

A SMART FLEXIBLE ENERGY SYSTEM: A CALL FOR EVIDENCE

INTRODUCTION

In our report, *Smart investment: valuing flexibility in the UK electricity market*, we outline how sustaining a balanced electricity system depends on maintaining both resource and flexibility adequacy. The analysis and findings of the report are detailed below and relate to the evidence questions in chapter 2 “providing price signals for flexibility” as well as some further thinking on how to create a smart flexible energy system.

The growing shift towards renewables, and the resulting increase in variability in generation, has meant that flexibility adequacy has become a dominant concern. The government’s current investment strategy has resulted in the creation of a larger, but less nimble, power system. In order to develop a smarter strategy with flexibility at its core, the report recommends a system which would use auctions to procure demand reduction and response alongside flexible power from gas plants and zero carbon sources.

THE NEED FOR FLEXIBILITY

When evaluating the usefulness of flexible technologies there are clearly better and worse options, particularly when evaluating system security challenges. Our analysis finds the main investment risk is with combined cycle gas turbines (CCGTs), which will become uneconomic halfway through their life due to a combination of climate policy and technology change. A more effective use of gas would be combined heat power plants (CHPs) due to a much lower emissions intensity.

The analysis also shows that the case for renewables is clear, their costs are falling and are popular with the public. However this will require a system which can cope with large changes in net load and net demand. When considering scenarios into the 2020s the clear winners are zero carbon flexibility resources, however, they may not be enough on their own and they will require a route to commercialisation. There is a need for some flexible gas capacity.

In order for this transition to increased renewable energy, a system wide transformation is needed. Evidence from Imperial and NERA has found that increasing flexibility reduces the overall cost of the energy system and maintains security as power system decarbonisation takes place¹.

KEY ISSUES

The analysis highlights two main issues with the current approach which hinders investment in flexible resources:

1) Government auctions do not value flexibility

Energy prices do not currently reflect the high value of flexibility in such a way as to drive investment in the flexible resources the system needs. The capacity market accounts for the resource adequacy challenge but does not value flexibility, therefore it fails to encourage an optimum resource mix.

¹ G Strbac et al, 2015, Value of flexibility in a decarbonised grid and system externalities of low carbon generation technologies, Imperial College and NERA Economic Consulting

2) *Reforms which have a narrow focus on procuring new CCGT power plants are distorting the capacity market*

The decision to increase the capacity targeted in the recent capacity market auction to 6GW has not proved to be an effective means of procuring CCGT. Instead, it very nearly rewarded a large quantity of highly polluting diesel engines. An improved capacity market would create opportunities for zero carbon flexibility sources (see Figure 1). These are especially valuable because they enable the UK to maintain a reliable supply of power while contributing to decarbonisation.

Figure 1. Forthcoming energy challenge: Comparing the usefulness of flexible technologies

	Period to 2020	Early 2020s	Late 2020s
Nature of the system security challenge	Increasing resource adequacy challenge as old plants retire	Resource adequacy challenge	Flexibility adequacy challenge
Conventional fossil fuel technologies			
CCGT	Useful	Useful	Uneconomic at low load factor
CHP	No policy driver; upfront cost	Useful	Very useful to help cut heat emissions
Highly flexible fossil fuel technologies			
Diesels	Too polluting	Too polluting	Too polluting
OCGT	Useful	Too polluting	Useful
Gas reciprocating engines	Useful	Too polluting	Useful
Zero carbon flexibility			
Demand response	Useful; scaling up needs new policy	Useful, but not enough	Ideal
Batteries	Useful; scaling up needs new policy	Useful, but not enough	Ideal, if cheap
Compressed air	Useful; scaling up needs new policy	Useful, but not enough	Ideal, if cheap
Pumped hydro	Useful; scaling up needs new policy	Useful, but not enough	Ideal, if cheap
Zero carbon capacity			
Interconnection	Very useful; around 7GW is possible	Very useful; around 12GW is possible	Very useful; up to 18GW is possible
Demand reduction	Useful; scaling up needs new policy	Very useful	Very useful

KEY RECOMMENDATIONS

The smart strategy recommended in the report calls for the existing capacity market to evolve into a stratified market which prioritizes flexible resources. In this framework, continuous forward assessments of system needs would be conducted and a system architect would determine the necessary quantities of each resource type. This would involve building fewer CCGTs, bringing them online sooner, and running them at higher load factors, before constraining them. It would make use of the low carbon, flexible technologies listed in the table on page seven.

1) *Evolve the market*

The capacity market should evolve into a stratified market, which can place a higher value on more flexible resources. The different types of resources would be specified by a system architect, determining the necessary quantities of each resource type to be procured, based on ongoing forward assessments of future system needs. This system could be realized through the following process:

- System architect: assesses what type of resources, in what quantities, will be needed in one and four years' time and then advise the system operator
- System operator: sets the size of the capacity auction pots based on anticipated system need, manages the capacity auction
- Resource owners: bid into the capacity auction, successful bidders sign capacity contracts and deliver the contracted resource in one or four years' time

2) *Reform the emission performance standard*

To ensure system security without compromising the UK's carbon reduction goals, the emissions performance standard (EPS) also requires reform. There are two issues with the current EPS. First, it only applies to all new fossil fuel electricity generation plants above 50MWe. As an increasing proportion of fossil fuel electricity generation is distributed, in the form of smaller gas engines and diesels, the 50MWe floor could permit harmful levels of emissions, putting carbon budgets in jeopardy. The second issue is that the current level of the EPS, 450g CO₂ per kWh, does not limit the construction of new gas plants, whose emission intensity is below that level. We recommend that:

- The EPS is extended to plants below 50MWe
- The EPS needs to decline over time, to ensure that emissions are constrained in line with carbon budgets. This trajectory should be set out soon, to give investors clear visibility and to ensure accurate capacity market pricing.

CONCLUSION

This new market structure avoids excessive subsidies for old and inflexible plants. It also avoids building CCGTs that will likely become stranded assets as carbon constraints tighten. The consequences of this market structure align well with several of the priorities outlined in Ofgem's position paper:

- Increases competition in the energy system by facilitating new demand response and demand reduction companies to compete with electricity generation

- Would result in cost reductions that would nearly 20 percent cheaper than the current strategy
- Would reduce carbon production by two thirds in 2030 putting the UK on the least cost pathway to meeting its carbon budget

The combination of a stratified capacity market with a declining, universal EPS would ensure that prices reflect the value to the energy system of flexible resources. It would clarify the investment landscape, giving developers the confidence to build a limited number of new CCGT plants, while avoiding the risk of stranded assets.

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REPORT

The full report can be found at:

http://www.green-alliance.org.uk/resources/Smart_investment.pdf