

TEMIX, a transactive profile of EMIX 1.0

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Abstract:

Status:

This document was last revised or approved by the OASIS Energy Market Information Exchange (eMIX) TC on the above date. The level of approval is also listed above.

Technical Committee members should send comments on this document to the Technical Committee's email list. Others should send comments to the Technical Committee by using the "[Send A Comment](#)" button on the Technical Committee's web page at <http://www.oasis-open.org/committees/emix/>.

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1 Introduction

TeMIX (Transactive Energy Market Information Exchange) is a subset or profile of the EMIX information model for Transactive Energy (see EMIX Note XX on Transactive Energy)¹. The TeMIX profile is described by conformance rules defined in EMIX 12.3. These rules restrict each TeMIX transaction to a single interval. For each interval, the rate of delivery of energy (power) over the interval is constant. For example, if the interval duration is one hour then the rate of delivery (power) for each five minute sub interval in the hour is the same. This makes it easy to add up a number of transactions for different intervals for a month, day, hour and 5-minute interval to determine the position in each 5-minute interval. TeMIX conformance rules also restrict the intervals to standard nested intervals such as a year, month, day, hour, and 5-minutes.

TeMIX products are restricted to Energy and Transport in single intervals and Options on these two products.

TeMIX tenders and transactions are useful for price discovery, negotiation and response to grid conditions using many small, automated tenders and transactions. Complex positions with ramps, shaped delivery, and storage and withdrawal can be automatically constructed and modified from several small TeMIX transactions of various sizes, durations and start times.

1.1 References

[EMIX]

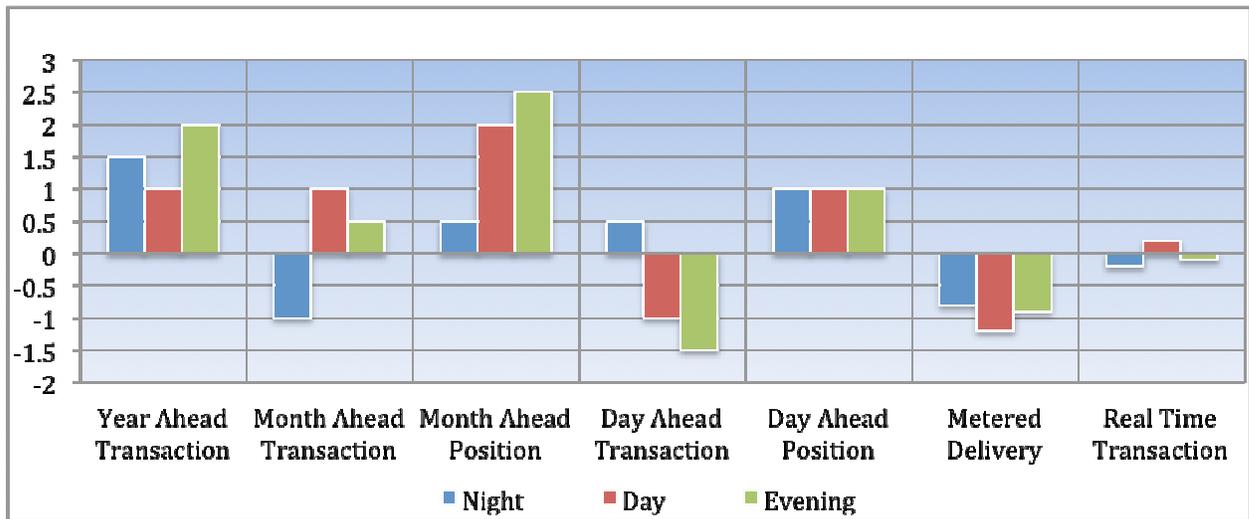
OASIS Energy Market Information Exchange [EMIX] Version 1.0, 08 September 2011. OASIS Committee Specification Draft and Public Review 04. <http://docs.oasis-open.org/emix/emix/v1.0/csprd04/emix-v1.0-csprd04.pdf>

¹ TeMIX was first described in a Draft White paper approved by the EMIX Technical Committee “Transactive Energy Market Information Exchange [TeMIX] an approved White Paper of the EMIX TC. Ed Cazalet et al. <http://www.oasis-open.org/committees/download.php/37954/TeMIX-20100523.pdf>.” This paper was written in the early stages of the work on EMIX and has not been updated to utilize the information models developed by the EMIX Technical Committee.

2 Transactive Energy Dynamic Price Example

This example is for a Load Serving Energy (LSE) serving retail customers (residential, commercial, industrial, distributed generation, or storage). The example applies to competitive and regulated LSEs. Determination of price is out of scope for this example. The LSE price is an *all-in price* for energy, transmission, distribution and fixed charges. The LSE tendered price is for the sale or purchase of a specific quantity of energy (a Tender) to a customer for a delivery interval and at a location. The buy and sell price and quantity may differ. Prices may vary by customer class. Customers will typically respond to LSE tenders but can also submit tenders to the LSE.

This example does not discuss the transactions between the LSE and the distribution operator, the system operator markets, other wholesale markets and other parties. Such transactions may or may not be based on TeMIX. The example assumes each retail customer purchases from a single LSE, but TeMIX allows for a retail customer to interact with multiple LSEs at the same time where regulations permit.



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FIGURE 1: ILLUSTRATIVE SEQUENCE OF FORWARD AND REAL TIME TRANSACTIONS

The sequence of transactions in Figure 1 illustrates this example. TeMIX profile conformance rules are used. The sequence begins with LSE tenders for night, day, and evening blocks of power for a year at a buy and sell price. The tenders may be made one or more years ahead of delivery and a tender may be withdrawn before acceptance and a new tender made at any time. The customer may use behind the meter generation (such as PV or storage) to offset its usage or to sell the LSE. The tender price is cost- or market-based depending on the LSE's regulatory status. The customer or an automated device decides the transacted quantity in each block and the customer is obligated to pay the transacted price and quantity.

Monthly and daily, the LSE also may tender similar blocks of power at current buy and sell prices. The customer or the customer's device may transact to adjust his position as indicated in

49 Figure 1. The customer incurs default 5-minute transactions for any difference between the 5-
50 minute position in each interval and the measured delivery at a real-time price posted before or
51 after the close of the interval.

52 The LSE may make tenders at any time. For example, ahead of each 5-minute interval the LSE
53 may tender energy in each 5-minute interval for each of the 5-minute intervals in the next two
54 hours. Customers may then forward buy and sell 5-minute energy at forward prices.

55 TeMIX transactions may be automatic using devices acting on the behalf of the customer and
56 based on customer preferences and not the LSE's preferences. Tenders made by the LSE will
57 typically reflect the LSE's marginal short and long-run costs for wholesale energy, ancillary
58 services, transmission congestion, transmission access, T&D losses, distribution congestion and
59 other fixed items. Theoretically, all such costs may vary by interval and be reflected in a varying
60 price in each interval. When because of variable demand, plant outages, transmission outages,
61 variable wind or solar or high levels of electric vehicle charging the tendered prices for each
62 interval location and customer price response can help to bring supply and demand into balance
63 at each location on the grid. For cost-based LSEs, the prices must, on average, recover regulated
64 cost and profits.

65 TeMIX Tenders can be for small quantities offered to a retail customer at the tendered price. If
66 the customer needs more, then the customer can access additional tenders, perhaps at different
67 prices. The responsiveness of the customer to priced tenders provides information to the LSE
68 on customer price sensitive demand that helps guide the LSE's bids into system operator
69 markets and transactions in other forward wholesale markets. By working with sequences of
70 small tenders and transactions stability of the grid is also protected from sharp price changes
71 avoiding the use of random or arbitrary restrictions on the customers to smooth responses to
72 price changes or control signals from the LSE.

73 Real Time Pricing (RTP) can be viewed as an application of TeMIX where the only transaction is
74 for the metered delivery of energy. The forward transactions in the above example are forward
75 hedges to the RTP to manage risk for both the customer and the LSE and to provide forward
76 information for forward wholesale transactions by the LSE. RTP may be optional or mandatory
77 and forward transactions may be optional or mandatory depending on regulations. This
78 approach provides the full incentive for customers and smart devices to save money based on
79 responses to real-time prices while providing for hedging and forward commitment where
80 customers and LSEs must make forward decisions.

81 3 Summary

82 For LSE's and retail customers, TeMIX is most useful for smart meter enabled customers that use
83 smart appliances and other such devices. TeMIX provides transacted baselines in each interval
84 so that the response of customers to price is discovered without verification and statistical
85 estimation of baselines. Settlement and billing is simplified. The same system can apply to
86 regulated or competitive LSEs and to all customer classes and distributed energy resources. A
87 major advantage of TeMIX in this application is that customers and their automated devices
88 respond with giving up any control of devices to the LSE and without providing forecasts or
89 demand curves to the LSE's.

90
91 TeMIX also has applications in other grid domains. The dynamic processes of TeMIX can help to
92 enable the coordinated, decentralized operation of variable renewables, distributed generation,
93 customer appliances, industrial processes, electric vehicles, storage, and peak load management
94 with distribution, transmission and centralized generation which is an important goal of the
95 smart grid.

96

Appendix A. Acknowledgments

97 The following individuals have participated in the creation of this specification and are gratefully
98 acknowledged:

99 Participants:

100 Edward Cazalet, Individual

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Appendix B. Revision History

Revision	Date	Editor	Changes Made
01	2011-09-29	Ed Cazalet	Initial Document
02	2011-09-30	Toby Considine	Converted to standard format

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