

Can Energy Markets Finance Infrastructure?

September 18th, 2007

DC ENERGY
QUANTITATIVE TRADING

One view of an economically rationale investment scheme

INVESTMENT



PRICE



DEMAND

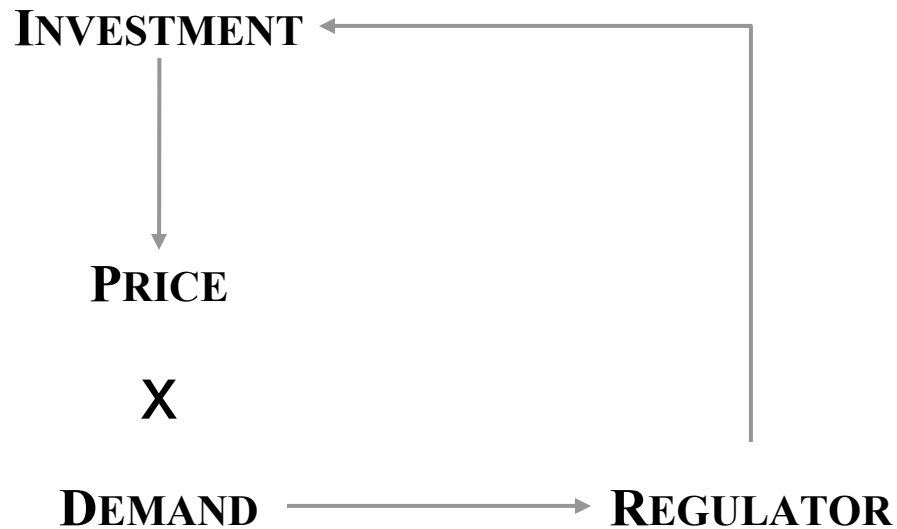
Examples

- **Computers**
- **Software**
- **Newspapers**
- **Airframe manufacturing**
- **Microprocessor chips**
- **Las Vegas casinos**
- **Paper mills**
- **Cellular communications**

Plant Investment

- \$500MM+
- \$10+
- \$500+
- \$1B+
- \$2B+
- \$2B+
- \$700MM+
- \$3B+

Regulatory history however, is designed around a different scheme



Examples

- Electricity
- POTS
- AmTRAK
- Water
- Toll roads

Market prices are the lynchpin to create an economically rationale investment structure — how do you ensure robust pricing, now and dependably overtime.

1) Let demand drive pricing

- Limit regulatory circumventing
 - Avoid Gresham's Law in energy
- Retail and wholesale
 - Demand response
- Consistent rules over time

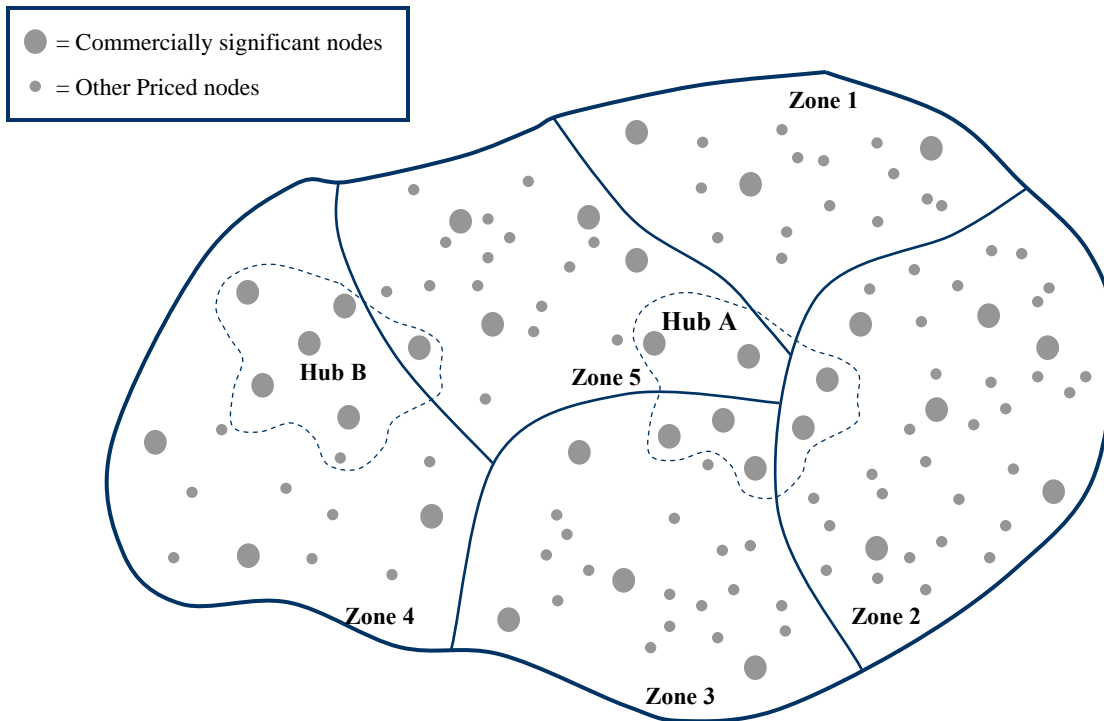
Market prices are the lynchpin to create an economically rationale investment structure — how do you ensure robust pricing — now and over time

- 1) Let demand drive pricing
- 2) **Nodal pricing — no just hubs**
 - Locational Marginal Price (LMP)
 - Maps to physical reality
 - Where business is done
 - Not manipulated/mitigated/suppressed

Locational Marginal Pricing reflects the true cost of electricity at each individual node

U.S. Wholesale Electricity Markets – With Locational Marginal Pricing (LMP) –

Nodes ≠ Hubs

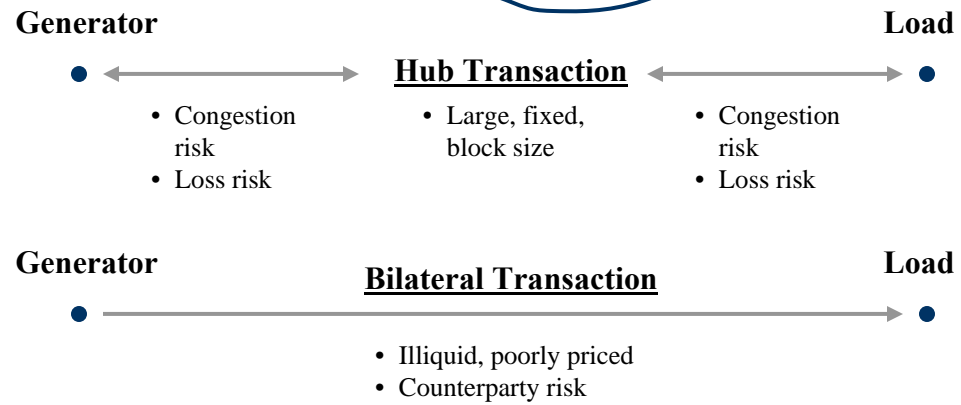
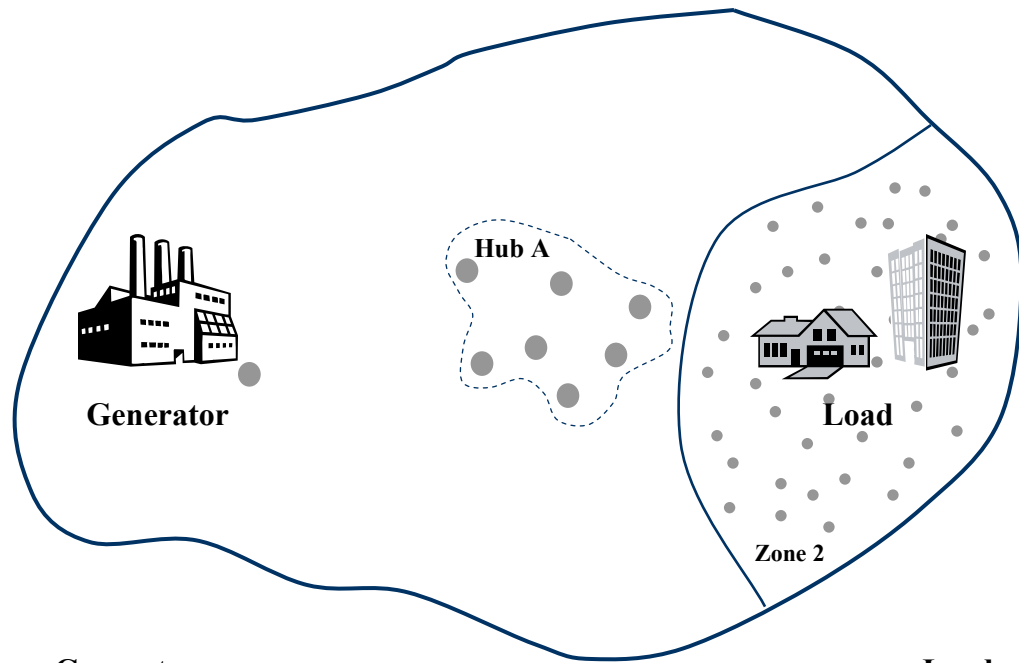


- **Nodal pricing is the outcome of supply and demand at a local level**
 - Marginal costs to produce power at each location (node) in the network
 - Respects limits of the transmission network
 - Reflects the true physical flows
- **PJM Western Hub only represents a very small physical portion of the PJM system**
 - 3% of load
 - 7% of generation

PJM: 3 cleared hubs
~ 1,000 commercially significant nodes
~ 9,000 nodes with unique prices

The available financial products for energy transactions do not adequately cover customer needs and risks

The Problem



When Nodal products are available they account for a large majority of the total market trading

Financial Market Volume Comparison

– 2004 through August 2005 –

PJM Energy Futures

– In TWh, excludes Virtual Energy –

Market	Nodal Auction	Hub Activity (Exchange)
Monthlies	N/A	276.8
Day Ahead (DA Demand)	450.8	13.2
Bal Day	N/A	54.9

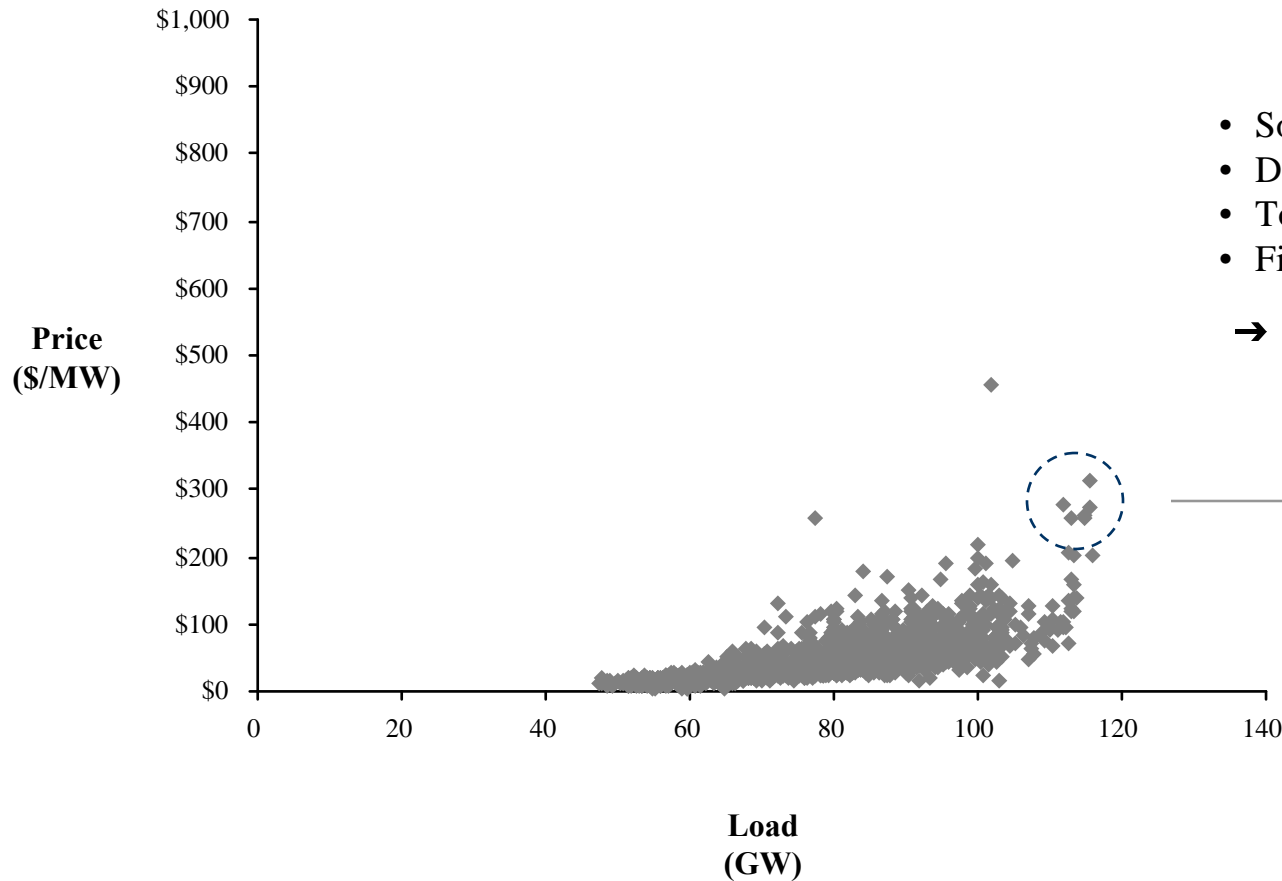
PJM Spreads

– In TWh –

Market	Nodal Auction	Hub Activity (Exchange)
Monthly & Annual	1,701	15.2
Weekly, Bi-Weekly	N/A	0.3
Bal Day	N/A	1.9

Nodal pricing doesn't always reflect true marginal economics

ISO Prices



Sources of Price Suppression

- Some plants have cost based limitation
- Dispatcher discretion – reliability
- Too many plants running at eco-min
- Fixed block units

→ *Costs get socialized through uplift when not included in price*

Record Load Days

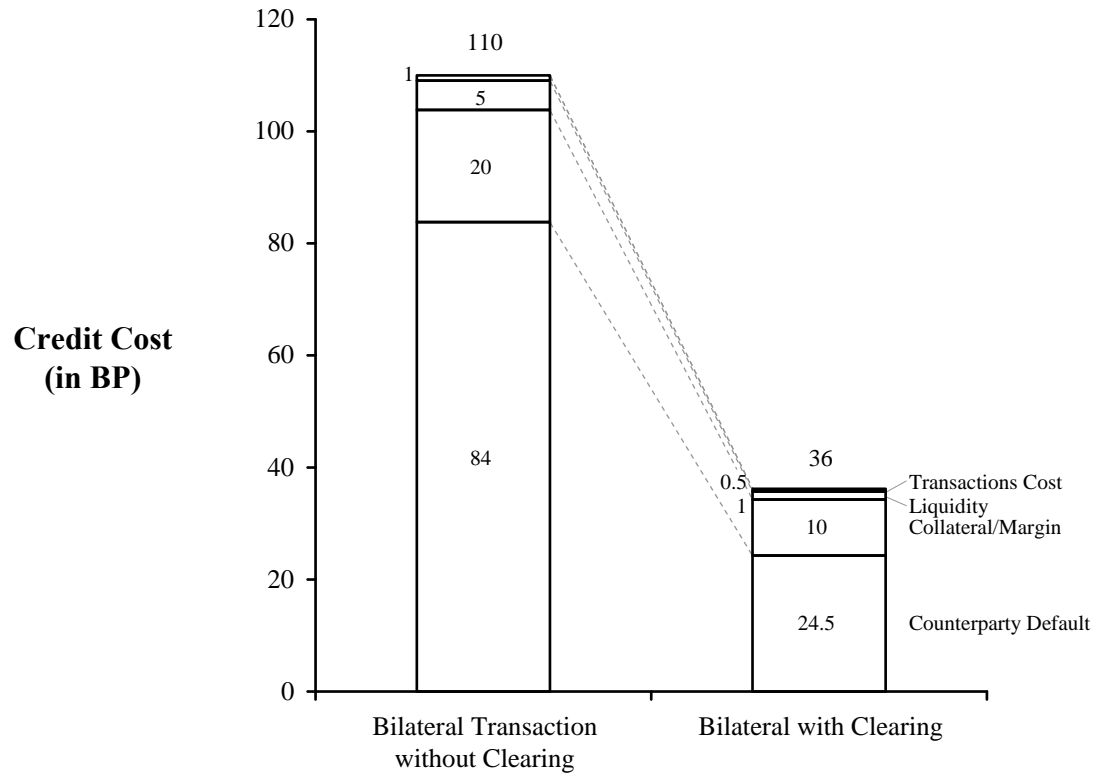
- Series of hot and humid days; July 31, August 1, 2
- Operators called significant amounts of interruptible load

Requirements for robust pricing

- 1) Let demand drive pricing
- 2) Nodal pricing — no just hubs
- 3) **Cleared financial products**
 - As much effort goes into counterparty risk as into pricing with bilateral deals
 - Higher credit costs

Significant advantages exist for clearing bilateral transactions

Credit Costs: Clearing vs. Non-Clearing – Bilateral Transaction –



Benefits

- Multilateral netting
- Efficient counterparty risk coverage
- Standardized contracts
- Contract sanctity
- Efficient/scaled market monitoring
-
-
-

Requirements for robust pricing

- 1) Let demand drive pricing
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- 4) **Exchange**
 - For liquidity
 - To get the best prices

Electricity is best served by an exchange, as are other commodities which have many suppliers, high volatility, and low differentiation

Commodity Comparison – U.S. View –

Category	Corn	Oil	Natural Gas	Electricity	Coal	Paper	Shipping (Truck Freight)
• Physical Suppliers	41,000	7,730	7,730	1,997	1,190	561	112,642
• Physical Wholesale Buyers	5,415	8,052	2,376	7,397	313	13,395	16,504
• Volume (Physical)	11.7B bushels (\$22B) (2005)	7.6B barrels (\$490B) (2005)	22B MMBtu (\$150B) (2005)	3.8B MWh (\$152B) (2005)	1.1B short tons (\$22B) (2005)	42MM short tons (\$32B) (2002)	1.5T ton-miles (\$164B) (2002)
• Price Volatility (Monthly)	23% (2006)	11% (2005)	29% (2002)	66% (2006)	6% (2004)	3% (2006)	15%–35% (2003)
• Exchange?	Yes	Yes	Yes, hub and basis	Limited	No	No	No

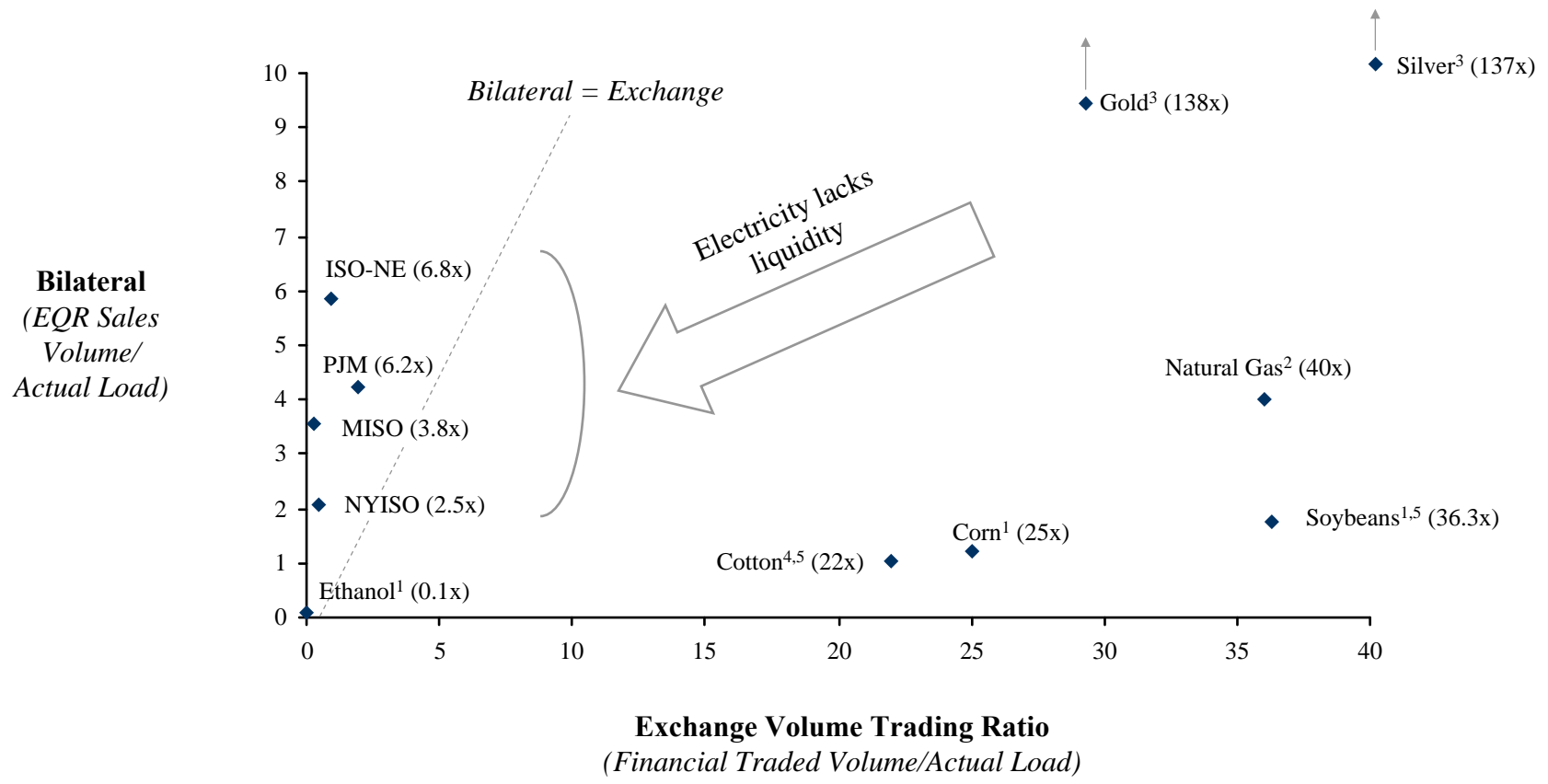
Source: EIA, USDA, World Bank, US Census Bureau, Corn Refiners Association, Platts, DOE, NGS, BTS, DC Energy data, *Pulp & Paper*

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Because of the lack of a proper exchange, electricity trading lags behind other commodities in the trading multiple over the physical delivery

Trading Volume Comparison



Note: Assumes 90% ICE and 10% NYMEX market share in financial trading

¹ Only considers CBOT trading volume on Futures products; half of the corn crop is traded 50x before delivery

³ International Financial Services, "Bullion Markets" January 2005

⁵ Note: Derived bilateral volume by assuming Exchange Volume: Bilateral Volume equal to ratio for corn

² Volume from NYMEX and ICE Natural Gas Trading; broker OTC market estimated at 10% of total volume

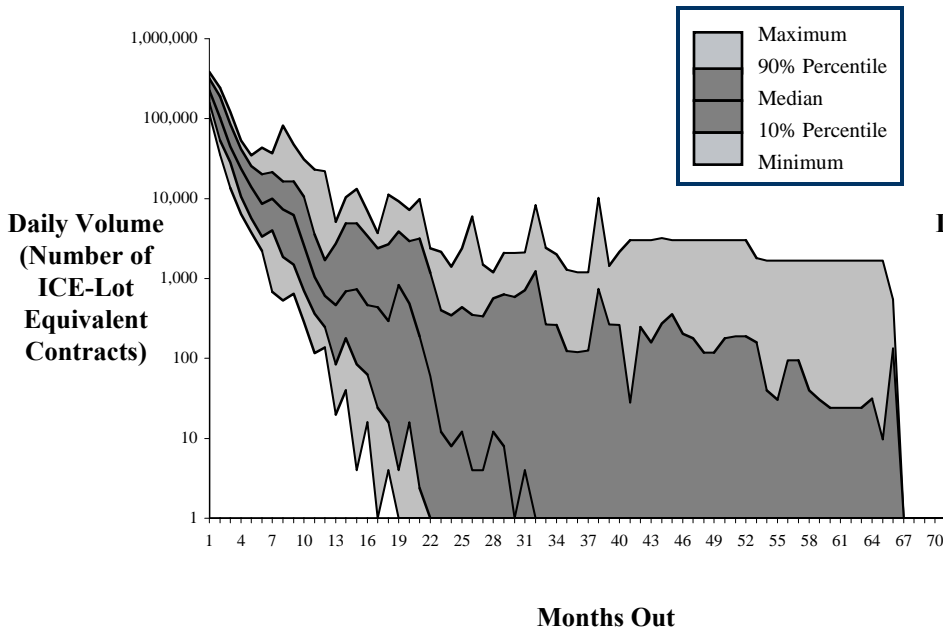
⁴ Only considers NYBOT futures volume

Source: Dean & Company analysis, ICE, PJM, NYISO, MISO, ISO-NE, FERC EQR, USDA/ERS, CBOT, NYBOT

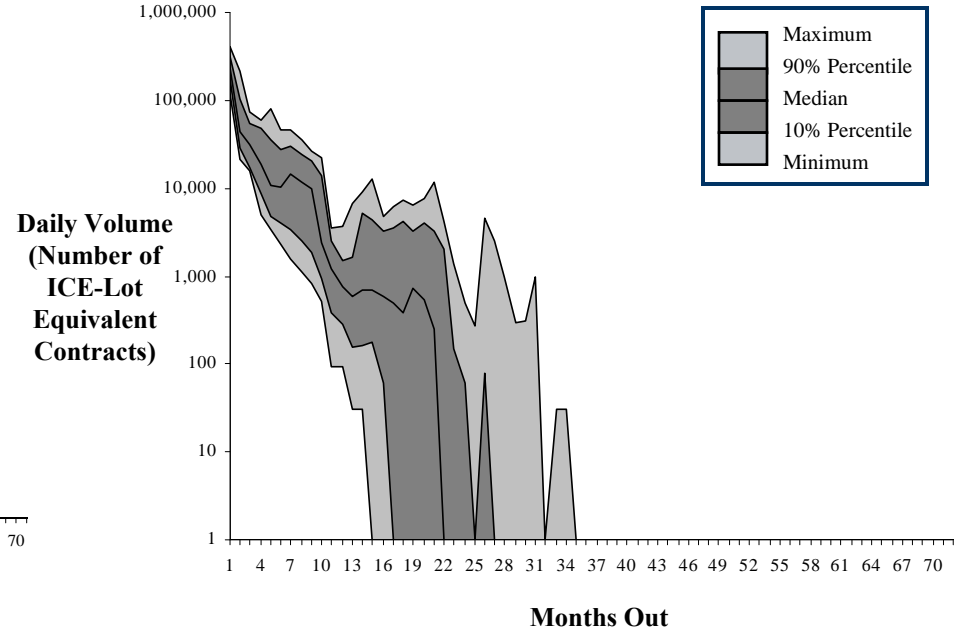
Long term liquidity needs to be preceded by ST liquidity, and by contracts designed for physical participants

Volume by Months Out

NYMEX
– 6/4/07 – 9/11/07 –



ICE
– 6/4/07 – 9/11/07 –



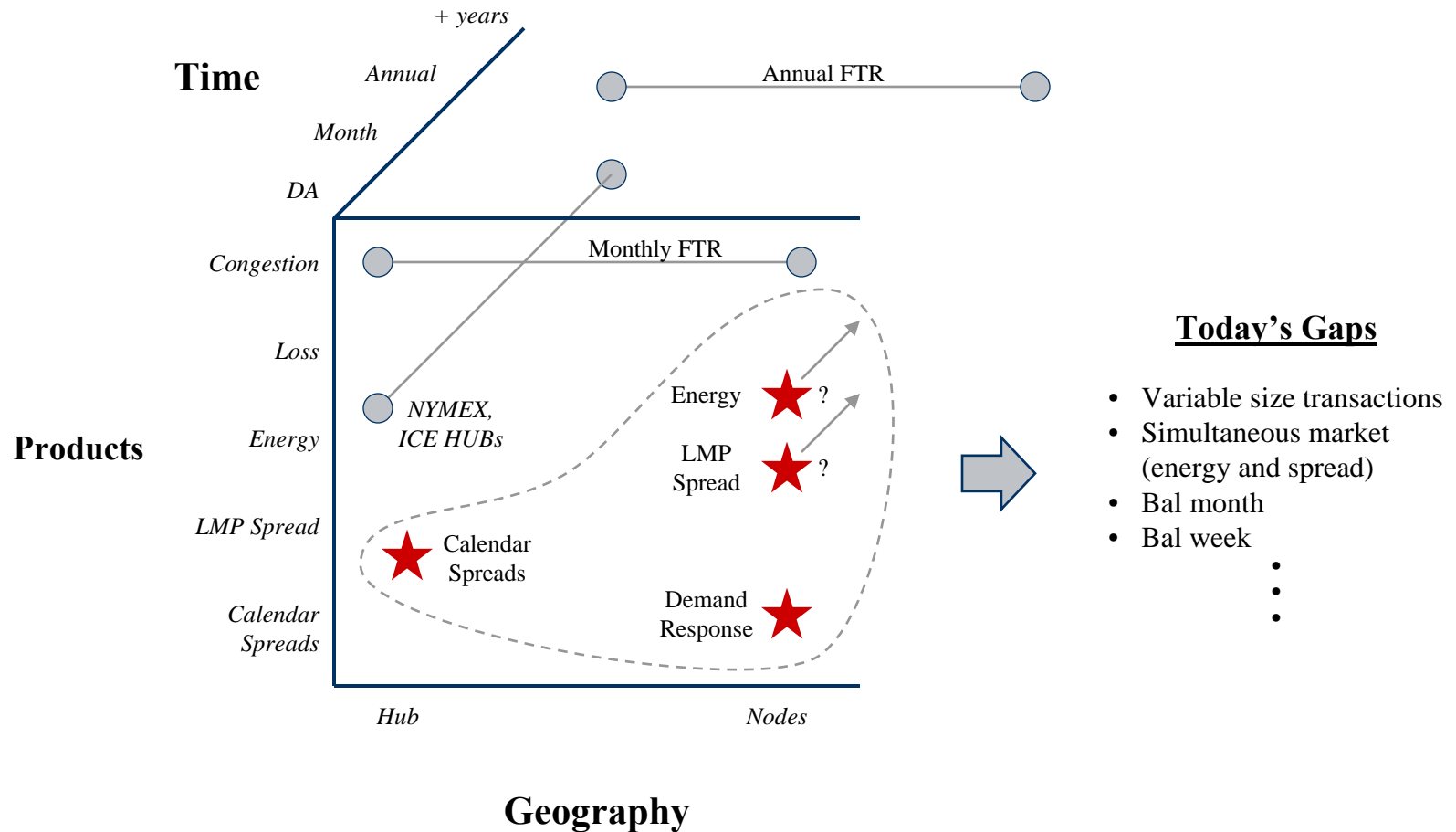
Source: NYMEX and ICE data

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- 4) Exchange
- 5) **More products**

There exists a large gap between current products and what participants need

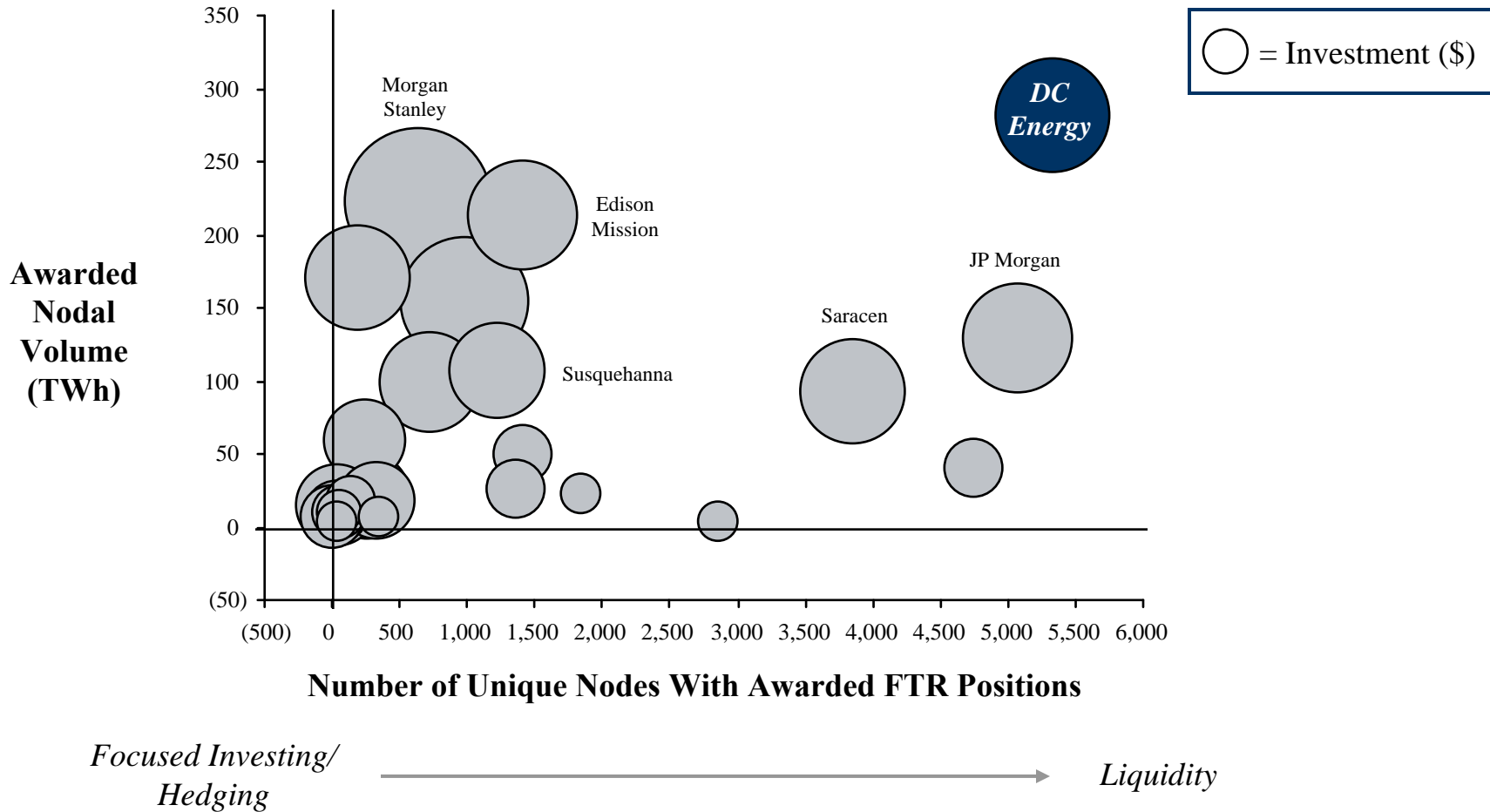


Requirements for robust pricing

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- 5) More products
- 6) **More participants**

Future liquidity needs to draw upon new participants

Top 25 Participants in U.S. Nodal Congestion Markets



Note: Includes awarded FTR positions settling in 2006 in NYISO, ISO-NE, MISO and includes all PJM PY06-07 BoPP and annual auctions

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