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Disruptive forces on the electricity industry: A changing landscape for utilities

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ABSTRACT

The energy sector has been navigating rapid technology innovation, slowing demand, and rising electricity prices. A steady shift towards renewable energy products is also exacerbating the disruption of utility business models. This article outlines the drivers of disruption for electricity utilities, and explores potential risks and opportunities should traditional business models evolve to embrace innovative technologies going forward.

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1. Introduction

1.1. The energy model transition

The underlying economics for conventional energy markets and systems have already shifted in favor of the decentralized models of clean technology – as afforded by solar PV and storage at the residential level, and larger renewable projects at the community scale. In effect, this has created excessive uncertainty for existing, 'traditional' energy market participants, and concerns are already being raised with regards to future industry investment and business decisions for energy companies (COAG, 2014; Allen et al., 2009; Grace, 2014).

With the attractiveness of new energy products and services such as solar PV and storage only increasing, the electricity industry is now regarded as ripe for disruptive potential (Frankel et al., 2014; Roberts, 2013). In particular, this new wave of technical innovation is set to disrupt electricity utility business models, dramatically affect the availability of capital in the industry, and further intensify issues within the electricity markets (Denholm and Margolis, 2007; Katiraei and Agüero, 2011; Yip, 2013).

As market dynamics force the hand of electricity utilities globally, changing the business model away from a conventional, grid-based system towards one that embraces distributed solar and storage across the entire network is the only long-term solution for electricity businesses (Tayal & Rauland, unpublished). Utilities undertaking future business planning and strategy development should be proactively looking to energy efficiency, solar PV, and storage as growth opportunities rather than as an existential threat, and acknowledging that their place in the energy system will only grow (Poudineh and Jamasb, 2014; Klose et al., 2010).

Ultimately, all electricity grids share a common goal of achieving a safe, secure, sustainable and affordable service of electricity to customers – and this can only be achieved by first recognizing that the old model is no longer suitable.

In the past decade alone, the energy sector has been navigating: rapid technology innovation (removing barriers to entry for small players); the falling cost of distributed generation; increased interest in demand-side management; slowing trends in demand; shifting government policies on renewable energy incentives; and rising electricity prices (Kind, 2013; Newcomb et al., 2014; Grace, 2014; Bunning, 2011). In combination, these factors are set to fundamentally change the way our electricity systems operate.

The key for electricity provision may include making industries and systems smaller, as efficiency advocates propound, but it must also require that they are redesigned in a way that replenishes, restores, and nourishes (Braungart and McDonough, 2002). And as Ashford et al. (2012) note, we need to be prepared to challenge ingrained, limiting, and outdated beliefs.

2. Background

2.1. The old model in a different setting

Traditional business models for utilities reflect the centralized system of electricity generation and network design (Kind, 2013; Bromley, 2015; Caldecott and McDaniels, 2014). This centralized system also drove a standard approach to system security and network planning, economic regulation, and underpinned the design of wholesale and retail markets and dispatch engines

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(Schaltegger et al., 2012; Richter, 2013; Roberts, 2015; Sioshansi, 2014).

Recognizing this "coupling" of volumes and profitability was at a natural tension with the assumption that electricity should be treated as a "public good," the electricity industry most commonly became a natural monopoly (Newcomb et al., 2014).

However, this view of electricity utilities as natural monopolies is now coming under increasing scrutiny due to a convergence of several factors across technology, economics, and public policy. Customer impacts are now driving investment trends in the opposite direction (through energy efficiency and distributed generation) and the increasing uptake of solar PV and storage will only exacerbate this trend (Zinaman et al., 2015).

3. Methodology

3.1. Literature review

A review of existing literature was carried out over 12 months to gain a broad understanding of the central drivers disrupting the electricity sector as a whole, across major electricity markets around the world.

4. Discussion

4.1. Existing barriers

Currently, the interests of utilities (preventing stranded assets, maximizing electricity sales, preventing increased competition) are in tension with the interests of consumers and the environmental imperative to decarbonize the electricity sector (Roberts, 2015).

Further, any solutions designed to meet the transitioning needs of the energy industry will need to be based on the individual regulatory and market contexts in which they emerge (Crawford, 2015; Hogan, 2014). For instance, utilities in competitive markets will be more directly exposed to the threats that arise from technology innovations such as solar and storage systems, given their ability to reduce electricity use and demand (Kind, 2013). There are also a series of regulatory, institutional, and financial barriers that remain and that inhibit the effective transition of electricity businesses to new ways of operating.

Utilities themselves are also likely to have a predisposition to inertia – what transition theory terms "path dependency" – being locked into a particular pathway that inhibits consideration and adoption of innovative ideas (Lee and Gloaguen, 2015). Traditional utilities have been found to rely on traditional forms of research and development (Frankel et al., 2014). This is a significant risk across the industry, given the momentum that new, distributed technologies and "big data" is gathering. Utilities of the future will be expected to have their own innovation hubs or partnerships, identify new ideas, and leverage the capabilities of other businesses that can provide products and services complimentary to their traditional offering.

> *Nimble information gathering produces a better foundation for strategic decisions and a more diversified flow of ideas for innovation* (Heiligtag et al., 2015).

The restructuring of electricity tariffs also creates significant obstacles for governments and policymakers to overcome. While regulatory frameworks allow for cost recovery in future tariff proposals, existing tariff structures can create the perverse incentive that results in customers without solar PV having to pay the most for lost revenues. As solar penetration increases, this cost recovery structure will only further attract political pressure to undo these cross subsidies, ultimately exposing utilities to the risk of stranded assets – see Section 4.4 below (Caldecott and McDaniels, 2014).

4.2. The Western Australia case study

Western Australia (WA) presents a uniquely challenging environment under the "traditional" approach to electricity service provision. WA occupies an area equal in size to the United Kingdom, but with a fraction of the population density – with around 1 million customers as opposed to 73 million (McGoldrik, 2016). This has always created challenges for the government-owned electricity utilities, which rely on millions of dollars of annual subsidies to provide uniform electricity tariffs to residential customers across the state, irrespective of location. Of course, the actual cost of supplying customers in the remote and rural towns scattered across WA is significantly higher than providing electricity to anyone living in the state's capital, Perth – which has established distribution networks, excess capacity, and a reliable distribution network (Government of WA, 2014).

In addition, the maintenance costs for such an expansive network are significant, in and of themselves, with additional threats of bushfires and cyclones preventing the state government from expecting to move to a cost-reflective centralized service model any time soon. However, with the declining costs in stand-alone power systems – with cheaper solar PV and battery storage components – WA has realized it may need to rethink this traditional centralized model. The outstanding question is what can be done to minimize the pain for these utilities to walk away from billions of dollars of investment in the grid infrastructure.

4.3. Banking sector acknowledgement

A number of banking institutions have already identified the decentralized electricity system as a necessary transition given the financial impact that would result from maintain existing models, and have adjusted credit and stock ratings of involved electricity businesses accordingly. For example, the financial risks created by disruptive technologies such as solar PV and storage systems include declining utility revenues, increasing costs, and lower profitability potential, particularly over the long term. Adding the higher costs to integrate increasing penetrations of distributed generation technologies will inevitably result in lowering profitability and, therefore, credit metrics. Failing to address these financial pressures with a restructure of business models would result in a major impact on equity returns, required investor returns, and credit quality (Kind, 2013; UBS, 2014).

Given the increasing pressure on traditional pricing structures and revenue sources, the financial institutions themselves are recommending utilities to develop "smarter grids" by partnering with solar, battery, and smart meter providers in order to leverage their existing relationship with customers (Rader, 2015).

UBS, a leading investment bank and financial analysis firm, is very optimistic about the impact of large (utility) scale solar on energy markets around the world, citing that by 2025, utilities could make up 50% of the solar market across the world (UBS, 2015). The UBS report (2015) goes on to suggest that utilities will be the "lead actors" in large-scale solar, replicating the business models of U.S. companies like SolarCity (UBS, 2015).

Table 1 summarizes the views from UBS and three other investment banks on the impact of electricity sector disruption.

4.4. Stranded asset risk

From an accounting perspective, stranded assets are those that succumb to unanticipated devaluations, early write-downs or are ultimately converted from balance sheet assets to liabilities.

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