

# Market Rules

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## **Chapter 8**

# **Physical Bilateral Contracts and Financial Markets - Appendices**

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## Appendix 8.1 – Mathematical Formulation of the TR Objective Function and Constraints

- 1.1 This Appendix describes the objective function used to determine the number of *transmission rights* to be awarded to each *TR bidder* and sold by each *TR offeror* in a given round of a *TR auction*.
- 1.2 The objective function used for each *TR auction* has as its mathematical objective the maximization of the benefit, measured in dollars, of the aggregate willingness of successful *TR bidders* to pay for *transmission rights* that they have been awarded in a given round of a *TR auction*, net of the amounts that successful *TR offerors* were willing to accept for those *transmission rights*, as constrained by the results of the simultaneous feasibility test required to be conducted in accordance with section 4.6 of this Chapter.
- 1.3 The objective function for each round of a given *TR auction* is to:

$$\max \sum_{j \in J_r} A_j B_j T_{iwpj},$$

where:

$J_r$  is the set of *TR bids* and *TR offers* for *transmission rights* submitted in round  $r$  of the *TR auction*;

$A_j$  is the proportion of *TR bid*  $j$  that is awarded in the *TR auction*;

$B_j$  is, in respect of a *TR bidder*, the maximum price that the *TR bidder* submitting *TR bid*  $j$  offers to pay for a *transmission right* in that *TR bid* and, in respect of a *TR offeror*, is the minimum price that the *TR offeror* submitting *TR offer*  $j$  for that *transmission right* offers to accept for that *transmission right*; and

$T_{iwpj}$  is, in respect of a *TR bidder*, the number of *transmission rights* associated with injection *TR zone*  $i$  and withdrawal *TR zone*  $w$  valid in period  $p$  that the *TR bidder* submitting *TR bid*  $j$  bids to purchase and, in respect of a *TR offeror*, the number of *transmission rights* associated with injection *TR zone*  $i$  and withdrawal *TR zone*  $w$  valid in period  $p$  that the *TR offeror* submitting *TR offer*  $j$  offers to sell;



subject to the constraint that:

$$0 \leq A_j \leq 1 \text{ for all } j \in J_r,$$

and also subject to the following two additional constraints, each of which must be honoured for every period  $p$  in which *transmission rights* available for purchase in the *TR auction* are valid:

$$\sum_{j \in J_r} A_j T_{iwpj} PSF_{iwc} + PT_{iwp} PSF_{iwc} \leq U_{crp} \text{ for all } c \in C^+,$$

and

$$\sum_{j \in J_r} A_j T_{iwpj} NSF_{iwc} + PT_{iwp} NSF_{iwc} \geq L_{crp} \text{ for all } c \in C^-,$$

where:

$PSF_{iwc}$  is the greater of (i) zero and (ii) the shift factor that determines the incremental effect on the flow of power over constraint  $c$  that results from an incremental injection at *TR zone*  $i$  and an offsetting withdrawal at *TR zone*  $w$ ,

$PT_{iwp}$  is the number of *transmission rights* associated with injection *TR zone*  $i$  and withdrawal *TR zone*  $w$  valid in period  $p$  that meet the following criteria: (1) they were purchased by or awarded to *TR participants* in a previous *TR auction* or in a round of the *TR auction* conducted before round  $r$ , (2) they have not been sold by their respective *TR holders* in a previous *TR auction* or in a round of the *TR auction* conducted before round  $r$ ; and (3) they have not been offered for sale by their respective *TR holders* in round  $r$  of the *TR auction*;

$U_{crp}$  is the maximum limit established for the flow of power over constraint  $c$  in period  $p$  for round  $r$  of the *TR auction*;

$C^+$  is, in respect of the flow of power across an *interconnection*, the set of constraints that specifies a maximum limit on the flow of power over that *interconnection*;

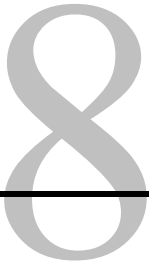
$NSF_{iwc}$  is the lesser of (i) zero and (ii) the shift factor that determines the incremental effect on the flow of power over constraint  $c$  that results from an incremental injection at *TR zone*  $i$  and an offsetting withdrawal at *TR zone*  $w$ ;

$L_{crp}$  is the minimum limit established for the flow of power over constraint  $c$  in period  $p$  for round  $r$  of the *TR auction*; and



$C$  is, in respect of the flow of power across an *interconnection*, the set of constraints that specifies a minimum limit on the flow of power over that *interconnection*





## Appendix 8.2

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