

Technologies required to fully integrate electric vehicles and the smart grid

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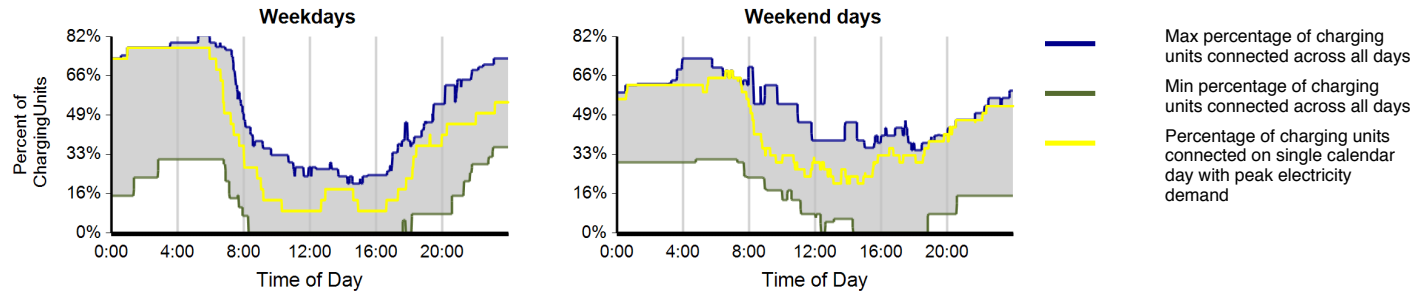
EV SMART GRID INTEGRATION

- **Off peak energy sales**
 - AMR smart meter
 - TOU EV rate
- **Grid support services**
- **Local grid reliability**
- **Demand response**
- **Energy storage**
- **Vehicle to grid**
- **Vehicle roaming**

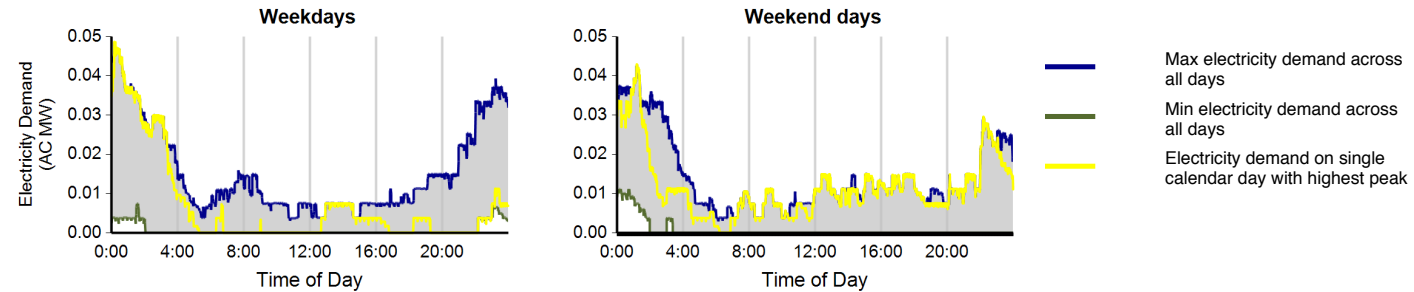


EV PROJECT DATA

Charging Availability: Range of Percent of Charging Units with a Vehicle Connected versus Time of Day³



Charging Demand: Range of Aggregate Electricity Demand versus Time of Day⁴



Individual Charging Event Statistics

	Weekday (WD)	Weekend (WE)	Overall
Average length of time with vehicle connected per charging event (hr)	9.8	11.1	10.2
Average length of time with vehicle drawing power per charging event (hr)	1.9	1.8	1.9
Average electricity consumed per charging event (AC kWh)	6.8	6.0	6.6

JUMP STARTING SMART GRID

■ Enabling Tasks

- Smart Metering
- Networks
- Control

■ Solutions



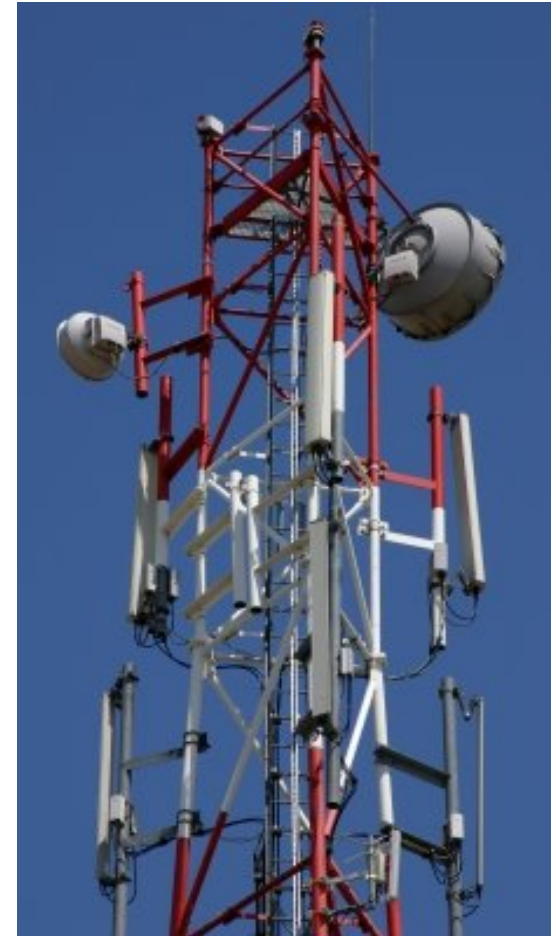
METERING

- **EV Rates**
 - Mandatory or voluntary
 - Savings realized
- **Separate vs Sub Meter**
 - Installation cost
 - Meter data management
- **Integral EVSE Meter**
 - Certification
 - Energy diversion
 - Verification



NETWORKS

- **AMI**
 - **Availability**
 - **Bandwidth/latency**
- **WiFi**
 - **Availability**
 - **Reliability**
 - **Security**
- **Cellular**
 - **Availability**
 - **Cost**



CONTROL – DEMAND RESPONSE

- **Hardware Cost**
 - Utility cost
 - Consumer cost
- **Implementation**
 - Utility
 - EVSP
- **Operation**
 - Notifications
 - Transparency



SOLUTIONS

- **The Devil Is In The Details**
- **Utility Coordination**
 - **Metering**
 - **Tariffs**
 - **Communications**
- **Smart Grid As A Service**
 - **Customer value**
 - **Utility flexibility**

