# DOCKETED

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|---|---|
| **Docket Number:** | 19-OIR-01 |
| **Project Title:** | Load Management Rulemaking |
| **TN #:** | 231538 |
| **Document Title:** | Presentation - Retail Automated Transactive Energy System Pilot |
| **Description:** | Presentation by Ed Cazalet on a pilot with SCE that tested the Retail Automated Transactive Energy System (RATES). |
| **Filer:** | Karen Herter |
| **Organization:** | TeMix Inc. |
| **Submitter Role:** | Public |
| **Submission Date:** | 1/15/2020 12:05:59 PM |
| **Docketed Date:** | 1/15/2020 |

# Retail Automated Transactive Energy System (RATES) Pilot

**Edward G. Cazalet, Ph.D.**

**CEO, TeMix Inc.**

**2020 Load Management Rulemaking**

**Commissioner Scoping Workshop**
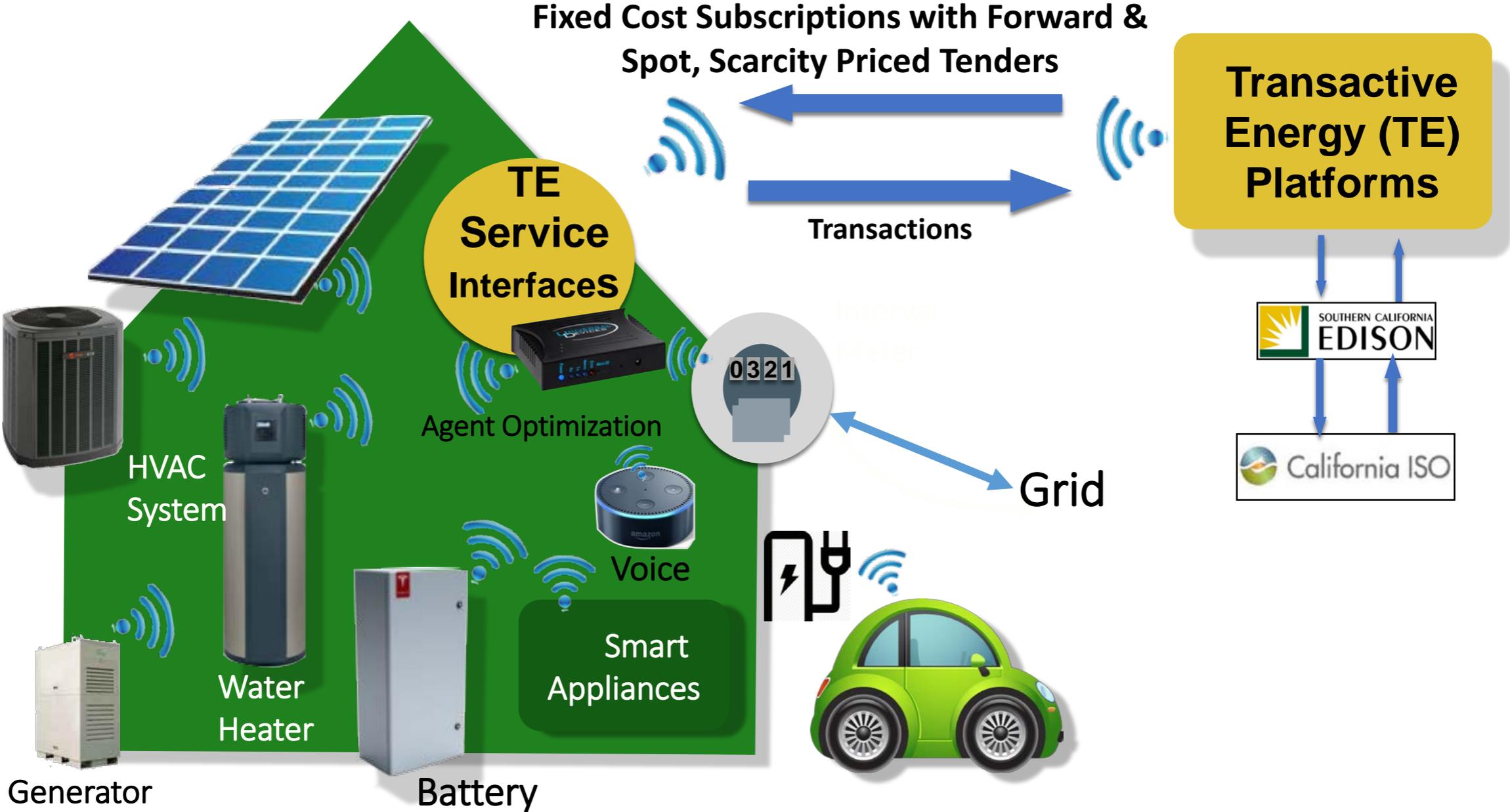
**California Energy Commission (CEC)**

**Sacramento, CA**

**January 14, 2020**

**GFO 15-311 / Group 2**

FUNDING PROVIDED BY THE
**CALIFORNIA ENERGY COMMISSION**

STATE OF CALIFORNIA
ENERGY COMMISSION
SINCE 1975

UNIVERSAL DEVICES

TeMix™
Transactive Energy Services

# RATES: Subscription Transactive Tariff + TE Platform + IoT



**Fixed Cost Subscriptions with Forward & Spot, Scarcity Priced Tenders**

**Transactive Energy (TE) Platforms**

Transactions

TE Service InterfaceS

Agent Optimization

HVAC System

Water Heater

Generator

Battery

Voice

Smart Appliances

Grid

SOUTHERN CALIFORNIA EDISON

California ISO

1. Fixed Cost Subscriptions Stabilize Customer Electric Bills
2. Variable Buy and Sell Prices Enable Self-Management & Flexibility
3. TE Platform Communicates Prices and Records Transactions
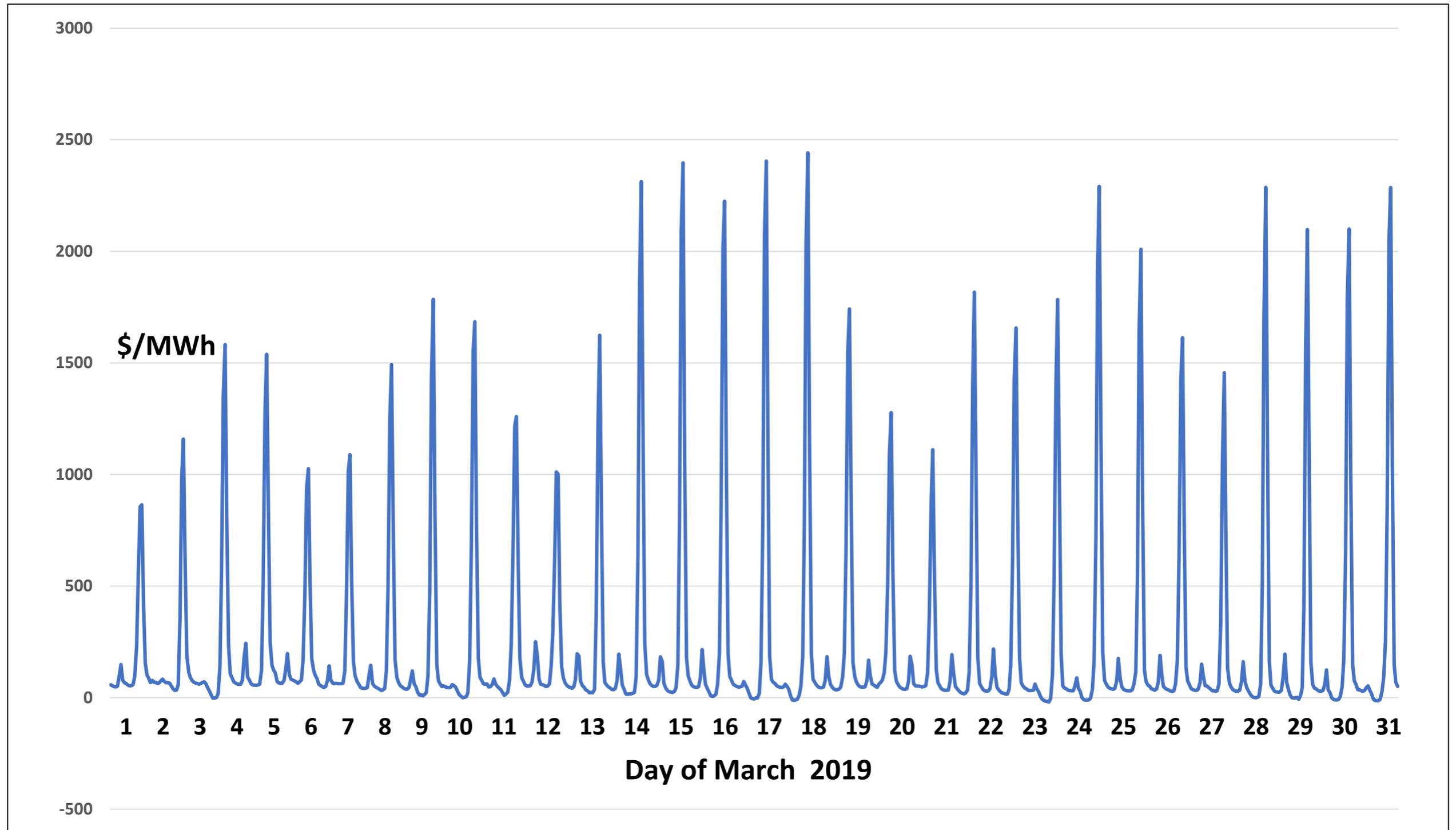
# Subscription Transactive Tariff
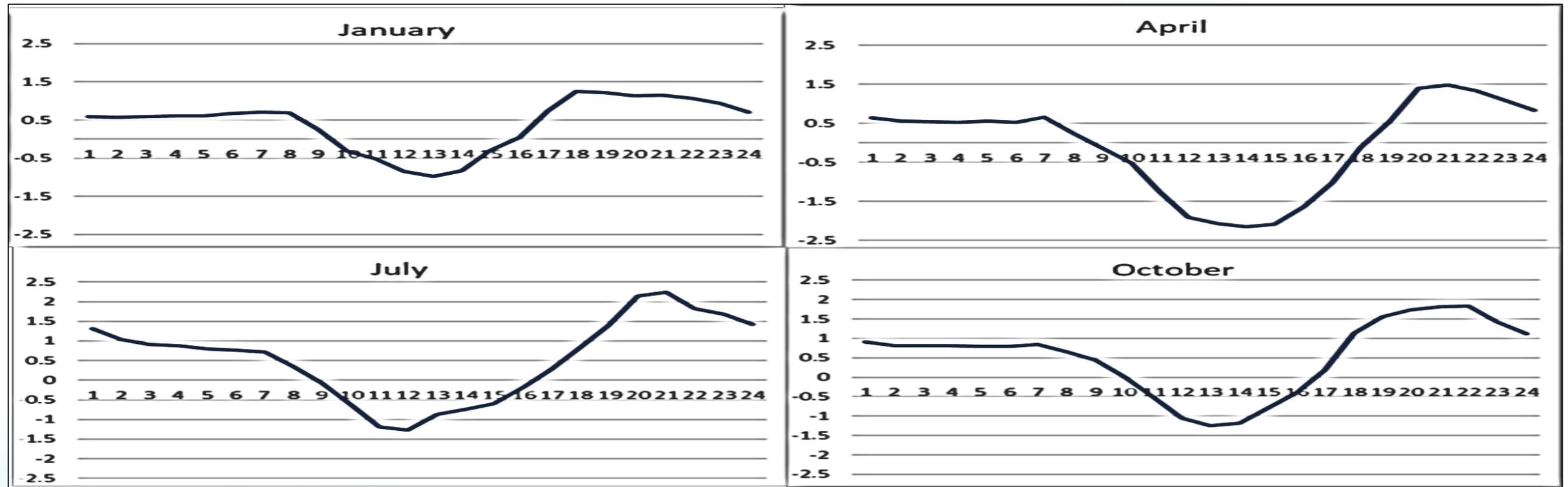


**Solar Customer Subscription Hourly kW @ Fixed Monthly Cost based on Existing Tariff**

**Tender Price = LMP@pNode + Base Gen Price + Flex Gen Price + Delivery Price**
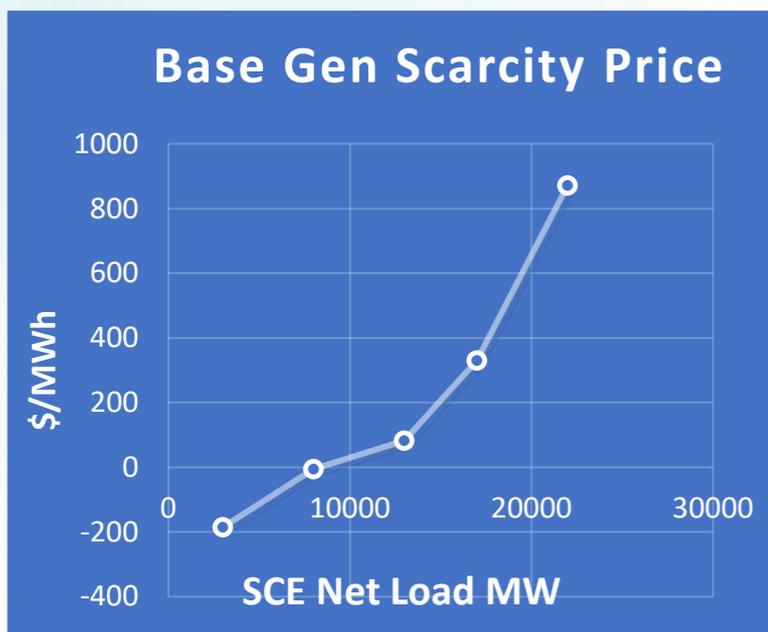
# Hourly Tender Prices for Moorpark for 31 Days of March 2019



Note: Scarcity pricing recovers all of the variable costs and most of the fixed costs with higher prices when generation capacity and distribution capacity is more heavily loaded.

# Pool Pump Agent Example

**Pool Pump Operation for January 9th to January 14th, 2019**

| Hour | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|
| 1 | 0.74 | 0.00 | 0.74 | 0.73 | 0.00 | 0.73 |
| 2 | 0.74 | 0.74 | 0.73 | 0.73 | 0.00 | 0.74 |
| 3 | 0.74 | 0.74 | 0.00 | 0.74 | 0.00 | 0.74 |
| 4 | 0.74 | 0.74 | 0.00 | 0.74 | 0.73 | 0.74 |
| 6 | 0.00 | 0.00 | 0.00 | 0.74 | 0.00 | 0.00 |
| 7 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8 | 0.00 | 0.00 | 0.00 | 0.00 | 0.74 | 0.00 |
| 9 | 0.00 | 0.00 | 0.00 | 0.00 | 0.73 | 0.00 |
| 10 | 0.00 | 0.00 | 0.73 | 0.00 | 0.73 | 0.00 |
| 11 | 0.73 | 0.74 | 0.74 | 0.00 | 0.73 | 0.00 |
| 12 | 0.74 | 0.74 | 0.00 | 0.00 | 0.73 | 0.74 |
| 13 | 0.74 | 0.74 | 0.00 | 0.74 | 0.74 | 0.00 |
| 14 | 0.74 | 0.73 | 0.00 | 0.74 | 0.74 | 0.00 |
| 15 | 0.00 | 0.72 | 0.00 | 0.73 | 0.00 | 0.00 |
| 16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 22 | 0.00 | 0.00 | 0.73 | 0.00 | 0.00 | 0.00 |
| 23 | 0.00 | 0.00 | 0.73 | 0.00 | 0.00 | 0.00 |
| 24 | 0.00 | 0.00 | 0.74 | 0.00 | 0.00 | 0.73 |

# Heat Pump Agent Example
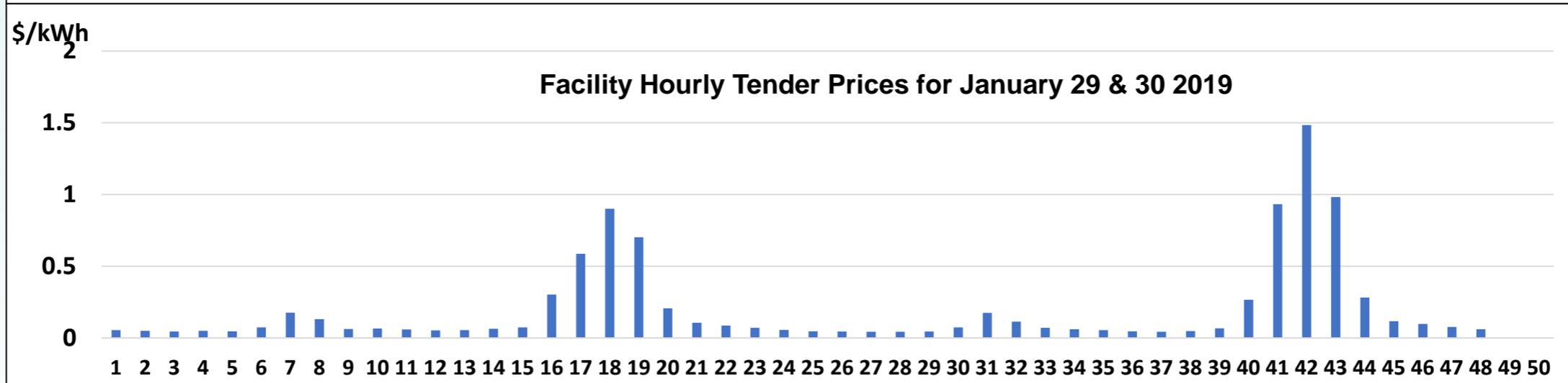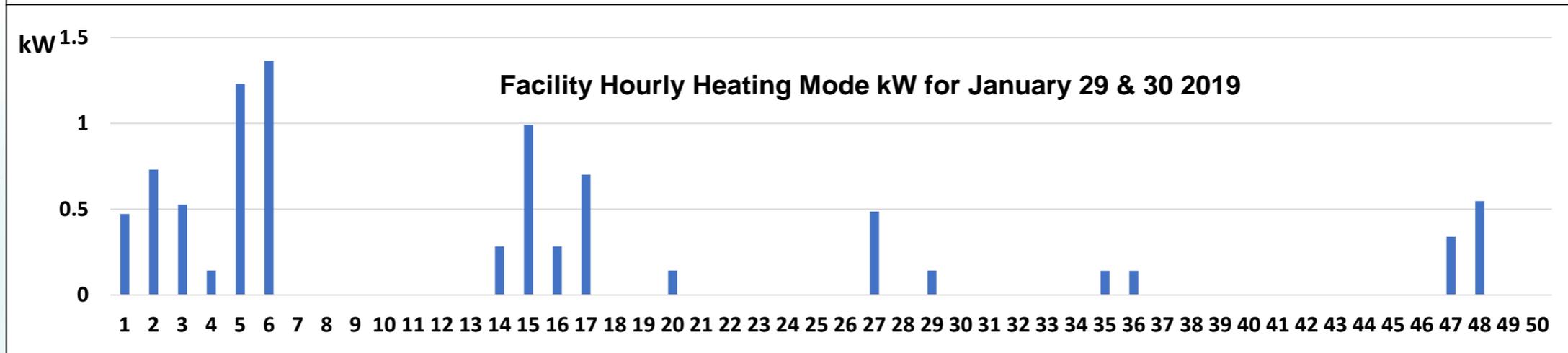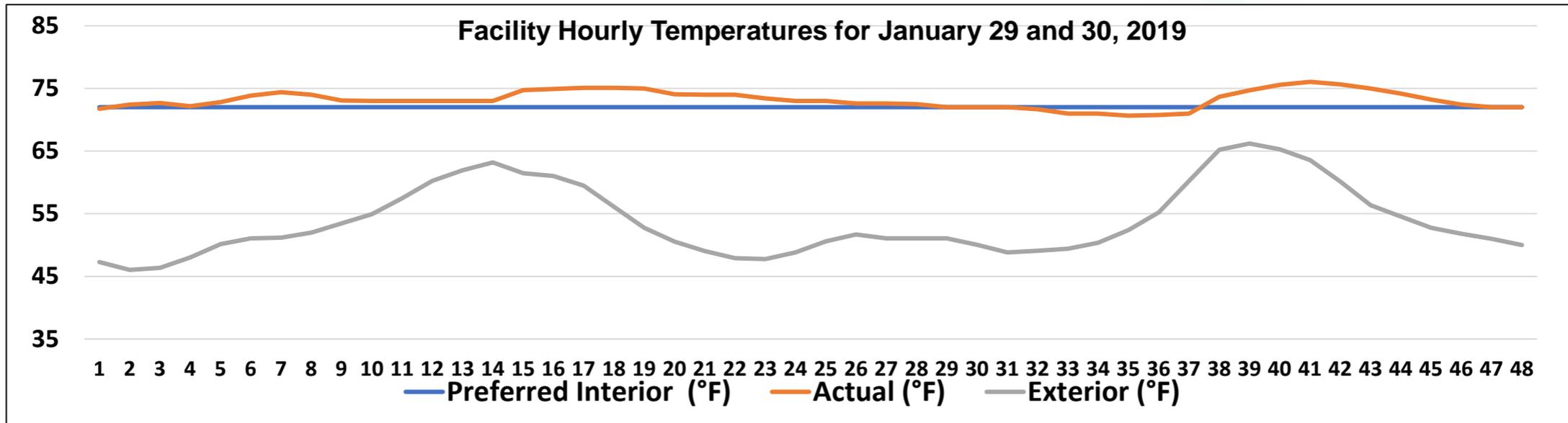
# Behind-the-Meter Battery Agent Example

## Self-Managed, Automated Battery Charge and Discharge
## for February 7th and 8th, 2019

**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
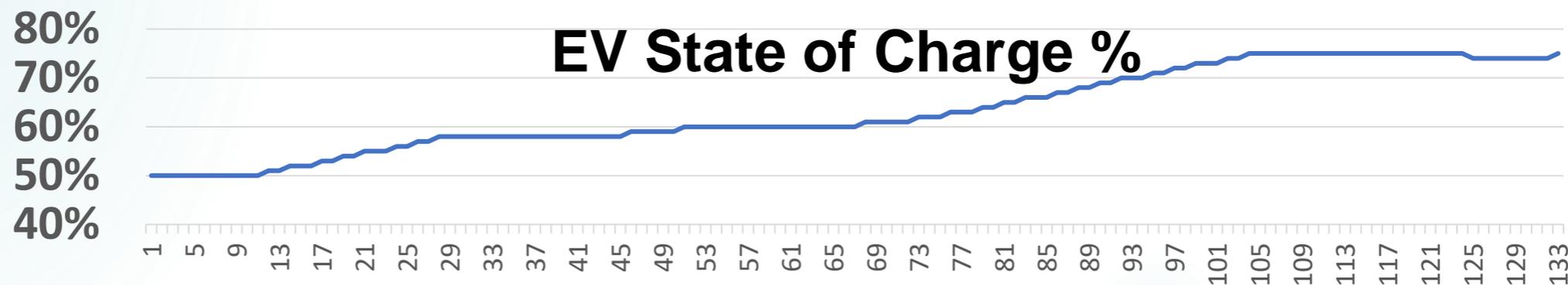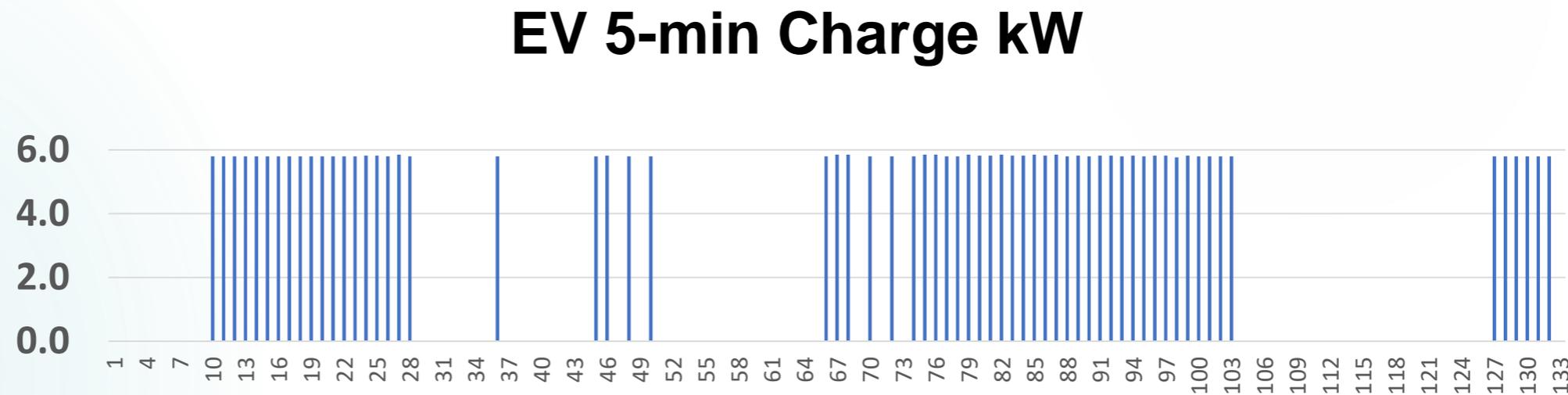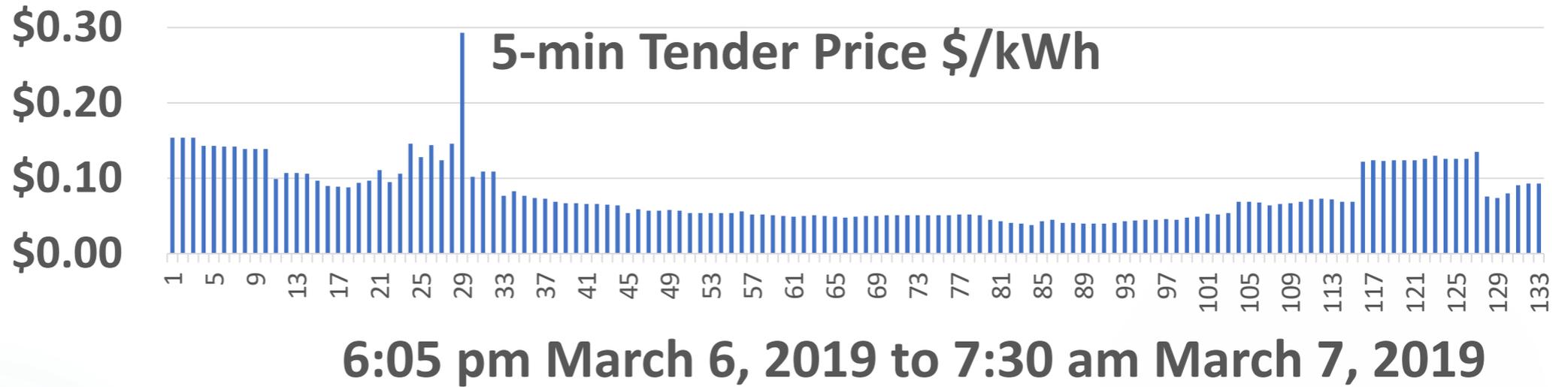**$13.50** Second Day Net Revenues

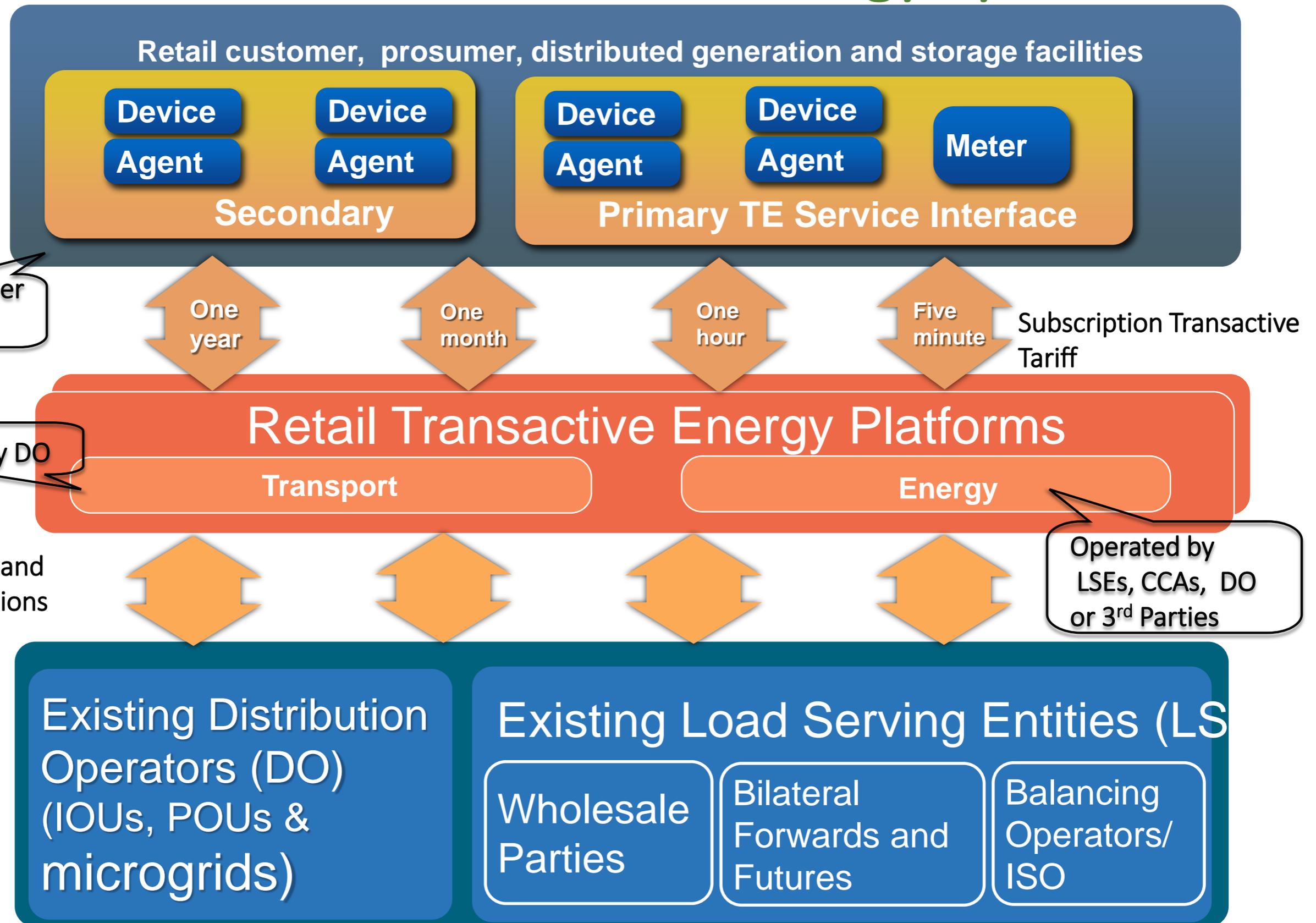TeMix Inc.
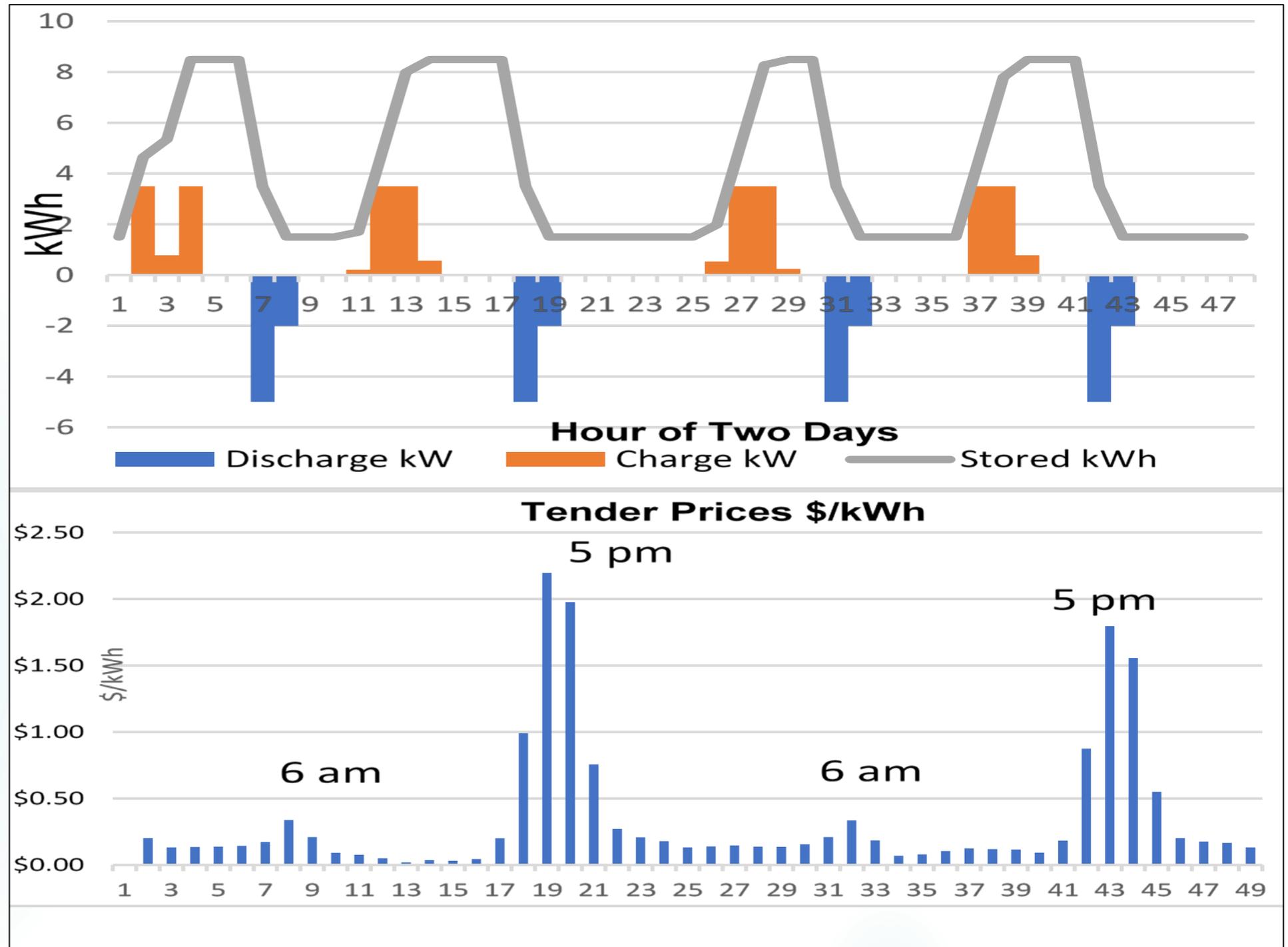
# Tesla Model S EV Agent Example

100 kWh Battery

6 kW Residential Charger

Initial Charge 50% at 6:30 pm

Requested Charge 75% at 7:30 am



**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 %**

# End-to-End Transactive Energy System

**Retail customer, prosumer, distributed generation and storage facilities**

| Device | Device | | Device | Device | |
|--------|--------|---|--------|--------|---|
| Agent | Agent | | Agent | Agent | Meter |

**Secondary**

**Primary TE Service Interface**

Peer-to-Peer Supported

| One year | One month | One hour | Five minute |
|----------|-----------|----------|-------------|

Subscription Transactive Tariff

## Retail Transactive Energy Platforms

**Transport**

**Energy**

Operated by DO

Operated by LSEs, CCAs, DO or 3rd Parties

Tenders and Transactions

Existing Distribution Operators (DO) (IOUs, POUs & microgrids)

Existing Load Serving Entities (LS

| Wholesale Parties | Bilateral Forwards and Futures | Balancing Operators/ ISO |
|-------------------|--------------------------------|--------------------------|

# Deployment of RATES

**Focus on medium and larger retail customers with flexible technology:**

- electric heat pumps, electric water heating, pumps, battery storage, solar, electric vehicles & commercial refrigeration.
- California's 100 percent clean energy and electrification goals will result in many customers with these technologies.

**Load serving entities (incl. CCAs) and distribution operators implement:**

- automated interfaces to RATES, and
- the Subscription Transactive Tariff on an opt-in basis by the customers with flexible technologies.

**Tailor to each customer's situation:**

- 5-, 15-minute or hourly metering,
- with or without HAN interface to the facility meter, and
- with or without automated energy management systems and forward transactions.

# Benefits of RATES

Highly dynamic tariff prices enable more flexibility for renewables than static TOU tariffs

Simple, granular tariff; No demand charges, DR events, capacity payments or DER baselines

No need for DER to bid into wholesale markets and be dispatched

Forward tenders support optimization of storage, EVs, HVAC, electric water heaters, and pumps

Subscriptions support low income policies and can retain net metering solar benefits

Lower IT, settlement and program costs