



ETI INNOVATION LEARNINGS ENERGY STORAGE

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KEY CONCLUSIONS

A major transition is currently occurring in the UK energy system. The use of renewables is expanding, energy production is becoming more distributed, and new and different end-use technologies are being deployed (e.g. heat pumps and electric vehicles). In response, most experts believe that new, more distributed approaches to energy storage will become increasingly important. If successfully developed, these will supplement and, in some cases, even replace the traditional UK system storage solutions of pumped hydro, strategic gas stores and coal stockpiles.

Many of the alternative energy storage solutions currently being deployed are very expensive. Consequently, the UK needs innovation to drive down the cost of storage to help it meet its carbon targets more affordably. This process needs to be

effective and rapid with several critical components: market confidence, finance, public policy and the capability to innovate.

In this context, the Energy Technologies Institute invested in Isentropic, an innovative UK SME set up to develop and demonstrate a cost-effective energy storage device that uses heated gravel as the energy storage medium as opposed to the more common but expensive battery based technologies.

This project showed there is the potential for delivering innovative energy storage solutions. However, technical capability alone is insufficient to deliver innovative products to a commercial market which is still emerging.



KEY LEARNINGS

- There is a clearly articulated need for cost-effective energy storage solutions for the UK energy system. However, price incentives for storage do not currently exist in the UK market which makes it an unattractive investment.
- Realising all of the potential commercial benefits of distributed energy storage requires significant changes in business and regulatory models, and in the behaviour of system operators and consumers. The current regulatory environment is failing to incentivise technologies that are not needed in the current energy system but have been clearly identified as crucial components of a future system. Changes are being considered by the regulator but arguably 'too little, too late'.
- Isentropic was one of many start-ups with a product with the technical potential to meet UK distributed storage needs but, like many others, they did not succeed in turning their innovative solution into a commercial product before the company ran out of funds – even with support from the ETI. They were faced with the major challenge of raising commercial funding for a research and development based proposition where market prospects for early returns were unclear. Developing other market opportunities may seem like an obvious approach to mitigate this risk but in itself brings the need to raise still more capital.
- The UK energy sector is often better at accessing and building innovation than commercialising it. Consequently, innovative SMEs in the sector often lack the business models that enable them to capture early value, resulting in lower growth than investors can gain in other sectors despite the potential to create long-term value. They are also operating in a sector where lead times to development are unusually long and there is considerable risk and uncertainty from potential future government policy changes, making it even harder to attract the required levels of private finance. The experience of Isentropic is an important example of the benefits of a group such as the ETI - which can bring organisations together to share risk and make investments that allow emerging technologies to be assessed, rejected, refined or developed. Irrespective of the outcome, this process adds to the stock of knowledge, which in turn drives further, valuable innovation activity.
- Following Isentropic's administration, the ETI has invested further to ensure this promising technology is not lost. A new collaboration with a UK university is allowing the storage system development to complete but without the pressures of raising immediate commercial funding.

OUTCOMES

In 2012 the ETI invested in a five year project led by a Hampshire based SME, Isentropic Ltd, to demonstrate the feasibility of an innovative, distribution-grid scale approach to storing electricity. The project aimed to develop and demonstrate a cost-effective 1.5MW/6MWh energy storage device that would operate on a UK primary substation owned by Western Power Distribution (WPD). As part of the funding agreement, the ETI became a minority equity shareholder in Isentropic, a private company, founded in 2007 to exploit its Pumped Heat Electricity Storage (PHES) technology for distribution scale energy storage.

Based on an innovative combined heat pump/heat engine, the system used electricity to create a large temperature difference (500°C hot and -160°C cold), which could be stored in two low cost gravel silos. Energy from these hot and cold stores could be released to regenerate electricity with an overall efficiency of 75%.

The ETI made their investment with two aims: to provide financial support allowing the company to develop the technology and the associated skills base and to use an established position in the sector to accelerate and expand the testing of this new UK technology. Ultimately, the ETI was seeking to identify the large-scale deployment potential for the technology in a UK market where there are approximately 5,000 substation sites within a suitable power range.

Energy storage products, like the one Isentropic was seeking to develop, have the potential to offer a number of additional services to the energy system, including grid balancing, frequency control and reduction in network reinforcement costs. Delivering these requires proven commercial products, innovative business models, and changes to regulation.



OUTCOMES

Continued

The current UK energy system is dependent on long lifespan previous investments in infrastructure. These established assets can act as a barrier to investment in new 'disruptive' and higher risk technologies. Consequently, when faced with innovative product options, existing operators and investors will naturally seek extensive evidence of proven commercial operation, underpinned by mature supply chains, strong product support and operating warranties.

Although the technology development phase of the Isentropic project was successful, the company was unable to meet the exacting demands of operating commercially in a sector where lead times to deployment are unusually long and there is considerable risk and uncertainty, more so than for most other areas of innovation. They lacked the business models that would enable them to capture early value in the very immature market for energy storage that currently exists in the UK, one in which the value of the services provided is uncertain (and varies widely under the range of potential future scenarios) and is subject to an evolving regulatory environment.

As a result of these issues, Isentropic was unable to attract the additional investment needed to support their development of a commercial product line and they

consequently went into administration early in 2016. Despite this, the ETI has been successful in securing a future for the technology, working with an academic partner who is now taking on the company's assets and continuing the technology development and testing programme. The ETI will licence IP from the project to the academic partners alongside seeking an IP commercialisation deal with a third party.

Isentropic is far from the only young, inexperienced company with great technical potential but lacking the broader range of capabilities, financial capacity and the strategic investor support needed to survive in a difficult market. The ETI's support helped maximise their chances of success but even then the very slow development of the market proved too great a constraint on the company. There is a case for government, as a strategic investor in the future industrial base of the UK, to provide both information and more active financial and development assistance to help new businesses in the energy sector to learn to survive these difficult early years.

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FURTHER READING



Accelerating low carbon energy innovation in the UK

<http://www.eti.co.uk/insights/accelerating-low-carbon-energy-innovation-in-the-uk>



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