## Electricity distribution structure of charges project
## Consultation on the methodology to be applied across DNOs

### Response to Ofgem document 104/08 by
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We welcome the opportunity to respond to some of the issues raised by Ofgem in its letter of 22nd July 2008. We intend to restrict our comments to the methodology that DNOs might apply from 1st April 2010 rather than express any view on the governance of the enduring arrangements, which we see as a matter for the industry. We have therefore focussed on Annexe 2 to the consultation letter, and in particular the pros and cons of the various methodologies that have been considered and are noted in tables 2, 3 and 4.

### *Introduction*

The University of Bath in conjunction with various DNOs has been at the forefront of developing the LRIC approach to distribution network charging. The approach is based on AC power flow modelling of the extant system coupled with a relatively simple economic concept that is designed to provide good signals for the efficient location of load and generation. Considerable research has been devoted to exploring the attributes and application of the approach but the methodology is still to some extent in a state of evolution. Some of the shortcomings in its early exposition have now been addressed and other issues that have been raised are under active consideration.

Our views on the features noted in tables 2 - 4 have also been cast in the context of the principles stated in the consultation paper. Ofgem has reiterated the principles of a charging methodology that were defined in the April consultation paper and we refer to these as the primary principles[1]. The 22nd July consultation letter expands on these by noting a number of more specific principles that have been developed in discussion with DNOs. We have made reference to these as the secondary principles[2].

Although the features of three EHV charging models are described in table 2 we have concentrated on the relative merits of the LRIC and FCP models. ICRP is an established approach for transmission charging and uses a similar economic idea to that used in LRIC for determining the marginal or incremental cost of serving demand or generation at each node on a network. However, because ICRP assumes that all circuits are fully utilised, an increment of load or generation will cause the addition or avoidance of an element of infinitely divisible investment. Averaging the output of LRIC and ICRP models will tend to dilute the locational message from the LRIC model that reflects the utilisation of assets. Other than noting this point we have not

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[1] The primary principles are those of:- cost reflectivity, simplicity (at point of use), transparency, predictability and facilitation of competition.

[2] The secondary principles are those of:-

1. inclusion of all relevant information;
2. symmetrical application to both demand and generation;
3. reflection of all significant cost drivers;
4. minimising distortion of price signals when adjustment is necessary to recover allowed revenue;
5. recognition of incremental costs and benefits of network use on a forward-looking basis;
6. locational charges for EHV users derived from use of power-flow modelling at the EHV level;
7. transparency and predictability so that users can estimate future charges.

chosen to comment on the prospects for ICRP as a distribution use of system charging methodology.

In principle there is no theoretical barrier to the use of the LRIC methodology at voltages below EHV. Indeed given the intrinsic symmetry of the approach in the treatment of generation and demand it would be desirable to extend the methodology to HV where smaller distributed generation might compete with larger units connected at EHV. However, the size of the data sets at this voltage may require the use of standard networks to represent different parts of a DNOs network. These developments have yet to be given any significant consideration, but if the approach is embraced at EHV then it would be desirable to extend it to lower voltages in due course to achieve the same degree of economic efficiency. In recognition of this the University of Bath has lodged a research proposal with all DNOs that would investigate adapting the LRIC methodology to HV/LV networks.

In the context of this consultation we have not considered this prospect. Instead we have concentrated on considering the scope for developing the DRM to cater for distributed generation at HV and LV as an interim arrangement.

The numbering of the paragraphs below follows the numbering in the Annexe 2 tables for ease of reference.

***Pros of EHV Charging models***

1. LRIC does not purport to recover fully the costs of future investment but to signal the economic cost or benefit of locating load or generation taking into account the utilisation of extant assets. By reflecting incremental costs and benefits it satisfies the fifth of the second set of principles noted in the consultation paper. In contrast the FPC approach is a total cost recovery method and thus fails this principle. Although listed as a "pro" in table 2 the use of a 10 year horizon in the FCP introduces the prospect of charging instability since it creates a threshold in time when future costs that had previously been ignored will be recognised.

2. All the charging methodologies reviewed in the consultation paper make use of power flow modelling of the existing system. This is a significant departure from the established distribution network methodologies and holds the prospect of a more realistic representation of the future costs of meeting increments of demand and generation.

3. Transparency is one of the primary principles. Although the FCP approach draws extensively on publicly available information both LRIC and FPC would require the publication of significant data sets and the models themselves to enable users to replicate the calculations and predict charges. The use of information that is currently in the public domain may not therefore represent much of an advantage since a much wider publication of data is likely to be required under any new approach.

4. LRIC is founded on an incremental cost approach whereas FCP would appear to be reflective of total costs. As already observed LRIC therefore meets the fifth of the secondary principles. By so doing it will tend to encourage a more economically efficient use and development of the distribution network.

5. FPC draws on actual anticipated costs to calculate charges and thus will represent all cost drivers that are seen as relevant for a particular scheme, which accords with the third principle in the second list of principles. It may, however, have a downside in that the cost drivers will be those apparent to the network planners and may not easily be discerned by users thus making the prediction of charges more difficult. The LRIC approach currently incorporates costs that reflect thermal limitations of circuits, voltage support requirements and compliance with the P2/6 security standards. The manner in which fault level costs could be incorporated is currently being researched. This point is addressed further below.

6. A key requirement of a use of system charging methodology should be to obtain symmetry between charges or credits for generation and load. Unless this is achieved then the economic worth of generation that supports the network, or load that facilitates the connection of additional generation, will be obscured. In terms of the principles this is recognised in the facilitation of competition in the primary list, and the methodology being applicable to both generation and demand in the secondary list. The LRIC approach meets these principles in that the same method is used to derive charges for load and generation. The FCP approach would appear weak in this respect since it employs different models for generation and load at the EHV level (and also at HV/LV).

7. It is suggested in the consultation that the FCP approach has wider industry support than LRIC. In fact the reverse is the case. LRIC has been implemented at the EHV level by two DSAs (WPD) but is under active development by a further five (CE and EDF). ENW are also considering it albeit as a part of a methodology that is an amalgam of LRIC and ICRP.

***Cons of EHV Charging Models***

1. It has been suggested that LRIC will lead to instability in tariff rates and make charges more difficult to predict. Compared to the FCP approach LRIC relies less on assumptions in calculating charges, but it will reflect developments in system conditions. To the extent that the system configuration changes, or the connection of large generators and point loads affect the utilisation of circuits, then the nodal charges produced by an LRIC model will vary. However, we would suggest that this is a merit of the approach in that it provides an economic signal that reflects developments in network topography. Price signals will evolve with time but future charges will be predictable if system development is closely monitored and logical assessments made of the future. By contrast the FCP model is likely to produce less stable charges since it has thresholds that are temporal (in its 10 year horizon) and in circuit utilisation (since it ignores the reinforcement of circuits where the utilisation is less than 87%). These will lead to step changes in charges as network conditions alter.

2. The response of the LRIC model when circuits are highly loaded provides a strong economic incentive. The pricing signal is most acute when the background growth rate is very low or zero. Generally we believe that this is an appropriate pricing message to display to users, although this feature has been criticised as producing excessive charges under extreme conditions, especially where system reinforcement is overdue and circuits overloaded. Under such conditions the LRIC algebra will produce a very high charge but we would suggest that it is wrong to extrapolate the algebra into such

conditions. If network reinforcement has been delayed for extraneous reasons then it would be inappropriate to visit the pricing consequence of this on the user. A possible solution is to cap the reinforcement horizon in the model at a reasonable planning horizon, say three years. This will mitigate excessive charges that might otherwise emerge. The FCP model produces weaker locational signals because the network is arbitrarily zoned before prices are derived. This also appears counter to the sixth of the secondary principles that requires charges for EHV users to vary with location.

3. We are puzzled by the suggestion that employing an annuity in deriving the LRIC prices is a weakness in the approach. Network assets are long lived and are likely to be used by many users over their lifetime. To spread the charge by way of an annuity over the economic life of the asset would appear an appropriate method of dealing with the lumpiness of network investment. The weakness in using an 87% threshold in the FCP model has already been noted.

4. At present the LRIC methodology does not incorporate fault level costs although the prospect for this is being researched. In theory it should be possible to take the same approach to deriving additional switchgear costs from increased fault levels as is used for determining additional circuit and transformer costs for thermal capacity and voltage support. It would then be possible to establish how an increment of generation or load will accelerate the reinforcement horizon for switchgear. Establishing the relationships between the growth in fault levels and the growth in demand and generation is likely to require significant further analysis. Consequently an interim approach may be necessary. The use of system charging methodology beyond April 2010 will need to be adopted in conjunction with an appropriate connection charging methodology. In the interim it may prove more effective for fault level costs to be reflected through connection charges than through the use of system methodology. The FCP model incorporates fault level costs in the use of system charges but only on a scenario basis and thus suffers from the weakness that it is a total cost rather than incremental cost methodology. By using a different model for demand and generation it also fails the charging principles concerned with creating symmetry between generation and demand.

***Pros of HV/LV demand models***

1. The DRM is a well established approach and can easily be replicated by users provided that the underlying description of the model is published. Its continued use until a suitable development of the LRIC methodology enables the methodology to be deployed at the HV level would appear a better prospect than changing to a methodology based on RRP data. If a practical charging methodology based on economic principles can be developed for load (and generation) at these voltages then switching to an approach based on RRP as an interim would introduce unnecessary disturbance in charges. Furthermore the RRP data would need to be published to gain the transparency attributes that have been accorded to it. Publication of each DNO’s DRM model would provide a similar level of transparency.

2. The DRM is a forward looking approach in that it employs a standard 500 MW network that represents the future system a DNO expects to employ. It lacks the sophistication of the LRIC approach but would appear better able to meet

the charging methodology principles than basing charges on RRP data that is historic, and thus backward looking.

***Cons of HV/LV demand models***

1. At present various forms of DRM are in use. Aligning these into a common approach, as used to be the case prior to 1990, would be a useful exercise in any event. It might also encourage commonality in the structure of DUoS tariffs, which would appeal to suppliers in that it should simplify their billing systems. Creating commonality in the DRM would seem to be a "Pro" in network charging. The weakness of relying on RRP data as mechanism to create a view of future costs has already been commented on above.

2. The DRM used by each DNO is relatively opaque but publication would aid transparency. As models they would then be likely to be far more enduring than the RRP data which can show significant volatility from year to year.

***Pros of HV/LV generation models***

1. Whilst the models that are being promoted for HV/LV connected generation recognise the contribution that appropriately sited generation can have for system security and the deferral of network costs, they do not differentiate charges with location. This would seem a particularly important aspect to address since the nature of HV networks in a DSA can show substantial variation. It will also be important for the economic development of distributed generation that there is symmetry between the generation and demand charging models such that the impact of DG on the distribution network is appropriately recognised.

2. Although the methods employed by these approaches have been described, transparency will be helped by the publication of the associated data used to derive charges.

3. An appropriate assessment of the contribution that DG makes to system security would seem a pre-requisite for deriving economic charges (or credits) for DG. The conventional treatment is to assess the contribution DG makes at system peak but it might be more appropriate to assess the contribution that the generation makes to relieving system stress whenever this occurs. Local systems could be most heavily loaded away from the system peak. For example city centres could be most heavily loaded on summer business days when air conditioning load predominates, whilst rural networks where storage heating load is prevalent could be most heavily loaded on winter nights. This opens up the prospect of time of use assessments which are not currently apparent in the models. The use of the P2/6 factors is addressed under the "Cons" below.

4. DG connected at HV and LV will be small in size which argues for charging arrangements that can be readily understood. However, this criterion is equally applicable to small loads connected at these voltages.

***Cons of HV/LV generation models***

1. The use of the P2/6 factors to provide an estimate of system support provided by different DG technologies may require further consideration. The factors are intended to reflect the energy that various technologies contribute, which

may not map directly to the support a DG technology provides to the network. These factors may be used as default estimates but as noted above the support that is credited should be linked to times of system stress rather than times of the overall system peak.

***Conclusion***

We believe that the adoption of a common methodology will enable the implementation and future development of an approach that will be enduring in the face of the profound changes that are anticipated for distribution networks. It is inevitable that there will be tensions between the various principles that have been identified for a distribution use of system charging methodology. However, it remains our view that of the methodologies that have been considered so far the LRIC approach offers the best prospects for satisfying these principles in the round, and providing a robust basis on which networks can develop economically.