# Review of electricity market design in Great Britain

PHASE 2 REPORT - KEY MESSAGES

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AFRY
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1. **Evolutionary change is advised to maintain investment momentum**

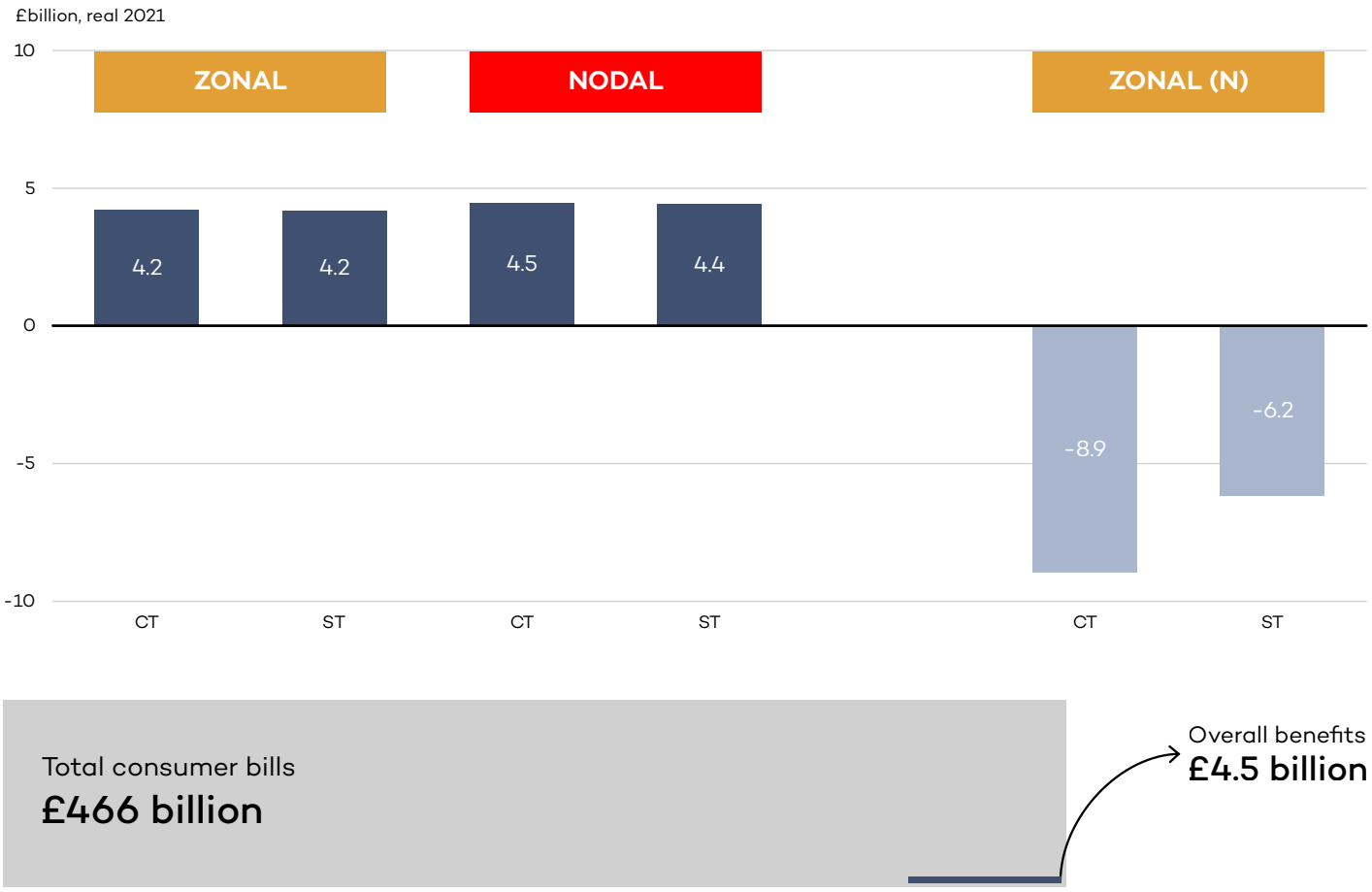
   The first phase of our work concluded that although change is required in GB electricity market arrangements, an evolutionary rather than a revolutionary approach is advisory in order to maintain investment momentum in the Net Zero Transition.

   In this second phase of our work, we find that there are some merits of moving to a locational energy market. However, the potential benefits of a significant change to market design are fraught with risks to investment, making risk management the central challenge. Maintaining a national energy market poses fewer risks to investment, with maximising operational efficiency the central challenge. Given the current need for investment in the near term, any implementation of locational markets would need to be accompanied by a very robust risk management framework, which could in turn reduce the benefits from increased locational signals.

2. **There is only a small economic welfare benefit of changing to a locational energy market**

   In this second phase of our work, we modelled alternative locational market arrangements, against two decarbonisation scenarios (Consumer Transformation and System Transformation from the NGESO's Future Energy Scenarios). We find that adopting our Zonal market case could achieve a small overall economic welfare benefit relative to current arrangements of £4.2 billion (NPV 2028-2050, 3.5% discount rate), while the Nodal case could achieve a further benefit of between £0.2 billion and £0.3 billion. If achieved, this would represent a saving of around 1% against consumer bills over the same period (£4.5 billion versus £466 billion, or £4.4 billion versus £397 billion, in the Consumer Transformation and System Transformation scenarios respectively, excluding costs of implementation). Any move to a locational market runs the risk that the small overall welfare gains are overshadowed by the scale of wealth transfers between parties and the myriad of other uncertainties between now and 2035.

   The Exhibit shows that the economic benefits of locational markets are small in absolute and relative terms, and (as detailed in Key Message 6 below) could become negative under alternative assumptions about the risks to investors.




Total economic welfare benefit, Zonal and Nodal cases versus National BAU by scenario, and compared with consumer bills (Net Present Value 2028 to 2050, £billion real 2021).

Notes: All figures are based on Net Present Value over the period 2028 to 2050, with a 3.5% discount rate.
Zonal (N) = the Zonal case with a +100bps hurdle rate increase for CfD-supported new-build renewable capacity, to reflect the addition of basis risk between national and zonal prices
CT = Consumer Transformation, ST = System Transformation, both based on NGESO's Future Energy Scenarios 2022.

3. **Locational markets give better dispatch incentives, particularly for interconnection**

   The challenge ESO faces in redispatch is well documented. In particular, the integration of interconnection to the market is currently poor, with some interconnectors not flexible after the day-ahead schedule. Locational markets can provide operational efficiency benefits compared with a national market.

4. **Locational markets might not strengthen locational investment signals compared to current national market arrangements**

   For investment, we find that for many technologies, locational signals under a zonal or nodal market design may be stronger in 2030 but weaker by 2035. Longer term, and contrary to conventional wisdom, today's national market with locational transmission network charging would provide a stronger and more robust locational investment signal. Note this is under the assumption that where the level of congestion justifies it, reinforcements can be built in a timely matter. At any location, hedging and risk management options may not be available for the production profile or duration needed to support investment.

5. **Risks to investor confidence are larger in a locational market**

   Our investment methodology assumes perfect foresight and therefore does not truly reflect the uncertainties investors face. We have run a sensitivity test assuming an unanticipated delay to grid build, which reduces economic welfare overall under all market designs. In terms of total economic welfare, locational markets are more resilient to transmission delays. However, the cost of delays would be unevenly felt – with winners and losers depending on location. The impact of delayed grid build is severely negative for generators who end up being held behind an export constraint for longer, with the risk of some generators going out of business because they happen to be in the wrong place. This effect is especially harsh if generation investments proceed in expectation of grid build which does not materialise. We have not modelled any secondary impacts to overall welfare changes or consequential transfers between consumers and producers that might need to follow in managing such an infrastructure shock.

6. **The potential economic welfare benefits of changing to locational energy markets disappear if investment risk in generation increases**

   The small positive benefits in the base Zonal and Nodal cases were achieved assuming no increase in the cost of capital for renewable and nuclear generators (renewables are assumed to have 15-year CfD contracts). The cost of capital was assumed to increase by 50 to 100 bps for other new generation. We have found that modest increases in the cost of capital for new renewable generation of +52 bps in Consumer Transformation, and +56 bps in System Transformation would eliminate all welfare benefits in each of the respective scenarios before any consideration of implementation costs.

7. **The increased complexity of locational markets may create barriers to entry**

   The complexity of the energy market will increase with the number of locations, creating additional challenges for predictability and decision making. Exposure to unforeseen events would increase for generators in a locational market, with an associated cost in time and resources devoted to understanding and managing them. Furthermore, the number of active market participants is likely to decrease if the market is segmented into locations. Fewer buyers and sellers could have an adverse impact on market liquidity. For smaller or less sophisticated developers, the complexity and cost of working out if a location is a good one in a locational market may be a significant barrier to entry.

8. **With simple changes to locational grid charges, we were able to replicate some but not all of the benefits of locational markets**

   Great Britain already has locational incentives. We have explored ways of enhancing these locational incentives, to avoid the disruption of moving to a locational energy market. We were able to replicate most of the locational investment signals by modelling simple changes to locational grid charges within an enhanced national market framework. However, this approach would not provide the operational efficiency benefits of an 11-zone zonal market. We believe tariff reform would result in less risk to investment and be easier to implement than changing to locational markets. The addition of time-of-use transmission tariffs and reformed network charges for interconnectors would be likely to bring further operational efficiency benefits within an enhanced national market, but were not modelled as part of this study.

9. **The window for reform to support the transition to a net zero power sector by 2035 is limited**

   Locational markets are being considered as part of an electricity market reform programme to achieve a fully decarbonised power system by 2035. We assume the very earliest a locational market could be implemented is 2028. This leaves a short window of seven years or less where a change to a locational market could potentially support net zero power system goals.

**Our recommendations reflect the difficulty of changing market arrangements during a period of required investment**

We recommend – based on the evidence available to us – that:

- Nodal pricing should not be progressed further. The practical aspects of centrally dispatching a set of decentralised resources under within-day uncertainty would need to be addressed. AFRY considers that it is – at best – unproven whether such a market design would be workable in the context of a decarbonised system, with heavy reliance on decentralised resources for system balancing, or whether such a design is deliverable in a timeframe which supports the 2035 investment challenge. The trade-off between the additional welfare benefit we have modelled and the increased complexity of the market arrangements appears unfavourable.
- Any further exploration of a zonal market design should be accompanied by a programme of work to explore ways in which the risks – and wealth transfers – could be mitigated. More evidence is needed on the implications of locational markets for cost of capital. Such a programme of work may have its own delivery challenges and create a period of uncertainty for investment.
- If the existing national market is retained, effort is required to provide more targeted investment and operational dispatch incentives, particularly for interconnectors and for resources behind transmission constraints. Further work should also be undertaken to improve stability, incentives, and information flows under the existing national market design.

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