

THE BENEFITS OF LOCATIONAL MARGINAL PRICING IN THE GB ELECTRICITY SYSTEM

A review of FTI's assessment of the benefits

28 SEPTEMBER 2023

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Key conclusions from our review of FTI's LMP assessment

FTI has performed extensive quantitative analysis of the impact of LMP. However, because of choices made in their modelling, *their claimed benefits are likely to be very significantly overstated and should not form the basis of decision making.*

First, *FTI focus on a scenario with £24.5bn of system benefits, when its own sensitivity analysis shows significantly lower benefits of £14.4bn (a reduction of 41%) when taking account of the now approved Holistic Network Design (HND) investment plans.*¹

Second, *FTI incorrectly ascribes these system benefits to the implementation of LMP.*

- *Optimised dispatch (c. 58% of system benefits)* – FTI assumes that in a national market ESO fails to take efficient redispatching actions available to it, particularly in relation to interconnectors, while assuming perfect dispatch under LMP. They never consider why this perfect dispatch could not be achieved in a national market.
- *Optimised investment (c. 42% of system benefits)* - FTI assumes investment is optimised for location under LMP, but they completely ignore the role that locational transmission charges already play in siting decisions in the GB market. This is not to say that LMP could have no impact. However, FTI's analysis does not tell us anything about whether or why an LMP locational signal leads to better locational decisions by investors than under an alternative such as TNUoS.

Third, *FTI's claimed customer benefits of £50.8bn, underpinned by significant value transfers from producers to consumers, are overstated.* FTI appears to ignore adverse customer impacts related to CfD support costs and the cost of capital. Policymakers also need to be comfortable that any such transfer is seen as fair for existing investors.

Fourth, *FTI gives limited consideration to the potential costs of LMP.* They ignore costs associated with the transition to LMP (e.g. delays to investment) and downplay the risks of increases in investor cost of capital. FTI's own limited analysis shows cost of capital impacts could remove 30-50% of its claimed system benefits, but in our view the potential impacts are much greater.

Fifth, *FTI's analysis does not consider wider policy design.* Ultimately, the benefits case for LMP is intrinsically dependent on wider policy choices such as the extent of grandfathering of network access rights, or whether locational signals are reflected in renewables support arrangements. While analysis of these was outside the scope of FTI's analysis, we cannot truly understand the implications of LMP in isolation of these wider choices.

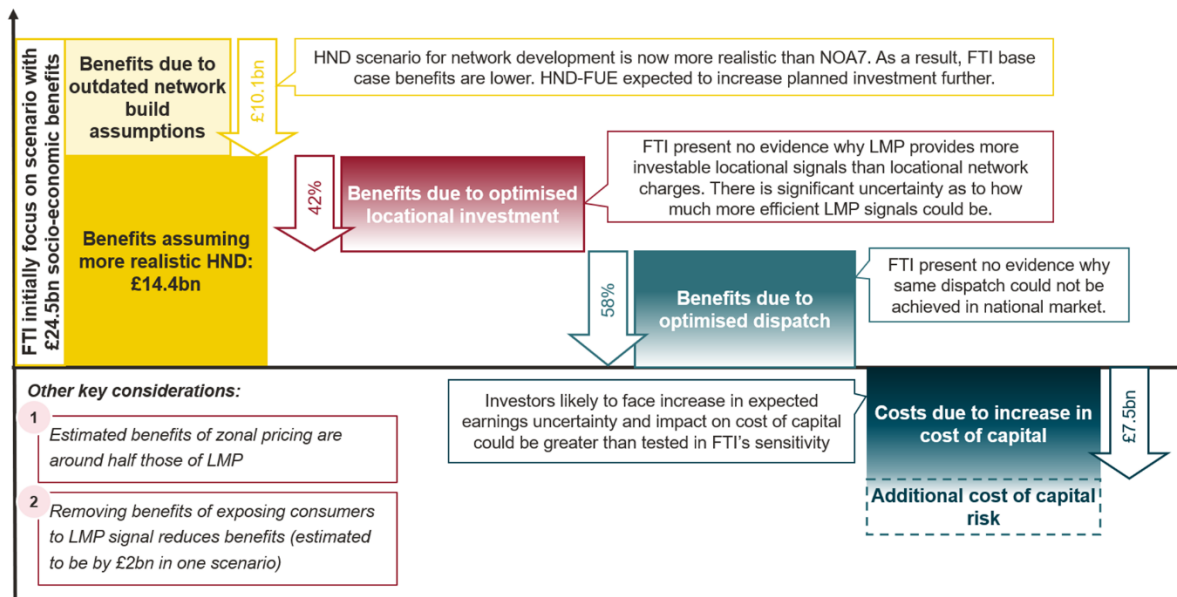
¹ FTI do not consider the Holistic Network Design Follow Up Exercise (HND-FUE) which will consider further transmission grid reinforcements and connections. Based on the impact of additional network build in FTI current scenarios the impact of further network build will likely reduce future benefits.

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FTI asserts that their quantified results are robust to different assumptions and are conservative, but their analysis does not support these conclusions. They selectively quote their own sensitivity analysis and fail to consider properly factors which could mean their benefits are overstated.

All that said, FTI’s analysis does demonstrate that optimising the location of investments and optimising dispatch of domestic and international sources of supply and demand can lead to substantial consumer and system benefits. This implies *there is significant value that could be captured through incremental market reforms*. For example, on FTI’s numbers there are £14bn of potential benefits from improvements to ESO market dispatch, which could be achieved without LMP.

Figure 1 The benefits claimed by FTI are likely to be overstated for a number of reasons



Source: Frontier illustration of 'Locational pricing assessment in GB: Final modelling results', FTI, July 2023

Notes: We have applied the same % allocation of benefits to the components of optimised investment and optimised dispatch derived from FTI's scenario with £24.5bn of system benefits to the lower benefits of the HND sensitivity.

The conclusions in this report reflect our review of the information made available by FTI. A comprehensive critique of the work is not possible without publication of FTI’s detailed description of its approach and results.

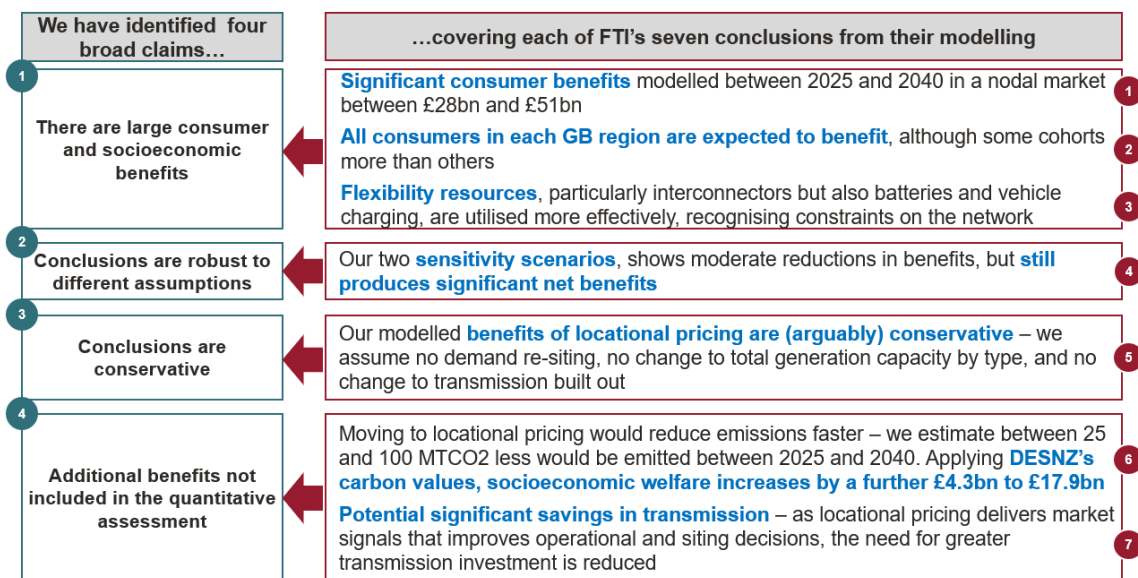
Introduction

Locational marginal pricing (LMP) remains a hotly debated topic in GB. There have been numerous reports considering the nature of its benefits case, including our own.² The most prominent piece of quantified analysis, commissioned by Ofgem and carried out by FTI, has now been completed.³ FTI estimates significant customer benefits of £28bn to £50.8bn for implementing LMP, which may create the impression that the case for LMP is clear cut. Frontier Economics has been commissioned by a group of four parties (SSE, Scottish Power, RWE and RES Group) to set out an independent review of the approach taken by FTI to assess the potential move to LMP. This short report summarises our findings.

Throughout the period that FTI has carried out its analysis, we have shared a number of concerns regarding their approach. In particular, we argued that FTI was making a number of unproven assumptions (or assertions) to underpin its benefits case. Now that this work has been completed, we reflect on the final analysis and conclusions and clarify what conclusions can be drawn from FTI's analysis by policymakers.

FTI's report presents seven key conclusions for policymakers, which we have grouped into four categories as set out below in Figure 2.

Figure 2 FTI's claims about the benefits of LMP



Source: FTI's conclusions, grouped by Frontier according to themes.

Note: The order presented above does not reflect the order presented by FTI. It has been changed to fit with the themes on which our report is structured

² "An assessment framework for a move to LMP in the GB electricity market", Frontier Economics, October 2022; <https://www.frontier-economics.com/media/ekemhlz3/an-assessment-framework-for-a-move-to-lmp-in-the-gb-electricity-market.pdf>

³ Ofgem, FTI Consulting; Locational Pricing Assessment, workshop material available from Ofgem upon request; <https://www.ofgem.gov.uk/publications/locational-pricing-assessment>

Our approach in this report is to consider FTI's conclusions under each of these categories in turn, stepping through the evidence presented by FTI to understand whether their conclusions are valid.

We note that although our review has focused on FTI's analysis of LMP, FTI also assessed the case for a zonal market, concluding it would also bring benefits, albeit smaller in magnitude than LMP. While we have not considered this assessment in the same level of detail (and FTI presents less information on it – for example, sensitivities are not applied to zonal results) we believe that at a high-level our conclusions relate to both their nodal and zonal analysis.

Category 1: FTI's claims that LMP is associated with large consumer and socioeconomic benefits

FTI claims that LMP would result in significant customer and system benefits. In its most prominent scenario these amount to £50.8bn and £24.5bn respectively. However, when reviewing these benefits policymakers need to be aware that:

- The majority of the system benefits (on FTI's modelling, up to £14bn) relate to improvements to the way in which the ESO redispatches the system. LMP may be one way in which to capture this value (if the dispatch algorithm is perfectly efficient). However, there are also likely to be alternative, far less disruptive options, meaning it is not appropriate to attribute these benefits solely to LMP.
- The remainder of the system benefits (on FTI's modelling, up to £10bn) relate to more efficient locational siting of investments. However, these cannot be fully attributable to LMP, because FTI has not assessed the extent to which this can also be achieved under the existing (or any improved) locational network charging arrangements. Furthermore, it is not possible to truly understand the implications of LMP for siting decisions absent a clear view on the wider policy frameworks that relate to investment.

FTI focuses on its estimated customer benefits. However, the system benefits represent the real efficiency gains due to the policy change. Customer benefits are larger than the system benefits due to significant transfers from producers to customers. When considering customer benefits, it is important for policymakers to be comfortable that the distributional effects will be perceived as fair, and to correctly understand any wider detrimental implications.

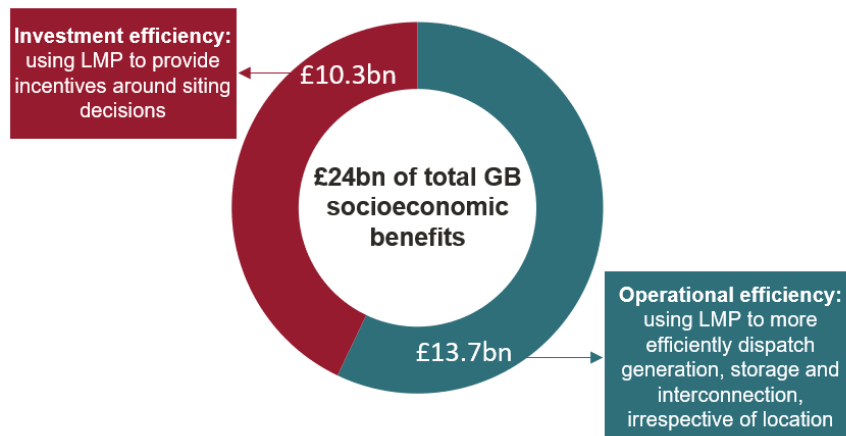
In the remainder of this section we focus on:

- why the attribution of claimed efficiency system benefits to LMP is not justified; and
- why the customer benefits, underpinned by significant transfers from producers, appear overstated.

Claimed efficiency benefits are not clearly linked to LMP

FTI provides relatively limited information on the source of their modelled efficiency savings. However, based on one of their sensitivities we are able to roughly decompose the £24bn of system benefit into two components, as set in Figure 3.⁴

Figure 3 Broad decomposition of FTI's overall system benefits



Source: Frontier illustration of 'Locational pricing assessment in GB: Final modelling results', FTI, July 2023, page 74

Operational efficiency

First, with regard to *operational efficiency*, FTI assumes that LMP leads to more efficient dispatch, particularly relating to interconnectors and storage. In citing these benefits, FTI is implicitly assuming that:

- the algorithm underpinning an LMP market can perfectly optimise all of the available resources, both domestically and internationally, taking into account all technical constraints faced by power stations; but
- the same optimal dispatch cannot be achieved by the ESO's use of a similar algorithm in the national balancing market today.

For example, in the modelled national market, FTI assumes that interconnectors do not change their flow even when doing so would be a cheaper option for ESO than redispatching domestic generation, other than to prevent unserved energy.⁵ In principle, there is no reason why the same dispatch could not be achieved under both national and LMP markets.

⁴ In their cost benefit analysis, this scenario has £24.5bn worth of system benefits. But in subsequent summaries and sensitivity analysis, this reduces to £24bn.

⁵ FTI fixed the price of interconnector bids at €130/MWh in 2025 and €100/MWh from 2030 onwards, effectively making it more expensive than unabated gas, thereby making changes to interconnector flows a "last resort" option for ESO.

FTI's assumed inefficiency may be reflective of inefficiencies in the current arrangements. However, FTI implicitly assumes that any current inefficiencies can only be resolved by LMP. In fact, a key message for policymakers from this analysis is that there is potentially significant value (on FTI's modelling, up to £14bn) that could be captured by society through improvements to the way in which the ESO redispatches the system. LMP may be one way in which to capture this value (if the algorithm is perfectly efficient). However, there are also likely to be alternative, potentially less disruptive, options within the framework of today's market.

Investment efficiency

Second, with regard to *investment efficiency*, FTI assumes there are large benefits associated with generation and storage investments choosing to site in more efficient (i.e. lower system cost) locations under LMP. FTI observes that compared to a national market, LMP results in changes in the location of significant volumes of:

- *wind energy investments*, with a general move from the north to the south to capture higher wholesale revenues. In one scenario as much as a third of wind capacity changes its location; and
- *storage investments*, with a general movement from the south to the north in order to capture wide spreads in market prices between constrained and unconstrained periods. It appears that FTI models a scenario where similar spreads in the south are cannibalised by the high take-up of EVs acting as storage in England.

As a result of these assumed changes in the location of investments, FTI estimates a significant reduction in overall system costs due to less wind energy being curtailed (because it is located in less constrained zones or because storage is able to store the excess energy), and by corollary, there is less need for more expensive (and polluting) gas generation.

Again, FTI over-states the benefit of LMP, because their analysis ignores the role that locational transmission charges play in the GB market. This is because in the national market counterfactual, FTI do not assume that assets choose to locate based on current locational investment signals from TNUoS and varying revenues from locational balancing. FTI takes the locations of assets in the counterfactual from FES which does not consider the location of assets based on current market signals. In other words, FTI's analysis only highlights the potential benefits of optimising the location of resources (in particular, generation and storage). It does not tell us anything about whether or why an LMP locational signal leads to better locational decisions by investors compared to an alternative such as TNUoS.

FTI acknowledges that this approach could lead to an overestimation of benefits attributed to LMP, and therefore conducts a sensitivity analysis where the same optimised locations are assumed under both the national and LMP market i.e. in effect neutralising the investment

benefits of LMP.⁶ This reduces their quantified benefits by around £10bn, which amounts to roughly 40% of the total system benefits (see Figure 3 above).⁷

It is worth noting that comparing FTI's zonal and nodal modelling makes clear that their nodal results see significant within-zone changes to location, as well as inter-zone movements⁸. This could be viewed as an indication that more granular locational LMP signals could lead to more efficient siting decisions than a signal that is averaged over a larger area i.e. in a zonal market or via TNUoS charges.

However, this still does not mean these benefits can necessarily be attributed to LMP:

- there is no evidence that investors can easily respond to very granular signals i.e. even if forecasting of supply and demand changes across large constraint boundaries were possible, it is likely to be much harder to make very local estimates that might drive within zone changes in location. FTI's assumption of perfect foresight may be exaggerating the effect on producer decisions compared with a national baseline; and
- even if very granular signals were judged to be more accurate *and* investable, there is (in theory) no reason that TNUoS charges could not be made more granular. It should be noted that current TNUoS is more locationally granular than FTI's zonal modelling (since there are 27 zones for generator TNUoS charges, compared to the seven zones modelled by FTI), and the number of TNUoS zones could be increased further if judged to be more efficient.⁹

FTI's analysis has not brought us any closer to understanding whether investors are likely to respond any more or less efficiently to an LMP signal compared with the locational TNUoS signal provided in the national baseline. To understand that we need to understand:

- the extent to which different technologies are able to respond to locational signals given the economic, technical and administrative constraints of investments;
- whether an LMP signal is more or less accurate in terms of reflecting the long-run avoided costs of network investment; and
- whether an LMP signal should be considered more or less predictable or investable for investors.¹⁰

⁶ FTI summarise this on page 74 of their June report.

⁷ The fall in benefits by £-10.3bn is arrived at through a decrease in congestion rent (£-15.4bn), lower wholesale price increase (£+3.3bn) and reduced producer surplus reduction (£+2bn).

⁸ This is clear from the fact that the benefits FTI model for LMP are greater than those for a zonal market with seven zones.

⁹ The Transport Model which is used to calculate the raw TNUoS charges is a nodal model. The raw charges are then averaged up to a zonal level. The number of TNUoS zones is already being considered by Ofgem, ESO and wider industry through existing industry processes.

¹⁰ More detail on this is available in our previous report on the topic: '*An assessment framework for a move to LMP in the GB electricity market*', Frontier Economics, October 2022

These are difficult questions to answer, and the lack of relevant analysis in FTI's work is also reflected in the wider academic literature, a point noted by Pollitt (2023).¹¹ However, the lack of evidence does not mean these fundamental questions should be ignored. The key question for policymakers is how much of FTI's estimated £10bn of investment benefits can truly be attributable to LMP and could not be achieved under the existing (or any improved) locational network charging arrangements.

Finally, we note that wider policy design (in particular, renewable support arrangements) will be a key determinant of how generators respond to any locational signals. For example, some CfD designs would significantly change the degree to which investors are exposed to the LMP signal, and hence the degree to which they can be expected to change their siting decisions.

FTI has been clear that detailed policy design was outside their scope. However, perhaps as a result, their approach is internally inconsistent:

- on one hand, FTI assumes that wind investors are fully exposed to the LMP locational signal. It is the fact that wind investors in congested zones are expected to earn lower revenues that drives so many wind investors to change the location of their investment in FTI's model; but
- on the other, for the purposes of estimating the impacts on consumers and producers, FTI has assumed a CfD design that significantly insulates investors from the effect of the LMP locational signal. FTI models a CfD design that sets the nodal price as the reference price, meaning that where plants face a low nodal price, they receive a higher top-up payment via the CfD. In effect this means that wherever they are located, plants are not exposed to the locational variation in prices that is the primary driver of the investor responses that FTI model. To ensure the projects which are developed do in fact reflect nodal prices, FTI assumes a fundamental redesign of the CfD, namely that projects are selected based on the lowest expected support payment rather than the lowest strike price. We note that this change would require government basing its choice of projects on its own forecast of nodal prices.

FTI's modelling therefore does not consistently recognise the essential point that policy design matters to the benefits case. It is not possible to truly understand the implications of LMP absent a clear view on the wider policy frameworks.

¹¹ 'Locational Marginal Prices (LMPs) for Electricity in Europe? The Untold Story', Michael G. Pollitt, Energy Policy Research Group and Centre on Regulation in Europe, 3 July 2023

Customer benefits appear overstated

Customer benefits are different from the system benefits because they also include transfers. In FTI's modelling the net transfers from producers to consumers are significant (roughly £26bn)¹², meaning that modelled customer benefits significantly exceed the system benefits.

From FTI's modelling we have limited detail about the different components that make up the transfer to consumers. However, an important component is likely to relate to the ending of curtailment compensation for generators. There are likely to be different effects on different investors.

- For *existing investors*, the loss of curtailment income simply represents a transfer to customers. Under the current regime, all generators have invested on the basis of a guaranteed 'firm' access to the network i.e. if they are asked to curtail their output they will be compensated. Grandfathering these rights (to protect existing investors) could be considered by policymakers, but it is important to recognise that to do so would remove a significant customer benefit from FTI's analysis. Unfortunately, there is no detail to determine the reduction in customer benefits which would result from such a policy.
- For *new investors*, the loss of expected curtailment income can be taken into account when making an investment. For example, CfD plants are likely to require a higher strike price to compensate for the fact that some of their potential production volumes would no longer earn any revenues as network constraints restrict them from generating. FTI has captured the benefit to customers of not making the curtailment payments but appears to have ignored the knock-on implications that would result in offsetting higher CfD support costs for customers. Given the scale of future capacity expected to connect under a CfD contract this is likely to be a significant omission that would substantially reduce the modelled benefit to customers of LMP.

Irrespective of their scale, while such transfers may be viewed as representing a positive aspect of a move to LMP, it is important for policymakers to be comfortable that these will be perceived as fair, and to correctly understand any wider implications for producers e.g. changes in the cost of capital or delays to investments.

Category 2: FTI's claims that its conclusions are robust to different assumptions

FTI assesses a wide range of scenarios and sensitivities covering some important uncertainties. However, in their conclusions, FTI refers only to two sensitivities, stating that they show a moderate reduction in benefits. These are difficult to describe as "moderate":

¹² FTI estimate a direct transfer from producers to consumers of £38bn, which is then partly offset by a £12bn transfer to producers for increased CfD support payments.

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- FTI's 'dispatch-only' sensitivity demonstrates a reduction in benefits of £10bn from removing the impact of LMP on investment decisions, which reflects to roughly 40% of FTI's modelled efficiency benefits for LMP; and
- FTI's 'load-shielding' sensitivity removes the exposure of domestic consumers to the LMP signal, while maintaining the exposure to all other market participants. This sensitivity reduces benefits by over £2bn.

They also model further sensitivities not reflected in their conclusions which are, again, difficult to describe as "moderate":

- a cost of capital sensitivity which reduces benefits by £7.5bn (equivalent to around 30% of total system benefits in FTI's most optimistic scenario); and
- a network build scenario, which reflects the now approved Holistic Network Design (HND) investment plans, reduces system benefits by £10.1bn (equivalent to roughly 40% of total system benefits).¹³

There are also important uncertainties which are not considered by FTI. For example:

- even though FTI accepts that there is some uncertainty around the operational efficiency benefits they model, they do not appear to recognise that, in principle, there is no reason why the same benefits could not be achieved under both national and LMP markets. Given the operational benefits are larger than those relating to investment efficiency, it is clearly important that their sensitivity to alternative options for improving dispatch efficiency are also well understood; and
- FTI presents the cost of capital increase required to remove all customer benefits but does not present an equivalent analysis related to the removal of system benefits (the increase in cost of capital would be much lower).¹⁴

We have separately indicated that changes in investor cost of capital are likely to be a major consideration in relation to the benefits of LMP. FTI's apparent preference to downplay this risk to their quantified benefits appears to stem from two flawed positions:

- first, FTI argues that the locational signal under LMP is no less predictable than the locational signal under the current national market, citing the fact that in its modelling there is no difference in the volatility of hourly wholesale prices within a modelled year under a national and LMP market; and

¹³ FTI do not consider the Holistic Network Design Follow Up Exercise (HND-FUE) which will consider further transmission grid reinforcements and connections; based on the impact of additional network build in FTI current scenarios the impact of further network build will likely reduce future benefits. More details of HND-FUE can be found here: <https://www.gov.uk/government/groups/offshore-transmission-network-review>

¹⁴ The increase required to remove all consumer benefits ranges between 139bps and 341bps. The increases required to remove system benefits would be lower.

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- second, FTI argues that even if there is a change in predictability of returns, this has no impact on investors' cost of capital because any change in risks can simply be diversified within a wider portfolio of investments.

With regard to the first point, FTI has chosen not to engage in the analysis set out in our earlier report¹⁵ regarding the relative uncertainty faced by investors in a national and LMP market. Their own volatility analysis cannot justify the conclusion they draw because:

- it is focused on hourly prices in a particular year, which does not reflect the increase in revenue uncertainty over asset lifetimes that investors face when making investment decisions; and
- it compares short term volatility of wholesale prices in a national and LMP markets, rather than comparing uncertainty in the locational signal (i.e. uncertainty in locational TNUoS charges as compared to uncertainty in the LMP locational signal, as measured by the predictability of the spread between nodal and average prices over asset lifespans).

With regard to the second point, FTI adopts without question the results of the Capital Asset Pricing Model (CAPM) to conclude that policymakers should consider any change in risk as irrelevant. We do not dispute that the CAPM model is the best conceptual framework we have for explaining the cost of capital for individual asset or classes of assets. However, simply because it is the best we have does not mean it is always accurate or indeed relevant. In fact, given the assumptions which underpin CAPM, there is reason to believe that its predictions are not always a good guide for policymakers in the real world.

If the results of CAPM were always reliable, it would never make sense for policymakers to consider idiosyncratic risks in developing support mechanisms or to consider interventions designed to encourage new sources of finance into particular asset classes, because CAPM assumes that investors everywhere are always perfectly diversified.

In reality, policymakers frequently do recognise the limitations of the CAPM framework. In the GB electricity sector, the EMR programme was predicated on the idea that through changes to support arrangements, the cost of capital could be reduced by insulating investors from wholesale price risk and new sources of finance could be attracted into low carbon generation. Particularly where policymakers are aiming to support investments over a short time period and where there is a risk that assets important to diversification are not tradable on liquid markets, simply assuming that CAPM's conclusions are always relevant may be a barrier to achieving policy objectives.

None of this is to say that there are clear answers to the question of diversifiability and its relevance. However, for FTI to dismiss risks of increases to the cost of capital without properly

¹⁵ "Locational Marginal Pricing – Implications for Cost of Capital", Frontier Economics, October 2022; <https://www.frontier-economics.com/media/gzwnyljs/implications-of-cost-of-capital.pdf>

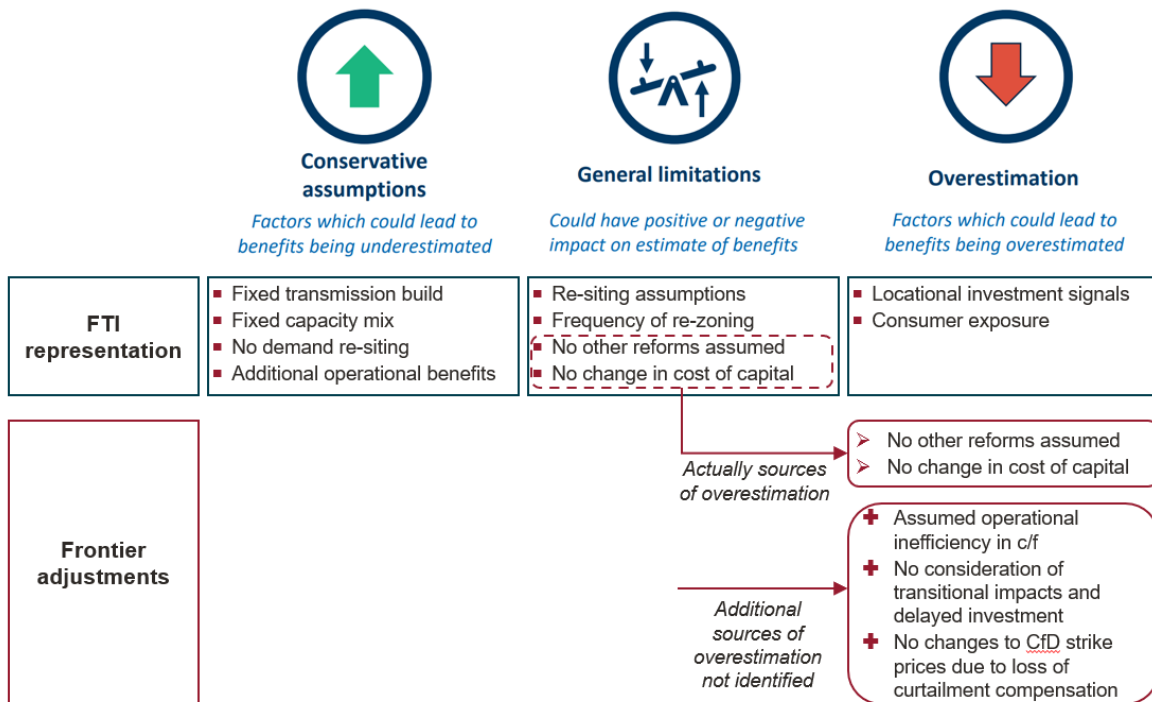
engaging with the topic is a significant omission which means it is dangerous for policymakers to rely on their conclusions.

Category 3: FTI’s claims that their results are conservative

FTI helpfully identifies general limitations to their approach, and assumptions which are likely to lead to benefits being underestimated and overestimated. Their analysis is reproduced below in the top part of Figure 4.

If we accept FTI’s summary as complete, it is difficult to reconcile the issues they identify with a conclusion that on balance the assessment is conservative. At the very least, one might conclude that there are factors that might push the results in either direction, given there is no obvious basis to conclude that the conservative assumptions are of a greater magnitude than those judged to lead to overestimation. FTI’s conclusion seems even more surprising given their own quantitative evidence from the two sensitivities referred to suggests the system results could be overestimated by up to £12bn.¹⁶

Figure 4 FTI’s assessment of key uncertainties and Frontier’s adjustments



Source: Frontier presentation of FTI analysis

¹⁶ Based on the dispatch sensitivity benefit of £10bn and the load-shedding benefit of £2bn summarised in the previous section

FTI's conclusion becomes even more difficult to support when the broader set of issues discussed in this report are added. We have identified a number of further limitations with FTI's results, which we have added to the lower half of Figure 4, including in particular:

- the lack of evidence to support FTI's assumption that LMP can impact siting decisions to the extent modelled given the existence of locational TNUoS in the counterfactual;
- the lack of assessment of whether the significant operational benefits claimed can be achieved through less disruptive reforms; and
- the potential for increases in the cost of capital for investors as a result of the move to LMP, which according to FTI's own sensitivity might reduce system benefits by £7.5bn.

While we do not have any quantitative evidence of the potential impact of the conservative assumptions, it is clearly unjustified to argue that *a priori* they must dominate the factors which could lead to quantified benefits being overstated.

Category 4: FTI's claims of additional benefits not included in their quantitative assessment

FTI suggests that there are two additional benefits of LMP not included in their main quantified results. These relate to a *reduced need for transmission investment* and *reduced emissions valued using DESNZ's carbon appraisal values*.

With regard to *savings in transmission investment*, FTI argues that they have been conservative in their assessment of LMP because they have not quantified the benefits that could arise from avoided network investment. It is not clear precisely what is meant by this, but their point may have some validity in the context of an optimised network. If the potential for congestion is reduced due to different siting decisions, then in theory there may be some investments in network that were previously optimal which are no longer economic, making the "optimal" network smaller than it would otherwise have been. By not attempting to model this optimisation,¹⁷ some benefits may have not been quantified.

However, given our doubts as to the evidence underpinning the quantified benefits of changes in siting, those same doubts would apply to these additional benefits. In addition, it is clear that FTI has not modelled an optimal network to begin with. It is likely that an assessment with optimised transmission investment would result in lower benefits as evidenced by the significant reduction in benefits between FTI's NOA7 and HND scenarios.

FTI's analysis results in *emissions savings* because they model less gas generation under LMP. This in turn appears to result from the fact the model results show less curtailment of

¹⁷ In fact, in theory, a re-optimisation of the network might further change LMP signals, leading to yet more changes in investor siting decisions, and still further scope to avoid network investment. In reality, such iterations would take place within the context of a network planning process with imperfect information as to the future, and against myriad wider changes to demand and supply which would impact the optimal network design.

wind, and more imports via the interconnectors.¹⁸ Putting aside the questions raised above as to whether these changes to dispatch and investment should be expected, there are a number of further issues to be aware of specifically in relation to emissions:

- first, the scale of emissions is closely linked to the timeframe considered for FTI's analysis. FTI assumes an LMP implementation date of 2025, and while they acknowledge this may be unrealistic, they do not consider its impact on emissions. Starting in 2025 means the analysis covers a period where the GB electricity system is much more carbon-intensive than it is expected to be in the future. The scope for emissions savings would therefore be reduced under later, more realistic implementation dates; and
- second, FTI assumes that imports have zero emissions. This is not necessarily an unreasonable assumption to make if the focus of the analysis is on UK territorial emissions (which is consistent with government appraisal guidance). However, if this is the case then emissions reductions should be considered in the context of the UK Emissions Trading Scheme (ETS). For all participating sectors in the scheme, the amount of carbon that can be emitted is fixed in each year. If the electricity sector reduces its emissions for any reason, resulting in "surplus" carbon allowances, the price of carbon will be reduced (other things equal). This may in turn lead to increased purchases of allowances and emissions in other sectors. As a result, it might be reasonable to argue that, while GB power sector emissions could be reduced, however, the link to UK reducing territorial emissions is less clear.¹⁹

FTI's conclusions in relation to non-quantified benefits therefore need to be carefully interpreted. The first hinges on the judgements already described on the extent to which LMP improves siting decisions relative to other means of sending locational decisions. The second is heavily influenced by the unrealistic assumption that LMP is implemented in 2025. On the basis of the evidence presented, it would be dangerous to assume significant non-quantified benefits.

¹⁸ Ofgem, FTI Consulting; Locational Pricing Assessment, pages 43-45: <https://www.ofgem.gov.uk/publications/locational-pricing-assessment>

¹⁹ This assumes that the ETS caps are not adjusted in response to faster than expected power sector emissions and does not account for future potential changes that increase the linkages between the EU ETS and the UK ETS.

Conclusions

We summarise our key observations on each of FTI’s four broad claims below.

Figure 5 Summary of our review of FTI’s key conclusions

We have reviewed four broad claims made by FTI...	...and identified the following key concerns to consider when reviewing FTI’s analysis
<p>1</p> <p>There are large consumer and socioeconomic benefits</p> <p>FTI claims LMP results in operational and investment efficiencies that significantly reduce system and customer costs</p>	<ul style="list-style-type: none"> ■ The significant benefits to customers (and the system) primarily rest on whether you believe LMP drives greater investment and operational efficiency versus the national price scenario. ■ FTI’s claimed benefits depend largely on significant assumed inefficiencies in the counterfactual: <ul style="list-style-type: none"> ▫ FTI assumes optimal dispatch can only be achieved under LMP when, in principle, there is no fundamental reason why the same (or at least very similar) dispatch could not be achieved under national market. ▫ FTI assumes there is no locational signal in the counterfactual, which completely ignores the role of locational transmission charges today, or their potential future role following reform. ■ FTI has not engaged with the fundamental question of why an LMP signal is more efficient than alternatives.
<p>2</p> <p>Conclusions are robust to different assumptions</p> <p>FTI claims positive benefits across a number of scenarios and sensitivities</p>	<ul style="list-style-type: none"> ■ FTI claim their sensitivities show only a moderate reduction in benefits, however: <ul style="list-style-type: none"> ▫ they focus on only two sensitivities, one of which (‘dispatch-only’) reduces benefits by £10bn (c. 40%). ▫ they ignore their cost of capital sensitivities in their conclusions, despite reducing benefits by £7.45bn. ▫ their conclusions do not reflect a £10.1bn reduction in system benefits associated with the HND network transmission build. ▫ key sensitivities are not carried out in relation to operational efficiency, despite serious doubts raised as to whether these can be attributed alone to LMP
<p>3</p> <p>Conclusions are conservative</p> <p>FTI outlined the key areas of under and over estimation and concluded they are conservative</p>	<ul style="list-style-type: none"> ■ FTI’s presentation of key uncertainties, on the face of it appears balanced, yet they still conclude they are conservative (even after scale of benefits reduction in sensitivities noted above). ■ Taking account of a broader set of issues that we have raised it is clear that the balance is likely to be heavily shifted towards overestimation.
<p>4</p> <p>Additional benefits not included in the quant assessment</p> <p>FTI claims further benefits related to emissions and avoided transmission network investment costs</p>	<ul style="list-style-type: none"> ■ The scope for additional transmission network benefits not quantified is directly linked to the extent to which you believe LMP can drive more optimal locational decisions than <u>TNUoS</u> which FTI has not clearly evidenced. ■ Putting aside our broader concerns, emissions reductions are significantly influenced by the assumed early implementation date of 2025 when system is more carbon intensive, and in any case, GB power sector emission reductions are unlikely to reduce UK territorial emissions as a sector within the UKETS.

Source: Frontier Economics

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