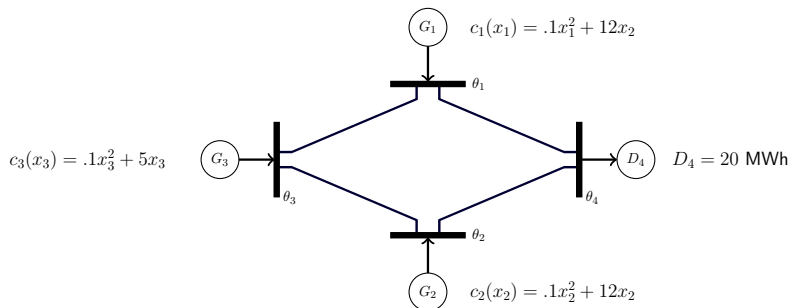


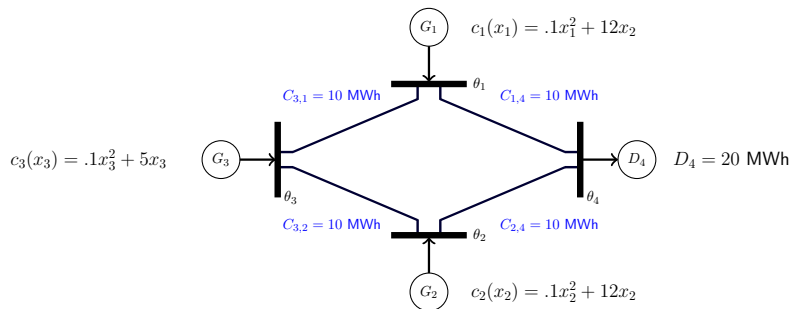
Four-Node Three-Generator Network Model



DC power flow model with identical susceptances:

$$\exists \theta \in \mathbb{R}^n : x_i - D_i = \sum_j \theta_i - \theta_j, \forall i \quad (\text{Nodal Balance})$$

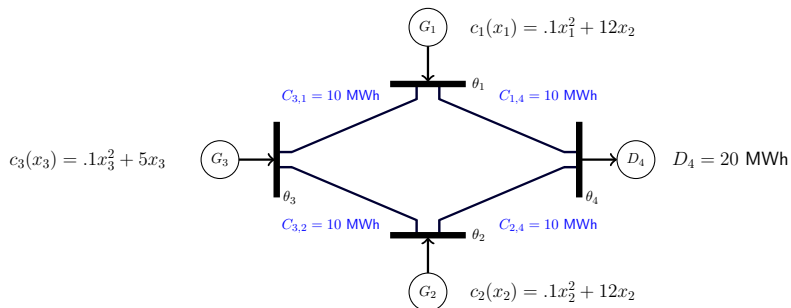
Four-Node Three-Generator Network Model



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Four-Node Three-Generator Network Model

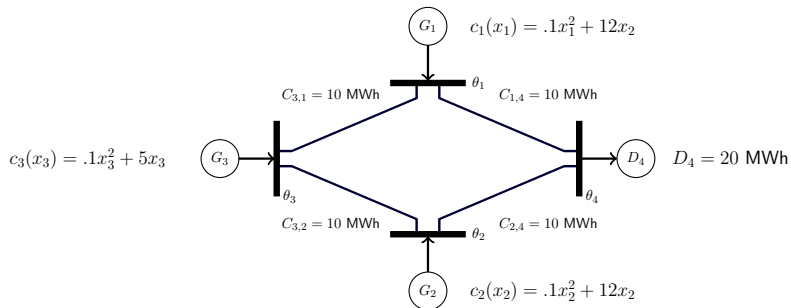


DC power flow model with identical susceptances:

$$\exists \theta \in \mathbb{R}^n : x_i - D_i = \sum_j \theta_i - \theta_j, \forall i \quad (\text{Nodal Balance})$$

$$\theta_i - \theta_j \leq C_{ij}, \forall i, j \quad (\text{Line Limits})$$

Four-Node Three-Generator Network Model



Four-Node Three-Generator Network Model

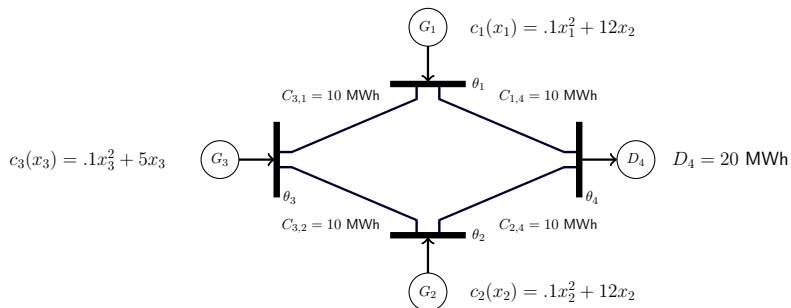


Table: LMP outcomes for the model (CHF) (p: payment, u: utility)

	Truthful Bidding			
	p (u)	x		
Generator 1	0 (0)	0		
Generator 2	0 (0)	0		
Generator 3	180 (40)	20		

Four-Node Three-Generator Network Model

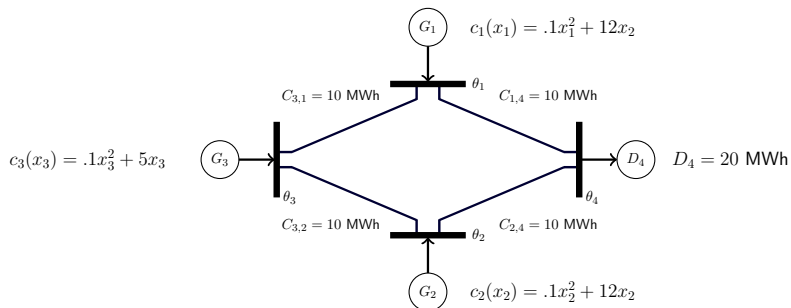


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Four-Node Three-Generator Network Model

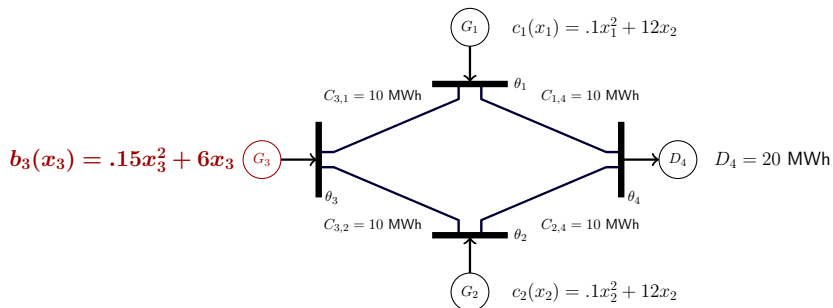


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Four-Node Three-Generator Network Model

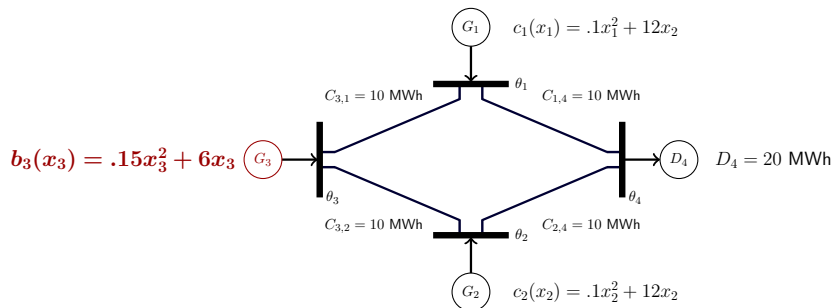


Table: LMP outcomes for the model (CHF) (p: payment, u: utility)

	Truthful Bidding		Generator 3 deviates	
	p (u)	x	p (u)	x
Generator 1	0 (0)	0	0 (0)	0
Generator 2	0 (0)	0	0 (0)	0
Generator 3	180 (40)	20	240 (100)	20

Four-Node Three-Generator Network Model

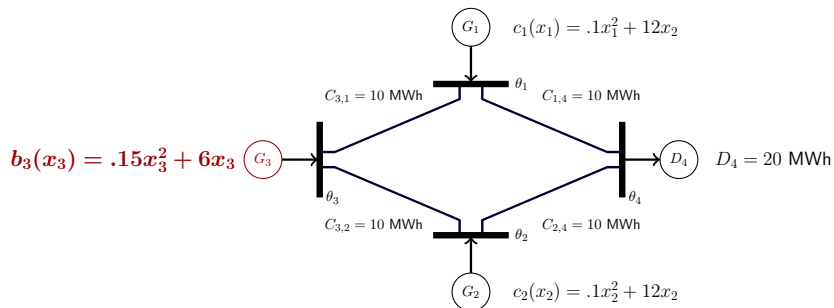
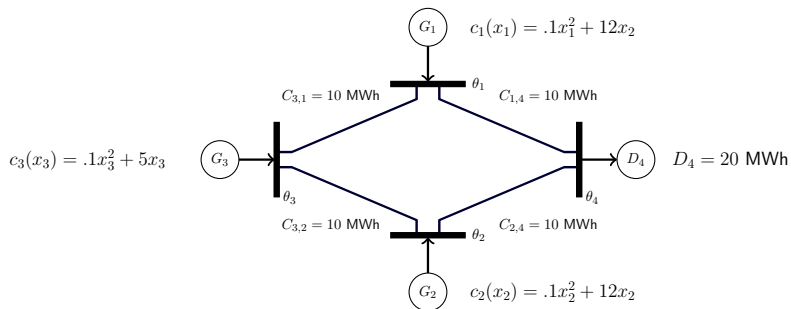


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Generator 3	180 (40)	20	240 (100)	20

Under LMP, unilateral deviation is profitable for bidders

Four-Node Three-Generator Network Model



On the other hand, VCG eliminates such unilateral deviations.

Four-Node Three-Generator Network Model

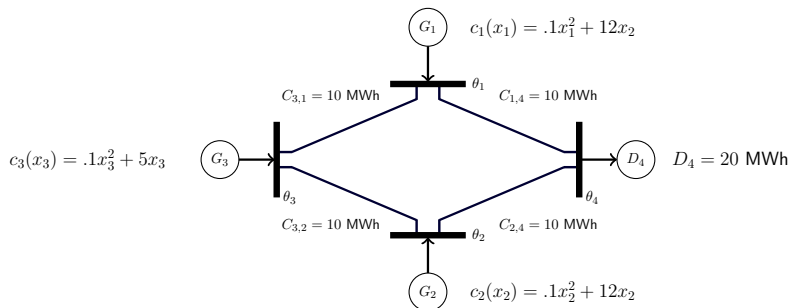


Table: VCG outcomes for the model (CHF) (p: payment, u: utility)

	Truthful Bidding			
	p (u)	x		
Generator 1	0 (0)	0		
Generator 2	0 (0)	0		
Generator 3	260 (120)	20		

Four-Node Three-Generator Network Model

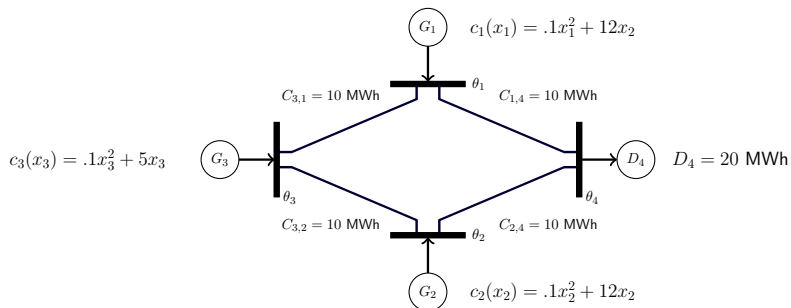


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Generator 3	260 (120)	20		

Truthful bidding is the dominant strategy

Four-Node Three-Generator Network Model

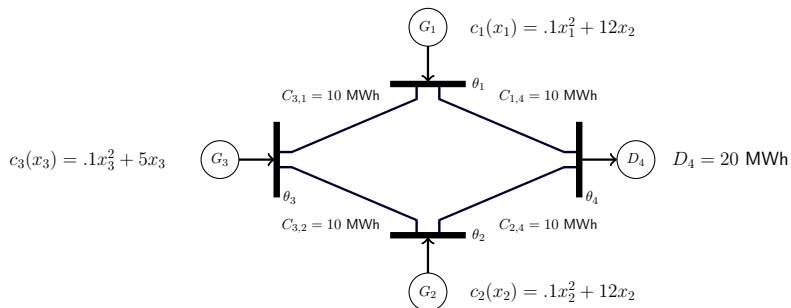


Table: VCG outcomes for the model (CHF) (p: payment, u: utility)

	Truthful Bidding		1 and 2 colludes	
	p (u)	x	p (u)	x
Generator 1	0 (0)	0		
Generator 2	0 (0)	0		
Generator 3	260 (120)	20		

Four-Node Three-Generator Network Model

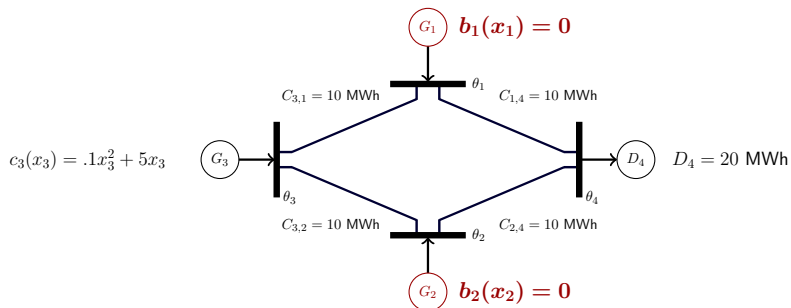


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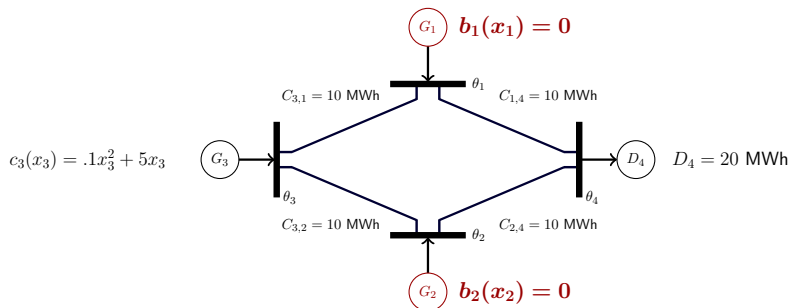


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	p (u)	x	p (u)	x
Generator 1	0 (0)	0	140 (10)	10
Generator 2	0 (0)	0	140 (10)	10
Generator 3	260 (120)	20	0 (0)	0

Four-Node Three-Generator Network Model

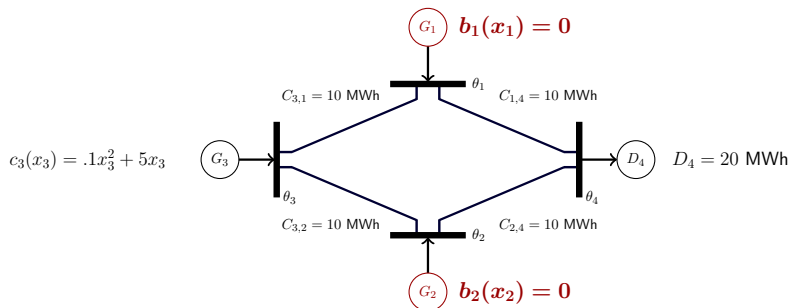


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	Truthful Bidding		1 and 2 colludes	
	p (u)	x	p (u)	x
Generator 1	0 (0)	0	140 (10)	10
Generator 2	0 (0)	0	140 (10)	10
Generator 3	260 (120)	20	0 (0)	0

High total payment: Generator 3 is willing to supply for less