PG&E’s BMW i ChargeForward Pilot Program

October 19, 2015
Pacific Gas and Electric Company

**Company Facts**
- Fortune 200 company located in San Francisco, CA
- $17B in operating revenues in 2014
- Over 22,000 employees

**Energy Supply**
- Services to 15M people:
  - 5.2M Electric accounts
  - 4.3M Natural Gas accounts
- Peak electricity demand: Approx. 22,000 MW
- Approx. 55% of PG&E’s electric supply comes from non-greenhouse gas emitting facilities

**Service Territory**
- 70,000 sq. miles with diverse topography
- 160,000 circuit miles of electric transmission and distribution lines
- 49,000 miles of natural gas transmission and distribution pipelines

BMW leads EV innovation by leveraging customer feedback

MINI E (2009-2012)
- Comprehensive user study of EV driving & charging patterns, range needs, etc.
- Battery 2\textsuperscript{nd} Life pilot projects using MINI E battery packs

Active E (2012-2014)
- Continued broad user study of “Electronauts”
- Established award winning “Renewable Energy Certificates with Green Mountain Energy

i3 Series (2014-to date)
- Leveraged MINI E and Active E user studies to develop EV from the ground up
- Launched BMW i ChargeForward program
PG&E and California are seeing strong EV market growth but barriers to adoption still exist

3 Key EV challenges today:
1. Higher upfront cost of EVs relative to conventional vehicles
2. Range anxiety and lack of available charging infrastructure
3. Lack of easily-accessible customer information about EVs

Cumulative EV Sales by County

PG&E Service Area

70,000 EVs in PG&E service area today

1. EPRI, R.L. Polk Data, Sep 2015
PG&E’s resource mix has changed significantly and will continue to change.

### 2002 Actual
- 11% of total bundled retail sales

### 2013 Preliminary
- 22% of total bundled retail sales

### 2020 Projected
- 33% of total bundled retail sales

**Total RPS-Eligible Procurement**
- **2002 Actual**: 7,504 GWh
- **2013 Preliminary**: 17,030 GWh
- **2020 Projected**: ~26,500 GWh

Note: Generic means PG&E will procure from to be determined resources. Some of these resources will be procured through mandated programs such as: RAM, ReMAT and upcoming SB 1122 bioenergy feed-in tariff.

Flexible resources will be an important part of the resource mix in the near future

Load, Wind & Solar Profiles – High Load Case
January 2020

8,000 MW in 2 hours
6,300 MW in 2 hours
13,500 MW in 2 hours
Goal of the pilot is to reduce the overall cost of EV ownership, increasing EV sales while supporting the grid.

**PG&E-BMW Contract**

- Grid services Provided to PG&E

**BMW-Driver Incentive ($$$ / vehicle)**

- Automated response of Vehicle/2\textsuperscript{nd} life batteries

PG&E - BMW Contract

BMW- Driver Incentive

Grid services PROVIDED to PG&E

Automated response of Vehicle/2\textsuperscript{nd} life batteries
Significant demand for the pilot with over 500 customers indicating interest in 100 available spots.
BMW selects vehicles for charging delay based upon owner preferences and notifies customers, who can opt out as desired. Stationary battery provides additional power as needed.

BMW leverages “smart charging”, battery storage or both to supply grid services to PG&E

1. PG&E contacts BMW server (OpenADR 2.0b) to request load drop

2. BMW Server

3. Customer Cars

100 kW

Monitoring equipment verifies that total desired load drop is achieved.
BMW has met performance targets with a combined approach in each event since project launch.
Evening demand response events have resulted in a significantly higher share from the pool of EVs.

Weekday Residential Vehicle Charging

- DR events between 7-8AM resulted in an average of ~5% from the vehicle pool.
- DR events between 8-9PM resulted in an average of ~33% from the vehicle pool.
Time-of-use rates likely influence charging behavior for *many* customers

**Weekday Residential Vehicle Charging**

- **Anytime Chargers**
- **Scheduled Chargers**

- **Power Draw (kW)**
- **Hour of Day**
Customers charge during the day more but overall less on the weekend.
BMW and PG&E will partner with a research institution to better understand the following:

1. Motivation for Pilot Program Participation
2. Customer Feedback on Program Mechanics
3. Understand Role of Incentives
4. Smartphone App User Testing
5. Identify customer’s home electricity needs

Estimate contract executed by end of October 2015
Thank You!

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The i ChargeForward pilot is focused on evaluating three key objectives that may lead to scalable programs.

1. Determine if automakers are willing to provide grid services

2. Evaluate the benefit of smart charging and second-life battery uses

3. Develop incentives to reduce the total cost of owning an EV
PG&E has been working closely with automakers on this pilot since mid 2013

BMW i ChargeForward Timeline

- **2013**
  - RFI Released 3Q 2013

- **2014**
  - RFP Released 3Q 2014

- **2015**
  - Pilot Launch
    - BMW enroll up to 100 customers

- **2016**
  - Grid Services Provided
    - 100kW provided via smart charging and/or 2nd life batteries

- **2017**
  - BMW Selected for Pilot 4Q 2014