

## Storage Business Models: Lessons for Electricity from Natural Gas, Cloud Data and Frozen Food

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Electrical energy storage (EES) has a multiproduct nature and may offer different revenue streams to those that operate or own the facility. The size of their value depends on different factors such as the place where the facility is located, the type of service/benefit, the type of technology, the market and regulatory context, etc. Even though there are powerful forces promoting electrical energy storage, there are factors affecting its deployment such as regulatory barriers, market barriers, technological barriers and the lack of appropriate business models (BMs).

This study explores well-established non-electric storage markets such as natural gas, cloud data and frozen food storage to identify some key lessons applicable to electrical energy storage (EES) operated by electricity distribution companies. A look at different non-electric storage markets provides valuable insights on the way in which the different components of business models are interacting and capturing value to both customers and storage firms. We have classified EES as an emerging market (Introduction stage) which is being introduced in a few jurisdictions, but usually limited to trials (especially in Europe). Cloud storage is in the second stage (growth stage) and its adoption is increasing dramatically among both business and final consumers. We look at the case study of Google Drive. This study places frozen food storage between the growth and maturity stage. This is a well-established market that will continue expanding due to the high demand for frozen food, which is attracting more competitors in refrigerated warehouse capacity. Our case study is Oakland International, a third-party logistics firm that operates in the UK and Ireland.

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Gas storage is in the third stage (maturity stage). It is a well-established market with many competitors (including LNG imports). Our case study is Centrica Storage, a gas storage firm that operates Rough, the largest seasonal storage facility in the UK (whose closure has recently been announced). The selection of non-electric markets that are in different stages of their respective life cycles allows us to capture the different operating approaches across their business model components.

The business models' discussion across the different markets is based on the method proposed by Johnson et al. (2008). The authors identify four interconnected components: the customer value proposition (CVP), the revenue formula, key resources and key processes. CVP is about creating value with which to target customers that relates to the job to be done, understanding all its dimensions and the solution (offering) provided that fulfils the need. The profit formula defines how the companies generate value for themselves while providing value to the customers. Key resources and processes are needed to deliver the value to customers (CVP) and to the companies (profit formula).

In general, we observe the existence of well-developed business models in growing and mature storage markets. Successful business models provide a value proposition to customers and can generate profits for the storage firms. All storage products are also sensitive to regulation, but the degree of sensitivity varies by storage type (gas and EES are the most sensitive ones). Finding the optimal configuration of ownership of storage facilities is an important part of business models. Restricting this arbitrarily may be not beneficial for the development of EES. There has been a lot of innovation in storage business models, especially in technology and in contracting (market and bilateral), which should be facilitated in EES. The Internet of Things and digitalisation could play an important role on the democratisation and accessibility of EES products.