability of the business model to (foreseeable) changes in the market environment in which it operates and how the model copes with such changes.	Example: Extreme sale volume reduction could initiate "death spiral" (see introduction for additional risks).

Table 1 offers a brief example application of the various dimensions to the existing utility business model (column 3). Before investigating possible Utility 2.0 candidates and applying the framework to these business model options, it is worthwhile to expand on the application of the analytical framework (with the exception of existential risks which is covered in the introduction) to the conventional energy utility:

Infrastructure: The U.S. energy infrastructure is one of the most advanced energy systems in the world. Reliable, affordable and increasingly clean power and fuels are transmitted, stored, and distributed throughout an infrastructure that spans approximately 2.6 million miles of interstate and intrastate pipelines, about 640,000 miles of transmission lines, 414 natural gas storage facilities, 330 ports, and over 140,000 miles of railways (DOE, 2015). The functions provided by this complex infrastructure operate 24 hours a day, 365 days a year with high reliability and the longevity and high capital costs associated with the deployment of this infrastructure create a path-dependency where today's decisions will either enable or constrain future energy system dimensions (DOE, 2015). The resulting electric utility landscape that manages the flows of all these energy sources has experienced consolidation to the point where a "baker's dozen" of 13 holding companies represents 50% of all integrated utilities, 64% of all restructured utilities, and 52% of the retail segment (Brooks, 2015).

Revenue model: The first and best established functions of the state commission are to determine a utility's revenue requirement and to establish the prices or rates for each class of consumers (Lazar, 2011). Investor-owned utilities in the U.S. operate under conditions of guaranteed rate of return set by the state commission. The cost structure of the conventional utility is further determined by its focus on large-scale asset investment, pursuit of economies of scale, and long-term infrastructural commitment. The cost-of-service (COS) model is a core feature of the conventional utility (Burr, 2007; McDermott, 2012). The model entails the "[t]he rate-making process … i.e., the fixing of "just and reasonable" rates, involves a balancing of the investor and the consumer interest" (Federal Power Commission v. Hope Natural Gas Co. 320 U.S. 591, 603, 1944). This has also been called the "End Result Doctrine" – "the aim of regulation is to preserve the balance of the original bargain between investors and customers" (McDermott, 2012).

Customer interface: Conventional energy utilities establish a utility-consumer relationship (Byrne & Taminiau, 2015) characterized by standard, billing-based interactions that can be seen as impersonal, distant, and standardized (Hannon, Foxon, & Gale, 2013). This distance is partly a result of the fiduciary obligation to the owners of the conventional energy utility – its shareholders (Byrne & Taminiau, 2015). A second aspect of the distance is that conventional energy utilities only limitedly interfere with the consumer as they do not go "beyond the meter" (e.g., behavioral stipulations of energy use are limited) (Hannon, Foxon, & Gale, 2013). Although the conventional energy utility, through demand-side management processes, offers financial assistance to the consumer to address their energy use pattern, the consumer is typically responsible for managing such changes (e.g., switching to high-efficiency appliances). Finally, and in key contrast to for instance multi-decade power purchase partnerships, supply contracts provided by the conventional energy utility model are short-term and, as such, provide flexibility to the consumer to switch providers (Hannon, Foxon, & Gale, 2013).

Value proposition: the business model of the conventional utility pursues asset base expansion and, through its commodity-focused strategy, increased sale of products to deliver additional value to its shareholders: "Under traditional COS regulation, a utility is motivated to solve system reliability and customer access issues by investing capital instead of maximizing the value it can extract from existing assets" (Satchwell & Cappers, 2015). The goal of the conventional utility, as such, can be conceptually positioned at one end of a profit motivation spectrum: the "motivation to build incremental assets for the primary purpose of expanding its rate-base" (Satchwell &

Cappers, 2015). Regulators reward or punish utilities for taking actions to achieve public policy goals and to maintain "just and reasonable revenues". So-called 'incentive regulation', however, establishes the working conditions of the utility. Within these conditions, "[g]iven any set of regulations, utilities will take those actions which most benefit their principal constituencies — shareholders and management — while meeting the requirements of the regulations" (Lazar, 2011). The principal constituency of the investor-owned utility is its shareholder base. To deliver shareholder value, the utility extends service to its customer base.

Organizational logic and mandate: the conventional utility enjoys a co-evolutionary history with the regulation that organizes and controls its operations (Lazar, 2011). Within this system, the conventional utility is granted a natural monopoly (at least for its network components such as transport and service deliveries). Driven by a three-fold mission of electrification, safety, and controlling the ability of franchises to exert monopoly-pricing power, the result is a centralized and top-down system (Burr, 2007). The institutional architecture in place to govern energy positioned underlying principles that guided this evolution: energy as a public necessity, an emphasis on affordability and abundance, a support for large-scale and centralized production, supply expansions to meet forecasted demand increases, a sense of technological optimism, and the need for expert control to account for the intrinsic complexity of the resulting system (Sovacool, 2011). The 'regulatory compact' establishes the conditions between the utility and the government including the utility's general objective to ensure the provision of safe, adequate, and reliable service at prices (or revenues) that are sufficient – but no more than sufficient – to compensate the utility (Lazar, 2011). In addition, investor-owned utilities are governed by the stockholders and need to make decisions in the best benefit of this shareholder base.

Business model resilience: utilities, with their large asset base and commitment to reliable and stable service, display limited flexibility to respond to new challenges or opportunities. Response to new risks or market environment changes depend on adaptations in the regulatory environment (Nyangon, Byrne, and Taminiau, 2017). Nevertheless, signaling modern society's dependence on the viability of the energy utility, such changes have happened repeatedly throughout the lifetime of the COS model (McDermott, 2012). The energy transition to distributed photovoltaics, for instance, elevates business model concerns about the potential need for higher electricity rates or cost-shifting to non-solar customers, reduced utility shareholder profitability, reduced utility earnings opportunities, and inefficient resource allocation (Barbose, et al., 2016). Among proposed responses to address these concerns are to reduce compensation to customers that have distributed energy installed, to facilitate higher-value distributed energy deployment, to gain utility ownership and financing of distributed photovoltaics, or to align utility profits with the deployment of distributed energy (Barbose, et al., 2016). However, as Hess (Hess, 2015) and (Bayulgen & Ladewig, 2016) note, several of these strategies can be construed as attempts at regime preservation rather than adaptation.

3.0. UTILITY 2.0 CANDIDATES: NY'S REV INITIATIVE AND GREAT BRITAIN'S RIIO

To test whether the parameters listed in Table 1 can adequately evaluate Utility 2.0 candidates, this section applies the Table 1 framework to the case study analysis of the NY REV Initiative and Great Britain's RIIO models. To that end, Section 3.1 and Section 3.2 discuss the REV and RIIO business models, respectively.

3.1. NY REV Business Model

In New York, retail peak demand is approximately 75% greater than average system load and 9% of power is lost in transmission (NYPSC, 2015a). Essential infrastructure investment is projected at $30 billion over the next ten years to address these and other challenges. [12] A primary response strategy by New York state government is the Reforming the Energy Vision (REV) approach. At its core, Governor Cuomo's 2014 REV Initiative provides a business model that enables utilities to act as Distributed System Platform (DSP) providers to coordinate distributed energy markets and transition New York to a cleaner, more resilient, and more affordable grid.[12] The 2015 New York State Energy Plan (NYSEP) outlines a series of support programs and mandates to enact REV: a 40% reduction in GHG (from 1990 levels), a 23% decrease in building energy consumption (from 2012 levels), and 50% renewable energy generation; all by 2030 (NYPSC, 2015a).

The REV model foresees a 'transactive grid' where "consumers and other parties can take full advantage of every type of energy resource – on both sides of the meter"

(Zibelman, 2016). Key within this ambition is to modify the traditional regulatory model and realign utility interests with consumer interests: utilities will be provided with the opportunity to share in the savings associated with efficiency increases (Zibelman, 2016). Two price signal processes play a critical role in this regard. First, REV establishes benefit-cost analysis as a foundational procurement tool to determine distributed energy resource deployment (Nyangon, Byrne, and Taminiau, 2017; Zibelman, 2016). Perhaps chosen due to its regulatory familiarity and apparent simplicity (Felder & Athawale, 2016), the benefit-cost analysis is to work in tandem with the multi-year distribution system integration plans (DSIPs) – developed by the utilities under the REV approach – in order to assure a fair, open and value-based decision making process (Zibelman, 2016). [3] The benefit cost approach will be applied in four key categories of utility expenditures:

a) Investments in DSP capabilities;
b) Procurement of distributed energy resources through competitive selection;
c) Procurement of distributed energy resources through tariffs; and
d) Energy efficiency programs (Zibelman, 2016).

The second key tool is to use locational marginal pricing principles to distribution to determine the full value of distributed resources. Locational marginal pricing principles can help distinguish what configuration of distributed resources and systems produces the overall best value for the system (Zibelman, 2016).

[3] How the benefit cost tool can be best applied – or whether other tools should be used instead – is still under discussion (Felder & Athawale, 2016).

The REV model shares some characteristics with other ambitious and successful initiatives, particularly the German Energiewende (Binder & Foster, 2016). While New York is not alone in its efforts to motivate the further integration of distribution planning with distributed and renewable energy (similar efforts are happening in California (California Public Utilities Commission, 2014), Hawaii, Massachusetts, and Minnesota, the REV model represents a promising candidate for Utility 2.0 as it, at least, challenges two fundamental components of the conventional model: REV challenges the "assumptions that demand is inelastic, and that economies of scale make central generating stations the most economic way to meet power needs" (Brooks, 2015).

Such a new perspective could unlock significant benefits. For instance, a 2009 study conducted by the Brattle Group for the New York Independent System Operator (NYISO) determined that, "...dynamic pricing can provide substantial benefits in New York State by reducing total resource costs, lowering customer market costs, and improving economic efficiency. With estimated market-based cost savings in the range of $171 million to $579 million per year, the benefits to electric consumers can be significant, especially when technology serves to facilitate demand response and energy conservation" (Newell & Faraqui, 2009).

3.2. Great Britain's OFGEM Business Model

Up to 2013, Ofgem operated a five-year transmission and distribution network cost pricing policy. Under this system, network charges were adjusted for inflation using the Retail Price Index combined with an efficiency savings target. Known as RPI-X, OFGEM reached the conclusion that this approach would be unable to meet projected energy infrastructure investment requirements (Newton, 2010).[4] In addition, the RPI-X framework, introduced after privatization, was found to favor capital solutions over DSM and DER, and was also considered too complex (Fox-Penner, Harris, & Hesmondhalgh, 2013). In an effort to respond to identified need for investment (Blyth, McCarthy, & Gross, 2015), OFGEM turned to a new model where network companies' revenues are composed of the sum of incentives, innovation, and outputs (RIIO model) (OFGEM, 2010). Network charges under this model are "closely linked to intelligent and forward-looking investment and to […] producing the services that consumers want" (Newton, 2010). The overriding objective of the approach is to encourage energy network companies to a) "play a full role in the delivery of the sustainable energy sector" and b) "deliver long-term value for money network services for existing and future consumers" (OFGEM, 2010).

As part of the RIIO approach, the pricing framework period was extended from its previous five-year installments to eight years – the first installment of RIIO runs from 2013 to 2021. The longer time period is intended to establish investor confidence, a resource in short supply in the distributed and renewable energy field (Parker & Guthrie, 2016; EEFIG, 2015). Network companies that display innovation throughout this time period will be rewarded while those that failed to innovate face penalties and regulatory scrutiny – in aggregate, rewards of about 170 million pounds and penalties amounting

[4] OFGEM estimates that about 200 billion pounds are required to update the UK's energy infrastructure, of which about 32 billion pounds need to be directed towards upgrading energy supply networks (Newton, 2010).

up to 220 million pounds are expected (OFGEM, 2011). This performance based revenue requirement approach with decoupling was first introduced in 2013 for pricing transmission and gas distribution networks, and later in the 2015 electricity distribution price control reviews (Fox-Penner, 2010; Fox-Penner, Harris, & Hesmondhalgh, 2013).

The first evaluation reports regarding RIIO's performance appear to suggest that the distribution companies are delivering on their required outputs at lower than expected cost. For instance, on the gas distribution side, the network companies are expected to outperform cost allowances by 2.1 billion pounds (12.5%) over the eight-year period (OFGEM, 2016) and, on the electricity distribution side, the network companies indicate that they will meet or exceed stated targets for the output categories (OFGEM, 2015). However, as listed in the risk section below, the targets are likely too low essentially rewarding effort too easily – in other words, additional savings are possible but not being captured.

4.0. MULTI-DIMENSIONAL BUSINESS MODEL ANALAYSIS

The seven dimensions listed in Table 1 are applied to the two case studies.

4.1. Infrastructure

Both models were put in place to address the infrastructural challenges raised in the introduction. Using advanced data analytics, both REV and RIIO aim for a shift to low-carbon decentralized generation and a multi-directional flow of data and energy. These models are also positioned to achieve what we might call the *Infrastructure to Services*

Transition, i.e. the evolution of infrastructure for commodity delivery to support greater personalization of value—new purposes, new platforms, enabled new infrastructure, and new apps (services) (Cooper, 2016). In New York, nearly double the $17 billion invested over the past decade to replace the State's aging electric transmission and distribution infrastructure is needed between 2015 and 2025 to meet currently projected energy demand (NYPSC, 2015b). On the other hand, RIIO's fifth transmission price control review (TPCR5) includes provisions for a wide range of options (e.g. charging and access rule changes, and infrastructure solutions for delivering outputs relating to reliability and availability of network services) (OFGEM, 2010).

4.2. Revenue Model

RIIO establishes a comprehensive, multi-criteria price control process intended to incentivize distribution company innovation (OFGEM, 2010). In contrast, the NYPSC (2015b) concluded that deployment of advanced metering infrastructure (AMI) is necessary to implement REV, arguing "dynamic pricing will require signals both to and from end-use equipment. Settlement of transactions will often require time-stamped usage data" and that "at a minimum, each utility DSIP will need to include a plan for dealing with advanced metering needs; however, plans that involve third party investment may be preferred over sweeping ratepayer funded investments." The NYPSC's REV proceeding also addresses the limits of traditional utility revenue models, the need for reform as well as other revenue issues in the electricity market such as earnings sharing mechanisms, "net plant reconciliation mechanism" or “clawback”reforms, and total expenditures or totex, and recovery of DSP-related investments.

4.3. Customer Interface

Both REV and RIIO emphasize improved customer choice, and lower cost of service for consumers. For instance, the REV model underscores enhanced customer knowledge and tools for effective management, market animation and leverage of ratepayer contributions, system-wide efficiency, fuel and resource diversity, system reliability and resiliency, and carbon emissions reduction (NYPSC, 2015a, 2015b). Likewise, RIIO stresses the need for improved customer satisfaction, reliability, safe network services, competitive connection terms, and social obligations as well as meeting the set environmental targets (Fox-Penner, Harris, & Hesmondhalgh, 2013).

4.4. Value Proposition (Sub-sectoral Price Control Versus Whole-Sector Price Control and Planning)

The two price control strategies can be differentiated in terms of their target. RIIO has three price control targets: transmission (RIIO-T1), gas distribution (RIIO-G1), and electricity distribution (RIIO-ED1). In contrast, the REV strategy is applied to the energy industry as a whole (NYPSC, 2015b).

In addition, the filing processes that dictate cost structure are handled differently. RIIO’s price control review structure takes 2- 2.5 years. It occurs in 4 main stages:

a) outputs and price control methodology;

b) business plans and proportionate treatment;

c) revised business plans and detailed assessment; and

d) setting the price control.

Through this approach, RIIO encourages companies to submit well-justified business plans. These plans should include outputs, efficient expenditure, efficiency financing, uncertainty, and risk. A high quality plan can be fast-tracked. The final price control decision will include many different aspects, including the following:

- Expected primary outputs (categorized as customer satisfaction, reliability and availability, safe network services, connection terms, environmental impact, and social obligations) and the level at which primary outputs must operate;
- Base revenue and allowed rate of return;
- Portion of totex to be recovered in year it was spent and the proportion to be recovered through regulatory asset value (RAV);
- Assumed asset lives for deprecation;
- Amount of money to be collected from consumers for the innovation stimulus package;
- Secondary deliverables (intermediate outputs that will ensure delivery of longer term high cost projects);
- Upfront efficiency incentive rates;
- Other incentives and penalties;
- Arrangements for future market testing;
- Third party agreements;

- Uncertainty mechanisms; and
- Midpoint review scope and timing.

On the other hand, REV is envisioned as a three-phase process involving filing a

1) Energy efficiency transition implementation plans (ETIPs). Such plans were submitted March 31, 2015 and implementation began in January 2016.
2) Interim action plan and
3) Distribution system implementation plans (DSIPs) to summarize how the utility plans to implement REV over the next 5 years. They will be updated every two years. DSIPs contain proposals for capital and operating expenditures to build and maintain DSP functions, and the system information needed by third parties to plan for effective market participation.

This DSIP filing will be a two-part process. The Initial DSIP, due June 30, 2016 should include distribution system planning, forecasted demand growth, identification of beneficial DER locations, distribution grid operations, and distribution system administration data. A supplemental DSIP is expected to be added in future, and will include information on distribution planning and grid operations, granularity of pricing, data access to facilitate market transition, and overall system planning.

4.5. Organizational Logic and Mandate (Aspirational Versus Standardized Ratemaking)

REV is a socio-environmental aspiration encouraged by the transition of distribution utilities to DSPs and supported by a series of targeted initiatives. RIIO is a standardized ratemaking framework that transitions the gas and electricity sectors towards a cost-effective sustainable core.

In other terms, REV is altering political structure, while RIIO is altering economic structure. In RIIO, the obligations of stakeholders remain the same, but in REV, obligations change. Distribution utilities are asked to act as DSPs. To further elaborate, a DSP is defined as "an intelligent network platform that will provide safe, reliable, and efficient electric services by integrating diverse resources to meet customers and society's evolving needs. The DSP fosters broad market activity that monetizes system and social values, by enabling active customer and third party engagement that is assigned with the wholesale market and bulk power system" (NYPSC, 2015b). Furthermore, ESCO's, which currently provide only commodity service in NY, are encouraged to offer more classes of service. RIIO does not change the mandate of involved parties like REV does, but instead encourages behavior changes by altering the rate base to reflect more parameters.

4.6. Business Model Resilience (Specialization Versus Generalization)

RIIO has three innovation funds (outside of the rate-case structure) available separately for both the gas and electricity sectors. REV has a network of over tenfold-more programs such as NY Green Bank, NY-Sun, K Solar, Charge NY, BuildSmart NY, etc. However, the usage of some of these programs will be built into rate-cases. RIIO offers modifications for existing rate cases should the price control prove to act against public interests.

Both processes involve a more exhaustive analysis of costs in categories previously ignored. Increased stakeholder involvement, longer-term rate contracts, and the sheer regulatory size of the initiatives increase complexity.

4.7. Potential (Existential) Business Model Risks and Risk Management

A common difficulty with price control strategies is to determine the level at which such prices are set. In the case of RIIO, for instance, British Gas indicated that the targets stipulated by RIIO were "overly generous": 38 out of 40 targets were reached by the network companies in the first year (out of a 8-year strategy) (British Gas, 2014). This concern of "over-remuneration" – targets are linked to direct rewards and penalties – was shared by the Citizens Advise Bureau in their consultation submission to OFGEM (Citizens Advise, 2014). Such a risk should be of primary concern to the RIIO approach: in part, the RPI-X was criticized and replaced precisely because of over-remuneration of the network companies for their services. For instance, under RPI-X, rates of return for gas distribution and gas transmission companies were higher than expected (OFGEM, 2014). Similarly, review of the first two years of performance on the RIIO electricity side show that all network companies are expected to "exceed the allowed return of 7%, by 2-3 percentage points" (OFGEM, 2015).

Other concerns with distribution utilities acting as DSPs include discrimination against third parties, favoring utilities' facilities, information asymmetry, and lack of access to lower costs of capital (NYPSC, 2015b). However, distribution utilities were selected because they are well positioned to take on the responsibilities and are able to do so quickly at lower system cost. To reduce the market concerns, utility DER ownership is limited to:

- Energy storage and generation on utility property
- support demonstration projects and
- where there is no market (such as low income communities).

4.8. Combined Analysis of Dimensions

Table 2 introduces the combined analysis of the dimensions.

Table 2: Common framework analysis of business models

	NY REV Model	Great Britain's Ofgem (RIIO) Model
Infrastructure	• Both REV and RIIO address the infrastructure related challenges raised in the introduction section. • Emphasize *Infrastructure to Services Transition*, i.e. support for greater personalization of value—new purposes, new platforms, enabled new infrastructure, and new apps (services). • In New York, $30 billion of investment in the State's aging grid infrastructure is needed in the next ten years.	• RIIO's TPCR5 has infrastructure related provisions including charging and access rule changes, and reliability and network infrastructural-related services. • Apply advanced data analytics, and multi-directional flow of data and energy for improved service delivery.
Revenue Model	• Distribution utilities will act as Distributed System Platform (DSP) • Market animation and leverage of ratepayer contributions; system-wide efficiency; fuel and resource diversity; system reliability and resiliency; reduction of carbon emissions • DSPs[5] will provide pricing structures • Efficiency will be treated like part of utility revenue requirement, not a dedicated surcharge	• Comprehensive, multi-criteria price control. • 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"[14] • For base revenues, benchmarking analysis of historical costs • Partially symmetric upfront incentives • IQI[15] sets the strength of the upfront efficiency incentives according to the differences between utilities forecasts and Ofgem's assessment • Use the return on regulated equity (RORE) developed in DPCR5 to check that package fits together appropriately

[5] DSPs (distributed platform providers) act like "mini-ISOs" situated between the NYISO and consumers. DSPs will provide pricing structures by using localized automatic systems to balance production and load in real time to allow for more DER integration.

[14] "Totex" is total expenditures. Under totex, that capital and operating expenditures are treated as equivalent and recovered under the same formula. The formula sets a ratio of "slow" money to "fast money". The "slow" money is included in the RAV and the "fast" money is recovered on an annual basis.

[15] Known formally as the Sliding Scale Incentive (introduced in DPCR4), the IQI discourages the submission of inflated expenditure forecasts. The IQI individualizes efficiency incentive rates.

	• PSRs[6] and MBEs[7] replace EIMs[8] • Modified clawback[9] mechanisms to encourage third party interactions • ESMs[10] tied to performance index • Scorecards[11] to evaluate non-monetized measurements • 3-year rate plans (opt in for 5) • Value of DER calculated as LMP+D[12] • Increased encouragement of TOU[13] rates	
Customer Interface	• Emphasize enhanced customer knowledge and tools for effective management.	• Emphasizes improved customer satisfaction, reliability, safe network services, better connection terms, and social obligations as well as meeting the set environmental targets.

6 PSRs (platform service revenues) are revenues that utilities, in their capacity as DSP providers, will earn from market participants.

7 New MBEs (market based earnings) could include value added from services such as an online portal for customers, transaction/ platform access fees, optimization/scheduling services that add value to DER, energy services financing, engineering services for micro-grids, etc.

8 EIMs (earning impact mechanisms) are monetized. Performance incentives. They could be used for peak reduction, EE, customer engagement and information access, affordability, and interconnection. Different EIMs do not have to have the same directionality. They should be established on a multi-year basis.

9 “Clawback” refunds unspent amounts of utilities’ capital budget to consumers. This can be revised so the money that would have been spent on a project can be retained if DER supplants the need for project. Clawback could also be modified so that utilities are indifferent to whether it is spent by them or a third party.

10 ESMs (earning sharing mechanism) allow utilities to retain earnings above a baseline return on equity. Beyond that level, earnings are shared between utilities and customers. At higher levels, savings are dedicated entirely to consumers.

11 Scorecards measure performances that do not have any direct earnings impacts. Scorecards are proposed for system utilization and efficiency, distributed generation, EE, and dynamic load penetration, carbon reduction, opt-in TOU rate efficiency, market development, MBE use, customer satisfaction, customer enhancement, and conversion of fossil fuel end uses.

12. The “value of the D” is the benefit that should be produced to the customer in terms of total cost avoided or reductions to the distribution system by DER. The value of the “D” is not established, while LMP is.

13 Time of use rates

Value Proposition	• Remove market barriers to enable a dynamic clean energy economy at a scale to create opportunities and growth while protecting the environment • 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	• Encourage energy network companies to play a full role in achieving a sustainable energy sector and delivering long term value in network services for current and future consumers. • Emphasize customer satisfaction, reliability, safe network services, better connection terms, environmental integrity, etc. • Transparent, upfront price control framework sets out what outputs network companies need to deliver upper limit on allowed return, symmetrical incentives. Increased involvement of network companies and non-network parties.
Organizational logic and mandate	• NY Department of Public Service Case 14-M-0101 Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, proposed 4/24/14 (NYPSC, 2014) and order adopted 2/26/15 • 2015 NY State Energy Plan outlines how to enact REV. • Integrates three strategic pillars: o PSC's REV Docket promotes greater consumer choice in energy use o NYSERDA's Clean Energy Fund provides $5B in new green energy investment over 10 years, starting in 2016. o NYPA's programs lead by example. • New York State Department of Public Service wrote REV • Public Service Commission (PSC) 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,	• RPI-X@20 Recommandations Consultation proposed 7/26/10. • Ofgem's RIIO final Decision (OFGEM, 2010) and handbook 10/4/10 • 3 pillars o Upfront ex-ante 8 year price control o Option for third parties for deeper engagement o Time limited innovation stimulus open to both utilities and third parties • 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 [16]

[16] Transmission (TPCR5), gas distribution (GDPCR2), electricity distribution (DPCR6) price control reviews.

	DER, consumer control, and wholesale market issues; considers whether distribution utilities should serve as DSPs ▪ Track 2: regulatory and ratemaking changes	
Business Model Resilience	• 43 different programs offered in NY Plan. • Transactions take place in a nonlinear manner.	• Distribution network operators submit and publish realistic business plans with demonstrable value to consumers.
Potential (Existential) Risks and Risk Management	• Market power concerns over distribution utility acting as DSP. • Concerns over whether MBEs can replace traditional utility earnings. • Combine financial incentives such as new MBEs, ratemaking adjustments, concrete targets with positive, symmetric, and bidirectional earnings impacts.[17] • 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, adjustments to conventional rates, new positive only symmetrical bidirectional earnings impacts.	• Reopeners i.e. uncertainty mechanisms • Third parties can appeal to the Competition Commission make requests for price control before instituted[18] • 3 part time-limited innovation stimulus[19] o Annual Network Innovation Competition replaces the Low Carbon Network Fund o Network Innovation Allowance funds small scale innovation projects • Innovation Roll-out Mechanism where companies can apply to additional funding to apply a proven innovation • Right balance between 8-year price control and reopeners • If efficiency inventive rates are properly set • Risk sharing through the symmetric efficiency uncertainty mechanisms • Provision in the revenue system to cater for rise in demand or volumes of activity

[17] Staff recommends an opt-out data exchange because integrating DER requires standardized time stamped energy usage information. A single entity to operate a data exchange is being considered.
[18] Any party can make a price control modification request to GEMA during the final proposals stages. GEMA, the gatekeeper, determines whether this modification request should be referred to the Competition Commission.
[19] Companies can compete for partial finding outside of the price control framework. There is one fund for gas and one fund for electricity. Both are open to network and non-network parties.

5.0. CONCLUDING REMARKS

The analysis presented in this paper represents a method for systematically structuring and reviewing key dimensions of 'Utility 2.0' candidates. The approach highlights the importance of a multi-dimensional reflection of the business model of new proposals for utility and energy governance.

We offer that the multi-dimensional deconstruction of business model functioning, like we have done in this paper for the two utility business models, could become a function of the Utility 2.0. and beyond. Such an integrated platform and approach provides a suitable analytic tool for studying the still hazy future of the Utility 2.0 marketplace. Five issues, in particular, incorporate the lessons we have learned through the application of this framework, namely:

- Infrastructure to services network transformation inevitably offers the support for deepening personalization and value maximization that electric utilities should prioritize and seize to sustain the next phase of their business model transformation e.g. new services, and new platforms for extending commodity distribution, system continuity, and stability;
- Market disruption and disintermediation pose a less predictable future and significant risks to traditional rate-based revenue models. Consequently, utilities should formulate a more flexible revenue model to keep with new market realities and to deliver value beyond reliable and affordable kilowatt-hours;

- The grid-customer interface will become more sophisticated as the rate of interaction between consumers and utility providers go up, requiring new level of flexibility, preferences, and expansion in seamless customer-facing automation beyond the current services;
- A compelling value proposition should be expanded to include distributed generation and energy storage opportunities, particularly in using curtailable renewable energy options for grid control, resiliency, and create additional value for different categories of consumers;
- A multi-dimensional analytical approach along the lines proposed in this paper should be reconstructed beyond dimensions of profit motivation and profit achievement to prioritize energy cost savings, carbon mitigation, future-proofing of energy infrastructure, and reducing economic impact of extended outages, especially in a decentralized and disaggregated marketplace envisioned in the Utility 2.0 regime (Satchwell & Cappers, 2015; Zinaman, et al., 2015).

Based on these lessons learned, several avenues for further research emerge. In particular, analysis will need to bear out how the various dimensions interact with each other and perhaps strengthen or weaken the (intended) functioning of the overall policy proposal. A pricing control strategy, for instance, is primarily utility-focused and could perhaps have unintended consequences for end-use customers of energy. A second avenue for research is to determine the interaction pattern between existing policy conditions and the proposed business model reform. Previous policies in the United Kingdom for instance have been put forth to accelerate the deployment of renewable energy and energy efficiency but might have complicated interaction effects with the platform-based reform represented by RIIO. Questions about whether such interaction effects slow or accelerate the transition to sustainable energy will need to be investigated and answered. Finally, an obvious pathway for future research is to apply the framework devised throughout this paper on additional business models and seek further improvement of the analytical tool.

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