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The Case for Pumped Storage Hydro in the UK's Energy Mix

Policy Briefing

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Key Messages

- Electrical energy storage (EES) is increasingly being considered as a necessary complement to intermittent renewable generation and a valuable source of flexibility for electricity markets. Energy storage is not new - the GB electricity system has had pumped storage since the 1960's. But no new stations have been built since the liberalisation of GB energy markets.

- There is a fundamental need to **recognise and articulate the value EES may provide** both in potentially contributing to cost-effective running of the electricity system and to society as a whole. This is a complex task given the diversity of stakeholders involved and the need to set any valuation at energy system level in terms of its low carbon electricity generation properties. Our analysis highlights the need to link EES to outcomes valued in the political economy. That is, how having EES in the mix can affect the impacts of increased security and flexibility in energy supply on how we live our lives and how the economy functions.

- In terms of learning from past experience, the question is whether these features were implicitly recognised in decision making regarding investment and deployment of pumped hydro energy storage (PHES) in the 1970s and 80s, In any case, given a shift in governance and decentralised markets for energy, there is clearly a need for more formal recognition of the need to value a broader set of outcomes in today's complex policy and societal environment. Ultimately, future research in energy policy generally, and the storage domain in particular, must give attention to principles and methods set out, for example, in HM Treasury's 'Green Book', for valuation and evaluation of less tangible societal costs and benefits. Societal costs and benefits should be part of an assessment of future energy system requirements performed by Government, Ofgem, and those making decisions on how and what role that storage can play. This will have important impacts on those actually making investment decisions on delivery of different types of storage capacity. In this regard, there is an urgent need to understand what policy changes may be required.

- One key issue is the need to **define storage within the electricity system market framework**, and to develop this more effectively to obtain the best commercial solutions over the long term. Specifically, EES needs to be considered in terms of what it actually does, which is the storage of already generated electricity at times when it is in surplus or at low cost in order to avoid curtailment or generator ramping, and the later release in times of high demand or risk of system imbalances. Arguably, the planned definition of storage as a subset of generation is insufficient to fulfil this need. In practical terms, this will involve the removal of double-charging in the context of levies and network charges. This must be accompanied by the **creation of a 'level playing field'** where EES solutions are able to compete with other flexibility technologies such as thermal generators and interconnectors.

- A further important issue is **enabling the recognition of the full commercial potential of EES** and how commercial benefits may lead to benefits to consumers. Within this, it is arguable that more long-term value stacking (i.e. the provision of several services in general and simultaneously) should be enabled where technically possible. There is a range of issues around **potentially stranded assets**, where EES may displace current flexibility provision.

Indeed, there is likely to be resistance from current flexibility and generation providers, where, by reducing average and peak prices in various electricity markets, EES has the potential to indirectly impact the business models of existing generators and flexibility providers.

- We conclude that there is a need to underpin all of this with more **policy certainty** around low carbon economic development pathways general, and renewables deployment targets and EES specifically. In the case of the latter, our conclusion is that the societal and **political economy valuation** issue highlighted in this paper is the fundamental challenge that must be agreed and addressed in a more integrated whole (energy, economy and society) system approach to energy policy formulation.

Our research

Among others, the National Infrastructure Commission has argued that the current regulatory framework unintentionally disadvantages EES by directly and indirectly preventing participation in a range of markets, despite the clear contribution EES can make in enabling flexibility and security. From our analysis, we contend that the problem is somewhat deeper in that the institutional memory as to how the need for energy storage was once valued has eroded over the last three decades. Using the example of pumped hydro energy storage (PHES) – the dominant EES technology currently deployed in GB – as a reference, our work considers the question of how EES has been valued in the past and what valuation approaches might be appropriate for assessing future investments in and deployment of storage capacity.

Our work focuses on 'value' which requires the consideration of both costs and benefits. Traditionally, the value of energy technologies is assessed using economic indicators such as private cost and returns in a lifecycle context. We reflect upon what is meant and understood by 'value', and how it needs to be assessed to inform decision making in the political economy. Our research suggests that assessment of the value delivered by energy storage must extend to consider what increased flexibility and security in the energy system offer in terms of outcomes that **are valued in a wider political economy setting.**

The challenge for storage

Real concerns are being articulated around the need for energy storage to secure and balance our changing energy needs. The challenges that seem to point to storage solutions are ones of decarbonisation, increased dependence on intermittent renewables and a likely shift towards electrification of heat and transport. PHES has proven its ability over many years to provide these flexibility services for power systems, albeit initially in a context dominated by concerns around nuclear generation, but where it can also potentially play a key role in terms of more current needs around renewable integration and grid stability.

Our analysis identified a lack of recognition and articulation of the value of EES not only to the electrical system but also to the wider political economy. We also considered some specific barriers that deter further investment and deployment of EES. Markets should recognise that benefits from EES solutions are split across multiple stakeholders of the electricity system and include transmission and distribution extension deferral, relief of network congestion, provision of balancing and regulation services, as well as the potential to replace baseload generation. PHES faces particular barriers arising from its large capital investment needs – projects are characterised by long operational lifetimes (often 80 years), high capital costs, lengthy construction and specific locational requirements – which require a high level of confidence in future revenues, in turn needing an environment of 'storage-friendly' policies. While EES offers services to many markets, it is restricted from actually participating in these markets simultaneously, despite its technical potential.

Conclusions

Our work focused particularly on PHES as a mature technology, but our conclusions are relevant across the wider portfolio of potential EES options. We draw three main conclusions from our research. First, that there is a need to account for and articulate the value of EES. Second, a market framework that recognises this value is needed. Third, development through both of these stages requires greater policy certainty and clarity round low carbon economic development pathways in general, and the outcomes that may be served by EES in particular.