

The debate over REMA continues fiercely as the next government consultation paper is awaited. One of the most contentious topics is whether the national market should be subdivided into zones or nodes. A nodal market would in turn require a more centralised approach to trading, scheduling and dispatch.

AFRY published the results of a year-long study in August<sup>1</sup>, funded by 12 industry members<sup>2</sup> and supported by active contributions from key stakeholders as observers. The study findings are our own and we had robust debates with our study group, who held diverse views on the topics. We believe that our work is independent and has cut through some of the polarisation.

Note that we did not conclude against locational (zonal) pricing; although we did caution that if it is to be taken forward, substantial work would be required on contract frameworks and access rights to ensure that this would deliver positive benefits. Conversely, a continuation of the national market would also require improvements, especially in the efficiency of scheduling and dispatch.

Since our publication, there have been further contributions to the debate. We refrain from direct criticism of the work of other consultancies, which is likely to create more heat than light. We will deal with any points of detail in private with our clients and stakeholders.

Taking into consideration the latest discussions, we find the following.

### **Locational pricing may bring operational efficiency gains.**

Setting aside the more extreme scenarios and misleading metrics, we find that there are real – if small – welfare benefits which could be achieved through a move from a national market to a system of locational pricing. We found potential benefits (before implementation costs) for locational pricing of £4.2-£4.5 billion in the period 2020-2050 (around 1% of consumer bills); other studies found perhaps 2%. These are small but non-trivial benefits.

The potential welfare gains mainly arise from improvements in operational efficiency, because of the difficulties of achieving optimal dispatch in redispatch under today's national market.

### **Locational pricing would not radically improve incentives for siting decisions by investors**

Considering potential welfare improvements under a locational market arising from incentives to invest in congested regions, the story is more

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<sup>1</sup> [Review of electricity market design in Great Britain | AFRY](http://www.tinyurl.com/AFRY-REMA)  
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<sup>2</sup> Funding study members included Drax, Greencoat, Octopus, RES, RWE, Shell and SSE; our clients and observers are under no obligation to be identified although they may choose to do so.

nuanced. Today's TNUoS (and transmission loss) arrangements already give sharp locational investment signals, and these will increase over time<sup>3</sup>.

TNUoS prices are based on distance (and the type of grid used to connect areas) whereas locational pricing is based on congestion. If grid build lags behind generation deployment, then the introduction of locational energy markets would strengthen siting incentives compared to a national market.

Conversely, if grid build succeeds in reducing congestion, then a locational market would yield weaker locational signals than the status quo and could increase incentives for investment in areas which are distant from the centre of the network.

Our models assume perfect foresight by investors of price patterns. Although this is (broadly) plausible under a zonal pricing regime, we believe that it is highly implausible under nodal pricing. Our own study found only a small improvement in operational efficiency in moving from a zonal to a nodal market for this reason. To allow like-for-like comparisons of cases we allowed optimisation of investment decisions on the national and zonal cases but no further optimisation of investment in the nodal case. This is an important aspect of our methodology and we believe is more realistic than alternative approaches.

### **Locational pricing could increase risk to investors which would wipe out any benefits**

The risk to investors from a move to a locational market is real. Smaller markets increase price and quantity volatility, and there are no suitable contracts to hedge this risk. CFDs expose generators to market outcomes with zero prices or in which they do not generate, and this would occur more frequently under locational markets.

There has been extensive comment on this in Britain and other markets although little quantitative evidence, and it is very difficult to quantify due to the complex contract structure and the inherent risk associated with TNUoS changes<sup>4</sup>. However, if investors perceive increased risk then hurdle rates will increase and investment will be deterred irrespective of what hindsight eventually reveals<sup>5</sup>.

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<sup>3</sup> Zonal pricing would sharpen the alignment of locational incentives with (short term) scarcity but would not necessarily yield stronger signals: the recent publication of a ten-year ahead TNUoS forecast [5 Year Projection 2029-30 to 2033-34 \(nationalgrideso.com\)](https://www.nationalgrideso.com/5-Year-Projection-2029-30-to-2033-34) reveals a range of almost £100/kW per annum between locations for a 45% load factor intermittent generator, almost a trebling from today's range.

<sup>4</sup> Professor Michael Pollitt recently published a paper commenting on the lack of evidence to support the case for nodal pricing [text-2318-revised-180723.pdf \(cam.ac.uk\)](https://www.cam.ac.uk/research/publication/text-2318-revised-180723.pdf). He made this telling point "The calculated savings arise from models which assume LMPs are the right answer and give efficient signals."

<sup>5</sup> It is implausible to suggest that additional risk to investors from a locational market would not add to system costs: this is a special case under the Capital Asset and Pricing Model for a perfectly hedged portfolio but is not a description of the real world (any more than the Perfect Competition model of microeconomics). No perfectly hedged portfolio is available to investors: any such portfolio would include network assets which they are

If we assume only a small increase in risk (100bp) to commercial investors, we found that the 1% improvement in welfare from locational pricing could easily become a 1% loss in overall welfare.

### **Wealth transfers are an important consideration**

In any move to a locational market, the distribution of benefits is largely arbitrary, depending on future allocation of congestion revenue and the distribution of residual network charges. Consumer benefits could be substantially boosted (in the short term) at the expense of producer surplus through removal of existing access rights to generators, although this could be done under a national market if it were considered desirable.

The scale of wealth transfers and the extent of mitigation measures, contract renegotiation and grandfathering of rights would need careful consideration if any form of locational pricing were introduced. There is no existing design for transmission access rights which hedges the actual risks faced by investors and market participants (for example to enable long term renewable PPAs between participants in different price areas).

### **Centralised (nodal) markets are not designed for decentralised resources and new technologies**

Nodal markets are centralised in operation, covering the trading timeframe which results in scheduling and dispatch. The interaction between location and delivery of flexibility is complex to analyse, but any move to a centralised nodal market would require some substantial breakthroughs compared to existing centralised markets if we are to believe that the dispatch process would be efficient:

- Optimisation routines should be developed to optimise technologies such as batteries and demand side resources, including a large number of decentralised resources.
- Co-optimisation algorithms would need to encompass the new system services needed for a decarbonised system, some of which are locational in nature.
- Centralised pricing algorithms should include non-linear costs in pricing (e.g. start and no-load costs), rather than applying these as bilateral out-of-market payments.
- Centralised markets should deal with intraday trading and optionality, rewarding flexible assets and allowing very frequent adjustments deal with changes in forecasts.
- Centralised markets could be implemented in time to have any positive effect and without holding up investment, which is critical given the 2035 target for a decarbonised power system.

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forbidden to own. There are no transmission access rights in existence which hedge risk over investment timeframes or for actual production or consumption profiles. To set up a market model which requires investors to hold a balanced portfolio would be a deterrent to independent investment, a barrier to market entry and would hamper competition.

For this reason we consider that a move to a centralised market – a necessary step for nodal pricing – is not advisable.

## **Overall**

After careful reflection, we believe that the various studies and subsequent discussion support our general recommendations.

**In conclusion, we found that the benefits of a move to locational pricing in Britain are small, and could be outweighed if additional risks to investors cannot be mitigated.**

Our recommendations for the GB market reform were as follows:

- nodal pricing should not be progressed further due to the scale and risk of change, the time needed for implementation and the doubt over whether a centralised market is compatible with the future range of decentralised resources;
- 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; and
- further work should be undertaken to improve incentives and information flows under the existing national market design: specifically more targeted investment and operational dispatch incentives, particularly for interconnectors and for resources behind transmission constraints.

Our recommendations reflect the difficulty of changing market arrangements during a period of high investment needs. While there is a case for change, existing arrangements have had significant success in delivering decarbonisation, whereas radical change is likely to deter the investment.

The balance of outcomes depends heavily on the scenario assumed, and a wide range of results is plausible. The impacts (positive or negative) of locational markets are greater when congestion is high, and would reduce if congestion is mitigated by grid build and better siting decisions by investors. The government acceptance of the recommendations of the Winser report<sup>6</sup> makes it more likely that networks are developed at pace, which would reduce the overall impact and importance of locational pricing.

The real emphasis should be on designing and building a coordinated network without placing unmanageable risks on investors, which would only serve to delay and increase the cost of the energy transition.

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<sup>6</sup> [Accelerating electricity transmission network deployment: Electricity Networks Commissioner's recommendations - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/674242/accelerating-electricity-transmission-network-deployment-electricity-networks-commissioner-s-recommendations.pdf)