1. Introduction

1.1. This Policy Document (PD) supersedes EM7907 and updates the information in accordance with revised Engineering recommendation P2/6. Although reference is made to transmission and generation, this PD is issued as a guide to distribution planning only.

1.2. ER P2/5 took into account the results of extensive reliability studies using fault statistics and risk analyses and the relationship of these to the costs of system reinforcement including the effect on losses. ER P2/6 does not revisit these analyses; it simply replaces the previous table 2 which related to large steam and OCGT sets (that were prevalent at the time ER P2/5 was published in 1978), with a new table 2 that takes account of modern types of Distributed Generation (DG). In addition to the new Table 2 the guidance on how to assess the security contribution from generation has been captured in a new ENA Engineering Technical Report, ETR130; this ETR also contains the references to the background work on the methodology and data capture that underlie the new Table 2.

1.3. With regard to the contribution to System Security afforded by DG, Table 2 provides deterministic values that will allow an assessment to be made. However, it may be necessary to carry out a more detailed assessment to determine the contribution from a particular DG plant. Guidance on how to conduct such a detailed assessment is contained in ETR 130 and a computerised modelling program. The application guide for the modelling program is contained in ETR 131.

2. Recommended Levels of Security

2.1. Table 1 sets out the normal levels of security required for transmission and distribution networks classified in ranges of group demand. Reinforcement proposals will be required to be justified by comparison with these standards and subject also to the qualifications set out in Section 3.

2.2. For each class there is laid down in Table 1 the maximum interruption time permissible because of the first circuit outage under average conditions of system control and road travelling. Only when the Group Demand exceeds 60MW is a specified time for restoration of supplies on the occurrence of a second outage.

2.3. The restoration time of 15 minutes can be met by automatic switching or remote control but if these facilities are not available then a firm supply arrangement may be planned according to the economics of the case. The restoration time of three hours includes time travelling to one or more switching points under average conditions. The time permitted has to be extended when necessary to include that required to bring transportable diesel plant to restore an island or an otherwise isolated supply network. The repair time does not necessarily include that required for the repair of submarine cables as transportable diesel plant can be made available in such emergencies.

2.4. These standards refer to general distribution and not to individual consumers. Individual commercial or industrial consumers may demand a degree of security appropriate to their special requirements and in that event the extra costs will be taken into account in the negotiations for supply.

2.5. Alternative feeds over low voltage distribution are often available in the under 1MW class. These interconnections are included in the design specification in the Chief Engineers' Conference Report No 13 (1966). They are not an essential part of the network design and in any case are not usually capable of maintaining more than one third of the maximum demand of a distribution network on the loss of an 11kV/LV substation.

3. Security Standards – Qualifications

3.1. The following points should be borne in mind when preparing a reinforcement proposal to bring a network up to an appropriate level of security.

3.2. If it is known that higher voltage reinforcement is expected in the near future, the improvement in security resulting form this reinforcement may enable lower voltage reinforcement to be deferred.

3.3. There may be difficulties either physical or economic which prevent the undertaking of normal forms of reinforcement in particular locations. In these circumstances relaxations to the levels of security may be proposed by System Planning. These departures from the recommended level of security defined in this PD may require detailed risk and economic studies to be undertaken including the costs of any out of merit generation.

3.4. If possible over the period of the network peak load, the distribution network should be rearranged so that sections of that particular network can be retained in a lower "class of supply".

3.5. On loss of supply, automatic switching or remote control may enable a network to be rearranged. For example a circuit may have a potential maximum load of 16MW and have an alternative supply with a 13MW limitation.

On loss of supply automatic switching into 13MW and 3MW sections would be arranged with a subsequent operation of the automatic sequence equipment to restore 13MW from the alternative source (i.e. within the 15 minutes allowed).

The 3 hour period is then available to restore the 3MW potential load. This would be done either form some new source or from the same source as the 13MW section if loading conditions due to weather or time of day made this practicable. If the latter circumstance was the only solution under loss of supply then consideration would have to be given to further network switching or to the provision of emergency generation before the onset of the peak load period. Up to 1MW of this 3MW may be disconnected for the repair time of the faulty circuit and still be within the standards set in P2/6.

4. Capability of a network to meet demand

4.1. Studies have shown that the existence and possible provision of transfer capacity should always be considered when assessing the need for reinforcement.

4.2. The capacity of a network to meet group demand after the first and second outages should be assessed as:

(a) The appropriate cyclic rating of the remaining transmission or distribution circuits which normally supply the group demand following outage of the most critical circuit (or circuits)

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(b) Transfer capacity which can be made available from alternative sources

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(c) For demand groups containing generation, the effective contribution of the generation to network capacity.

4.3. The assessed capacity may need to be reduced to ensure that, under normal running conditions equipment is not loaded to a point where it would suffer loss of life.

5. Voltage standards

5.1. The statutory voltage limits specified in the Electricity Safety, Quality and Continuity Regulations 2002 must be observed both for high voltage and low voltage consumers. This assumes that:

(a) Normal voltage is maintained at the bulk supply points
(b) All distribution circuits and plant are in service
(c) Weather conditions are not worse than "average cold spell".

5.2. Under peak load conditions (average cold spell) and with all transformers in service in a primary or bulk supply substation containing two or more transformers connected to the same busbar, the transformer tap range should be able to maintain 5% above the normal voltage on the distribution busbars (33kV or 11kV). With the largest unit out of commission and therefore only the firm capacity available under the same conditions, it must be possible to maintain normal voltage.

5.3. Where the emergency or alternative supply depends on HV network interconnections, for example because the primary or bulk supply substation has only one transformer, then under outage conditions voltages less than set out in 5.2 are acceptable. These conditions however, should not be worse than would apply with voltage reduction as part of the load shedding programme otherwise consumers' equipment may suffer damage due to low voltage. If the voltage at the consumers' terminals is liable to fall below –12% it would be preferable to disconnect some load rather than maintain supply so far outside the statutory limits.

These circumstances could also apply when supplies are maintained by emergency low voltage network interconnections.

Full advantage must be taken of line-drop compensation equipment under conditions involving emergency network feeds and the consumer nearest the voltage controlled source will be expected to accept the upper limit of voltage. The available range is therefore 18% but this is, of course, inclusive of HV, LV and service voltage drops. Minor fluctuations lasting less than five minutes should be ignored in these calculations.

5.4. The number of tap steps available to boost the network voltage can often be limited by the internal regulation of the transformer particularly when the load factor is not good. It may be appropriate to study this aspect in particular cases.