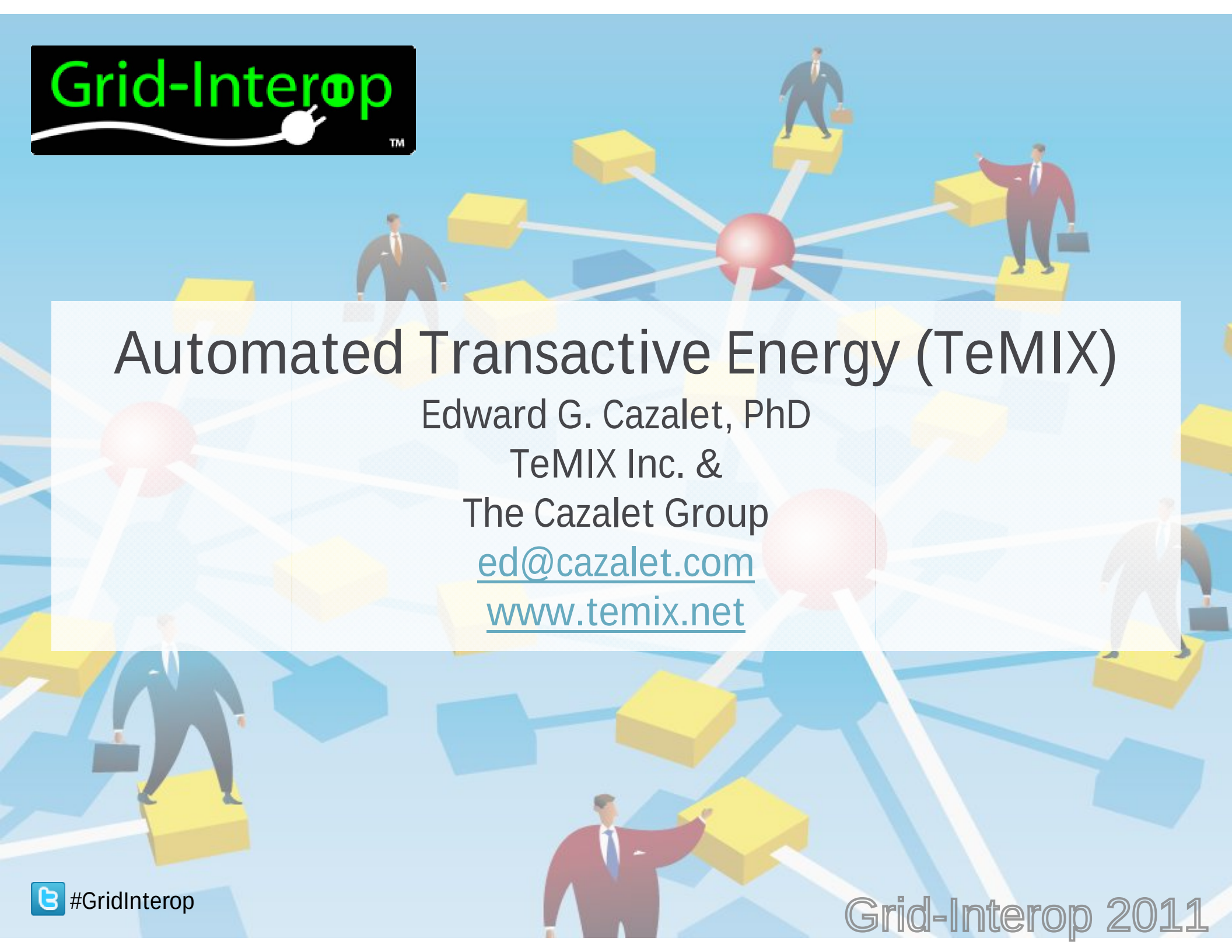


Automated Transactive Energy (TeMIX)

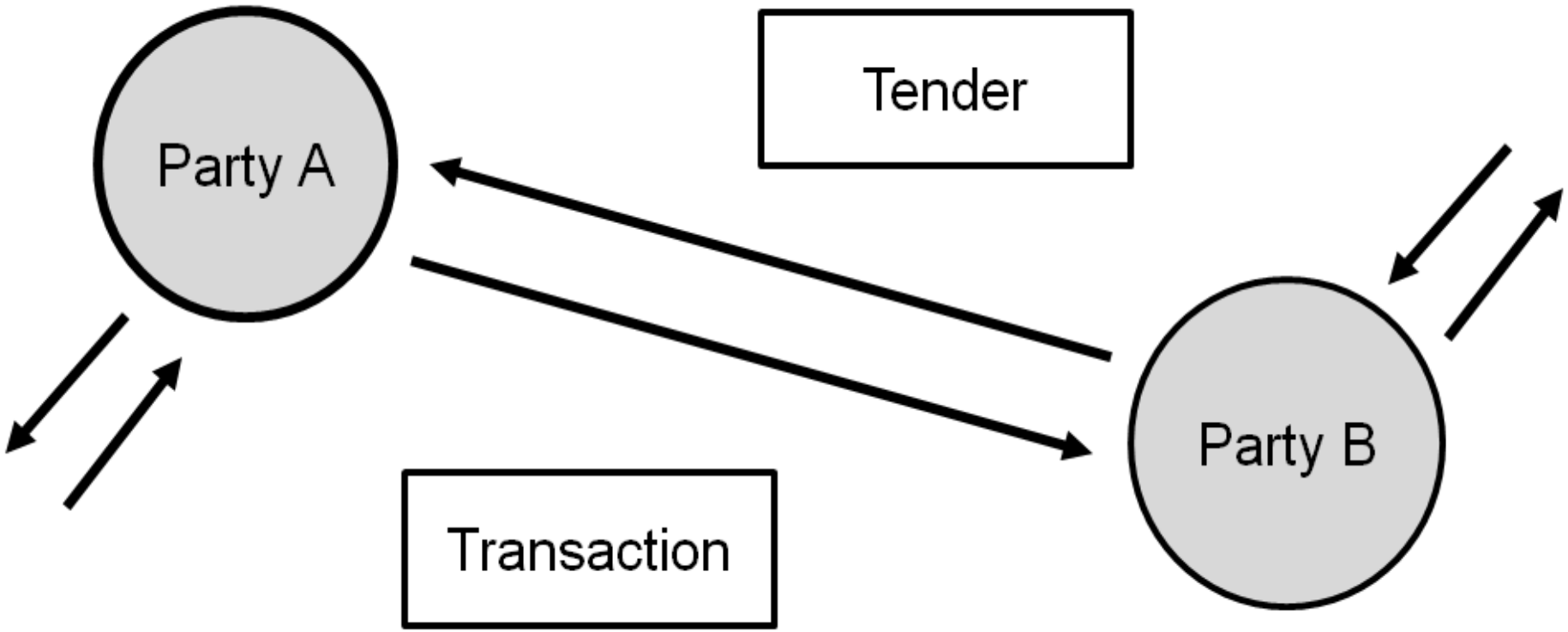
Edward G. Cazalet, PhD
TeMIX Inc. &
The Cazalet Group
ed@cazalet.com
www.temix.net

Transactive Energy and TeMIX

- **Transactive Energy**: A business process for energy transactions (regulated & competitive).
- **Transaction**: An exchange among parties of a product for a price.
- **OASIS eMIX and Energy Interop:** Information Model and Web Services for Transactive Energy & DR events.
- **TeMIX**: Transactive eMIX is a profile of OASIS Transactive Energy for automated transactions.

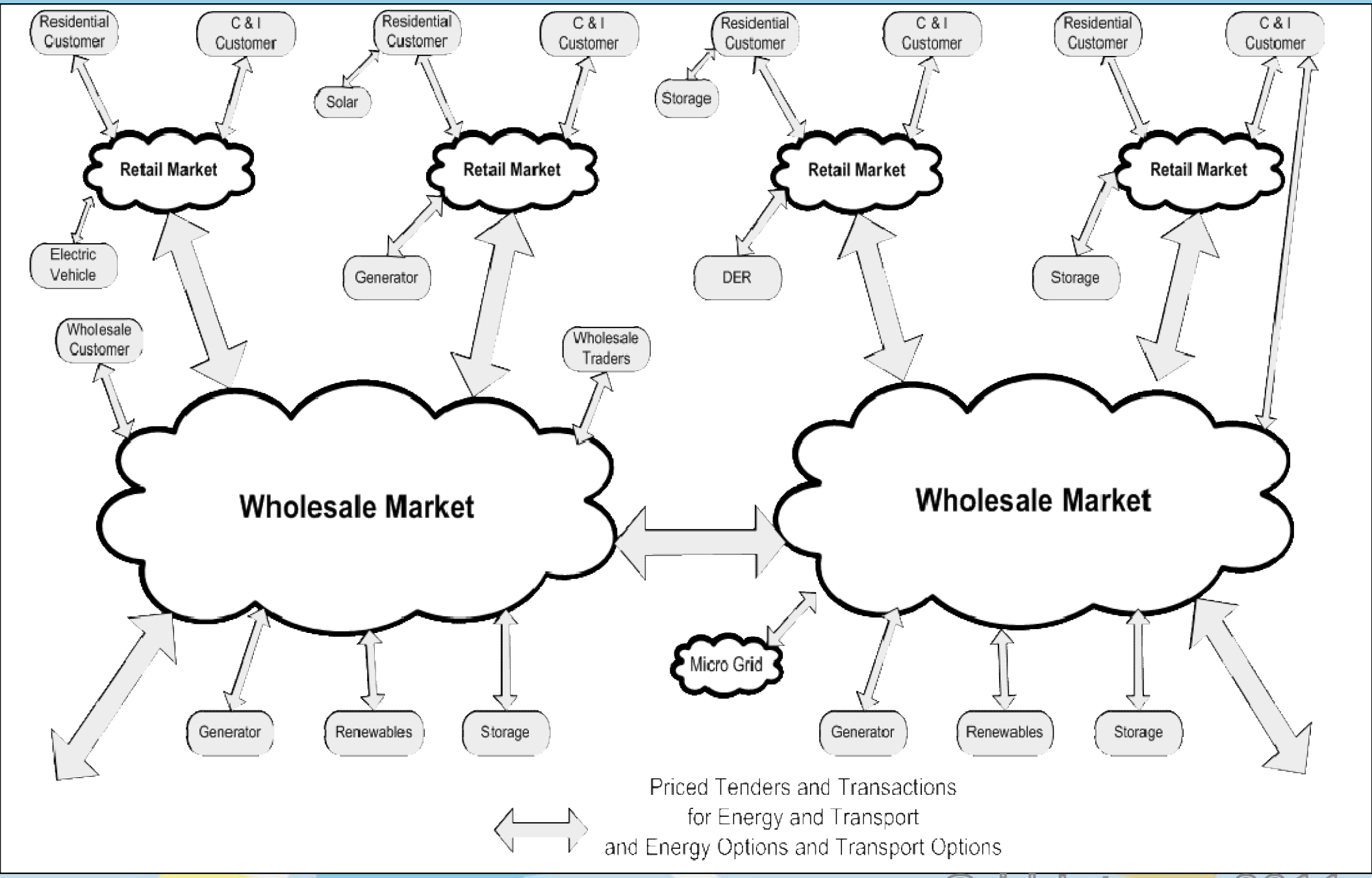
TeMIX Party-to-Party Interactions

Side: Buy or Sell

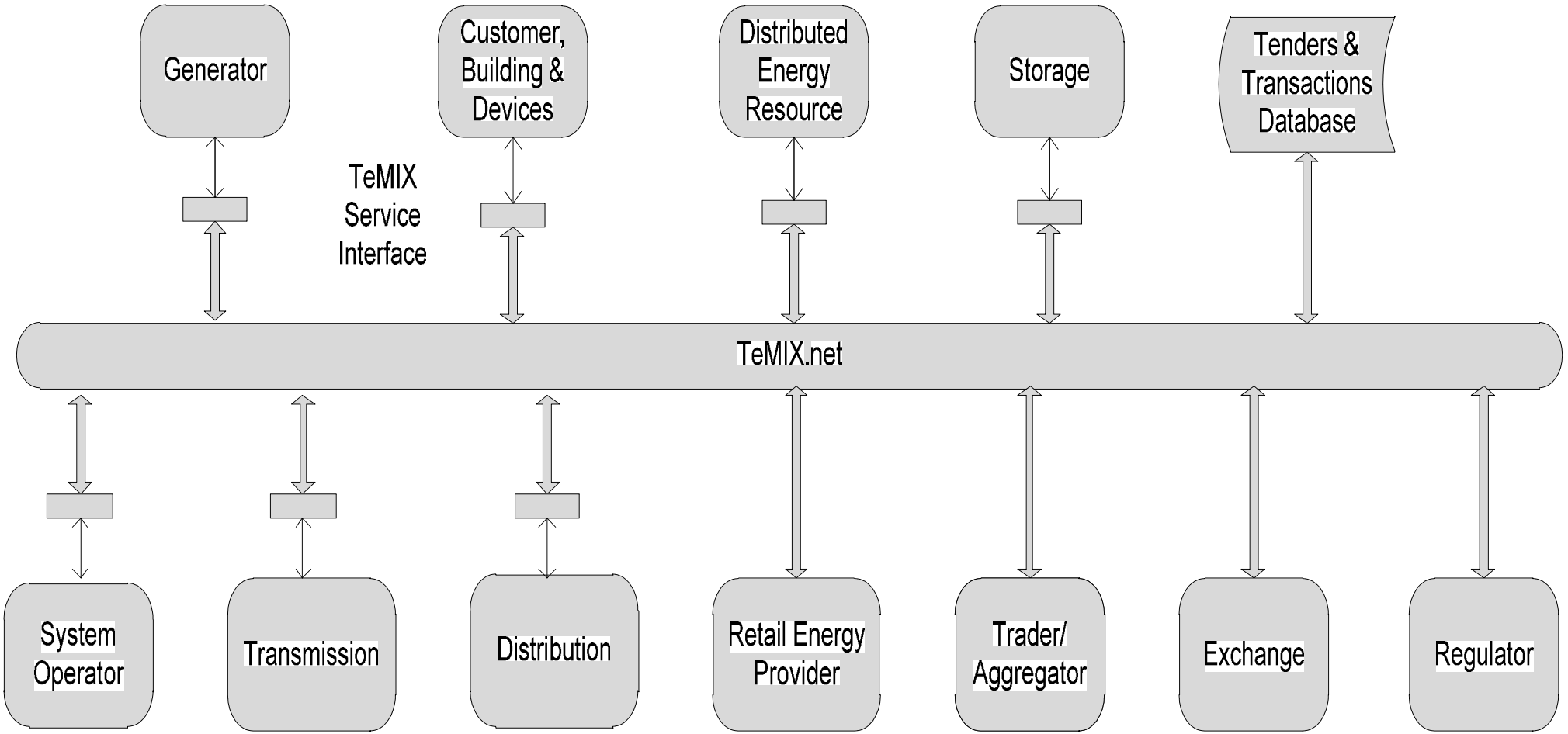


TeMIX Transactions are at a constant rate of delivery (MW) over a duration of a year, month, day, hour, 15 min, 5 min, or 4 seconds, for example.

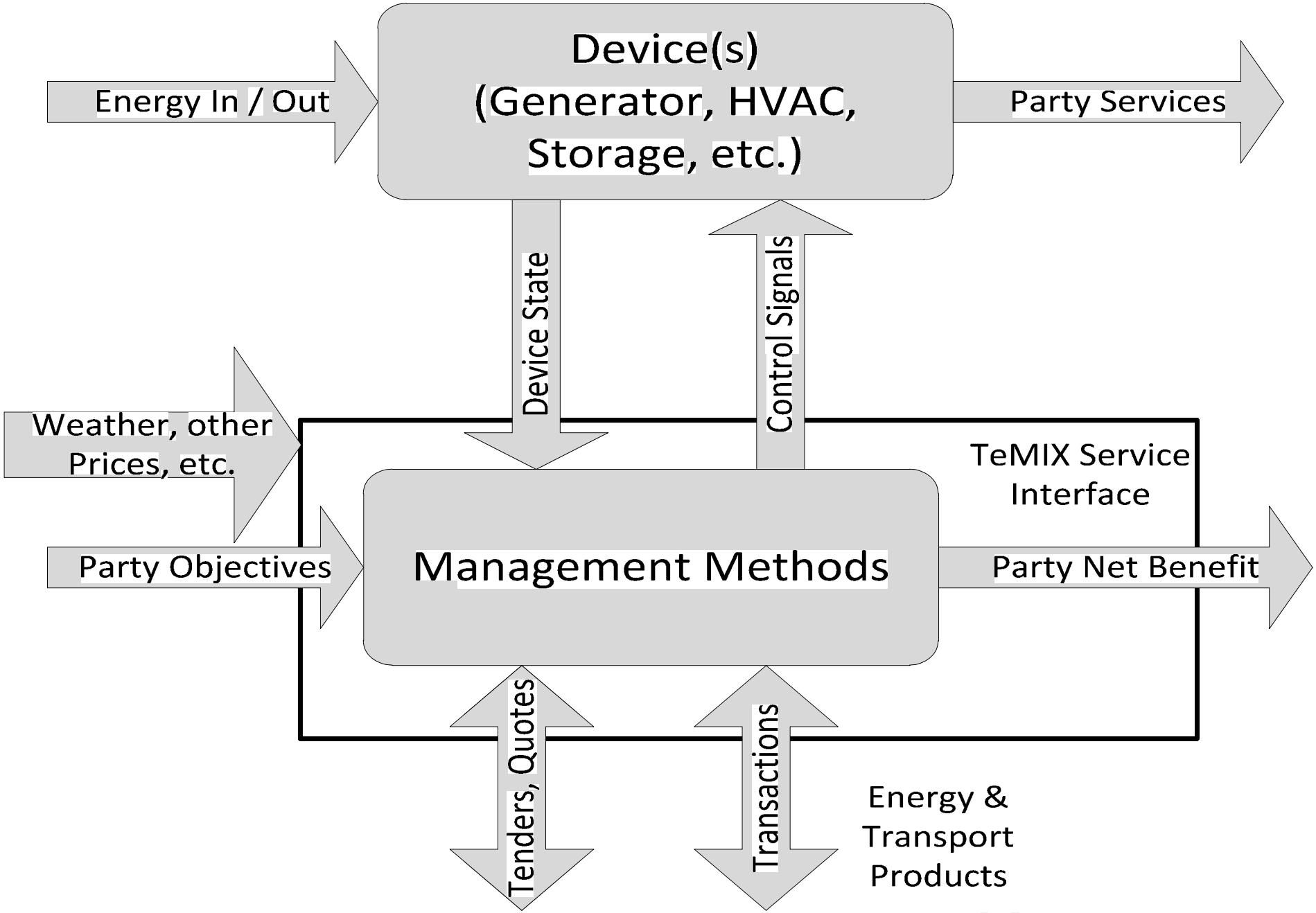
TeMIX Market Structure



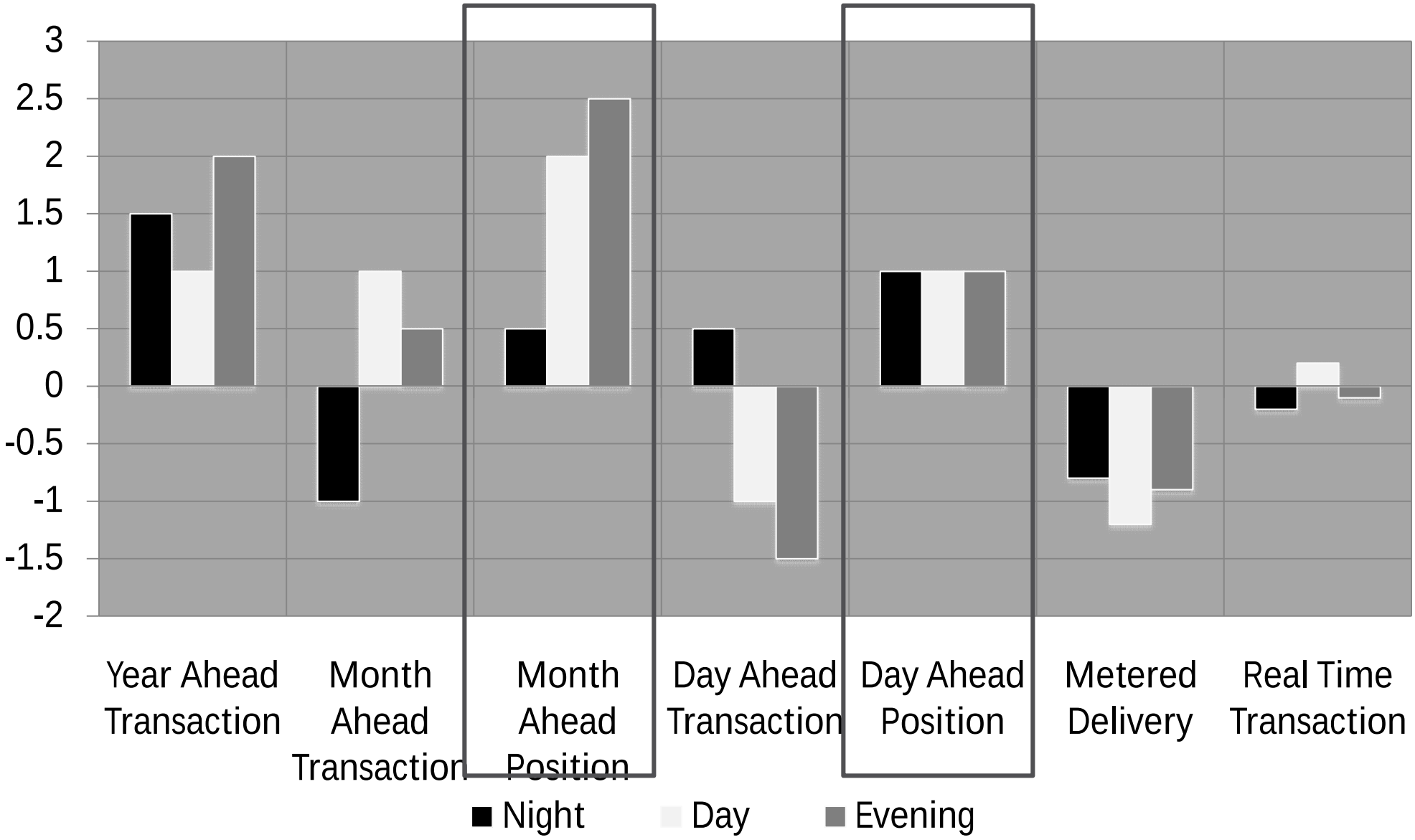
TeMIX Network



TeMIX Service Interface



Forward Transactions & Positions



TeMIX Transactive States

Price response is discovered through
1. many small tenders and automated transactions
2. Asynchronous interactions

TeMIX Payload

TeMIX Power Element	Description
EMIX Product	Power, Transport, and Power Option, Transport Option
EMIX Interface	One Node for Power and two Nodes for Transport
Start Date Time	Interval begins
Duration	Extent of time of the Interval
Price	Unit Energy Price
Energy Item	Real Energy (Power * Time) Units
Power Quantity	Rate of delivery of Energy
Transactive State	Indication of Interest, Tender, Transaction, Delivery, or Publish.
Side	Side the information originator is on: Buy or Sell.
Expires Date	Date Time Tender expires.
Power Item	Units for Power
Currency	Currency for the exchange

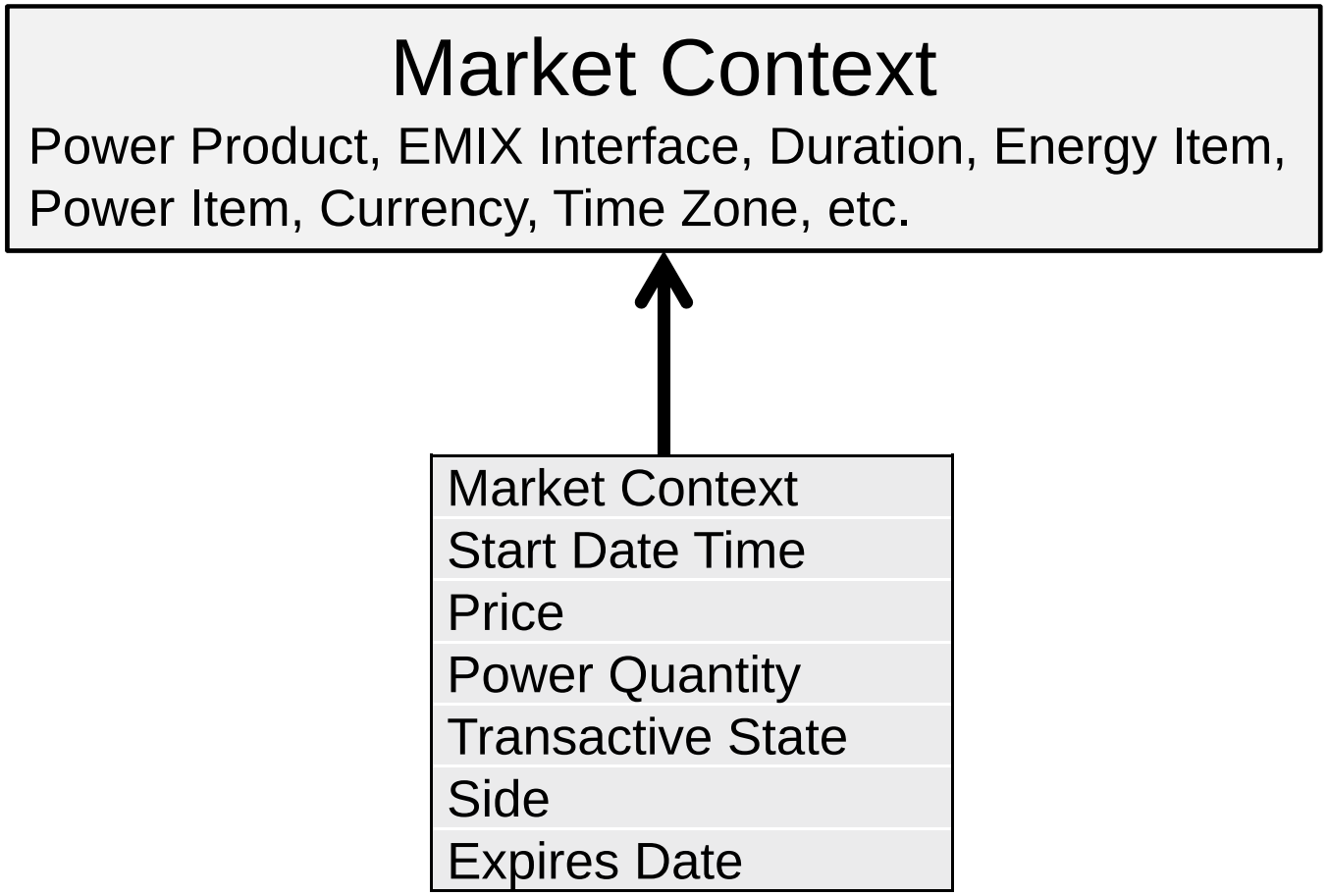
TeMIX Option Element	Description
Option Holder Side	Side which may exercise Option. Other side is Writer.
Option Strike Price	Price the Option Holder pays Option Writer to deliver.
Exercise Lead Time	Minimum notification duration.
Option Exercise Schedule	Periods that the option can be exercised
Temporal Granularity	A 15-minute Granularity, one-hour option starting at 10:00 can be called for10:00, 10:15, 10:30, or 10:45.

EMIX Power Interface

Elemental Type	Description
MRID	As defined in IEC-TC57 [13] identifies a physical device (Customer Meter or other End Devices).
Node	As defined in IEC TC57, a place on the grid. Many, but not all nodes are associated with meters.

EMIX Interface	Interface for EMIX Power Product Delivery
Service Area	Locations or regions relevant to power transactions.
End Device Asset	Physical device, MRID).
Meter Asset	Physical device or devices that perform the role of the meter (MRID).
Pricing Node (PNode)	Location in an ISO / RTO where participants submit bids and the ISO / RTO publishes locational prices.
Aggregated Pricing Node	Specialized type of Pricing Node for zone, control area, or for aggregated generation, load, or trading hub.
Service Location	Location where the ownership of the service changes hands. Potentially has many Service Delivery Points.
Service Delivery Point	Logical point where the ownership of the service changes.
Transport Interface	Delineates the edges at ends of a transport segment. Name two nodes: point of receipt and point of delivery.

Market Context Reduces Payload Size



TeMIX Web Services

Service	Reply Service
EiCreateTender	EiCreatedTender
EiDistributeTender	EiDistributedTender
EiCancelTender	EiCanceledTender
EiRequestTender	EiRequestedTender

Service	Reply Service
EiCreateTransaction	EiCreatedTransaction
EiRequestTransaction	EiRequestedTransaction

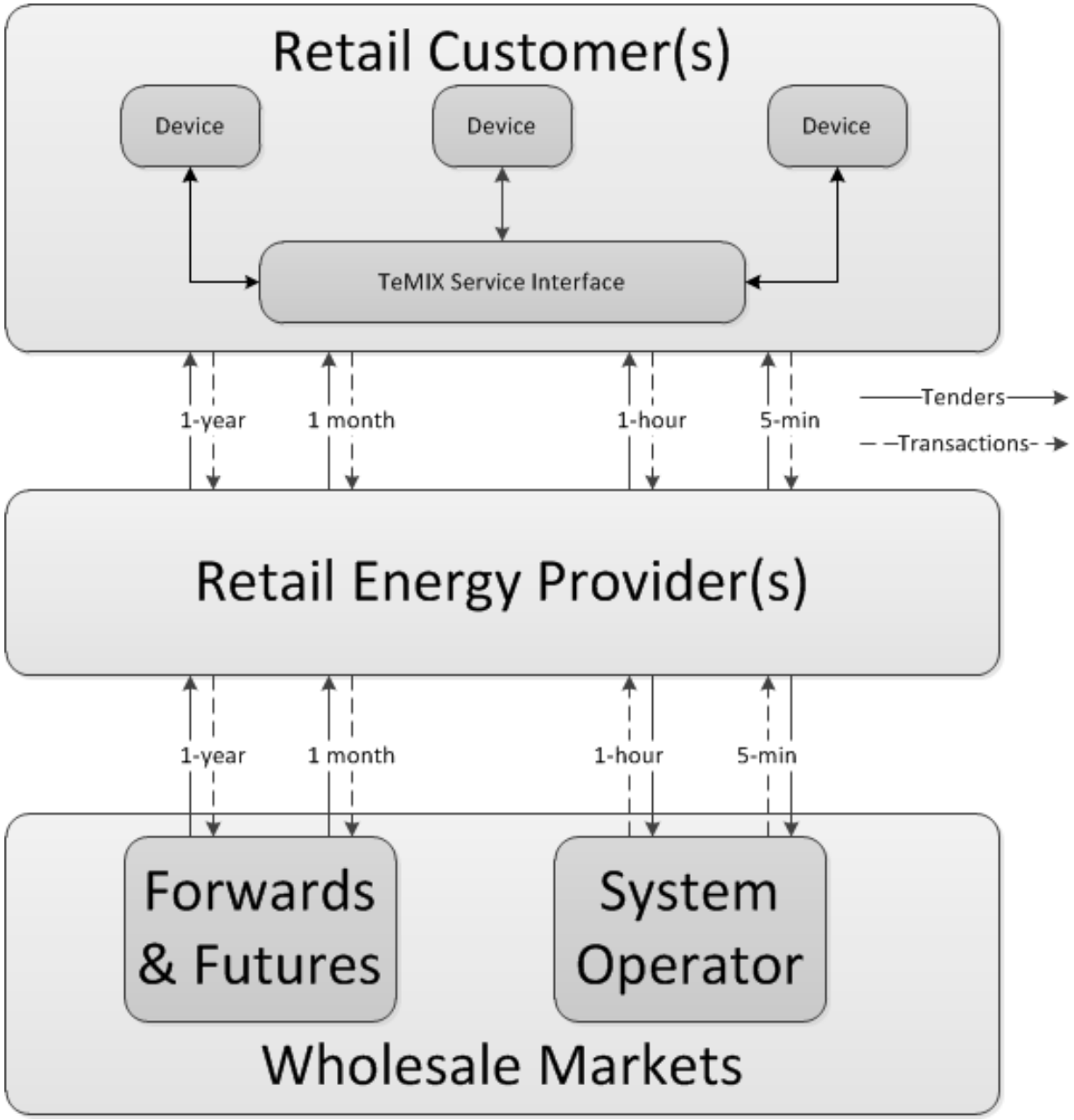
The Case for Retail Dynamic Pricing

Science and implementations prove that Retail Dynamic Pricing is a far better alternative than *flat* or *time-of-use* pricing with event-based *demand response*.

"cost-effective, acceptable and fair"

TeMIX Dynamic Pricing =
Forward & Real-Time Transactions
at Dynamic Prices

TeMIX Retail Market Structure



TeMIX Summary

- Automates Transactive Energy
- Actionable, forward priced tenders
- Optimization at the edges of the grid
- Device independent: load, supply, storage
- Transport products for T&D
- Fast
- Low-cost
- Highly scalable
- Based on open, free standards