September 2001

Embedded generation: price controls, incentives and connection charging

A preliminary consultation document

Executive summary

This is Ofgem's first consultation paper on embedded generation. It builds on the recommendations of the joint Embedded Generation Working Group (EGWG). The group's findings were published by DTI on 12 January 2001.

A main recommendation of the EGWG report was that Ofgem should review the structure of regulatory incentives on Distribution Network Operators (DNOs) in the light of the new statutory duty on DNOs to facilitate competition. Ofgem is committed to doing this.

The issues raised by embedded generation are far-reaching and often complex. Extensive development of embedded generation would involve, among other issues, both a new approach to the control of generation within distribution systems, with the implication that holds for operational security of supply, and a new approach to the price control of distribution companies. Work to develop embedded generation will therefore, as the EGWG recognised, extend over a long period, and involve many parties in addition to Ofgem. This document does two things: first, it describes the principles which Ofgem will apply in its work on embedded generation; second, it identifies the actions which Ofgem believes are appropriate as short term and immediate steps designed to eliminate barriers to embedded generation.

Both these are needed. All concerned with embedded generation should be aware both of the principles Ofgem will seek to apply consistently in its work on embedded generation as it extends forward; and of the particular actions Ofgem now proposes.

Ofgem's principal statutory objective is to protect the interests of consumers, wherever appropriate by promoting effective competition. Where there is scope to do so, it has been Ofgem's policy to seek appropriate market-based solutions, ensuring equitable treatment of parties, and cost-reflective pricing. In other circumstances the appropriate regulatory policy is one of controlling the exercise of monopoly power.

Where effective market arrangements can be put in place, and where participants are treated equitably, relative efficiencies, costs and benefits will determine outcomes most likely to be in the long-term interests of consumers. In considering possible transitional adjustments to incentives, and in responding to the changes in network design and operation that increased amounts of embedded generation may be expected to bring,

Ofgem will seek to apply the same principles that have guided work on access to other types of network. Key areas for consideration will be:

- network access;
- network reliability;
- appropriate recognition of costs and benefits in pricing; and
- the question of 'deep' versus 'shallow' connection charging.

Deep connection charges involve a one off, up front payment. The charges include the costs of replacing equipment associated with protecting the network or with voltage control, up to the boundary of the distribution network. Where fault levels are increased above the rating of installed equipment, the cost of replacing that equipment would be included in the charge. By contrast, shallow connection charges involve paying for the assets specifically required for the connection, usually up to the first transforming point. The remaining re-inforcement costs, if any, are regarded as general load growth. They are recovered through use of system charges.

The focus of this consultation paper is to ask whether it may be appropriate to make early changes to the regulatory framework to remove perceived barriers to the connection of greater quantities of embedded generating capacity. The paper suggests that some changes might be implemented from April 2002, which in practice is the earliest possible date. Ofgem has publicised its substantial work programme on embedded generation, which involves working closely with other interested parties, up to 2005. Further change is anticipated up to the introduction of the new distribution price control which will take effect from 1 April 2005.

Under the existing framework, DNOs are probably right to argue that there is no profit for them in connecting embedded generation. They receive no distribution use-of-system (DUoS) revenue from embedded generators, and the existing price control rewards efficient operation of the networks as presently configured and managed. There is an incentive to build network, which will form part of the regulatory asset base, rather than to connect generation. Significant amounts of embedded generation would require a move to more active management of distribution networks – at least on some circuits.

There would also need to be investment in protective equipment. The last distribution price control review did not envisage such investment.

The initial proposals set out in this consultation document are put forward to stimulate discussion of what may prove to be workable short-term changes aimed at ameliorating the position of prospective embedded generators. The specific areas for discussion are:

- a move from 'deep' to 'shallow' or 'shallower' connection charges;
- the payment of use of system charges;
- information requirements; and
- metering.

DNOs should be encouraged to move to a shallower basis of connection charges for embedded generators, recovering costs up-front only in relation to dedicated connection assets. These generator contributions would continue to be regarded as excluded service revenue for DNOs.Ofgem considers there to be a need for increased certainty and transparency in the negotiation of connection charges for embedded generation. While regulatory intervention should be kept to a minimum, a right of appeal to Ofgem will remain an important safeguard, both in terms of redressing inequality of bargaining position and in ensuring that, as nearly as possible, efficient and economic outcomes are achieved.

The preparation of Condition 4 Statements under the new distribution licences, which require DNOs to publish the basis of their charges for DUoS and connection to their system, presents an opportunity to increase transparency, and to make it easier than it has hitherto been to challenge connection quotations.

Simple, standard connection procedures and charges should be put in place for micro-generation and domestic combined heat and power (DCHP) connections.

Generator DUoS charges could be used to recover the 'deeper' reinforcement costs arising from the connection of embedded generation. Some form of 'with-without test' might be used as a basis for varying generator DUoS charges to acknowledge the positive or negative effects of connection to a particular part of the network.

Ofgem would presently envisage a relatively simple generator DUoS charge. Such an interim mechanism would be unlikely to survive the next distribution price control review and the review of distribution charge structures unchanged. Charging practice might be expected to evolve further, as understanding of the effects of embedded generation improves.

It seems unlikely that metering technology presently constitutes a particular problem for the development of embedded generation. Ofgem takes the view that customer interests will be best protected by import/export metering for embedded generation, including micro-generation and DCHP installations.

These proposals constitute a draft for discussion. They represent an early step in an important dialogue about the future of embedded generation. Achieving the right regulatory framework for embedded generation is an important priority for the future.

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1. Introduction

Purpose of this document

1.1 Embedded generation is generating plant connected to a local distribution system rather than to a high voltage transmission system. In England and Wales embedded generation is therefore connected at 132kV or below. In Scotland 132kV is a transmission voltage, and embedded generation is that which is connected at lower voltages. Most embedded generation consists of renewable or combined heat and power (CHP or 'co-generation') generators located on industrial sites, but other types of generating plant may also be embedded in distribution networks, including in the future micro-generation and Domestic Combined Heat and Power (DCHP) technology.

1.2 This is Ofgem's first consultation paper on embedded generation. It builds on the recommendations of the joint Embedded Generation Working Group (EGWG). The group's findings were published by DTI on 12 January 2001[1]. Ofgem gave its initial response to the EGWG report on 6 April 2001, and published its outline work programme on 31 July. These documents[2] set out Ofgem's commitment to taking forward the issues raised by EGWG.

1.3 This document deals primarily with distribution network issues, although it sets out some initial thoughts that begin to address some questions that will become increasingly important in terms of non-discriminatory generator access. There may also be implications for the way in which transmission networks are operated.

1.4 The focus of this consultation paper is to ask whether it may be appropriate to change the regulatory framework to remove perceived barriers to the connection of greater quantities of embedded generating capacity. One of the key areas will therefore be to examine connection policies. It may then be possible to identify changes that could be implemented over a transitional period, before the next distribution price control review. The paper suggests that some changes could

[1] The EGWG document may be found on the DTI's website at www.dti.gov.uk/energy/egwg/index.htm
[2] Both documents are available on the Ofgem website at www.ofgem.gov.uk

be implemented from April 2002. The new distribution price control will take effect from 1 April 2005.

Background

1.5 In recent decades Great Britain has relied almost exclusively on electricity generated by large power stations (e.g. the large coal stations constructed in the 1960s and the major nuclear stations) connected directly at 132kV and above. The distribution networks have been designed and operated to facilitate the transfer of energy from connections to the transmission system (Grid Supply Points – GSPs) to end users. In fixing price controls, setting licence obligations and monitoring system performance, electricity regulation has sought to ensure that networks are operated in an efficient, economic and cost-effective manner. Regulatory obligations are therefore closely linked to the current operating model for each type of business. Since, moreover, the aggregate capacity of embedded generators has been relatively small, their influence has not hitherto been great.

1.6 Ofgem's December 2000 consultation paper on the structure of electricity distribution charges[3] gave the following data for the output of non-centrally-despatched embedded generation, connected in Great Britain (as at 31 March 2000):

Connection voltage	No. of generators connected	Volume of exports (GWh)
132kV	18	1800
66kV	13	1200
33kV	123	3400
22kV	3	0
11kV	785	3300
6kV	2	0
LV	508	200
Total	1452	9900

1.7 The total capacity of larger embedded generating stations (i.e. having an installed capacity of 5MW or greater) in England and Wales has increased in recent years.

[3] 'The Structure of Electricity Distribution charges – Initial consultation Paper' Ofgem, December 2000.

Year	Embedded generation (E&W - GW)	Total generating capacity (E&W - GW)	Percentage
1997	3.23	60.97	5.3%
1998	3.33	62.39	5.3%
1999	3.63	63.84	5.7%
2000	4.44	66.69	6.7%
2001	4.75	68.15	7.0%

1.8 The following factors have contributed to the present consideration of embedded generation:

- growing competition in the electricity generating market, including from new entrants;
- the Government's environmental targets, reflecting obligations under the Kyoto Agreement, to achieve 10 GW of CHP by 2010 and to generate 10% of electricity from renewable sources by the same date;
- the new obligation that the Utilities Act 2000 placed on distribution network operators (DNOs) to facilitate competition (formerly, only transmission operators had been under such an obligation);
- pressures for increased network reliability, at reduced cost to customers;
- Ofgem's work on the Environmental Action Plan, in response to the Government's draft guidance on social and environmental matters;
- perceived environmental as well as economic benefits of locating generation close to demand; and
- the desire to secure cost savings by avoiding transmission charges.

1.9 Several existing and prospective embedded generators suggest that they are at a relative disadvantage compared with those connected to transmission systems. The EGWG report notes that there is presently no financial incentive on DNOs to connect embedded generation. They also suggest that the structure of distributors' connection charge policies constitute a barrier to entry.

1.10 It is for consideration whether the existing incentive arrangements are unduly distorted against embedded generation. It will be necessary to consider what modifications to these arrangements may be both desirable and practicable, both in the shorter and longer terms, to reflect the contribution of embedded generation.

1.11 A generator seeking connection to the transmission network would expect to pay only 'shallow' connection charges relating to costs of providing, operating and maintaining the assets necessary to facilitate connection. Costs of deeper reinforcement would be met from general transmission use of system (TUoS) revenues. Those connecting as embedded generators presently face the full, up-front costs of connection to the distribution network, although they pay no ongoing use of system charges. It is for discussion whether this difference in treatment is justifiable and whether the levying of 'deep' connection charges might constitute an inappropriate barrier to entry for embedded generators.

Rationale

1.12 The main recommendations of the EGWG report were that:

- Ofgem should review the structure of regulatory incentives on Distribution Network Operators (DNOs) in the light of the new statutory duty on DNOs to facilitate competition[4]; and that
- a group should be established under Government leadership to co-ordinate and take forward the implementation of EGWG's recommendations for the longer term.

1.13 This paper represents the beginning of a wider review of regulatory incentives on distribution network operators. DTI and Ofgem issued a statement about the establishment and terms of reference of the proposed co-ordinating group on 31 July 2001.

1.14 Generators connected to the transmission system pay TUoS charges: they are a source of revenue to the transmission network operator. Embedded generators do not currently pay distribution use of system (DUoS) charges. Some have

[4] Section 9 of the Electricity Act 1989, as modified by section 50 of the Utilities Act 2000.

suggested that, as embedded generators are not a source of revenue to DNOs, there is no incentive to connect them to the networks. On the other hand, the transmission operator is exposed to an uncertain return on assets, while DNOs have a guaranteed return that may be interpreted as a greater incentive.

1.15 The likely effect of exposure to imbalance charges under the new electricity trading arrangements (NETA) has been a matter of concern to some embedded generators. Ofgem has reviewed the effect of NETA arrangements on small generators, and published its report to DTI on 31 August 2001. DTI will consider whether any changes might be desirable. The issue will not be considered further in this paper.

1.16 Ofgem's principal statutory objective is to protect the interests of consumers, wherever appropriate by promoting effective competition. Increased embedded generation may bring benefits in terms of the reliability and security of supply, and, in the longer term, reduce the price of electricity. On the other hand, it is possible that it could reduce reliability and increase costs. Ofgem's principal objective suggests a thorough review of the implications of embedded generation for electricity consumers.

1.17 The Government's draft guidance on social and environmental matters in relation to electricity (made under section 14 of the Utilities Act 2000) specifically asks Ofgem, taking account of its duty to encourage competition in generation, to have regard to the desirability of:

- removing barriers to embedded generation;
- access to the network on fair and transparent terms for embedded generation, including fair recompense for the benefits afforded to the network, through providing system security, deferring the need for system reinforcement, or otherwise;
- distribution systems that are capable of accommodating the likely growth in embedded generation, having regard in particular to the Government's targets for renewable generation, and for CHP;

- arranging charging regimes for the connection of embedded generation on fair and transparent terms; and

- easy availability, within the public domain, of information relevant to prospective generators' decisions, including clear and transparent rules governing the connection of generation to the distribution networks[5].

1.18 Ofgem also has a statutory duty to carry out its functions under the Electricity Act 1989 in a manner that it considers is best calculated to secure a diverse and viable long-term energy supply[6]. Requirements of diversity and viability suggest work on ensuring:

- that network investment does not create bias in the development of particular generating technologies;

- non-discriminatory generator access to networks; and

- the removal of monopolistic restrictions.

1.19 There may be a need to make modifications to the regulatory framework, although it may not be desirable to make changes to price controls until the next review. There would, however, seem to be a case for considering some transitional steps.

1.20 In terms of incentives and pricing, this consultation will consider:

- whether the overall regulatory framework ensures that embedded generation is treated equitably both in terms of reflecting the costs and benefits imposed on the system and also in terms of the environmental benefits of embedded generation;

- the implications of growth of embedded generation for distribution company costs, charges and incentives;

- whether it is appropriate to implement transitional measures to modify the regulatory framework and whether it might be appropriate to defer measures

[5] Ofgem is consulting separately on the Long Term Development Statements that will be required by Condition 25 of the Distribution Licence.
[6] Electricity Act 1989, sub-section 3A(5)(c) as substituted by section 13 of the Utilities Act 2000.

until the price control review (it would also be necessary to consider the processes to effect and manage any changes); and

- whether the possibility of domestic and other micro-scale generation raises any additional social, environmental and technical issues.

1.21 It is not yet clear what the ultimate degree of penetration of embedded generation will be. The EGWG report suggested that, while initial new connections might be accommodated with relatively little change to the existing configuration and operation of distribution networks, additional connections might, over time, necessitate the installation of significant amounts of new network infrastructure, together with a move to more active network management. The regulatory framework should be capable of allowing for a range of market-driven outcomes, and of responding to changes to the DNOs' cost structures.

Guiding principles: Introduction

1.22 The issues surrounding the connection of increased amounts of embedded generation to electricity distribution systems cannot be considered in isolation. Some of these issues are closely related to those arising in respect of connections to high voltage electricity transmission systems. Similar questions have arisen in considering access to gas transportation networks. Although this is a preliminary consultation, exploring the possibility of transitional changes to incentives for the connection of embedded generation, Ofgem considers it important that common principles are recognised – and applied where possible.

1.23 Ofgem's principal statutory objective is to protect the interests of consumers, wherever appropriate by promoting effective competition. Where there is scope to do so, it has been Ofgem's policy to seek appropriate market-based solutions, ensuring equitable treatment of parties, and cost-reflective pricing. In other circumstances the appropriate regulatory policy is one of controlling the exercise of monopoly power.

1.24 Where effective market arrangements can be put in place, and where participants are treated equitably, relative efficiencies, costs and benefits will determine outcomes most likely to be in the long-term interests of consumers. In

considering possible transitional adjustments to incentives, and in responding to the changes in network design and operation that increased amounts of embedded generation may be expected to bring, Ofgem will seek to apply the same principles that have guided work on access to other types of network. Key areas for consideration will be:

- network access;
- appropriate recognition of costs and benefits in pricing;
- the question of 'deep' versus 'shallow' connection charging; and
- network reliability.

Guiding principles: Network access

1.25 In considering access to electricity transmission networks, Ofgem's policy has been the introduction of a market in firm access rights, based on proper reflection of the underlying physical characteristics of the transmission network, and of the temporal and spatial nature of transmission constraints. There are attractions in allocation of firm entry and exit access rights, in a non-discriminatory way, through an auction. It will be desirable as regards for there to be consistency with Ofgem's policy on competition in connections to distribution systems. Work on the Standard Licence Condition 25 Long Term Development Statements is also of relevance to prospective embedded generators, who will require technical information from DNOs. Ofgem has consulted separately on these statements[7].

1.26 In time, the increased connection of embedded generation may amount to significant new generating capacity. This could lead to changes in the design and operation of distribution networks. They may develop characteristics currently associated with transmission, including more active management, and the need to allocate existing network capacity between competing generation connections. Potentially, the issues are the same as for transmission access.

[7] 'Proposed Electricity Distribution Licence Condition 25 – Form of Long Term Development Statement – Consultation Paper', Ofgem, 4 June 2001.

1.27 At present, however, the design and operation of distribution networks mean that a mechanism for DNOs to pay compensation to generators with non-interruptible connections would not be feasible. Capacity constraints on distribution networks are not yet generally such as to constitute a problem for potential embedded generators. Ofgem will, however, continue to monitor the situation, taking such action as becomes necessary to ensure equity of treatment for all interested parties.

1.28 Ofgem will be consulting separately on connection and charging policy for new generation connecting to the transmission system in the North of Scotland. Some issues are common to the two consultations, including the question of 'deep' or 'shallow' connection charging and issues of network access. However, the configuration of networks in the North of Scotland, the pattern of network constraints, and the relative balance of generation and demand connections are not typical. Moreover, the structure of the Scottish electricity industry and its arrangements for joint management of distribution and transmission networks make the situation prevailing there somewhat different from circumstances elsewhere in Great Britain.

1.29 Another aspect of access to networks is that of planning permission. The planning process has delayed many renewable generation projects beyond the timetables originally envisaged for them. This, however, is a local authority matter and not a responsibility of Ofgem.

Guiding principles: 'Deep' v. 'shallow' connection charging

1.30 Up-front charges for connection to transmission networks (in England and Wales) and to gas transportation networks are 'shallow' or 'shallowish', in that they recover the costs only of local reinforcement. In principle, Ofgem considers that connection charges for embedded generators should also be 'shallow', unless there are genuine, practical reasons indicating the contrary.

1.31 Treating transmission and distribution connections in the same way would tend to reduce perverse incentives for marginal generators choosing between connection above or below the transmission/distribution boundary. This consultation seeks views on whether it may be possible to move towards

shallower connection charging, as an interim measure. The issue will, however, need to be looked at again as part of the next distribution price control review.

Guiding principles: Embedded costs and benefits

1.32 The removal of perverse incentives to connect either to transmission or distribution networks also suggests the proper recognition, in pricing mechanisms, of the connection of generation at a particular point on the network. The question of embedded costs and benefits, in the context of NETA, was discussed in Ofgem's report to the DTI, published on 31 August 2001.

1.33 In considering the incentives for the connection of embedded generation, Ofgem will be concerned to ensure consistency with work already done in the NETA context. The term 'embedded benefits' is used to refer collectively to a group of different trading rules that reflect the specific circumstances of embedded generators, as compared to those generators having transmission connections. Essentially they are rules that would apply to generation netted-off against local demand rather than traded on the transmission system. These embedded benefits include the avoidance of transmission losses, avoidance of NGC generation charges and the ability to reduce the NGC supply charges to the local supplier.

Guiding principles: Network reliability

1.34 Maintaining and improving network reliability is a key element in protecting the interests of customers. It requires a stable commercial framework for generator connections and consistency with signals produced by, for example, Ofgem's Information and Incentives Project (IIP). Embedded generation technologies suited to connection at lower voltages could help to improve network security. In other circumstances, replacing investment in a relatively reliable network with investment in generating plant that may be less reliable could constitute a disbenefit.

1.35 Ofgem considers it essential to develop the regulatory framework, in response to increasing connection of embedded generation, in a manner consistent with existing policy on the distribution price controls, the structure of distribution

charges and the incentives for improvements in service to consumers envisaged in the IIP.

Guiding principles: Distribution monopolies

1.36 As there is currently no major extension of distribution systems in Great Britain, DNOs are effectively local monopolies. Not having access to competition for distribution services, customers require regulatory protection against the exercise of monopoly power. Those seeking demand and generation connections do not have the advantages of information and knowledge of network conditions enjoyed by DNOs: they cannot deal with them on an equal footing. Moreover, a holding company with a distribution subsidiary is also likely to have subsidiaries with generation interests. There is a danger that DNOs may, in the absence of effective regulatory controls, favour the generation of associated undertakings over other prospective embedded generators.

1.37 The right to appeal to Ofgem for determination of disputes constitutes an effective check on the monopoly power of DNOs. Ofgem will also ensure that DNOs do not seek to distort access to networks by competing generators. Depending on the circumstances, it may be appropriate to enforce compliance with conditions in the new electricity distribution licence or to exercise Ofgem's powers under competition legislation.

Guiding principles: The longer term

1.38 The principles set out here, together with their associated workstreams, will shape the development of the regulatory framework for distribution networks and embedded over the coming years. The present consultation takes place early on the path to completion of much this work. Ofgem intends, however, that any transitional changes to incentives flowing from this consultation should, as far as possible, be consistent with the broad strategic direction that Ofgem has identified.

Structure of document

1.39 Chapter 2 of this document looks at the present commercial and regulatory framework. Chapter 3 compares distribution and transmission systems, from the

viewpoint of embedded generation. Chapter 4 considers the incentive framework in distribution. Chapter 5 introduces connection and use of system issues. Metering issues are discussed in Chapter 6. Chapter 7 looks at some relevant secondary issues. Chapter 8 sets out Ofgem's initial proposals, for discussion. Finally, Chapter 9 suggests issues which might best be dealt with outside the timescales of this consultation. Appendix 1 sets out a proposed licence modification that would be required to implement the Ofgem proposal in Chapter 8. Appendix 2 looks in more depth at Condition 4 Statements. At the end of the document there is a short glossary.

Timetable

1.40 In the short term, requesting responses to this consultation by mid November would allow publication of a decision document in late December. That would, if DNOs agree, allow sufficient time for implementation of appropriate changes for April 2002. On that timetable, any revised incentive arrangements would be operative in 2002/3 and 2003/4,.

1.41 During the period July 2001 to January 2002, we plan to participate in work on:

- consideration of changes that might usefully be made to Engineering Recommendation P2/5[8];
- network design issues relevant to increased levels of embedded generation;
- information requirements of DNOs and potential embedded generators (concurrently with related work on Long Term Development Statements);
- understanding the concerns of existing embedded generators about possible changes to connection and distribution charging mechanisms; and
- considering the implications of domestic and micro-generation.

[8] In order to meet consumer demand, DNOs are obliged to develop their networks in accordance with the security requirements of Engineering Recommendation P2/5.

1.42 The deadline for responses to this consultation is Friday 16 November 2001. Responses should be sent to:

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1.43 Should you have any questions regarding this document, Arthur Cooke on 020-7901-7297 or Steve McBurney on 020-7901-7371 would be pleased to assist you.

Confidentiality

1.44 In accordance with our normal practice, we intend to make responses to this consultation publicly available, through the Ofgem Library. However, if asked to do so, we shall respect the confidentiality of any response. Respondents wishing their responses to remain confidential should clearly mark the documents to that effect.

2. The present commercial and regulatory framework

The present arrangements

2.1 A main recommendation of the EGWG Report was that Ofgem should review the structure of regulatory incentives on DNOs, in the light of the new statutory duty placed on them to facilitate competition. These regulatory incentives relate primarily to the distribution price control and to the policies that have developed for charging for new connections to distribution networks. This chapter sets out the present arrangements.

Connection charging: Introduction

2.2 Embedded generators, unlike demand customers and unlike generators wishing to connect to the transmission system, pay 'deep' connection charges, but no UoS charges. The EGWG paper on charging principles notes that the key concern in respect of charging for embedded generation is to ensure that DNOs receive appropriate remuneration for embedded generation, while at the same time removing barriers inherent in the existing charging mechanism. In essence, this is a question of achieving an appropriate balance in the proportion of distribution costs recovered from up-front connection charges and UoS charges.

Legal basis for connection charges

2.3 DNOs have a statutory duty[9] to make a connection when requested to do so by the owner or occupier or premises (or by an authorised supplier acting on behalf of the owner or occupier) for the purposes of enabling electricity to be conveyed to or from the premises. There is a complementary statutory right[10] to recover the expenditure reasonably incurred in making a connection. Any dispute as to the terms of connection where a special agreement is not entered into may be referred to Ofgem for determination.

[9] Electricity Act 1989, section 16 as substituted by section 44 of the Utilities Act 2000.
[10] Electricity Act 1989, section 19, as amended by section 46 of the Utilities Act 2000.

2.4 Standard Condition 4 – 4C of the distribution licence governs:

- the preparation of statements setting out the basis of connection charges and use of system charges;
- non-discrimination in connection charging;
- the requirement to offer terms for connection; and
- Ofgem's role in determining disputes in respect of such offers.

The last two points will normally be relevant for prospective embedded generators. Ofgem can enforce compliance with DNOs' licence obligations.

Connection charges and the role of regulation

2.5 EGWG's paper on charging principles recommended that Ofgem should, in conjunction with key parties, undertake detailed analysis on the options for connection charging. Acknowledging that the issues are complex, and inter-related with other considerations, the EGWG paper suggested that it would be important to assess the impact of the different options on interested parties and on Government policy, both in the short term (within five years) and in the longer term (beyond five years). This paper sets that process in motion, with particular emphasis on the short term.

2.6 Ofgem considers that regulation should not, in general, interfere with the negotiation of commercial arrangements. In those instances, however, in which negotiation would not achieve an efficient and economic outcome, regulatory mechanisms may be useful in redressing the balance. Used judiciously, regulatory intervention could help to ensure fair treatment of prospective embedded generators, without imposing undue costs or increasing perceived regulatory risk.

2.7 In this context, an important regulatory power is that of determination of disputes about the terms of network connections[11]. While the power to

[11] Under section 23 of the Electriicty Act 1989, as amended by paragraph 26 in Schedule 6 to the Utilities Act 2000.

determine a dispute relates only to the parties and subject matter of that dispute, determinations can be a useful way of clarifying the interpretation of relevant provisions, and of promulgating regulatory policy.

DUoS charges: Introduction

2.8 Because embedded generators cover all the costs of connection in one, up-front, 'deep' connection charge, they have not been required to pay DUoS charges. However, there is nothing to prevent DNOs from levying DUoS charges on embedded generators. Costs of connection that are not recovered through up-front connection charges could be recovered through some form of DUoS charge. It would be for the next distribution price control review and the review of distribution charge structures to consider the structure of any generator DUoS charge in the longer term.

Legal basis for DUoS charges

2.9 DNOs will be able to levy UoS charges on parties connected to their networks. There is no statutory distinction between demand and generation connections[12]. Where both the initial and ongoing costs associated with the connection have not been recovered through up-front, 'deep' connection charges DNOs can levy UoS charges. Where there is a 'special agreement' agreement for connection, DUoS charges will be covered by the agreement between the DNO and the connected party[13].

2.10 Standard condition 4 - 4C of the distribution licence governs:

- the preparation of statements setting out the basis of UoS charging;
- non-discrimination in UoS charging;
- the requirement to offer terms for UoS; and
- Ofgem's role in determining disputes.

[12] Electricity Act 1989, section 16 as substituted by section 44 of the Utilities Act 2000.
[13] Electricity Act 1989, section 22, as substitiuted by section 49 of the Utilities Act 2000.

Ofgem has the power to enforce compliance with obligations imposed by conditions in DNOs' licences.

DUoS charges and the role of regulation

2.11 DUoS charges paid by demand customers form part of allowed revenue under the distribution price control. In other words, they are capped by the price control formula set out in the distribution licence. An exception is DUoS charges paid by EHV customers, which are excluded service revenue, outside the price control.

2.12 Ofgem periodically reviews the distribution price controls. Balancing the desirability of allowing DNOs a period of stability during which to manage the businesses under a known control with the uncertainties of long-term forecasting has meant that distribution price controls have generally lasted for about five years. The current distribution price control expires at the end of March 2005. Ofgem would normally expect begin the next price control review in 2003. Ofgem can propose, but not impose, the licence modifications necessary to amend the price control. Should a DNO refuse to accept a proposed price control modification, it is open to Ofgem to refer the matter to the Competition Commission for formal determination.

2.13 The price control condition in the DNOs' licences empowers Ofgem to secure the information necessary to conduct a price control review. This covers information about both price-controlled and excluded service revenue.

2.14 Ofgem approves the form of the DNOs' Condition 4 Statements, but cannot prescribe in detail what their content should be. That is a matter for the DNOs.

3. Distribution in comparison with transmission

Introduction

3.1 Although some have suggested that prospective embedded generators are at a relative disadvantage in having to pay 'deep' connection charges, it has not been conclusively proved that this is the case. On the face of it, the one-off, 'up-front' connection charge paid by embedded generators looks more likely to constitute a deterrent than do 'shallow charges' and on-going UoS payments. However, to compare transmission and distribution networks is hardly to compare like with like. It is not self-evident that the connection policies of the two types of network operator should necessarily be the same.

System design and operation

3.2 Transmission networks have been designed and developed to accept generation connections[14]. Distribution networks, in contrast, are frequently radial and 'tapered'. They are designed to meet minimum voltage requirements for customers at the end of circuits furthest from substations, but will frequently lack the capacity to export significant amounts of distally- connected embedded generation.

3.3 Transmission systems are actively managed, having the appropriate control systems in place. Few distribution systems have anything that could be described as active management. There are no control or monitoring systems at low voltage, where it now seems that micro-generation and domestic combined heat and power (DCHP) installations may be connected in significant numbers. Connection of additional embedded generation may require DNOs to make up-front investment that should, arguably, be reflected in up-front charges.

3.4 It may prove difficult for DNOs accurately to attribute the reinforcement costs associated with micro-generation and CHP. Although this is not a problem faced by transmission operators, it may indicate that shallower charges for embedded generation connections could be appropriate. The 'deeper' costs of

[14] There are, exceptionally, derogations relating to transmission-connected generators who have accepted connections that do not meet security standards and who agree contractually to be constrained off, on occasion.

reinforcement could then be spread over all demand customers or, if such connections were treated as excluded services, over all embedded generation connections.

Connection requirements

3.5 It is not necessarily true that generators seeking transmission connections enjoy any real advantage. Transmission connections are made in accordance with strict standards. The generator is required to pay a security deposit, and would expect to be liable for termination payments. The requirements of distribution connection are such that the prospective embedded generator can choose between quality and cost of connection, while not being subject to a deposit of termination payment.

3.6 Distribution connections may also allow more scope for choice in respect of access to higher voltage networks, including (for higher voltage connections) access to the transmission network. Prospective embedded generators will often have the option of negotiating lower connection charges by accepting non-firm connection and the possibility of being constrained off for restricted periods.

Costs, benefits and incentives

3.7 Because of differences in approach to network design, generation connections will impact very differently on transmission and distribution circuits, for example in respect of electrical losses and reliability. Differing costs and benefits might imply that differing connection charging policies could be appropriate.

3.8 This sort of consideration also raises the question, not so far explored in any detail, as to whether, for distribution networks, 'deep' connection charging policies may be more economic than the 'shallower' option.

3.9 In the light of comparisons of this sort, it is for discussion whether transmission network operators currently have, in reality, a significantly greater incentive to connect generation than do DNOs. While this is a debate that is unlikely to be resolved within the timescales specified in this paper, it should be kept in mind when other issues are considered.

4. The incentive framework in distribution

Introduction

4.1 In the longer term it will be important to consider whether the existing framework of incentives in distribution businesses, embedded generators, customers and suppliers:

- reflect the different costs and benefits that embedded generators might impose in distribution systems;
- facilitate effective competition in the generation of electricity.

4.2 It is important to be clear as to whether the present relatively low level of embedded generation connections is wholly or in part attributable to disincentives in the price control and connection charging regime or to some other cause. It would not be appropriate to introduce changes in the regulatory framework to offset extraneous influences, such as increased gas prices, however strongly these may be perceived to cause problems for embedded generation.

The price control regime

4.3 In the current framework, DNOs are probably right to argue that there is no profit for them in connecting embedded generation. There is no DUoS revenue from embedded generators, and the existing price control rewards efficient operation of the networks as presently configured and managed. On the other hand, deep connection charging means that income is not at risk.

4.4 There is an incentive to build network, which will form part of the regulatory asset base, rather than to connect generation. Significant amounts of embedded generation would require a move to more active management of distribution networks – at least on some circuits. There would also need to be investment in protective equipment. The last distribution price control review did not envisage such investment.

Technical considerations

4.5 DNOs can argue that existing and planned technical requirements act as disincentives to the connection of embedded generation. While embedded generation could, in some circumstances, be used as a substitute for network reinforcement and could enhance reliability, DNOs are required, by their licences, to design networks in accordance with Engineering Recommendation P2/5[15]. Reliance on embedded generation rather than on network reinforcement could breach P2/5. The possible value of embedded generation (e.g. in terms of reduced losses) is not reflected. In the longer term, it might be possible to review P2/5. Ofgem will be discussing the possibilities with other interested parties.

4.6 Ofgem's Information and Incentives Project (IIP) aims to improve the reliability of distribution networks, setting network performance standards linked to the price control. The IIP standards cover:

- monitoring and measuring quality of supply and network performance;
- telephone response (this is separated into the speed of telephone response via measurement and customer views of how their call was handled via a survey);
- number of supply interruptions per 100 connected customers (CI's); and
- number of minutes lost per connected customer (CML's).

4.7 While the increased connection of embedded generation would not necessarily conflict with the achievement of IIP standards of performance, substituting embedded generation for network investment might constitute a threat in that an individual section of overhead or underground network is likely to be more reliable than a single embedded generator. In the long term, if distribution systems settle to revised configurations and operating methods, more reliant on widespread embedded generation (perhaps in conjunction with developing energy storage technology), such a problem may be less acute. For the moment, however, Ofgem notes that meeting IIP requirements will be a major concern for DNOs when considering embedded generation.

[15] In order to meet consumer demand, DNOs are obliged to develop their networks in accordance with the security requirements of Engineering Recommendation P2/5.

Structural factors

4.8 In some countries, governments have created additional incentives for the connection of embedded generation. In the Netherlands, for instance, CHP capacity grew from 3,000 MW at the end of 1993 to 7,000 MW by the end of 1997. This seems to have been achieved through the creation of an investment subsidy, a special gas tariff and a compulsory tariff applicable to purchase of exports from CHP plants. Great Britain has not hitherto adopted incentive mechanisms on this scale, although it is possible for good-quality CHP plants to secure exemption from Climate Change Levy (CCL). Such incentives would be for the Government, rather than for Ofgem. They are not considered further in this paper.

5. Connection and use of system charging

Principles for connection charging

5.1 The policy for connection charging is for the individual DNOs to set, subject to the licence requirement for Ofgem's approval of the form of the Condition 4 statements.

5.2 Ofgem considers that connection charges for embedded generators, as for other parties seeking connection, should be efficient, equitable and comprehensible.

5.3 Charges should be efficient in that they give appropriate cost signals to prospective generators. If charges do not reflect costs, they may lead to connections at inappropriate points on the network. In the longer term, this could result in further investment for reinforcement that could have been used more efficiently elsewhere.

5.4 Connection charges should be equitable in that they do not create cross-subsidies between customer groups and do not recover network costs (such as general reinforcement, betterment or asset-replacement costs) that should properly be met from that part of DUoS revenue that is price-controlled. In this context the comparability of transmission and distribution connection charging is relevant, in that the combined effect should not be skewed in favour of either embedded or non-embedded schemes. Consideration should also be given to equity as between generation customers and load customers. These complex issues of perceived discrimination will have to be considered in the light of Ofgem's statutory duties under the Electricity Act 1989.

5.5 Ofgem appreciates that, as with connection schemes for EHV load customers, the calculation of connection charges for large, one-off embedded generation schemes may be complex. The policy and methodology for calculation should however be transparent. For small embedded schemes, and particularly for micro-generation installations, charges should be readily comprehensible to the layman.

5.6 **Comments are invited as to the principles that should properly underlie connection charges for embedded generation. Are those set out above**

appropriate? Do they constitute a consistent basis for construction of a charging policy? Is there anything that they fail to capture?

Current practice

5.7 Load customers connecting to distribution systems currently pay relatively 'shallow' connection charges. That is to say that they pay for the assets specifically required for the connection, usually up to the first transforming point. The remaining reinforcement costs, if any, are regarded as general load growth and are recovered from the generality of demand customers through DUoS charges. Embedded generation connections are currently charged the full cost of work arising from the connection, up to the boundary of the distribution network (at the local Grid Supply Point (GSP)).

5.8 Deep charges for embedded generators include the costs of replacing equipment associated with protecting the network or with voltage control. Where the generator would increase fault levels above the rating of installed equipment, the cost of replacing that equipment would be included in deep connection charges.

5.9 DNOs have a considerable degree of discretion about charging policies. What is described here is the generally current, but not the necessary, practice.

Generation and demand

5.10 While considering whether different treatment of demand and generation connections to distribution networks is equitable or desirable, it might be worth considering the extent to which the two categories are, or are likely to remain, distinct. With more connection of CHP installations, DNOs are increasingly being required to provide standby services. Considerations of network capacity and DUoS pricing for such services may not be dissimilar to those associated with low load factor demand customers. On this view, the case for applying different policies in respect generation and demand connections may be weakened.

5.11 EGWG foresaw that an increase in micro-generation and DCHP could mean that there would be times when there would be no net power flow on parts of the

system, and that it would perform a balancing rather than a universally power-delivery role. While some of these changes in network services may begin to manifest during the period that is the prime focus of this consultation paper, the blurring of the distinction between demand and generation connections is likely to be gradual. Nevertheless, it would be sensible to bear possible future developments in mind when considering what interim changes might be put in place for the period to April 2005. It might be helpful to opt for arrangements that are likely to prefigure, and to a degree to test, those that may be appropriate in the longer term.

5.12 There will, of course, always be some factors distinguishing generation from demand. An example is the ability of generators to energise the distribution network. However, there remains a question of the extent to which such factors should modify a common approach to connection issues rather than prompting radically different treatment of the two sorts of connection.

5.13 **Ofgem would be interested to hear views on the degree to which generation and load connections remain truly distinct as regards the majority of network services. Is the present situation likely to change, and how might it do so?**

'Deep' versus 'shallow' connection charging

5.14 EGWG's paper on charging principles reviews five options for dealing with the 'depth' of connection charging. This paper considers, and seeks views on, these options. However, it might be helpful to start with a more straightforward examination of the simple distinction between the 'deep' and 'shallow' principles.

5.15 EGWG have suggested that the significant up-front cost of 'deep' connection charging may constitute a barrier to market entry. That seems to be a reasonable hypothesis, but it can be difficult reliably to identify barriers in markets. Embedded generation could vary across a spectrum from a 1kW DCHP installation to a 100MW plant. 'Deep' connection charging may be a deterrent to some sizes of embedded generator but not to others. It seems desirable at least to attempt to test the hypothesis. Ofgem would find it helpful to receive evidence of instances in which this has, or has not, been the case. We shall respect the confidentiality of documents whenever requested to do so.

5.16 **Ofgem is interested to receive evidence as to the degree to which 'deep' connection charging may constitute a barrier to entry to the embedded generation market.**

5.17 Advantages of well-defined 'deep' connection charging may be that they:

- contribute to the low-risk status of distribution businesses;
- avoid structuring DUoS charges for generators;
- avoid the stranded costs that can arise if a generator ceases to generate (although termination payments could achieve the same end); and
- that they give an unequivocal locational signal.

5.18 It has been suggested that 'deep' connection charges do not satisfy the legal requirements on DNOs to:

- facilitate competition in the supply and generation of electricity[16];
- develop and maintain an efficient, co-ordinated and economical system of electricity distribution;
- avoid discrimination between persons or classes of person in carrying out works for proposed connection to the system[17]; and
- avoid setting connection charges that restrict, distort or prevent competition in generation[18];

5.19 Other possible disadvantages of 'deep' connection charges are that they:

- may require the generator to pay for more additional capacity than he requires;
- may charge the embedded generation a higher proportion of consequential asset replacement costs than is equitable (e.g. full cost of circuit breaker upgrading where the new embedded generator's marginal contribution to

[16] Section 9 of the Electricity Act 1989, as substituted by section 50 of the Utilities Act 2000.
[17] Distribution Licence Condition 4A, paragraph 1.
[18] Distribution Licence Condition 4A, paragraph 4.

fault level represents only a small proportion of the continuing contribution from other sources);

- fail to accord prospective embedded generators network access on terms analogous with those available to the transmission-connected generators with whom they would compete;

- exacerbate the issue of second-comers' 'piggy-backing' on the network paid for by the original contributor; and that they

- tend to weaken the incentive on DNOs to develop efficient network price structures.

5.20 However, transmission connection arrangements are, as a result of obligations on security standards, somewhat more stringent than are distribution connections. It could be argued that embedded generators, being able to seek access on less stringent terms, might obtain the relative advantage of low cost secure connections.

5.21 The suggestion that 'deep' connection charges provide unequivocal locational signals merits further discussion. It is not clear that they are necessarily the most effective way to incentivise network investment. In certain circumstances, they might tend to deter what would otherwise have been desirable network investment. This could happen if:

- the prospective generator were to undervalue the connection, relative to the 'deep' charge;

- the DNO's estimate of connection costs were inflated or overcast[19];

- the prospective generator were unable to secure competitively-priced funds to finance the difference between 'shallow' and 'deep' charges; or

- a combination of any of these three.

5.22 It would be possible to build locational price signals into DUoS charges, although a thorough review of such charges would have to be deferred until the

[19] Regulatory determination of connection charge disputes with both generators and demand customers have frequently resulted in significant reductions in the connection charges levied by the DNO.

next distribution price control review. Adding to the complexity of DUoS charges would run counter to moves, which have been welcomed by some parties, to make them simpler. As simpler DUoS charges could facilitate competition, there could be a trade-off between cost reflectivity and facilitating competition.

5.23 Network access on fair and transparent terms implies cost-reflective charges. This might tend to reinforce the case for deep connection charging, although there would be a trade-off against the perceived disincentive effect.

5.24 'Deep' connection charges have the consequence that embedded generation connections have firm access to the transmission network. Where a 'shallow' charging policy operates, and in locations where network constraints are an issue, there may be a need to negotiate interruptible connections. Alternatively it may be possible to agree something analogous to the capacity charges by which demand connections currently reserve system capacity. It is unlikely that the issue of interruptible connections will be resolved within the timescales envisaged by this consultation paper. Ofgem intends to give it fuller consideration later.

5.25 Connection charges are regarded as 'excluded service revenue' under the existing distribution price control. That is to say that they are not subject to the revenue constraints imposed by the price control formula. Those paying connection charges are protected from the monopoly power of the DNOs by the right to seek regulatory determination of disputes. Ofgem considers that up-front connection charge revenue should remain excluded revenue, even if it is decided to move to a 'shallower' connection-charging regime. This raises the question of the treatment of DUoS revenue, which is considered later in this chapter. Whatever interim solution may be chosen, the next distribution price control review (possibly from 2003) will need to re-consider the basis of connection charges and price controls.

5.26 **Ofgem would welcome views on the respective advantages and disadvantages of 'deep' and 'shallow' connection charges for embedded generators.**

5.27 **It would also be helpful to receive preliminary views on the extent to which interruptible generation connections may, under a 'shallow' connection-charging regime, be an issue at distribution voltages.**

Banding of embedded generators

5.28 The range of generating capacities and likely connection voltages embraced by the term 'embedded generation' suggests that the methodology for fixing connection charges may need to vary across different bands of generator. At one end of the spectrum, the largest generators will almost certainly be one-off schemes requiring treatment similar to that currently given to EHV load connections. At the other extreme, the successful marketing of DCHP installations to the general public (as well as to potential installers) would seem to require a simple, standard pricing mechanism.

5.29 It seems sensible to aim for a balance between negotiated and standard connection charging. The Independent Pricing and Regulatory Tribunal in New South Wales have done some interesting work on negotiated connection charging. Reference to this will be made later in this document.

5.30 **Ofgem would be interested to learn consultees' views on the bands or classes into which prospective embedded generators might justifiably be divided.**

Negotiation

5.31 There has always been an element of negotiation in connection charging, although the DNOs, enjoying what is effectively a monopoly position, and having a significant benefit in terms of access to information, have been able to negotiate from a dominant bargaining position. Ofgem considers there to be a need for increased certainty and transparency in the negotiation of connection charges for embedded generation. DNOs carry on what are, effectively monopoly businesses, a right of appeal to Ofgem will remain an important safeguard, both in terms of redressing inequality of bargaining position and in ensuring that, as nearly as possible, efficient and economic outcomes are achieved.

5.32 A fresh approach to the negotiation of connection charges should open up the possibility of:

- a negotiated balance in cost-recovery between connection and UoS charges;
- wider knowledge and understanding of the principles of generator connection charging; and
- addressing such issues of interruptible or firm connection as may arise.

5.33 Although the operation of electricity networks and markets in Australia differ in some important ways from those in Great Britain, the work done in New South Wales on negotiated charges remains of interest. It has centred on identifying the benefits that an embedded generation proposal might bring to a distribution network, and ensuring that these are appropriately shared. The benefits may come in the form of reduced UoS charges, reduced future investment in the distribution system, and reduced electrical losses.

5.34 At the centre of the New South Wales guidelines on embedded generation is the 'with-without test'. This takes the form of an assessment of network costs with and without the prospective embedded generator. To the extent that the embedded generator reduces these costs, the available savings are allocated, through negotiation, between the DNO and the generator. The test effectively introduces a forward-looking marginal cost basis for pricing access to embedded generation. Published guidelines indicate how variations to a 'standard' embedded generation access price could be negotiated to reflect potential network savings.

5.35 In Great Britain it would be possible to negotiate both the up-front connection charge and any associated DUoS charges to be recovered from the embedded generator, in such a way as to reflect likely savings. Consideration would also have to be given to the timing and extent of sharing these savings with the generality of connected customers. The foundations of such negotiations could be:

- the DNO's Condition 4 Statement (perhaps in a form somewhat differing from the Condition 8 Statements[20] (Condition 2 Statements, in Scotland) currently published).

- a possible protocol on negotiation, setting out the principles, procedures and timings that a prospective embedded generator could expect to find applied to the consideration of any given connection proposal;

- published guide prices on the likely cost of preparing specific connection schemes;

- the long-term development statements on which Ofgem recently consulted[21];

- a reasonably acceptable methodology for modelling power flows and losses on the specific circuits under discussion; and

- the right of appeal to Ofgem for determination of disputes.

5.36 A drawback with this approach might be that broadly concurrent developments on the network might sometimes complicate the picture sufficiently to make it difficult to attribute specific costs or benefits to the embedded generator under consideration. The development of competition in connections might complicate negotiations, which would perhaps have to involve both the connection provider and the distribution business.

5.37 Another drawback could be the fact that the European Commission clearly favours regulated access arrangements over negotiated access. It has proposed that a published and regulated tariff structure should be the minimum norm for transmission and distribution systems. The draft EU Directive on common rules for the internal market in electricity and natural gas[22] emphasises the pivotal role of national regulatory authorities in ensuring non-discriminatory network access. However, this need not necessarily be a barrier to building on existing practice

[20] These are charging statements that PES Licences have required the distribution businessesto produce. They give some information on connection charging policy, together with some indicative figures for the more common classes of network connection.
[21] 'Proposed Electricity Distribution Licence Condition 25 – Form of Long Term Development Statement – Consultation Paper', Ofgem 4 June 2001.
[22] Proposal for a Directive of the European Parliament and the Council amending Directives 96/92/EC and 98/30/EC concerning common rules for the internal market in electricity and natural gas. COM(2001) 125 provisional version, (proposed new Article 16).

in Great Britain to achieve an interim solution. A considered move to regulated access arrangements could follow.

5.38 A further option would be to extend the process to demand connections. On this view, a DNO could charge an increased amount for a demand connection that failed to employ an embedded generation solution likely to reduce network costs. A 'with-without test' might be helpful in such a context. While this option might produce an equitable connection policy, it could be unwieldy to administer.

5.39 Ofgem publishes connection charge determinations, without disclosing the identity of the parties to the dispute. Publishing the charges agreed in respect of all those connections for which the prospective generator felt able to give permission for disclosure could extend the transparency that this brings. DNOs could be placed under a requirement to request connected parties to agree to disclosure, although there would be no obligation on them to agree.

5.40 **Ofgem would welcome the views of interested parties on the extent to which disclosure of specific charges (and relevant technical detail) might be helpful.**

5.41 Any of the connection charging options set out at the end of this part of this paper could establish a starting point for negotiation aimed at fairly reflecting the circumstances of a particular connection. The amount of negotiation that a prospective embedded generator would want would depend on the capacity of the scheme. The largest, like EHV demand connections, would probably be fully negotiated as one-off proposals. Condition 4 Statements could prescribe a standard approach for the great majority of connections, which could be modified by negotiation to reflect individual circumstances. At the other end of the scale, DCHP connections on standard terms would probably be attractive to householders looking for a convenient and trouble-free connection without the need to negotiate with the DNO.

5.42 **Ofgem would welcome views on the potential scope for increased, more structured and more transparent negotiation of charges as an interim mechanism for the connection of embedded generation.**

5.43 **It would also welcome reasoned suggestions as to what the upper limit might be for the prescription of connection charging principles in Condition 4 Statements. In other words, what size of prospective embedded generator could be expected to be treated as a one-off scheme, analogous to EHV demand connections.**

5.44 **It would also be helpful to have comment on the availability of, and prospects for, methodology for modelling power flows and losses in a 'with-without test' form – and any alternatives.**

Second-comer issues

5.45 As part of its response to the Utilities Act 2000, Ofgem consulted[23] on the future of The Electricity (Connection Charges) Regulations 1990. The regulations are intended to reimburse initial contributors to network reinforcement from connection charges levied on subsequent connections, but the consultation acknowledged that they had been difficult to apply in such a way as to achieve that outcome in practice. As a result of that consultation, Ofgem decided to make only such consequential changes to the connection charge regulations as were required by the new primary legislation. It was recognised that the prospect of increased connection of embedded generation would prompt a reconsideration of these 'second-comer' issues.

5.46 The 'deeper' the connection charging option adopted, the more significant the question of subsequent reimbursement becomes.

5.47 Ofgem does not consider that it would be realistic to aim for a full review of the connection charge regulations within the timescales envisaged by this paper. To do so would be to add an element of complexity that might hinder the early removal of inappropriate disincentives to the connection of embedded generation. However, now is the time to begin exploring the possibilities.

5.48 It should be possible for DNOs to maintain a register of assets associated with new generator connections. Such registers could form the basis for subsequent reimbursement of the initial contributor by 'second-comers' – at least for a stated period of years. Key factors in maintaining such registers would be:

[23] 'Electricity and gas connections. Charge regulations. Consultation April 32/01'

- the ability to identify and to distinguish between shared and dedicated distribution assets;

- availability of records on the criteria for charges levied on initial contributors; and

- the ability to model the behaviour of discrete parts of the network.

5.49 **Ofgem would welcome preliminary views on the issue of reimbursement of initial contributions to network reinforcement, particularly in the context of embedded generation. Such comment would be of considerable assistance in informing future consultation on the subject.**

5.50 **It would also be helpful to have some indication from DNOs as to the suitability of existing records as a basis for similar treatment of existing embedded generation connections.**

Condition 4 statements

5.51 Condition 4 in Section B of the standard distribution licence requires DNOs to prepare statements setting out the basis on which charges will be made for the provision of use of system and connection to the distribution system. Ofgem has to approve the form of these statements in England and Wales, and, in Scotland, their content. This obligation continues, and is substantially the same as, the obligation placed on PESs by Condition 8 of the PES licences. There were similar obligations in the Scottish composite licences. Statements have to be reviewed annually and may, with Ofgem's approval, be amended.

5.52 Under Condition 4C of the distribution licence or under section 23 of the Electricity Act 1989, as amended by paragraph 26 in Schedule 6 to the Utilities Act 2000, Ofgem can determine disputes about terms of connection. The content of charging statements is often relevant to such determinations.

5.53 The existing PES charging statements are somewhat general. While they give a useful, broad indication of the likely cost of connection at various voltage levels, they are not sufficiently detailed to allow those seeking a connection to understand the method used by PES distribution businesses to produce connection charge quotations in specific cases. The statements tend to reflect the

long-standing reluctance of distribution businesses to give full breakdowns of quoted connection charges, even in response to a complaint. Ofgem acknowledges that it is not feasible to give more than general guidance about EHV connections, as these tend to be unique, individual projects requiring specific costing. The same is likely to be true of larger embedded generation connections. For smaller connections, there may be a case for more specific charging statements.

- Those proposing small embedded generation connections, like those intending to connect relatively small loads, should be able to use the condition 4 statement to make an initial assessment of the likely costs of connection. It should also be of assistance to them in understanding the DNO's quoted connection charge.

5.54 **It would be helpful to receive creative proposals from DNOs as to how Condition 4 statements could be made more specific and accurate than those currently published - particularly for embedded generation connections. The views of existing and prospective embedded generators as to the user-friendliness, or otherwise, of the existing PES charging statements would also be of value.**

5.55 To the extent that a new sort of charging statement might be desirable, it would be incumbent on Ofgem clearly to set out the criteria that it would take into account in deciding whether to approve Condition 4 charging statements. Responses to this consultation could be of considerable assistance in informing that sort of judgement. Annex B to this paper suggests what the form of the generator-related parts of Condition 4 statement should be in order to secure Ofgem's approval.

5.56 As a separate initiative, the Electricity Connections Steering Group is currently working on producing a national connections charging statement that would be significantly more transparent that those so far prepared by the PESs. Relevant responses to this consultation could help to inform the decisions of the Electricity Connections Steering Group.

Broad policy options for connection charging

5.57 This section of the consultation paper sets out the broad options for connection charging for embedded generation, together with Ofgem's preliminary comments on each. The options are closely based on those identified in Annex 4 to the EGWG Report. It could be argued that the focus on three 'stakeholders' on which the EGWG options are based is essentially static and not, in itself, helpful in addressing the key question as to what implications the options would have for perceived barriers to entry. Consideration might also be given to how the options would relate to the principles of efficiency, equity and comprehensibility proposed earlier in this Chapter.

5.58 Under Option 1: the status quo would be preserved with:

- generators' paying 'deep' connection charges;
- demand customers' paying 'shallowish' charges; and
- demand customers' paying the balance of reinforcement cost, via DUoS.

Stakeholder	Positive Impact	Negative Impact
DNO	• absence of change • potential windfall benefits • reflects existing price control	• no incentive actively to support embedded generation • generation could take up spare network capacity • initial contributor issues
Generator	• no UoS payments	• high capital cost of connection • different treatment of demand • expose to potential 'cliff face' costs
Supplier/demand customer	• unchanged billing systems • direct allocation of generator connection costs	• non-generator-related costs continue to be met by demand

5.59 Option 2 would see:

- shallow charging for generator and demand connections; while
- load customers continue to pay reinforcement costs via DUoS.

Stakeholder	Positive Impact	Negative Impact
DNO	• no changes required to billing systems	• step change in requirement for capital expenditure • possible mismatch with the 'shallow' definition used for transmission connections, with consequent inefficient locational signals
Generator	• reduced capital cost with no consequent increased running cost	• little prospect of a market for ancillary services etc.
Supplier/demand customer	•	• Increase in DUoS in the form of a cross-subsidy to generators

Ofgem comment: This option does not lend itself well to the unbundling and economic pricing of distribution services. It preserves what may be the increasingly invalid distinction between generation and demand connections, while tending to disadvantage demand customers. It could put DNOs in breach of their licences. Moreover, it envisages what would, effectively, be a subsidy to generators by reason of their not being required to pay DUoS charges. Ofgem would be most unlikely to regard this option as either acceptable or workable. Ofgem is consulting separately on connection and charging policy for new generation connecting to the transmission system in the North of Scotland.

5.60 Option 3 envisages:

- demand continues to pay 'shallowish' connection charges;
- generation pays 'shallow' connection with some level of UoS (entry)charge, perhaps as excluded service revenue; and
- reinforcement is financed from DUoS in the form of demand (exit) and entry charges.

Stakeholder	Positive Impact	Negative Impact
DNO	• income stream from embedded generation • return on network investment	• more complex charging • increased capital requirements • loss of locational signal(?)
Generator	• reduced capital cost for new entrants	• entry/UoS charges may be positive or negative
Supplier/demand customer		• possible short-term increase in DUoS • potential zonal pricing issue

Ofgem comment: EGWG point out that this option would involve a trade-off between downward pressure on DUoS charges payable by demand customers and upward pressure on those charges resulting from recovery of some costs arising from generator connections. Chapter 5 of this consultation document considers UoS charges. Discussion of their relation to the price control is to be found there.

5.61 Under Option 4 :

- demand would continue to pay 'shallowish' connection charges;
- generation would pay 'shallowish' charges, and some level of entry/UoS charges (perhaps as excluded service revenue); and
- reinforcement costs would be financed from exit and entry (UoS) charges paid by both demand and generation.

Stakeholder	Positive Impact	Negative Impact
DNO	• income stream from embedded generation • return on network investment	• more complex charging • increased capital requirements • loss of locational signal(?)
Generator	• reduced capital cost for new entrants	• entry/UoS charges may be positive or negative • some generators would see increased overall project costs
Supplier/demand customer		• possible short-term increase in DUoS • potential zonal pricing issue

Ofgem comment: This Option is little different from its predecessor. The main distinction is in terms of the structuring of DUoS charges, which is considered later in this consultation paper.

5.62 Option 5 envisages that:

- Small and medium-sized generators would, like comparable demand connections, pay 'shallowish' connection charges and some combination of UoS charges; and
- Larger generator connections would be treated on a site-specific basis.

Stakeholder	Positive Impact	Negative Impact
DNO	• similar treatment to load • acceptable transaction costs • income from embedded generation • potential for better network management	• increased capital requirements • more complex arrangements and new billing systems
Generator	• lower capital costs for smaller new entrants • choice, for larger generators, over capital or running costs	• generators will have exposure to ongoing costs
Supplier/demand customer	• generators would be meeting a share of network costs	• possible increased UoS charges to fund generator-triggered reinforcement.

Ofgem comment: This option has some attraction in that larger embedded generation schemes would be treated similarly to EHV demand connections. There would also seem to be some scope for negotiation, at least over the balance of cost recovery through up-front connection charges and DUoS charges (which might be treated as excluded service revenue).

5.63 The EGWG report suggests that Options 2 to 5 would require:

- fundamental changes to the regulatory pricing structure for connection of embedded generation;
- a clear commitment from Ofgem as the treatment of funding under current and future price control periods; and
- significantly more analysis aimed at understanding the impact of any proposed change on the various parties.

5.64 It is difficult to see how Ofgem could effectively give firm undertakings as to the treatment of funding under future price controls. That sort of decision is for the next price control review, which will offer ample opportunity for all parties, and particularly the DNOs, to explain their concerns and to suggest solutions.

5.65 Any changes to incentives that it might be sensible to make during the currency of the existing distribution price control would probably constitute at best a 'half-way house' to the full implementation of one of the options set out here.

5.66 **Ofgem would welcome views as to the respective advantages and disadvantages of the foregoing options as either interim or final solutions.**

DUoS charge structure consultation

5.67 It is important to re-emphasise here that this consultation focuses on possible short-term changes to charging practices under the existing distribution price control. The aim is to identify anything that can be achieved quickly to secure equitable treatment of prospective embedded generators. In the wider context, Ofgem is already consulting on the future structure of distribution charges. The next distribution price control review and Ofgem's review of distribution charge structures will provide opportunities for more thorough review and reassessment of DUoS charges.

5.68 If it were decided to move to shallower connection charging for embedded generators, it would seem appropriate for DNOs to recover the balance of their costs through DUoS charges. In suggesting an interim solution of the type sought by this consultation, it would helpful to bear in mind that the connection of significant amounts of embedded generation could, over time and irrespective of other drivers for changes in charging structure, create pressure for unbundling of DUoS charges.

5.69 To the extent that DNOs, in negotiation with prospective embedded generators, could identify the likely costs and benefits of proposed connections for the network, it might be possible to adjust any generator DUoS charge to recognise them. Such an approach, however crude initially, might be instructive in informing consultation on the next distribution price control.

5.70 One option for the longer term might be site-specific charges for larger generators (however defined) and profiled charges for smaller installations. In time, more sophisticated and locally cost-reflective DUoS charges might be developed. Ofgem will need to consult further on these issues as it becomes clear how much additional embedded generation is being connected to distribution networks and what technologies may be available to accommodate it.

5.71 **Ofgem would be interested to hear views on the extent to which, as an interim measure and in addition to straightforward recovery of connection costs, any generator DUoS charges might be adjusted to reflect the costs or benefits to the network of the proposed generator.**

Options for rapid modification

5.72 There are a number of ways in which early regulatory changes of the sort envisaged by the EGWG report could be delivered. This section briefly outlines the policy options.

5.73 Re-opening the existing price control would permit quite radical changes in the treatment of prospective embedded generators. To do so would, however, run counter to the policy, generally adopted by economic regulators, of not re-opening price controls unless absolutely necessary. The resultant perceptions of

regulatory risk would be likely to increase the cost of capital of regulated businesses, creating upward pressure on prices. It is not clear, moreover, that radical changes involving revision of the assumptions underlying the control are what are presently required. The complexity of exploring radical change with interested parties could delay adjustments likely to result in more equitable treatment of prospective embedded generators.

5.74 Early closure of the present control and, hence, bringing forward the next price control review might be an option. It might avoid the problems of regulatory risk attendant on re-opening the existing control. It would not, however, obviate the problem of the time that it would be likely to take to consult on and introduce a new control. Aiming to implement the new control a year early (from April 2004), for example, might not be appropriate to the timing envisaged for the Government's targets for CHP and renewable connections. The EGWG report was clear that Ofgem should be considering possible revised incentives for more rapid implementation.

5.75 Adjusting allowed revenue in accordance with the assumptions underlying the existing price control might be worthy of consideration. It might assist in delivering the sort of interim solution under which demand customers, or embedded generators and demand customers, meet the 'deeper' costs of generator connection through adjusted DUoS charges. However, this would not be a straightforward exercise. It is doubtful whether sufficient data and analysis yet exists to inform a defensible decision. Moreover, there would seem to be a fine line between adjusting allowed revenue and re-opening the price control.

5.76 Treating all embedded generation connections as excluded services would overcome the need to change the existing price control. Revenue from both shallow connection charges and generator DUoS charges would then be excluded service revenue. This relatively simple solution would not seem capable of allocating any of the costs to demand customers, but it is not clear that such a change could quickly be made on any justifiable basis. There might still be an increase in cost of capital under this option, arising from uncertainties over future cash-flows and cost recovery. Advantages of the excluded service option would seem to be that:

- it would prevent DNOs from responding to the perceived unpredictability of some embedded generation by seeking to recover any anticipated revenue shortfall from demand customers; and that

- it would permit treatment of generator DUoS on a similar basis to excluded EHV DUoS (including a requirement that excluded DUoS charges should not diverge significantly from assumptions underlying the price control[24]).

5.77 **Ofgem would welcome views as to whether it would be preferable partially to re-open the existing distribution price control or, alternatively to treat all generator connection contributions and DUoS charges as excluded service revenue.**

5.78 It is important to reiterate that any solution derived from options less radical than that of bringing forward the next distribution price control review would be of an interim nature. A full reassessment would still have to be made at the next review, and there would be no guarantee that the comprehensive review process would endorse any part of an interim solution.

5.79 At Annex A to this document is a suggested modification to the definition of excluded service revenue in the distribution price control. It is for discussion whether the excluded service approach would be appropriate but, if were to be adopted, this is the licence modification that Ofgem would propose. Annex A is included here because of the relatively tight timetable envisaged for interim changes. A preliminary consultation might help to speed the process of modification by securing consent early, and bringing forward any 28-day notice under section 11 of the Electricity Act 1989.

Zonal and site-specific charging

5.80 Embedded generation necessarily has local effects on the distribution circuit to which it is connected. If DUoS charging were fully to reflect the costs and benefits of adding a generation connection to the distribution system some sort of local charging mechanism would be required for both demand and generation customers. The issues here seem to be substantially the same as those

[24] As with EHV charges, the schedule of excluded services could provide for deviations from price control review assumptions to trigger directions from Ofgem as to the proper level of embedded generator DUoS.

discussed earlier in this paper under the heading of 'banding' embedded generators. However, there is a balance to be struck between simplicity and comprehensibility on the one hand, and clarity of cost signals on the other.

5.81 Charges in respect of the largest embedded generation connections have always been site-specific. This would presumably continue to be so if some of the costs were recovered through DUoS charges instead of 'deep' connection charges. More work would seem to be necessary, however, on recognising the potential costs and benefits of embedded generation in terms of system stability, reactive power, loss-reduction, and so forth. As with the current TUoS charges, DUoS charges of the sort envisaged here could be either positive or negative, depending on location. There may be occasions on which these considerations could now be addressed when negotiating terms of connection.

5.82 **It would be interesting to hear the views of DNOs and generators on the feasibility of moving immediately to negotiation of site-specific DUoS charges for larger embedded generators that would take account not only of connection cost, but also of the technical benefits (or problems) that these larger embedded generators could bring to the local distribution system.**

5.83 Ofgem considers that it would not be realistic to expect DNOs to develop a cost-reflective zonal DUoS mechanism within the timescales envisaged by this paper. Not least among the difficulties is the fact that zonal generator DUoS charges would not be directly comparable with the existing zonal TUoS charges levied in respect of an interconnected grid system. While zonal DUoS charges might deliver precise signals, radial networks present many more discrete sections of circuit than are encountered on a transmission system. Cost reflective zonal charges would be highly sensitive to the consequences of any response to those signals themselves. Small zones could lead to perverse signals. The price disturbance likely to arise from the introduction and maintenance of zonal charging requires careful consideration. This should not, however, prove an obstacle to deferring payment in the form of DUoS charges, nor yet of negotiating appropriate charges in situations where the costs and benefits are clear.

5.84 For micro-generation, and particularly for DCHP, the considerations are different. There would seem to be a strong argument in favour of standard charges, forming a DUoS component in a profile-based tariff. In the longer term, consideration would need to be given to the effects of the connection of DCHP and similar equipment in significant densities, the costs that might be occasioned, and how they might best be recovered.

Existing embedded generators: Introduction

5.85 In considering changes that might result in the more equitable treatment of prospective embedded generators, regard must be had to those already connected and generating. Existing embedded generators will have paid the 'deep' costs of connection up-front.

Existing embedded generators: Connection charges

5.86 If the interim arrangement were simply to allow prospective embedded generators to pay some of the costs of connection, over time, through some form of generator DUoS charges, existing embedded generators would not, in most cases, be directly affected.

5.87 Increases or decreases in the capacity of existing embedded generators would, however, require some consideration. The installation of additional or larger generating sets at given premises might require system reinforcement. Appropriate charges could be negotiated on the same basis as for new generator connections.

5.88 More difficult might be the treatment of a reduction in capacity by an existing embedded generator. This occasionally happens, for example, when one or more generating sets are removed from a landfill gas site, to reflect a reduction in methane yield. Demand customers can usually secure a reduction in charges by negotiating a reduction in reserved network capacity. It might be inequitable to deny generators a comparable refund from the up-front charges that they initially paid – particularly as their 'deep' connection charges would have paid for a higher proportion of assets likely to be shared by other network users.

Existing embedded generators: DUoS charges

5.89 If any interim solution were to involve generator DUoS charges covering more than a portion of the initial costs of connection, some consideration might have to be given to DUoS charges for existing embedded generators. Such charges would perhaps be tailor-made, site-specific, and calculated net of any connection element. Charges would reflect some identified cost or benefit to the distribution network, and might be either positive or negative.

5.90 If it were thought appropriate to introduce methods of DUoS charging more sophisticated than those currently applied, it might be helpful to think in terms of an initial 'DUoS holiday' for existing embedded generators. However, Ofgem presently considers it unlikely that charging mechanisms taking account of factors such as generators' contributions to loss reduction or reactive power could satisfactorily be introduced before the next distribution price control review.

5.91 **Ofgem would welcome views on the treatment of existing embedded generators, under any interim charging arrangements introduced prior to the next distribution price control review.**

5.92 **It would be helpful to receive proposals, particularly from DNOs, on how increases and decreases in generating capacity by existing embedded generators might most equitably be handled.**

6. Metering

Introduction

6.1 This part of the consultation paper should be read in the context of developing policy on metering as set out in Ofgem's March 2001 consultation paper on metering strategy[25]. Whatever trading arrangements are adopted for embedded generation, there will be separate contracts for metering and supply. The installation and operation of metering equipment will be open to competition. DNOs will no longer necessarily own newly-installed meters.

6.2 Ofgem is not aware of any technical problem that might cause metering to constitute a barrier to the connection of embedded generation. Indeed, the technology for recording the import and export of both active and reactive power from a generator's premises is well understood and readily available. What metering equipment is required in any particular application, while subject to certain requirements of the Balancing and Settlement Code (as determined by size of customer) is primarily a matter for commercial judgement.

6.3 Depending on the size of embedded generator and the way in which generators, suppliers and DNOs choose to value imports and exports, different metering solutions will be chosen. There should, however, be no unwarranted restriction or distortion in access to or operation of competition, arising from the type of metering installation connected with embedded generation. This consultation is, however, an opportunity for interested parties to raise any concerns about metering technology or applications in respect of embedded generation.

6.4 **Ofgem would like to be informed of any problem of metering technology encountered by existing or prospective embedded generators, and particularly where such problems have deterred or might deter otherwise viable embedded generation schemes from going forward.**

[25] 'Ofgem's strategy for metering. A consultation paper', March 2001, 28/01

'Net metering'

6.5 There have been calls for 'net metering' to become the norm for embedded generators, and particularly for those employing renewable technologies. The term is usually interpreted to mean the measurement of both import and export units, coupled with a commercial arrangement under which the generator receives the same price for exported units as he pays for imports. Sometimes it is taken to mean metering that shows imports net of exports (under which arrangement, to the extent that generation displaces imports, the customer values exported units at the export price).

6.6 Ofgem's initial view is that the issues involved are complex and that equating the value of imported and exported units is unlikely to be an appropriate precedent to set. The issues of 'net metering' should be examined against the wider background of work on the EGWG recommendations. To do that effectively will require a considerable amount of further analysis and consultation.

6.7 'Net metering' and the equation of import and export prices might be attractive to some renewable generators, but not all embedded generation technologies would require, or necessarily benefit in the long term from, such an arrangement. Moreover, careful consideration would have to be given to the creation of what could, in effect, constitute a subsidy to a particular type of generation. It is difficult to see that such a departure from the cost-reflective pricing of units of electricity would be compatible with Ofgem's principal objective of protecting the interests of consumers. It would, moreover, be likely to create a perverse incentive to locate new generation on distribution networks.

6.8 Some proponents of 'net metering' have pointed to experience in Germany, where such arrangements have resulted in the installation of considerable amounts of domestic generation. The parallel does not, however, seem to be particularly helpful. The schemes in question have largely been the initiatives of vertically-integrated local government utilities. Introducing something similar nationally, and in the UK's liberalised market, would not be straightforward. Moreover German tax law enables participants to claim benefits not currently available in the UK. A 'net metering' scheme on the German model would also

be expensive. Equipment is typically provided at 0% finance. The price of export units is generally higher than the customer pays for imports (meaning that the German schemes are not 'net metering' in the generally-accepted sense).

6.9 It seems clear that larger embedded generation schemes, like major generators connected to the transmission system, will have conventional power station metering. At the other end of the scale, EGWG's supporting paper on 'Options for Domestic and Other Micro-Scale Generation' envisages three alternative metering arrangements for the size of generation with which it is concerned. Single-directional metering would register only imports. Bi-directional metering would register a net figure of imports minus exports, while import-export metering would register two figures – total imports and total exports. Judgements will have to be made about the value of metered data, in any given set of circumstances, against the costs of metering equipment, meter reading, data processing and billing. Ofgem's present view is that the desirability of protecting the interests of consumers generally would make import-export metering likely to constitute the most attractive option – even for the smallest embedded generators.

6.10 **Ofgem would welcome views on metering arrangements for smaller embedded generation installations.**

6.11 The development of more sophisticated methods of charging for distribution services may in time achieve an improved attribution of costs and benefits between the various connected parties. The delivery of units of electricity at different points on the network, and at different times, could then result in a range of prices – most of them almost certainly greater or less than the 'import price' paid by the generator in question.

Metering and renewable generation

6.12 Modelling the effects of renewable generation on distribution networks, so as to identify the likely costs and benefits and to derive an appropriate charging methodology, is a complicated matter. Some work has been done in the field, from which it appears that an appropriate model might simultaneously have to take account of meteorological factors, generating set characteristics and network performance.

6.13 There are clearly renewable generation schemes for which it would be financially beneficial to equate the price of imported and exported units. However, it is not Ofgem's role to favour one form of generation over another. Subsidies to promote renewable generation could have significant financial effects for competitor generators and for electricity consumers: such subsidies are a matter for Government. Ofgem's focus must be its principal statutory objective of protecting the interests of consumers, which implies the achievement, where possible, of cost-reflective pricing.

Metering for DCHP and micro-generation

6.14 DCHP technology is developing fast. Significant numbers of installations may be expected before the end of the current distribution price control. A number of micro-generation equipments suitable for housing associations or small industrial or commercial premises are becoming available. Exports from individual DCHP and micro-generation systems are, at first, likely to be in the order of a few kWhs, although a high density of them could present difficulties on particular circuits.

6.15 It is open to embedded generators to have metered data on their exports collected either via the Supplier Volume Allocation Agent System or centrally via the Central Data Collection Agent. In the former case, half-hourly export metering would be registered to a given supplier. In the latter, the generator would itself be registered in central systems. However, it seems clear that few, if any, owners of micro-generation or DCHP equipment would currently wish to participate in NETA in either of these ways. Ofgem understands that there is no obligation for them to do so, and that micro-generation and DCHP do not therefore necessarily require half-hourly metering.

6.16 Some have argued that requiring anything more complicated than existing uni-directional metering would be expensive and thus a deterrent to the marketing particularly of DCHP equipments. The DCHP boilers currently proposed would generate when the central heating system was in operation – typically on winter evenings when demand on distribution networks tends to be at its highest and when electricity is most expensive. Ofgem, however, considers that

import/export metering would best validate profiles and ensure cost-reflective pricing.

6.17 Given sufficient production volumes, it may be that even the cost of sophisticated (or 'smart') metering equipment itself would not necessarily constitute a deterrent to DCHP and micro-generation. Spread over the time (say five years) that it would take the DCHP unit to pay for itself, the capital cost of an import/export meter would hardly be significant. The marginal cost of collecting and processing the additional data would be more than offset by the consumer benefits derived from accurate information about exports to the network.

6.18 Failure to record exports would militate against both the derivation of a fair export price and the proper understanding of the effect of exports on the operation of the local distribution network. Some form of export metering would be desirable, even for the smallest embedded generators.

6.19 The 'supplier hub' principle, under which it is the supplier's responsibility to ensure the provision of appropriate metering and metering services, might prove to be the catalyst for the installation of smart metering in association with micro-generation and DCHP. Suppliers, as well as DNOs, can now choose to buy and service their own meters. Suppliers seeking to achieve product differentiation, to add value and to provide service to consumers may see business opportunities in 'smart' metering for micro-generation and DCHP generators.

6.20 Another consideration may be that the customer's ability readily to change supplier might deter investment in metering or DCHP equipment. There may be a case for facilitating contractual arrangements that envisage a longer relationship for some services, perhaps between the customer and a company offering comprehensive energy or 'smart building' services. The '28-day Rule' which allows customers readily to change supplier should, however, remain. It would not prevent the development of separate contractual arrangements (with energy service companies, for example), whoever happened to be the supplier for the time being.

Separation of distribution and supply

6.21 In countries where there is no separation of distribution and supply businesses, and where there may be no right for small consumers to exercise a choice of supplier, the local electricity utility can ascribe a value to units of electricity exported by embedded generation. In Great Britain, full supply competition has been established and complete legal separation of distribution and supply is soon to be effected. Exported units will therefore have two values – to the DNO and to the supplier to whom the metering point is registered.

6.22 This paper indicates that DNOs will ascribe a value to exports from embedded generation, although it acknowledges that the mechanisms for so doing are unlikely to develop immediately. Exports could, in certain circumstances, reduce the costs of network operation. Where networks are more actively managed, DNOs might wish to contract with embedded generators for reserve, reactive power and so forth. Modelling of network operation, together with any appropriate metering, will enable prices to be agreed.

6.23 Suppliers will continue to include larger embedded generation in their power purchase agreements. Appropriate metering and pricing methodologies are already in place. It is less clear how suppliers would value exports from micro-generation and DCHP equipment.

Conclusion

6.24 It seems unlikely that metering technology presently constitutes a particular problem for the development of embedded generation.

6.25 **It would be helpful if responses to this consultation could indicate whether the approach to metering set out here and in the context of the March 2001 metering strategy consultation is broadly right, or whether there are issues that need to be addressed before the next distribution price control review.**

7. Secondary issues

Operation and Maintenance (O&M) and Tariff Support Allowance (TSA)

7.1 O,R&M and TSA were discussed in Ofgem's December 2000 consultation paper on the future structure of distribution charges[26]. These issues are also relevant to work on competition in connections to distribution networks. In the context of this consultation paper, it is not the intention to pre-empt complex issues the consideration of which properly belongs to the next distribution price control review. An attempt to do so might jeopardise early decisions on the sort of interim changes with which this paper is concerned.

7.2 As connection assets have not been included in the regulatory asset base, for the purposes of the distribution price control, capitalised O,R&M costs have been recovered as part of connection charging. While it might be possible to recover these costs through generator DUoS charges, there have been problems with O,R&M charging. It has not, for example, always been clear where the boundary between connection assets and the wider system lies.

7.3 As embedded generators do not currently pay DUoS charges, TSA has not been applied to generation connections. A move to shallower connection charges might, however, raise the question of a mechanism, similar to TSA, to prevent double charging.

7.4 Ofgem has indicated its intention, as part of the distribution charge structure review, to explore the possibility of simplifying connection charges, perhaps including the abolition of O, R&M and TSA. A number of companies have already simplified their charging policies in these respects. These are issues for the charge structure review, rather than for the present consultation.

Information requirements: Introduction

7.5 DNOs obviously enjoy a significant advantage over prospective embedded generators in terms of access to information about the configuration and operation of their distribution systems. The EGWG report and one of its supporting papers make reference to the inadequacy of the information

[26] 'The structure of electricity distribution charges – Initial consultation paper', Ofgem, 21 December 2000.

sometimes available to those developing embedded generation schemes. This compares unfavourably with the information about the transmission network contained in NGC's Seven Year Statement, although it has to be acknowledged that distribution systems consist of a large number of individual circuits with differing characteristics.

7.6 The lack of transparency about distribution network information has long manifested itself in disputes about demand connections to distribution networks. Regulatory staff have often found that considerable investigation is necessary to establish the network information relevant to connection charge quotations.

7.7 Lack of information can deter prospective embedded generators from proceeding with schemes. It can make it difficult to challenge connection charge quotations. DNOs are effectively monopoly providers of distribution network services, while embedded generation schemes, often being linked to a particular power source for the prime mover, are not always able to relocate to an area where information is more readily available.

EGWG's recommendations on information provision

7.8 EGWG identified the need for three key principles to be met, namely that:

- high level network information should be available to inform the market-place, to assist developers and to make connection costs more transparent;
- there should be an appropriate balance between the value of information and the cost of providing it; and that
- there should be a consistent approach across DNOs.

Technical information

7.9 Ofgem has already begun to address the issue of technical information. In early June, it issued a consultation paper[27] on the information that might be contained in the Long Term System Development Statements that DNOs will be required

[27] 'Proposed Electricity Distribution Licence Condition 25 – Form of Long Term Development Statement – Consultation Paper', Ofgem, 4 June 2001.

to provide under Standard Licence Condition 25 of the Distribution Licence. Responses to that consultation are currently being considered.

7.10 It is not intended that this paper should duplicate any aspect of the Condition 25 consultation, but it is recommended that those with an interest in embedded generation and who have not already done so, should read it. Comments from the viewpoint of prospective embedded generators would still be of interest.

Basic information

7.11 The technical content of Long Term Development Statements might usefully be complemented by the publication of more basic non-technical information and guidance on connection of embedded generation. This might be intended for those potential embedded generators who do not have the experience and knowledge of larger players. Those with an interest in micro-generation and DCHP might find something along the lines of 'plain man's guide' helpful.

7.12 Basic information of the sort that might be helpful in achieving the consistency mentioned by EGWG could include:

- details of where to find information (e.g. Condition 4 and Condition 25 Statements);
- a, possibly voluntary, code of practice on negotiating terms of connection;
- contact details for:
- organisations able to give advice and support (e.g. CHPA, AEP etc.);
- suppliers offering 'DCHP tariffs'
- enquiries to the DNO;
- equipment manufacturers;
- energywatch and Ofgem.

7.13 It may be that provision of basic information could be achieved relatively quickly, and certainly within the timescales envisaged in this consultation paper.

As such it might make a modest but useful contribution to improving the position of potential embedded generators in the short term.

Conclusion

7.14 **Ofgem would still welcome comments on information in Long Term Development Statements (Condition 25 Statements), specifically from the viewpoint of embedded generators.**

7.15 **It would be helpful to have views on the usefulness, or otherwise, of the early provision of basic information about embedded generation connections – particularly targeted at prospective micro-scale and DCHP generators.**

8. Ofgem's initial proposals

Introduction

8.1 The initial proposals set out here are for discussion. They do not represent a settled regulatory view of the short-term changes that might be made to the incentives in connection and DUoS charges for embedded generators. Ofgem puts them forward to stimulate discussion of workable short-term changes aimed at achieving fairness and transparency for prospective embedded generators.

8.2 In considering the possibility of short-term changes to create a fairer business environment for prospective embedded generation, it seems desirable to attempt, as far as possible, to achieve a sensible progression towards likely future outcomes. Ofgem's initial proposals therefore seek to avoid short-term subsidies or distortions of competition that might not prove sustainable in the longer term.

Connection charges

8.3 DNOs should be encouraged to move to a shallower basis of connection charges for embedded generators, recovering costs up-front only in relation to dedicated connection assets. These generator contributions would continue to be regarded as excluded service revenue.

8.4 The balance of costs of connection of new embedded generation (e.g. those costs associated with deeper reinforcement) should be recovered over time in the form of a generator DUoS charge. At this interim stage, generator DUoS charges could be calculated similarly to those levied on demand customers. The overall structure of DUoS charges would then be considered at the next distribution price control review.

8.5 Whether the initial connection quotation is derived from a one-off study (for larger schemes) or based on standard costings set out in Condition 4 Statements, DNOs should be prepared to use the quotation as a basis for genuine negotiation with the prospective generator aimed at taking as full as possible account of the costs and benefits for the network of the proposed connection. Consideration should be given to using some form of 'with-without test' to inform such negotiations.

8.6 Simple, standard connection procedures and charges should be put in place for micro-generation and DCHP connections.

8.7 The preparation of Condition 4 Statements under the new distribution licences presents an opportunity to increase transparency, and to make it easier than it has hitherto been to challenge connection quotations.

8.8 DNOs should, from April 2002 onward, consider maintaining registers of connection assets associated with embedded generators. These would, in some cases at least, provide a basis for equitable reimbursement of the initial contributor from the connection charges paid by second comers.

8.9 Ofgem suggests that this approach should address the deterrent effect of up-front payment of deep connection charges. It seems to be capable of rapid introduction and would avoid the more complex charging issues that should properly be left to the distribution price control review.

DUoS

8.10 Generator DUoS charges could be used to recover the 'deeper' reinforcement costs arising from the connection of embedded generation. Some form of 'with-without test' might be used as a basis for varying generator DUoS charges to acknowledge the positive or negative effects of connection to a particular part of the network.

8.11 Ofgem would presently envisage a relatively simple generator DUoS charge, primarily as part of the attempt to minimise the deterrent effect of full up-front charging. It might be attractive to calculate generator DUoS charges on a similar basis to those applied to demand customers. Such an interim mechanism would be unlikely to survive the next distribution price control unchanged. Charging practice might be expected to evolve further, as understanding of the effects of embedded generation improves.

8.12 Generator DUoS charges should, at least initially, be treated as excluded service revenue. To do so would accord with the presently relatively unpredictable nature of much embedded generation, and would prevent attempts to recover any anticipated revenue shortfall from price-controlled consumers.

Metering

8.13 Ofgem takes the view that customer interests will best be protected by import/export metering for embedded generation, including micro-generation and DCHP installations.

Information

8.14 Ofgem's separate consultation and work on Long Term Development Statements will continue to be of direct relevance to prospective embedded generators. This will address the requirement for technical information.

8.15 Smaller prospective embedded generators, right down to DCHP and domestic PV systems, would benefit from the provision of basic information. DNOs should give consideration, now, to what information would be helpful and how it might best be made publicly available. Discussions with equipment manufacturers and with energywatch would be helpful in designing information material.

Existing embedded generators

8.16 There is probably no requirement, within the timescales envisaged by this paper, to change the treatment of existing embedded generators. They would, of course, have to be considered in future reviews.

8.17 An exception is the treatment of capacity increases and decreases by these existing generators. Ofgem considers that DNOs should, on a case-by-case basis, be prepared to:

- treat increases in embedded generation capacity comparably with increases in the capacity requirements of load connections; and to
- give some credit for reductions in generating capacity that release network capacity for other demand or generation users.

Effect of these proposals: introduction

8.18 The initial proposals outlined in the previous paragraphs are intended to promote discussion. Nevertheless, this consultation has the potential to affect a number of related areas and interested parties. The objectives of this consultation are limited to identifying any desirable transitional changes to incentives for the connection of embedded generation. At this early stage, it is difficult to make a reliable estimate of the number of additional connections that might result from any chosen option. Equally, it is difficult to make any robust assessment of the environmental benefits that may be achieved.

8.19 There may be other unquantifiable effects. Even minor, interim changes in incentives, prior to the next distribution price control review, could signal that the electricity supply industry is moving towards a greater recognition and acceptance of embedded generation. There could be a pump-priming effect that might manifest itself in additional research and development work, or in decisions to proceed with commercial initiatives not hitherto regarded as justifiable.

8.20 This preliminary consultation builds on the EGWG Report. It explores whether it may be appropriate, in advance of the next distribution price control review, to change the regulatory framework so as to remove barriers to the connection of greater quantities of embedded generating capacity. The intended effect of the initial proposals is therefore to permit the early connection of embedded generation in accordance with the principles set out at the beginning of this consultation document.

Consequences for different parties

8.21 DNOs could benefit from an income stream from embedded generation, and from a return on the associated network investment. They might see the changes as an opportunity to develop more efficient network pricing structures. The proposals on metering would ensure that DNOs received accurate information on both imports and exports from all sizes of embedded generator. Ex-PES DNOs would have to agree to the proposed changes, before they could be implemented.

8.22 DNOs would face increased capital requirements and increased business risk (and particularly the risk of stranded costs). The magnitude of these would depend on the number of additional embedded generation schemes in each distribution service area. They would be faced with more complex charging systems than those now in use and would face the costs of providing additional network information (although this might not be significantly greater than that to be imposed by the Long Term Development Statements required by Standard Condition 25 of the Distribution Licence). Finally, DNOs might argue that a move away from a 'deep' connection charging policy would mean the loss of unequivocal locational signals.

8.23 Prospective larger generators would benefit from reduced capital cost of new connections. They would have access to better information on which to base decisions and on which to draw in the increased level of negotiation envisaged by the proposals. There might be the prospect of reimbursement of some up-front costs from capital contributions paid by others in respect of subsequent connections. On the debit side, there would be uncertainty about the level of the ongoing DUoS charges for which embedded generators would become liable. In a few locations (at least, they would almost certainly be few in the shorter term), a move to 'shallow' connection charging might involve a loss of firm network access rights. Interruptible connections might then have to be negotiated.

8.24 Prospective micro-generators and DCHP schemes would benefit from simple connection procedures, consistent with technical work on connections being taken forward under the aegis of the Electricity Association. Those considering the installation of micro-generation or DCHP would have access to readily comprehensible information on which to base judgements.

8.25 The effect of these proposals on existing embedded generators would be slight. They could look forward to stability in their relationship with DNOs, and to equitable treatment in respect of changes in capacity.

8.26 While suppliers and customers generally might expect some price variations in the medium term, some might experience them as price reductions. It is too early to suggest whether there might ultimately be a move to zonal pricing.

However there seems to be little enthusiasm for it, and it is most unlikely that such a move would be directly triggered by these limited proposals. Customers and suppliers could be confident that demand connections would not be providing a cross-subsidy to embedded generation. They could look forward to the development of more efficient pricing structures including robust, cost-reflective profiles for micro-generation and DCHP consumers. Customers generally would expect to benefit from the improved customer information suggested in the proposals.

8.27 There would be no significant effect on transmission operators at this stage. Significant penetration of embedded generation would be expected to have implications for transmission networks, but these are issue that can be left for later consideration. There are special circumstances affecting generation connections in the North of Scotland, but Ofgem will address these through a separate consultation.

8.28 Operators of private, unlicensed networks would have access to improved information about ex-PES distribution networks, and might find it easier than it now is to export surplus generation, but would otherwise be unaffected.

8.29 For Ofgem, the proposals would preserve the assumptions underlying the existing distribution price control. Increased connection of embedded generation between 2002 and 2004 could help to inform both the distribution charge structure review and the next distribution price control review. The proposals are consistent with work that has already been done on Long Term Development Statements, on the structure of distribution charges, and on generator connections in the North of Scotland. They leave sufficient scope to develop appropriate regulatory solutions over the coming years, as the effects of additional embedded generation become better understood.

The proposals in the light of Ofgem's statutory objectives

8.30 Ofgem's principal objective is to protect the interests of consumers (including future consumers), wherever appropriate by promoting effective competition. Removal of inappropriate barriers to entry by generators would tend towards the promotion of effective competition in generation. Consumers might increasingly benefit from the reduced cost of losses and the lesser use of system charges

likely to be associated with embedded generation. The price effects of these initial proposals would, however, be modest.

8.31 In time, embedded generation could have a valuable contribution to make, at a local level, to ensuring that reasonable demands for power are met. Ofgem is under a statutory obligation to further the principal objective in a manner best calculated to secure that such demands can be met. These proposals represent just a first step in the area of embedded generation but they are consistent with the duty in being intended to ensure that generation schemes that would otherwise be economic are not prevented by perverse incentives in the commercial and regulatory framework.

8.32 Ofgem has also to have regard to the interests of certain potentially disadvantaged groups. Removing unjustifiable barriers to the installation of micro-generation and DCHP could bring benefits in the areas of social housing and paying for fuel, and is consistent with the wider objectives of Ofgem's Social Action Plan. Ofgem considers that the interests of rural consumers would not be threatened by these proposals, but the possible implications of significant connection of embedded generation to rural distribution circuits may be an issue for the future.

8.33 Finally, Ofgem considers these proposals to be in line with the Secretary of State's draft statutory guidance on social and environmental matters recently circulated by the DTI. It accords with Ofgem's recently-published Environmental Action Plan.

Conclusion

8.34 These proposals represent an early step in a continuing dialogue about the future of embedded generation. Ofgem considers, however, that the proposals would accord with its statutory duties and that the balance is such that the impact on customers would be broadly positive.

9. Timing

Introduction

9.1 This consultation focuses on possible interim changes as part of a wider, and possibly fundamental, reassessment of the role of distribution networks and the charges levied for their use. The issues arising from the connection of significant amounts of embedded generation are complex. The way in which networks presently operate is well understood, but it is difficult to predict the degree and timing of the sort of changes that may be expected. As this consultation represents the start of the process of devising what could be a somewhat modified regulatory structure, it may be helpful for this part of it to consider what lies ahead.

9.2 This part of the consultation attempts to point up the major areas for future decision. Most of the necessary work will be done as part of the next distribution price control review. Being aware of the possibilities at this stage, however, may assist in giving some sort of strategic direction to the present debate and may help to orient any interim solutions in an appropriate general direction. It may also help to prepare the ground for the price control review, and for other work on related issues.

9.3 Like the rest of the document, this part concentrates on the incentives in mechanisms for charging for connection to and use of distribution networks by embedded generators. It does not attempt to identify all the technical questions of distribution engineering.

The changing role of distribution networks

9.4 Embedded generation, together with the possibilities created by the development of energy storage technology could, in the more extreme scenarios, combine with advances in IT for modelling and system control to result in distribution systems which operate more like ‘energy webs’ than simply channels between the transmission system and end users. Between that sort of outcome and the existing model of electricity distribution lies a range of possibilities. There are likely to be developments of different degree and pace in

different parts of Great Britain and on different circuits within any given DNO's system.

9.5 Initiatives such as IIP, together with recognition that embedded generation can directly affect the reliability and quality of supply is likely to result in a shift towards performance-based regulation. A consequence could be a move from deterministic models of network management to a more probabilistic approach, focused more finely on individual circuits or groups of circuits.

9.6 The impact of the increased presence of embedded generation, including relatively unpredictable renewable schemes, uncertainties about the impact of performance-based regulation, and the requirement for increased investment in network assets, on the cost of capital and the degree of investment required to develop efficient and economic distribution systems will be considered as part of the next distribution price control review.

Zonal or locational charges

9.7 Rewarding embedded generators for the cost-savings that they may offer to DNOs, or charging them for additional costs imposed, could imply a move to location-specific or possibly zonal charges in place of the averaged, regional charges currently applied. Such a change might accord with the shift of emphasis to the point of use brought about by CHP. Ofgem notes, however, that responses to the recent consultation on the structure of distribution charges did not generally favour zonally differentiated charges.

9.8 There is a considerable amount of work to do in analysing the various options. The desirability of accurate cost signals would have to be balanced against the computational burden of charging on the basis of specific circuits or relatively small zones. There would need to be general agreement on what should determine the size of charging zones.

9.9 Frequently adjusting zonal or circuit-specific charges to keep them cost-reflective could introduce uncertainty, and might threaten the price-stability valued by many customers. Rigorously cost-reflective DUoS charges could prove unacceptably complex. Complex DUoS charges would be likely to constitute a barrier to entry and to restrict the development of competition, as a result of the

administrative burden placed on generators, distributors, customers and their suppliers. The interests of rural customers would require careful consideration, both because rural distribution networks tend to be more expensive to maintain than those in urban areas, and because of the potentially disproportionate impact of embedded generation on circuits with a relatively low density of demand connections.

Conclusion

9.10 The areas for consideration set out here will clearly require extensive consideration and consultation over a period of some months. In Ofgem's view, it would be unrealistic to attempt to address them in the timescales envisaged by this document. Ofgem would, however, be interested in preliminary views on these and related topics. Starting the dialogue now could be useful in paving the way for further work on the price control framework and on balancing the relative complexity of charging arrangements with the promotion and development of effective competition.

Appendix 1 Draft licence modification

Introduction

1.1 Assuming that it does not prove necessary to revisit the distribution price control, one option would be to treat any generator DUoS charges as an excluded service. This would require only minor modifications to the special price control condition in the proposed distribution licence.

1.2 This would take the form of the insertion in Part C of Schedule A of additional text, closely modelled on the existing EHV provision already included in the proposed condition.

1.3 This appendix sets out the modification that Ofgem would propose, under section 11A of the Electricity Act 1989, as inserted by the Utilities Act 2000, should the consultation process confirm that this is the appropriate way of dealing with the matter. Consulting on the suggested modification now would save time, making it more likely that any introduction of excluded service generator DUoS charges could be implemented from April 2002.

Objectives

1.4 The objectives of the modification would be to:

- ensure that excluded service generator DUoS charges accord with the principles underlying the price control; and that
- deviation from those principles would enable Ofgem to determine the appropriate level of such charges.

Proposal

1.5 The following proposed text would relate generator DUoS charges to the information provided to Ofgem and used to construct the PUM term in the price control. PUM is the basic allowance, comprising operating expenditure, depreciation and rate of return[28]. EHV DUoS currently contains an allocation of

[28] 'PUM' does not expand like a normal acronym. The letters indicate that some elements of base revenue (P) relate to use of system (U) and some to metering (M).

these components, and the proposed modification would have the same effect for generator DUoS charges.

1.6 The suggested modification would take the form of the following additional paragraph as Schedule A, Part C (Excluded Services), paragraph C3(c):

"units of electricity exported by generating plant directly connected to the licensee's distribution system, provided that the licensee's charges for the distribution of such units do not exceed the charging rates underlying the information as to generator DUoS revenue and generator units distributed given by the licensee to the Authority and used by it for the purposes of setting the term PUM in Special Condition B (Restriction of distribution charges), subject only to such adjustments as may be appropriate in the reasonable opinion of the Authority either to secure proper allocation of costs between price-controlled and excluded service revenues or to reflect material variations between the actual charges made and charging rates undying the information as to generator revenue provided to the Authority by the licensee."

1.7 If this amendment is made, some consequential modifications to the distribution price control provisions are likely to be required.

Responses

1.8 **Ofgem would welcome responses on the proposed modification to the distribution price control, as set out in this appendix.**

Appendix 2 Condition 4 Statements

Introduction

2.1 This appendix is concerned only with the way in which connection charging statements (presently Condition 8 Statements) relate to the connection of embedded generation. It is not intended to lead to a general standardisation of the various statements the form of which has already received the requisite regulatory approval. However, consideration of the requirements of prospective embedded generators would seem to constitute an opportunity to review the charging statements.

2.2 While there are strong similarities between the existing Condition 8 Statements, they differ in form and content. Some DNOs already include the some of the elements suggested in this appendix. There would seem to be a case, in respect of embedded generation connections, at least, for the general adoption of best practice.

Format of statements

2.3 Most connection charge statements mention embedded generation, although the information sometimes appears buried in text dealing principally with demand connections. Ofgem consider that DNOs might usefully devote a discrete section of the statement to generation.

2.4 Ofgem is holding a separate dialogue with interested parties about competition in connections, and it is not the intention to discuss those issues in detail here. It seems important, however, that the connection charging statements should be clear about contestable and non-contestable work on generator connections. Potential embedded generators should have the opportunity to benefit from competition in connections on the same footing as those seeking demand connections. One charging statement helpfully provides a table relating contestable and non-contestable work to the overall work programme for making a connection. Other DNOs might consider something similar.

2.5 It would be helpful if all Condition 4 Statements could be clear about:

- who would have the entitlement to request a connection;
- the definition of terms used in the statement;
- the likely terms and conditions of connection and use of system agreements;
- whom to contact to discuss connection proposals;
- application of the distribution code and CUSC;
- adoption of assets by the DNO;
- accreditation of contractors to carry out contestable work;
- energisation of contestable works; and about
- target times for response to enquiries about potential connections.

2.6 Existing statements classify potential connection customers by 'customer group' (e.g. 'Business Monthly HV'). It would be helpful if prospective embedded generators could be 'banded' by size or type to facilitate clear and separate guidance (including connection charge information) for each group.

Calculation of charges

2.7 Existing connection charging statements are somewhat lacking in detail on the way in which connection charges are calculated. Public Electricity Suppliers, like the Area Electricity Boards before them, were reluctant to give full breakdowns of connection charge quotations. That lack of detail is still a feature of the statements, but it is increasingly inappropriate in a liberalised industry from which customers are expecting competition, transparency and negotiation.

2.8 Illustrative lists of non-standard charges are often not particularly specific. Factors likely to influence costs and charges are sometimes summarised in a brief bulleted list. The same is often true of lists of items of significant cost (e.g. new transformers or sizes of cable of overhead line, by length). DNOs should consider expanding on all this information.

2.9 Worked examples of typical connection charges can be helpful – especially to smaller undertakings and individuals unused to making connections to networks

and seeking to understand the methodology. Existing connection charging statements are not consistent in this regard. One company claims that it is 'not feasible' to give worked examples for embedded generation connections, while another gives three worked examples with supporting network diagrams. Although such diagrams are helpful, only one company's statement makes use of them. Others might consider doing so.

2.10 Some charging statements make no reference to the assessment of fault levels, load flows and system losses likely to be associated with a generation connection. Prospective generators would probably find it helpful to have an indication of the timescales within which such studies could be performed, together with an assessment of their likely cost.

2.11 It is for discussion whether tariff support allowance (TSA) and capitalised operation, repair and maintenance charges should be levied on embedded generators. Where they are likely to apply, however, Condition 4 statements could usefully give more information than do those currently available. In particular the calculations underlying O, R & M percentages could be set out in more detail. Similarly, it should be possible to supplement a statement of the principles of TSA with the illustrative calculations.

Negotiation

2.12 The provision of additional information on the calculation of connection charges would be of assistance in reaching the negotiated settlements suggested in the body of this consultation paper. The statements might also constitute a vehicle for a 'code of practice' on negotiation of connection charges, related to different sizes of prospective embedded generation project.

2.13 Some statements specify that all charges are payable in full and in advance. It is doubtful whether this requirement remains justifiable. Ofgem's initial view is that the timing of charges should, like their level, be a matter for negotiation.

Subsequent connections

2.14 As this consultation paper acknowledges, there is scope for further discussion of the 'second comer' issue of reimbursement of initial contributors. For the moment Ofgem considers that all connection charging statements should specifically refer (as some already do) to the Electricity (Connection Charges) Regulations 1990.

2.15 Many existing charging statements indicate that embedded generators will be charged the full cost of replacement of assets installed to connect them to the network. This suggests both that DNOs are able to identify those assets, and that they should be able to reimburse generator initial contributors from charges levied in respect of connections subsequently made to them.

Glossary

In this document, the following terms and abbreviations are taken as having the meaning indicated here.

Ancillary Services	voltage support, frequency response, reserve and black start
CHP	Combined Heat and Power
DCHP	Domestic Combined Heat and Power
P2/5	Engineering Recommendation P2/5[29]
PES	Public Electricity Supplier[30]
'Smart buildings'	Buildings having automatic systems to control energy use[31]
'Smart metering'	Metering capable of communication and/or computation

Voltage levels (typical levels used by UK distribution systems):

EHV – Extra High Voltage (connections at 22kV, 33kV, 66kV or 132kV

HV – High Voltage (connections at 6.6kV or 11kV

LV – Low Voltage (connections at 230V (single phase) or 415V (three phase))

[29] DNOs are required to develop their networks to comply with the security requirements of P2/5. It is therefore, a major influence on network design.

[30] PESs are the successors to the former Area Electricity Boards. Under the Utilities Act 2000, PES licences are to be split into separate distribution and supply licenses.

[31] Smart buildings may also incorporate other systems (e.g. security) and will usually be associated with sophisticated IT and communication equipment. 'Smart metering' may be incorporated.