Charging Condition 2: Incremental Cost of Capacity

CISG

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Introduction

- Condition 2
  - The condition
  - Timescales
- What is Incremental Cost of Capacity
  - How is it currently calculated
  - How is it used
- Areas targeted for review
  - Options
  - Views ?

Condition 2

- ‘To review, identify and asses further the technical basis for a range of alternative methods (incl…) of estimating, and reflecting in locational charges, the cost of incremental capacity’.
- If improvements identified, bring forward modifications for implementation in April 2007.
- If no improvements publish a report setting out the conclusion to the review.
- Progress report to be published in April 2006

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Calculation of ICoC 3 Stage Process

- Calculated for each Price Control Period
- 3 stage process
  - Calculate Investment cost per MWkm
  - Calculate annuity including overheads allowance
  - Derive Expansion Factors

New Build Costs

- Costs taken from 2004 “TR3” document
- Costs derived from actual tender information, estimates from suppliers, or previous information indexed using transmission cost indices
- TR3 process has been externally audited
- The costs reflect general site conditions
- Costs excluded:
    - Land costs
    - Engineering charges
    - Associated equipment

New Build Costs

- Overhead line costs:
  - Assumes > 30km build
  - 70% suspension towers
  - Cost of crossings not included e.g. rivers/road/rail
  - Miscellaneous costs e.g. undergrounding, telecoms, tree felling, soil reinstatement, area supervision, surveying are not included
  - Financing costs are not included e.g.Interest During Construction
- Cable costs assume direct burial

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OHL New Build Costs

400kV						
	OHL Rating	Cost per km	Cct kms in last 10 Years	£/MWKm	Weighted £/MWkm	
	6840	707	451	103.363	46616.52	
	6840	[redacted]			0	
	3420	[redacted]			25614.835	
	3420	[redacted]			32931.087	
	4020	[redacted]			121376.12	
	5040	[redacted]			24166.667	
	5360	[redacted]			6977.6119	
			Cct km Weighted Avg:		**113.168**	
			Straight Average:		**118.873**	

400kV OHL Expansion Constant

400kV		
		£/MWkm
OHL Cost		**113.168**
Annuitised		7.469
Overhead		2.037
Total £/MWkm		**9.506**
2005/6 RPI		3.06%
Final £/MWkm		**9.797**

Annuity Factor:	0.066
Asset Life:	50
Capital:	0.0625
Overhead Factor %	1.8

Lower Voltage Expansion factors

- Adjusted to reflect quantity of circuits planned or capable of being uprated to 400kV from 132kV or 275kV
- Expansion factors weighted by percentage of 400kV factor and actual voltage e.g. 83%/17% for 275kV cable:

  83% x 20.88 + 17% x 20.67 = 20.70
- Based on data supplied during GB Charging process

How is it used?

- Transport model produces marginal MWkm
  - represents the increase in use of the system of 1MW is injected at each node.
- Representation of the system at peak
- Uses SYS data
- Flows are not constrained
- nodal MWkm are converted to zonal weighted MWkm
- Multiplied by expansion constant and security factor
- Locational element calculated - provide differential
- Adjusted to ensure correct revenue recovery - tariffs

Areas targeted for review

- Transparency
- Forward looking vs. Historic
- Thermal ratings
- Spare capacity
- Dis-aggregation
- Cost reflectivity of expansion constant

Transparency

- £9.81/MWkm ?
- Can we add transparency to current methodology
  - the method
  - the data
- Change the basis of calculation
- Need to be reflective of GB - STC confidentaility

Transparency (2)

- Current process centred around TR3
- Data:
  - Can we provide
    - the cost per rating and voltage
    - the assets less than 10 years old
- Would enable users to calculate £9.81/MWkm
- Methodology:
  - Add the principles to Statement of UoS
- Allows users to understand the basis on which ICoC is calculated

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Transparency (3)

- Recent historic costs
  - calculate directly based on recent costs
  - Suggested 3 year period
  - SYS capacity increase / cost incurred per MW
  - Annual
- Would implicitly include elements of upgrading and refurbishment.

Transparency feedback

- Views…….

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Forward looking vs. Historic

- What did you cause / what will you cause?
- Treat new and existing users the same
- Methodology needs to be forward looking
  - how far forward & which elements?
- ICoC is an estimate of predicted costs
- What investments are used in the charging model?
  - Interaction with Condition 5 report
- Uncertainty over future investments
- Propose to include monitoring in Condition 5 report
- Transcost approach
- Limiting the use of historic data

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Transcost

- Calculates possible investments for future 10 years
- Each year investments are added to meet forecast
- Produces matrix of node to node costs for each year
- Node to node costs reduced to individual node costs
- 10 years then weighted to provide year ahead tariff
- Compressors considered, but slope dictated by pipe costs
- Cost of pipe established by historic costs
  - similar to electricity

Limiting the use of historic data

- Consider using 3 years rather than 10 years of historic costs.
- Relating the costs directly to the capacity increase.
- Consider what to use if no data available.

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Forward looking vs. Historic

- Views…..

- Current system
- Transcost approach
- limited historic data approach

Thermal Ratings

- Current methodology assumes unity power factor
  - MVA = MW
- Reactive power investment separate
- ICoC is actual a MVA figure
- Transport produces a MW figure
- AC approach
- e.g 1000 MW PS
  - local lines are 1100 MVA to allow for 0.85 power factor
  - TEC is MW based
  - MVAr component not directed

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Thermal Ratings - Options

- Calculate incremental km on MVA
  - Use an AC load flow model
  - Balance of accuracy vs. complexity, cost, predictability
  - charge based on MVA
- Calculate ICoC on MW
  - Assumed power factor
  - Valid for spurs not for meshed system
- Scale TEC for use in the tariff model
  - Increase the charging base to represent MVA
  - Charging based on MVA

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Thermal Ratings

- Views…..

Spare capacity

- ICoC is £/MWkm i.e it does not include spare capacity
- Transport model calculates the unconstrained MWkm
- Discussed a length during GB charging process
- Cost of spare capacity is deal with in the residual element of the charge.

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Spare Capacity

- Views……..

Cost reflectivity of ICoC

- Also cover dis-aggregation
- Review the element that make up ICoC
  - Cost of capital
  - asset life
  - Review excluded elements
    - e.g. IDC, land costs …
  - upgrade factors
  - Operational Costs

Elements of ICoC Asset life

- Asset life
  - current calculation assumes 50 years
  - Assets life ranges for different assets
  - differences between the technical, regulatory life
  - Assets are used beyond the book life
  - 50 years is seen as a reasonable approximation

Cost of Capital

- The current ICoC is based on National Grid's cost of capital
- 6.25 (0.066)
- The Scottish TO have a different cost of capital
  - 8.7 and 8.9
- Inclusion will increase the ICoC
  - GB to approximately 0.0683 annuity factor
- Should they be applied on a zonal basis
  - complex interaction between tariff and transport
- Consider if the current approximation is reasonably representative

Cost of Capital

- How can it be dis- aggregated?
  - Transport could be developed to provide the marginal km on a zonal basis
  - Tariff model would have zonal ICoCs
- Alternatively could amend the transport data to reflect the additional cost i.e use the expansion factors.
- SP and SSE would have 400kV factors greater than 1
  - 26% and 29% higher respectively

Elements not included in ICoC

- Elements not included
  - Interest during construction
  - Engineering Charges
  - Associated Equipment
  - Under grounding
  - Telecoms
- Not km based

Techniques for increasing capacity

- OHL based
  - Re profiling
  - Re conductoring
- Quad boosters
- Reactive compensation

OHL based capacity

	Weighting Scenario			
	Cost as a percentage of new build	1	2	3
Re-condustoring	140%	50%	40%	30%
Re-profiling	20%	20%	20%	20%
New build	100%	30%	40%	50%
average		104%	100%	96%

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OHL based capacity

- Refurbishment more expensive on cost per MVA
- Re profiling is cheaper
- Both cost just looking at the conductor costs
- Other costs could be included
  - ‘right off’ costs
  - additional towers
- Both techniques have limits
- On balance new OHL build is considered a reasonable proxy

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QBs

- Redistribute flows on a boundary
- Increase the boundary transfer
- Normal mode of operation is mid tap
  - Tap after fault, provided for security
- Capacity increase is not proportional to size of the QB
  - Subjective increase
- QB does not have a km base
  - stretch QBs in model
  - calculate a proxy £/MWkm and add to SVC
  - calculate a new zonal (non km based charge)
- Wider planning considerations

Stretch QBs

- OHL 6840 MVA provided at £707k/km
  - £103 / MVAkm
- 2 x 2750 MVA QBs give 1000 MVA extra on a boundary
  - different for each boundary
  - boundaries are not charging boundaries
- 2 x 2750 MVA QB cost £15M (for demonstration purposes)
- That is £15k/MVA
  - 1km of OHL cost me 103£/MVA
  - QB can be represented as 145km
- 145km is the point at which QB cost per MVA equals OH

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Calculate proxy

- Same figures as previously +
  - need an average length of circuits on boundary
  - say 80km
- 5 circuits on boundary - £3M per circuit
- over 40 years equals a £198k annuity
- 1000 MVA shared over 5 circuits is 200 MVA each
  - 198k/200 = 990 £/MVA
- If average length is 80km
  - 990/80 = 12.4 £/MVAkm
- (£15 M for 1000MVA vs. £56 M for 6840 MVA)
- Very dependent on average boundary length

New zonal charge

- Each QB can be allocated a ‘sphere of influence’
- Generation or demand on either side could be interpreted to drive the need for that QB
- The cost of the QB would then be allocated as an additional charge
- Very subjective
  - e.g South Wales - every generator not in South Wales responsible for Whitson QBs!
  - If if flips to export all generators in S Wales responsible.
- Benefits not necessarily appropriate for historic costs - it is not long run

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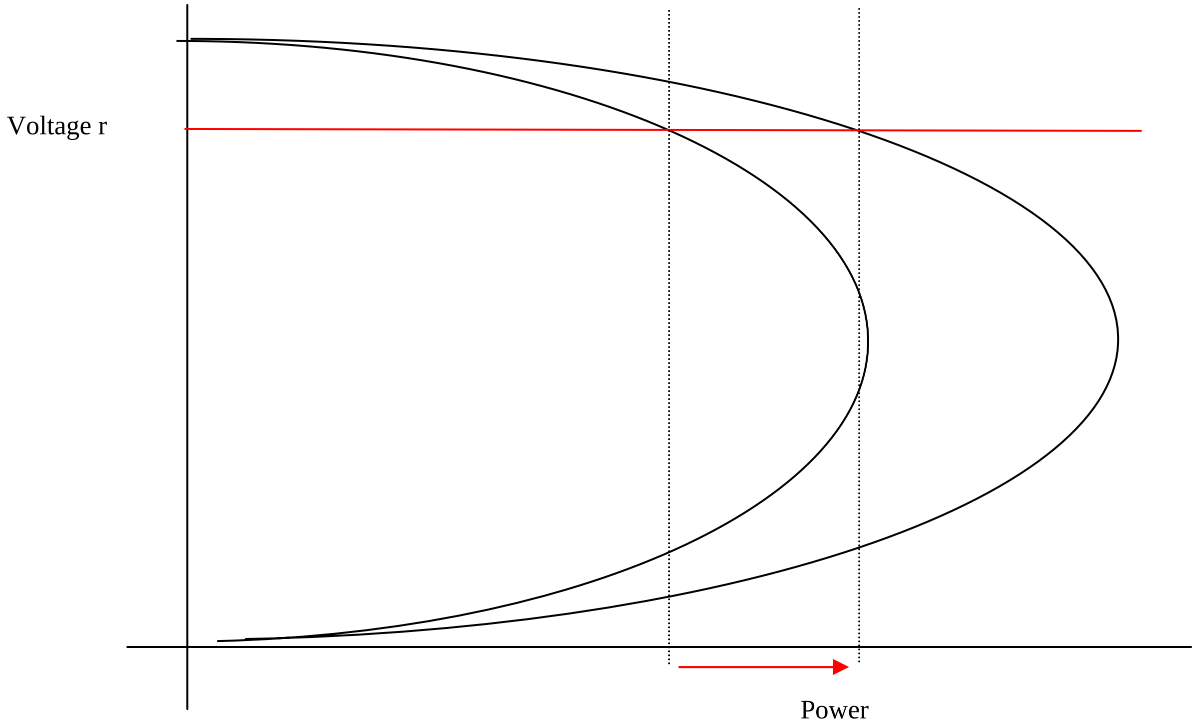
Reactive compensation

- Reactive compensation increases the boundary transfer



Reactive compensation

- Difficult to dis-aggregate between local and transmission requirement.
- Provided by static and dynamic compensation
- Dynamic also provided for stability
- Dynamic capacity generally post fault - security?
- Driver may not be winter peak
  - 11:45am is poorest P/Q ratio
- Interaction with load being considered separately
- Similar to QBs - don’t have a km
- Not in transport model

Reactive compensation

- Could include a pseudo element in DC LF
  - length approximate to cost / benefit
- Could incorporate cost in ICoC as QBs
- Could apply on a zonal basis
  - zones subjective
  - benefit subjective
  - transparency, simplicity
- Taking output of DC LF too far?

Focus

- Wide range of diverse issues
- Need to focus on the original condition
- Concentrate on the Incremental cost of Capacity