

# EVS26

GRANDES MENTES PENSAM ELETRICAMENTE  
LAS MENTES BRILLANTES TIENEN IDEAS ELÉCTRICAS  
**GREAT MINDS THINK ELECTRIC**  
LES GRANDS ESPRITS S'ILLUMINENT  
AGAR BUDDHIMAN HO BIJLI YAAD KARO  
GROTE GEESTEN ZIJN VERLICHT KLUGE KÖPFE DENKEN ELETRISCH

*26th International Electric Vehicle Symposium*

## A First Look at the Impact of Electric Vehicle Charging on the Electric Grid in The EV Project

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Laboratory

ORGANIZED BY THE WORLD ELECTRIC VEHICLE ASSOCIATION, WEVA

HOSTED BY ELECTRIC DRIVE TRANSPORTATION ASSOCIATION, EDTA

IN COLLABORATION WITH



# Idaho National Laboratory

- U.S. Department of Energy (DOE) Federal laboratory
- 890 square mile site with 4,000 staff
- Support DOE's strategic goal of reducing the nation's dependence on foreign oil
- Multiple RDD&D programs
  - Nuclear, renewable, and unconventional fossil energy
  - Advanced vehicles and batteries
  - Homeland security and cyber security

- Overview of the EV Project
  - Project objectives
  - Product specs
  - Current status
- Early results
  - Impact of Nissan LEAF™ residential charging on the electric grid in Q4 2011

World's largest EV infrastructure deployment project

- Build mature EV charging infrastructure in 14 US regions
- Study:
  - Infrastructure deployment process
  - Customer driving and charging behavior
  - Impact on electric grid
- Create a learning laboratory to understand the infrastructure deployment requirements for the first 1 million grid-connected electric drive vehicles

- Deploy >13,000 residential and public EVSE units
- Enroll >8,000 privately owned Nissan LEAF battery electric vehicles and Chevrolet Volt extended range electric vehicles
- Deployment from Oct 2010 – Dec 2013
- INL data collection phase from Jan 2011 – Dec 2013



## Sponsor



## Primary Partners



ECotality North America



Nissan North America



Chevrolet



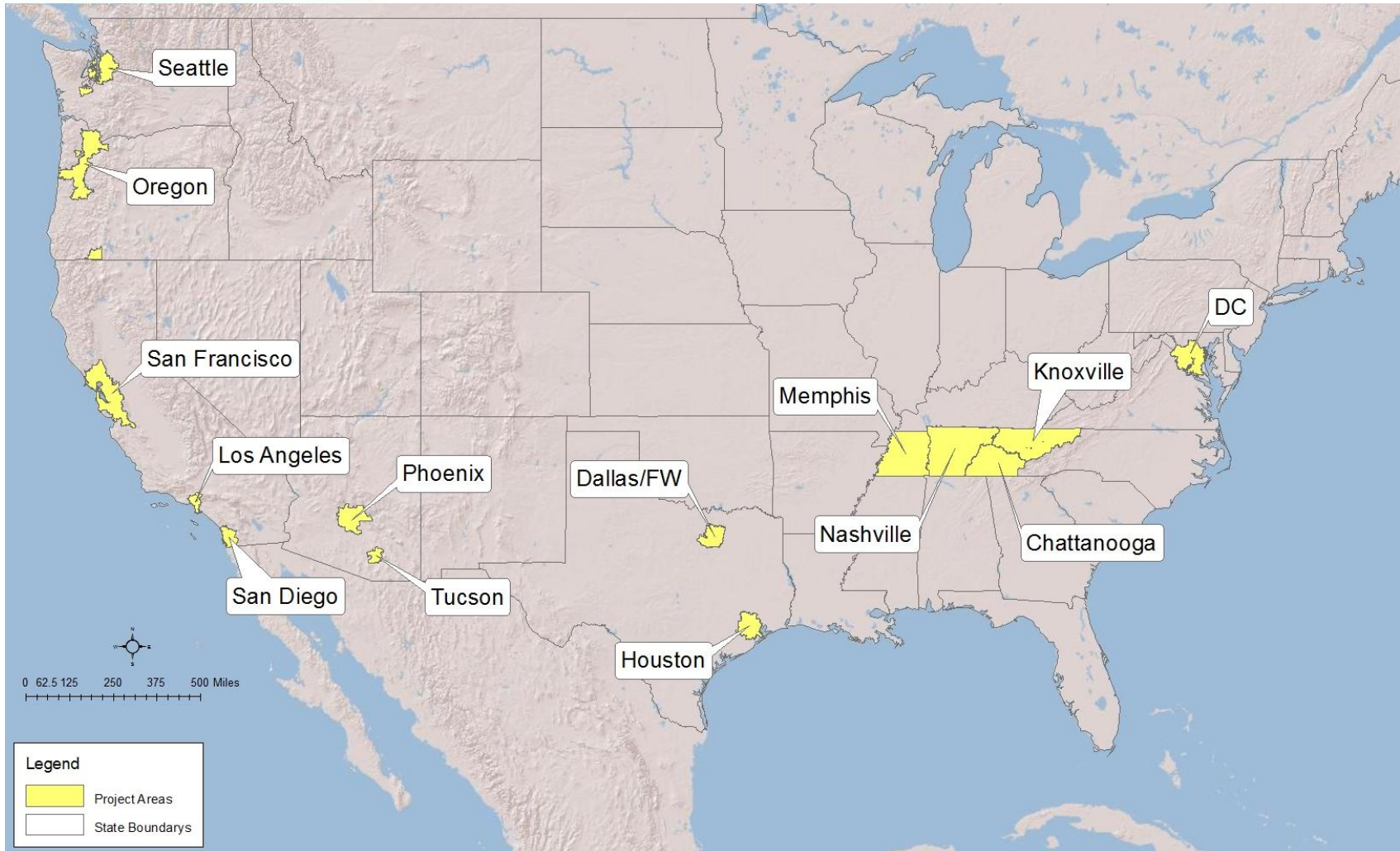
Idaho National Laboratory

# EVS26

MAY 6-9, 2012  
LOS ANGELES, CALIFORNIA

ELECTRIC VEHICLE SYMPOSIUM

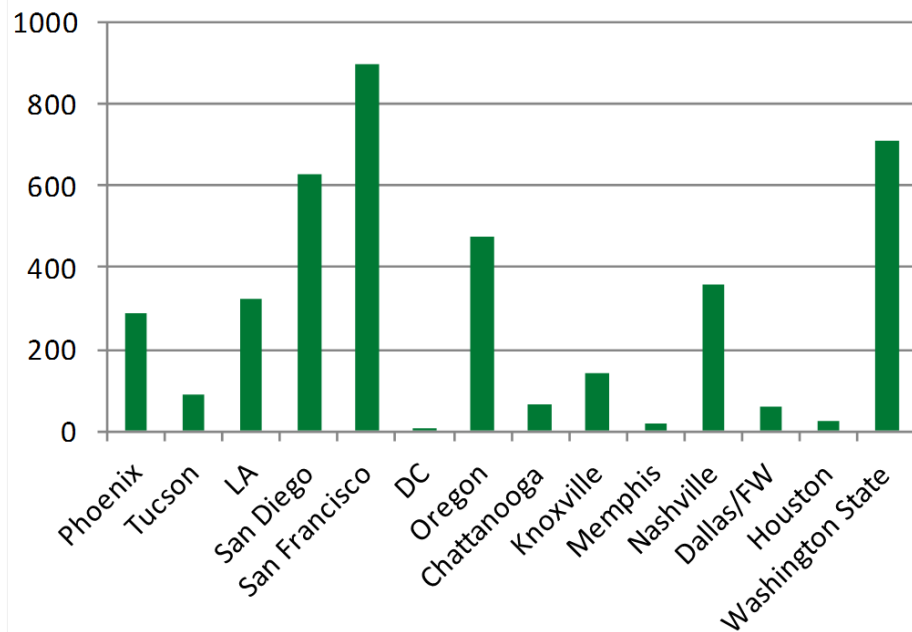
## The EV Project Regions



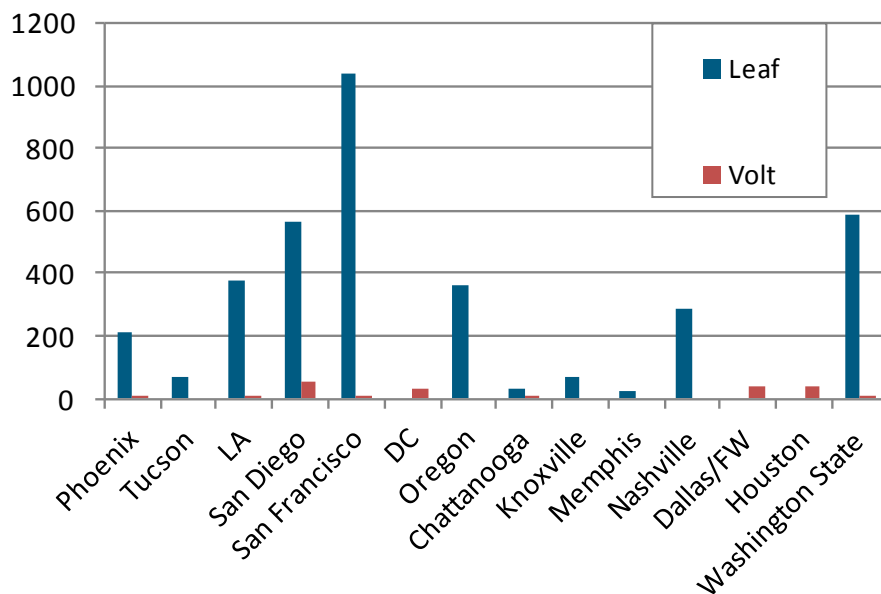
# Deployment at the end of 2011

- 3,785 EVSE (467 publically available)
- 3,629 LEAFs, 218 Volts

Number of EV Project EVSE Installed to Date\*



Number of EV Project Vehicles Enrolled to Date\*



\* Varies from manuscript due to refinement of reporting criteria

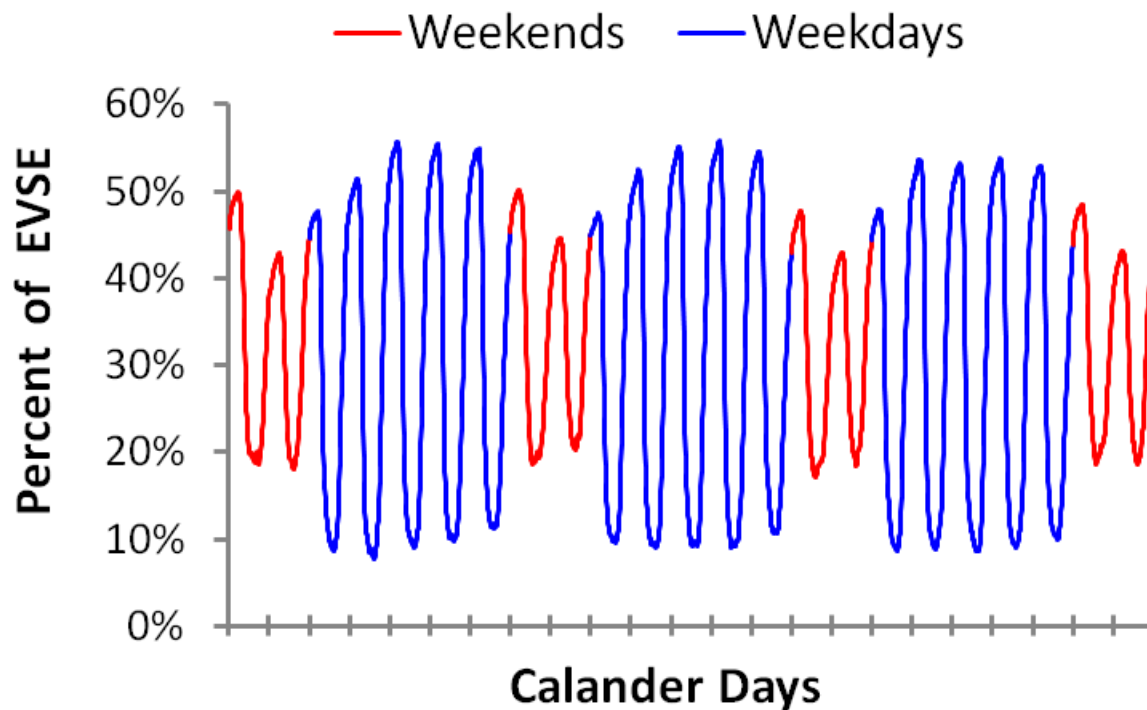


- Share early EV Project residential EVSE usage and demand on the electric grid
  - Residential AC Level 2 EVSE in private households with Nissan LEAF battery electric vehicles
  - Based on data collected from 2,704 EVSE in Q4 2011
- This information is provided to help analysts assess the impact of early adopter PEV charging on the electric grid

Two metrics:

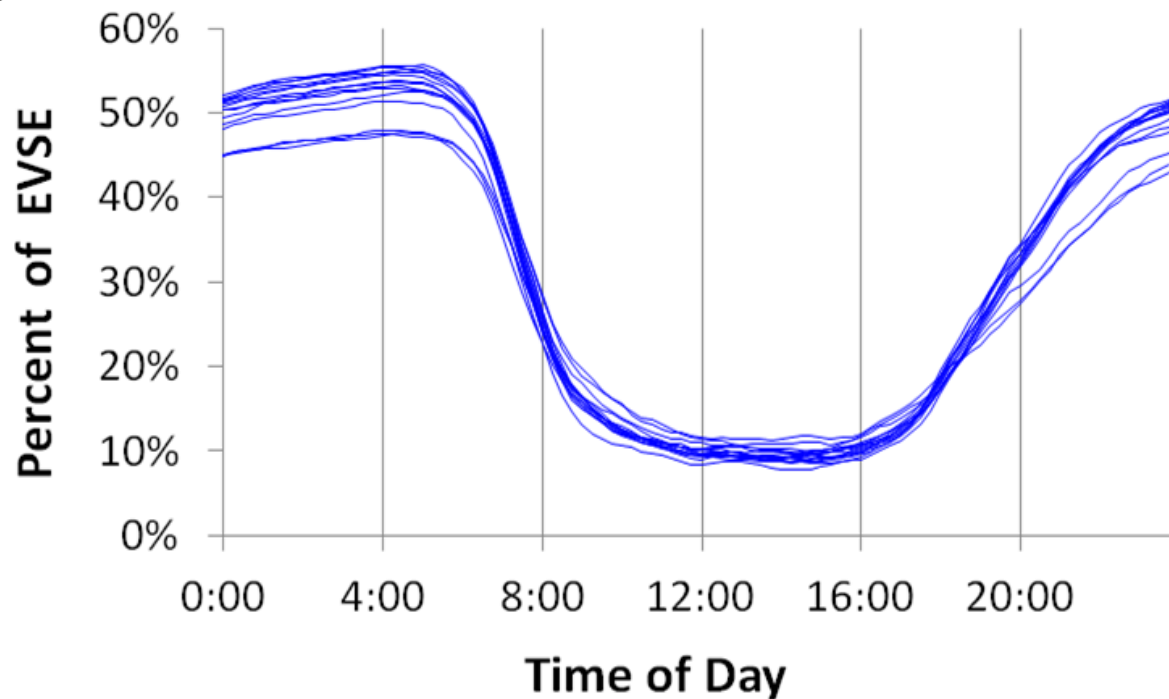
- Charging availability
  - the percentage of EVSE in a geographical area that are connected to a vehicle at a point in time
- Charging demand
  - total amount of power being drawn from the electric grid by EVSE in a geographical area at a point in time

- Percent of EVSE with a vehicle connected vs. time over a 3 week period



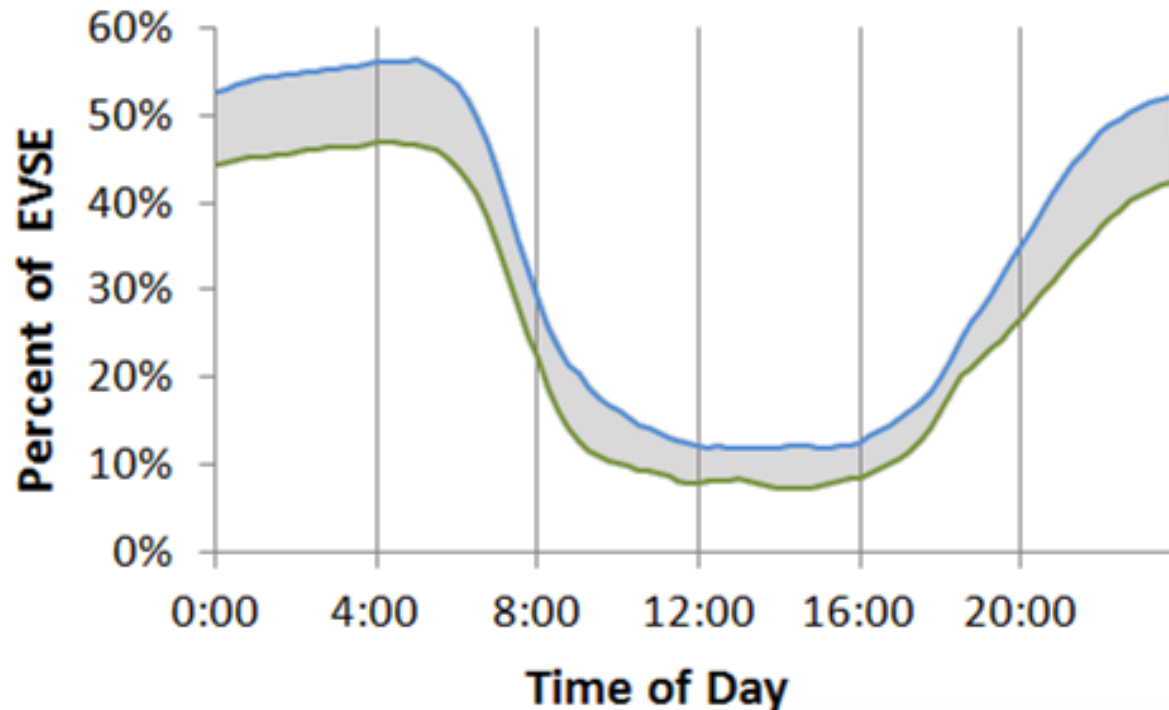
## Charging Availability Time-of-day Plot

- Charging availability curves for each calendar day are superimposed on the same 24-hour scale



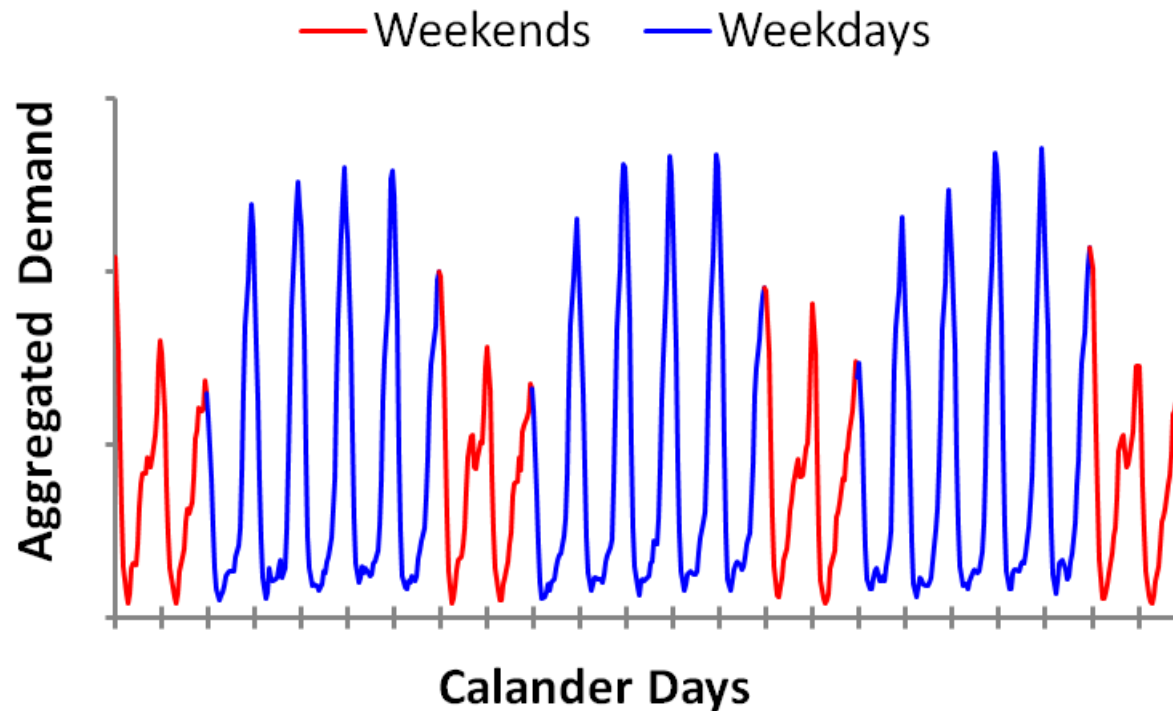
## Charging Availability Time-of-day Plot

- Fill in area between the maximum and minimum curves at each point in time to reduce noise



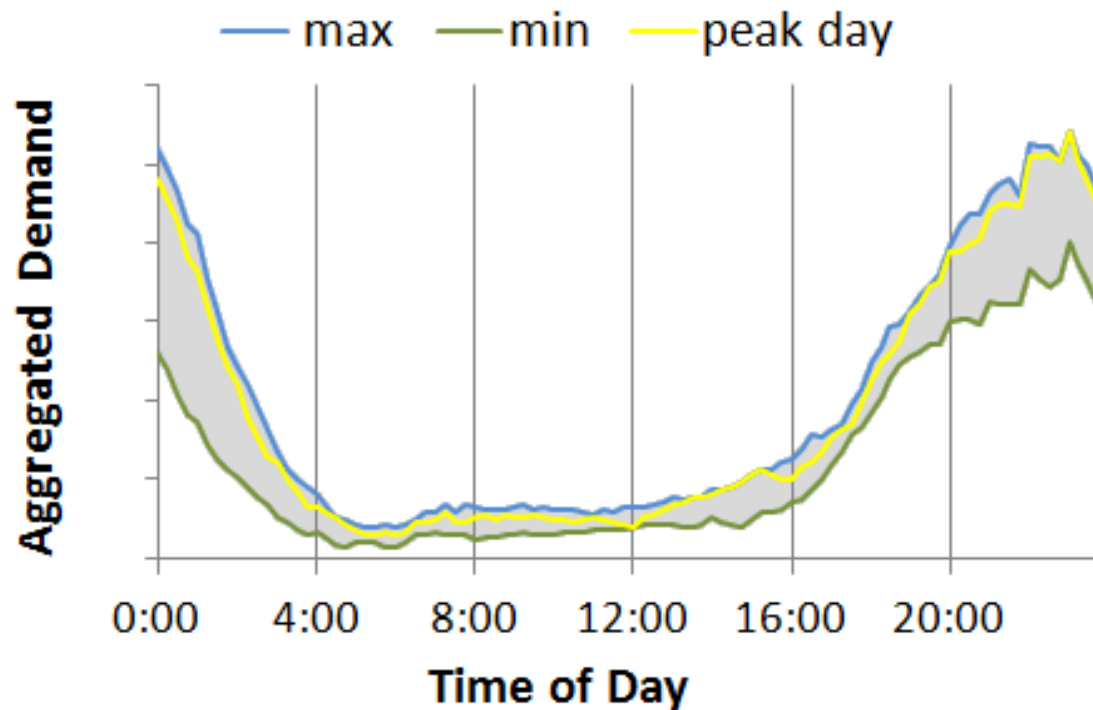


- Follow same process for charging demand



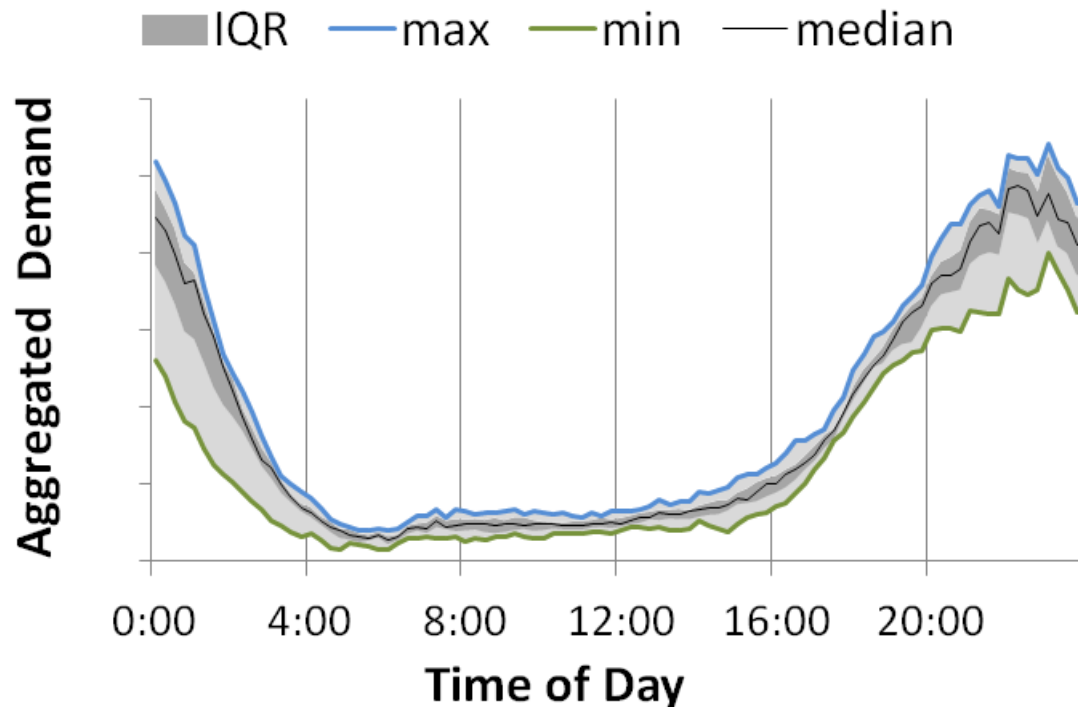
## Charging Demand Time-of-day Plot

- Add line to show demand on single calendar day with peak demand



## Charging Demand Time-of-day Plot

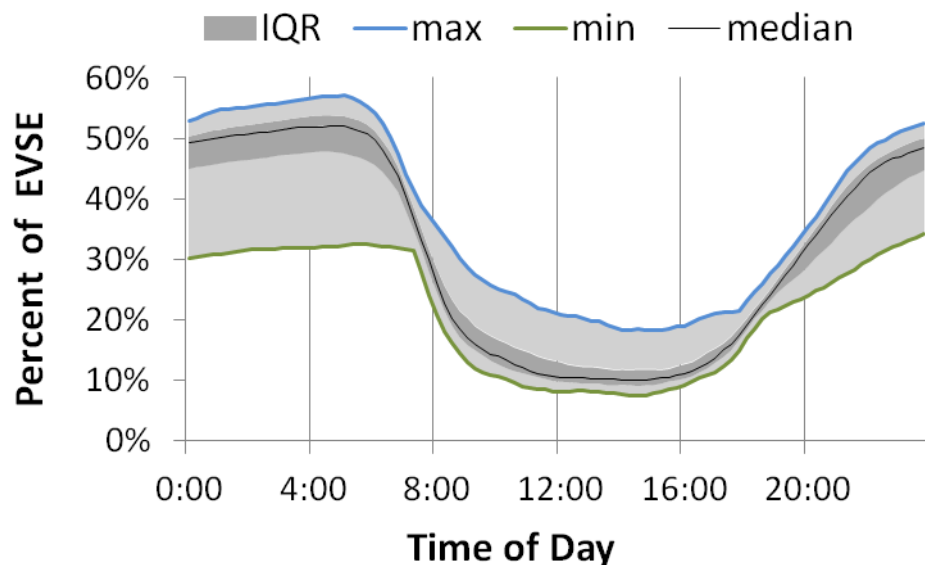
- Or show distribution using min, median, max, and inner quartile range



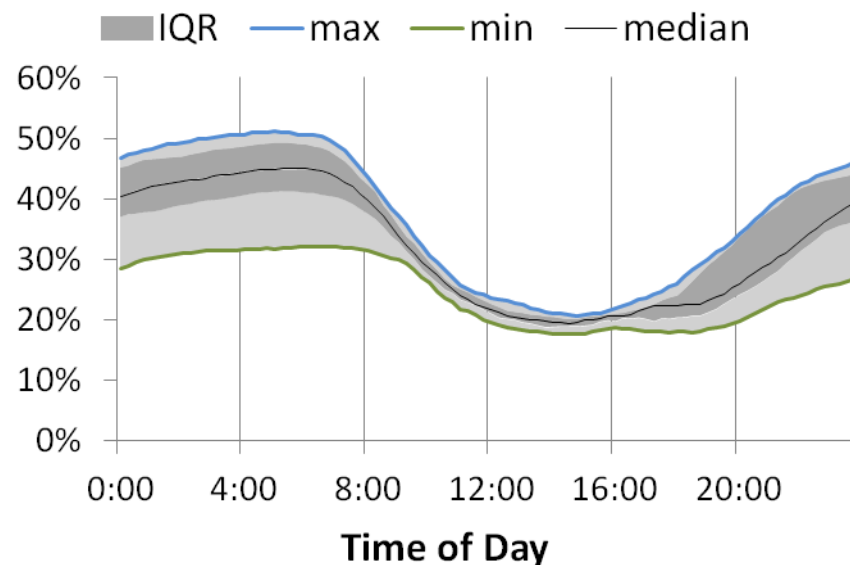
# 2011 Results: Charging Availability

## All EV Project Regions

### Weekday



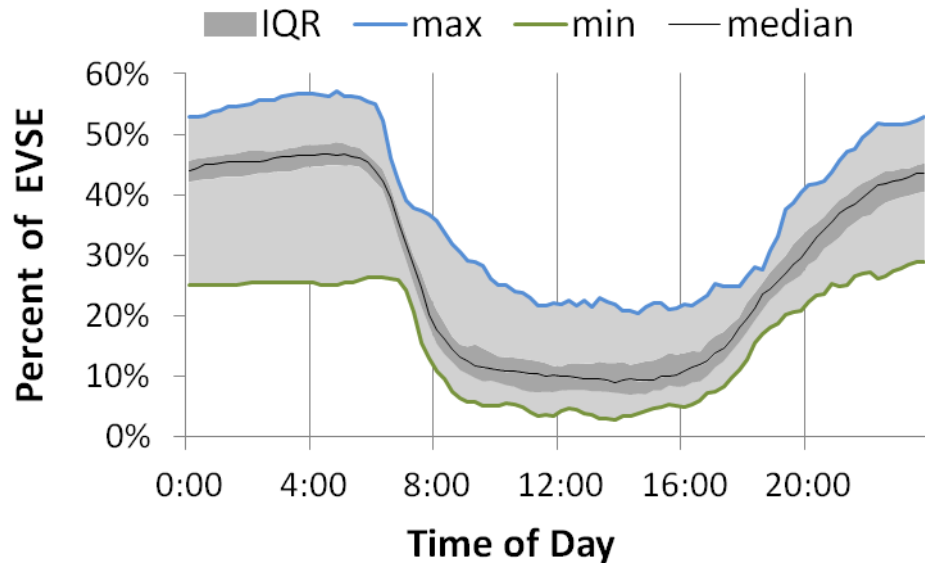
### Weekend



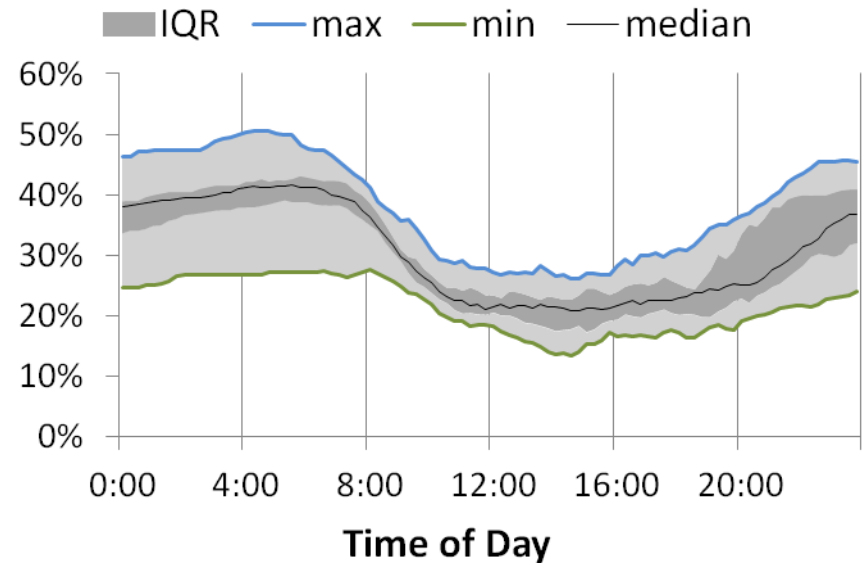
# 2011 Results: Charging Availability

## Nashville Region

### Weekday



### Weekend

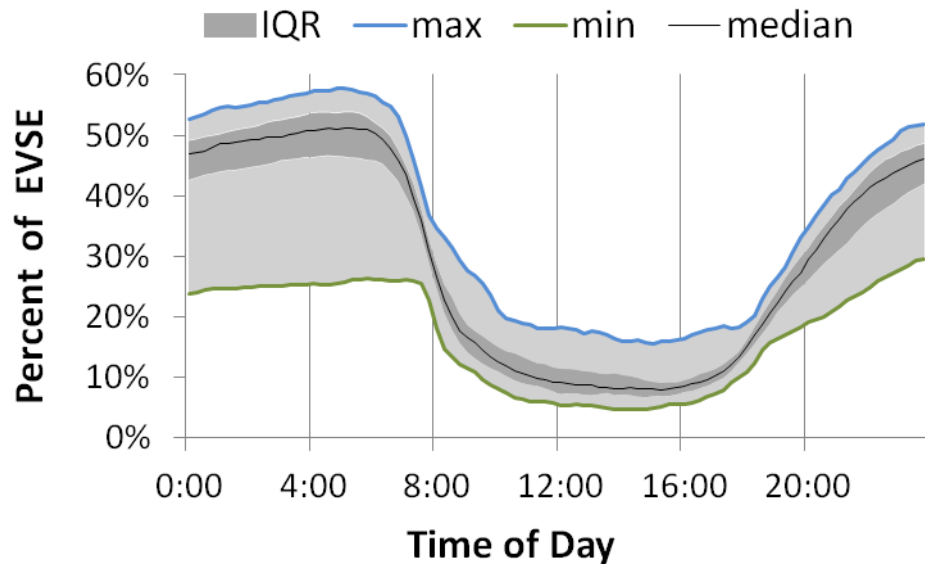




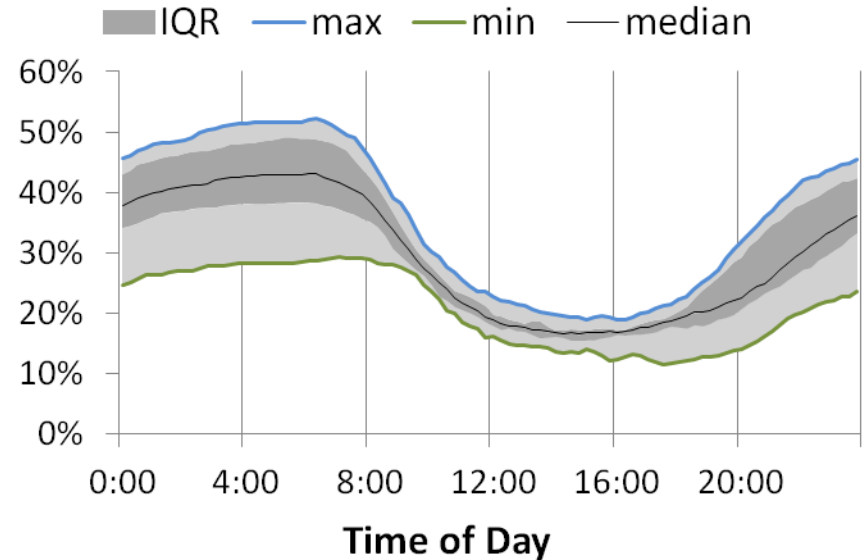
# 2011 Results: Charging Availability

## San Francisco Region

### Weekday



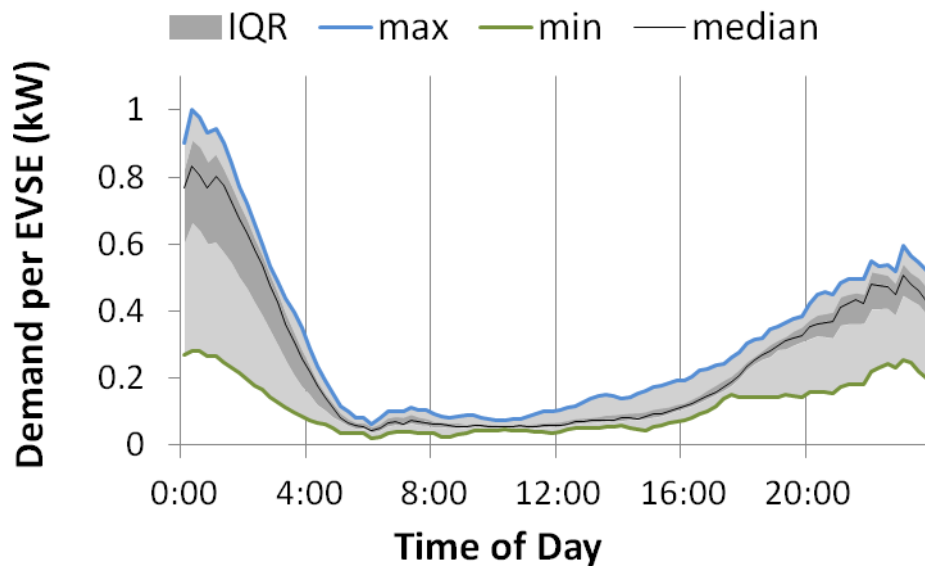
### Weekend



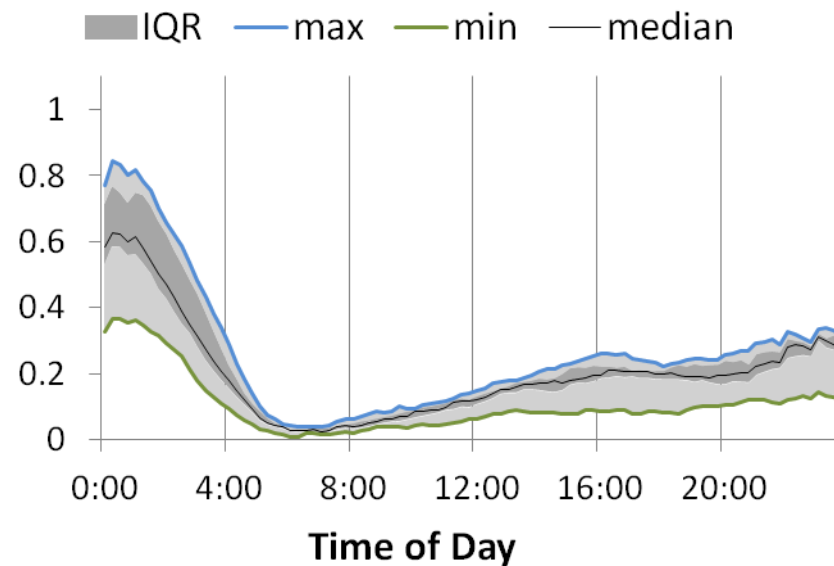
# 2011 Results: Charging Demand

## All EV Project Regions

### Weekday



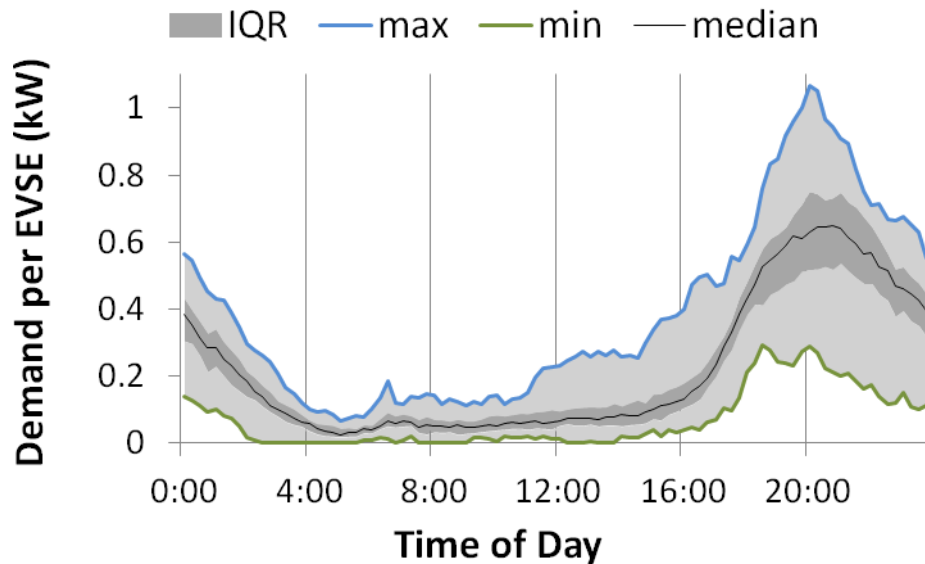
### Weekend



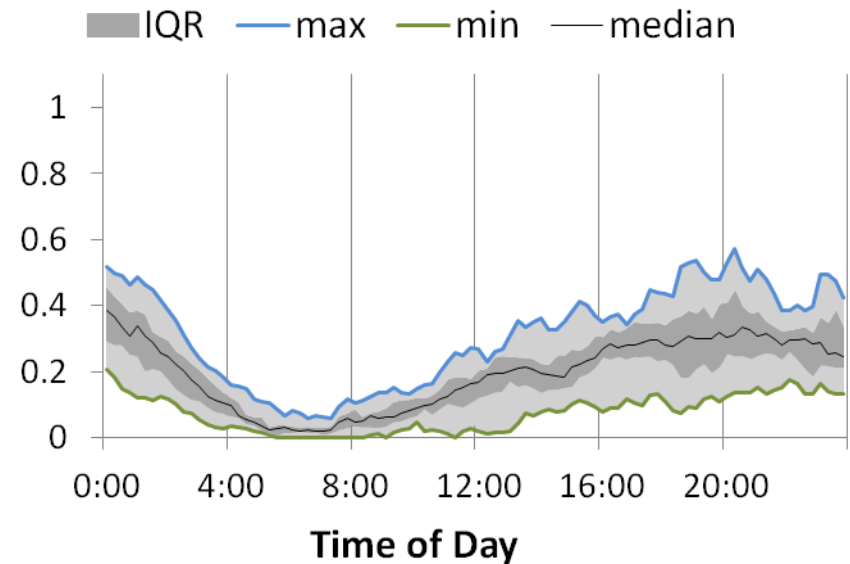
# 2011 Results: Charging Demand

## Nashville Region

### Weekday

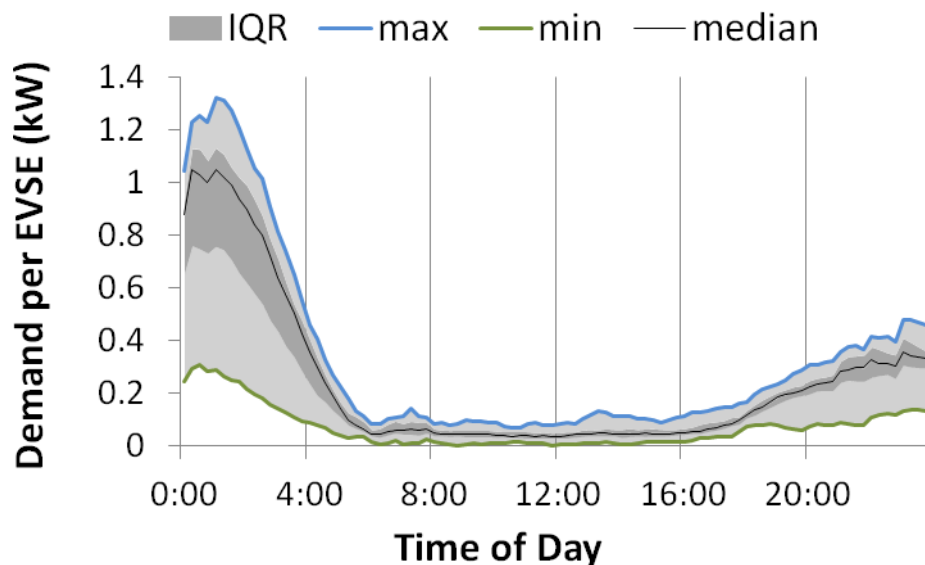


### Weekend

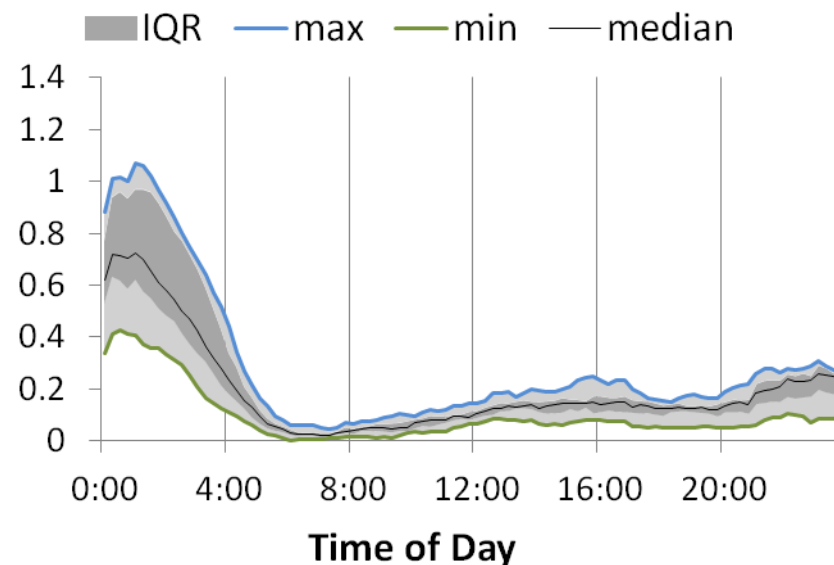


## San Francisco Region

### Weekday



### Weekend

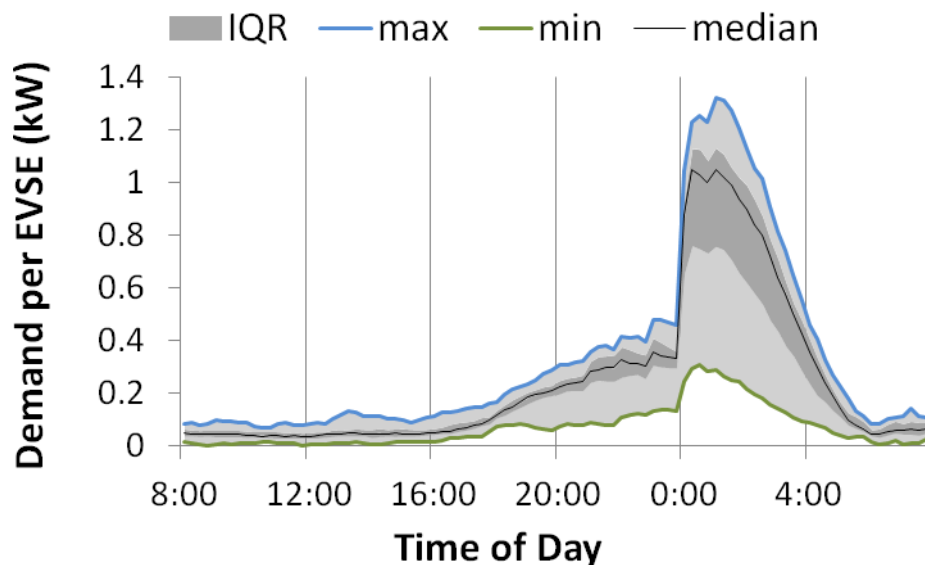


- 90% of EV Project participants in San Francisco region are PG&E customers
- PG&E offers a special EV time-of-use (TOU) rate plan
  - Off Peak, Partial Peak, Peak
  - Weekday off-peak period is 0:00 to 07:00
  - Weekend off-peak period starts at 21:00

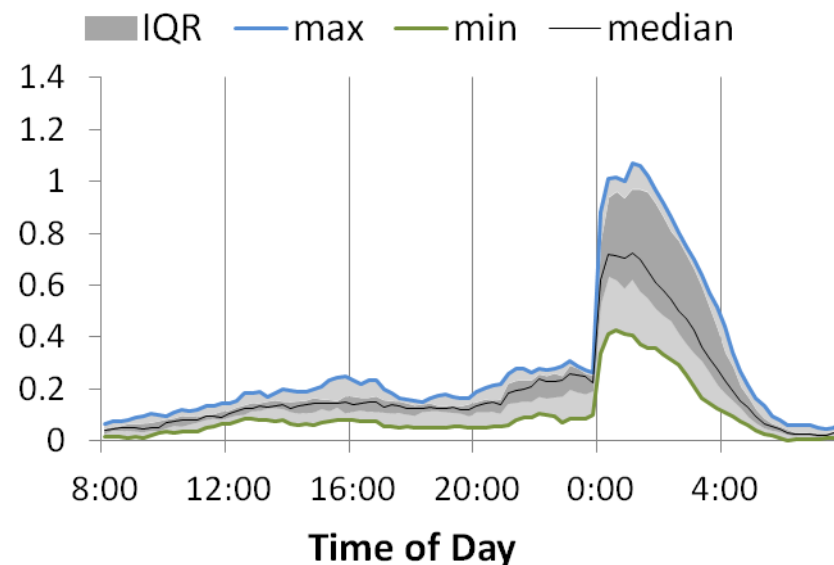


## San Francisco Region

### Weekday



### Weekend



When all regions examined in aggregate

- Demand peaks on weekdays and weekend days during the 00:00 hour
- Minimum weekday demand is between 06:00 and 12:00, at nearly 0 kW per EVSE
- Day-to-day variation in charging availability and charging demand on weekdays is high during Q4 2011, due to holidays

### In Nashville (no TOU rates)

- Demand increases each evening as charging availability increases, starting at about 16:00
- Demand peaks in the 20:00 hour on weekdays

### In San Francisco (EV TOU rates available)

- Demand spikes at 00:00 at beginning of the off-peak electricity rate period
- Demand peaks at 01:00

Quarterly and project-to-date reports and other information available at The EV Project and INL websites:

[www.theevproject.com](http://www.theevproject.com)

<http://avt.inl.gov/evproject.shtml>

## Acknowledgements

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