Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Black Start from Distributed Energy Resources

Tick if this answer has been provided verbally: ☐

Project code	ESOEN01	Question Number	7
Question date	7 August 2018	Answer date	9 August 2018
Submission section question relates to	n/a		
Topic	d) Innovative		
Question	Please explain how the CEGB would have fulfilled this function prior to the advent of large centralised generating plant.		
Notes on question			
Answer	Considering the advent of large (2,000MW) generation in 1968, our response refers to our view of how Black Start would have been undertaken in the period 1957 – 1968. The CEGB owned and operated both transmission and generation assets in England and Wales, and had a fleet of 300MW Coal-fired generators, most of which we believe were fitted with Black Start Capability. Control of the energy system was undertaken by a series of Regional Control Centres, working with Generator Control Centres and manned substations. These regional systems, although interconnected, were designed to be able to operate independently of one another. We believe that to deliver a Black Start at this time, each Generator Station would have self-started, then the CEGB workforce based across the country in Regional Control Centres, Generator Control Centres and manned substations would have worked via telephone calls to reenergise the Transmission network and reconnect customers' supplies.		

Figure 1 shows that annual electricity supply was ~75-180TWh per annum during this period, compared to values of ~300TWh today, so the scale of the restoration task today is considerably greater.

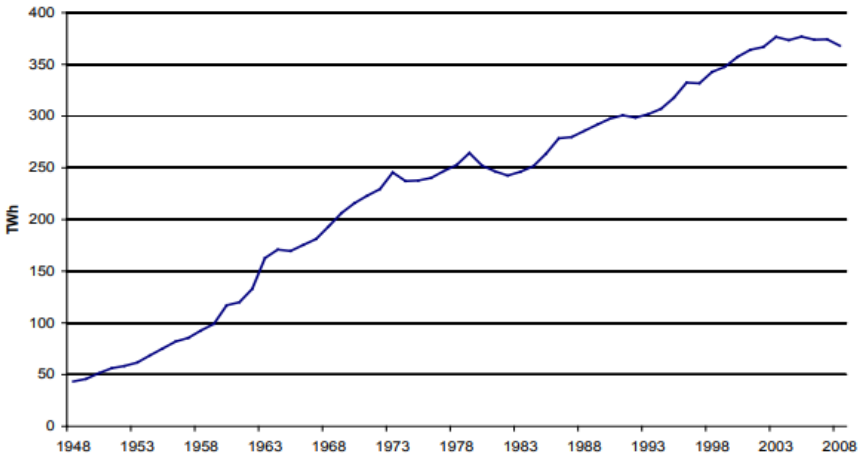

Figure 1: Electricity Supplied (net) 1948 to 2008[1]

During this period, the Transmission system was interconnected across England and Wales, with bulk transfers to Scotland, however this was managed across the regional areas with the generation needing to be close to the demand centre. Each regional control centre would manually predict demand and instruct energy despatch via an instruction log. This required the organisation to be very heavily resourced. Today, a drive for efficiency and automation has meant that we now have a single National Control Centre, to operate the GB system. Our Black Start process essentially emulates the manual despatch of generation described above, as this is the most resilient approach. However, it is clearly limited by the available resource, both within the ESO and across the industry. Generators are often now unmanned, and have common control centres, sometime outside of GB.

The CEGB operated a more static system than today, with less variability. This was a function of the available technology, the design of the system, and the manual nature of operation. Over the decades, the system has evolved to become more dynamic, with intermittent generation, more advanced ICT and more sophisticated control systems. The manual CEGB approach suited the static system of the time, but would not work in a future landscape where intermittent renewables will need to play a part in the restoration process if 100% of consumer demand is to be restored.

As a vertically integrated organisation, CEGB also had control over where new generation assets could be built – be they to relieve transmission constraints, or to facilitate a more efficient restoration in the event of a black out. This is very different to today, where ESO and DNOs have very limited control over where DER is connected.

Consumer expectations and needs have also changed. In the 50s and 60s, power cuts were a regular occurrence. Today's consumers would not stand

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/65896/1_20090729135638_e____dukes60.pdf

	for electricity reliability issues, not to mind black outs lasting days or weeks. Consumers today are also acutely sensitive to cost increases. It is simply not acceptable to build large generators for the sole purpose of Black Start, and large increases in Black Start-related BSUoS are not tolerable. Lastly, consumers are becoming very environmentally conscious, and want to see increased investment in, and utilisation of, low-carbon and decentralised generation.
Attachments	