

A Transmission and Energy Exchange (TEX) for ERCOT

Presented to

Texas Nodal Team

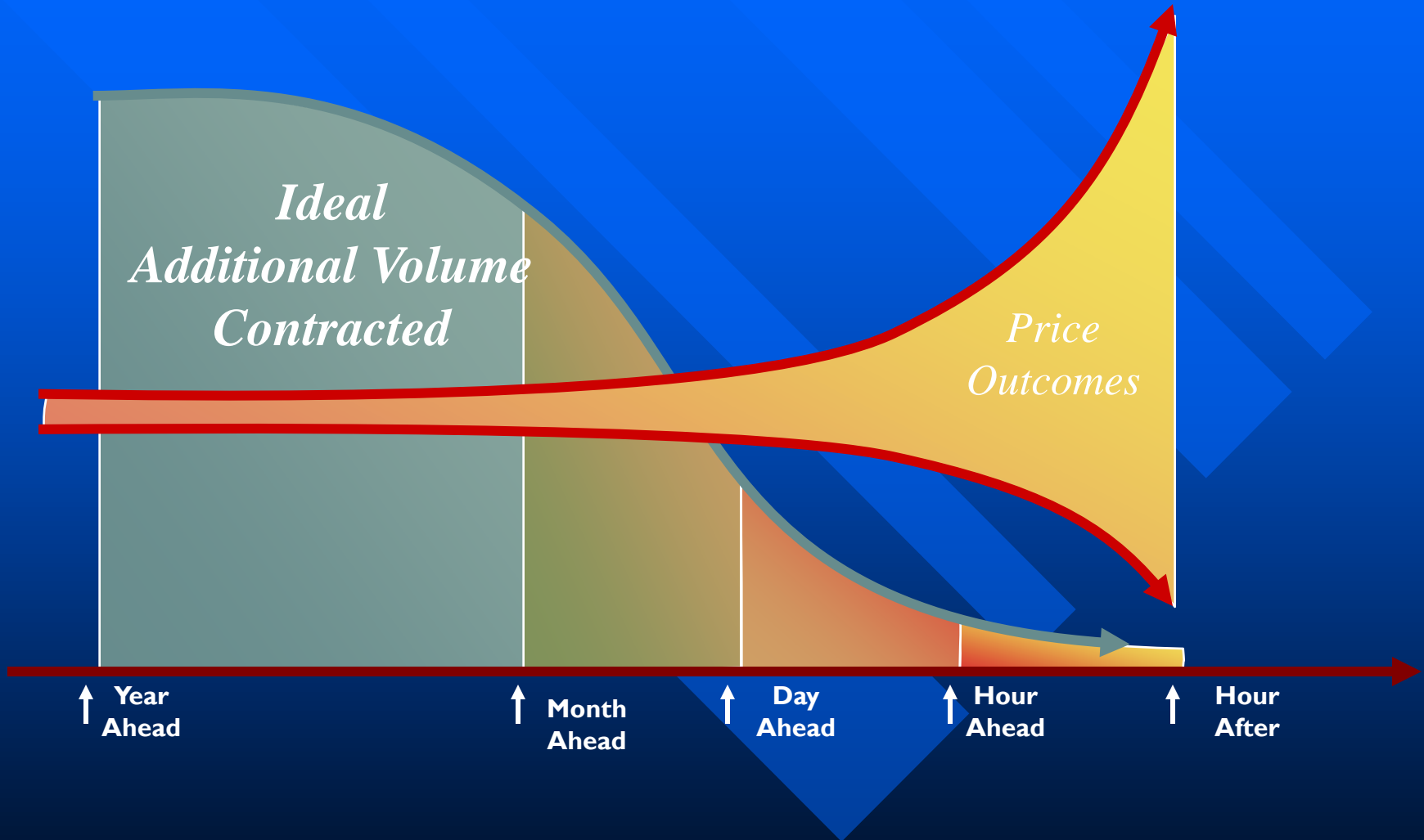
by

Edward G. Cazalet, Ph.D

The Cazalet Group, LLC

October 22, 2003

Price Volatility & Forward Contracts



Benefits of a Robust Locational Forward Market

- Better locational forward price signals and incentives for investment, maintenance, storage, commitment, dispatch and demand management
- Better risk and credit management
- Better resource adequacy and reliability
- Consistency with real-time LMP avoids gaming
- If the forward market fails everyone is hurt

Forward Power Markets are Very Difficult?

- Electric markets are locational and fractured because of transmission limits
- Volatility is high because of generator capacity limits and high cost of storage
- Real-time price volatility may be artificially suppressed with price caps, ancillary services support and central operator intervention
- Wholesale real-time and forward market prices may not be passed through to retail real-time and forward prices creating demand inelasticity
- Developing liquidity is *the* big challenge

TNT Design Issues

- Day-ahead
 - Integrated day-ahead security constrained unit commitment market
 - Auction day-ahead market
- Congestion revenue rights (CRR)
 - Point-to-point
 - Flowgate
 - Hybrid
 - Obligations and options
- Clear CRRs against real-time or day-ahead locational prices

Integrated Continuous Forward Market Transmission Energy Exchange (TEX)

- Energy, transmission, ancillary services
- Clearing at settlement points: nodes, load zones, hubs
- Point-to-point and flowgate
- Options and obligations
- One-part tenders (buy bids and sell offers)
- Continuous and auction clearing

Continuous versus Auction Clearing

- Auction market price discovery is ex-post
- Continuous market price discovery is ex-ante
- With forward prices generators will usually not commit until forward prices are cover all costs
- Storage resources optimize easily with forward prices
- With ex-post prices as in an auction, generators may prefer simultaneous auction across a day with multi-part tenders and central unit commitment
- Continuous markets in multiple products and time periods can work in parallel for efficient dispatch
- Single-part tender markets are easier to settle – uplifts not necessary to cover commitment costs

TEX: Day-ahead to Real-time

- Continuous trading of hourly and block energy & transmission products to DA scheduling deadline
- Optional auction at DA deadline
- Schedules due at DA deadline
- ERCOT may purchase through TEX for reliability on behalf of participants (RUC)
- Continuous (feasible) trading, of hourly and sub-hourly energy & transmission products to real-time with continuous reporting to ERCOT
- Transmission congestion revenue rights settled DA or real-time at participant option

TEX: Year(s)-ahead to Day-ahead

- Energy traded continuously in annual seasonal, or monthly blocks
- Initial simultaneous auction of pt-to-pt and flowgate transmission rights (CRRs)
- Additional rights released in monthly auctions or continuous market
- Simultaneous continuous trading of energy and transmission rights

Trading

- Trading Screen shows current pt-to-pt prices for transmission congestion rights
- Energy prices at any location can be translated to any other location
- Every energy tender in ERCOT can be translated to participant choice of location
- Simultaneous or nearly simultaneous energy and transmission transactions can be done

Wednesday August 16, 2000 21:21:38

TRADING

TRADING / ENERGY
Market

With permission of APX
Cazalet does not represent APX

ENERGY

- Market
- Bilateral
- OneLook
- Orders Summary
- Reports
- TRANSMISSION**

Hyatt Generation Market: (more...) Mont/Ida/Ut/Wyo Hub Hourly 0.1 MW All-in Prices

Interval	Market	Transmission Price		Order Quantity	Order Price	Per Mkt			
		for Buy	for Sell			Pend Buy	Pend Sell	Contracted	Total
Aug 22, 2000 01	Mont/Ida/Ut/Wyo Hub	7.26	-6.71						
	New Mexico Hub	4.51	-2.38						
	Northwest Hub	7.81	-7.65						
	Colorado Hub	6.40	-5.48						
	No California Hub	-0.20	0.26						
	Arizona Hub	1.97	0.75						
	So California Hub	-2.95	3.26						
Aug 22, 2000 02	Mont/Ida/Ut/Wyo Hub	7.26	-6.71						
	New Mexico Hub	4.51	-2.38						
	Northwest Hub	7.81	-7.65						
	Colorado Hub	6.40	-5.48						
	No California Hub	-0.20	0.26						
	Arizona Hub	1.97	0.75						
	So California Hub	-2.95	3.26						
Aug 22, 2000 03	Mont/Ida/Ut/Wyo Hub	7.26	-6.71						
	New Mexico Hub	4.51	-2.38						
	Northwest Hub	7.81	-7.65						
	Colorado Hub	6.40	-5.48						
	No California Hub	-0.20	0.26						

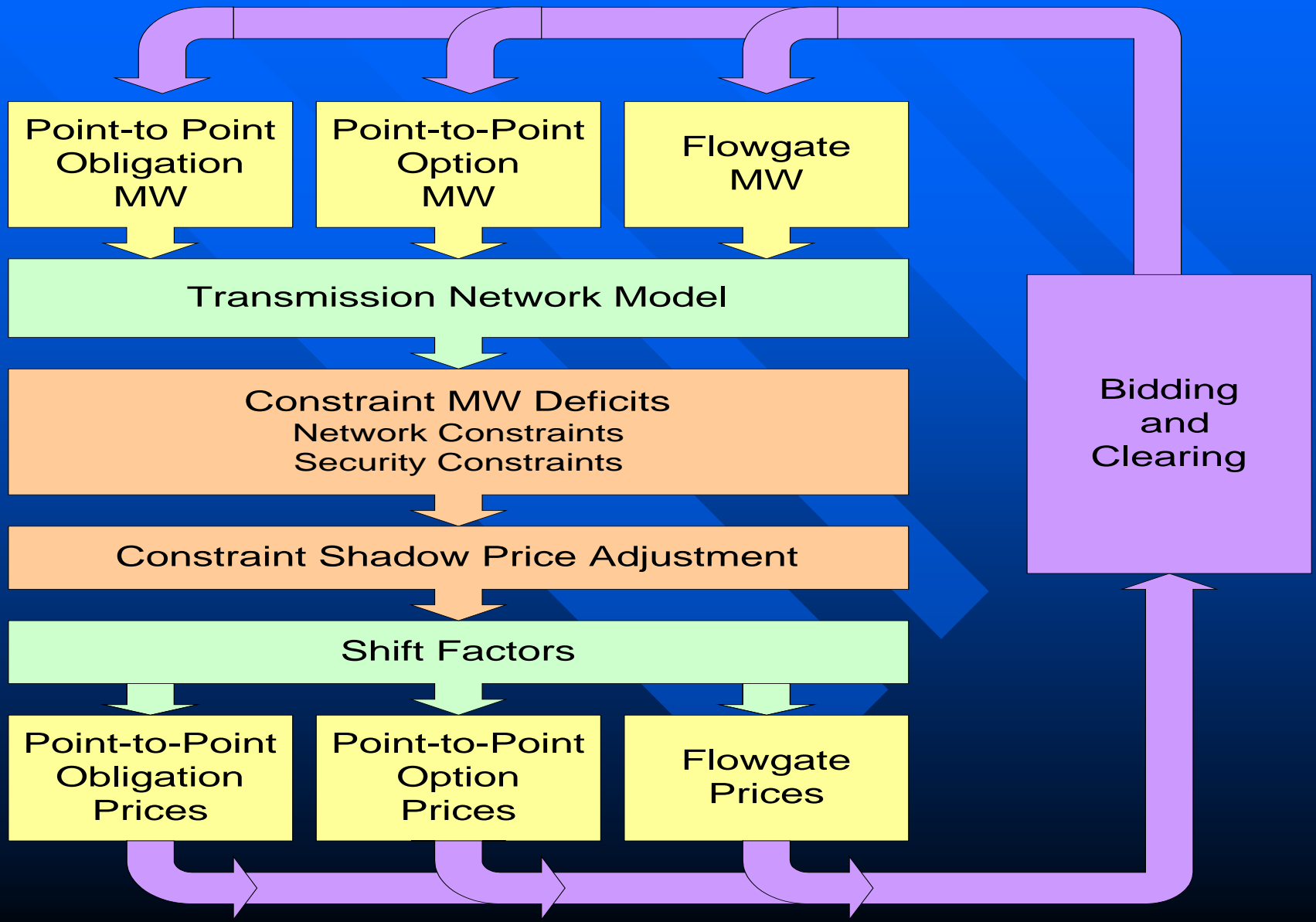
Market Depth		Interval Depth				Recent Transactions				Transportation Requirements				Graphs		Price History	
Bid	All-In Prc	Price	Volume	Location	Lot Size	Ask	All-In Prc	Price	Volume	Location	Lot Size						
	22.65	15.00	50.0	Northwest Hub	0.1 MW		20.05	20.25	50.0	No California Hub	0.1 MW						
	21.48	16.00	50.0	Colorado Hub	0.1 MW		20.47	18.50	50.0	Arizona Hub	0.1 MW						
	20.74	24.00	50.0	So California Hub	0.1 MW		20.55	20.75	80.0	No California Hub	0.1 MW						
	20.71	14.00	20.0	Mont/Ida/Ut/Wyo Hu	0.1 MW		20.76	16.25	50.0	New Mexico Hub	0.1 MW						
	20.21	13.50	50.0	Mont/Ida/Ut/Wyo Hu	0.1 MW		21.30	24.25	50.0	So California Hub	0.1 MW						

Review + Submit Withdraw Options **Automated Power E**

Reconfiguration Market for Rights

- Operates like reconfiguration auction with simultaneous feasibility test
- Clears continuously in response to participant tenders of rights
- Shadow prices on constraints determine which pt-to-pt and flowgate tenders are reconfigured
- Shadow prices set in initial auction and updated in response to participant tenders

CRR Forward Reconfiguration



Implementation

- Trading Screens and API
- Forward market software + network model
- Exchange – automated credit management with counter party selection and/or third party credit support
- Simulate before implementation
- Most likely ERCOT run or ERCOT sponsored service

Bid Sufficiency and Mitigation

- In an auction market (integrated or otherwise) insufficient supply bids can cause price spikes. After the fact you can only artificially mitigate
- In a continuous market insufficient bids cause price increases which then is a signal, incentive and time allowance for more supply or demand reduction bids. Mitigation is needed less and there is more time to apply mitigation.

The Question for Any Market Design: Liquidity?

- Impact of retail market design?
- Impact of ancillary services design?
- Impact of market power mitigation?
- Impact of rules to penalize non-participation
- “Voluntary” or “mandatory” participation – what does this mean?
- Market makers?

A Transmission and Energy Exchange (TEX) for ERCOT

Presented to

Texas Nodal Team

by

Edward G. Cazalet, Ph.D

The Cazalet Group, LLC

October 22, 2003