

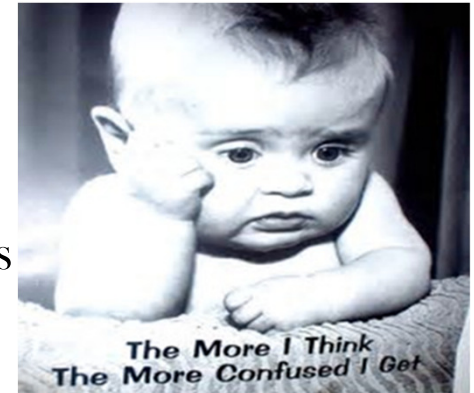
# Transactive Energy

What is it?  
Why is it important?  
What's it got to do with OpenADR?



# What is Transactive Energy?

- It's Block Chain!
  - No, it's really not
- Most widely used definition comes from PNNL/GWAC
  - “A system of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using **value** as a key operational parameter”



# Transactive Signals = Price Signals?

- How do we
  - Recoup transportation charges?
  - Represent Reactive Power?
  - Address CPUC Rule 21/3?
- Since there's no binding delivery and payment commitment/records
  - Settlement requires costly estimated Baselines + M&V
  - Forecasting is not optimal: relationship between quantity and price is implicit

If there are no "Transactions" anywhere so why even call it Transactive?

# RATES

## Retail Automated Transactive Energy System

### GFO 15-311 - Advancing Solutions That Allow Customers To Manage Their Energy Demand Group 2

- Load Management Systems that Facilitate Participation as Demand-side Resources
- Evaluate customer response to **Transactive Signals**



# The Authentic Transactive Energy

## And Why Is it Important?


- Transactions at specific *locations* on time *intervals*
  - Energy related products such as Real and Reactive Power
    - Can possibly address most if not all of CPUC Rule 21/3
  - Transport related products such as two-way energy transport
- Full lifecycle
  - Tender (or offer), transaction, and delivery
  - Bidirectional to buy/sell (DER)
  - Settlement does not require baselines and measurement/verification
- Tariff independent
  - Changing tariffs does not change the underlying services

# RATES 2-Way Subscription Tariff















## Forward Subscriptions with Spot Transactions

- Subscribe at specific *costs* and *quantity* for each interval
  - Energy or Reactive Power (as needed)
  - Easily automated using subscriptions, positions, and preferences
  - Buy more at spot tenders prices or sell at spot prices if desired
  - Shed/shift load and/or DER
- Scarcity pricing used to recover more fixed cost when the delivery or generation system is more heavily loaded (in either direction)
- Addresses
  - Bill, revenue, and grid volatility
  - Recovery of both fixed and variable costs for all parties with settlement calculations
  - Forward transactions support better forecasting of operations

# Price Signals

Signals						
ID	Name	Type				
 27b14c60f134eba01e10	ENERGY_PRICE	price				

Intervals						
ID	Duration	Start Time	End Time	Type	Value	Mode
 0	3600 (seconds)	2018/04/23 12:00:00 AM	2018/04/23 1:00:00 AM	float	0.023000 USD/KWh	N/A
 1	3600 (seconds)	2018/04/23 1:00:00 AM	2018/04/23 2:00:00 AM	float	0.023000 USD/KWh	N/A
 2	3600 (seconds)	2018/04/23 2:00:00 AM	2018/04/23 3:00:00 AM	float	0.021000 USD/KWh	N/A
 3	3600 (seconds)	2018/04/23 3:00:00 AM	2018/04/23 4:00:00 AM	float	0.019000 USD/KWh	N/A
 4	3600 (seconds)	2018/04/23 4:00:00 AM	2018/04/23 5:00:00 AM	float	0.023000 USD/KWh	N/A
 5	3600 (seconds)	2018/04/23 5:00:00 AM	2018/04/23 6:00:00 AM	float	0.029000 USD/KWh	N/A
 6	3600 (seconds)	2018/04/23 6:00:00 AM	2018/04/23 7:00:00 AM	float	0.037000 USD/KWh	N/A
 7	3600 (seconds)	2018/04/23 7:00:00 AM	2018/04/23 8:00:00 AM	float	0.028000 USD/KWh	N/A
 8	3600 (seconds)	2018/04/23 8:00:00 AM	2018/04/23 9:00:00 AM	float	0.021000 USD/KWh	N/A
 9	3600 (seconds)	2018/04/23 9:00:00 AM	2018/04/23 10:00:00 AM	float	0.022000 USD/KWh	N/A
 10	3600 (seconds)	2018/04/23 10:00:00 AM	2018/04/23 11:00:00 AM	float	0.019000 USD/KWh	N/A
 11	3600 (seconds)	2018/04/23 11:00:00 AM	2018/04/23 12:00:00 PM	float	0.023000 USD/KWh	N/A
 12	3600 (seconds)	2018/04/23 12:00:00 PM	2018/04/23 1:00:00 PM	float	0.023000 USD/KWh	N/A
 13	3600 (seconds)	2018/04/23 1:00:00 PM	2018/04/23 2:00:00 PM	float	0.025000 USD/KWh	N/A

Targets	
Groups	
MOORPARK_6_N001	

# Transactive Energy Using RATES

## RATES Report

UUID: 00:21:b9:02:12:e4

Alias: ThousandOaksCustomerA

04/23/2018

Update positions

View Hourly



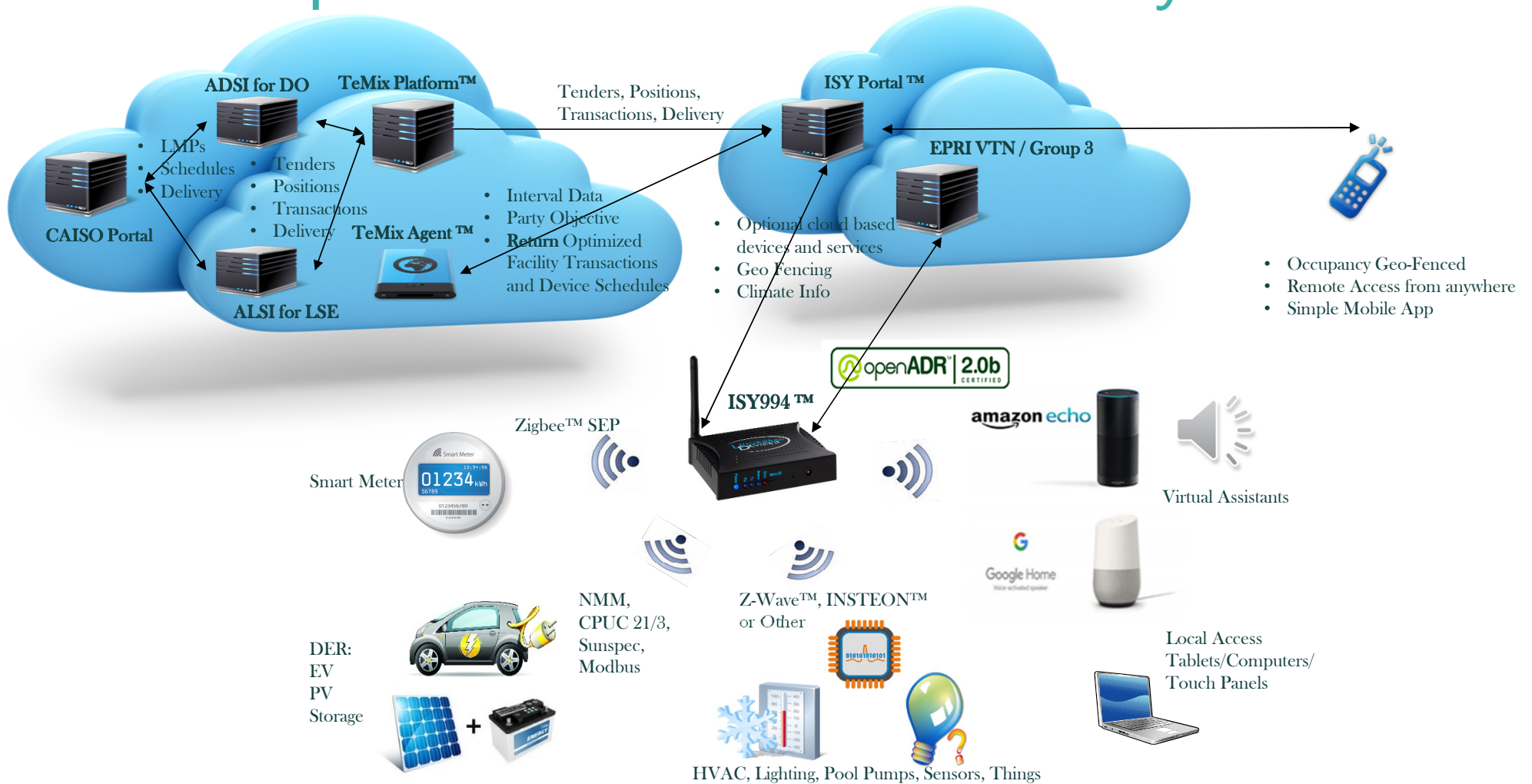
Show 100 entries

Search:

Time	kW	Buy At	Sell At	Inside	Outside	Clouds	Facility kW	HVAC kW	Mode	Cool SP	Heat SP	Occupied
00:00	5.5800 / 0.01\$	0.0327\$	0.0316\$	76.0°F	55.9°F	0%	5.5801 / 0.0150\$	0.0000 / 0.0000\$	Cool	76.0°F	69.0°F	100%
00:05	5.9962 / 0.01\$	0.0339\$	0.0327\$	76.0°F	55.9°F	0%	5.9963 / 0.0166\$	0.0000 / 0.0000\$	Off	76.0°F	69.0°F	100%
00:10	5.8611 / 0.01\$	0.0341\$	0.0330\$	76.0°F	55.6°F	0%	5.8612 / 0.0164\$	0.0000 / 0.0000\$	Off	76.0°F	69.0°F	100%
00:15	5.9436 / 0.01\$	0.0307\$	0.0297\$	76.0°F	55.0°F	0%	5.9436 / 0.0150\$	0.0000 / 0.0000\$	Cool	76.0°F	69.0°F	100%
00:20	6.2299 / 0.01\$	0.0310\$	0.0300\$	76.0°F	55.0°F	0%	6.2300 / 0.0158\$	0.0000 / 0.0000\$	Off	76.0°F	69.0°F	100%
00:25	5.9371 / 0.01\$	0.0306\$	0.0296\$	76.0°F	55.0°F	0%	5.9372 / 0.0149\$	0.0000 / 0.0000\$	Off	76.0°F	69.0°F	100%
00:30	6.1276 / 0.01\$	0.0305\$	0.0295\$	76.0°F	55.0°F	0%	6.1276 / 0.0153\$	0.0000 / 0.0000\$	Cool	76.0°F	69.0°F	100%
00:35	6.0087 / 0.01\$	0.0331\$	0.0320\$	76.0°F	55.0°F	0%	6.0087 / 0.0163\$	0.0000 / 0.0000\$	Cool	76.0°F	69.0°F	100%
00:40	6.0984 / 0.01\$	0.0311\$	0.0301\$	76.0°F	55.0°F	0%	6.0984 / 0.0155\$	0.0000 / 0.0000\$	Cool	76.0°F	69.0°F	100%
00:45	5.9703 / 0.01\$	0.0306\$	0.0296\$	76.0°F	54.6°F	0%	5.9704 / 0.0150\$	0.0000 / 0.0000\$	Off	76.0°F	69.0°F	100%
00:50	6.1636 / 0.01\$	0.0305\$	0.0295\$	76.0°F	54.0°F	0%	6.1636 / 0.0154\$	0.0000 / 0.0000\$	Cool	76.0°F	69.0°F	100%
00:55	0.9993 / -0.00\$	0.0290\$	0.0280\$	76.0°F	54.0°F	0%	0.9992 / 0.0024\$	0.0000 / 0.0000\$	Cool	76.0°F	69.0°F	100%
01:00	0.2603 / -0.00\$	0.0304\$	0.0294\$	76.0°F	54.0°F	0%	0.2602 / 0.0006\$	0.0000 / 0.0000\$	Cool	76.0°F	69.0°F	100%



# It's Complex But We Have Already Solved It!



# Challenges to Overcome

- Transactive energy is most optimal with real-time metering info
  - Some meters had to be replaced
  - About 10% of meters have intermittent connectivity issues
    - Most recover within half an hour
    - 2% recover after 4 hours
    - 1% recover after 24 hours
  - Can partly be solved by back filling using Green Button but not as granular
- Existing equipment
  - Customers Do not want to replace their existing equipment
    - Especially Nest and EcoBee thermostats and Zodiac Pool Controllers
  - Some Inverters have to be replaced so that we can communicate with them

# What's It Got to Do with OpenADR?

- OpenADR is a known and mature brand
  - The standard for communications between the utilities and customers
- They share many concepts
  - TeMIX and OpenADR are both based on OASIS | eMIX
- Complements OpenADR
  - OpenADR 2.0a/2.0b address Informational and Directive signals
  - Transactive Energy addresses Transactional signals
    - Very important for microgrids/DER
- Regulatory, utility, manufacturer, and ultimately more customer friendly
  - Dealing with multiple standards is costly and confusing for everyone

# Thank You!

## Contact Information:

Universal Devices, Inc.  
Michel Kohanim  
[michel@universal-devices.com](mailto:michel@universal-devices.com)  
818-631-0333