Sustainable Energy Technologies and Assessments 19 (2017) 59–69

Contents lists available at ScienceDirect

Sustainable Energy Technologies and Assessments

journal homepage: www.elsevier.com/locate/seta

Original article

Future business models for Western Australian electricity utilities

Dev Tayal *, Vanessa Rauland

Curtin University Sustainability Policy Institute (CUSP), Kent Street, Bentley, Perth, Western Australia 6102, Australia

ARTICLE INFO

Article history:
Received 5 September 2016
Revised 22 November 2016
Accepted 29 November 2016

Keywords:
Solar
Storage
Electricity
Business models
Innovation

ABSTRACT

There is growing interest and investment in solar photovoltaic (PV) panels and battery storage systems, driven by the rapidly decreasing technology costs and the movement towards more sustainable energy solutions.

The increasing adoption of solar and storage systems presents both a challenge and an opportunity for electricity utilities amidst wider technological disruption in the sector. This paper investigates how Western Australian utilities can best adapt to this disruption, and in particular, explores how existing business models will need to evolve beyond traditional energy economics. Distinctive characteristics of new business models are classified, before being qualified for appropriateness to the local Western Australian context through interviews with a variety of energy market participants. For Western Australian utilities, it is suggested that these characteristics be adopted in a modular approach, to ensure capabilities are maintained, costs minimised and customers retained.

This research aims to fill this local context gap in existing literature, to inform Western Australian Government policy makers and industry participants on how to evolve their existing networks and processes to create innovative and sustainable electricity systems of the future.

Introduction

The energy model transition

Inherently, energy markets are complex and dynamic structures. They usually have a variety of stakeholders, representing different agendas on price, system security and reliability, and environmental issues, who are constantly lobbying governments for regulatory and industry reform. For example, renewable energy developers tout the advantages of clean energy and the need for regulatory reform to encourage more projects to connect. However, for projects to be financially viable in Western Australia (WA), they still rely on Federal subsidy schemes (Large and Small Scale Generation Certificates), if not State support as well (such as generous Power Purchase Agreements and network connection assistance for non-reference services). In contrast, network utilities must manage intermittency and hosting capacity within existing capital constraints and regulatory frameworks, which in WA includes unconstrained access for generators connecting to the network. Therefore, from a utility's perspective, current business models discourage projects that add costs without increasing revenue, particularly in the context of WA's plentiful base-load plant, and within a market that already has excess capacity.

In WA, the complexity is made even more apparent by the state's geographical isolation, preventing any feasible prospect for WA's networks to be connected to neighbouring systems. However, within this challenging environment, WA's unique isolation also presents an opportunity to study the extent to which renewable energy technologies and distributed generation can be utilised to disrupt the conventional, centralised models of our existing systems.

The underlying economics of renewable generation have already shifted in favour of the decentralised models of clean technology – as afforded by solar PV and storage, and concerns are already being raised with regards to future industry investment and business decisions for energy companies [9,1,19].

With the attractiveness of these new energy products and services only increasing, the electricity industry is now being regarded as a sector ripe for disruption [15,64]. 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 [12,25]; [80]. For example, as customers drive the uptake of solar PV and storage systems, coupled with smart 'behind-the-meter' appliances, utilities are faced with changing demand patterns, falling revenues, increased requirements to maintain

* Corresponding author.
E-mail address: dev.tayal@student.curtin.edu.au (D. Tayal).

http://dx.doi.org/10.1016/j.seta.2016.11.007
2213-1388/

system security, and the threat that any future large infrastructure investments may be undermined by further erosion of revenue and increasing costs.

WA utilities are beginning to be acutely aware of these challenges for future investments. Following destructive bushfires in January 2016 that destroyed up to 50 km of power lines in the South West, Western Power chose not to re-build the network, but determined that distributed energy options, such as stand-alone power systems and micro-grids provided more economical solutions [79].

As market dynamics force the hand of electricity utilities globally, electricity businesses must start exploring the value of changing business models away from a conventional, grid-based system to new models, such as one that embraces distributed generation and storage across the entire network, as well as new opportunities to provide energy efficiencies services. Failing to change will almost certainly exacerbate the challenges being faced by incumbent businesses (see section 'The old model in a changing landscape' below). However, this will require utilities to break from the inherent path dependence and lock-in common to such complex socio-technical structures as the electricity system – irrespective of potential reversal costs [28]. Utilities undertaking future business planning and strategy development should be open to these business model explorations, although this may require a change in mindset to see technology innovations as growth opportunities, rather than as existential threats, acknowledging that innovation is inevitable, and may drive existing business models to become obsolete [58,26].

Using WA as a case study to explore how these future business models may be implemented in practice, this paper presents a series of evolutionary business models for WA electricity businesses to consider. These models relate particularly to the development and integration of residential solar PV and battery storage and have been identified through an extensive literature review. These models are then validated through a series of semi-structured interviews with WA market participants and stakeholders.

For policymakers and regulators currently grappling with a fluctuating electricity service and delivery model, this research aims to provide valuable insights and recommendations on how to help facilitate the transformation of the electricity system, and overcome the significant inertia of a system when exposed to change [57].

It is hoped that this research can also be used in practice to encourage energy businesses and utilities operating in WA (and those in similar energy markets around the world), to utilise solar PV and storage systems in a strategic fashion in order to reduce grid congestion, remove (or at least defer) the need for network investments, maintain downward pressure on electricity prices, help to decarbonise the electricity network, and most importantly, to stay relevant in the evolving, highly disrupted energy market.

The authors note that, ultimately, all electricity grids share a common goal of achieving a safe, secure, sustainable and affordable service of electricity to customers. Achieving this will inevitably involve leveraging and integrating new technologies into existing grid structures and business models.

This paper begins by providing some background around traditional business models for electricity generation and supply in Australia before specifically highlighting the opportunity that is being presented in WA. This is followed by an overview of the methodology and analysis used. Results are discussed in terms of existing barriers, new business models and the need for new partnerships and energy companies. This is then examined in relation to how WA could respond to these challenges, and concludes by highlighting some potential policy implications.

Background

The old model in a changing landscape

The current business model of utilities reflects the legacy of a centralised electricity generation and distribution design, underpinned by large upfront capital requirements relative to marginal operating costs, driving a natural motivation for electricity utilities to maximise the production and sale of electricity through existing networks [27,6,8].

Historically, electricity demand was thought to be largely inelastic and the main driver of cost was capacity peaks and the resultant infrastructure spend to cater for them. A view of ever-rising peak demand also contributed to a standard approach to power system and security planning, network regulation, and energy market dispatch design. Utilities, therefore, created a traditional service of delivering electricity at price per kilowatt hour [69,63,65,72].

Recognising this 'coupling' of volumes and profitability was at a natural tension with the assumption from customers that their electricity supply should be treated as a 'right', the electricity networks most commonly became a natural monopoly (e-lab [13]. In WA's case, the result was a regulatory agreement between government and the government-owned utility (Western Power) to provide affordable, reliable and accessible electricity to all consumers across the State at a uniform price [17]. This led to a growing gap between the cost of electricity supply and the cost paid by consumers, with the Government absorbing the deficit.

Meanwhile, each technology improvement or institutional enhancement in the system was only ever an incremental development tracing along the same traditional pathway – constrained by previous decisions which effectively 'locked the industry in' [33].

However, the standing of electricity utilities as safe and steady businesses is now coming under increasing pressure due to a convergence of several factors across technology, economics and public policy. In the past decade alone, the energy sector in Australia 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 across the country [27]; e-lab, 2014; [19,7]. In combination, these factors are set to fundamentally change the way our electricity systems operate.

The very tenets of the status quo 'traditional path' are being challenged. Not only has it become cost prohibitive for the WA Government to continue to subsidise energy costs to consumers, but the impact of rising costs on some customers is now beginning to drive investment trends in the opposite direction for those who can afford it and are motivated enough to analyse their energy costs (through energy efficiency and distributed generation). The increasing uptake of solar PV and storage will only exacerbate this trend [81].

The WA opportunity

A variety of unique factors are forcing WA to become an early adopter in the transition to a new electricity network and system based on renewable, distributed energy. Because the WA Government has traditionally subsidised the centralised model of fossil fuel generation as a political offering to consumers, the state is now faced with some of the highest electricity costs in the world [67]. The Government now admits this subsidy is unsustainable, and is seeking to benefit from the some of the best renewable resources available [32,6,68].