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Locational incentives under forward cost pricing

Summary

1. This paper is a brief review of aspects of the forward cost pricing method proposed by the G3 group of distribution network operators.

2. This is to examine the following concerns raised by Ofgem:

> "Whether the cost signals arising from the FCP approach are sufficient to drive changes in behaviour for existing customers and to provide a sufficient locational signal to new customers, particularly given the overwhelming contribution that scaling makes to end tariffs."
>
> "The use of what appears to be an average cost model, rather than a model which reflects cost impact on the network of changes in user behaviour."

3. The context for these concerns includes a so-called LRIC method proposed by WPD, which Ofgem decided in 2007 not to veto.

4. The structure of electricity distribution charges is a complex and multi-faceted matter. This paper focuses on use of system charges (excluding any reactive power charges) for demand EHV customers. It does not consider in detail issues linked to charging for distributed generation, reactive power, or users connected at lower voltage levels.

Analytical approach and structure of this paper

5. The paper begins by outlining the G3 and WPD methods, and identifying the concepts of cost and cost allocation that underpin them. This serves as a point of reference for the remainder of the paper, and is designed to enable readers to determine how the analysis in this paper applies to particular methods or proposals irrespective of any conflicts in terminology that might exist (e.g. in the use of the term LRIC).

6. We then identify the issues of customer behaviour and their impact of the network that appear most relevant to Ofgem's concerns. We give a tangible expression of these concerns by developing hypothetical scenarios to be used to analyse the effect of different possible structures of charges.

7. Based on these hypothetical scenarios, we then consider in what circumstances and to what extent the G3 and WPD methods, or variants thereof, might succeed or fail in meeting the relevant objectives.

8. A final section seeks to identify ways in which the G3 and WPD methods might be developed, and the kind of obstacles that might need to be overcome for such developments to succeed.

9. The paper focuses on principles — which cost concepts are estimated, and how they are allocated or converted into prices — rather than on implementation. In particular, we do not review the basis of any assumptions made about demand growth, load flow modelling, or financing and discounting assumptions.

Main findings

10. Our overall conclusion is that both the WPD and G3 methods provide locational incentives in the right direction, but that both face serious challenges in providing the customer incentives that Ofgem appears to seek.

11. For either method, it is easy to construct hypothetical scenarios in which that method would not provide optimal incentives. This reflects the difficulty (indeed, perhaps the outright impossibility) of providing satisfactory incentives covering all forms of customer behaviour through the narrow instrument of annual distribution use of system charges.

12. A main difference between the WPD and G3 methods is that the WPD method is subject to the risk of overstating locational differences, which could lead to excessive charges being levied on customers who use network elements on which this effect of the WPD method manifests itself (e.g. elements close to full utilisation but with low demand growth rates so that little investment is in fact needed). The main risk with the G3 method is of understating locational differences.

13. From the point of view of regulatory incentives, errors in either directions (overstating or understating locational effects) do not appear to be very different: in both cases, they lead to some sub-optimal locational decisions. We cannot say on the basis of our brief theoretical review whether the magnitude of the errors or their impact is bigger for either method in any particular circumstances.

14. But we can say is that a method that overstates locational effects creates larger risks of conflicting with competition law than a method that understates these effects.

15. Whilst we suggest some directions for further development starting from both the WPD and G3 methods, we have not identified a replacement method that could provide a major improvement with a feasible short-term implementation.

Conclusions

16. In summary, the G3 method provides an improvement over the current charging method in terms of aligning incentives for customers, and it is a possible base from which to develop better methods in the future. Whilst it may not fully meet Ofgem's objectives, there appear to be no simple way of addressing its potential shortcomings immediately without raising significant implementation difficulties.

17. A similarly mixed verdict might be given for the WPD method. On the basis of this brief review we cannot reach any view on whether the imperfections of the WPD method are more or less significant than those of the G3 method.

18. The risks associated with the WPD method are different to those of the G3 method. In particular, the WPD method as specified creates a risk of non-compliance with competition law, against which an Ofgem decision not to veto would offer no protection to the distribution companies. The G3 companies may legitimately take the view that these risks prevent them from putting forward a method similar to WPD's as an option for the structure of charges on their networks.

19. Neither method addresses the risk of inefficient construction of private networks for loads that are locally supplied by distributed generation. This issue results from the structure of the separate demand and generation price controls determined by Ofgem in 2004, rather than from the locational charges for load which are the focus of this paper.

20. Both the WPD and G3 methods have the prospect of being developed and improved in the longer term. The risk that such developments reveal insurmountable problems in the G3 method is not strongly correlated with the corresponding risk for the WPD method, as the two methods rest on quite different concepts. This risk is probably lower with the G3 method than with the WPD method, because the G3 method is less dependent on assumptions such as those related to the lumpiness of future investments or the long-term growth rate. For example, sustained negative demand growth would seem to render the WPD method unworkable. It would not seem a prudent regulatory policy to channel all efforts through the WPD method.

21. A further factor to be taken into consideration is the issue of transitional arrangements for customers subject to large price increases. The understatement of locational differences in the G3 proposal is likely to provide a fairly smooth transition, whereas the WPD method runs the risk of imposing very large changes in charges at some locations which may subsequently need to be reversed if the method is refined to deal with the kind of problems identified in this paper.

22. Vetoing the G3 method would have an immediate detrimental effect in at least two ways:

    (a) It would maintain the current structure of charges with no locational incentives.

    (b) It would erect unnecessary barriers to the development of better charging methods, and to the process of transition towards such methods.

Essential features and cost concepts in the G3 method

23. The basic building block for the G3 method is the set of planned network reinforcement projects in a network group. In the original G3 proposals described in this paper, only reinforcements that are planned to occur within a 10-year period are taken into account.

24. For each relevant planned reinforcement, the method involves calculating:

    (a) A reinforcement cost, expressed as a present value of forecast expenditure on reinforcement.

    (b) A demand integral, defined as the integral over time (the same 10-year period) of forecast use of capacity on the part of network subject to reinforcement, with a discount factor.

25. Distribution use of system charges at EHV voltage levels are based on capacity. The G3 "forward cost pricing" element of the charge, per unit of capacity, is calculated as the ratio of the present value of reinforcement costs by the demand integral. If the expenditure and demand outturn matches the forecasts, then the effect of this component of charges is to recover the costs incurred by the distribution network operator within the 10-year period by spreading these costs across all forecast users of the assets to be reinforced and of the reinforced assets across the 10-year period.

26. The definition of the discount factor or the recovery period can be adjusted within the general G3 method. Possible variants would involve specifying the proportion of costs to be recovered in the period leading up to the planned reinforcement as a function of the capacity increase delivered by the reinforcement, rather than by spreading recovery over a fixed 10-year period.

27. A 10-year demand forecast (or equivalently an assumed demand growth rate for the 10-year period) is an important element of the G3 method. This forecast affects both the reinforcements included in the 10-year reinforcement costs and the demand integral (or other mechanism for allocating costs over time).

28. In addition to the "forward cost pricing" term outlined above, a number of geographically uniform cost-based terms are included in the calculation of EHV charges. Geographically uniform fixed adders (defined for each voltage level) are then added so as to make up revenues to the amount expected under the price control regime. These terms do not affect locational incentives. Separate fixed adders are used for generation and demand, so as to match the separate price control restrictions on distribution use of charges income from generation and demand.

Essential features and cost concepts in the WPD method

29. The basic building block for the WPD method is a network element. This appears to refer to a particular asset on the network.

30. For each network element, a time to reinforcement is calculated using information about current utilisation of the asset's capacity and an assumed growth rate. The time to reinforcement can be anywhere from immediate (or even in the examples set in the past) to centuries in the future. The method requires the growth rate to be positive, so that all network elements are deemed to require reinforcement at some future date.

31. For each node on the network, a load flow model is used to estimate the effect of an additional increment of demand being connected there.

32. The effect of that additional load will normally be to increase the current load on some of the network elements, and therefore to shorten the estimated time to reinforcement.

33. The method is based on an estimate of the net present value cost of the bringing forward of reinforcement requirements due to the load increment. As this is an entirely hypothetical exercise to be repeated for each node, it is not possible to rely on any actual network reinforcement plans. Instead the method uses an assumption that reinforcement always consist of duplicating existing network elements when they reach full load.

34. The next step in WPD's method is to convert the net present value lump sum estimated by this method into an annual use of system charge. WPD uses a 40-year annuity starting today: this means that the period over which the estimated marginal cost is spread into charges may end well before, or well after, any of the reinforcements that are assumed to take place.

35. Finally, separate fixed adders for generation and demand (defined by voltage level) are added so as to match the respective price control restrictions, as in the G3 approach.

36. Despite some shared terminology, the WPD method is quite different in its structure and its objectives from the LRIC or LRAIC methods used in telecommunications network cost modelling. In the WPD method, the calculations reflect the actual network structure (not a notional scorched-node or scorched-earth network), and the focus is on a small (1 MW) load increment (not on an increment defined as a whole network-wide service as in telecommunications modelling). Analyses of the telecommunications network cost modelling form of LRIC offer no guidance on the properties of the WPD method. We do not think that the telecommunications network cost modelling LRIC methods provide a relevant route to explore for electricity structure of charges, since the increment that needs to be considered to provide the incentives sought by Ofgem is necessarily a small increase in the scale of the whole electricity distribution service.

Worked example of WPD method

37. A worked example of the WPD method is given in an IEEE paper.[1] In this example, the network element for which reinforcement is considered has a capacity of 45MW. As the only form of reinforcement taken into account is duplication, this means that the cost of bringing forward a 45MW investment in order to accommodate demand starting 1MW higher is converted into a price applied to each 1MW of load.

38. The spreadsheet calculation specified in table 1 follows the specification of the WPD method given by the paper. This calculation reproduces the results from the worked example as published in the article: see table 2 below.

Table 1 Microsoft Excel formulae to reproduce IEEE paper example of the WPD method

Variable	*Symbol and formula*	*Value*
Current load (MW)	C2	5
Current capacity (MW)	C3	45
Growth rate	C4	1.60%
Cost of reinforcement	C5	£ 3,193,400
Discount rate	C6	6.90%
Current years to reinforcement	C7=LN(C3/C2)/LN(1+C4)	138.4
NPV of reinforcement costs	C8=C5/(1+C6)^C7	£ 311
Load assuming an additional 1MW	C9=C2+1	6
Years to reinforcement assuming an additional 1MW	C10=LN(C3/C9)/LN(1+C4)	126.9
NPV of reinforcement costs assuming an additional 1MW	C11=C5/(1+C6)^C10	£ 670
Change in NPV of reinforcement costs due to additional 1MW	C12=C11-C8	£ 359
Convert into a 40-year annuity starting now (£/MW/year)	C13=PMT(C6,40,-C12)	£ 26.6

Table 2 Results from reproduction of IEEE paper example of the WPD method

Current load (MW)	*Charge (£/MW/year)*
5	£ 26.6
10	£ 209.5
20	£ 1,783.0
30	£ 6,364.0
40	£ 15,783.3
44	£ 21,341.4
45	£ 22,916.0

Source for tables 1 and 2: Reckon LLP re- implementation of worked example in Li, Furong and Tolley, David L (2007) Long-run Incremental Cost — Pricing Based on Unused Capacity.

39. The charges calculated by the WPD method can be sensitive to the assumed growth rate. Using the same values as above for the other parameters, table 3 illustrates this

[1] Li, Furong and Tolley, David L (2007) Long-run Incremental Cost — Pricing Based on Unused Capacity, preprint of IEEE Transactions on Power Systems, Volume 22, Issue 4, pages 1683–1689.

sensitivity in three cases: a part-loaded circuit (30MW used out of 45MW), a well-loaded circuit (40MW) and a nearly fully loaded circuit (44MW).

Table 3 Sensitivity of WPD method to demand growth assumption

Demand growth assumption	*Charge (£/MW/year) (initial load 30MW)*	*Charge (£/MW/year) (initial load 40MW)*	*Charge (£/MW/year) (initial load 44MW)*
0.10%	£ 0.0	£ 382.5	£ 183,941.7
0.20%	£ 0.6	£ 5,937.5	£ 124,975.6
0.40%	£ 196.9	£ 16,892.0	£ 74,137.1
0.80%	£ 2,508.4	£ 20,282.7	£ 40,612.6
1.60%	£ 6,364.0	£ 15,783.3	£ 21,341.4
3.20%	£ 7,214.2	£ 9,906.3	£ 11,006.6
6.40%	£ 5,495.0	£ 5,614.0	£ 5,654.1

Source: Reckon LLP calculations using WPD method applied to several possible demand growth assumptions.

40. The figure for 0.1 per cent annual growth and a current load of 44MW is particularly extreme: it implies a total income from customers of more than £8 million a year (44MW*£183,941.7/MW), when the only network investment planned is a £3.2 million reinforcement that would accommodate load growth for the next 716 years (log(90MW/44MW)/log(1.001)). We consider this feature of the WPD method with low demand growth assumptions further below.

Assumptions under which the WPD method implements marginal cost pricing

41. The underlying objective of the WPD approach appears to be to implement marginal cost pricing. The calculation of the change in present value will reflect a long-run marginal cost concept if the following two conditions are met:

(a) The unit cost of reinforcement through duplication of network elements is a reasonable approximation of the cost of reinforcement by the most efficient method.

(b) The notional load increment used in the calculation is small enough to be properly characterised as a marginal increment relative to the factors that drive network reinforcement decisions.

42. If so, and provided that the relevant customer decisions (e.g. whether to connect, close down, expand activities, etc.) are also small enough to be treated as marginal increments relative to the factors that drive network reinforcement decisions, then one would expect that the output of the above process would reflect the costs (expressed as a net present value) caused by customer decisions.

43. A further assumption arises from the 40-year annuity used in the WPD method. Because of this, the objective of providing cost-reflective locational incentives to customers can only be met if customer behaviour is driven by the present value calculated over the next 40 years of use of system charges assumed to continue at a constant level (plus inflation).

Impact of deviations from these assumptions

44. The assumptions above will not be completely satisfied in practice, and the objective of matching the locational structure of charges with a long-run marginal cost concept will therefore not be fully met. In the next few paragraphs we explore briefly the effect of deviations from these assumptions. This review supports the discussion of the implications of these deviations on the achievement of the relevant policy objectives in the hypothetical scenarios considered in the latter part of this paper.

45. A first kind of deviation from assumptions which might occur relates to the marginal nature of the increment used to calculate the change in the present value of future reinforcement costs. In most cases, treating an increment of 1MW (the figure in the IEEE paper) or 0.1MW (the figure in WPD's approved method[2]) as a marginal increment would be expected to become a good approximation. However, this expectation will not always be met, particularly in the case of very low growth rates: if growth is slow, even a very small change in load could lead to a major change in the estimated time to reinforcement. This is the reason for the very high charging rates in Table 3 above when the load is 44MW and the growth assumption is low.

46. In the extreme limit of a zero growth rate, using figures from the above worked example, the WPD method would imply that:

(a) An increment added to a nearly fully loaded network element would bear the whole cost of the reinforcement it would cause (if the charges were maintained over the 40-year annuity period), because it would be deemed to bring the estimated time to reinforcement from the very distant future to now, so that the net present value of reinforcement costs increases from almost nothing to the full cost of the reinforcement.

(b) In all other cases, the charge is negligible, as the estimated time to reinforcement would be very long whether or not the increment is included.

47. If there is a non-negligible positive growth rate, then the extreme effects outlined above in the limit of zero growth are smoothed out, so that the price varies with the degree of loading in a smooth manner. If the current load is also sufficiently far below capacity then the WPD calculation can be a good approximation of the marginal cost.

48. A second possible deviation from the assumptions highlighted above would occur if the actual load to which charges are to be applied is not small enough to be properly considered as a marginal increment on the network. For a load that is a main user of the reinforcement, the actual incremental cost of reinforcement that it causes would be at most the total cost of the reinforcement, but the charge determined by a marginal cost estimation method could be much higher. For example, using the figures from the IEEE paper's worked example (tables 2 and 3 above), a 45MW new load added to a 44MW existing load would only cause £3,193,400 of capital expenditure, whereas it

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[2] Western Power Distribution (2006) Implementation of the combined Long Run Incremental Cost (LRIC) and Distribution Reinforcement Model (DRM) methodology (Amendment Proposal: WPD/WALES/WEST/UOS002A).

would incur a locational charge of £960,363 a year (45*21,341.4), derived by annuitising a marginal cost of about £37 million — wholly out of proportion with the incremental capital expenditure caused by the relevant load.

49. A third possible deviation from the aim of facing customers with cost-reflective incentives arises from the use of a 40-year annuity to convert the estimated capital expenditure into an annual use of system charge. In cases where the time to reinforcement is longer than 40 years (likely to be an issue if growth rates are low), this could lead to excessive costs being imposed on load as they would be paying the charge based on the 40-year annuity for longer than 40 years. In cases where the time to reinforcement is short, there is a possibility that the incentive could be lower than the relevant incremental cost, as in some cases the charge calculated by the WPD method would drop dramatically immediately after the reinforcement is delivered. This effect might offset the discrepancy between incremental and marginal cost noted above in the case of a larger load, but there is no guarantee that it would do so — indeed in the case of a 45MW load added to the 44MW scenario in the IEEE paper the charges after reinforcement would be higher as a further reinforcement would then be planned for the short term.

50. A further implication of the features reviewed above is that the prices produced by the WPD method depend significantly on the assumptions made about the demand growth rate and the lumpiness of investments.

Objectives and relevant customer behaviour scenarios

51. In order to analyse the performance of different pricing methods, we first need to specify the relevant objectives.

52. The focus of this paper is on the incentives provided to customers through distribution use of system charges. To give a practical expression to the underlying objectives, we identify a handful of hypothetical scenarios in which the desired customer behaviour is known. This is used in the following section to analyse the performance of the G3 and WPD methods against the relevant objectives.

53. The relevant objectives arise mainly from policy set by Ofgem for distribution use of system charges.

54. In addition to these regulatory policy objectives, we consider the constraints that might be placed by competition law (the prohibition on abuse of a dominant position). These need to be considered separately since competition law is directly applicable outside the sector-specific regulatory processes.

55. The complementary nature of regulatory and competition law obligations is further emphasised by Ofgem's disclaimer of any approval of the WPD method for competition law purposes, and more generally by the use of the "not vetoed" terminology for Ofgem's decisions: these decisions do not provide any protection to the companies against claims that their charges are illegal for other reasons.

Ofgem's policy objectives for distribution use of system charges

56. The general purpose of the changes sought by Ofgem to the distribution use of system charging methodologies appears to be to try and align the charges faced by customers with the network capital expenditure that is required to accommodate these customers.

57. In addition to this general purpose, Ofgem has identified a specific objective in the context of its work on distributed energy. According to the December 2007 review of distributed energy,[3] a relevant objective for distribution use of system charges is that the use of, and investment in, the main network should be offered as a real alternative to the construction of private networks connecting new generation and loads that are being developed in tandem.

Effects of the prohibition on abuse of a dominant position

58. Distribution network operators act as commercial enterprises in supplying access to their network. Except to the extent strictly necessary to meet other regulatory obligations, they must therefore comply with the Competition Act 1998.

59. The most important aspect of competition law compliance for the purposes of this paper is the prohibition on exploitative abuse. This applies in cases where the distribution network operator has a dominant position, i.e. faces no effective competition in supplying access to an electricity network (or a substitutable service) — this condition is likely to be often satisfied. If so, the prohibition is on reaping trading benefits that would not have been available to the distribution network operator had there been "normal and sufficiently effective competition". This means that, for example, if a network bypass would be a competitive solution but for some unnecessary regulatory restriction that means that the customer cannot bypass the network (e.g. perhaps something to do with planning regulations), then the distribution network operator must not charge more than the price that would have arisen from competition, unless objectively justified (e.g. by reference to efficiently incurred costs).

60. Competition law also prohibits discrimination by a distribution network operator in dominant position. This rules out schemes under which prices would be set to match individual circumstances of a customer that do not affect the cost of serving them — for example, giving special discounts to demand developed in tandem with a distributed generation project. This prohibition on discrimination mostly duplicates the prohibition on discrimination in the licence and the restrictions arising from practical considerations (e.g. establishing whether a customer meets the conditions for a discount).

Scenarios selected to analyse pricing methods

61. We defined four scenarios to encapsulate the objectives discussed above.

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[3] Ofgem and Department of Business, Enterprise and Regulatory Reform (2007) Distributed Energy — Initial Proposals for More Flexible Market and Licensing Arrangements.

62. Scenario 1 involves a new EHV load wishing to connect somewhere within a distribution network operator's licensed area. Several possible sites are being considered for the development, and electricity network access is potentially a material factor in choosing a location. This scenario tests performance of a pricing method against the objective that load should be incentivised to locate on parts of the network where it can be accommodated with less investment.

63. Scenario 2 involves an existing EHV load being considered for closure, and where electricity distribution charges are potentially a material factor in choosing which site to close, or when to close at all. This scenario complements the first scenario's test of performance against the objective that load should be incentivised to locate on parts of the network where it can be accommodated with less investment, but focusing on the behaviour of existing customers rather than future customers.

64. Scenario 3 involves a new load with a known location but flexibility to connect to the EHV distribution network through a short spur or a long spur (i.e. bypassing part of the network or not). This scenario tests performance against the objective of ensuring that the option of upgrading the public network infrastructure is not unduly overlooked in favour or a potentially inefficient bypass, and is intended to help detect perverse effects that might result from some forms of locational charging.

65. Scenario 4 involves a simultaneous development of generation and load, with a choice to be made between constructing a private network to connect generation to the load, and only take top-up (and frequency regulation) from the public network; or connecting both the load and the generation to the public network. This scenario tests performance against the objective of ensuring that the option of upgrading the public network infrastructure is not unduly overlooked in favour of a private network.

66. The four scenarios set out above do not provide a comprehensive set of tests for a distribution use of system methodology, but we believe that they are a practical way of covering the most important issues addressed in this paper.

67. Some relevant objectives are deliberately overlooked in this selection of scenarios:

(a) Cases similar to scenarios 1, 2 and 3 could be developed using generation connections instead of load. We do not consider them in this paper as we focus on demand charges.

(b) A case similar to scenario 3 but allowing connection at different voltage levels could be developed. We do not consider such a case in this paper as we focus on EHV charges.

(c) Cases involving comparisons of charges to an IDNO and charges to individual customers could be developed, for example to test for the risk of exclusionary abuse (margin squeeze). We do not consider such cases in this paper as we focus exclusively on EHV charges.

Performance of the methods against the relevant objectives

68. We now use the four scenarios selected above in order to review the performance of the G3 and WPD methods against the relevant objectives.

Scenario 1 (encourage new load to locate on less congested parts of the network)

69. Under the G3 method, the costs of planned reinforcements are being spread over the whole demand integral. These costs are therefore shared across all customers: at that level, this is an average cost method rather than a marginal cost method.

70. Thus, the new customer would only pay a proportion of the expected costs of necessary reinforcement by connecting in a location where reinforcement is necessary.

71. As an extreme example, if the planned reinforcement could be avoided altogether if the customer did not connect (i.e. if the existing network can accommodate all other existing and planned loads), then the proportion of the reinforcement costs allocated to that customer would be likely to understate significantly the effect of that customer's decision on network capital expenditure requirements.

72. The customer would also face other costs in order to connect, e.g. its own equipment costs and connection charges levied by the distribution network operator. But these can be assumed to reflect the costs of additional dedicated assets which are not included within the estimate of network reinforcement costs: thus they cannot be expected to correct the incentive.

73. Thus, there is a risk that the G3 method provides insufficient incentives to new customers to choose locations where they can be accommodated with less network capital expenditure.

74. Under the WPD method, charge differentials can be well in excess of what is necessary to provide the relevant incentives to customers, particularly when growth rates are low. The economic logic of the WPD method relies on the assumption that marginal and incremental costs are the same. The effect, as explained above, is that a customer (or IDNO) with a load well in excess of 1MW could be faced with charges that bear no relationship to the underlying costs.

75. This has two adverse consequences.

(a) First, customers might incur undue detriment by being effectively forced to opt for a less preferred location, only to avoid an electricity network charge that cannot be objectively justified by reference to capital expenditure requirements.

(b) Second, the distribution network operator might be accused of excessive pricing under competition law, insofar as it has a dominant position in providing electricity network access at the customer's preferred location and offers a price for that service which is higher than can be justified with reference to costs, and higher than would be available if the customer was able/allowed to commission the necessary network infrastructure enhancement in a competitive market.

76. In respect of the second risk, it might be quite difficult to establish (to the requisite legal standard) the existence of a relevant dominant position, the feasibility of the hypothetical competitive market in enhancements, and the price that would prevail in such a market. But the risk of a successful challenge nevertheless exists. We do not see how the consistent application of a WPD method for setting network prices, or its approval by Ofgem, could provide an objective justification.

77. This competition law risk has no counterpart under the G3 method, as the charges calculated under the G3 method are obtained by combining allocations of actually planned expenditure on network enhancement with the price-control-based fixed-adder contribution to common costs (and without double-counting). It is unlikely that the G3 charge would exceed the price that would prevail if network enhancement could be commissioned in a competitive market (given that the contribution to common costs would still be reasonably required); and even if it were the G3 method (if correctly applied with reasonable estimates of expenditure requirements) would provide a cost-based objective justification for the charges.

Scenario 2 (encourage load closures on congested parts of the network)

78. The analysis of scenario 2 is a close parallel to that of scenario 1, considering a hypothetical load closure rather than a hypothetical new load. As in scenario 1, the likely inaccuracies from the G3 and WPD methods are in opposite directions.

79. The corresponding risk of distorted incentives are that:

(a) Under the G3 method, a load may be kept in a location even though closing it would remove or defer a significant network expenditure need, to an extent that would justify closure. But this may not happen as the customer would only keep an insufficient fraction (given by its share of the demand integral) of that capital expenditure saving.

(b) Under the WPD method, a customer may be incentivised to close a load site to avoid electricity distribution charges, even in cases where savings in network expenditure do not provide an objective justification for that closure. This would occur when the WPD pricing rule attributes the whole cost of bringing forward a large lumpy investment (element duplication) to a single MW of load.

80. The competition law issues noted for the WPD method in scenario 1 may apply to the price offered to the customer in scenario 2: if a customer that is effectively forced to close down or relocate because it has been quoted an electricity network access price which is higher than what can be objectively justified by reference to cost, then this may amount to an abuse by the network operator.

81. We have considered other potential competition law issues in this scenario, and concluded that they did not give rise to significant additional risks for either method:

(a) Charging too little to a struggling customer (G3) or offering an excessive reward for closure (WPD) can hardly be called exploitative by itself.

(b) The increase in all other customer's charges that would result from the potential inefficiencies outlined above is unlikely to be attributable to an undue restriction on competition (especially given that the relevant charges would have been ratified by the price control process).

Scenario 3 (provide alternatives to bypass for new stand-alone loads)

82. The risk identified above that charges based on the WPD method may overstate the cost of the network investment required to accommodate a new load also implies that efficient opportunities to reinforce the public network might be lost, in favour of long spurs being built by customers to connect to a location where they can be accommodated within reinforcement of the public network — even if the cost of the spur exceed the cost of the reinforcement that would be necessary.

83. In such circumstances, the WPD method could lead to:

(a) Unnecessary costs of a standalone spur for the new customer.

(b) A tendency to favour uncoordinated network development which could have adverse long-term effects for the visual environment (and perhaps security of supply).

(c) A risk of competition law complaints, if the customer can establish grounds to believe that the distribution network operator has a relevant dominant position and benefits from some restrictions on competition (similar in Scenario 1).

84. There are no corresponding problems with the G3 method.

Scenario 4 (provide alternatives to private networks for locally-supplied loads)

85. In the absence of a fixed adder element to reconcile charges with price control revenue expectations, both locational pricing approaches would be able to provide the required incentives for scenario 4. For example, in a load-constrained area, the generation would attract P2/6 contribution credits which would appropriately offset the demand charges (leaving a reasonable net charge for access to top-up and other benefits of a connection to the public network).

86. It would be possible to maintain this incentive structure whilst matching an overall revenue expectation by applying equal and opposite fixed adders to demand and generation charges (so long as total connected generation is small relative to total connected demand).

87. However, both the WPD and G3 methods fail to provide appropriate incentives for this scenario. This is because separate fixed adders are used for generation and load. This in turn is a consequence of the separate distribution price controls in respect of generation and demand customers.

88. The problems revealed by this scenario 4 do not distinguish between the WPD and G3 methods for estimating locational charges.

Comparison of the performance of the G3 and WPD methods

89. We reach the following conclusions from our review of the G3 and WPD methods for setting the structure of electricity distribution use of system charges.

90. For both methods, there is a clear correlation between lack of spare capacity, reinforcement requirements, and higher charges: both methods appear capable of providing locational signals that encourage loads to locate where they can be support with less network investment.

91. But neither method passes all the tests set out above.

92. The G3 and WPD methods are likely to fail in different directions:

(a) Locational signals provided by the G3 method are likely to understate the impact of load location on electricity network capital expenditure requirements, leading to insufficient pressure on customers to locate load where total cost would be minimised, or to close load to reduce the need for network expansion.

(b) Locational signals provided by the WPD method could significantly overstate the impact of load location on capital expenditure requirements. This could lead to customers choosing less suitable locations or closing loads in cases where the saving in electricity network capital expenditure requirements does not justify the disadvantage.

93. In addition, the WPD method is vulnerable to two specific risks:

(a) The WPD method risks imposing charges on some customers in circumstances such as scenarios 1 and 2 that amount to an exploitative abuse of a dominant position by the distribution network operator. Such abuses are prohibited by the Competition Act 1998 and expose the network operator to significant commercial and financial risks, even if Ofgem has consented to the method used to calculate the charges.

(b) The WPD method could cause inefficient bypass of the public network in scenario 3. Even if an inefficient bypass does not occur, if the main distribution network operator has a unique advantage in meeting planning and regulatory requirements for network infrastructure (compared to a private bypass) then the application of the WPD method in scenario 3 could lead to an infringement of competition law. There is no corresponding problems for the G3 method, where the relevant charges are by construction lower than planned capital expenditure and therefore no more than the cost of a bypass (assuming efficient network planning and accurate cost estimation by the network operator, as we do throughout this paper).

94. There are some further problems that appear to affect both methods:

(a) Both methods appear likely to fail to meet the objective examined in scenario 4: with both charging methods, a private network solution may have an undue advantage, even if full credit is given for generation contributions to network security. This issue is associated with the separate price controls for generation and demand rather than with the locational costing method. If the price control issue is addressed (e.g. by allowing distribution network operators to sell virtual private network services, where the customer acts on behalf of both a generation and load site, and to allocate the revenues from these services to either the generation or demand price controls), then there seems to be no reason why either method could not provide appropriate incentives for scenario 4.

(b) In both methods, the locational element of charges might drop to a very low level after a large lumpy investment has been made. If such a lumpy investment is foreseeable by network users then incentives may be blunted. This issue appears to be in large part inherent in the use of annual charges reset each year as a way of incentivising one-off decisions by customers.

95. Other issues and inaccuracies exist for both methods. For example, the lumpiness of particular investments or economies of scope between renewals and reinforcement could mean that the same network upgrade would take place at the same time irrespective of whether a new load connects or not. Neither the G3 method or the WPD methods seeks to capture the effects of such complications.

Possible development of the methods

96. Some of these problems highlighted above might be addressed by adjustments to the methods.

97. Capping charges from the WPD method to an estimate of the cost of the investment actually required (or the cost of a notional bypass) would address the competition law issue and the risk of inefficient bypass identified for the WPD method in scenarios 1 to 3 above. However, this would introduce significant complexity (and probably what amounts to an ad hoc negotiation for each site) in the pricing regime, and does not address the risk that customers choose sub-optimal sites to benefit from cost differences that have been overstated by the WPD calculations.

98. In the case of the G3 method, it might be possible to strengthen the locational signals provided by excluding some load from the demand integral used in the calculation. Essentially, if a large part of the load is certain and only the top slice of load is uncertain and affects reinforcement needs, then the demand integral might be modified to capture only that top slice. But it is not clear how a reliable and objective rule could be designed to define the relevant top slice of load in respect of each network element requiring reinforcement.

99. Both ideas outlined above are speculative and subject to implementation difficulties. They might be worthy of further consideration and consultation, but we cannot be certain that they would provide an appropriate solution.

100. These difficulties and the different risks associated with the development of the G3 and WPD methods underpin the conclusions stated in the first section of this paper.