

DOCKETED	
Docket Number:	18-MISC-04
Project Title:	Vehicle Grid Integration Roadmap Update
TN #:	225717
Document Title:	Presentation - Understanding Consumer Behavior with Electric Vehicle Grid Integration @ UC San Diego
Description:	Presentation filed by Eli Harland (CEC) for UCSD.
Filer:	Eli Harland
Organization:	University of California San Diego
Submitter Role:	Public Agency
Submission Date:	10/31/2018 3:53:19 PM
Docketed Date:	10/31/2018

Understanding Consumer Behavior with Electric Vehicle Grid Integration @ UC San Diego

CEC Vehicle Grid Integration Roadmap Upgrade Workshop

October 30, 2018

Byron Washom

Director, Strategic Energy Initiatives

University of California San Diego

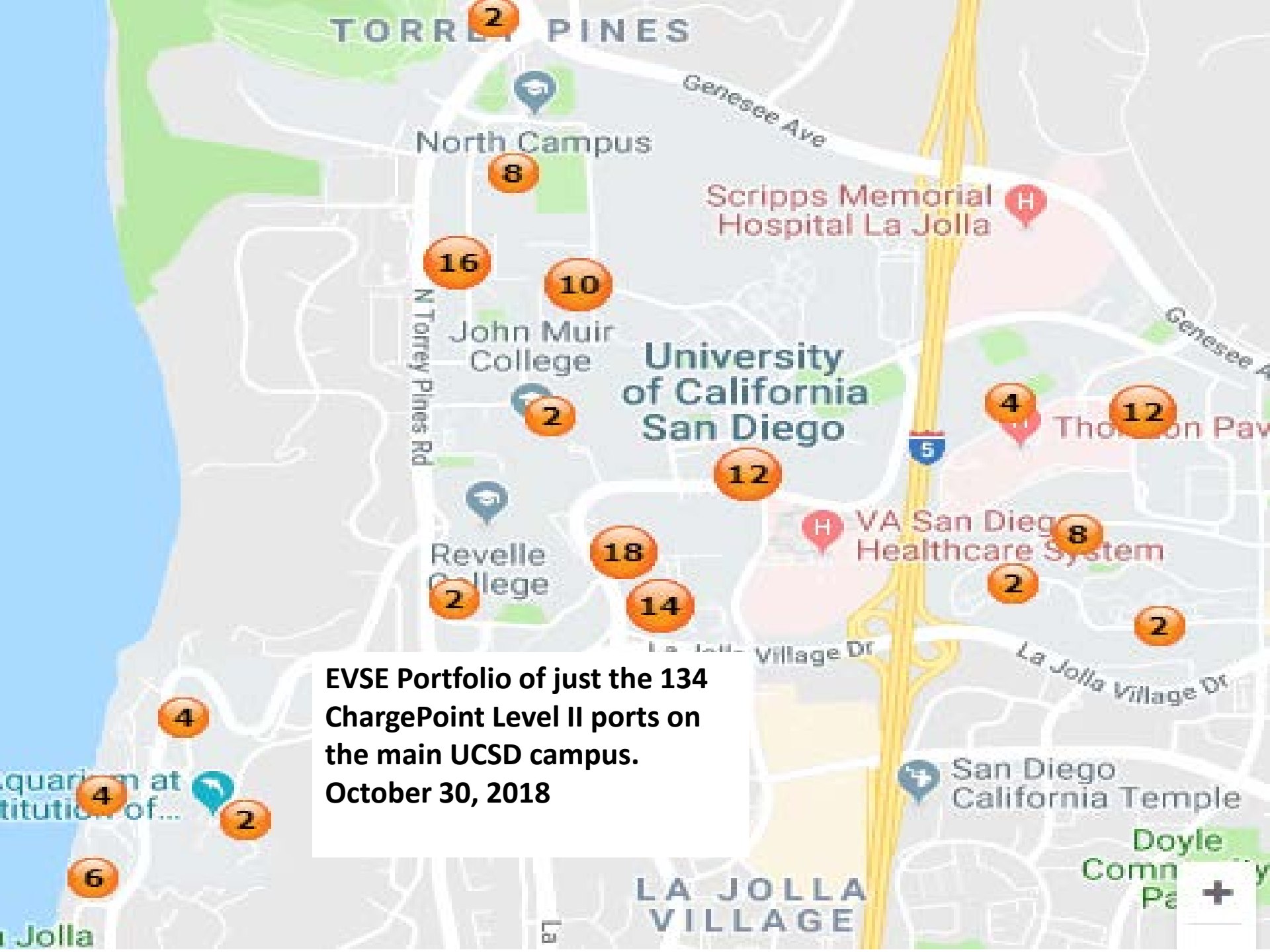
Distributed Energy Resources (DER)

Provides 85% of UCSD's Annual 47 MWp Load

- UC San Diego's Microgrid owns and maintains
 - 69 kV substation,
 - ninety-six 12 kV underground feeder circuits
 - Four 12 kV distribution substations
 - 2.8 MW CHP Fuel Cell using Directed Biogas integrated with a 350 Absorption Chiller
 - 3 MW of PV
 - 2.5 MW/5 MWH of Battery Energy Storage
 - 10+ mgal of Thermal Energy Storage
 - 27 MW CHP Natural Gas Turbine & 3 MW Steam Turbine
 - Imports the balance of 15% load as a Direct Access Customer contracted for 100% Renewables

“The best time to plant a fruit bearing tree was five years ago”

- 2014 was the pivotal year for VGI at UCSD, for it marked the first CEC Grant for demonstration of the twenty-six ISO 15118 Chargers with the highest IQ in Level II charging, 3 DCFCs, and the later purchase of 50 ISO 15118 compatible BEVs for fleet applications.
- It also marked the commitment of a “No Regrets” CAPEX Co-funding with EVgo for one hundred seventy 40 Amp Stub Outs that would later serve as the plug and play EVSE for a diverse portfolio of applications on campus including workplace, Multi-Unit Dwellings, retail, hospitals, visitor venues, parking structures, police station, fleet service yards, ZNE warehouse, and a ocean marine terminal.



**EVSE Portfolio of just the 134
ChargePoint Level II ports on
the main UCSD campus.
October 30, 2018**

UCSD's Electric Vehicle Support Equipment (EVSE) is the World's Most Diverse Portfolio

Fully Commercial Operations

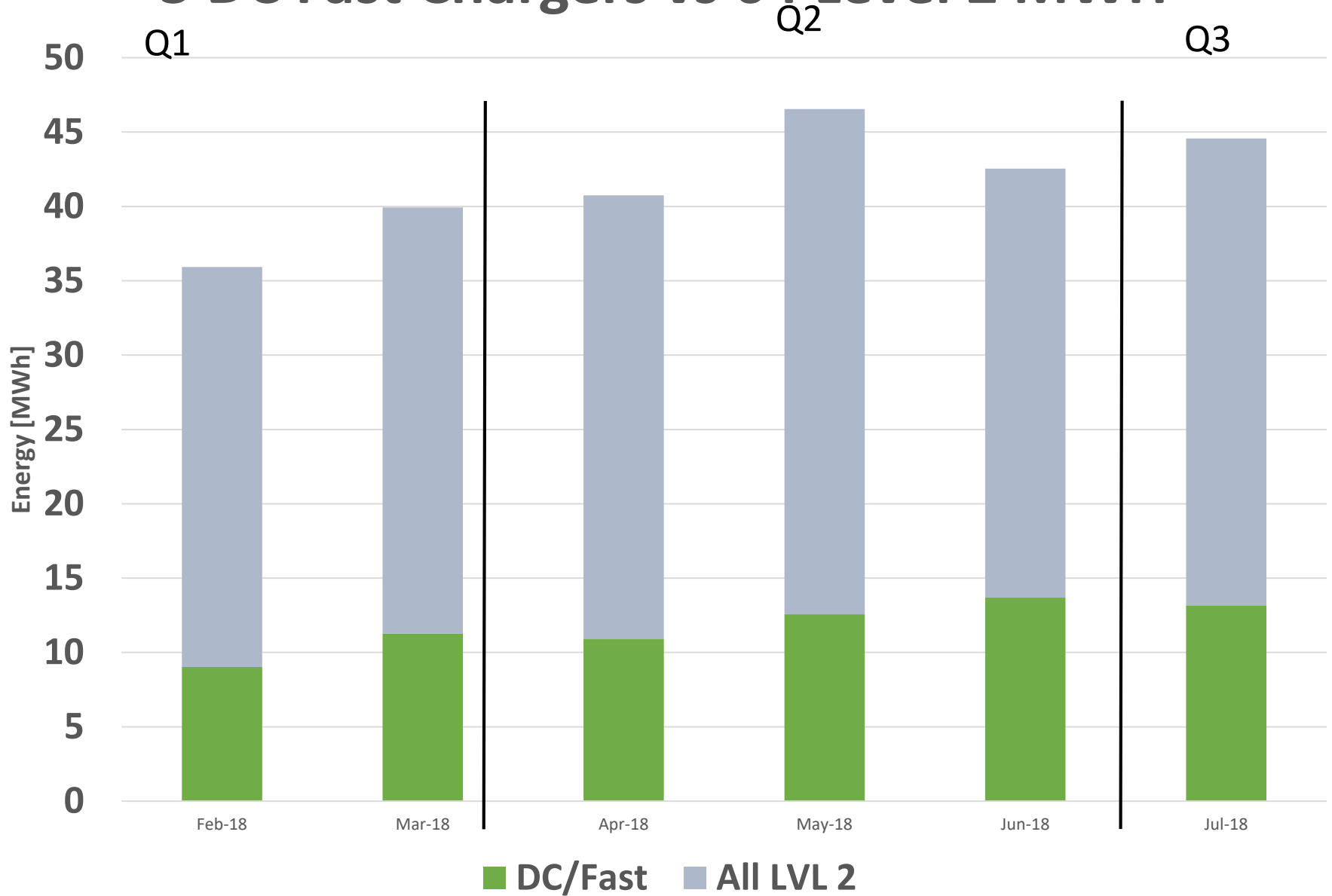
- 134 ChargePoint Level II
- Pending
 - 15 Innogy ISO 15118
 - 20 eMotorwerks
 - 18 SDG&E Power Your Drive (ChargePoints)
 - 10 Level 1 all day stay
 - 6 x 125 kW DCFC Plaza with EVgo

Strictly Demo & Prototypes

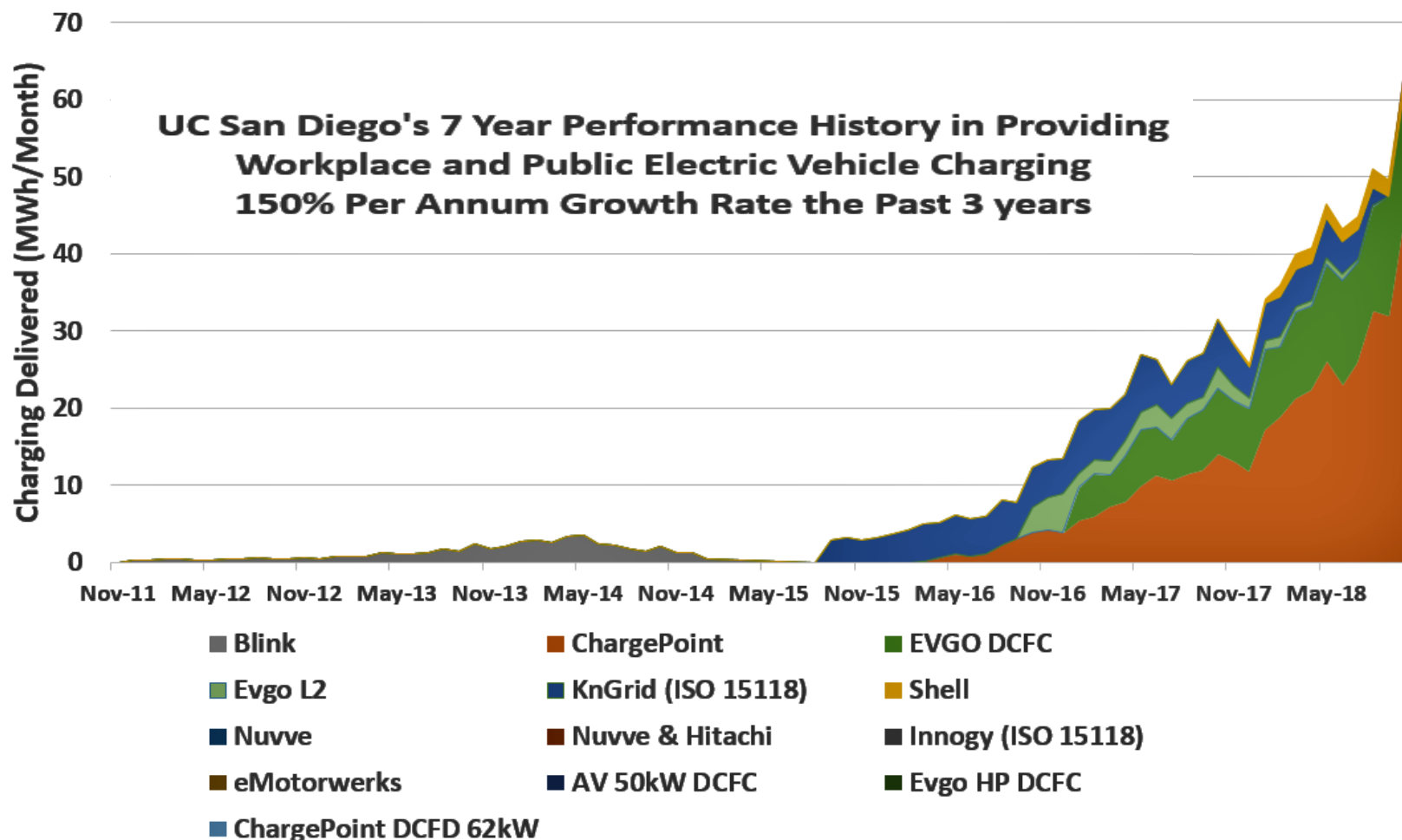
- 8 Nuvve Smart Level II
- 10 Hitachi/Nissan V2G
- 3 Princeton Power V2G
- 2 Honda/Nuvve V2G
- 10 Shell Level II
- 3 x 50 kW DCFC Integrated with PV and 2nd Life EV batteries
- 1 x 50 kW DCFC CP250

Recipient of GreenTech Media's "Grid Edge Innovation Award, 2018"

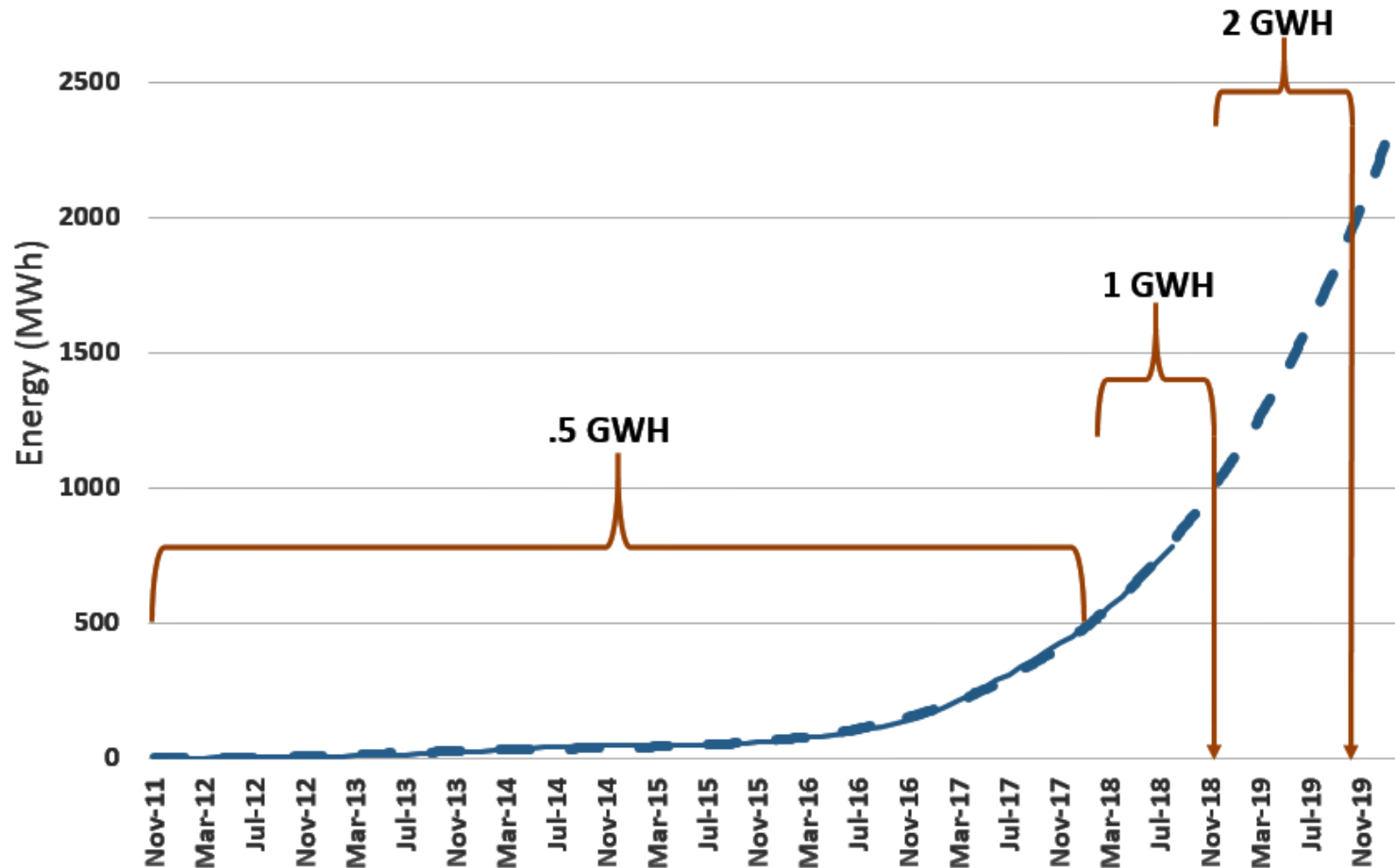
3 DC Fast Chargers vs 64 Level 2 MWH



Historical MWH Dispensed by Vendor/Technology by Month



It took 7 years to reach 1 GWh,
but next GWh within 1 Year



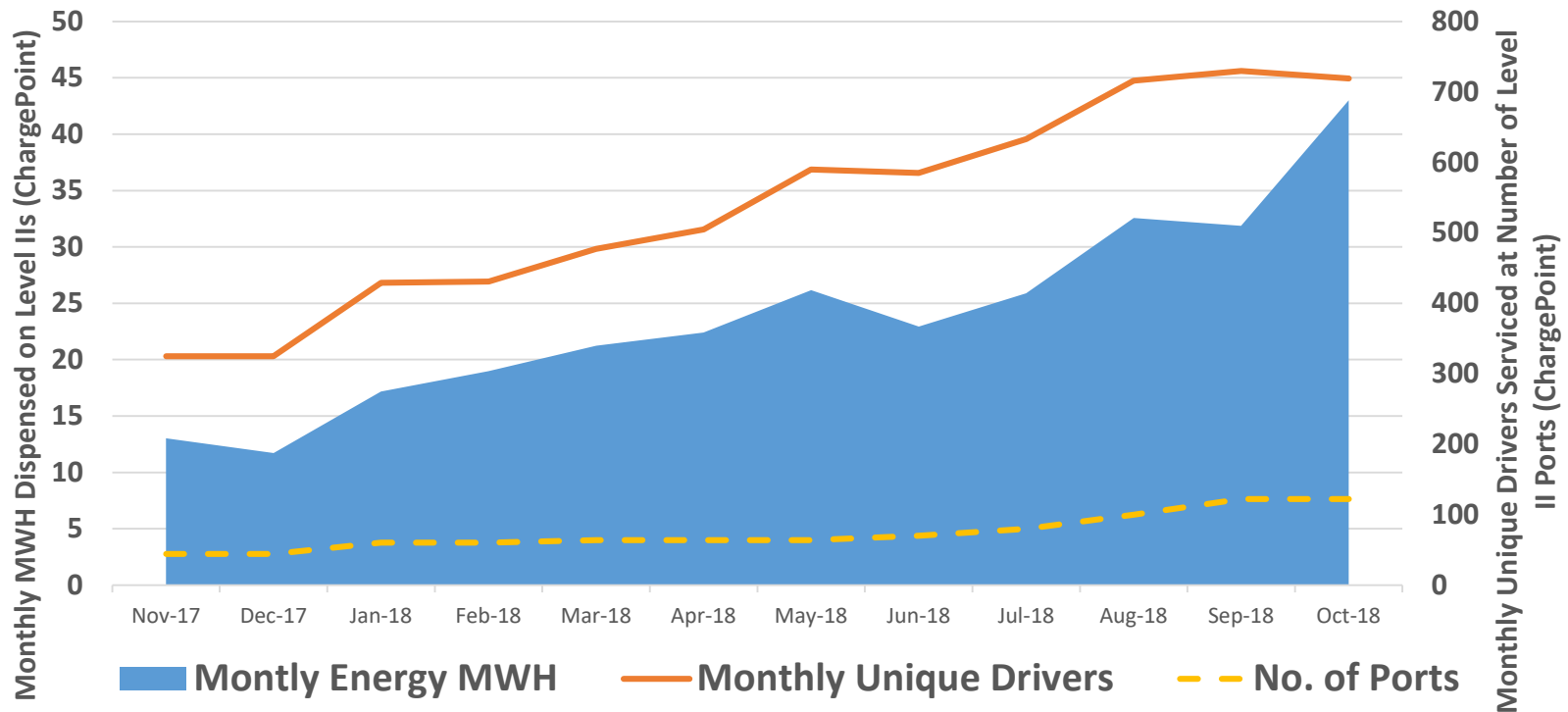
UCSD Key Performance Metrics Year-to-Date (October 28, 2018)

UCSD has already succeeded in meeting the following annual performance goals for Commercial Grade Level II (ChargePoint) EV charging

- **Dispensing >10 MWH of Level II charging within a single week (vs best of 3.3 MWH in CY 2017)**
- **Serving >500 unique commuter, public and fleet EVs during 1,222 Charging Sessions within a single week (vs best of 184 & 396 in CY17)**
- **Serving >2,300 unique commuter, public and fleet EVs during 18,384 Charging Sessions YTD (vs 1,092 & 12,845 in CY 2017)**
- **Dispensing >250 MWH year-to-date for 2018 (vs 120 MWH in CY 2017)**
- **Averaging >99% reliability of charging equipment**

Correlations between Monthly Unique Drivers, MWH & Ports

Past 12 Month Growth (Nov-2017 thru Oct-2018) at UC San Diego in
MWH Dispensed, Unique Drivers Served and Number of Level II ChargePoint Ports
Installed



UCSD by the Numbers: >2500 Unique Drivers YTD in Addition to 54 Fleet BEVs

5 OEMs Provide UCSD's Faculty, Staff & Students "Fleet" Prices

Defining the 2,500+ YTD 2018 Unique Drivers

UC San Diego Exclusive iPerformance Offers.

In appreciation of the strong relationship between BMW of San Diego and UC San Diego, along with a shared common goal of preserving our world's natural resources, we would like to present the following offers exclusively to members of the UC San Diego family:



UCSD & BMW of San Diego

- * \$2,500 State Rebate (Must Qualify)
- * HOV Lane Access
- * Plug Star of America Benefits
- * BMW Flex Mobility Program

All offers: On approved above average credit through BMW Financial Services. No Security Deposit.

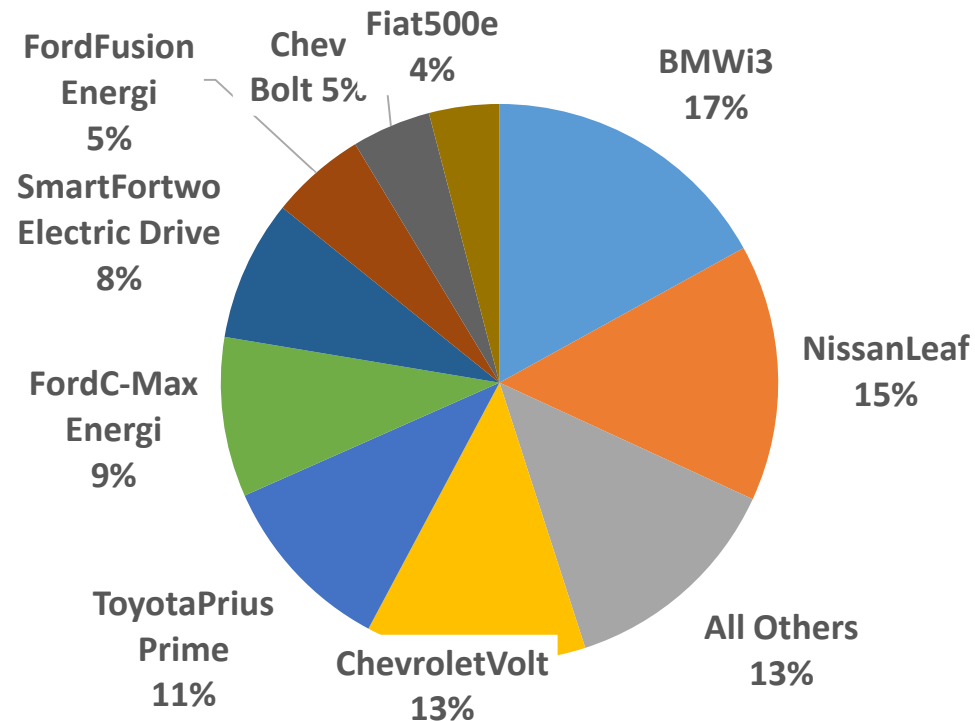
Lease a new 2018 **BMW i3 BEV** For Only **\$199 Per Month Plus Tax**



Closed-end lease for 30 months. \$5,000 due at signing. Plus government fees and taxes. 25k total miles. \$0.25 per excess mile. (Includes BMW Loyalty Incentive) Offer Ends: 11/30/2018

• All UC San Diego staff and students will receive Corporate Fleet Pricing on ALL BMW models.

• BMW of San Diego is the proud recipient of the Geela Award – Governor's Environmental & Economic Leadership Award. They are leading California into a cleaner and greener future. Join us today!

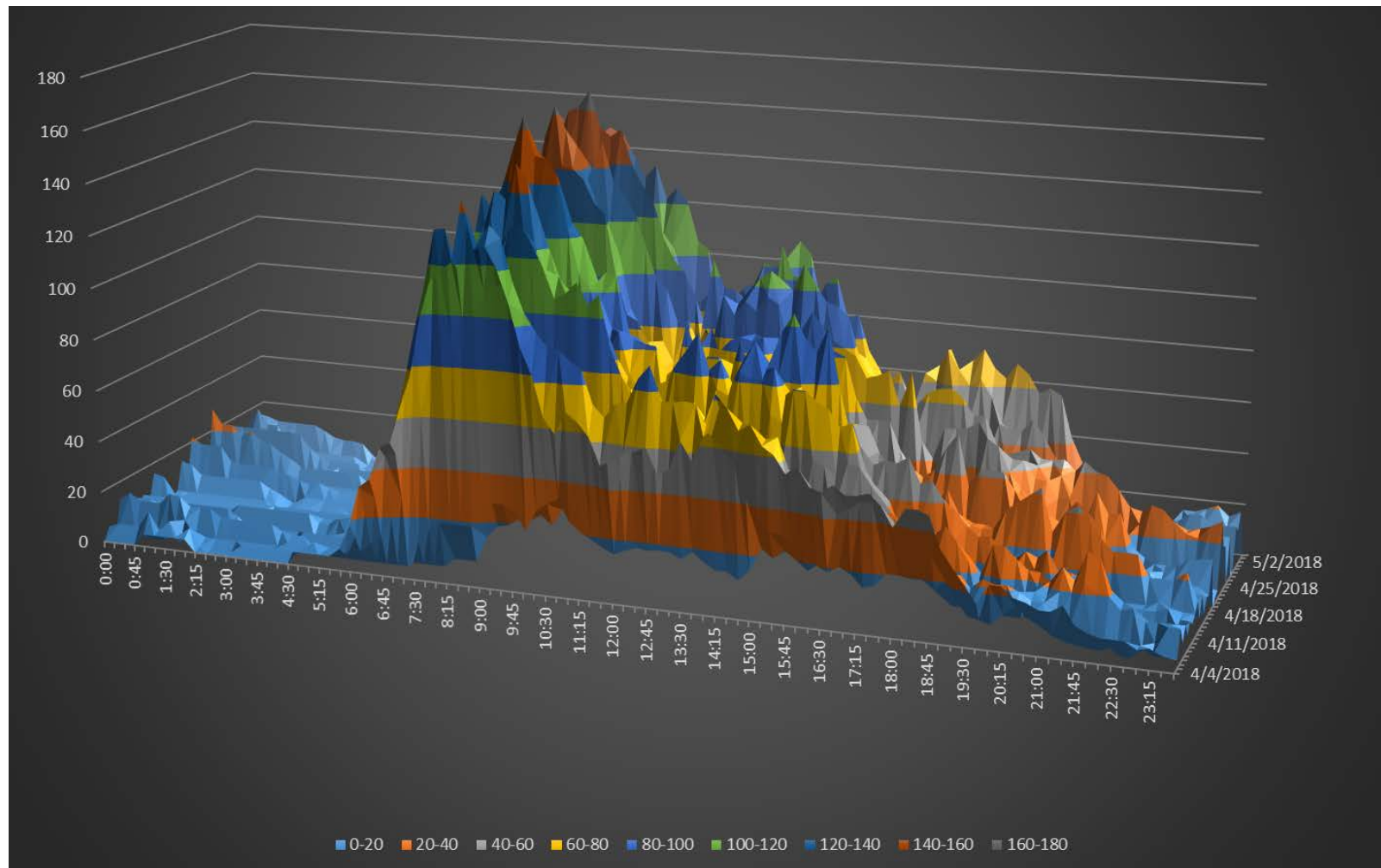


Implementation of the strategy was the recipient of the UCOP "Best Practices Sustainable Transportation, 2017" and Plug in America's Outstanding Organization Award, 2018

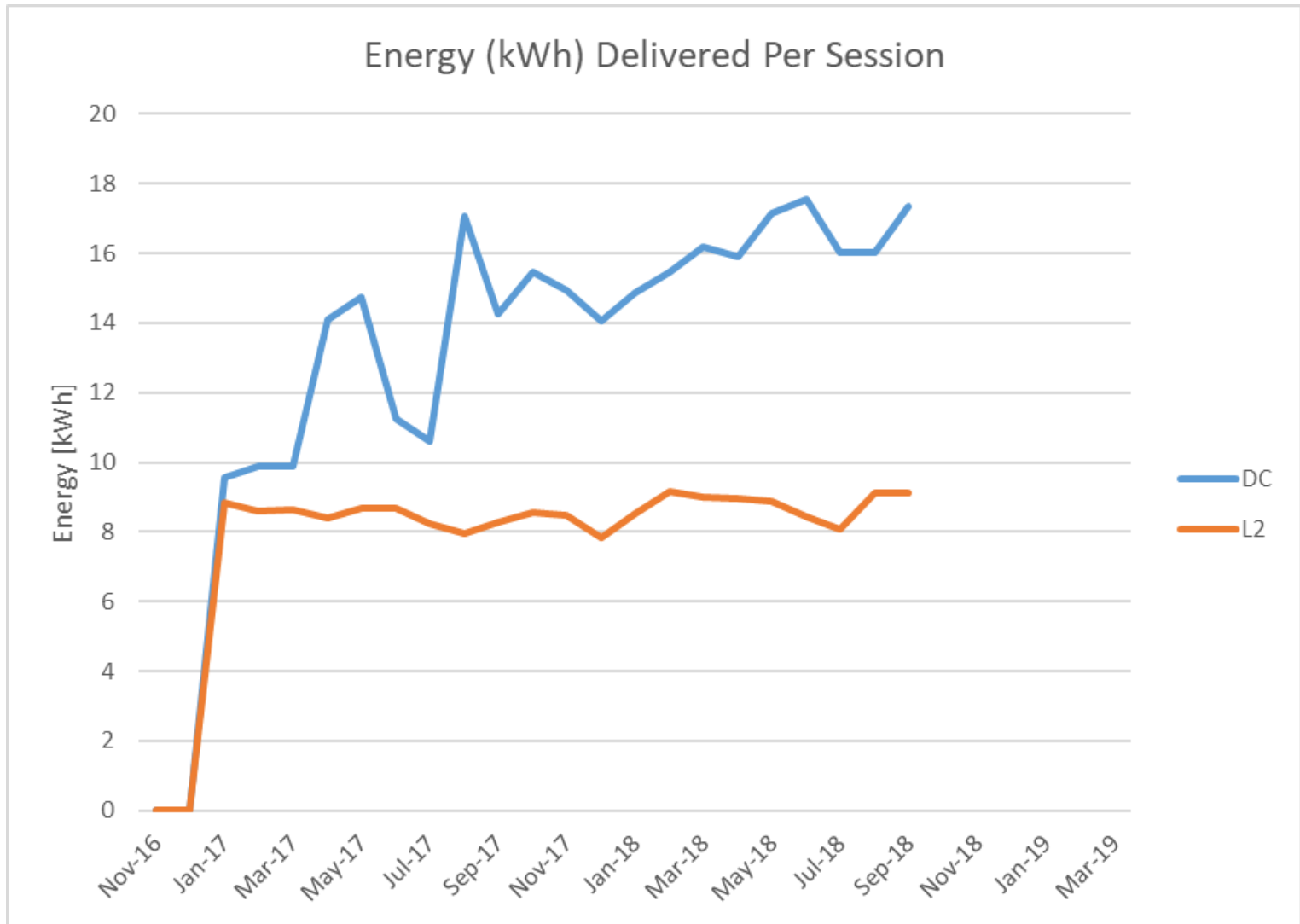
Synopsis of the Vehicle Grid Integration & Storage Challenge

- *An EV customer can choose when (time of day), where (location), how quickly (kW), how long (duration) and how often (frequency) to charge. For an EV customer, if EV fuel prices at one location and at one time are variable, it will influence EV charging not only at that location and time, but also charging at other locations and at other available times.*
- *To capture these interrelated location, variable costs, variable income opportunities and charging time dynamics, a market level approach (i.e., modeling all customer groups, vehicle types, charging locations, and prices) is required to evaluate load impacts and their corresponding costs and benefits for a price-based EV charging program. (JC Martin, SDG&E, CPUC Testimony on VGI, April 11, 2014)*
- This is what I would refer to as a “delicious” challenge.

Q2-2018 Growth in L2 kWh and Shift in Time of Day by 15 min Intervals



DCFC vs Level II Charging Patterns



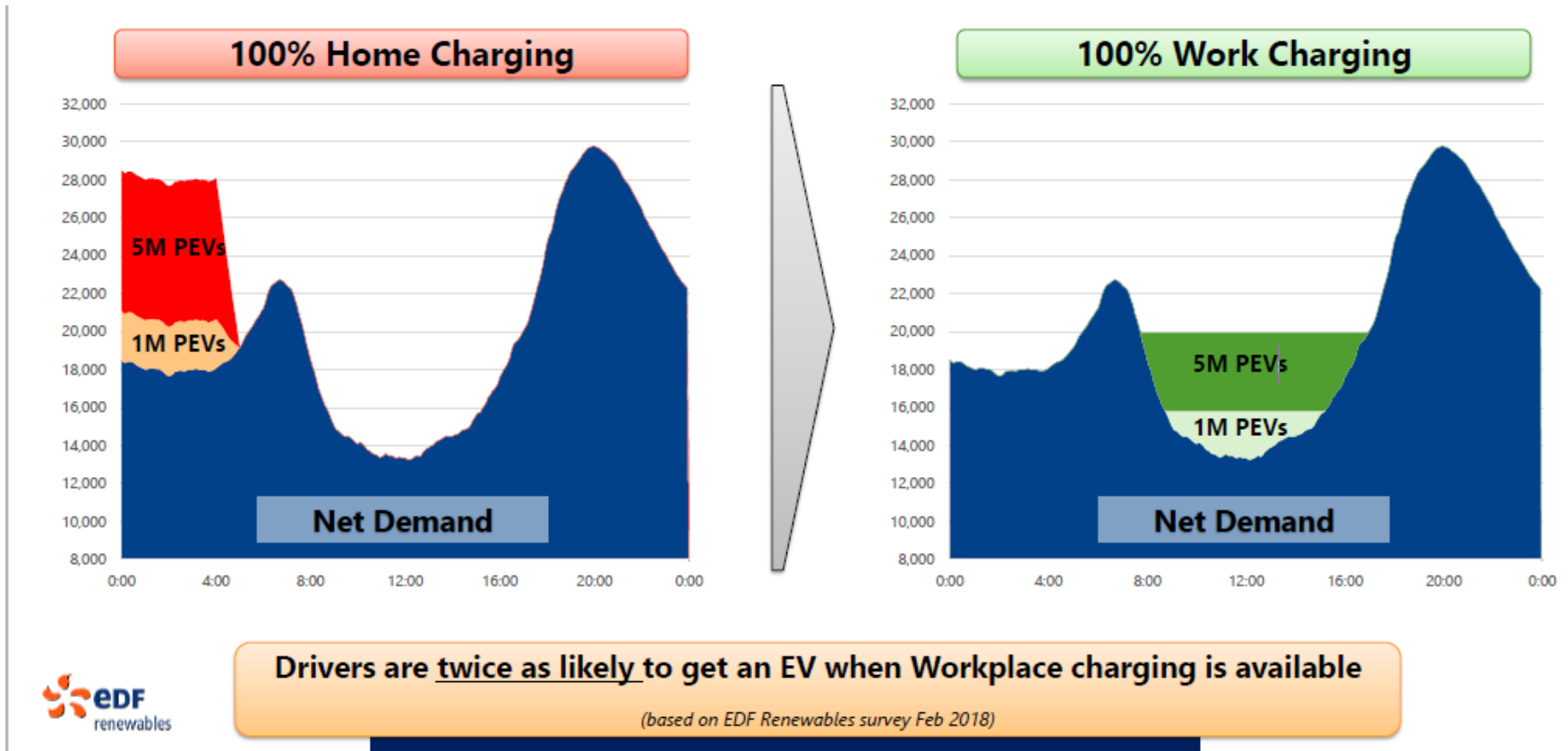
Goal: Utilize the microgrid as a replicable utility model subjected to the challenges and benefits of multiple Vehicle Grid Integration technologies

This is consistent with the CEC's 2017 IEPR that recommended an updating the VGI Roadmap to reflect

- ***the need to use open standards,***
- ***to return the value of grid integration to stakeholders,***
- ***to commercialize prior investments in research and maintain leadership in adv technology development"***
- ***To make EoT accessible to all Californians, and***
- ***To reflect recent policy directives for the installation of 250,000 charging stations by 2025, the deployment of 5 million zero-emission vehicles by 2030, and the use of clean electricity and carbon neutrality by 2045.***

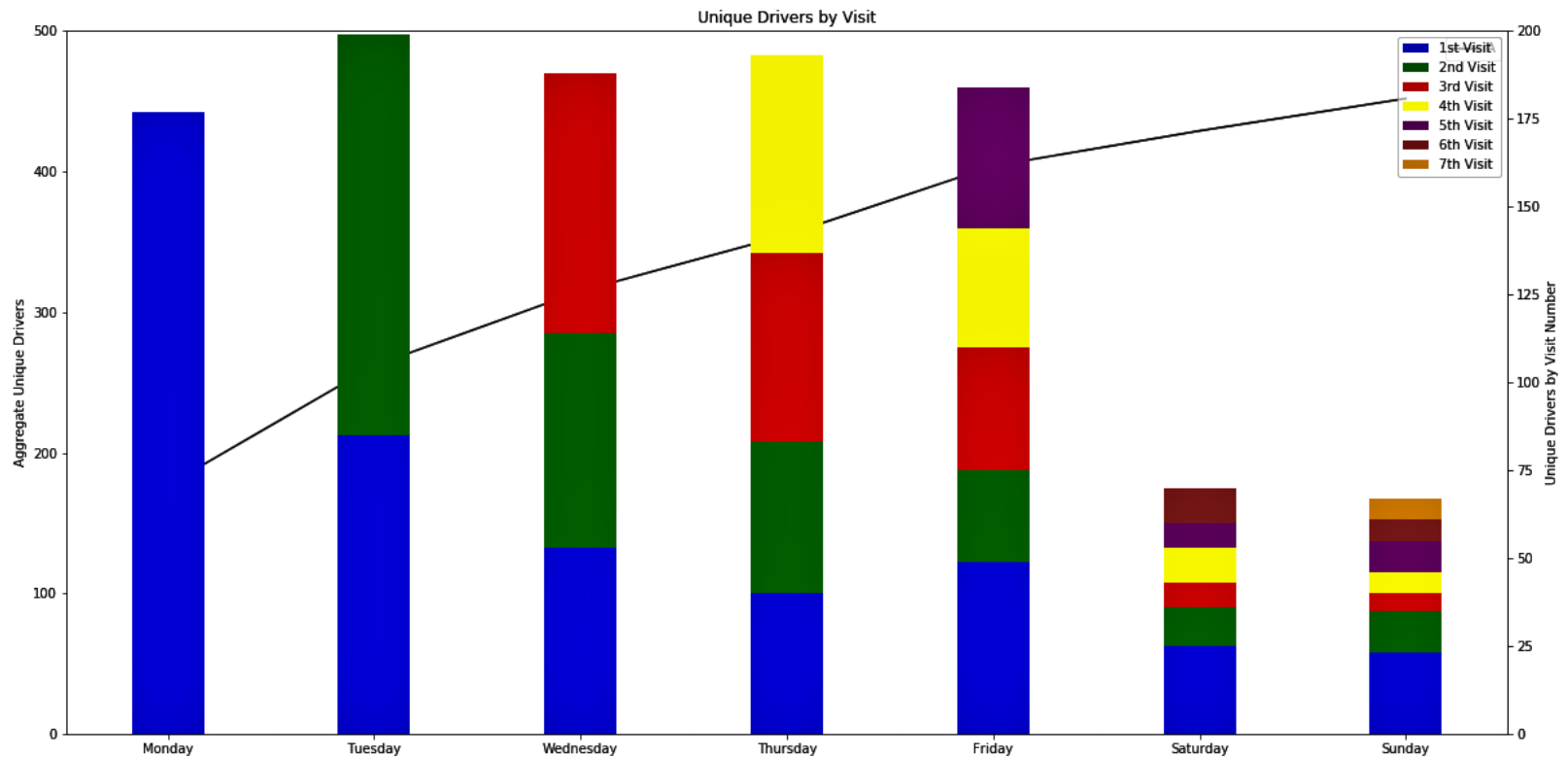
Critical User and Social
Considerations necessary to
ensure that these EVSE
investments are successful

Workplace Charging as the Greatest Enabler of EV Accessibility and Affordability for MUD & DAC Residents



LCFS' maximum "return of value for grid integration" to the Site Hosts and EV Commuters

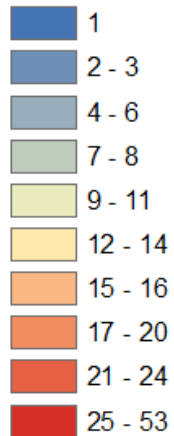
Intra-Week Cadence of Unique Drivers Charging Indicates Prevalence of No Access to Residential Charging



Number of Unique Visitors to UCSD Charging Stations by Zip code

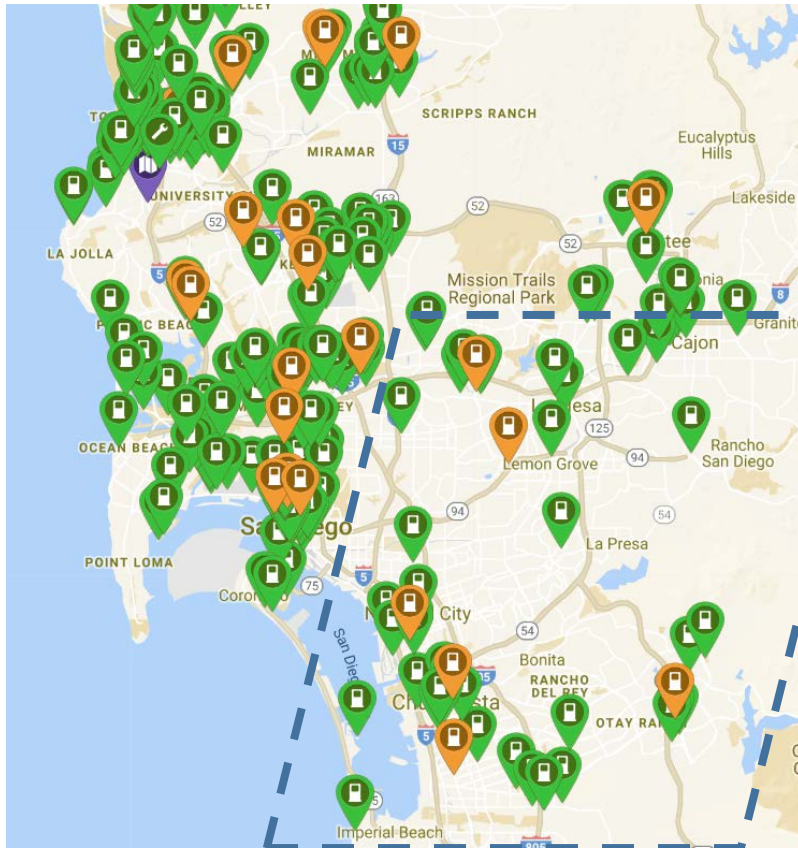
February 1, 2017 - January 31, 2018

★ UCSD



DAC's as a cornerstone of Environmental Justice

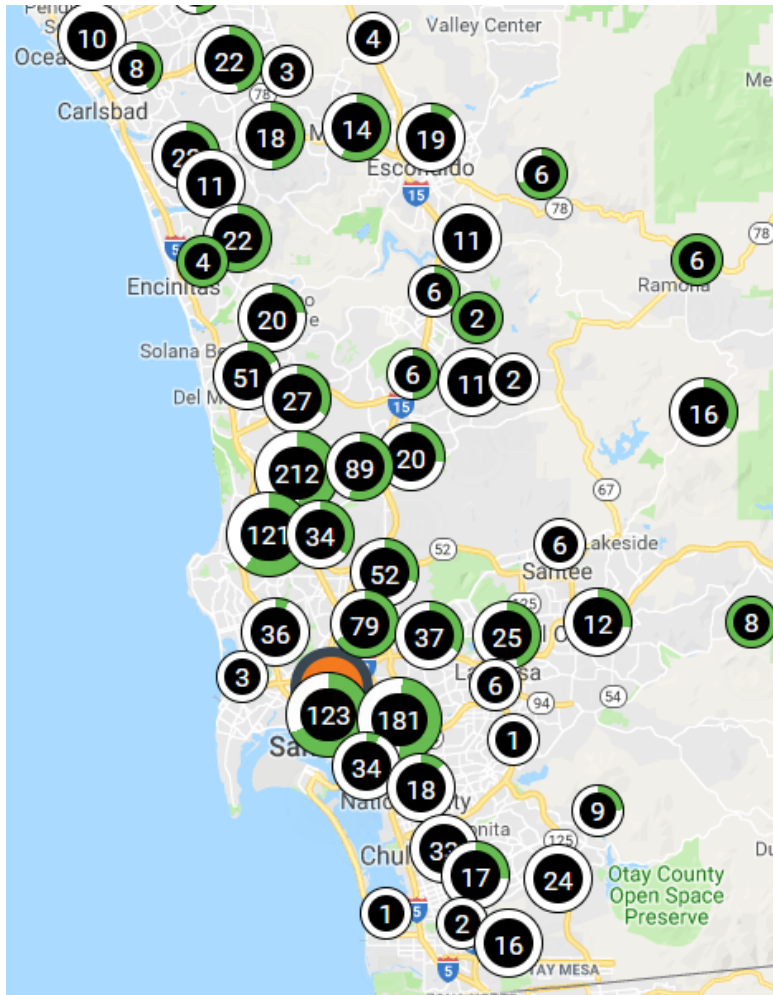
Disproportionate Access to Public Charging in DACs



Offering Workplace Charging to DAC Residents represents a “priming of the pump”

- UCSD has >2000 employees living in DACs
- “Cash on the Hood” Rebate helps downpymt
 - Higher CA rebates rates for lower income earners
- SB350 mandates DAC penetration which will also serve EV Ride Share

Fresh & Big Data of the Early Mainstream Adopters and not previous data from Early Adopters is Absolutely Essential in Developing Future VGI Policy, Deployment and Tariffs



UCSD Access to Proprietary Big Data VGI Resources

- Every ChargePoint charging sessions for the San Diego Region @ 15 min intervals
- All ChargePoint charging sessions @ UCSD at 15 min intervals over 4 years
- 3 years of 8 EVgo DCFCs within 3 IOUs and LADWP
- Forthcoming Data from Innogy, eMotorwerks, Shell

ISO 15118 Protocol

CEC Funded ISO 15118 Demo in 2014 with KnGrid, largest in North America (26)



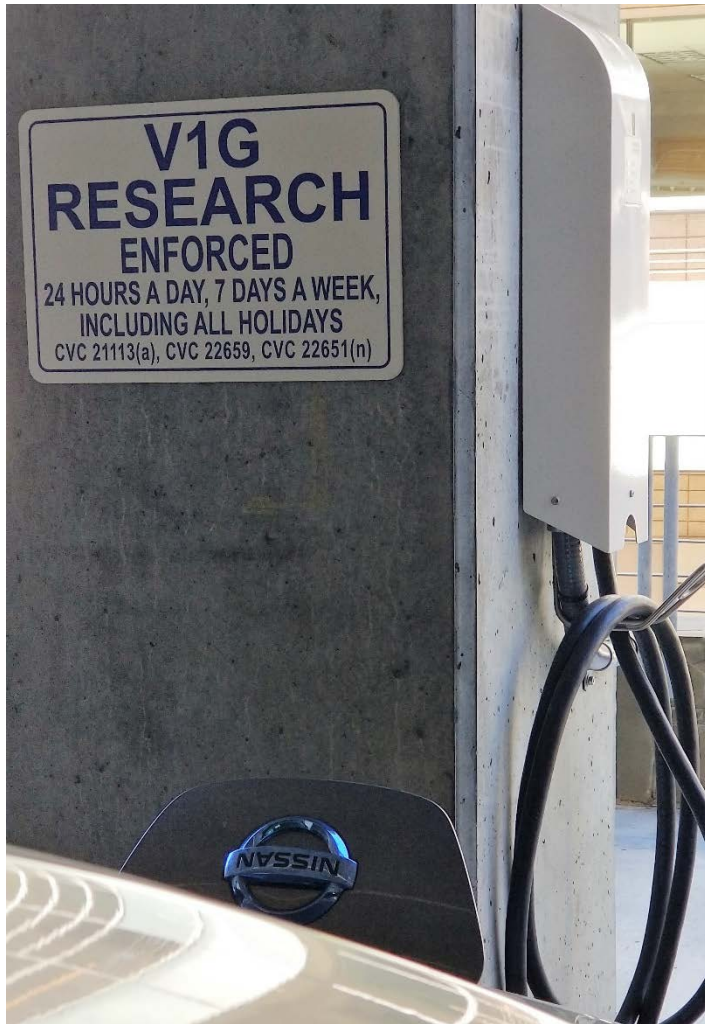
**Innogy/RWE Q4 2018
Deployment of 17 Level II ports,
Largest in North America**



The Ultimate Electrification of Transportation: San Diego Light Rail to Campus by 2021



The Art of the Possible in VGI @ UC San Diego



Byron Washom

Director, Strategic Energy
Initiatives

bwashom@UCSD.edu

