STORAGE BUSINESS MODELS: LESSONS FOR ELECTRICITY FROM NATURAL GAS, CLOUD DATA AND FROZEN FOOD

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Overview

Energy storage, along with interconnection and demand flexibility, is among the innovations that will support the transition to more flexible energy systems. In the UK, the Smart Power Revolution based on these innovations could save customers up to £8bn a year by 2030 (NIC, 2016), or 25% of current electricity expenditure. Based on the climate change targets set by the European Commission and national members, it is expected that intermittent generation such as wind and solar injected into the system will increase. Energy storage can help to balance supply and demand and to integrate less controllable power sources. The cost reduction of storage technologies (e.g. lithium-ion batteries) will also contribute to its expansion. Between 2010 and 2016, EV battery pack prices have fell around 80%, from US$ 1,000/kWh to US$227/kWh, with prices expected to be below US$190/kWh by 2020 (McKinsey, 2017). However, there are some barriers that need to be taken into account. Among these are regulatory barriers (classification of energy storage, charging methodology, connection rules, ownership and unbundling rules), market barriers (energy storage as a new market participant in the wholesale and ancillary services markets) and technological barriers (apart from batteries, only a few technologies are currently at the commercialisation level), (Anaya and Pollitt, 2015; BEIS and OFGEM, 2016). In addition, the implementation of well-designed and established business models for energy storage at distribution level in the European market is just being explored. The aim of this study is to examine well established non-electricity storage markets such as data cloud storage, frozen food storage, and gas storage in order to identify some key lessons applicable to the electrical energy storage (EES) operated by distribution electricity companies.

These markets, including EES, are in different stages of their respective lifecycle which allows us to capture the different operating practices across their Business Models (BMs) components (customer value proposition, profit formula, key resources/processes). We have classified EES as an emerging market (Introduction stage) which is being deployed in recent years in a few jurisdictions but usually limited to trials (especially in Europe). In this stage, competition is low (few participants) and the market is still in a developing stage (limited to trials and concentrated on specific technologies such as batteries).

Data cloud storage is in the second stage (growth stage) and its adoption is increasing worldwide (from individuals to big enterprises). The great growth of the internet has contributed to the deployment of cloud computing (which comprises cloud storage, software applications, databases, email servers, among others). There are two important kinds of cloud storage: public and private. Public cloud storage has many advantages to customers, such as lower costs (shared resources) and ability to remove or add-up capacity quickly (scalability/elasticity); however its main concern is related to security issues. This study explores data cloud storage associated to Software as a Service (SaaS) which represents the most basic form of cloud service (or cloud computing) model. Some examples of SaaS providers with a focus on data cloud storage are Google Drive (our case study), Dropbox, Amazon Drive, Microsoft One Drive and iCloud.

This study places frozen food storage between the growth and mature stage. This is a well-established market that will continue expanding due to the high demand in frozen food, which is in agreement with the growth of the cold chain (cold storage, refrigerated transport) over time. New cold storage additions in emerging economies have driven the increase in cold storage capacity worldwide. Frozen food has many benefits. It helps to reduce food waste, is non-seasonal dependent and is less expensive than fresh. Food waste is a big issue that not only represents a high cost to society (estimated in US$ 400 billion per year) but to the environment (7% of all GHGs or 3.3 billion tonnes per year are due to food waste) (WRAP, 2015). In the UK, the frozen food storage market is dominated by third party logistics firms, following by retailers and producers (BFFF, 2010). Our case study is represented by Oakland International, a third party logistic firm that operates in the UK and Ireland.

Gas storage is in the third stage (maturity stage) with a well-established market but challenging at the same time due to the decrease in the use of gas storage capacity over time. Underground storage is the primary way for storing gas and can be classified as depleted reservoir, aquifer reservoir, or salt cavern. USA is the country with the largest gas storage capacity with 9.2 trillion cb. feet in 2015 (EIA, 2017). In Europe, 52% of the total working gas storage capacity by March 2017 was hold by Germany, France and Italy (GSE, 2017). In terms of gas storage economics,

two different kinds of value are identified: intrinsic (seasonal spread) and extrinsic (arbitrage) (EIA, 2015). Pricing storage capacity usually involves bundled units (e.g. SBU) but unbundled services can also offered. Depending on regulation, gas storage capacity can be allocated through auctions or bilateral agreements. Centrica Storage represents our case in this market.

The paper is structured as follows. Section one discusses the introduction. Section two explains the business model (BM) methodology. Section three explores the three markets and discusses our main case studies. Section four compares and analyses the different case studies based on the methodology proposed and identifies key lessons for EES. Section five sets the conclusions.

Methods

- Case studies:
    - Innovative market: Cloud storage (Google Cloud)
    - Mature market: Frozen food storage (Oakland International)
    - Challenging market: Gas storage (Centrica Gas Storage)
- Business model framework (Johnson et al., 2008)
- Interviews

Results

We find that:

- Maturity and deployment of the market is in line with how well-established rules/regulation are.
- There are different types of storage ownership arrangements. Some of them are heavily dependent on third parties. Business models take the opportunity of providing additional and complementary services.
- Competitive mechanisms are also observed, especially in those with long term and specific commitments.
- Key performance indicators can help to manage more efficiently the whole storage process.
- There are different configurations of business models even within the same sector.

Conclusions

Findings:

- EES can benefit from a well-established regulatory framework and from the identification of new players.
- Business model components for EES are linked to the regulatory framework and developments in energy markets.
- The value of EES increases by the opportunity of providing ancillary services.
- Innovation helps move markets towards more sustainable business models.

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