

# Welcome!

- Thank you for joining today's webinar:  
**Electric Vehicles and Automated Demand Response**
- If you have a question please use the question box located on the right side of your screen.
- Questions for our speakers will be addressed at the end of the presentation.
- This webinar will be recorded for future playback.

# Today's Speakers

- Vipul Gore, President & CEO, Gridscape Solutions
- Venki Ramachandran, Director, Professional Services, AutoGrid Inc.
- Lin-Zhuang Khoo, Senior Vice-President, Greenlots

# Agenda

- EV and EV Charging Landscape
  - Opportunities
  - Challenges & Solutions
- Challenges with EV Charging
  - SCE's Pilot Objectives and Architecture
  - Workplace Charging Process Flow
- DR and EV Charging
  - Pilot Use Cases
  - Key Takeaways



# EVs and Charging Solutions

## *A Consumer Perspective*

Vipul Gore, President & CEO

Gridscape Solutions

[vipulgore@grid-scape.com](mailto:vipulgore@grid-scape.com)



# Agenda

- ▣ Gridscape Introduction
- ▣ EV and EV Charging Landscape
- ▣ Opportunities, Challenges & Solutions

# Gridscape Solutions

- ▣ Leading & Innovative Systems Integrator & Smart Energy Solutions Provider
  - ▣ *Founded in 2012*
  - ▣ *Global Presence – US, UK, India*
  - ▣ *Approximately 35+ Engineers*
- ▣ Turnkey Smart, Efficient Energy Solutions for
  - ▣ *Enterprises*
  - ▣ *Utilities*
  - ▣ *Manufacturers*
- ▣ Experts in Solar, Storage, Demand Response & EV Infrastructure integration



**Customers:**

A collection of logos for various customers. From top to bottom, left to right: nrg eVgo (with a colorful grid pattern), Schneider Electric (green box with white text), blink (black text), chargepoint+ (orange and blue text), STRATEGEN STRATEGIES FOR CLEAN ENERGY (blue and green text), BURNHAM (orange and white text), and GAF SOLAR (red and blue text).

**Affiliations:**

A collection of logos for various affiliations. From top to bottom, left to right: OPEN CHARGE ALLIANCE (yellow and white logo), openADR ALLIANCE (green and white logo), BOMA International (blue and white logo), and CESA CALIFORNIA ENERGY STORAGE ALLIANCE (blue and green logo).

**Case Studies:**

- *OpenADR Solution for EV Charging*
- *EV Charging Network Integration*
- *Mobile Applications for EV Charge Sharing*
- *Utility Back-office Integration*
- *Solar PV Design and Energy Portal*

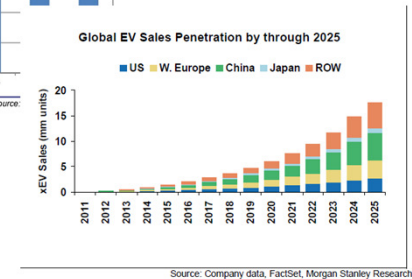
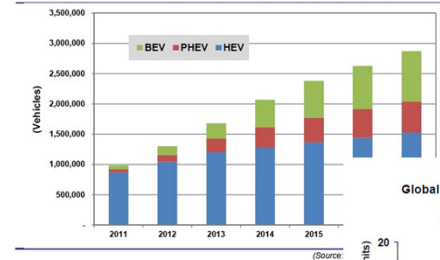
Visit [www.grid-scape.com](http://www.grid-scape.com) for details



# EV Landscape

- EV Sales are accelerating worldwide
- There are 40+ EV models available worldwide
  - Tesla, BMW, Nissan, Chevy, Ford, Fiat, VW, Audi, Toyota, Mitsubishi & so on
- Why EVs are becoming popular?
  - Cheaper to drive
  - Fun to drive
  - Clean and safe
- Barriers
  - Initial Cost (Government Incentives)
  - Lack of pervasive Charging Infrastructure
  - Change in Driving pattern & mindset

Chart 1.1 Annual Light-Duty Electric Vehicle Sales, World Markets: 2011-2017

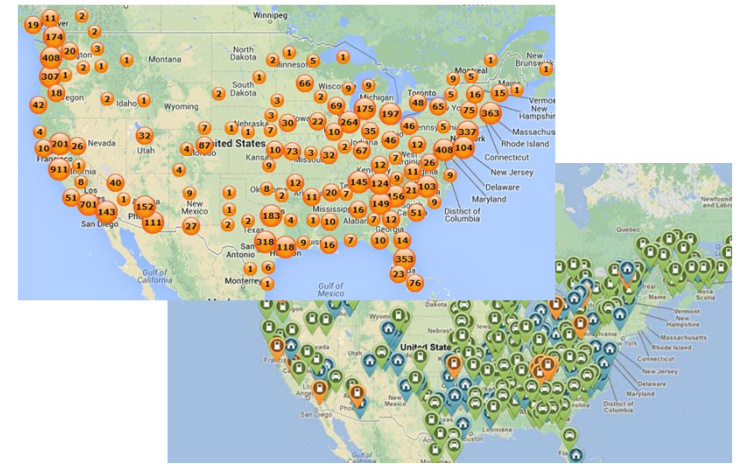


Source: Company data, FactSet, Morgan Stanley Research



# EV Charging Landscape

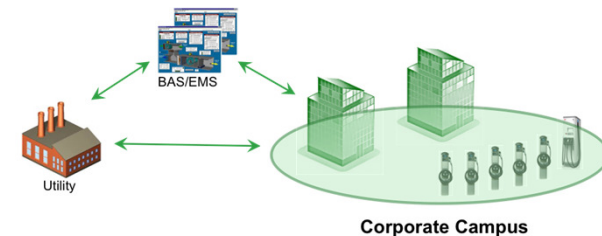
- Best Places to charge
  - Home, Work, Shop, Dine, Meet...
- Type of Charging
  - L1 Charging – “Trickle Charge”
  - L2 Charging – “Slow Charge”
  - DC Charging – “Fast Charge”
- Charging Infrastructure
  - Networks: ChargePoint, Blink, NRG eVgo, Greenlots, and so on
  - Stations: ChargePoint, Schneider, GE, Nissan, ABB, AV, and so on.
- Barriers
  - Expensive to install & deploy: No clear ROI
  - Lack of Standards (CHAdeMo, SAE, OCPP)
  - “Right” infrastructure at “right” place? How to find it?





# EV Charging - Challenges

- ❑ Residential Charging
  - ❑ MDUs, Shared Apartments?
  - ❑ How to measure energy consumed?
- ❑ Workplace Charging
  - ❑ Employee Benefit or Convenience?
  - ❑ Return on Investment?
- ❑ Destination Charging
  - ❑ Available Infrastructure? Power, panel capacity, upgrades?
  - ❑ How to monetize?
- ❑ Corridor Charging
  - ❑ Highway Stops? How long? How frequent?
  - ❑ Fast Chargers? ROI?
- ❑ Demand Response
  - ❑ Load Shed on Chargers?
  - ❑ How will Drivers get home?





## Electric Vehicles and Auto DR

Venki Ramachandran, Director, Professional Services

AutoGrid, Inc.

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AutoGrid

# Agenda

- Challenges with EV Charging
- SCE's Pilot Objectives and Architecture
- Workplace Charging Process Flow

# Challenges with EV Charging

- How to structure programs to incentivize EV end consumers and charging station vendors?
- Are EV Chargers a dependable demand side resource to bank on during a event?

# EV Charging Pilot Objectives

- Prove technology using open standards
- Run the pilot, collect data on user behavior, their reaction to price incentives and use data to suggest programs to PUC
- Help Commercial Office Building owners understand ROI and infrastructure considerations

# Technology needs

- Flexible open multi-standards based DR platform to communicate & manage with all demand side management resources
  - EV and Charging stations
  - Direct Load Control
- Expand at minimal cost to try new devices, new communication protocols and develop new rate programs for DR

# SCE Pilots

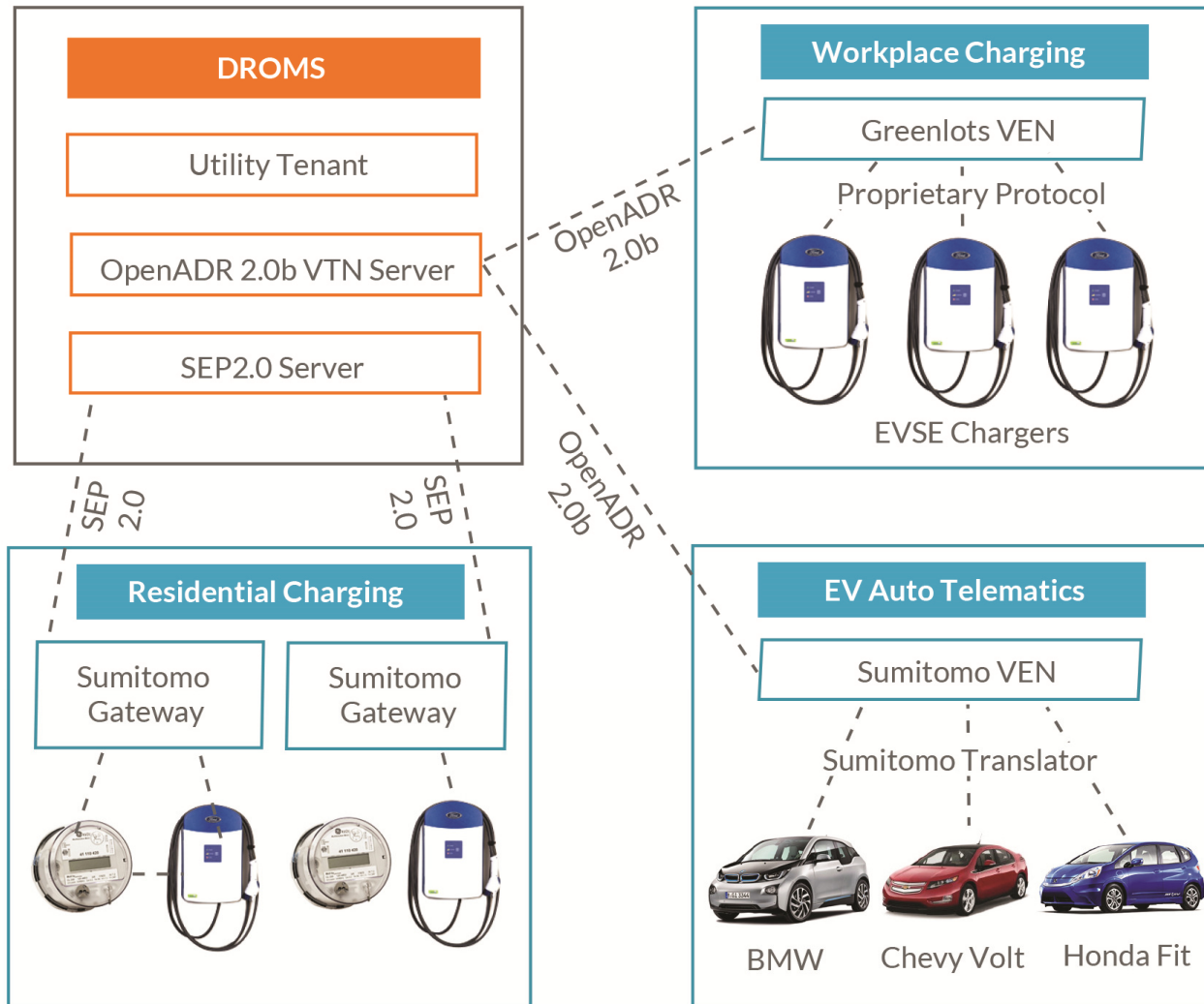
- The Smart Home Charging Pilot (SEP 2.0)
- Work place charging (OADR 2.0B)
- Automotive Telematics for EV's (OADR 2.0B)

# SCE Pilots

- The Smart Home Charging Pilot (SEP 2.0)
- Work place charging (OADR 2.0B)
- Automotive Telematics for EV's (OADR 2.0B)
- Ancillary Services
- DER and FR



# EVSE Pilots Architecture @ SCE



- oADR payloads:
1. eiRegisterParty
  2. eiEvent
  3. eiOpt
  4. eiRegisterReport
  5. eiReporting

# SCE Workplace Charging Flow

Daily Pricing and Display Update:

1. Utility will send out the 2 Baseline prices:
  - ▣ L1a = X \$ per kWh
  - ▣ L2a = Y \$ per kWh
2. ...and 2 Tiers (On Peak and Off Peak) + duration:
  - ▣ L1b = X \$ per kWh
  - ▣ L2b = Y \$ per kWh
3. ...Vendor will display initial 2 Baseline prices on Payment Module Display
4. Should Utility change baseline pricing options while users are charging, updates will only apply to unused EVSEs

## Welcome

1. Choose your Vehicle

1. Charging Selection:

\$ per kWh for L1  
["Slow Charge"?)

\$ per kWh for L2  
["Fast Charge"?)

L1- Assume 240V EVSE running at 6A= 1.44kW (Similar to 120V\*12A)

# Customer chooses Event Actions

Welcome

You chose L2 (\$X per kWh)

Choose your Event Action\*\*

- Remain Charging  
(pay premium price per kWh)
- Reduce Charging by 50%\*  
(pay reduced price per kWh)
- Reduce Charging to L1  
(pay premium L1 price)
- Stop Charging during event  
(pay nothing until charging begins)

# Customer Initiates Charging

Steps:

- Customer chooses or enters in preferred notification method and details
  - Text
- Customer enters payment details
- Customer charged according to Tier and Event action selected

# SCE sends a Simple Event

- SCE sends OpenADR 2.0 simple event with duration to vendor
- Event may include premium pricing info or premium pricing may have been transmitted w/ baseline
- Day ahead and near-real time
- Vendor applies selection to currently charging customers and notifies customer of event and advised to look at portal for further info
- “Event Active” shown on Payment Module
- Upon event completion, normal charging rates/prices apply

# SCE sends a Targeted Event

- SCE sends OpenADR 2.0 event with duration to vendor.
- Event will not include premium pricing
- Vendor applies event to currently charging customers and notifies customer of event and advises customers to look at portal for further info.
- “Event Active” shown on Payment Module
- Upon event completion, normal charging rates apply

# Charging Complete

- Charging completed (still connected)
- Customer notified of charge completion and informed of that vehicle must be moved in **30** minutes or pay additional fees (predetermined and managed by vendor).
- Customer unplugs
- Session ends (notification/billing)



# Electric Vehicles and Auto DR

By Lin-Zhuang Khoo

Senior Vice-President

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The logo for Greenlots, featuring the word 'greenlots' in a lowercase, sans-serif font. The 'g' is a larger, stylized green letter, and the rest of the text is in a lighter green color.



# About Greenlots

Greenlots is a developer of the leading open standards-based enterprise software platform for electric vehicle (EV) charging and grid management.

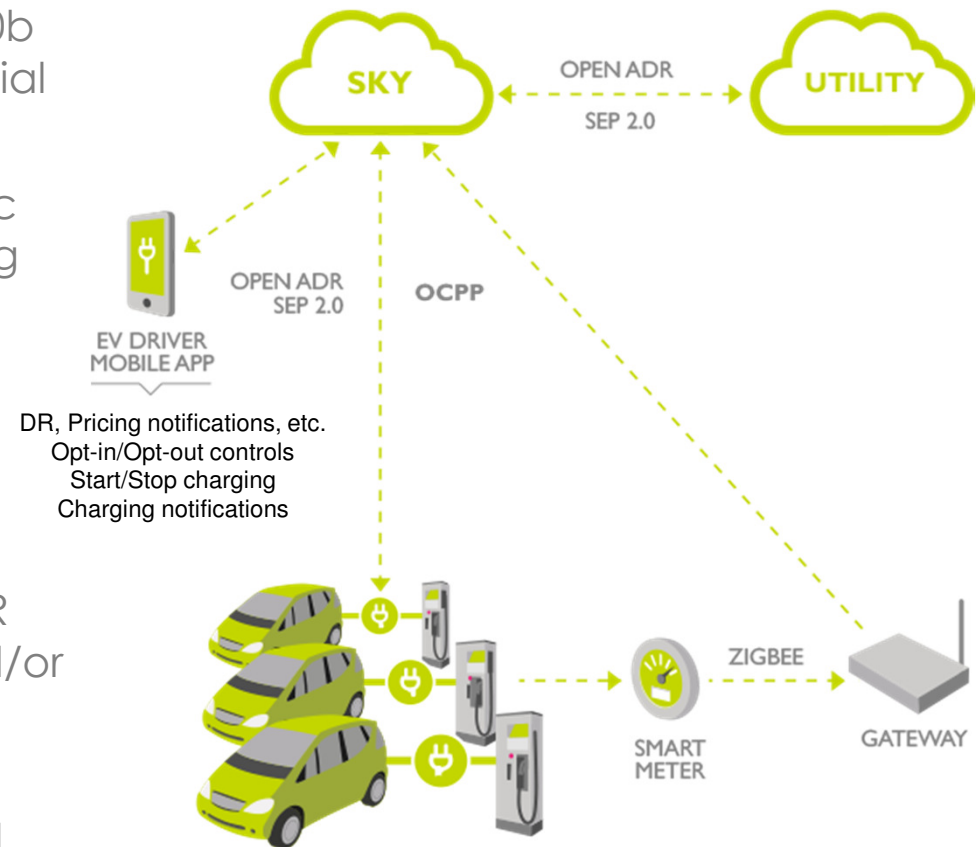
Greenlots develops solutions for payment, network and energy management of EV charging using open standards.

We are the first charging network to be certified to OpenADR 2.0 - enabling electric vehicles to be active grid participants.

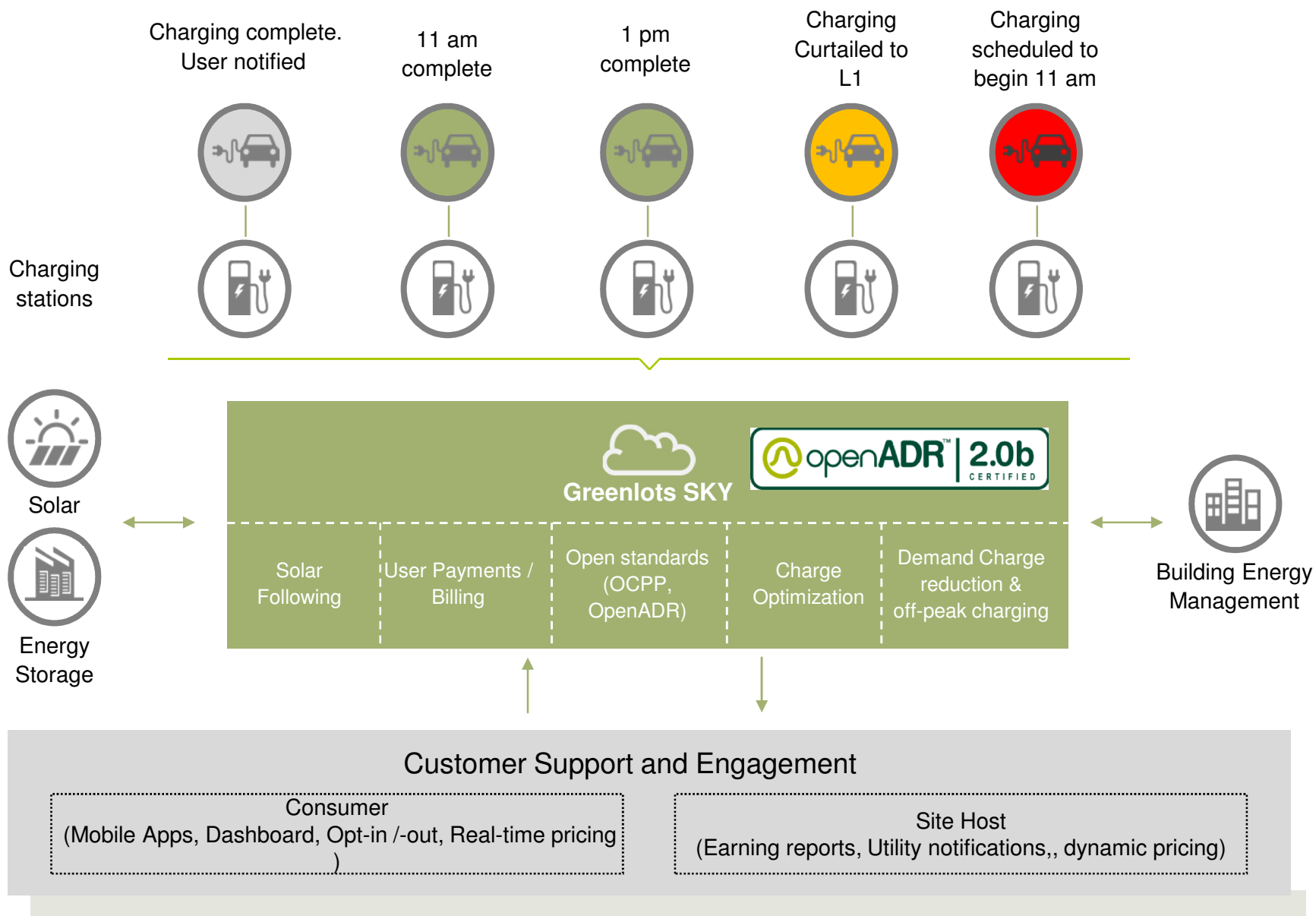


# DR and EV Charging

- Interface over SEP 2.0, OpenADR 2.0b to support commercial and residential smart charging
- Region/Site/Group based automatic load curtailment to avoid exceeding threshold ratings
- Enable site hosts and EV drivers to directly engage with the utility DR programs through Greenlots mobile app
- Incentivize EV drivers with special DR pricing at the EVSE point of sale and/or through Greenlots mobile app
- Actively engage with the consumer through SMS/email notifications and messaging enabled on Greenlots web portal and mobile app



# Complete Smart Charging



# SCE Workplace Charging Pilot

- *Demand Response Pilot* through end of 2015
- 70+ L2 EVSEs deployed at various SCE Facilities
  - EVSP Management: Billing, Communication and Control, Customer interactions, Reporting
  - Payment modules/GWs: Network support, Customer interface, EVSE status
- Open Standards: OpenADR 2.0, OCPP



# Pilot Goals

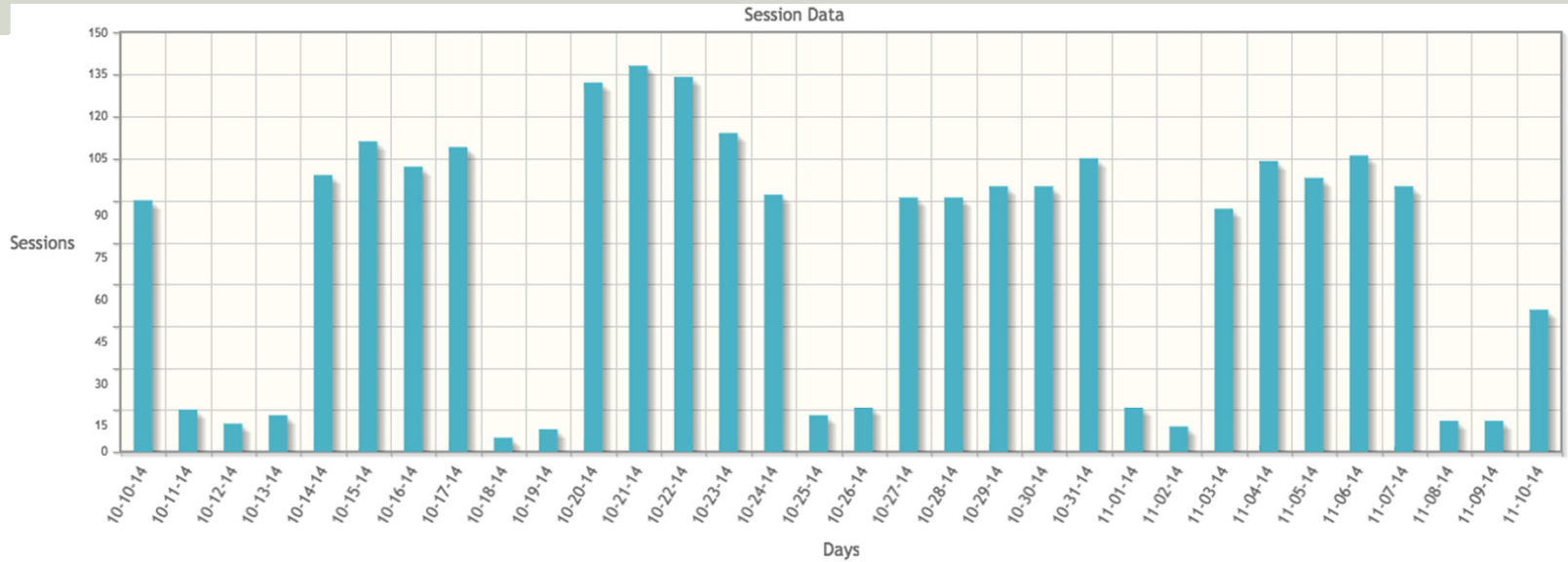
- How can SCE support commercial workplace charging?
- How should commercial customers deploy charging?  
(considering management, costs, type of EVSE, pricing)
- How can ADR be used to minimize local and system impacts of day-time charging?
- How will users respond to dynamic prices and load management?
- What is sweet spot pricing for L2, L1, curtailed charging?

# Workplace Pilot – Use Cases

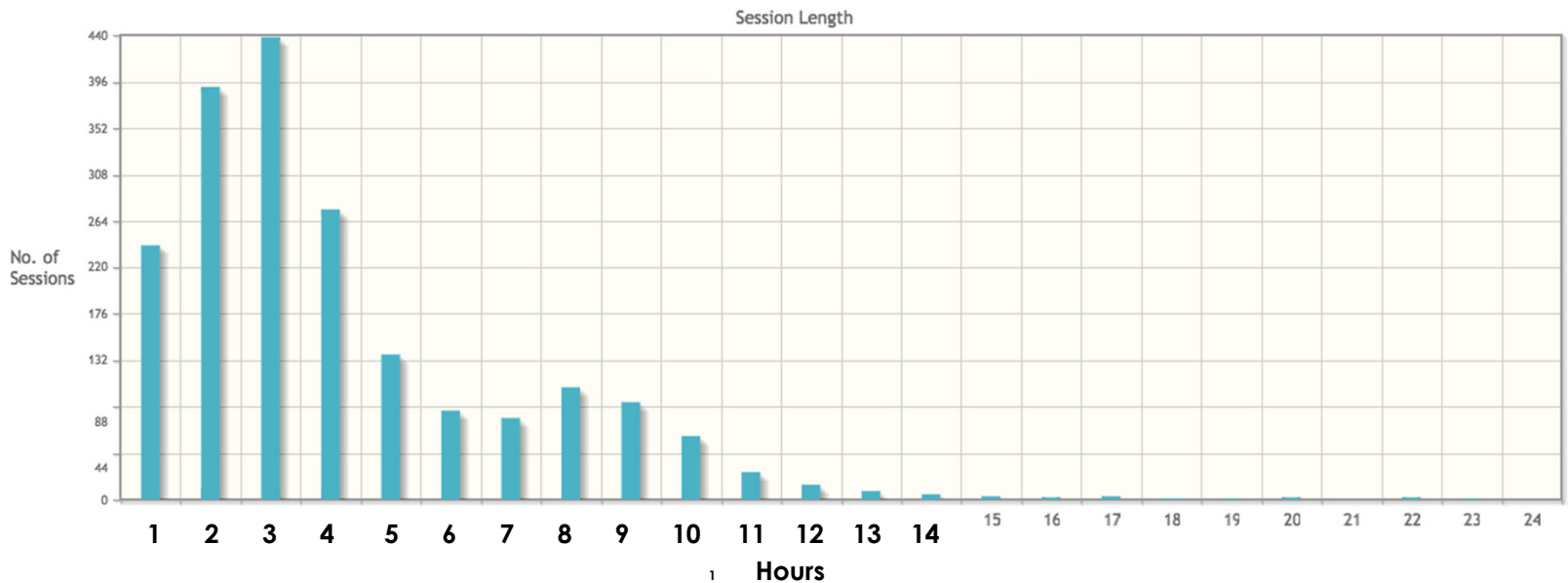
- OpenADR 2.0 Events: DR, Pricing and Reporting
- Varying pricing
  - X\$/hr (2 Tiers): L1, L2 (Daily, Weekly...)
  - Event Pricing
- Varying Curtailment Events
  - Targeted
  - Emergency
- Reporting
- Customer Notification
  - Events
  - Charging completed/Remove Vehicle
  - Disconnection (New session needed)
  - Errors (Resume charging)

# Reporting – Preliminary Data

Average #  
of sessions  
per day

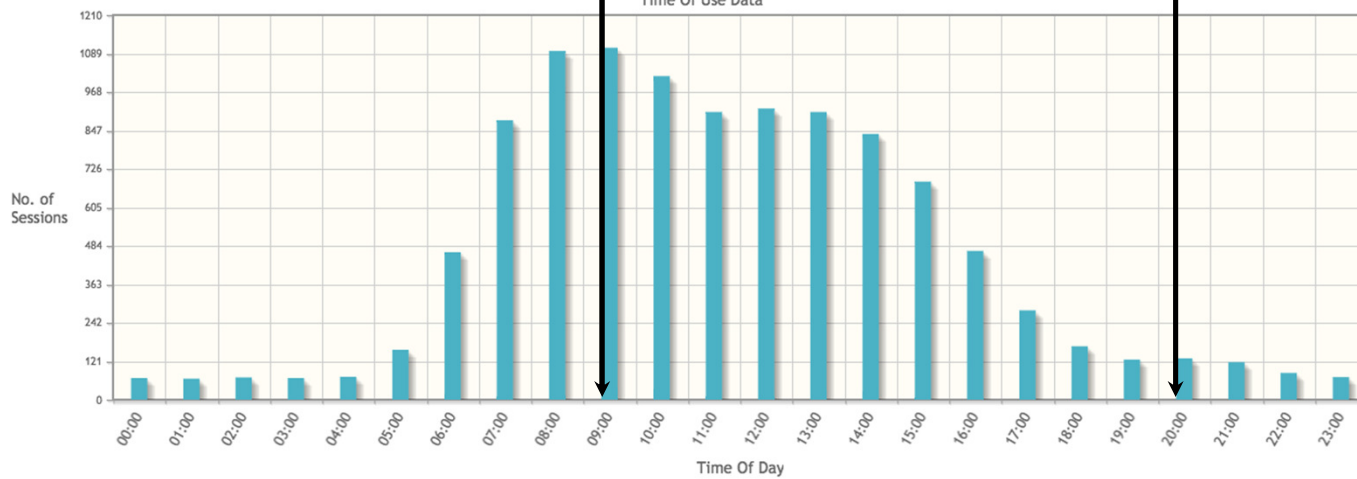
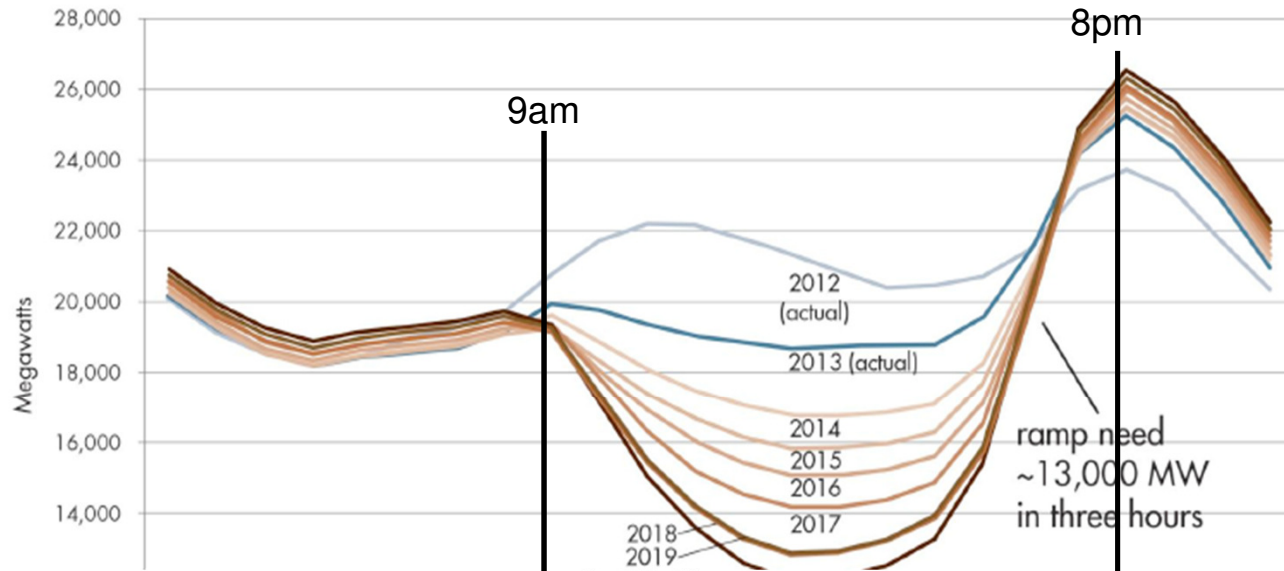


Average  
Session  
Duration

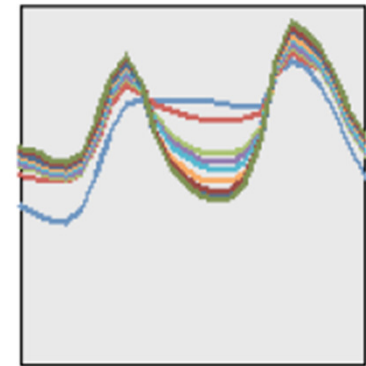


# Mirroring the Duck Curve

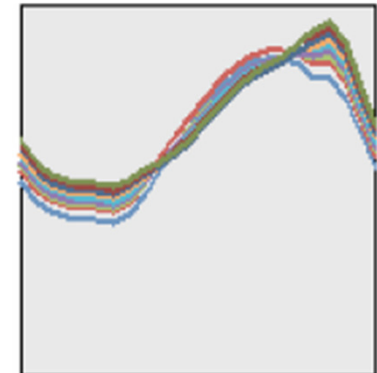
Net load - March 31



Winter - January 31st



Summer - August 10th





# Conclusions

- Automated DR enabled charging is emerging, but can be very favorable to the grid – both at the localized distribution and wider system level
- Using open standards like OpenADR and OCPP allow us to focus on features and innovation, instead of needing to reinvent the communication protocol
- User engagement and education is key to success of DR program

# Q&A

- Recording and slides from this presentation will be available at [www.openadr.org](http://www.openadr.org).
- The OpenADR Webinar Series will continue in mid-January 2015. More information and registration details coming soon.

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Thank You!

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