



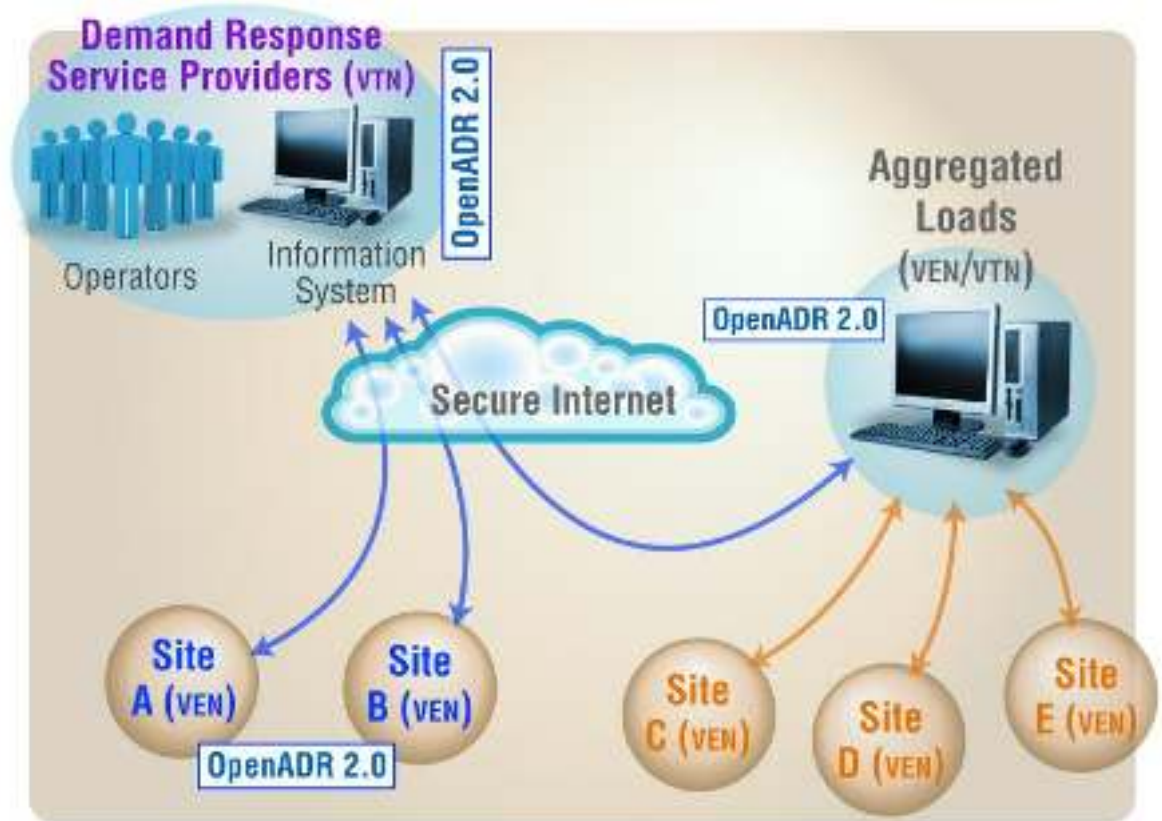
## OpenADR: Electric Vehicles and Demand Response

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# OpenADR and the EV Ecosystem

- OpenADR allows DR service providers to communicate DR, DER, and TE Signals directly to existing customers using a common language and existing communications such as the Internet.
- *DER a growing application space for OpenADR.*
- *How does OpenADR apply to the fast growing, changing Electric Vehicle Ecosystem ?*



# The 'Entities' of OpenADR

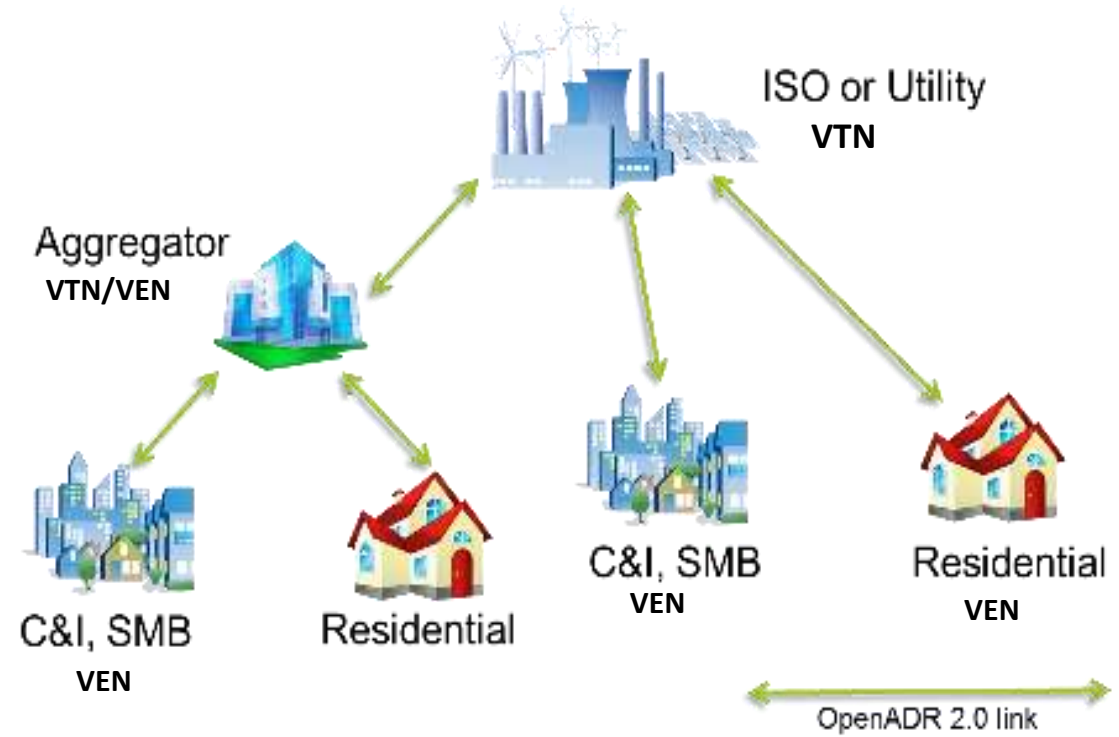
OpenADR is a message exchange protocol with two primary actors aka 'entities'

## Virtual Top Nodes (VTN)

- Manages Resources
- Creates/Transmit events
- Request Reports

## Virtual End Nodes (VEN)

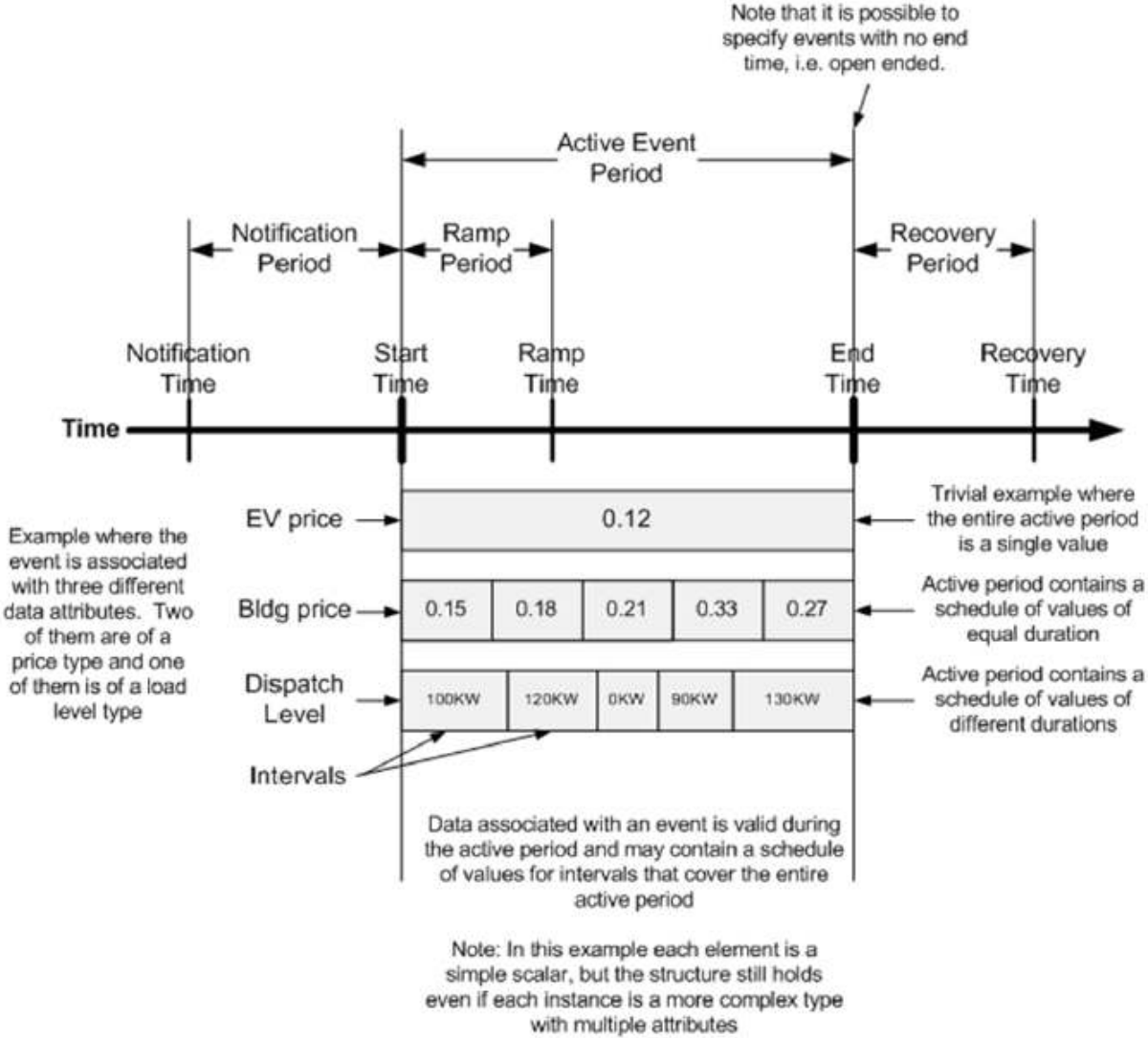
- Receive events and respond to them
- Generate reports
- Control demand side resources



# 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

# OpenADR 2.0 Event - Example

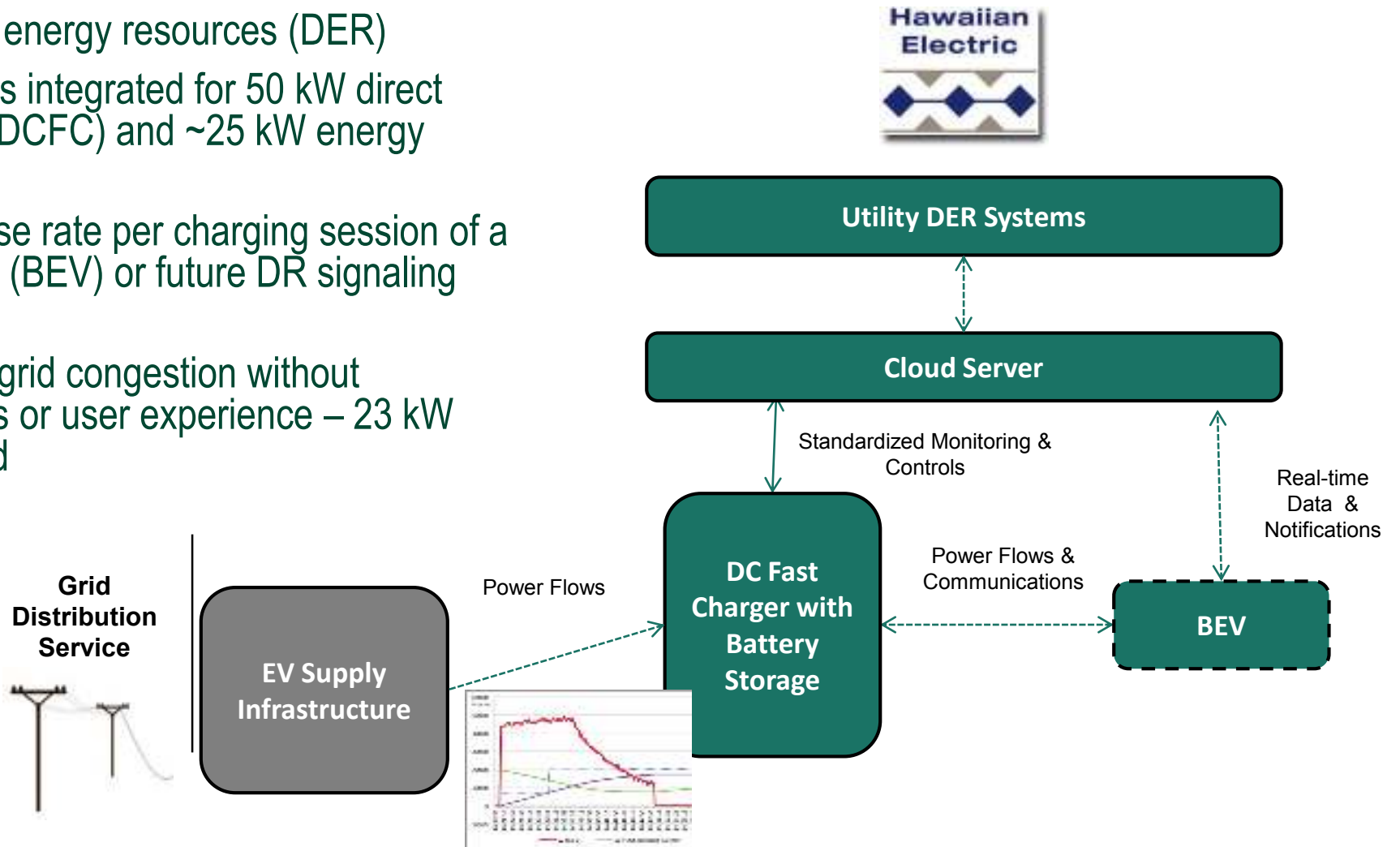


# EVs and Demand Response Programs Intro

- OpenADR has been specified in recent years in several early EV trials with utilities: Southern California Edison, Hawaii Electric, etc.
- EV Market is currently undergoing major transformations.
  - Automotive OEMs Volkswagen and GM are already building out charging networks, joining Tesla's older nationwide network,
  - A new generation of EV charging supply equipment (EVSE) businesses have started up, and some are already expressing interest in OpenADR as a standards-based element of utility interconnect and an integral part of their business model.
  - Utilities increasingly see EV market as “beneficial electrification” of the transportation sector.

# Hawaiian Electric Company

- Supporting distributed energy resources (DER)
- Monitoring and controls integrated for 50 kW direct current fast chargers (DCFC) and ~25 kW energy storage
- HECO EV-U time-of-use rate per charging session of a battery electric vehicle (BEV) or future DR signaling systems.
- Mitigation of localized grid congestion without compromising services or user experience – 23 kW maximum grid demand





# Southern California Edison

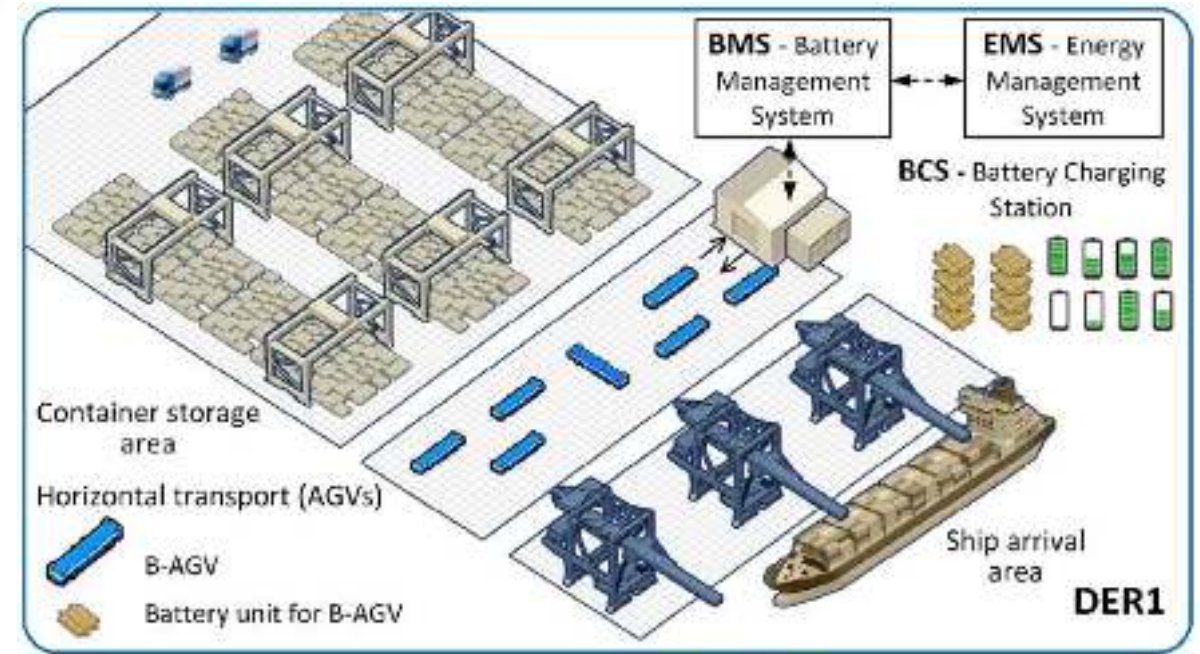
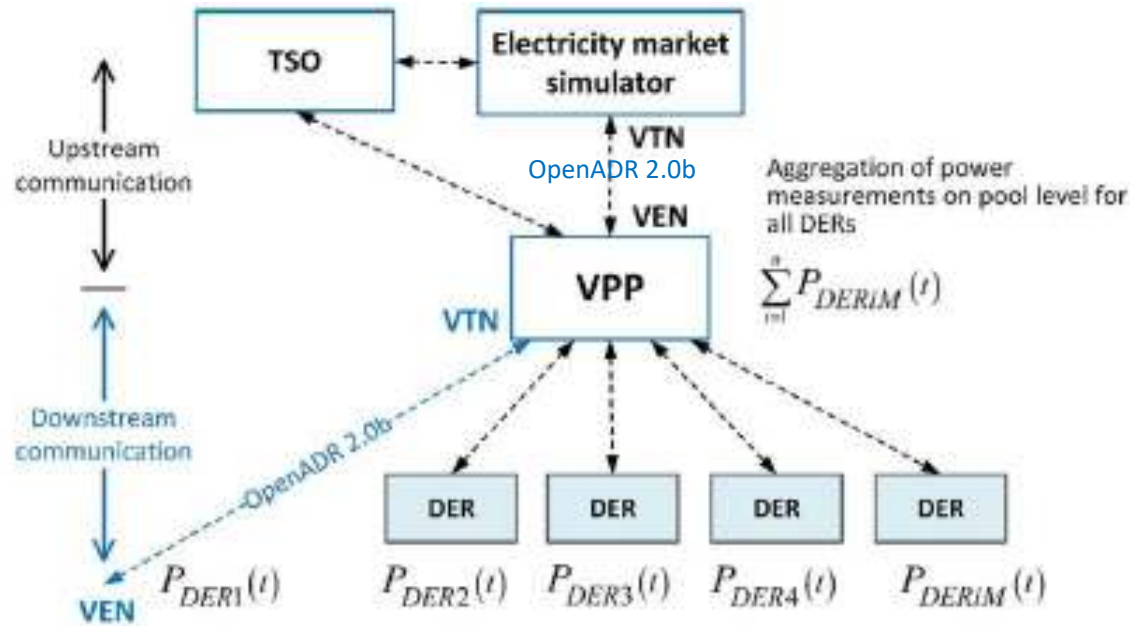
- Support EV TOU customers
- Deployed 80 L2 EVSEs with payment modules at 9 SCE facilities
- OpenADR
  - Varied Pricing: Tiers, Rate of Charge, Penalty
  - Varied Curtailment Events
- OCPP
  - Session Reports
  - EVSE Status
  - Credit Card





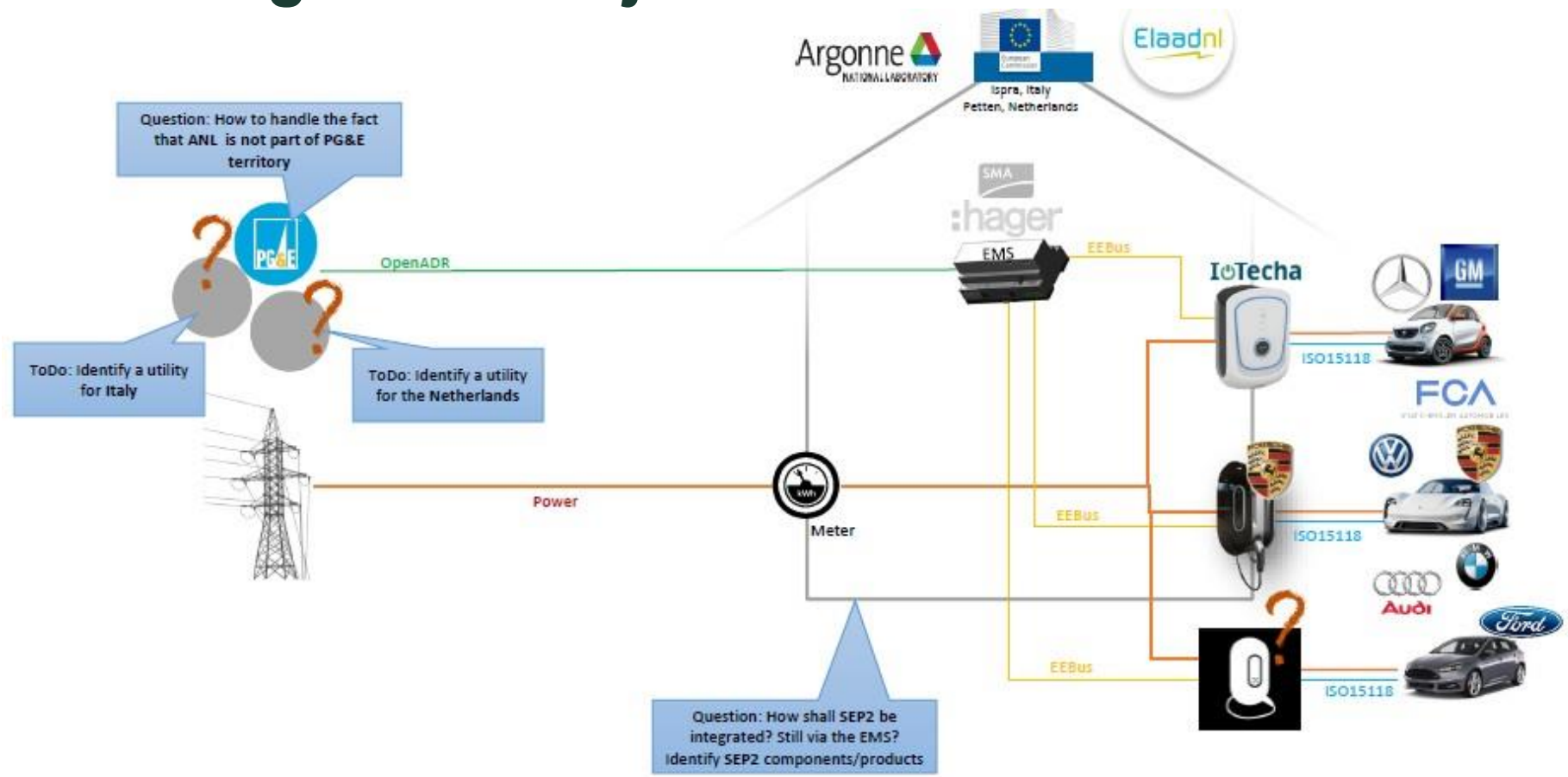
# Europe - Slovenia & Germany

## Virtual Power Plant (VPP)



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

# Pacific Gas & Electric – European Partnership Global Grid Integration Project



# EV Ecosystem Components

- Electric Vehicle Supply Equipment (EVSE) – Manufacturers, Network Operators
- Automotive Manufacturers (OEMs)
- Utilities
- (Battery/Storage Partners)

# Utilities

- PG&E (Albert Chiu)
  - Global Grid Integration Project
- Hawaiian Electric (Angie Eide)
  - Pilots
- Others
  - Partnership with OEMs
- SCE (Carl Besaw)
  - Charge Ready program = installation of 1500 EVSEs in workplaces.

# EVs and the Grid – Industry Activity

- CPUC V2G integration project
- CEC Clean Transportation [Program](#)
- EPRI Activity
- SEPA EV Working Group
  - Published *A Comprehensive Guide to Electric Vehicle Managed Charging*
  - Developing lab scenario of high concentrations of medium and heavy duty charging loads and alternative approaches to distribution planning using grid architecture and transactive energy; workshop at Grid Evolution Summit
- GGIP project (per previous slide)

# OpenADR Alliance Activities

- Protocol Alignment (OCPP, IEC 15118, etc.)
- Compile More Diverse Use Case Studies (Program Guide)
- Regulatory Participation
- Webinars for Utilities
- Distributech - demo of OpenADR for EV



# Thank you!

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