Transactive Energy Extensions for OpenADR

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Transactive Energy: Party-to-Party Tenders and Transactions

Tender: CreateTender and GetTender – A tender is an offer to buy or sell at a price a quantity of Product at an Interface over a time interval.

Transaction: CreateTransaction and GetTransaction – A transaction is the acceptance of all or a portion of a binding tender.

Position: GetPosition – the net quantity and extended price of all transactions of a Product at an Interface over a time interval

Delivery: CreateDelivery and GetDelivery – A meter reading for a Product at an Interface over a time interval.
### Tender

{“tenderID”: 187714951,
“agreementID”: 372
“partyID”: 2,
“start”: “2019-02-19T10:00:00Z”
“durationID”: 8
“side”: “Sell”,
“type”: “Binding”,
“price”: “17.91”,
“quantity”: 12.10,
“expDate”: “2019-02-19T09:55:00Z”,
“postDate”: “2019-09-19T09:00:00Z”
}

### Transaction

{“transactionID”: 613756,
“tenderID”: 187714951
“quantity”: 6.20,
“postDate”: “2019-03-19T09:54:00Z”
}

### Delivery

{“deliveryID”: 2744962,
“meterID”: 17
“start”: “2019-02-19T10:00:00Z”
“durationID”: 4
“sourceID”: “dist operator”,
“quantity”: 13.20,
“postDate”: “2019-02-19T10:06:00Z”
}

### Market Context

**AgreementID:** From PartyID, ToPartyID, InterfaceID, ProductID  
**ProductID:** Energy, Reactive Energy, Transport  
**InterfaceID:** Facility Interface to the Grid  
**Side:** “Buy”/”Sell”

<table>
<thead>
<tr>
<th>DurationId</th>
<th>1 : 4-sec</th>
<th>2 : 6-sec</th>
<th>3 : one-min</th>
<th>4 : 5-min</th>
<th>5 : 10-min</th>
<th>6 : 15-min</th>
<th>7 : 30-min</th>
<th>8 : hour</th>
<th>9 : day</th>
<th>10 : month</th>
<th>11 : year</th>
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Retail Automated Transactive Energy System (RATES)
One example application of the TE Protocols

RATES Can Reduce Costs of Meeting California’s 2045 100% Clean Energy, Electrification, and GHG Goals by Enabling Retail Customers to Self-Manage, Shape, and Shift Electricity Use, Storage, and Supply so that Net Electricity Usage Better Follows Variable Solar & Wind Generation using IoT + Subscription Transactive Tariffs + Transactive Energy Platforms
- Fixed Cost Subscriptions Stabilize Customer Electric Bills
- Variable Buy and Sell Prices Enable Self-Management
Tender Price Stack – January 29th & 30th, 2019

Heat Pump (Heating) Operation – January 29th & 30th, 2019

Pool Pump Operation – January 9th to 14th, 2019
Tesla Model S EV Agent

5-min Tender Price $/kWh

6:05 pm March 6, 2019 to 7:30 am March 7, 2019

EV 5-min Charge kW

EV State of Charge %

100 kWh Battery

6 kW Residential Charger

Initial Charge
50% at 6:30 pm

Requested Charge
75% at 7:30 am

Tesla Model S EV Agent
RATES Customer Battery Example

Battery Specifications:
- 9.8 kWh Storage Capacity
- 8.5 kWh Maximum Storage
- 1.5 kWh Minimum Storage
- 5 kW Maximum Discharge Rate
- 3.5 kW Maximum Charge Rate
- 90% Round Trip Efficiency

Operating Results:
- 14 kWh / Day Discharge
- 15.56 kWh / Day Charge

$17.00 First Day Net Revenues
$13.50 Second Day Net Revenues
The RATES Team Recommends:

- Further deployment of RATES focus on medium and larger retail customers with flexible technology:
  - electric heat pumps, electric water heating, pumps, battery storage, solar, and electric vehicles.
  - California’s 100 percent clean energy and electrification goals will result in many customers with these technologies.

- Load serving entities and distribution operators implement:
  - automated interfaces to RATES, and
  - the Subscription Transactive Tariff on an opt-in basis by the customers with flexible technologies.

- Tailoring RATES to each customer’s situation to reduce deployment costs: RATES can
  - operate with 5-, 15-minute or hourly metering,
  - with and without HAN interface to the home meter and settlement, and
  - and with and without automated energy management systems and forward transactions.

- RATES as foundation for California retail electricity markets interfaced the California ISO, whether applied by
  - a vertically integrated entity,
  - an LSE including CCAs, or
  - a distribution operator that is transporting electricity for one or more LSEs.

- Step-by-step deployment of RATES as outlined above.