



**OpenADR Introduction**  
**7/8 November 2019 – ASIA WEBINAR**

Rolf Bienert, Technical & Managing Director  
Don Dulchinos, Director Market Facilitation



## GoToWebinar

- Audio: Use the Audio pane to switch between Telephone and Mic & Speakers

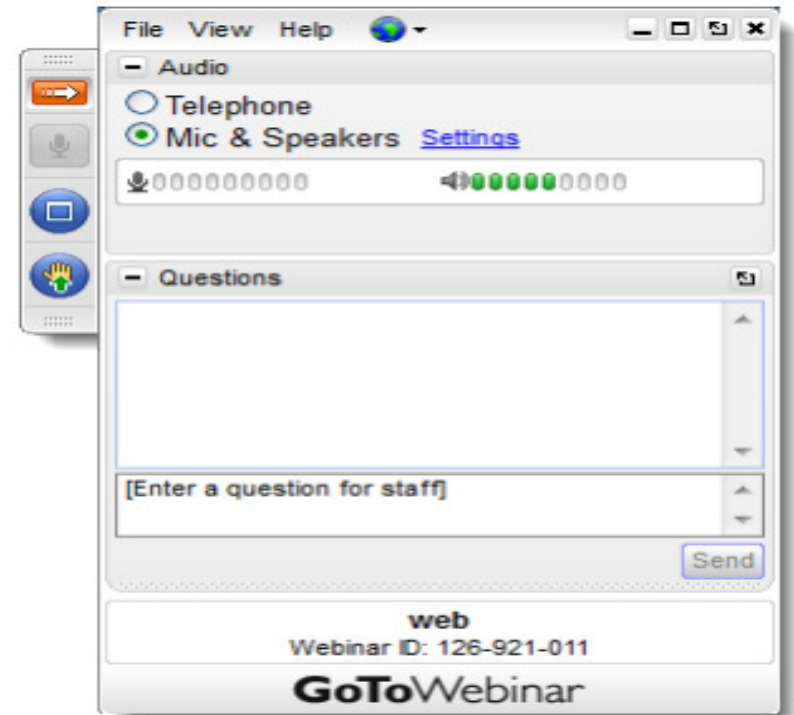
*You will be defaulted to mute by the organizer*

*Please use the Questions Pane for comments or questions.*

- Q&A: Post your questions for panelists to the question box.

*Questions will be addressed at the end of the presentation.*

- This webinar is being recorded. Webinar slides and audio will be made available on the OpenADR website.



# Agenda



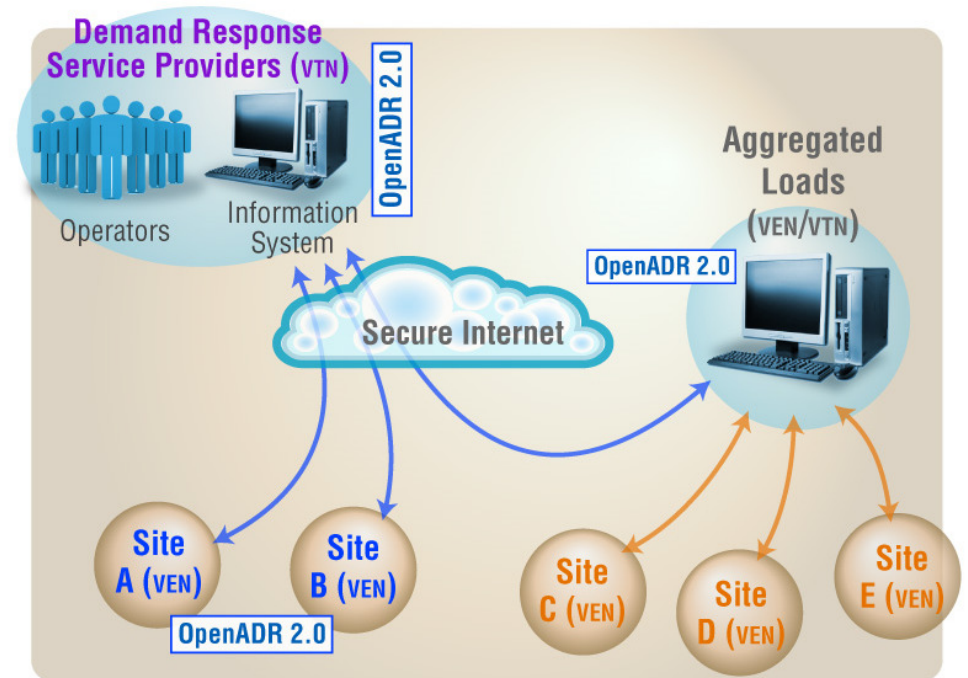
- Introductions – Rolf Bienert, Don Dulchinos (11:00-11:45 Jp Time)
  - OpenADR: Goals and Advantages
  - OpenADR Alliance: Organization Roles
  - OpenADR: How It Works
  - Specification Updates and Extensions



- Asia Pacific Implementation and Activity (11:45-12:45)
  - Japan Demand Response Market Hideo Ishii, Waseda University
  - Electric Vehicle Charging Applications John Wang, Noodoe, Taiwan
  - OpenADR Test Lab Support Erico Narita, TUV Rheinland, Japan
- Discussion – Q&A / 2020 Activity in Asia Pacific (12:45-13:00)

# OpenADR in a Nutshell

OpenADR provides a non-proprietary, open standardized DR & DER interface that allows DR service providers to communicate DR, DER, and TE (Transactive Energy) signals directly to existing customers using a common language and existing communications such as the Internet.



# What is the OpenADR Alliance?



**Vision: Facilitate the global deployment of OpenADR to reduce the cost of supplying and consuming electricity, while improving energy reliability and reducing environmental impact.**

- California based nonprofit 501(c)(6) corporation comprising 145 industry stakeholders
- Leverages Smart Grid related standards from OASIS, IEC, UCA and NAESB for OpenADR profiles
- Supports development, testing, certification, and deployment of commercial OpenADR
- Enables stakeholders to participate in automated DR, DER, dynamic pricing, transactive services, and electricity grid reliability

# Members

**Sponsor Members**

Honeywell IPKeys BERKELEY LAB  
P&E SIEMENS SOUTHERN CALIFORNIA EDISON  
An EDISON INTERNATIONAL® Company

**Contributor Members**

**Adopter Members**

EDF ETC ETRI  
HANWON Electric Company ISGF  
Korea Electrotechnology Research Institute KEPCO London Hydro  
NVEnergy



# Membership Examples



## ■ **Metering**

- Itron
- Fujitsu

## ■ **Controls/Systems**

- AO Smith
- Auto-Grid
- Azbil Corporation
- Fuji Electric
- Hitachi
- Siemens
- Many more

## ■ **Adopters**

- China Electric Power Research Institute
- ETRI
- Hawaii Electric
- NV Energy
- India Smart Grid Forum
- London Hydro

## ■ **Consumer Devices**

- Chargepoint
- Daikin Global
- Doosan
- Ecobee
- Evconnect
- Mitsubishi Electric

# Standards Interoperability *Lifecycle Process*

**An iterative development process for a standard to be deployed In markets**

1. Research and development
2. Pilots and field trials
3. Interoperability standards development
4. Deployment and market facilitation



# International Standardization

## ■ 2014

- International Electrotechnical Commission (IEC) approved the OpenADR 2.0b Profile Specification as a Publicly Available Specification (PAS) IEC/PAS 62746-10-1 as a basis for a new commission standard to be developed.
- The level of international support for the PAS validates the global importance of the OpenADR smart grid specification.

## ■ 2018

- The IEC Project Committee 118 (PC118) together with TC57 WG21 advanced the PAS to become an international standard.
- OpenADR 2.0b is now published as IEC 62746-10-1 Ed.1 as of November 19, 2018. <https://webstore.iec.ch/publication/26267>
- The technical requirements and functions are unchanged from OpenADR 2.0b.

# OpenADR Related Standardizations in Japan

- JSCA\*<sup>1</sup> Standard was published in 2012.  
It introduced several OpenADR use cases.  
\*<sup>1</sup>: Japan Structural Consultants Association
- ERAB\*<sup>2</sup> Guideline was published in 2017.  
It guides OpenADR payload construction.  
\*<sup>2</sup>: Energy Resource Aggregation Business Study Committee,  
established by Ministry of Economy, Trade and Industry.
- JEC-TR\*<sup>3</sup> series were published in 2018-19.  
The series advises detailed implementation  
of OpenADR and IEC61850.  
\*<sup>3</sup>: Japanese Electro-technical Committee of the Institute of  
Electrical Engineers in Japan



# Coexistence with Other Standards

- Due to the nature of OpenADR – *Inform & Motivate* – it is easy to connect OpenADR enabled systems to other standards
- Any building management or control protocol can be connected to gateways
- Some examples
  - OCPP                      Open Charge Point Protocol
  - EFI                         Energy Flexibility Interface (emerging European standard)
  - CTA-2045                Communications port for water heaters, other devices.
  - IEEE-2030.5             Basis for California Rule 21 Smart Inverter Profile

# Where are we today?




**OpenADR certified product database**

Welcome to our new and improved certified products database! Please feel free to search through the growing pool of OpenADR 2.0 certified products. We are proud of our existing products and hope to add many more for you to choose from. Happy searching.

**FILTER PRODUCTS ▶**


Show: **AB** ABC DEF GHI JKL MNO PQR STU VWX YZ View: 5 10 20 All 1 2 3 ... 20 Next >

- 

**Acuity Controls | LCAD ADR**

The GR2400 L2 ADR | GRV400 L2 ADR client, by Acuity Controls, allows an LCAD system to integrate with an OpenADR 2.0a Demand Response Automation Server (DRAS). The device communicates with the configured OpenADR DRAS to retrieve live power demand information from the utility company...


Product Type: VEN (Client) | OpenADR Profile: 2.0a

[View full profile](#)
- 

**Acuity Controls | nADR**

The nADR client, by Acuity Controls, allows an nLight system to integrate with an OpenADR 2.0a Demand Response Automation Server (DRAS). The device communicates with the configured OpenADR DRAS to retrieve live power demand information from the utility company and shed load according to pre-configured...

Product Type: VEN (Client) | OpenADR Profile: 2.0a

[View full profile](#)
- 

**Advanced Institutes of Convergence Technology | AutoDR Service on National Virtual Power Plant Business Platform**

National Virtual Power Plant (NVPP) Business Platform is being developed by government funding mainly for research purposes. As an open platform, it contributes to deliver or minimize peak load, balancing power at short time frame or energy exchange with consideration of grid bottlenecks. Major functional...

Product Type: VTN (Server) | OpenADR Profile: 2.0a-b

- Two completed specifications
  - >7 years for 2.0a
  - >6 years for 2.0b
- 8 test houses validated
- ~ 170 certified systems
- ~ 145 member companies

# Certified Products - Examples

## ■ VTN

- DERMS
- DR Optimization System
- Building Energy Management System
- Virtual Power Plant
- Load Balancing System



## ■ VEN

- HVAC Controls
- EV Charging Stations
- Smart Thermostats
- DR Client Software
- Energy Storage System
- Building Gateway Software



# Validated Test Labs

## ■ Test Facilities

- China
    - China Electric Power Research Institute [openadr\\_test@163.com](mailto:openadr_test@163.com)
  - Japan
    - Intertek Japan K.K. Matsuda Laboratory [info.etls-japan@intertek.com](mailto:info.etls-japan@intertek.com)
    - TUV Rheinland Japan Ltd. [telecom-lab@jpn.tuv.com](mailto:telecom-lab@jpn.tuv.com)
  - Korea
    - Intertek ETL SEMKO Korea Ltd. [derek.choi@intertek.com](mailto:derek.choi@intertek.com)
    - TUV Rheinland Korea Ltd. [youngju.yoon@tuv.com](mailto:youngju.yoon@tuv.com)
  - North America
    - Intertek Testing Services NA, Inc. [OpenADR2.0.admin@intertek.com](mailto:OpenADR2.0.admin@intertek.com)
    - Powertech Labs [openadr@powertechlabs.com](mailto:openadr@powertechlabs.com)
  - Taiwan
    - Electronics Testing Center, Taiwan [tonking@etc.org.tw](mailto:tonking@etc.org.tw)
- **Interested test houses can submit an inquiry to [certification@openadr.org](mailto:certification@openadr.org). Any test house is welcome and will be evaluated by location, expertise, etc.**

# OpenADR Evangelist Program

Evangelists of the OpenADR Alliance will help promote the value of the group, its initiatives, and OpenADR technology, as well as offer local industry support in native languages.

Global evangelists from the following companies: ENERES Co.,Ltd. in Japan, Toshiba Japan, Universal Devices, Nebland and Virtual Peaker

Contact [shannon@openadr.org](mailto:shannon@openadr.org) to contact local evangelists, or to volunteer to become an evangelist.

# OpenADR Alliance Can Provide Support

The OpenADR Technical Implementation Guide addresses these issues:

- Defines OpenADR best practices
- Defines deployment scenarios
- Defines DR program templates
- Provides guidance to utilities in selecting templates and deployment scenarios

<https://www.openadr.org/dr-program-guide>



## OpenADR 2.0 Demand Response Program Implementation Guide

Revision Number: 1.1  
Document Status: Draft  
Document Number: 20140701

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# Program Templates in the Guide – Models of Typical Programs

- Critical Peak Pricing
  - Prices raised during peaks, lower prices non-peak
- Capacity Bidding Program
  - Pre-committed day of/day ahead load shed capacity
- Residential Thermostat Program
  - Allow changes to PCT, free PCT/Discount/Rebate
- Fast DR Dispatch (Ancillary Services)
  - Pre-committed large real time load shed capacity
- Residential Electric Vehicle TOU Program
  - TOU pricing with day ahead price notification
- Public Station EV RTP Program
  - RTP influences customer charge decision
- Distributed Energy Resources (DER) Program
  - Uses harvested energy and load shed to offset high prices

# Other support

- Reference Material
  - Example - Hawaiian Electric Request for Proposals (RFP) for Grid Services, specifying aggregator requirements for integrating to HECO's DRMS via OpenADR 2.0b.
  - [https://www.openadr.org/heco\\_rfp](https://www.openadr.org/heco_rfp)
- OpenADR Alliance Endorsed Test Tool Available for Purchase - [click here](#)
- Training Available from partner QualityLogic

# QualityLogic OpenADR Developers Training Workshop

## Course Outline

- Introduction to OpenADR
- Big Picture
- Event Object
- Event Service
- Report Service
- oadrPoll and Service
- Opt Service
- OpenADR technical resources
- OpenADR demos session



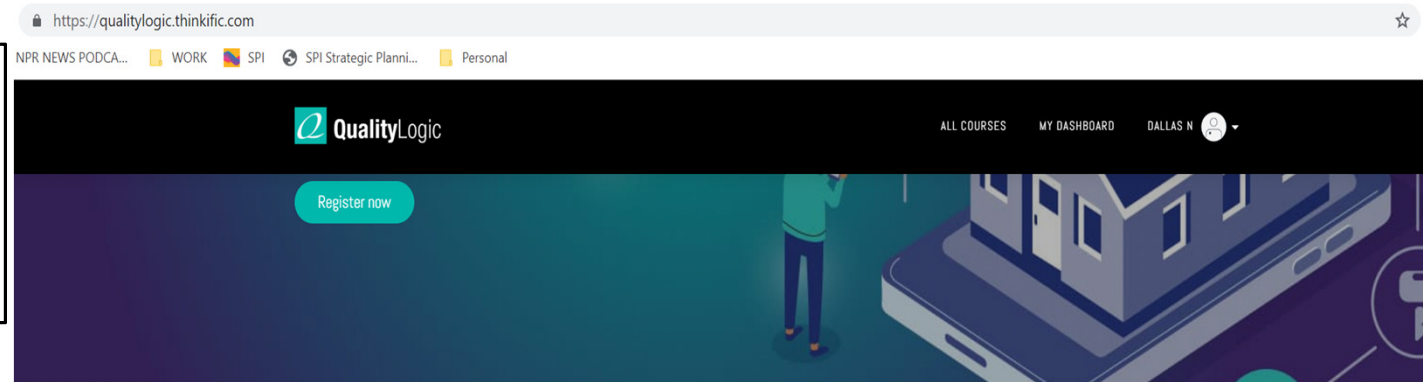
**Instructor:** Jim Zuber, CTO QualityLogic

**Credentials:** Jim led the OpenADR 2.0B profile effort, architected the OpenADR Test Harness, and continues to support the OpenADR Technical Working Group

- 2-Day workshop held at your facility
- Background on the origins of OpenADR
- High-level discussion of all the key aspects of the OpenADR standard
  - Supported transports
  - Security mechanisms
- Detailed technical discussion of each of the core services provided by OpenADR for A and B profiles.

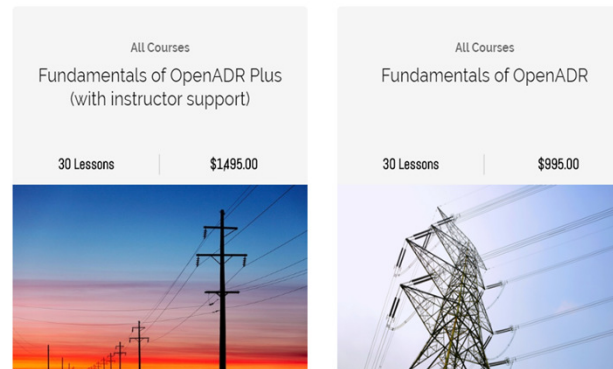
# QualityLogic OpenADR Online Learning Program

- Qualitylogic.Thinkific.com
- The program provides companies developing products involving OpenADR 2.0 a flexible way to prepare for development and implementation.
- A subscription to the program provides participants three months of access to nine training videos.
- Two courses are available – one with three hours of instructor support, and one without



## Our Courses

Additional classes coming soon!



# How it Works and Common Services

# The 'Entities' of OpenADR

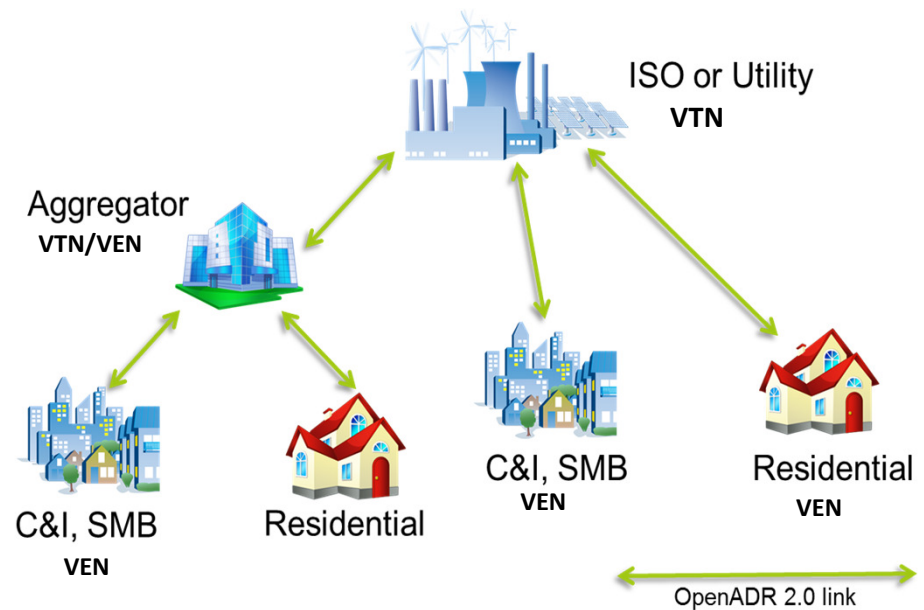
OpenADR is a message exchange protocol with two primary actors aka 'entities'

## Virtual Top Nodes (VTN)

- Manages Resources
- Creates/Transmit events
- Request Reports

## Virtual End Nodes (VEN)

- Receive events and respond to them
- Generate reports
- Control demand side resources



# The 'Services' of OpenADR

- Web Service like logical request-response services
  - Event Service – Send and Acknowledge DR Events
  - Opt Service – Define temporary availability schedules
  - Report Service – Request and deliver reports
  - RegisterParty Service – VEN Registration, device information exchange
- XML Payloads
- Communication through broadband or dedicated internet connection

# Cyber Security Certifications are Critical

- OpenADR security section went through NIST, SGIP, and IEC Cyber Security reviews
- Alliance had to implement server AND client certificates
- Usage of TLS1.2 is mandatory for certification
- Additional security (XML wrappers) are optional
- Alliance has established a Certificate Authority (DigiCert – formerly Symantec)



# Cyber Security (2)

## CA Overview

### 1 Governance

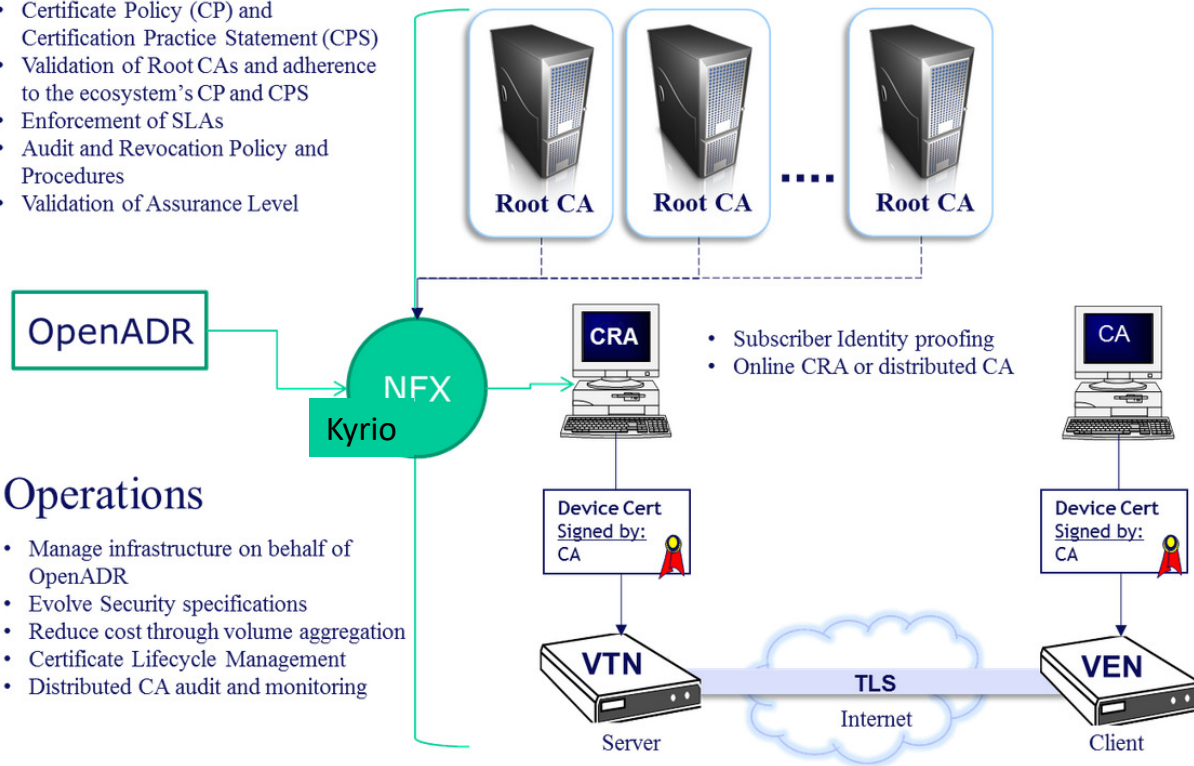
- Certificate Policy (CP) and Certification Practice Statement (CPS)
- Validation of Root CAs and adherence to the ecosystem's CP and CPS
- Enforcement of SLAs
- Audit and Revocation Policy and Procedures
- Validation of Assurance Level

### 2 Technology

- PKI components
- Cipher suite protocols

### 3 Operations

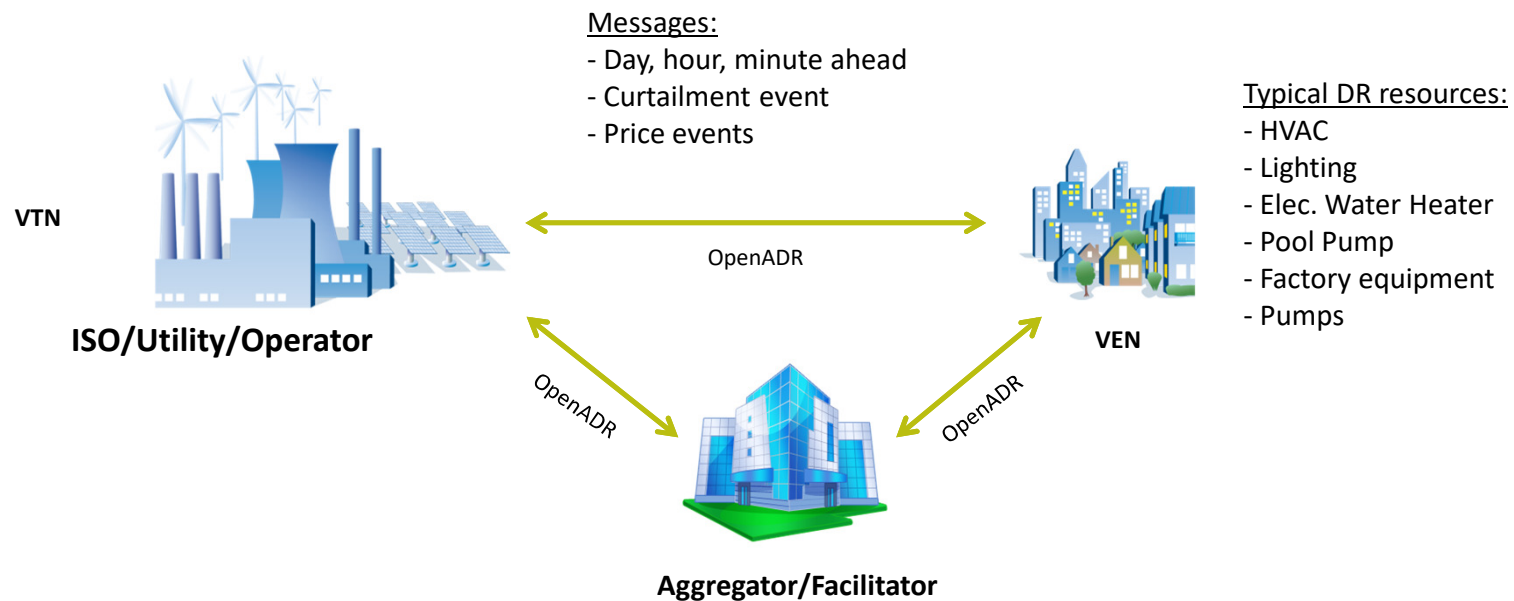
- Manage infrastructure on behalf of OpenADR
- Evolve Security specifications
- Reduce cost through volume aggregation
- Certificate Lifecycle Management
- Distributed CA audit and monitoring



# Transition from Demand Response to Distributed Energy Resources (DER)

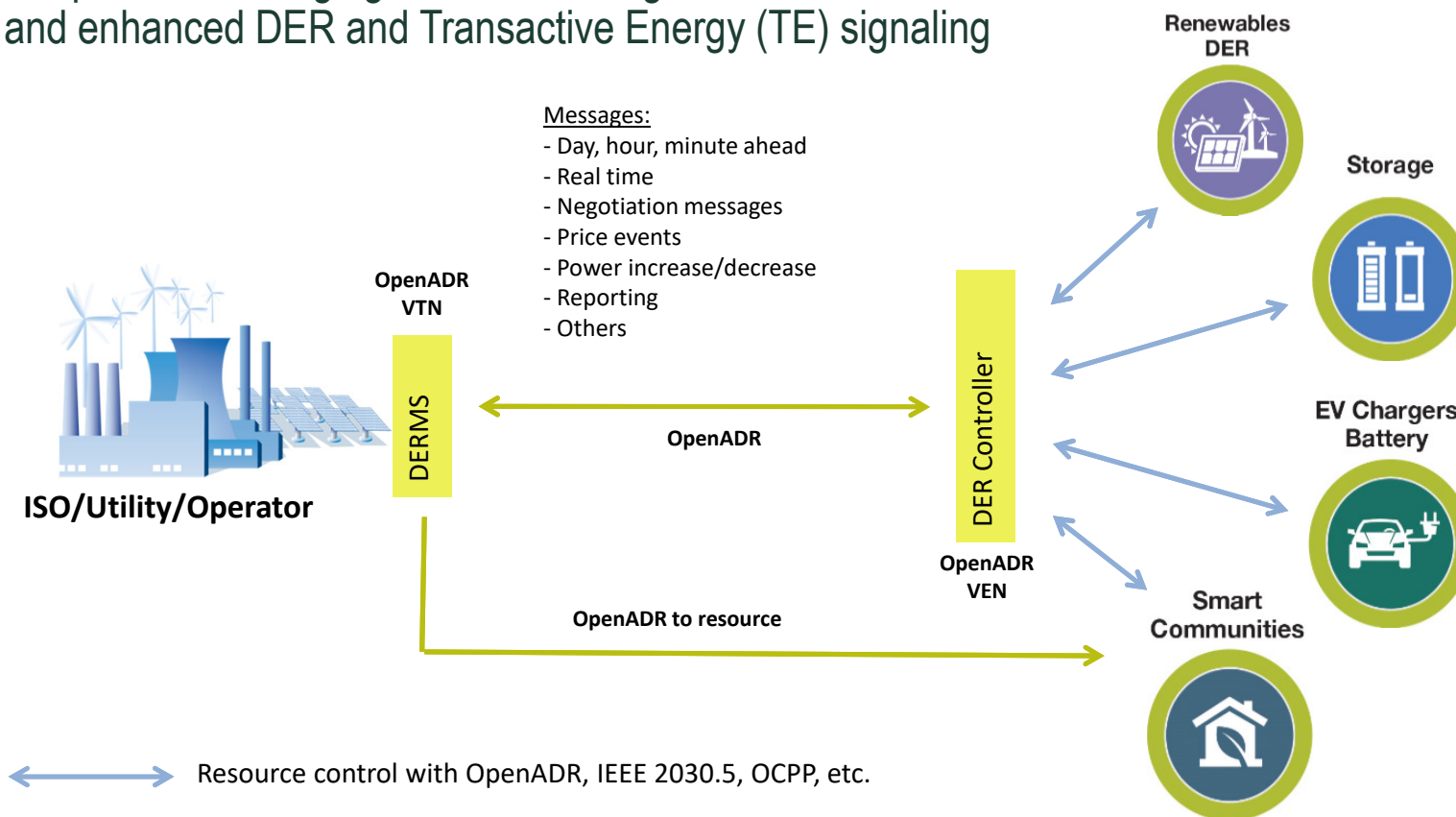
# Traditional DR with OpenADR

Original Demand Response (DR) is defined as “...action taken to reduce electricity demand in response to price, monetary incentives, or utility directives so as to maintain reliable electric service or avoid high electricity prices” (FERC 2007)



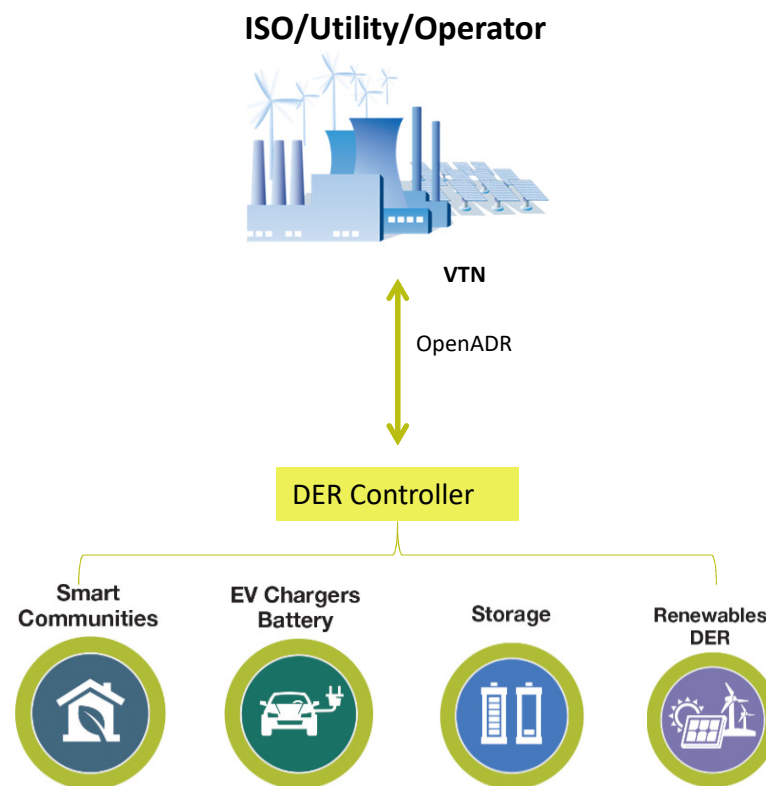
# DER Control Made Easy

OpenADR is capable of managing resources using classical DR messaging and enhanced DER and Transactive Energy (TE) signaling



# Advantages of OpenADR for DERs

- Provide targeted price and energy information
  - Target by area, zip code, resource ID, etc.
  - Bi-directional comms
- Receive reports (telemetry) from resources
- Exchange inverter specific requirements for a specific area
  - Volt/Var expectations etc (new signal types and report types planned)
- Transactive control
  - Include quotes, tender, delivery services

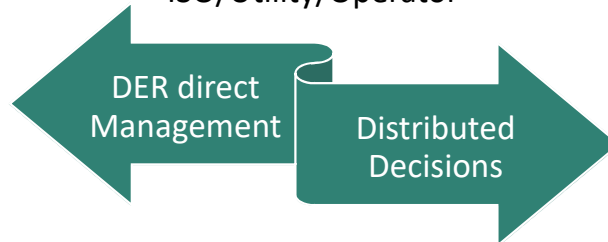


# DER Control Strategies

- Large resource
  - Solar farm
  - Wind
  - Etc.
- Need for tight control
  - Direct control
  - Modify parameters
  - Owned, or managed by utility/ISO



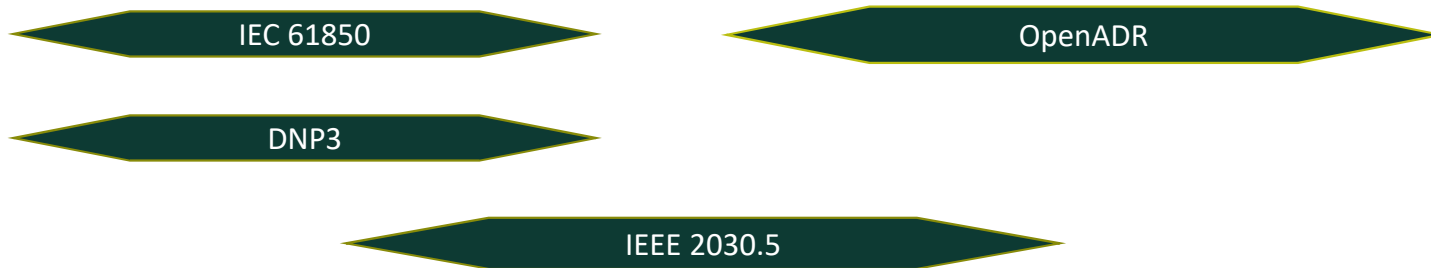
ISO/Utility/Operator



- Small(er) resources
  - Resi/small commercial solar
  - Generators
  - Batteries/cars
- Need for decoupled control
  - “Inform and motivate”
  - Incentive based control
  - Owned by customer or by aggregator/facilitator

## ■ SCADA

## ■ Information-based comms



# Enhanced DER control messaging

- Alliance is preparing a straw man proposal
- Goal is to provide a message framework that can be an alternative use case to CA Rule 21 / CSIP
  - Supported requirements: Define how to best use OpenADR for these functions
  - Requirements that need minor changes: Add necessary reports, signals, etc. to accommodate
  - Requirements out of scope of OpenADR: List functions not supported by OpenADR and refer to other standards
  - High level outline on IEC 61968-5 grouping support

# California CSIP Requirements Example

- Grid Support Functions

<b>Grid Support DER Functions</b>	
<b>Autonomous Functions</b>	<b>Advanced Function</b>
Anti-Islanding	Connect/Disconnect
Low/High Voltage Ride Through	Limit Maximum Active Power Mode
Low/High Frequency Ride Through	Scheduling Power Values and Modes
Ramp Rate Setting	Monitor Key Data including Alarms, DER Status and Output
Dynamic Volt-Var	Volt-Watt Control
Fixed Power Factor Control	Frequency-Watt Control
	Set Active Power Mode



# Transactive Energy Pilot: Retail Automated Transactive Energy System

- The California Energy Commission (CEC) awarded a [Grant](#) in March 2016 for the RATES pilot to Universal Devices inc. as prime contractor and TeMix Inc. as subcontractor, with Dr. Edward Cazalet of TeMix as principal investigator.
  - 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



# RATES 2-Way Subscription Tariff

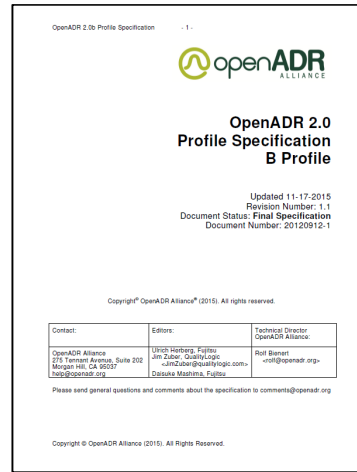
## Forward Subscriptions with Spot Transactions

- Subscribe at specific *costs* and *quantity* for each interval
  - Energy or Reactive Power (as needed)
  - 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

# Transactive Energy - 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

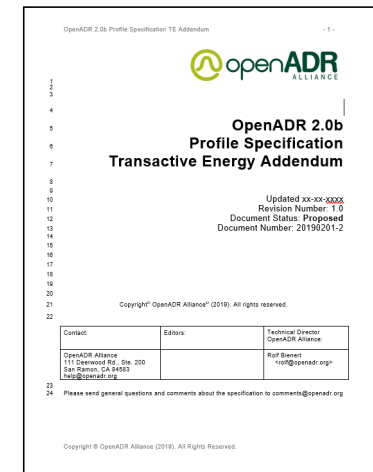
# Specification structure



OpenADR 2.0b (IEC 62746-10-1)  
Will remain unchanged

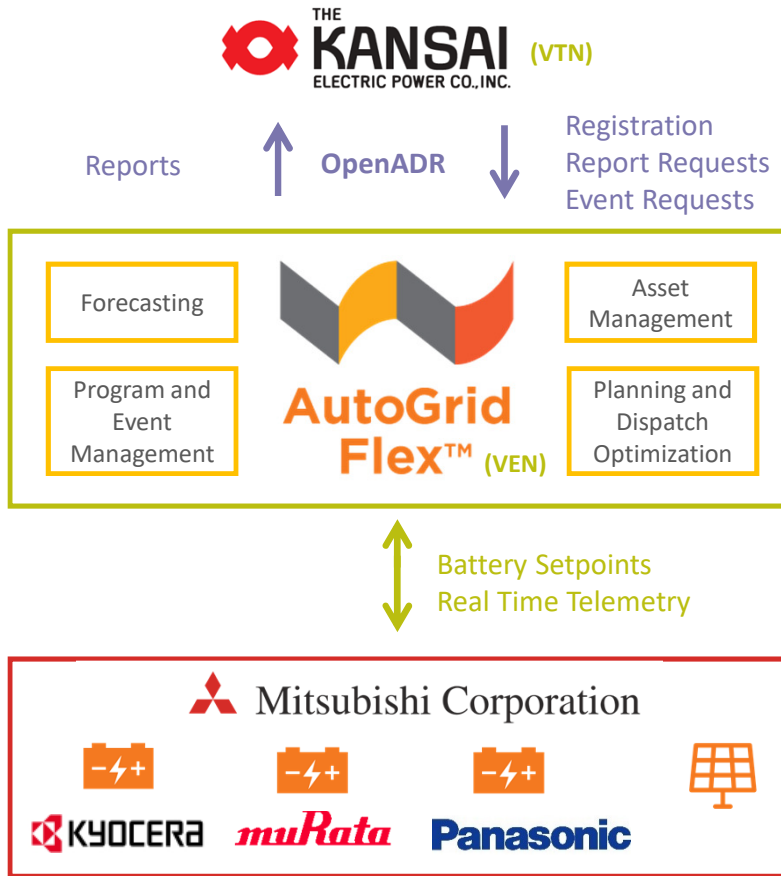


Addendum specifications for enhanced DER and  
TE functions – name and branding TBD  
(See R.A.T.E.S program example)



# Use Case examples

# Kansai Electric Power Co



## First Residential Solar and Storage Virtual Power Plant in Japan

### Profile

- Mitsubishi Corporation owns and operates 5GW of generating capacity and 1,000 km of transmission
- KEPCO supplies 13M customers in the Kansai region of Japan

### Problem

- METI-funded program for development of VPP applications
- Need flexible platform to support optimization over solar self consumption and communicate with multiple vendors
- Ultimately support more renewable integration for Japan

### Solution: AutoGrid Flex

- Aggregation of 300 residential storage assets on one monitoring and control platform
- Storage vendors including Kyocera, Murata, Panasonic
- Co-optimization of self-consumption with aggregate-level capacity

# National Grid

nationalgrid

Send Static  
Event



Measurement and  
Verification



OpenADR  
Dispatch Signal



Device Usage  
Information



## Gas DR with smart thermostats

### Profile

- 3.3 million U.S. customers in MA, NY, and RI

### Problem: Natural Gas in New York

- Natural Gas pipeline constraints entering Long Island
- Existing gas turbines running up to capacity during peak demand
- Looking for non pipes alternative to reduce peak load

### Solution: AutoGrid Flex

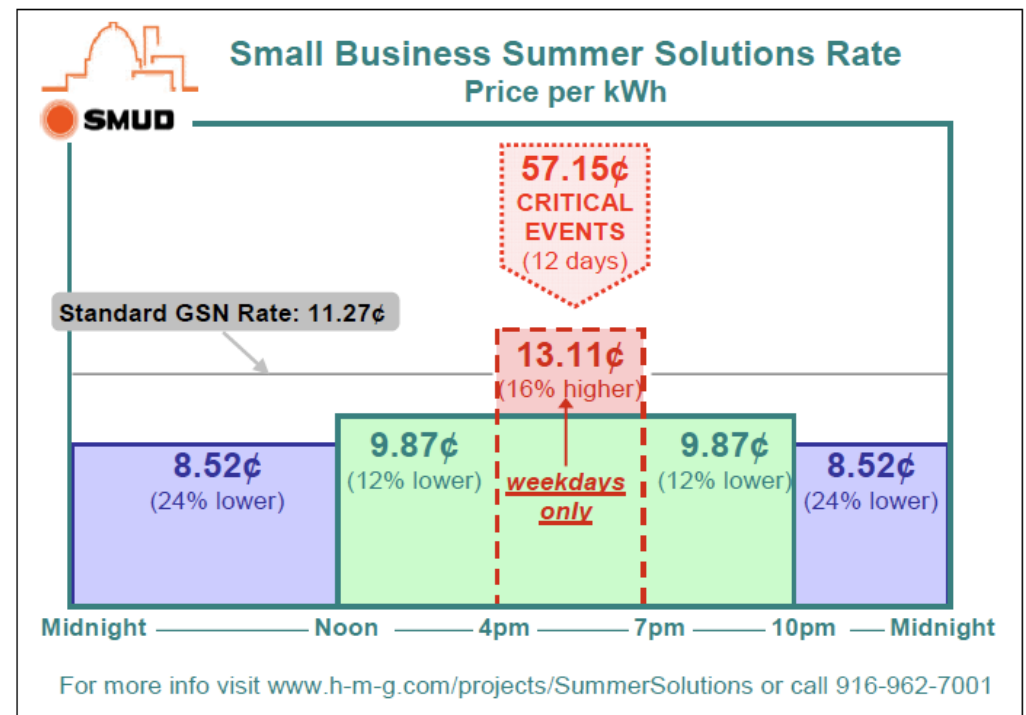
- Unified dashboard for gas and electric programs
- Focus on timely dispatch
- See device usage information at near real time on open platform
- First Natural Gas DR project in the world

# Sacramento Municipal Utility District



## Critical Peak Pricing Programs

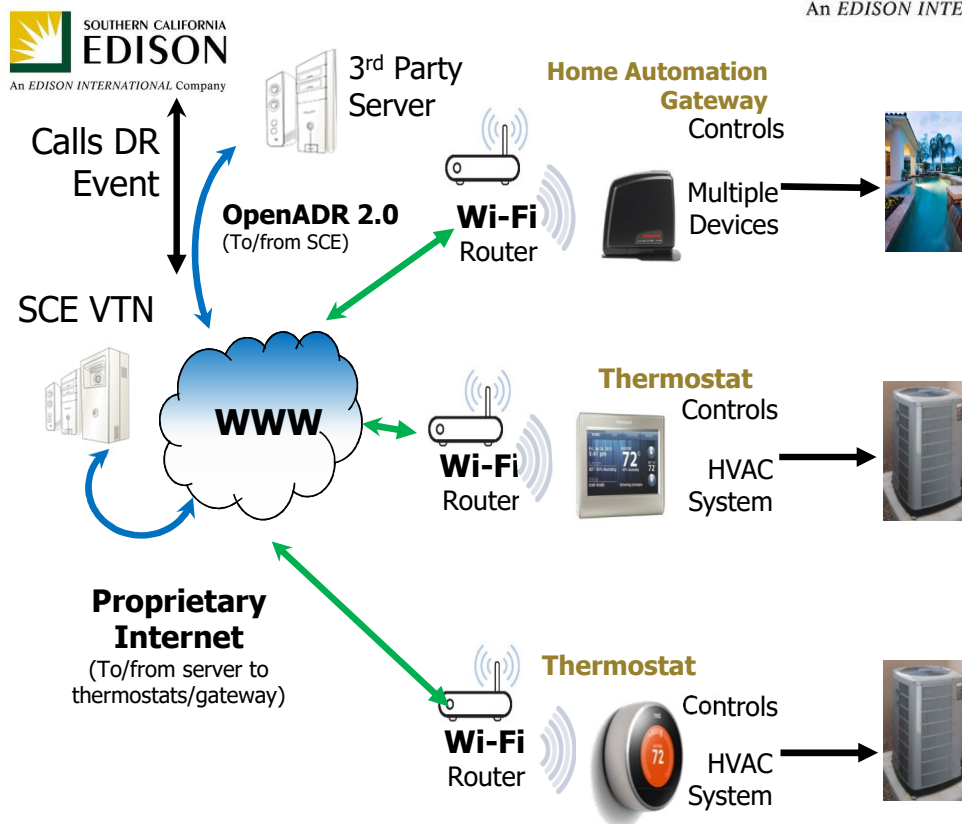
- Equipment pre-programmed to respond to price signals
- Rate and/or price structure designed to encourage reduced consumption
- PUCs adopting CPP programs for residential and commercial customers
- Signal with levels range from 1 to 3 and multiple prices in single event
- Supports price responsive demand for wholesale and retail prices





# Southern California Edison

- BYOT model
- 4,800 customers select own devices
- 8 events with an average 750 watts of load reduction per hour per customer
- Energy savings:
  - 3.6MW of average energy reduction per event (peak ~7MW)
  - 115.2MWh of energy saved annually

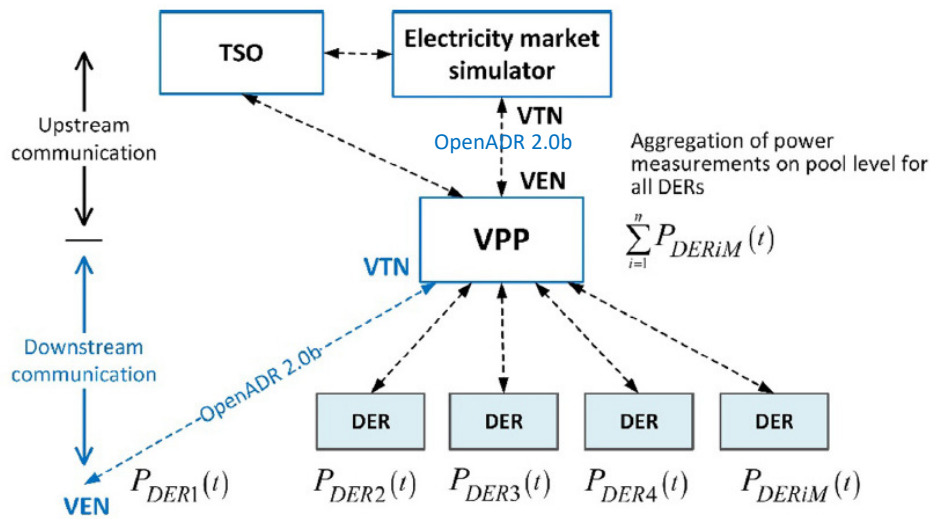


# Southern California Edison

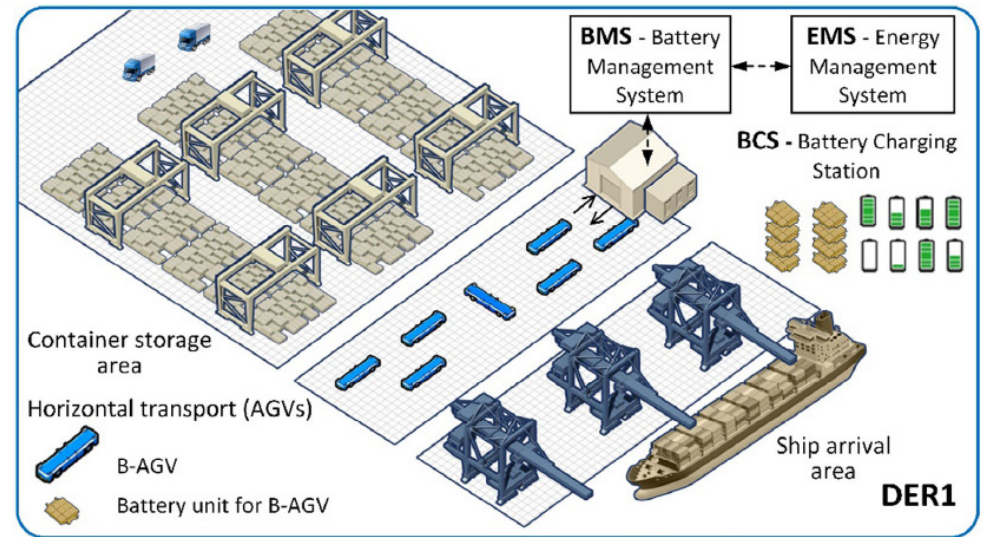
- Support EV TOU customers
- Deployed 80 L2 EVSEs with payment modules at 9 SCE facilities
- OpenADR
  - Varied Pricing: Tiers, Rate of Charge, Penalty
  - Varied Curtailment Events
- OCPP
  - Session Reports
  - EVSE Status
  - Credit Card



# Europe - Slovenia & Germany



## Virtual Power Plant (VPP)



<https://www.sciencedirect.com/science/article/pii/S0142061517311560?via%3Dihub>

# OpenADR in China

- **U.S.-China Green Building Center - [Link](#)**
  - Partnership of Lawrence Berkeley National Laboratory, OpenADR Board Member, with China Green Building Center
- **Big-Data Analytics for Electric Grid and Demand-Side Management - [Link](#)**
  - US-China DR + Big Data US Industry Advisory Board - Rolf Bienert, Member
- **Chinese led IEC PC118 committee to advance the OpenADR 2.0b standard through the IEC process. Now published as IEC 62746-10-1.**



# Questions?

- Recording and slides from this presentation will be available at [www.openadr.org](http://www.openadr.org).
- The OpenADR Webinar Series will continue throughout 2019. More information on the Alliance and future webinar topics can be found on [www.openadr.org](http://www.openadr.org).

# Planned Activities – OpenADR Alliance in Asia

- Plan to visit Asia in Spring, 2020
- Possible Japan workshop event in spring
- Possible participation at Asian Utility Week <https://www.asian-utility-week.com>, Jakarta. Sept 22-24, 2020
  - Contact us if member companies are interested in exhibiting there
- Visits to Australia and New Zealand in planning
- Open for suggesting for local seminars and workshops

# Follow OpenADR



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# Thank you!

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