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G3 Consultation Workshop

13th June 2007

Agenda

- Introduction
- Consultation Section 3: Forecasting future reinforcements
- Consultation Section 4: Determining forward looking costs

12:30 Lunch

- Consultation Section 5: The G3 tariff model
- Consultation Section 6: Other charging Issues
- Consultation Section 7: Illustrative charges
- Consultation Section 8: Next steps

~15:30 Close

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Forecasting future reinforcements

Forecasting Future EHV Reinforcement

Analysis by Network Groups

- 132kV and 33kV in England and Wales (typically)
- 33kV in Scotland
- Network normally supplied from a GSP or BSP

Mechanistic process using publicly available information:

- Long Term Development Statement (published annually)
- Engineering Recommendation P2/6
- Engineering Recommendation G74
- Other Distribution Code referenced documents

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Analysis Method for Demand

Determine Network Group Limitations

- Base Network AC load flow
  (Max demand & generation at appropriate F factor)
- Load increased in 1% increments up to 15%
- N-1 & N-2 contingency analysis in accordance with P2/6
- Network limitations and trigger levels identified

Determine Reinforcement Scheme

- Standardised reinforcement schemes
- Sense check of very large schemes

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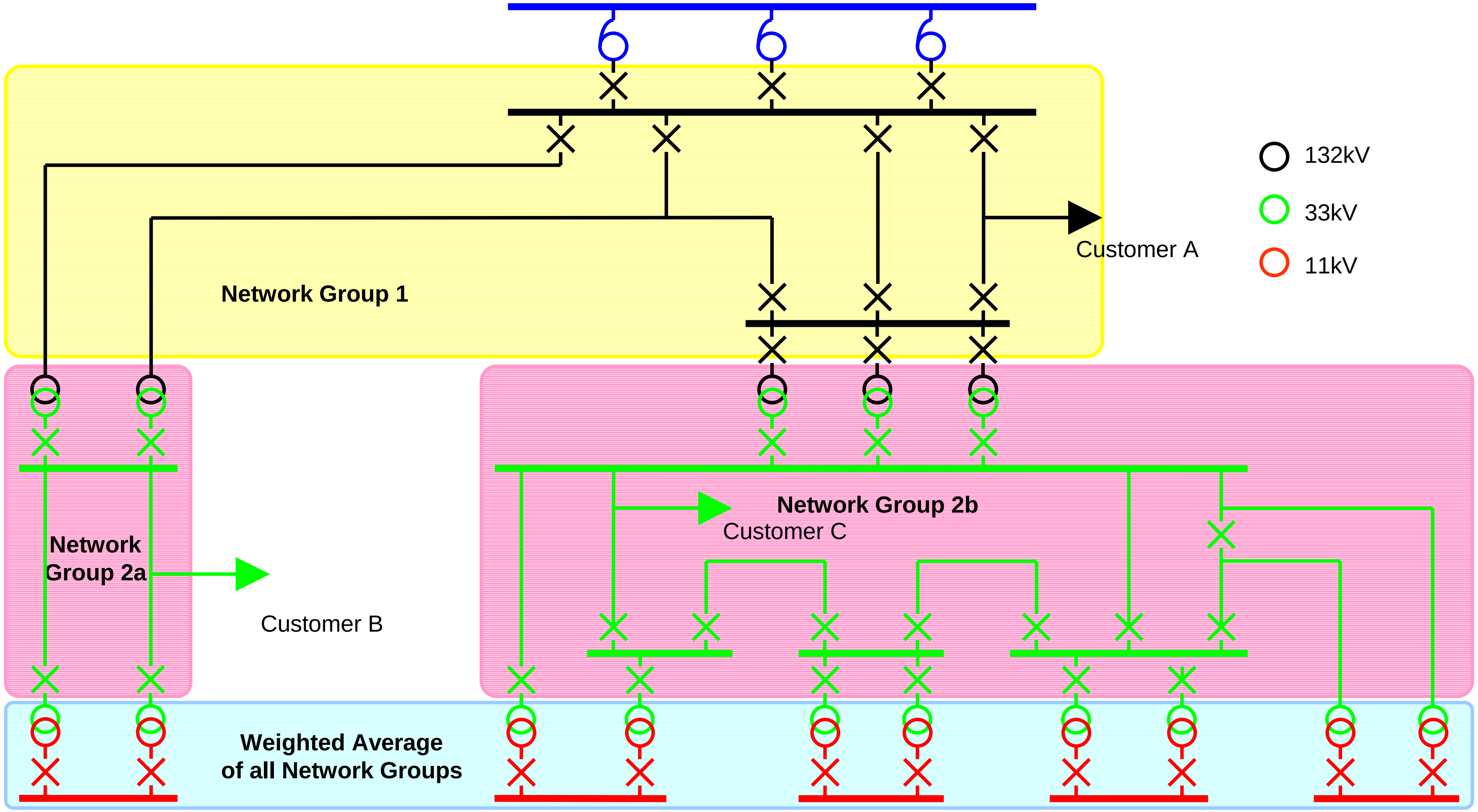
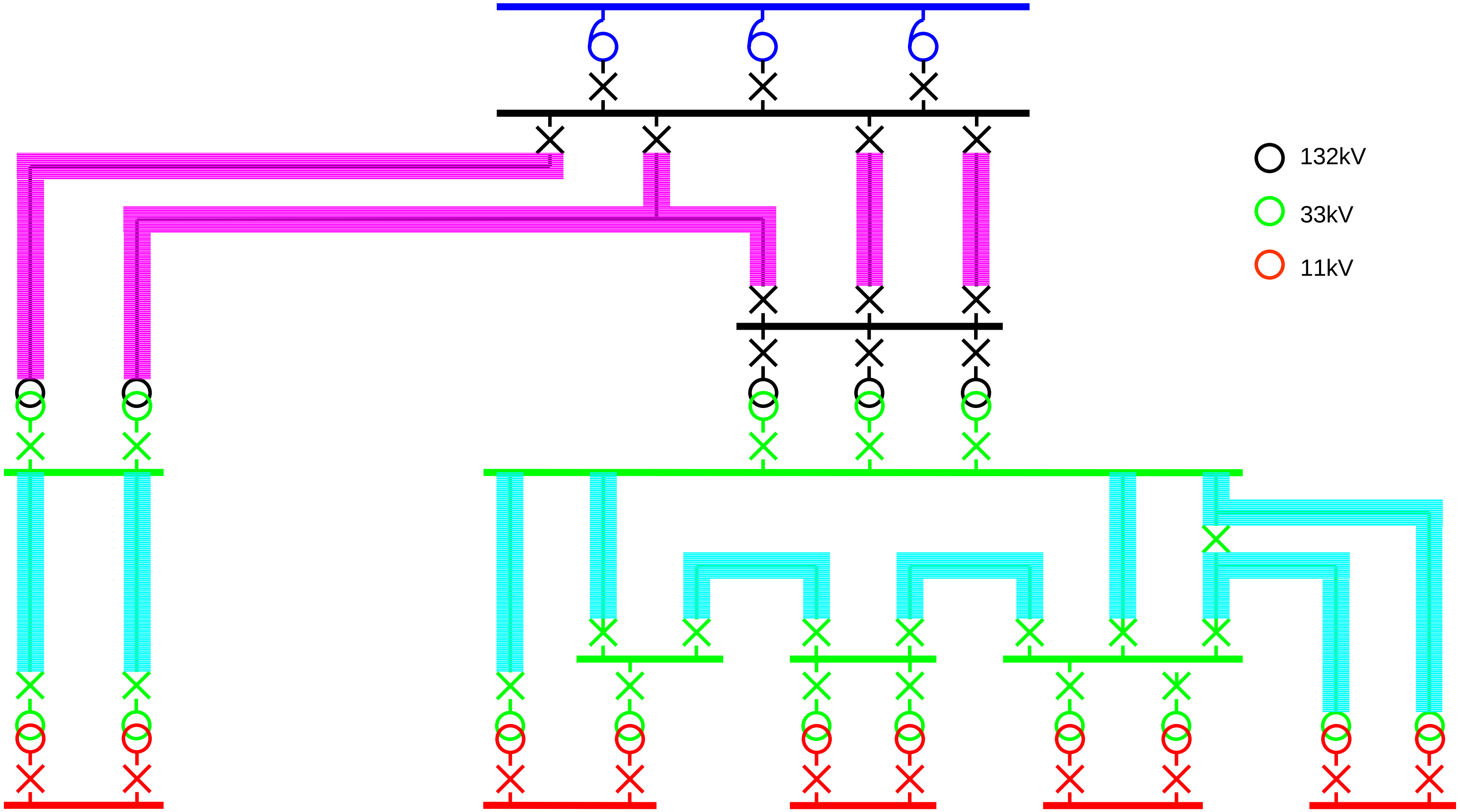
Analysis Method for Demand - Example



Analysis Method for Demand - Example



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Analysis Method for Generation

Generation is assumed to connect to the Principal Substation of the Network Group

Calculate headroom of existing system

- Base Network AC load flow
  (Min demand & max generation)
- Fault level calculations in accordance with G74

Calculate headroom of reinforced system

- Standardised reinforcement schemes

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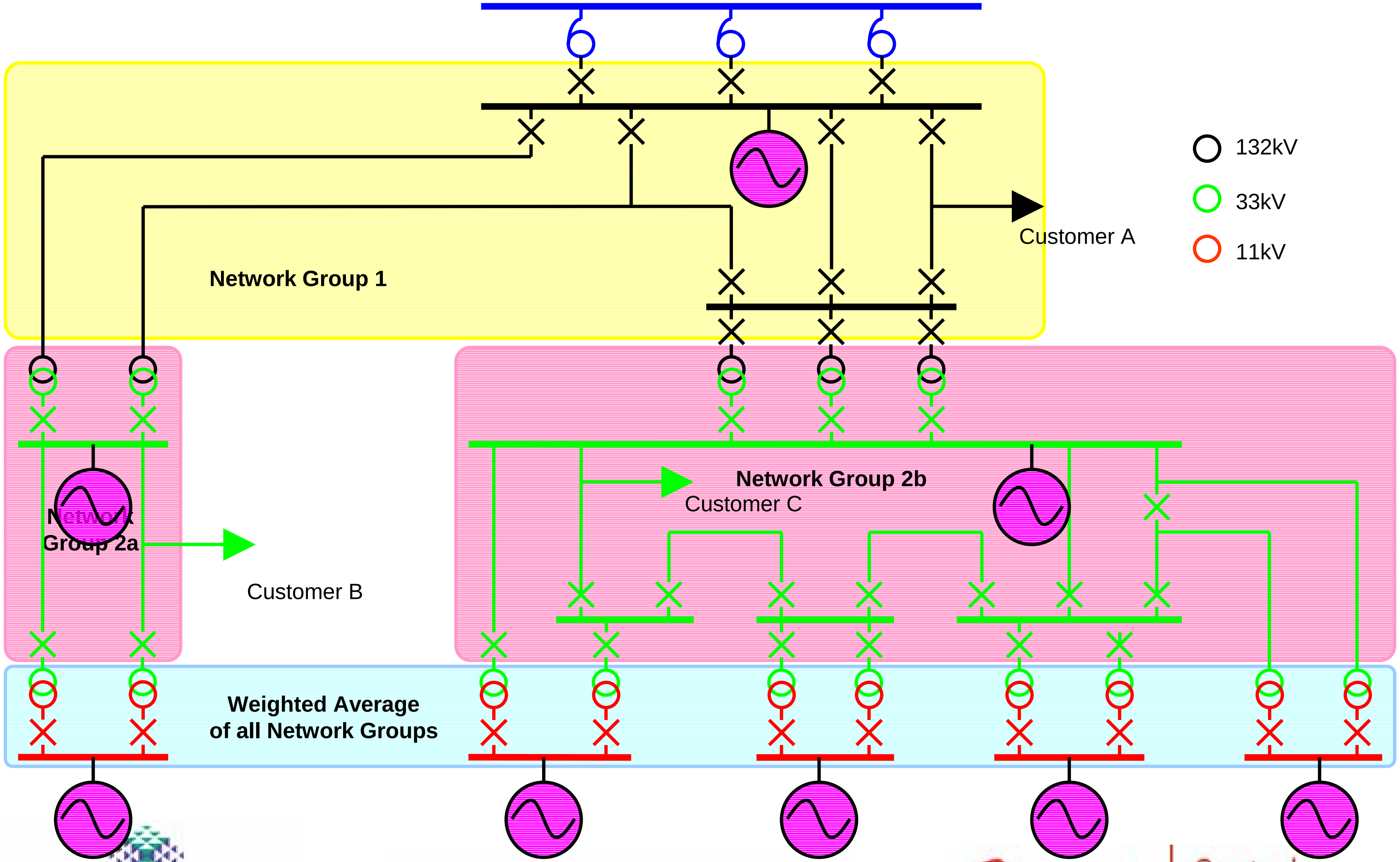
Analysis Method for Generation - Example



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Demand/Generation Difference

Demand growth is assumed to be evenly distributed across the network group and can be modelled with incremental growth.

=> 'growth-till' reinforcement calculations are valid

Generation growth sparsely distributed at present and an individual generator represents a significant step-change.

=> 'what-if' reinforcement calculations are more realistic

Generation costs are mostly based on fault-level (switchgear) reinforcement but load-flow analysis similar as with Demand is also performed.

Demand costs are mostly based on load-flow (circuits and transformers) reinforcement but fault-level analysis as with generation is also performed.

Forecasting Future HV & LV Reinforcement

Contingency analysis approach is not implemented at lower network voltage levels for practical reasons

Demand marginal costs forecasted from historical data

- Forecast using RPI
- Based on reinforcement data from the DNO Regulatory Reporting Pack (RRP)

Generation marginal costs are not currently included in the RRP

- Typical values for voltage level
- LV costs are initially set to zero.

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Views are invited on the following:

- The different approaches to demand and generation.
- Is analysis at the Network Group level appropriate?
- Is the approach of incrementing demands in 1% steps up to 15% and undertaking contingency analysis at each step reasonable?
- Is one year of actual cost data sufficient to produce forecasts for HV and LV reinforcement costs?

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Determining forward looking costs

Forward Cost Pricing

- Forecast EHV reinforcement costs recovered over 10 years (cost recovery period) from customers in each network group
- EHV reinforcement costs are averaged over all network groups for inclusion in HV and LV costs

Why 10 years?

- Aim: to utilise *spare* capacity. Demand should not be discouraged because capacity might be exceeded in 20 years or more
- Load growth forecasts are very uncertain for more than a few years ahead
- Increasing embedded generation (and the effect of high energy prices) is likely to affect longer term network loadings

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why 10 years? (cont)

- Reinforcements over longer periods depend increasingly on previous reinforcements which are not included in the current modelling process
- However, customers require a long enough period to plan and invest

Hence, choice of 10 years

Demand Marginal Charge Rates

- If capacity not exceeded within 10 years
  - No marginal charge
- Otherwise, gradually rising rate over 10 years till capacity exceeded
- Charge rate/kVA proportional to Present Value of the reinforcement (Accountancy method)

demand charge rates (cont)

- Amount recovered by year 10 is therefore proportional to the total kVA over the 10 years (the demand integral, *di*)

  - see equation at top of page 21
- When growth rate is very small

  di ~ 10 x *capacity* (kVA years)

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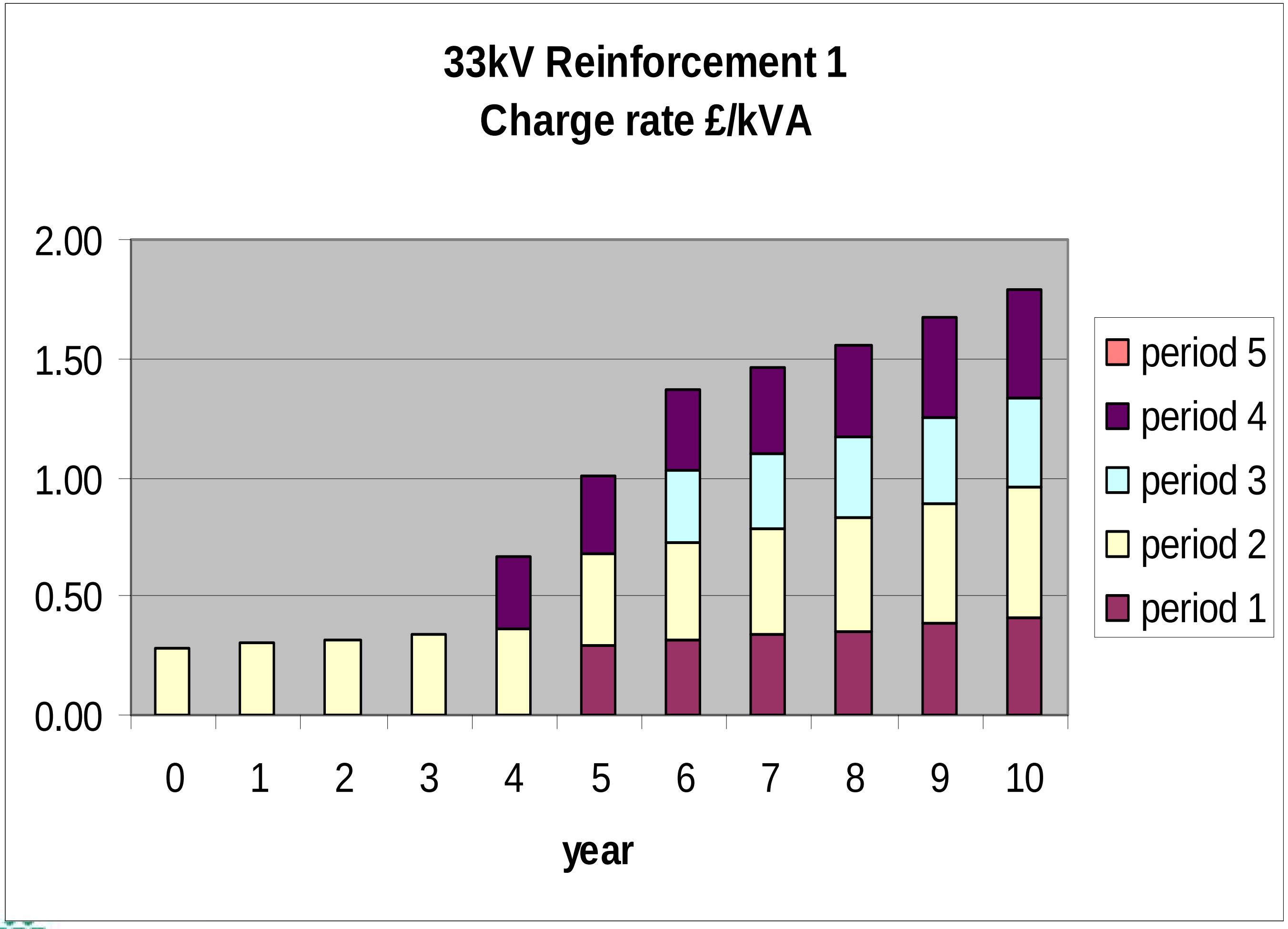
Multiple Time Periods

- Years till capacity exceeded will vary for the maximum demand in each time period
- Same charging rule is applied, based on the PV of reinforcement using the reinforcement time for each time period
- Last equation on page 21 shows demand integral weighted by the change in PV due to the difference in time to reinforcement
- Constant of proportionality is derived by dividing the reinforcement cost by the sum of the weighted demand integrals for each time period

Annual Charge Rates



Generation

- Demand model based on forecast growth rates not applicable to EHV and HV generation as new generation is added in sizeable discrete amounts
- Need for reinforcement based on assessment of additional generator
- Size of test generator based on 85th percentile of existing and planned generators for each company and voltage level

Generation (cont)

- Annual charge rate per kVA is derived by dividing the annuitised cost (over 15 years) of any reinforcement required to support test generator by the kVA available until further reinforcement would be required

Generator Benefits

- Where generators offset the need for reinforcement a benefit is credited equivalent to the demand charge according to the Firm Generation
- Firm Generation equals the Generation kVA multiplied by the P2/6 Generation Contribution Factor (f)

Generator Costs & Benefits

- Upstream and downstream costs and benefits differ between Demand and Generation
- Rules based on P2/6 are given in Appendix 2

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Generator Costs & Benefits (cont.1)

- **Example 1**

  33kV Network Demand incurs reinforcement costs for:

  132kV Switchgear Demand reinforcement (D1)

  132kV Circuit Demand reinforcement (D2)

  132/33kV Transformer Demand reinforcement (D3)

  33kV Switchgear Demand reinforcement (D4)

  33kV Network Demand reinforcement (D5)

  No benefits

Generator Costs & Benefits (cont.2)

- **Example 2**

  Generation adjacent to 132/33kV transformation - incurs reinforcement costs for:

  132/33kV Transformer Generation reinforcement (G3)

  33kV Switchgear Generation reinforcement (G4)

  receives benefits proportional to P2/6 generation contribution factor for:

  132/33kV Transformer Demand reinforcement (-f x D3)

  132kV Circuit Demand reinforcement (-f x D2)

Lower Voltage Networks

- The weighted average of marginal costs from EHV network groups feed into the marginal costs for HV and LV connected customers over the whole network

Views are sought on Demand

- The approach to determining EHV **demand** marginal costs
- The use of 10 years for the time horizon and cost recovery period
- The Time Periods used
- The mechanism for setting charges in each Time Period

Views are sought on Generation

- The approach to determining EHV **generation** marginal costs
- The approach of using a typical generator size
- Should the 10 year period for the time horizon used for demand also be used for generation
- Use of generic values of P2/6 contribution factors
- Relaxation of P2/6 based rules to assign benefits to LV generation

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Views are invited on the following:

- The approaches to determining demand and generation marginal costs.

- The time periods that should be used for determining costs.

- Is the approach for determining growth rates, and particularly the method of adjusting for embedded generation to determine underlying demand growth, appropriate?

Views are invited on the following (cont):

– Is the 10 year time horizon for considering network reinforcements and the associated cost recovery period a reasonable approach?

– Should the 10 year cost recovery period used for demand be used for generation also, or should the15 years assumed for generation in the distribution price control be used instead?

– Is the mechanism for determining charges in each of the time periods appropriate?

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Views are invited on the following (cont):

- Should uniform generic values of the P2/6 contribution factors be assumed? If not, should they vary by type of generator or by region (taking account of the type of generator that is more likely to connect there)? Should actual contribution factors be determined from historical output data for existing generators where this is available? For lower voltage levels should voltage level averages be used?

- Is the approach of using a typical generator size in determining the marginal cost appropriate?

- Should the P2/6 based rules on the benefits arising from LV generation be relaxed for charging purposes?

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The G3 tariff model

G3 tariff model – overview

- Identify cost:
  - O&M, Refurbishment, NGT Exit and Licence fees, Admin and billing
  - Marginal Costs
- Other inputs:
  - Customer Groups, Peaking Probabilities, Demand Estimation Coefficients, Loss Adjustment Factors and Forecast Usage Data.
- Cost allocated to customer yardsticks
  - Note: EHV Sole-use asset charges determined separately
- Revenue reconciliation

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Marginal Costs

- Higher voltage costs are taken from FCP
- Lower voltages, demand
  - From HV / LV reinforcement (historical) and peaking probabilities
- Lower voltages, generation

  Costs:
  - LV costs = zero, HV costs “typical” cost (forecasts BPQ or “actual” annual returns)

  Benefits:

  = - (Marginal demand cost) * (P2/6 Contribution Factor)

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Yardstick cost allocation, demand

- Marginal costs → marginal cost * demand
- NGET → demand at time of max. demand
- Licence fees → customer numbers
- O&M and refurbishment → demand at time of max. demand
- Admin, customer service and billing → customer numbers

Yardstick cost allocation, generation

- Marginal costs → marginal generation cost * average size at voltage level
- Costs restricted to voltage of connection
- Benefit at each voltage includes benefits to voltages above
- Net yardstick cost = (cost - benefit), capped to zero

Revenue reconciliation, demand

- Difference between yardstick costs and allowed revenue (+/-) is split between voltage levels in proportion to the Modern Equivalent Asset Value (MEAV) of the assets at that level in relation to the MEAV of the entire distribution network.
- Within each voltage level, a fixed adder per kVA is calculated (£/kVA) with the amount calculated above and the total kVA connected to that level.
- The fixed adder per voltage is then allocated to the different customer groups in that voltage (the yardsticks).
- Method allocates costs in relation to the amount of the network the customers use (i.e., EHV customers should not pay for HV or LV costs etc).

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Revenue reconciliation, generation

- Reconciliation: fixed adder, not differentiated by voltage level
- Note that the increase in generation charges is capped

Views are invited on the following:

- Is one year of actual cost data sufficient to produce forecasts of operation and maintenance and refurbishment costs?

- Is the proposed revenue reconciliation approach of applying a different 'adder' to each voltage level in proportion to MEA value appropriate?

- Should negative charges be permitted?

- Would it be appropriate to cap site specific EHV charges at the level of the equivalent generic HV charges to avoid perverse incentives at the boundary and, if so, should this be done before or after allocation of sole use asset costs to EHV charges?

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Other charging issues

Illustrative Example of Site-Specific EHV Demand Charge Calculation

- Sole Use Assets (SUA) Gross Asset Value (GAV): £2,000,000
- In this example assets assumed to be 100% contributed.
- Agreed Connection Import Capacity (kVA): 5,000
- O & M charge: 1%
- FCP marginal cost (£/kVA): 3.00
- Demand Scaling Adder (£/kVA): 2.00

- Annual Charge Calculation

		£
SUA O&M charge (1% of GAV)	**2,000,000 x 1%**	**20,000**
Capital charge (40 yr depreciation 2.5% of GAV)		**0**
Return on Net Asset Value (NAV) (6.9% on NAV)		**0**
FCP Marginal cost (£/kVA)	**5,000 x 3**	**15,000**
Scaling Adder (£/kVA)	**5,000 x 2**	**10,000**
Administration charge		**1,000**
Reactive charge		**0**
TOTAL CHARGE PER ANNUM		**46,000**

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Illustrative Example of Site-Specific EHV Generator Charge Calculation

- Sole Use Assets (SUA) Gross Asset Value (GAV): £1,000,000
- In this example assets assumed to be 100% contributed.
- Agreed Connection Export Capacity (kVA): 5,000
- FCP Generator marginal cost (£/kVA): (A) = 2.00
- FCP Generator marginal benefit (£/kVA): (B)
  = FCP Demand marginal cost x P2/6 F-Factor for site
  = 3.00 x 0.34 (34%) = 1.02
- FCP Net marginal cost (£/kVA) : (C) = (A) – (B) = 0.98
- Generation Scaling Adder (£/kVA): 1.50

- Annual Charge Calculation

		£
FCP Net Marginal cost (£/kVA) (C)	**5,000 x 0.98**	**4,900**
Scaling Adder (£/kVA)	**5,000 x 1.50**	**7,500**
Administration charge		**1,000**
Reactive charge		**0**
TOTAL CHARGE PER ANNUM		**13,400**

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Illustrative Example of Reactive Charges Calculation

- Rating of reactive compensation plant: 50 kVAr
- GAV of reactive compensation plant: £10,000
- Cost of operation & maintenance: 1% of GAV
- Nominal life of reactive correction plant: 10 years
- Annual cost recovery factor: $r(1 + r)^n / [(1 + r)^n - 1]$
  n = 10 years, r = cost of capital (6.9%) giving a factor of 0.1417

p/kVArh charge calculation

Annuitised cost of reactive compensation plant	0.1417 x £10,000	£1,417
Operation & maintenance	0.01 x £10,000	£ 100
Total cost		£1,517
Reactive charge (p/kVArh) (Total cost / 8760 x rating)	1,517x 100 / (8760 x50)	0.346

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Illustrative charges

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Next steps

Next steps

- Responses to the consultation to be submitted by 29th June.
- G3 will consider all responses received and decide on the need for further development of the methodology and consultation based on the nature of the responses. G3 will issue a summary of the responses together with an outline of its proposed way forward.
- The G3 companies plan to submit individual proposals for modification of their methodologies to the Authority in September.
- Depending on the Authority's decisions on these modifications, indicative tariffs will be announced in late December 2007 and prices will be confirmed in mid February 2008 for implementation with effect from 1 April 2008.

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Thank you!