



Silicon Valley Clean Energy C&I Community Roundtable Workshop Series

Welcome!

December 2017



Watts for Lunch?

- BTUs for Breakfast
- DR for Dinner
- Horsepower for Happy Hour . . .

C&I Networking and Collaboration

- Interactive SVCE updates
- Local peer networking
- Forum for learning/idea sharing
 - best practices
 - new technology, services
 - programs and incentives
- Understand customer priorities
- Guide SVCE program investments



Today's Agenda

11am	Welcome
11:05	Introductions
11:15	SVCE Update – Strategic Electrification
11:25	Supercharger Infrastructure - Tesla
11:35	Workplace EV Charging Network – PG&E
11:55	Watt do you think? Interest Survey - SVCE
12:05 pm	Lunch Break
12:15	Smart Charging and Storage - BMW
12:40	EV Club Influence - Genentech
1:05	EV Infrastructure Deployment - Google
1:30	Wrap-Up - SVCE

SVCE Mission



- Provide the SVCE community with carbon-free, affordable and reliable electricity, and innovative programs to reduce dependence on fossil fuels

Electricity Choices



GreenStart

Your default option, 1% below comparable PG&E generation rates

- Clean and carbon-free
 - 50% renewable energy
 - 50% hydroelectric energy



GreenPrime

Your voluntary option costs \$0.008 more per kilowatt hour than GreenStart

- 100% renewable energy
 - Green-e certified
 - carbon-free

SVCE Speeds and Feeds . . .

- 220,000 residential and 28,000 C&I customers
- 11 Cities and Santa Clara County; soon Milpitas
- 660MW Peak, ~3,600 GWh/year
- 97% enrollment rate
- Strong financial performance
- Monthly public board meetings

SVCE Board of Directors

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Town of Los Gatos

Daniel Harney, Vice Chair
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Liz Gibbons
City of Campbell

Rod Sinks
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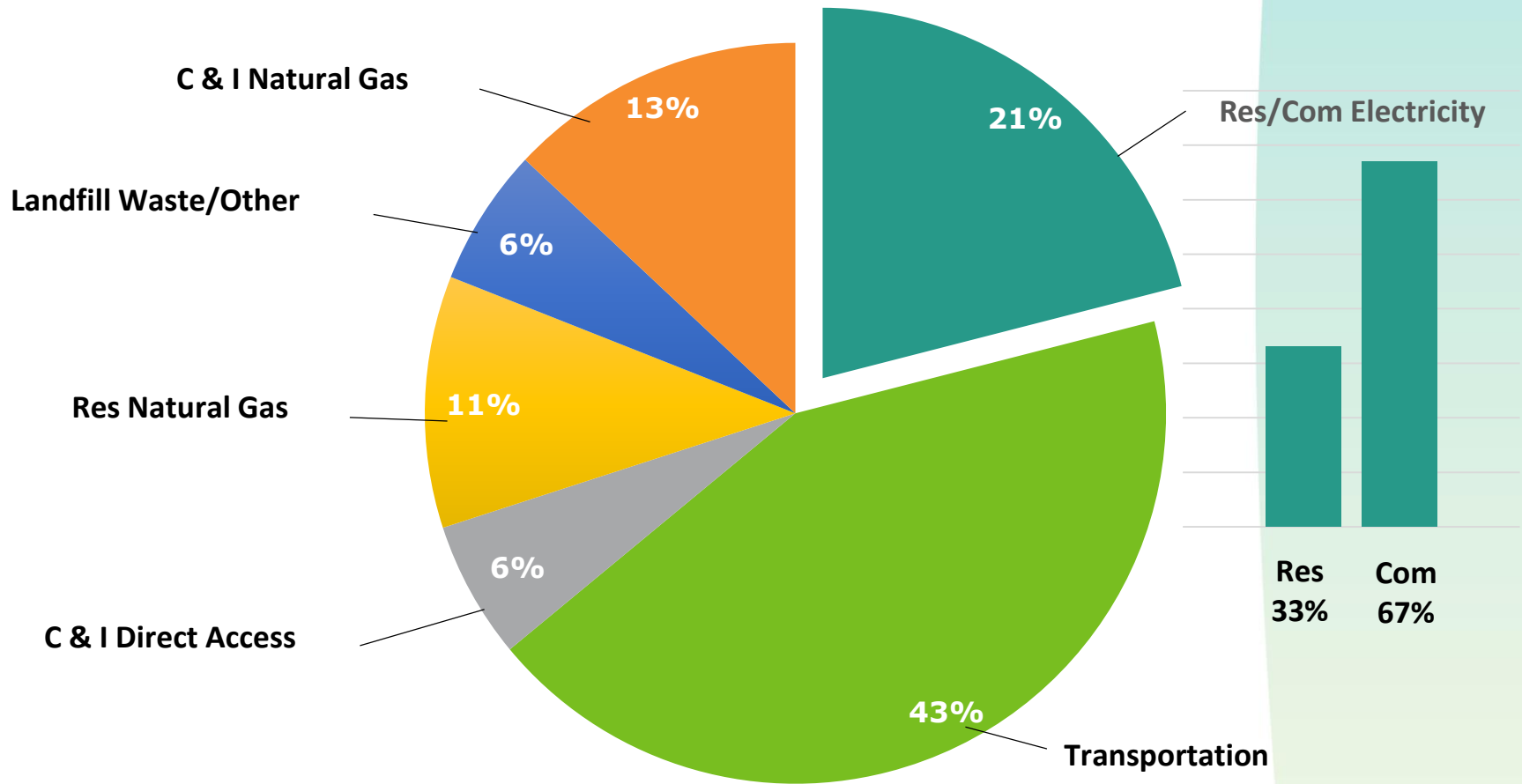
Jim Griffith
City of Sunnyvale

Dave Cortese
Santa Clara County



Achieving GHG Emissions Reduction

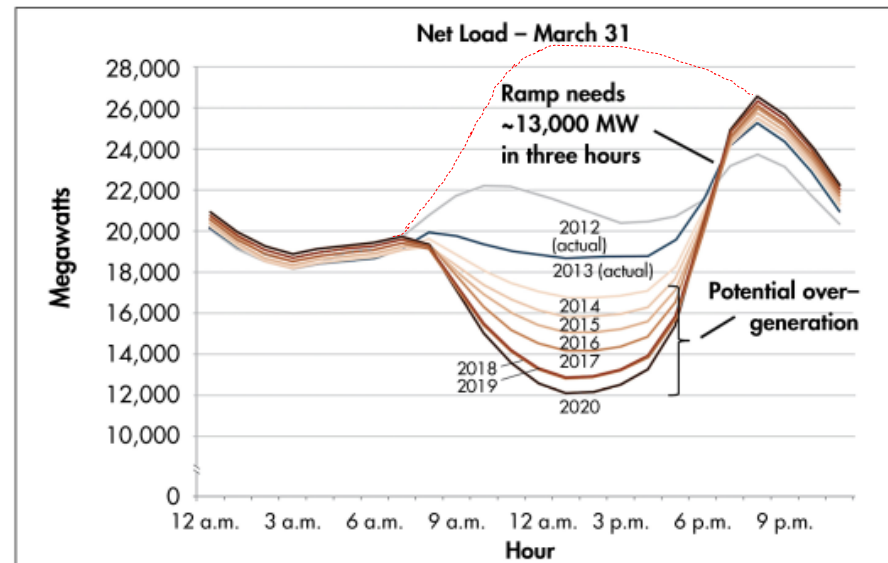
2015 Carbon Emissions by Source*



Key Challenges and Opportunities

- Expand use of clean, low-cost renewable electricity
 - alignment of demand with renewable energy supply
 - evolving TOU rates
 - storage and demand-shifting
- Electrification of transportation
- Fuel-switching and energy efficiency in buildings

Figure 1: Net load on the CAISO system



Source: CAISO

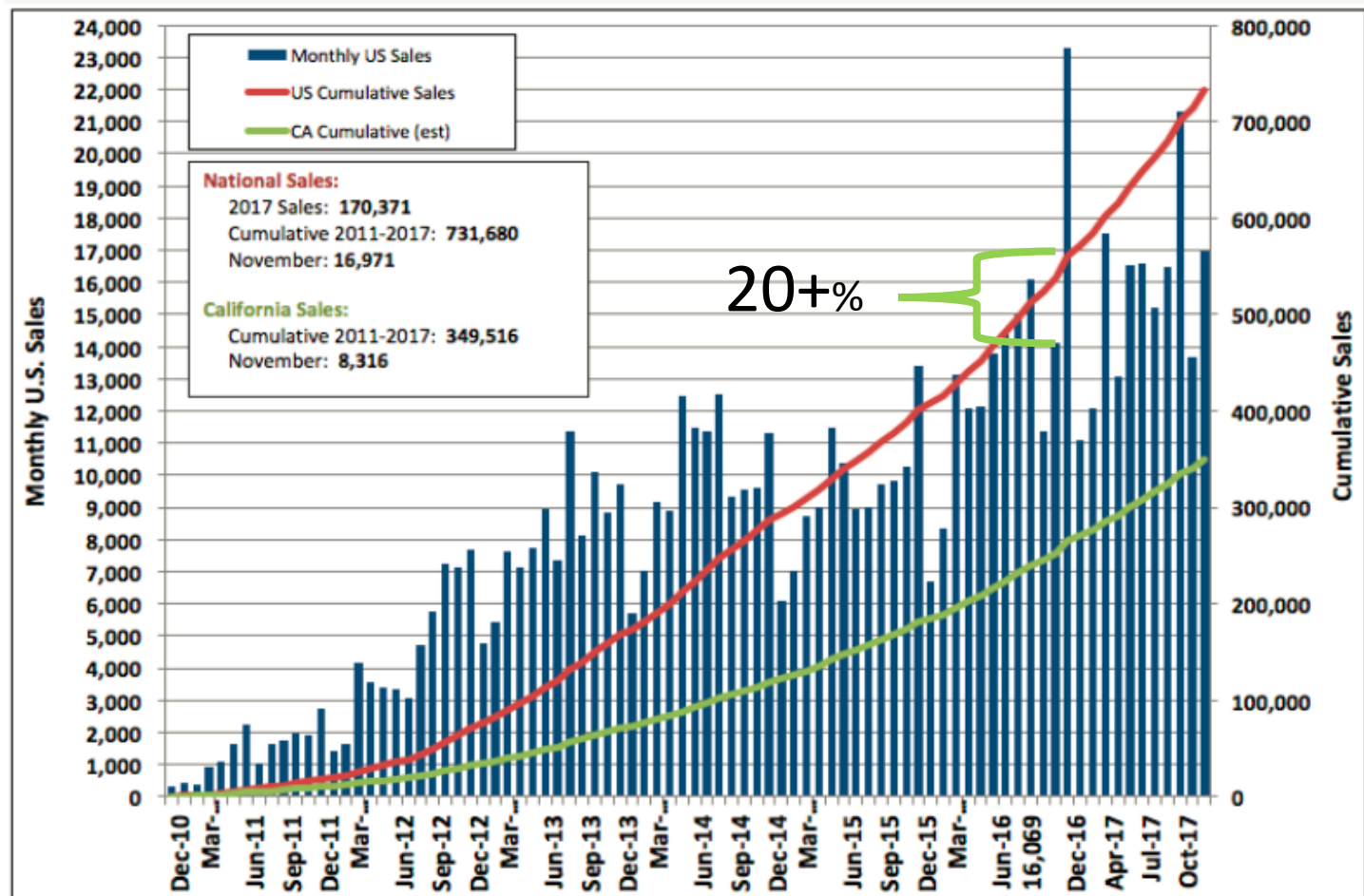
SVCE Energy Procurement

Developer	Project Name	Source	Generating Capacity (MW)	Storage technology	Storage Capacity (MW)	Storage Duration (Hours)	Location	Term (years)
Recurrent Energy Development Holdings, LLC	RE Slate	Solar PV	150	Lithium Ion Battery	45	4	Kings Cnty, CA	15
EDF Renewable Energy	BAR13 Solar	Solar PV	128	Lithium Ion Battery	40	4	Kern Cnty, CA	20
Pattern Development	Corona	Wind	200	n/a	n/a	n/a	New Mexico	15
NRG Renew, LLC	District 5 Wind*	Wind	43	n/a	n/a	n/a	Alameda Cnty, CA	15

*See Note under Timeline as NRG chose NOT to submit required documents by 11/27/17 deadline.

- Long-term procurements focused on Category 1 renewables aligned with SVCE load curve
- Solar + storage, wind at competitive rates

Expanding EV Market



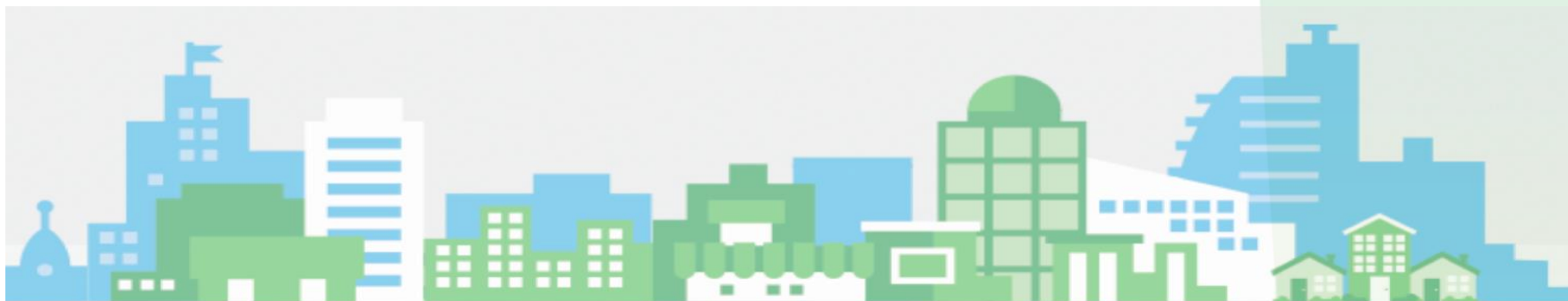
Note: Approximation assumes CA sales are 49% of national sales.

Reference: www.hybridcars.com

12/04/2017

SVCE Programs for C&I

- Reserving funds for ongoing program investment
 - electrification and de-carbonization focus
 - broad quantitative and qualitative measures
 - your priorities are key
- Objectives and strategy in early stages
- One-of-a-kind business environment in Silicon Valley – we look forward to working with you!



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Next 'Watts' Meeting . . .

- Late April/Early May 2018 – will send save-the-date after location confirmed
- Interested in being a site host? Please let us know!
- Primary topic(s) will reflect results of interest survey

Thank You!



SVCleanEnergy.org



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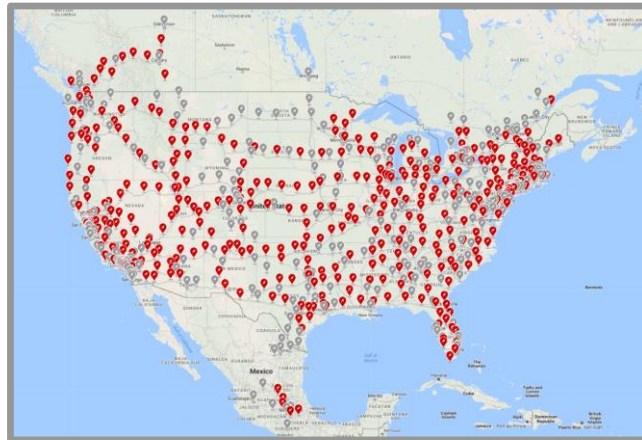
Tesla Supercharger Introduction



Tesla Supercharger Network

The World's Fastest Charging Station

The Supercharger network is your answer to long distance travel. Superchargers enable travel to your favorite destinations and charge Model S and Model X in minutes. Stations have multiple Superchargers to get you back on the road quickly and are located near restaurants, shopping centers, and Wi-Fi hotspots.



The Driver Experience



Navigate

Enter your final destination and Trip Planner automatically routes you through convenient Superchargers along the way.



Plug In

Plug in for about 30 minutes and grab a cup of coffee or a quick bite to eat while your vehicle charges.



Journey On

Your Tesla app will notify you when your vehicle is done charging.

2016 Production

80,000

Model S & X Owners

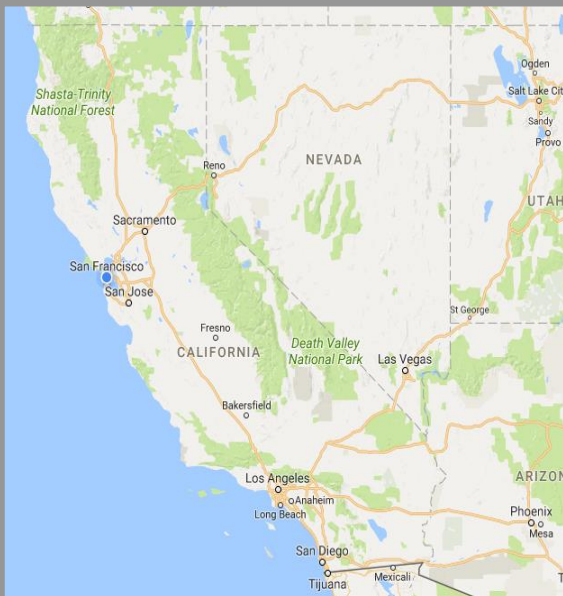


2018 Projected Production

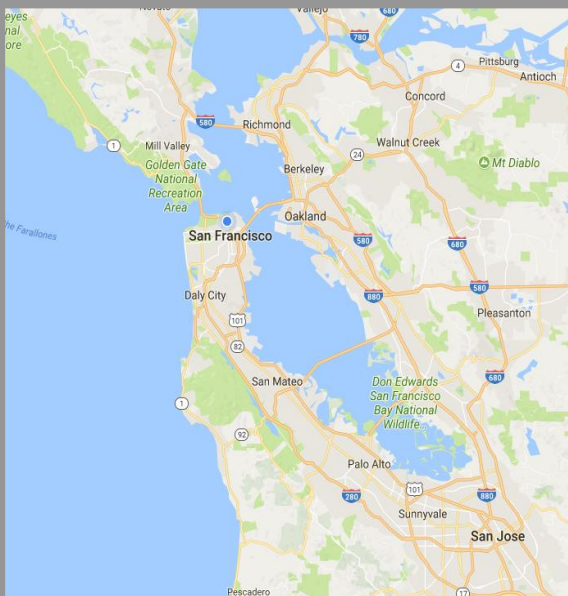
500,000

Model S & X & 3 Owners

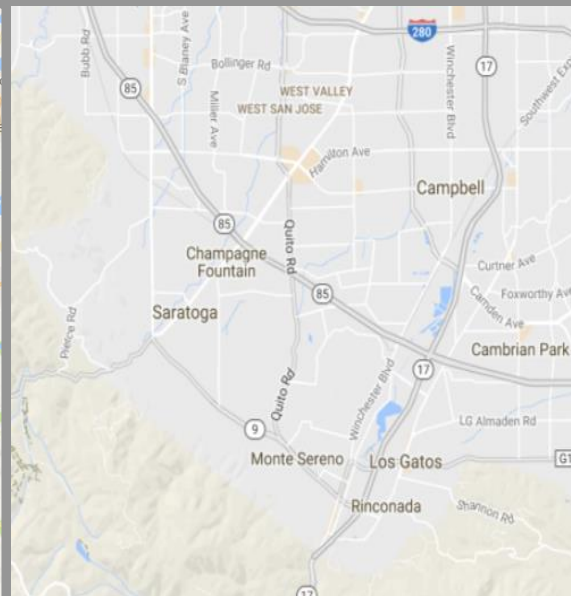
Long Distance Drivers



Regular Commuters

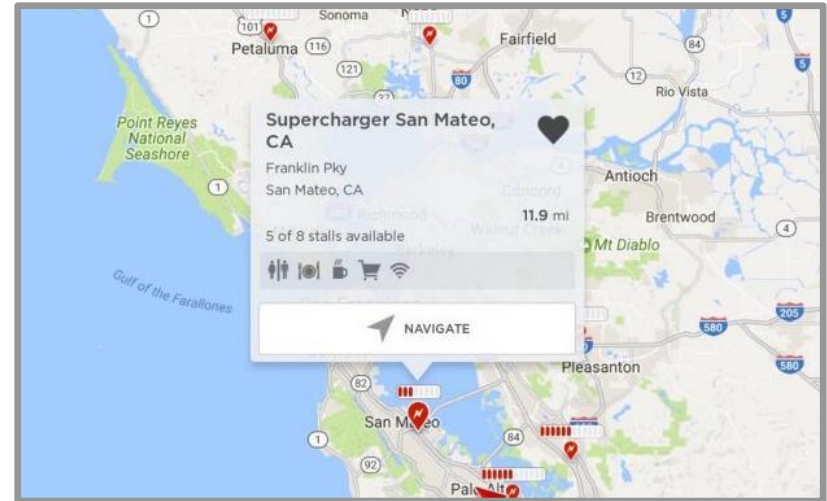
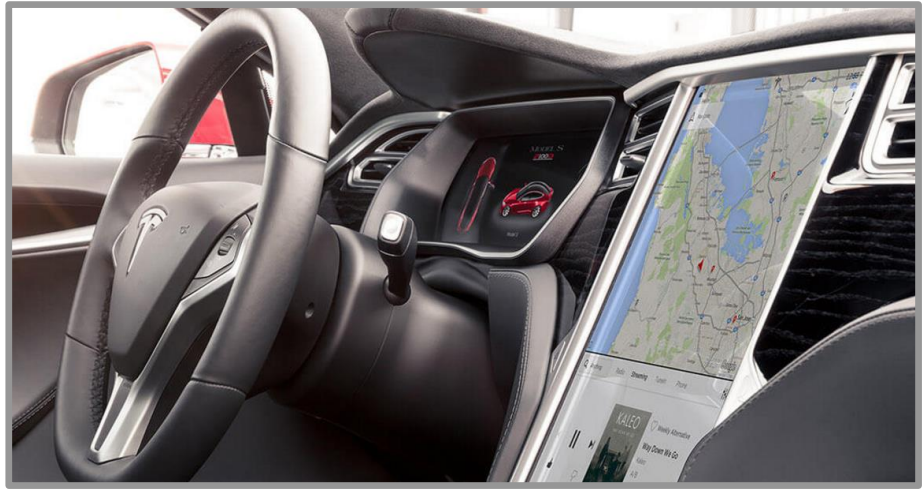


Local Residents

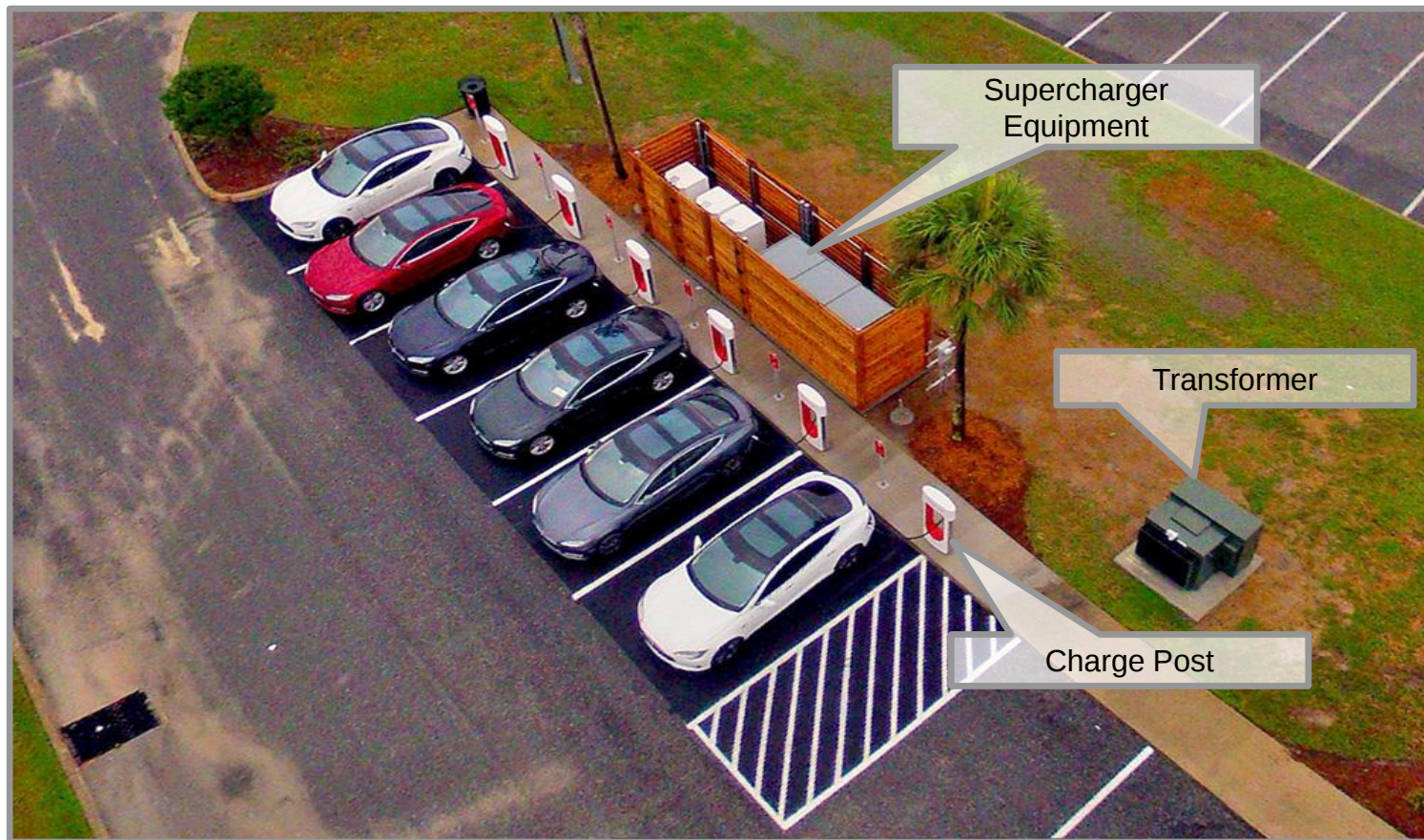


Main Talking Points:

- Customers use their Tesla app or the map on the touchscreen of their car to direct them to charging sites.
- Your property location and amenities are displayed in the vehicle's navigation map and on the Tesla website.
- We don't want prime parking. Our goal is to make use of the most underutilized areas of your parking lot.
- There's no requirement for these spots to be dedicated for Tesla owners.
- Thousands of new customers will visit your property each month.
- Average customer charge (dwell time) is 45-60 minutes for 200+ miles of range.



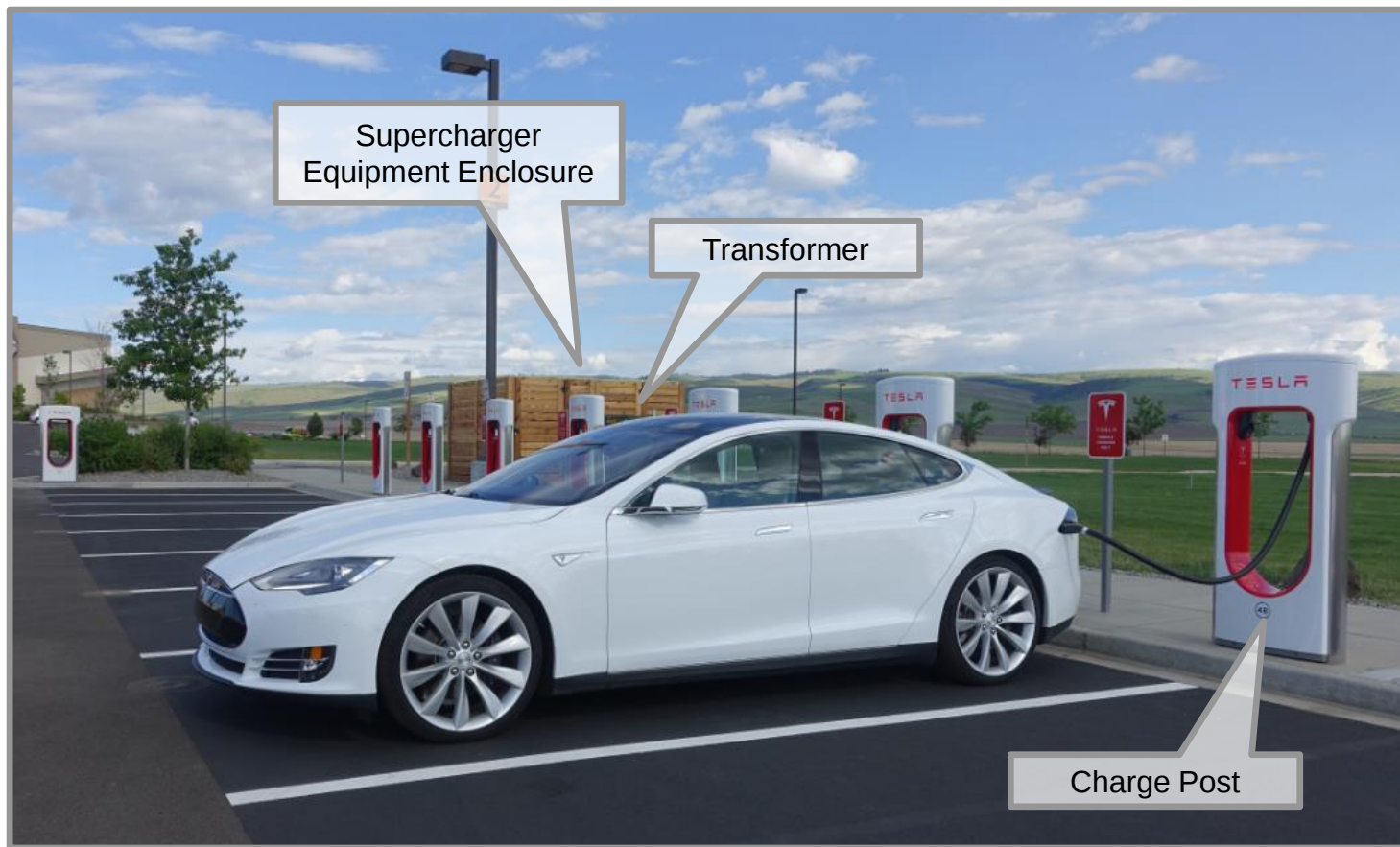
Supercharger Station Footprint



Different Supercharger Station Designs



Recently Built Tesla Supercharger



Our Contact Information:

South Bay: Dan Cronin – dcronin@tesla.com

East Bay: Adam Taylor – adtaylor@tesla.com

North Bay & SF: Robin Swartout– rswartout@tesla.com

Electric Vehicle Charge Network

Program overview



Together, Building
a Better California



- Program summary
- Customer journey
- Ownership
- Participant costs
- Rates and pricing
- Wrap up

Summary of approved decision

- **Scope:** 3-years, \$130M budget
- **Scale:** Up to 7,500 level 2 ports (approx. 500-750 sites)
- **Sites:** Multi-unit dwellings (MUDs) and workplaces
- **Ownership:** site or PG&E can own chargers, PG&E has limit to number they can own
- **Targets:** 15% in disadvantaged communities, 20% in MUD's

Current status and milestones

- Website and online application now available at www.pge.com/evcharge
- Full program launch in 2018



Key features

- All infrastructure from the transformer to the parking space will be paid for and coordinated by PG&E (construction, permitting, etc)
- In addition to the infrastructure, a portion of the charging equipment cost will be offset by the program¹
- Site has option to own the chargers (EV Charge Owner) or have PG&E own the chargers (EV Charge Sponsor)²
- Site can choose their charging equipment³
- Site can bill drivers or offer charging for free
- Site can define access to spaces (e.g., employees only, public use)
- Program requires a minimum of 10 contiguous spaces per site

¹Mechanism of offset depends on ownership model: rebate for site owned, participation payment for PG&E owned.

²PG&E ownership is available for MUD's and disadvantaged communities

³Equipment must be selected from qualified vendor list that meets quality and safety standards

1

Info & Application



Site hosts apply online at pge.com/evcharge

2

Initial Approval



PG&E reviews eligibility and site information

3

Preliminary Design



PG&E creates preliminary design; host chooses equipment

4

Final Design



PG&E and site host approve final designs. Host signs easement and participation agreement

5

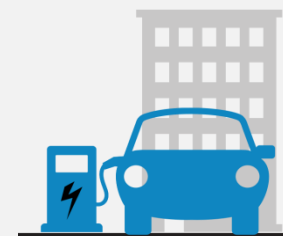
Construction



PG&E manages site construction with host

6

Activation



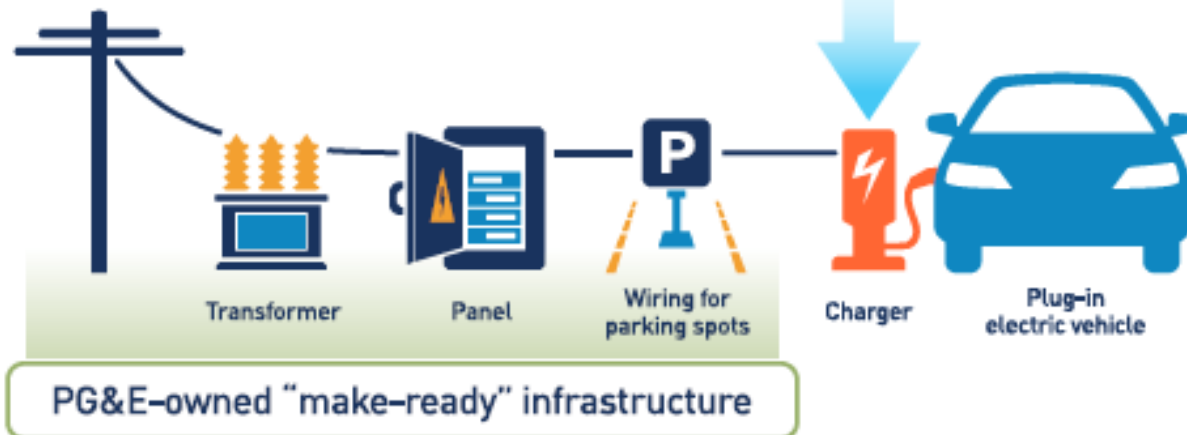
Chargers are energized and rebates are processed after inspection

Charger Ownership Options

EV Charge Owner: Site owns chargers

EV Charge Sponsor¹: PG&E owns chargers

Program participant or PG&E-owned
chargers: participant chooses



PG&E Owned Infrastructure

Regardless of who owns the chargers, PG&E will pay for, maintain, and coordinate all "make ready" infrastructure from the pole to the parking space (permitting, construction, etc). This is often 60-80% of the total project cost.

¹PG&E ownership is available for MUD's and disadvantaged communities

Program participant costs

Total costs will vary based on ownership, segment, and hardware

	EV Charge Owner (site owns chargers)	EV Charge Sponsor (PG&E owns chargers)
Infrastructure costs	No cost to site	No cost to site
Charger installation	Site responsibility	No cost to site
Ongoing costs (maintenance, network fees)	Site responsibility	No cost to site
Charger hardware	Site pays for hardware, receives rebate based on <u>segment</u>	Site pays PG&E a one time participation payment based on <u>segment</u> and <u>hardware</u>
Key benefits	Offers more charger options and greater control of maintenance and operations	Offers lower overall costs

Charger cost offsets

PG&E will provide program participants an offset for the cost of selected chargers based on:

1 Base Cost

The “base cost” is the cost of a basic charging configuration. Offset calculations will be based on this amount.

2 Site Segment

	Disadvantaged community	Other PG&E territory
Multi Unit Dwelling	100% of base cost	50% of base cost
Workplace	50% of base cost	25% of base cost

3 Selected Hardware

PG&E covers a portion based on segment

Site pays

Base cost

Extra cost for premium models

Rates and pricing

The site will always be the “customer of record” with PG&E and pay the electricity bill for the charging stations. If the site wishes to collect payments from drivers, they can work with their Electric Vehicle Service Provider (EVSP)¹ in two ways:

	Pass Through Pricing	Custom Pricing
Rates	Program participant pays Time-of-Use (TOU) rate to PG&E, using a dedicated meter that serves only the EV chargers.	
Pricing for EV drivers	Program participant passes the PG&E TOU rate directly to drivers.	Program participant creates their own pricing structure, such as free charging or flat-rate charging.
Pricing implementation	Program participant communicates the pricing structure to their Electric Vehicle Service Provider (EVSP).	Program participant communicates the pricing structure to their Electric Vehicle Service Provider (EVSP), and submits a load management plan to PG&E.

¹The Electric Vehicle Service Provider is the vendor that operates the stations and collects driver payments

Questions?

EVCN Website

www.pge.com/evcharge

BMW GROUP. SMART CHARGING AND STORAGE.



Technology Office USA.
December 2017.

**BMW
GROUP**

THE NEXT
100 YEARS



01

SMART CHARGING.

BMW SMART CHARGING VISION.

BMW envisions a future where electric vehicles help the grid reach **new levels of sustainability.**



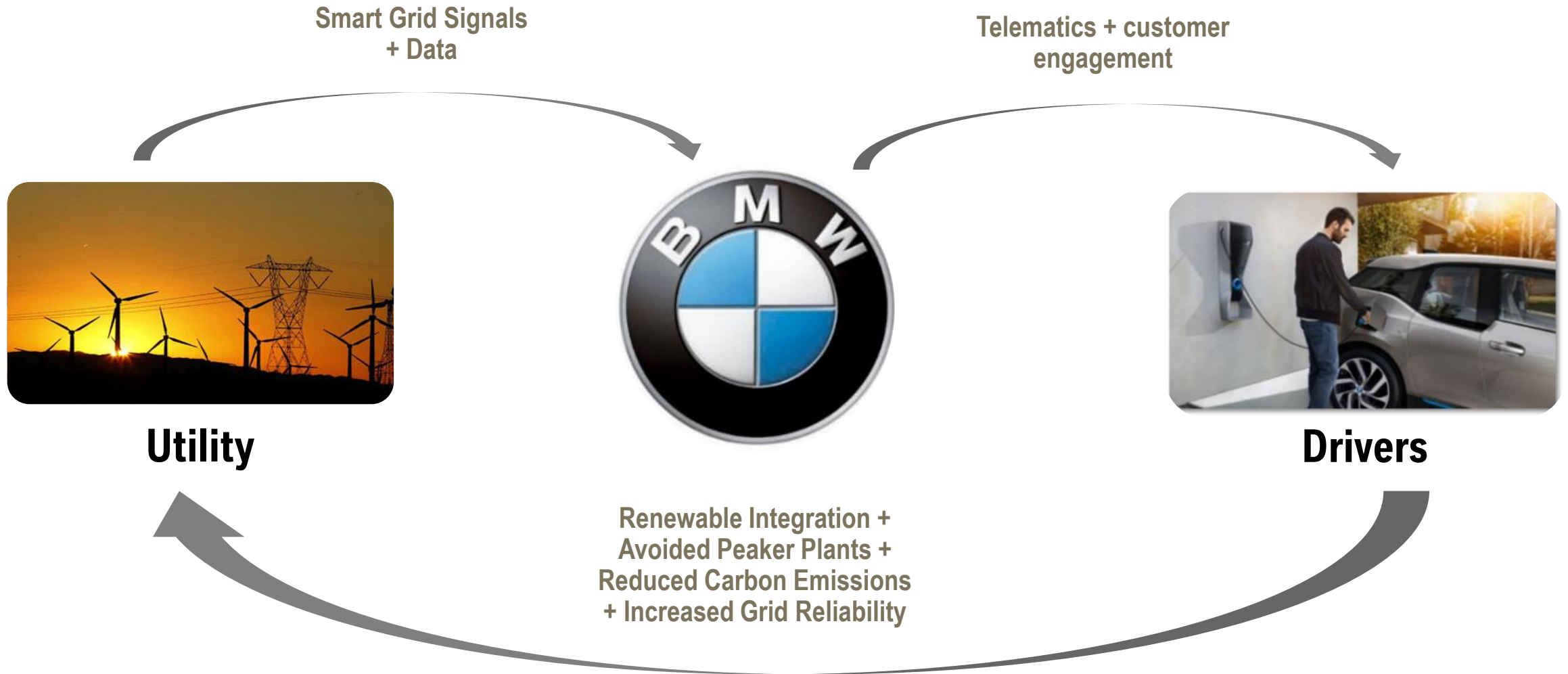
Utility



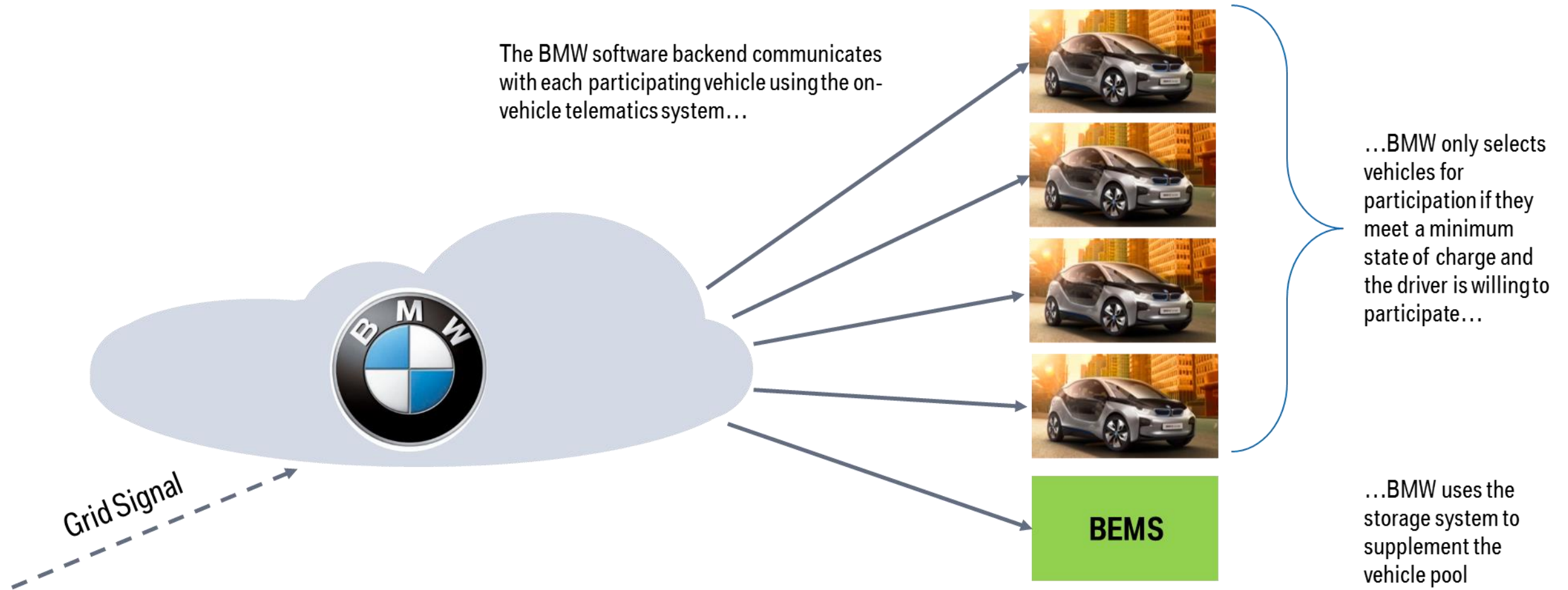
Drivers

BMW SMART CHARGING VISION.

BMW envisions a future where electric vehicles help the grid reach **new levels of sustainability.**



TECHNICAL SOLUTION: VEHICLE TELEMATICS.



THE CUSTOMER ALWAYS HAS THE RIGHT OF WAY.

BMW won't constrain drivers' mobility needs:

Automatic Enrollment in Demand Response Events, Rather than opting-in.

If the customer sets a departure time, it will always be obeyed.

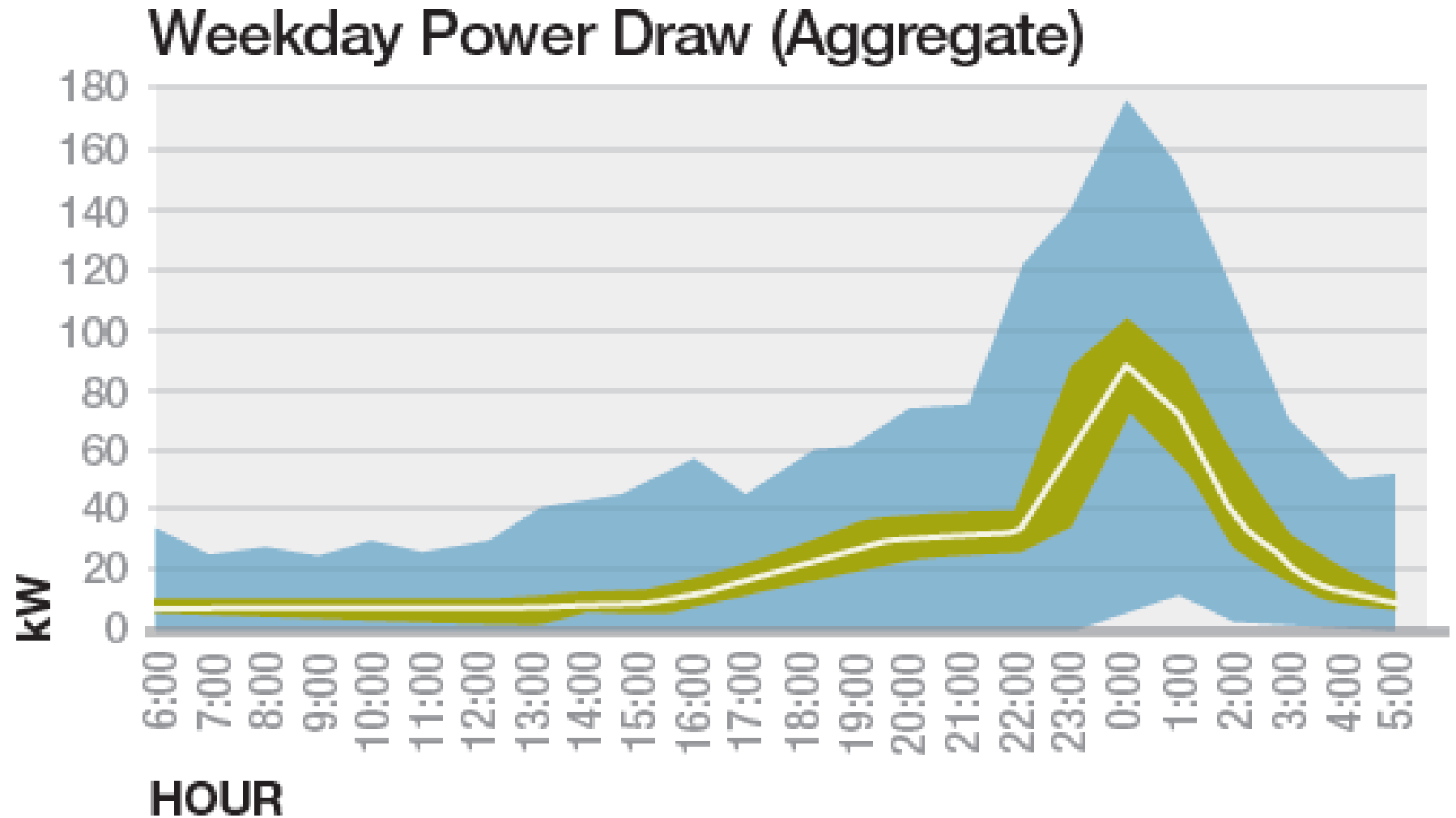
Pro-active opt-out: *'Today I don't want to participate'*.

Re-active opt-out: Push notification to inform customers if vehicle is paused from charging + option to react.



VEHICLES CAN BE AN EFFECTIVE GRID RESOURCE.

Successfully met load reduction for 90% of events using OpenADR and telematics.



BMW CHARGEFORWARD PHASE 2.

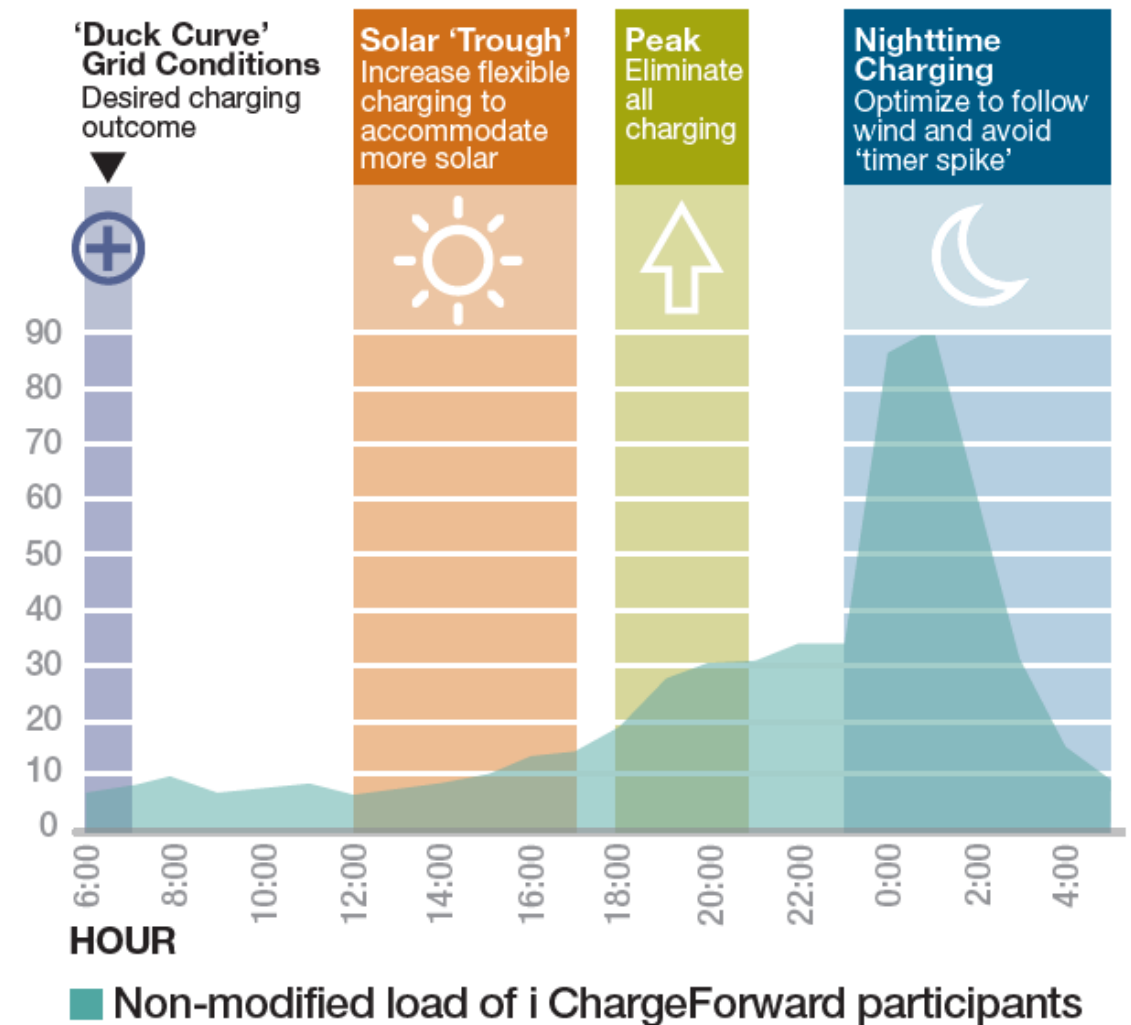
Smart Charging pilot project with the local electrical utility (PG&E) and real BMW electric vehicle drivers.

350+ participants throughout the San Francisco Bay Area.

Pilot Goal: Align charging with renewable energy and reduce utility grid operational costs.

Project Features:

- Optimizing nighttime charging
- Align away-from-home with solar generation
- Shifting charging across grid locations (home and away-from-home)
- Test advanced grid service functionality



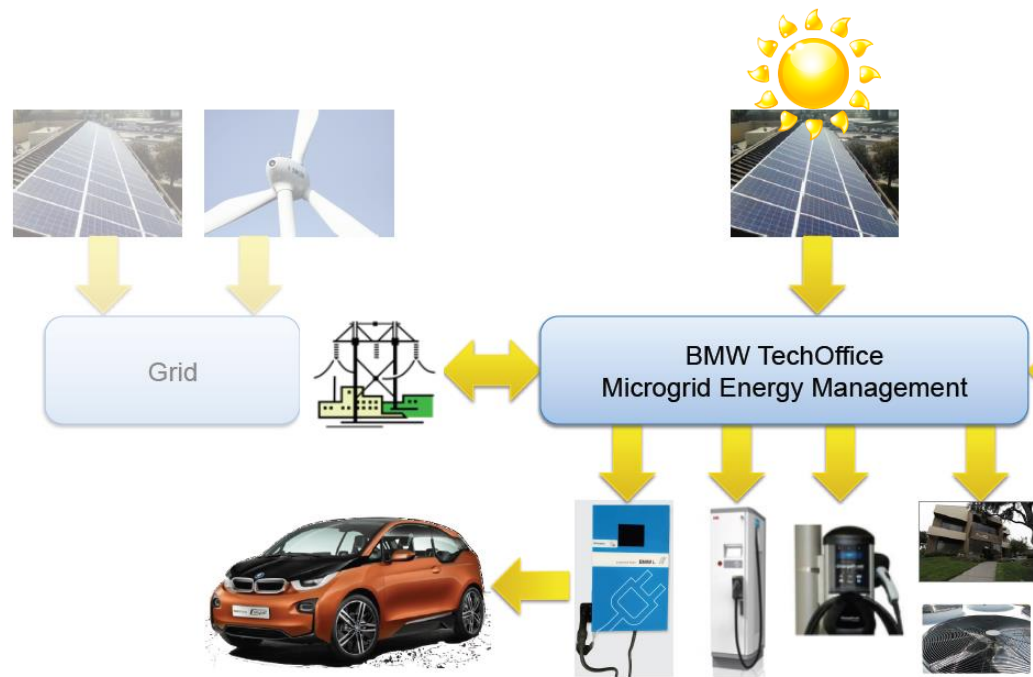
02

STORAGE.

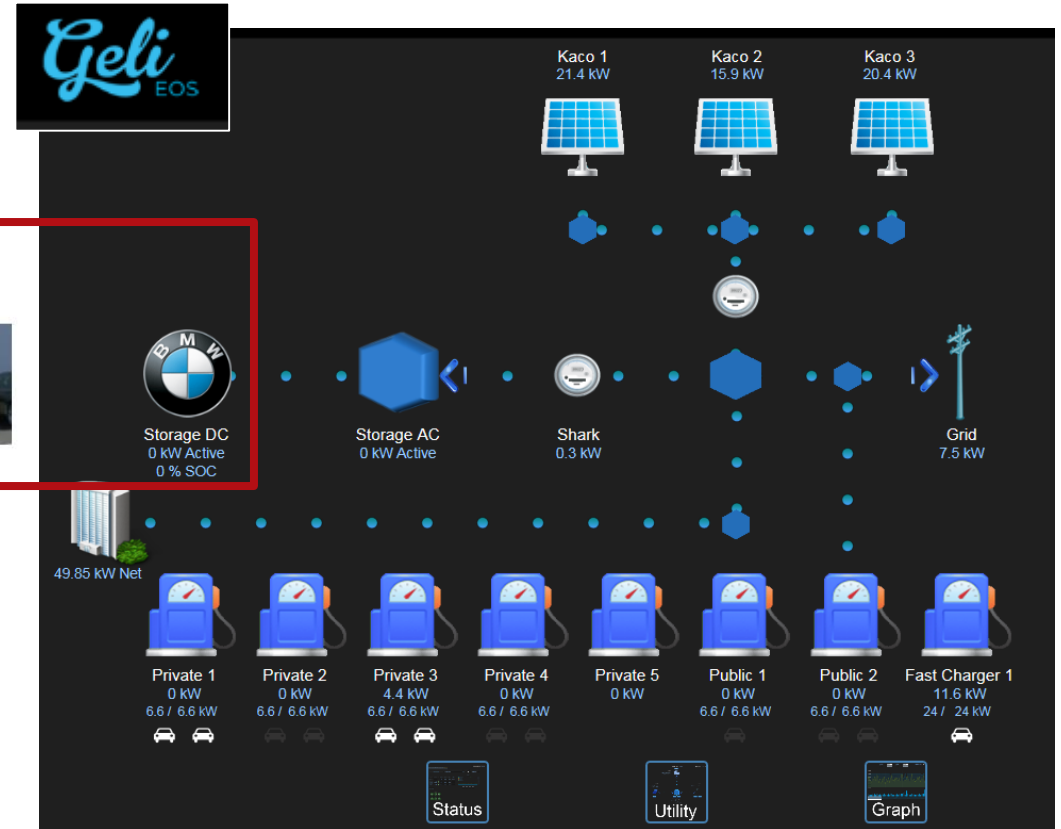
BMW BATTERY STORAGE SYSTEMS WORLDWIDE. PROJECTS IN ALL KEY REGIONS, RELEVANT SCALES AND MARKET-SEGMENTS.



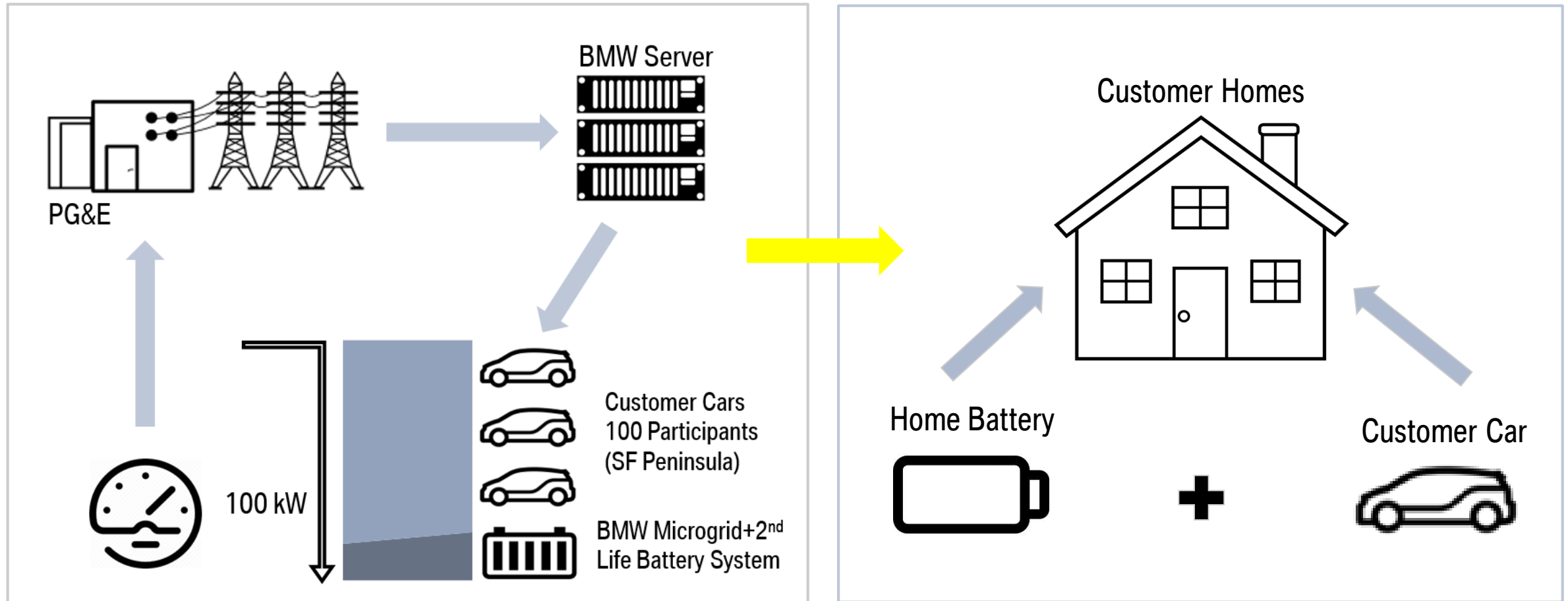
BMW I CHARGEFORWARD PHASE 1. TECHNOLOGY OFFICE 2ND-LIFE BATTERY SYSTEM.



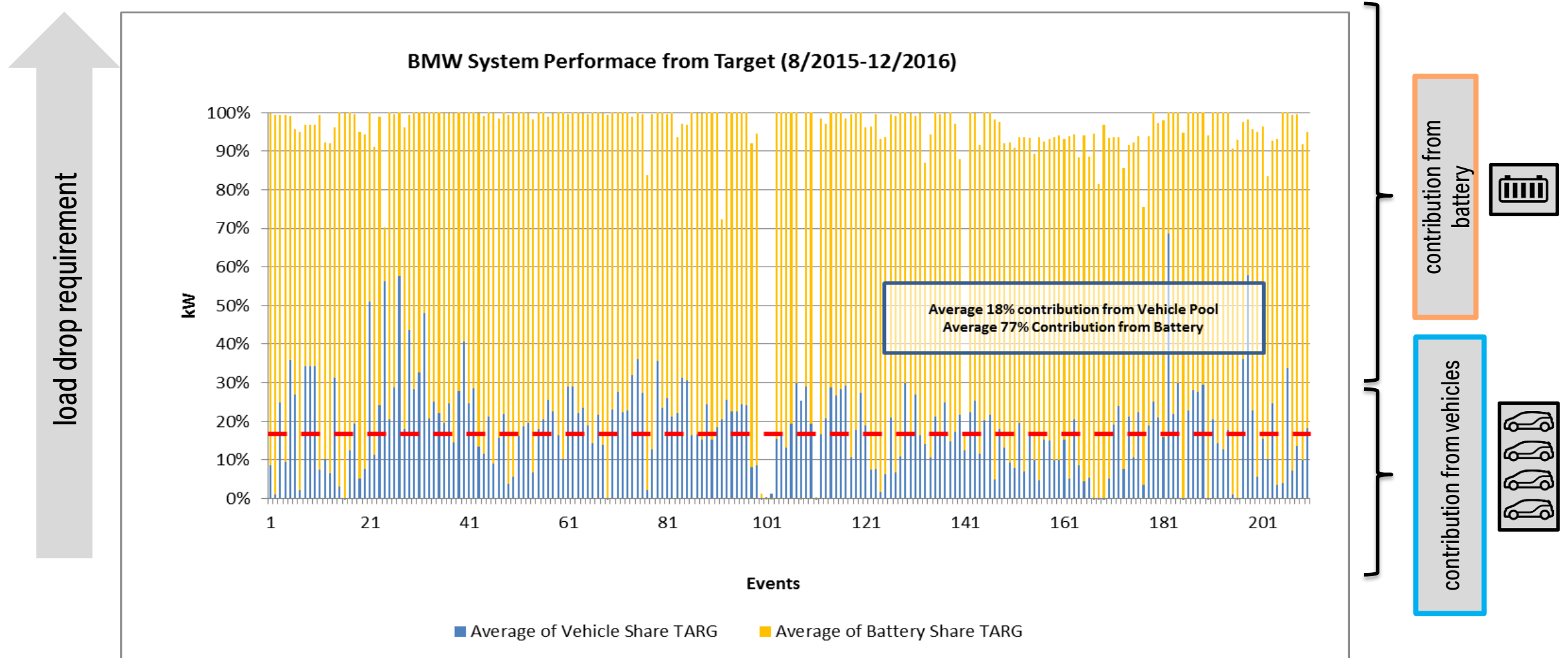
Living laboratory at the Tech Office
to evaluate innovative use cases.



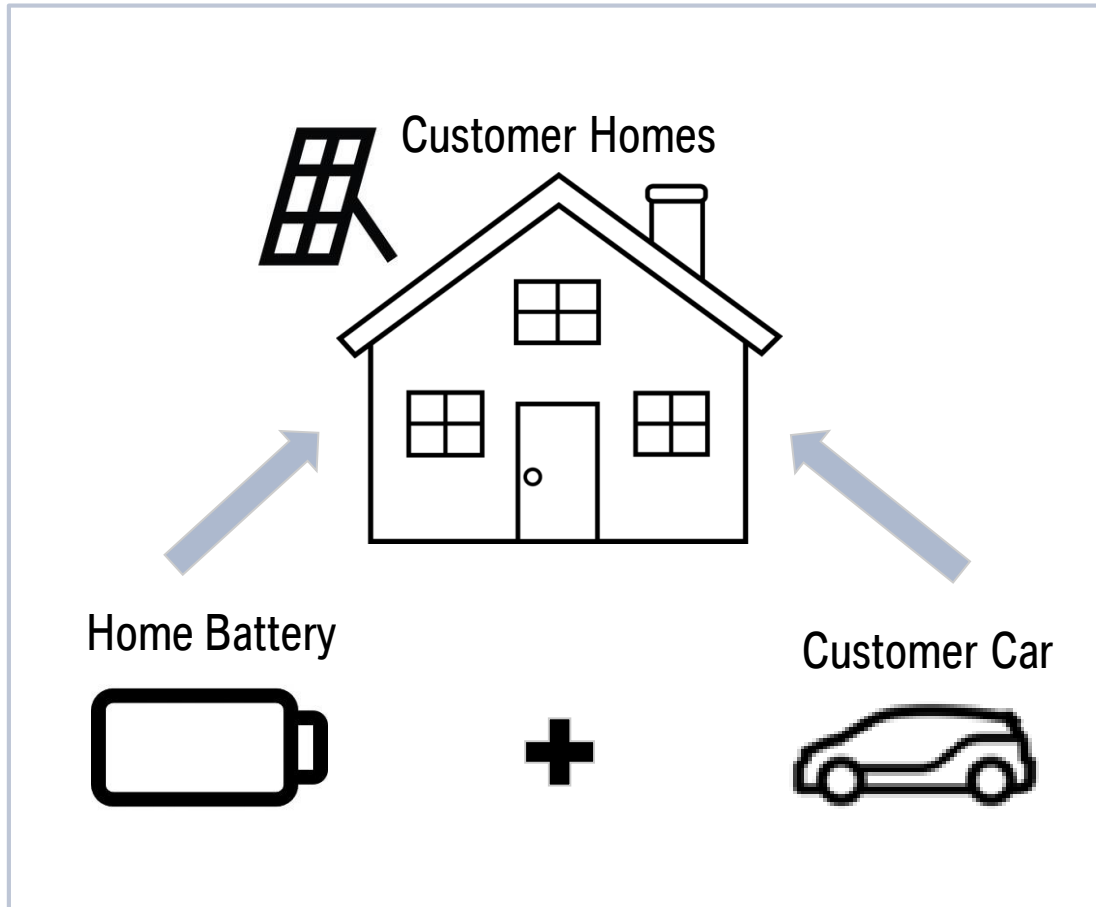
BMW CHARGEFORWARD STATIONARY BATTERY RESOURCE. SINGLE VERSUS DISTRIBUTED SYSTEMS.



BMW I CHARGEFORWARD PHASE 1 RESULTS. BATTERY RESOURCE MAKES UP 80% OF CONTRIBUTION ON AVERAGE.



BMW CHAREFORWARD PHASE 2. INTERACTION OF RESIDENTIAL ENERGY STORAGE AND EV CHARGING.



Research interests:

Investigate the interaction between EV and residential battery system under a variety of conditions...

- What conditions (electricity tariffs, solar, home load, etc.) make residential storage valuable to customers and the grid?
- What are the most valuable use cases?
- How does the ability to reach load reduction target change with distributed battery resources versus single central resource?



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THANK YOU.



Workplace Charging @ Google

*SVCE 'Watts for Lunch'
December 6, 2017*

*Rolf Schreiber, Program Manager
Energy Systems*

Workplace Charging: Motivations for Google

+ Alignment with Company Initiatives

- Sustainability - reduce overall corporate carbon footprint
- Environment - improve air quality in our community
- Obtain LEED certification for new building projects
- Support electrification of car & service vehicle fleet

+ Employee Benefits

- Day Zero demand for workplace charging!
- Enable employees with long commutes or without access to home charging to drive EVs
- Recruiting - workplace charging is a great perk!

+ Enable greater adoption of EVs via workplace charging

- Lead by example: encourage other workplaces to provide EV charging resources for their employees

Workplace Charging @ GOOG: The Early Days

Charging circa 2007

- + J1772: What's that?
- + Solar Carport with 110V cord reels powers Google.org's RechargeIt demonstration plug-in Prius fleet
- + Only plug-in cars are Priuses with Hymotion plug-in modules, plus a few legacy EVs



Fast Forward to 2010...

- + The plug-in vehicle ecosystem is rapidly changing
 - SAE J1772 adopted as industry standard
 - Production plug-ins (Volts and LEAFs) are on their way
 - Google's GFleet carsharing program (including the RechargeIt Priuses) is getting a refresh with new production plug-in vehicles
 - Googlers (early adopter tech geeks by nature) are already clamoring for workplace charging
 - Ad-hoc/reactive response to demand just won't scale
- + Google needs a holistic plan for workplace charging!
 - Commissioned a planning & deployment team
 - Members from green biz-ops, transportation, real estate, facilities
 - Put out an RFP to find the best solution

Workplace Charging: The Plan

- + **Goal: provide charging at 5% of regular parking spaces**
- + Provide free charging for employees and visitors
- + Design for scalability and low operational overhead
- + Standardize on J1772-based Level 2 charging stations
 - can support multiple charging sessions per day
 - better driver experience than Level 1 + travel charger
- + Require networked charging stations featuring:
 - remote management, monitoring & reporting
 - flexible access controls
 - driver features: realtime status/mapping & notifications
 - analytics
 - capability for future energy & station management via API

Workplace Charging: The Plan (con't)

- + Design with future expansion in mind
 - conduit, electric panel space, etc.
- + Provide additional flexibility
 - Charging pods include 240V + 110V GFCI outlets
 - Support for legacy EVs without J1772 charging ports
 - Provide shorepower for events, mobile command centers
- + Amend building project requirements to include EV charging for any building renovations or new buildings
- + Develop & deploy regular inspection, testing & cleaning program



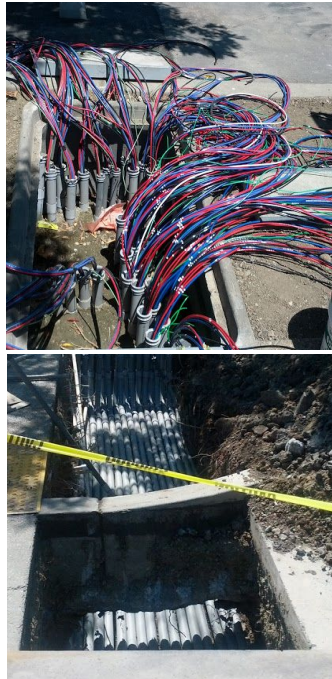
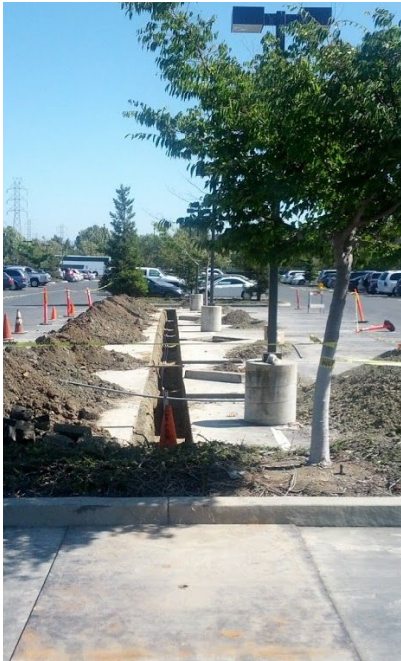
Project Planning - Siting Considerations

- + Placing the charging stations - factors considered
 - Proximity to building's power infrastructure
 - Best way to provide ADA-accessible space
 - LEED certification reqt's (e.g. preferred parking location)
 - Default to head-to-head parking when possible
 - ... but may conflict with LEED requirements



Typical Charging Station Deployment

- + Charging "Pod": Level 2 EVSEs + 240V NEMA 14-50R + 110V GFCI
- + Energy monitoring (Veris meters) deployed at service panels, integrated into building energy monitoring system
- + Accommodates future expansion (extra conduit to Christy boxes, capacity in circuit breaker panels, etc.)



Some of the Challenges

- + Providing accessible charging at each site
 - Must meet all ADA requirements, e.g. parking space dimensions, path of travel, grading
 - One accessible charging space required per 25 chargers
- + Code requirements may differ between cities
 - ADA requirements not uniform
 - EVSE disconnect switches required by some cities (Palo Alto)
- + Is workplace charging a taxable benefit?
 - “Commuter Tax Benefits” in IRS tax code allows fringe benefit exclusion for qualified parking... let the tax team figure it out!



PARKING FOR
EV CHARGING
ONLY

USE LAST

THIS SPACE
ALSO DESIGNED
FOR DISABLED
ACCESS

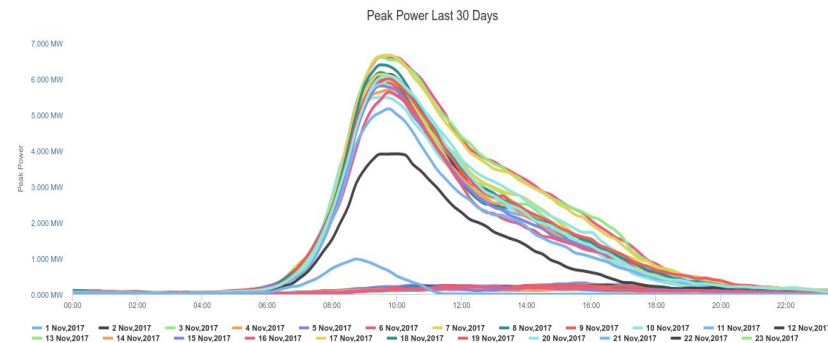
Thinking outside the (hardwired) box...

- + Self-contained solar carports
 - Augment charging at buildings with limited electrical capacity
 - Deploy in spaces where hardwired stations can't go
 - parking lots with no electrical infrastructure
 - buildings with temporary occupancy
 - sites we can't modify (historic designation, etc.)
 - Solar units still utilize networked charging stations
- + Mobile charging services



Current EV Charging Stats

- + Google Bay Area + 14 other US locations
 - 1200+ Level 2 ChargePoint Stations (2300+ ports)
 - 7 high power (30kW) chargers for MV Community Shuttle (provided to City of Mountain View by Google)
 - Nissan DC Quick Charger (CHAdeMO)
 - ABB DC Quick Charger (SAE Combo + CHAdeMO)
 - 6000+ registered EV drivers
- + A Typical Day at Google
 - 2900+ charging sessions
 - ~30 MWh energy delivered
 - Peak load ~6.5MW!
 - 12,000kg+ GHG avoided
 - 2200+ gallons of fuel displaced



Observations & Lessons Learned

- + ~1000% Growth after just three years!
 - Significantly faster adoption than originally anticipated
 - Stations were already oversubscribed at ~2 year mark
 - Already way past early adopter & fast follower stages
- + Some changes in strategies/policies along the way
 - Raised target charging capacity to 10% of parking spaces
 - Parking at charging stations now for active charging only
 - Preferred EV parking locations not needed or desired
 - Locate charging stations at head-to-head parking
 - New mantra: move cords, not cars!
 - Grassroots EV communities work well!
 - encourage local email lists and “swap buddies”
 - Implemented Waitlist feature at many locations
 - Stronger push to incentivize home charging as “primary”

Observations & Lessons Learned

- + Challenge: balancing EV adoption against trip reduction
 - Trip reduction even higher priority than EV adoption; ever increasing traffic & parking demand at Google
 - Compelling workplace charging benefit can inadvertently lead to more SOVs
 - Don't want to incentivize drivers to choose an EV over biking, carpooling, company shuttles or public transportation
 - Do want to incentivize EV carpools!

What's Next?

- + Scale up even further!
 - Deploy new features to better manage oversubscription
 - Enable higher density of charging ports via software controls that dynamically manage peak charging load
- + Develop strategy to mitigate peak load/demand charges
 - Active management of charging load via smart charging
 - Add onsite generation where possible (e.g. solar)
 - Integration of onsite storage
- + Explore possibility of monetizing workplace charging by providing grid services (fleet & employee vehicles)

A Peek at Charging Stations around Campus



Thank You! Any Questions?



Appendix

Further Engagement in Workplace Charging

- + Workplace Charging Advocacy
 - Member of the Department of Energy's "EV Everywhere Workplace Charging Challenge" since its inception
- + Ongoing work with Plug In America
 - Promote workplace charging & employee EV adoption
 - Pioneered "Experience Electric" test drive events
- + Collaboration with CALSTART
 - Hosted workplace charging summit at Google
 - Charter member of CALSTART's Employer EV initiative
- + Participated in case study for California PEV Collaborative

