

The TeMix Platform™ for Transactive Energy: Applications and Demonstration

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Abstract

Transactive Energy is a business process for energy transactions. A Transaction is an exchange among parties of a product for a price. Transactive Energy is most useful in decentralized competitive electric energy markets, but it has applications in centralized dispatch, vertically integrated electric utilities, and microgrids.

Automation of electric energy transactions enables a more efficient and customer friendly electric grid. Transaction automation also supports increased variable renewables on the grid with fast response. Transactive Energy Market Information Exchange (TeMIX) is a methodology to support automated energy transactions and decentralized management of energy use and supply on a smart electric grid. Using TeMIX, customer devices such as air conditioners, plug-in vehicles, distributed generation and storage automatically interact with distribution grids, transmission networks, and central generation and storage.

The TeMIX standard is a profile (subset) of Transactive Energy standards by (OASIS) Organization for the Advancement of Structured Information Standards. In its ideal implementation, TeMIX uses frequent communication of small tenders and transactions for products. TeMIX has just two products; Energy and Energy Transport, and Call and Put Options on these. Parties to transactions may be (1) owners of end-use devices, generation, and storage with interval meters, (2) financial parties providing risk management with no intention of delivery, (3) suppliers and consumers of physical energy transport services, or (4) suppliers and consumers of financial transport hedges. A Party may take the buy or sell side of a transaction. A consumer can sell by reducing a purchased position or by self-generating. A supplier can buy back from a sold position.

The TeMix Platform™

The TeMix Platform implements the TeMix transactive services for automation of energy transactions. At its core the platform supports the processing of tenders and transactions for a set of Parties or a Party. The design of TeMix and the platform is agnostic as to the roles of Parties in the market. As shown in Figure 1 the TeMIX Platform accommodates any Party roles.

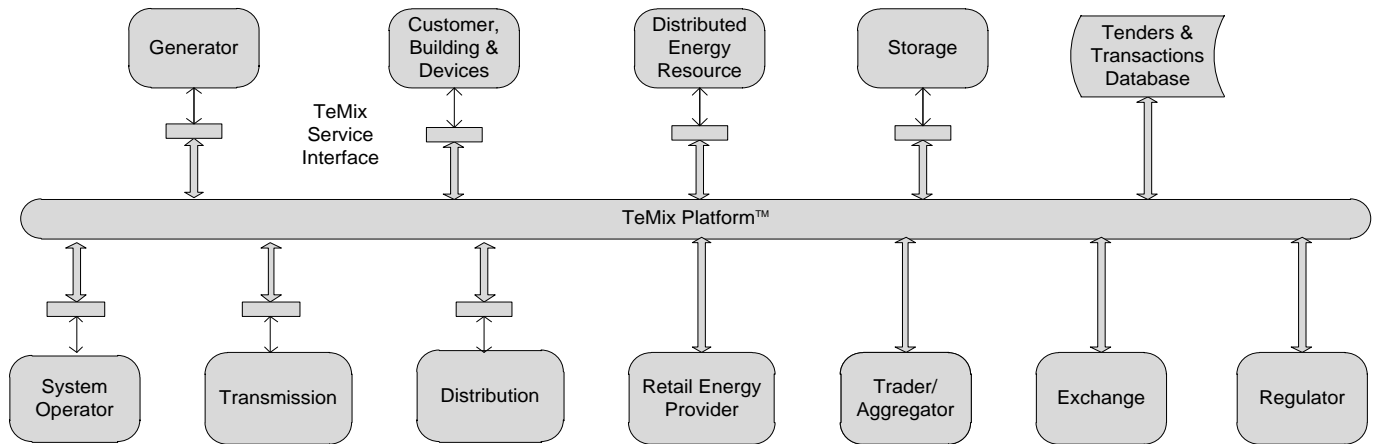


Figure 1: The TeMix Platform, Parties, and Service Interfaces

Intermediary parties such as Retail Energy Providers, Traders and Aggregators only process tenders and transactions whereas others, with devices, use a TeMix Service Interface to translate prices to device control signals. Parties with devices such as generators, storage, appliance, HVAC self-dispatch their own devices in response to actual or expected prices of tenders with other Parties. They then support their device dispatch with transactions to buy or sell the energy produced or consumed.

The TeMix Platform may be used by a large market, a regional market, a micro-market, a micro-grid, or a single Party. The platform is designed so that multiple platforms on different computers can interact as if they formed an integrated market. Thus the platforms scale to many millions of parties and billions of devices.

Applications

The following applications will be discussed:

1. Two-part, fixed and variable retail tariffs for regulated or competitive retail service.
2. Independent System Operator (ISO) wholesale prices to retail devices.
3. Integration of variable and self-dispatched distributed energy resources.
4. Distribution feeder two-way congestion management.
5. Micro-market operation and integration of multiple micro-markets.

Demonstrations

Two live demonstrations will be conducted:

1. Submission of a tender by a party and acceptance of the tender by a counter party.
2. A continuously running demonstration with the following occurring every 5 minutes:
 - 1) ISO wholesale tenders sent to a retail energy provider.
 - 2) Retail energy tenders sent to a retail customer.
 - 3) Distribution transport tenders for congestion and other costs sent to a retail customer.
 - 4) Customer dispatch of devices base on the total price of energy and distribution transport.
 - 5) Acceptance of the energy and transport tenders by the devices and communication of transactions to the retail energy provider and distribution provider.
 - 6) Acceptance of ISO tenders by the retail energy provider and communication of the transactions to the ISO.
 - 7) Metering and settlement.