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Is unbundling electricity services the way forward for the power sector?

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ABSTRACT

High penetration of distributed energy resources will lead to further fragmentation of the power sector, both in the services offered and its value chain. Successful business models will be those that are able to create new products, establish more efficient pricing mechanisms and monetize services, which customers could no longer receive free of charge. The principles of the 'sharing economy' could be applied to manage the fragmentation of the industry while keeping transaction costs in check.

1. Introduction

High penetration of distributed energy resources (DERs) could result in two market-altering outcomes that the industry and regulators cannot ignore (KAPSARC, 2016). First, that increased levels of DERs may result in regulation and policy becoming more local, with increasing fragmentation, both in the services offered and the power industry value chain. Second, that vertical unbundling may be augmented with a teasing apart of the elements of electricity supply and allow the emergence of platforms on which any resulting new products and services can be traded.

In this article, we try to envisage what new business models might arise by revisiting existing models in the electricity sector. The risk for incumbent utilities is the ongoing emergence of innovative new technologies, which may destabilize the industry with large sunk costs and where infrastructure is already in place. We suggest that utilities may evolve their business models and learn to compete in bilateral, platform-based markets that incorporate some features of what is known as the "sharing economy."

DERs are relatively small, geographically disseminated sources of energy that are connected directly to the distribution system, rather than through the bulk transmission system. They operate in parallel with the electric utility or standalone units. Power can be sold back to the grid where permitted by regulation. Among the most widely used DERs technologies are photovoltaic (PV) panels. PV generation is intermittent, dispersed, and uncertain (MIT, 2015).

We use the term "business model" to describe the way an organization delivers value to customers, encourages customers to pay for value, and converts those payments to profit (Teece, 2010; Casadesus-Masanell and Ricart, 2010; Zott et al., 2011). The business models of today's utilities are largely constrained by what regulation allows them to do. We will imagine in this exercise that electric utilities are able to set their business model without requiring regulatory approval – after all, electricity markets are opening up, creating demand for many different goods and services.

There are some limitations to the arguments we put forward. The first, obviously, is that no one can accurately predict the future. The second is that, because electric power markets are so idiosyncratic, it is not realistic to have a one-size-fits-all business model. Our aim is to provide a general framework and to identify business characteristics that are applicable to a variety of areas.

2. Business model

In many markets, the prevailing business model for electric utilities is a cost-plus structure, in which the utilities pass on the majority of their costs plus a return on their capital investment to customers as a variable rate ($/kWh). The objective is to operate in a cost minimization fashion, and the model sustains itself with further capital investment, sales growth, and sustainable prices. This has led to a business model where adding new infrastructure is the bread and butter of utilities' revenues. But can we still expect future utilities to operate within this framework, given massive investment requirements and lower sales? With lower sales, will

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the need to invest in new infrastructure be as great? The companies themselves need to find a new way to grow, and regulators need to ensure that the fixed-cost element of the system is not too great, as this would increase prices.

One obvious option for a utility is to cannibalize its core business with affiliate companies that provide DERs. Utilities themselves can be holding companies, where new, independent sister units cannibalize the legacy utility part and these sister firms help finance the holding company. However, it is unclear whether it is sustainable to plow earnings from the new businesses into a losing legacy segment. In other words, would this be profit-maximizing or, rather, a strategy to delay the inevitable profit decay?

We suggest that there are other alternatives, though. A utility does not only offer energy to its customers, but also spare generation capacity, ramping flexibility, operating reserves, ancillary services, etc. Customers do not value all these items in themselves since they do not see them or think about them. In the next section, we will consider alternative roles for the utility based on these attributes.

2.1. Unbundling services

New technologies make it clearer that electricity is a multidimensional commodity. The most straightforward dimension is "energy," determined by the amount of energy delivered, the timing, and location. But we should also consider the reason for using energy, such as charging a battery, running a fridge, or watching TV, end use – cooling and heating – and its reliability, i.e., the probability that supply would be available. For example, different people may have different thresholds of comfort or convenience, which are indirect services provided by electricity suppliers. Other intangibles can also be taken account of, such as the value of emissions not emitted, or even the value of non-consumption of energy for the system, a term coined as Negawatts.

The important feature for business models is that DERs eliminate opportunities for implicit cross-subsidy between these attributes, exposing the presence of potential free riding among customers and making it difficult to lump all services into a single tariff. Successful new business models will find a way to monetize the value of each of these previously described attributes, separately or combined, according to the consumer's preferences, without increasing transaction costs.

2.2. The sharing economy

The value proposition of the sharing economy is the use of the Internet to bring together people with underused assets and others that might like to use them, or rent them, in a timely manner; with low transaction costs, as information from both parties becomes more transparent through the use of a platform. It is also known as collaborative consumption or the collaborative economy, the asset-light lifestyle, or the access economy. The cornerstone of this concept is the existence of underutilized fixed assets and, therefore, excess capacity.

Experience from the sharing economy can shed light, as some of its principles are applicable to the power sector.

1) In the organization of the electricity sector, underutilized assets are the norm rather than the exception. This is because grid investments are dictated by the need to meet peak load requirements that occur in very short periods of time throughout the year. This underutilization raises concerns on the best way to cover grid maintenance costs and to finance expansion.
2) New technologies in the electricity sector will create nested markets to which some principles from the sharing economy can be applied. A multiple-sided market is a meeting place of a number of agents that interact through an intermediary or a platform (Rochet and Tirole, 2004). In these types of markets, an intermediary captures the value of the interaction between user groups, and network externalities may lead to one of these being charged a non-cost-reflective price (Weiller and Pollit, 2013). The distribution platform can act in similar ways to this.
3) The analogy with the sharing economy is relevant because technological advances have led to a world of distributed autonomy in which no single entity has full information or is able to bring about collective coordination. However, individual agents' actions affect the rest through the grid.
4) Representative firms from the sharing economy act in parallel to the formal sector, such as taxis or hotels, and in overregulated sectors. The electric power sector can also be characterized as overregulated. Most DERs operate behind the meter, alongside the formal power sector.
5) Thresholds are important. Incumbent firms and regulators have not challenged new entrants' behavior until they have achieved a noticeable market share. The same logic applies to incumbent utilities and regulators with a growing number of prosumers (See Adjali et al., 2016). Utilities have accommodated small-scale generators for decades, but it has only been recently that DERs have made greater inroads that threaten a utility's revenues.

2.3. How to price unbundled services? An example of risk

There is an inherent dilemma in the sharing economy in the definition of products and prices. This is because products are based on spare capacity, but in economics prices should reflect scarcity. So the definition of products and prices is not straightforward. We argue that unbundling services in the power sector will reveal what elements of attributes are spare and what are scarce.

Let us illustrate this with the example of reliability in domestic markets, viewed as an unbundled service. We know that in the future a growing share of generation would be at low or zero marginal cost. This would mean traditional utilities would end up having unused capacity for long periods of time. That, paradoxically, would make this dispatchable capacity more important, as they could act as suppliers of last resort.

So, even if every household is completely self-sufficient, these consumers would still find value in staying connected to the grid because utilities can offer options to provide coverage. If utilities are to leverage their infrastructure as insurance, they will need to change the way they charge customers – for example, by redefining who pays what, changing the basis of tariffs or the frequency of payments. A health insurance company's business model, for example, is based on healthy people financing the treatment of ill people.

The way forward for the utility could be to charge a fixed price to customers for them to retain the option of access to back up. In one version of this alternative, customers could pay a one-time access fee for a fixed amount of energy per year. Though the tendency is to have more real-time decisions with smart metering, in effect incrementally increasing the frequency of transactions, this proposal would, counterintuitively, decrease the number of transactions by charging a membership scheme, similar to Netflix, for example, instead of volumetric rates.

There is at least one caveat to this argument, though. Contracts for streaming services such as Netflix are feasible since there is no rivalry in consumption in their service. In other words, streaming