

THE
EV Project

**Information
Dissemination
Peer Review**

March 6 , 2013



Agenda

- **Introductions & Logistics** 9:00-9:15
- **DoE Perspective – Lee Slezak** 9:15-9:30
- **EV Project Overview – Don Karner** 9:30-10:00
- **Dissemination Strategy – Tom Garetson** 10:00-10:20
- **Q&A** 10:20-10:30
- Break** 10:30-10:45
- **Data Collection – Jim Francfort** 10:45-11:15
- **Information Dissemination– John Smart** 11:15-12:00
- Lunch** 12:00-1:00
- **Observations Dissemination– Steve Schey** 1:00-1:20
- **Understandings Dissemination – Don Karner** 1:20-1:40
- **Q&A/Breakout Logistics** 1:40-1:50

Breakout Sessions

- **Session 1** **2:00-3:15**
- Red Group - Vehicle and Charger Utilization**
- Blue Group - Deployment Issues and Operational Impacts**
- Break** **3:15-3:30**
- **Session 2** **3:30-4:45**
- Red Group - Deployment Issues and Operational Impacts**
- Blue Group - Vehicle and Charger Utilization**
- **Next Steps** **5:00-5:15**

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DoE Perspective

**Lee Slezak
March 6 , 2013**



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**EV Project
Overview**

**Donald Karner
March 6 , 2013**



Overview

➤ Project Objectives

➤ Deployment

- Residential
 - Vehicles
 - EVSE
- Non-residential
 - EVSE
 - DC fast chargers
- Status

➤ Operation

- Network
- Access control
- Revenue models

➤ Remaining Work

Project Objectives

- **Develop mature charge infrastructure “laboratories”,**
- **Collect and analyze data characterizing vehicle and infrastructure utilization,**
- **Demonstrate measures to minimize impacts of charging on the grid,**
- **Conduct trials of payment systems,**
- **Evaluate business models for non-residential charging infrastructure, and**
- **Document and disseminate the results of the Project.**

Residential Deployment

- **8,000 Residential EVSE (Nissan Leaf, Chevrolet Volt & Smart EV)**
 - Wall mounted smart EVSE
 - Programmable
 - Internet connected
 - Energy meter
 - Vehicle telematics
 - Odometer
 - SoC
 - GPS
 - Participants
 - Contracts
 - Data



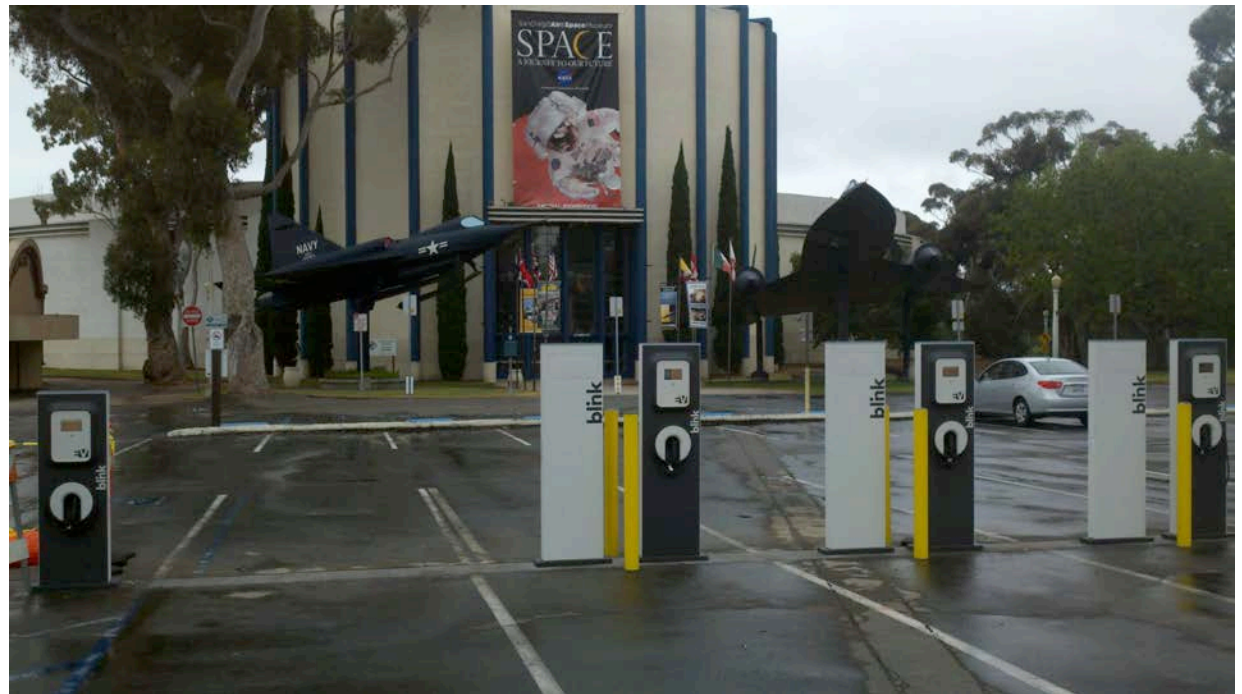
Non-Residential Deployment

- **5,000 Non-residential EVSE**
 - Commercial
 - Workplace
 - Public
 - Street side
- **200 DC Fast Chargers**
- **Internet connected**
- **Access controlled**
- **Hosts**
 - Contracts
 - Construction
 - Data

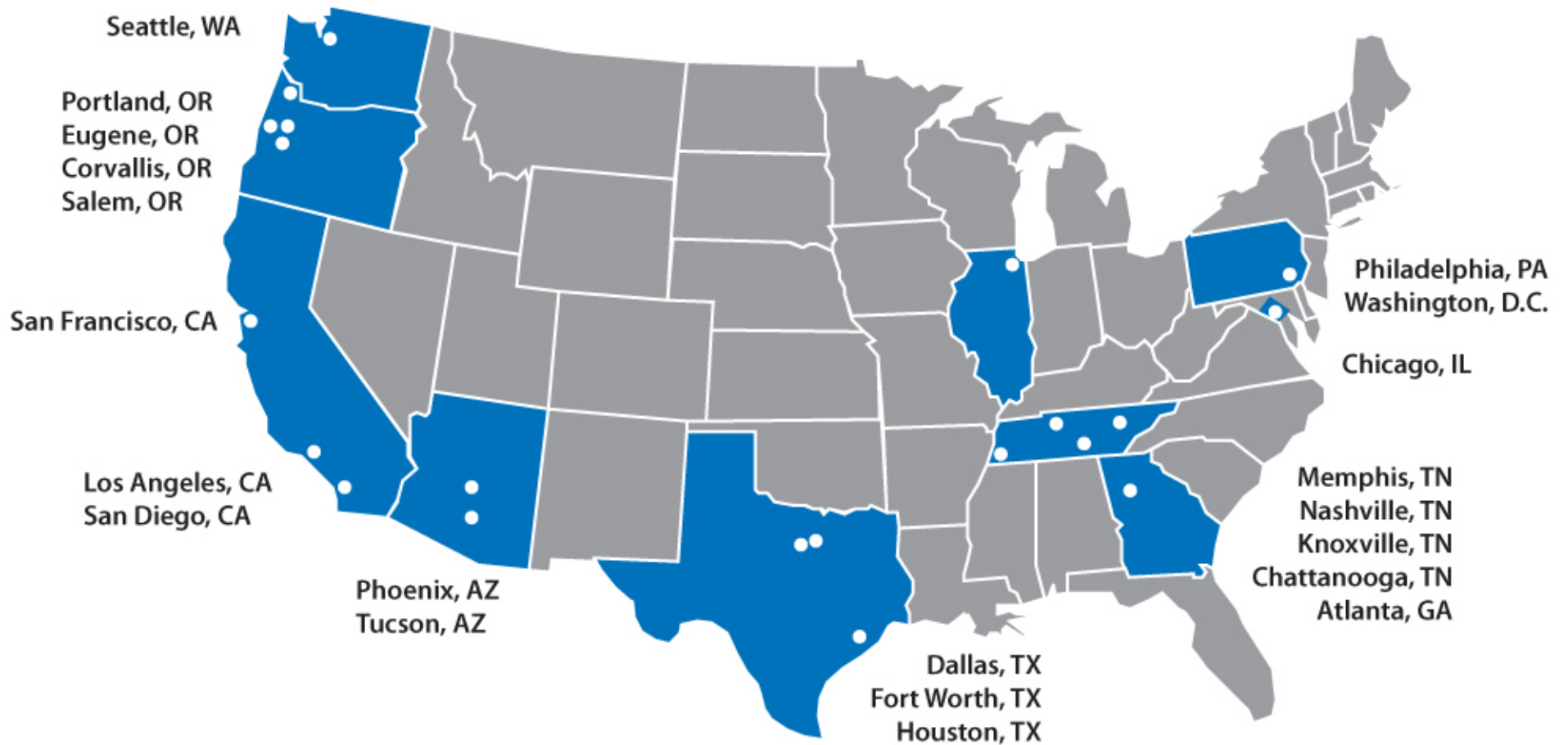


Deployment Schedule

- **Project Start**
10/1/09
- **Install Complete**
9/30/13
- **Project End**
12/31/13
- **Data Complete**
12/31/13
- **Project Closeout**
3/31/14



Deployment Markets



Infrastructure Planning

➤ Organize Regional Stakeholders

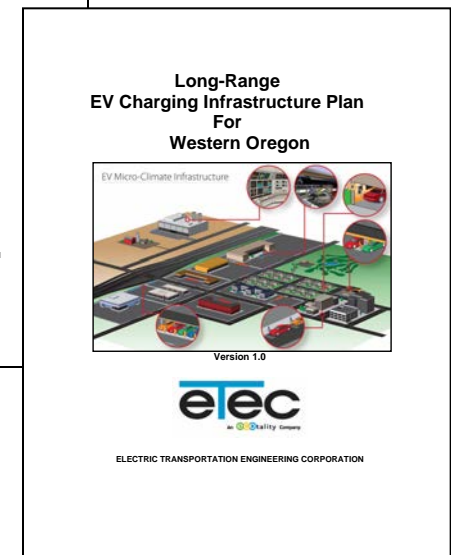
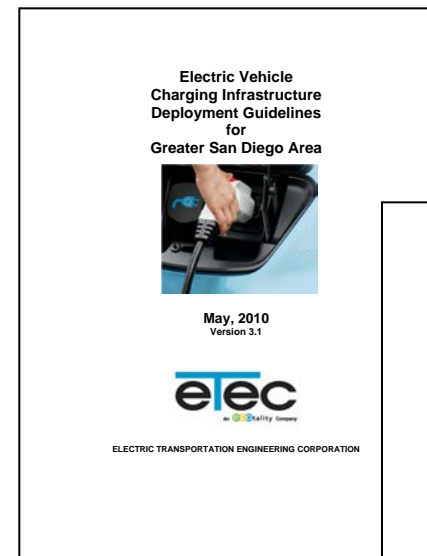
- Government
- Utilities
- Employers

➤ Develop Long Range Plan

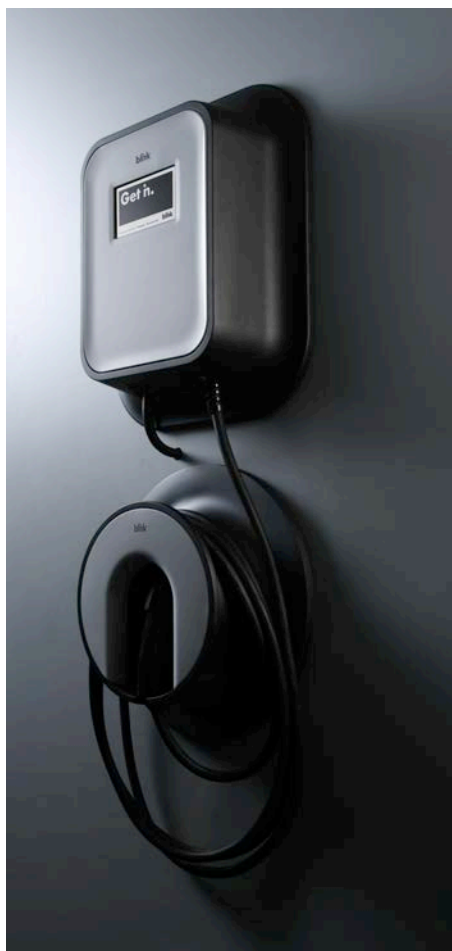
- Deployment area
- Vehicle penetration
- Infrastructure requirements

➤ EV Micro Climate

- Initial deployment
- Early information



Residential Installation



Commercial Installation



Workplace Installation



Public Installation



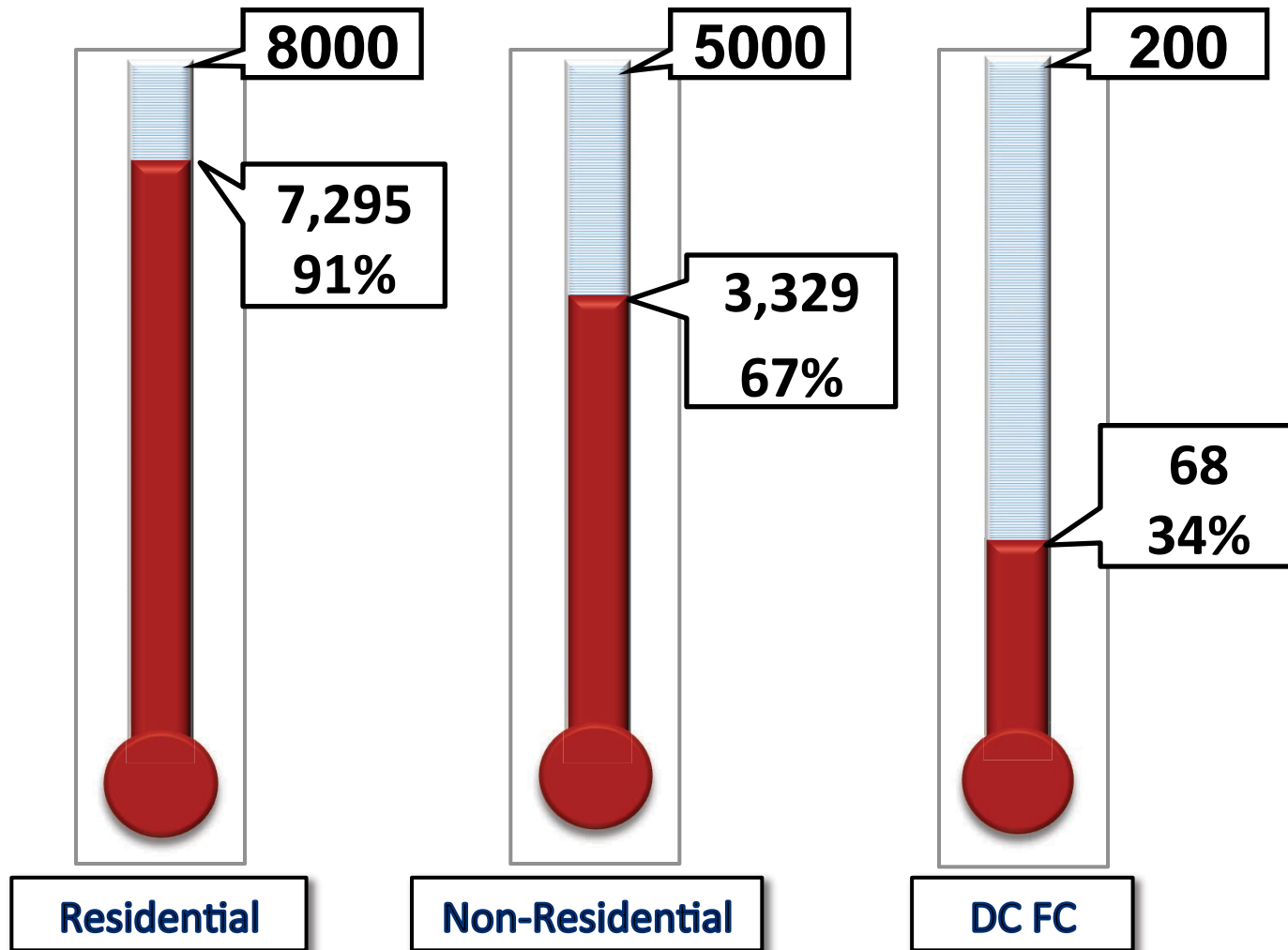
Street Side Installation



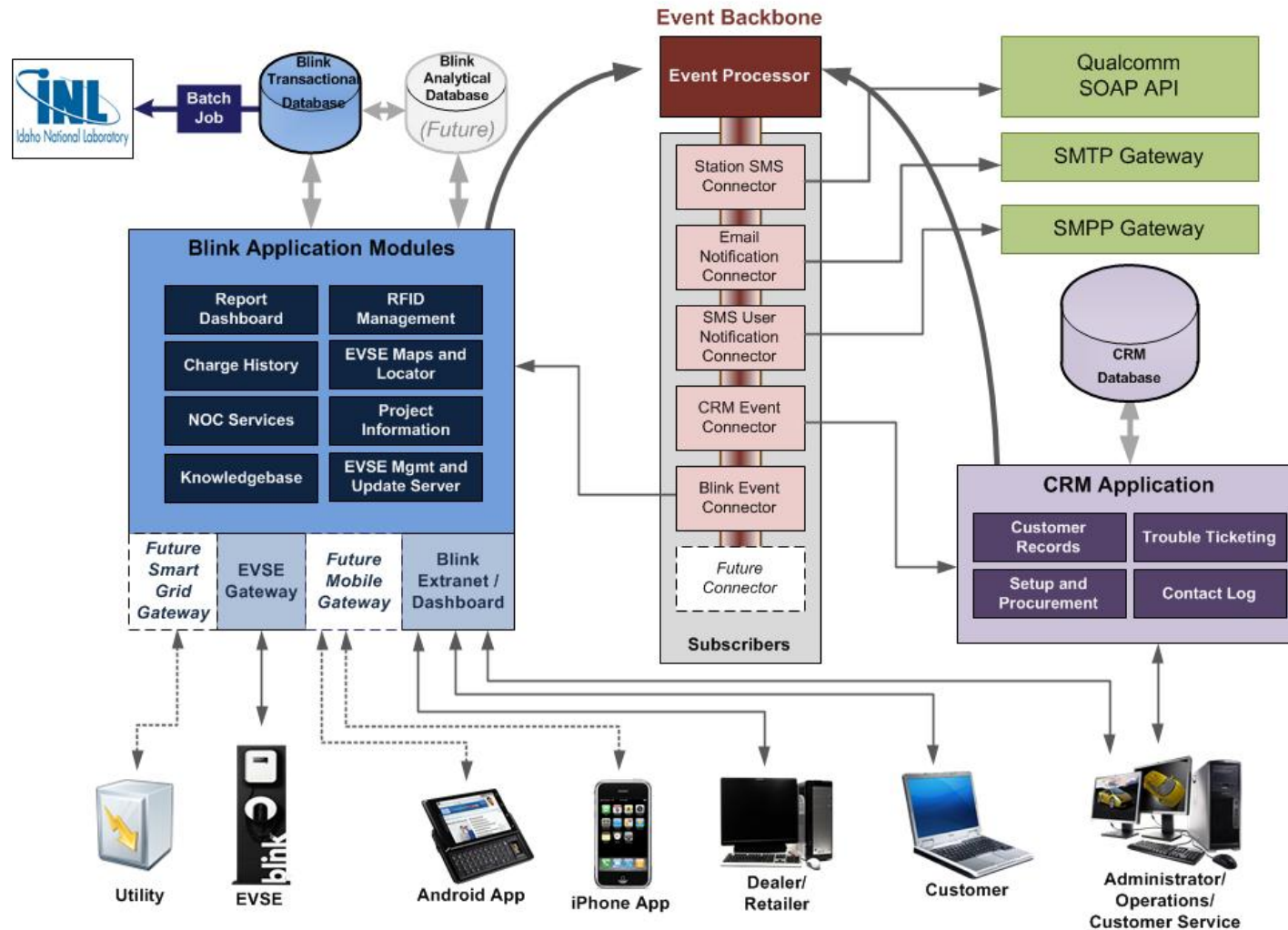
DC Fast Charge Installation



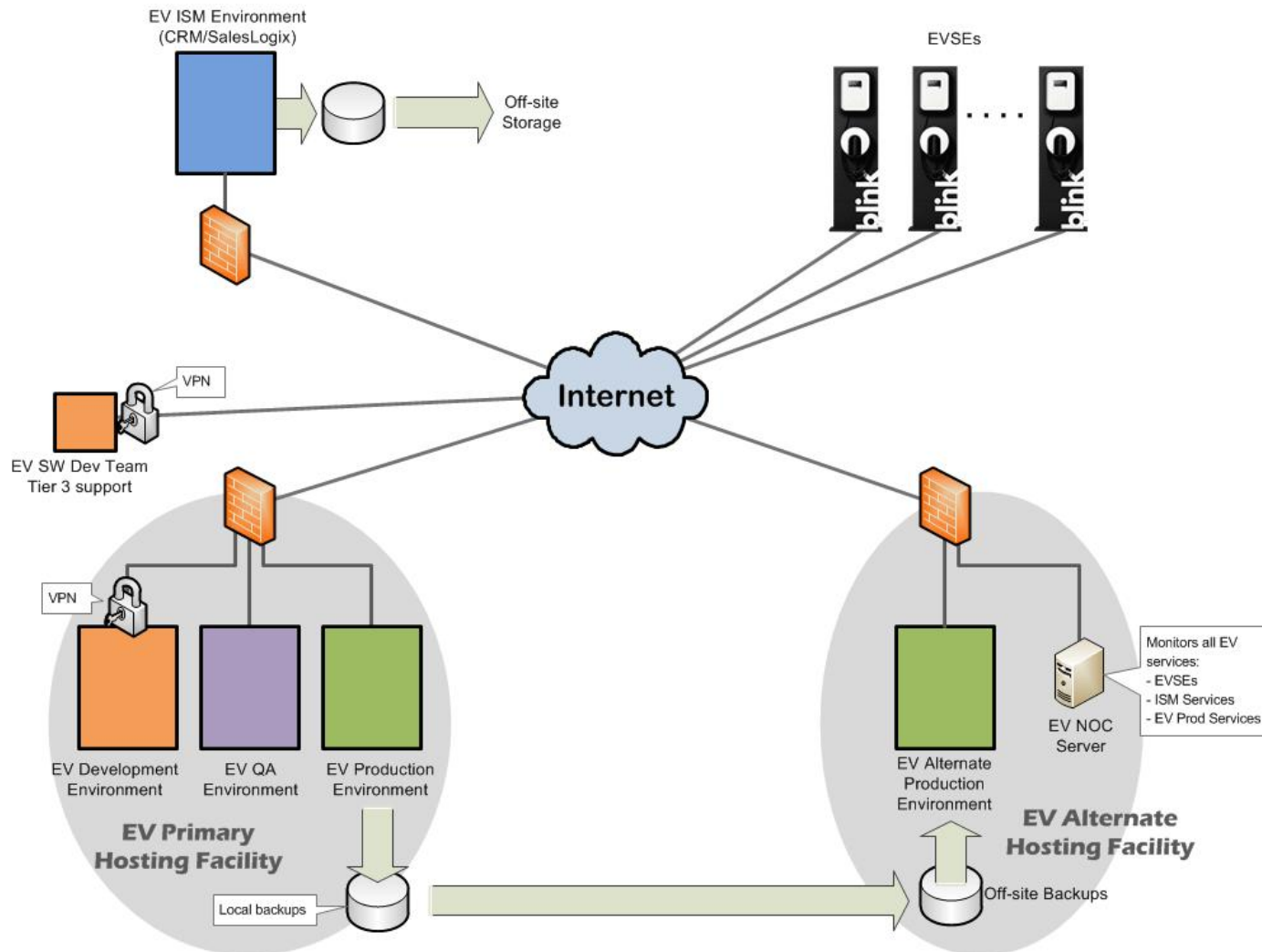
Deployment Status



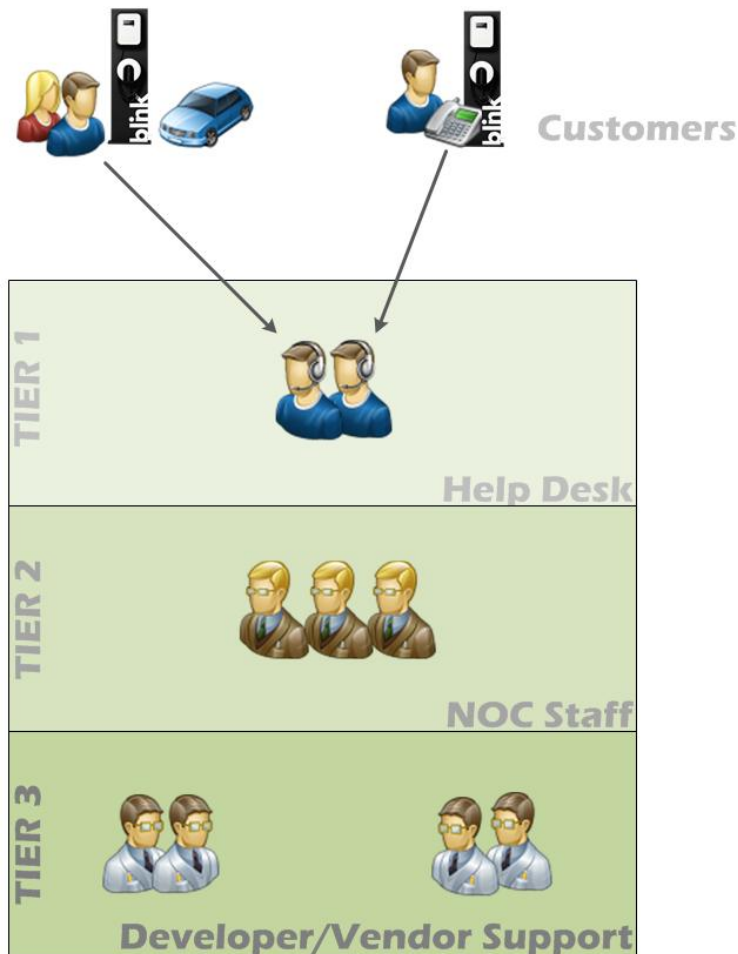
Network Operation



Network Infrastructure



Network Support



- Tier 1
 - Call center staffed Help Desk
 - Provided with scripts for most frequently asked questions
 - Provide basic technical troubleshooting
 - Captures information about each trouble call in a ticket
- Tier 2
 - Network Operations Center (NOC) staff
 - Technically knowledgeable of Back Office infrastructure
 - Provide more advanced troubleshooting
- Tier 3
 - The most knowledgeable staff
 - Expert depth of knowledge for various systems and tools
 - Able to resolve issues or enter as bugs

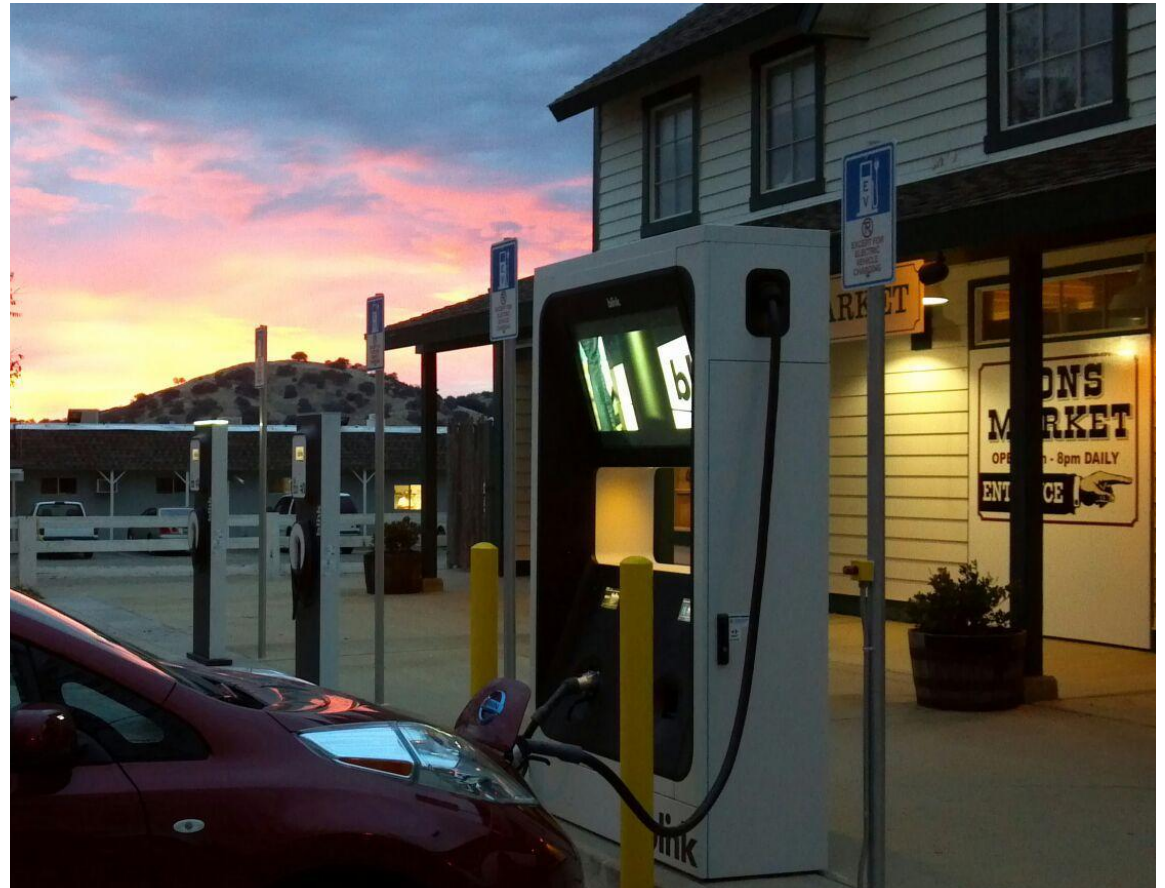
Access Control

- RFID Based
- Registered Through Website
- Provides User Data
 - Linked to User data in CRM
 - Linked to credit card
- Provides Usage History
 - Events
 - Energy consumption



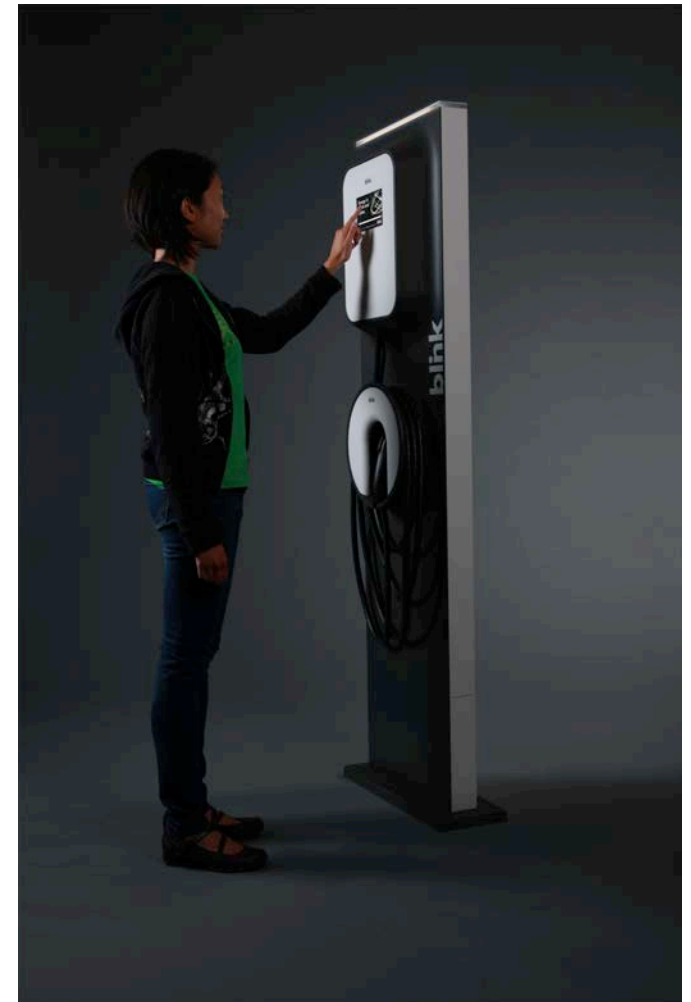
Revenue Models

- Access Fees
 - Level 2 Access Fees
 - Charge by time
 - Charge by kWh
 - Charge by event
 - Flat fee
 - DCFC Access Fees
 - Charge by time
 - Charge by event
 - Flat fee
- Advertising
 - Digital screens
 - Wraps



Access Fees

- Fee For Access
 - Implemented throughout Level 2 Blink Network
 - \$1.00/hr member (RFID)
 - \$2.00/hr guest
- Billed Through RFID Card
- Guest Access
 - Access code
 - Valid for 24 hours
 - No cost if not used
 - Smart Phone
 - Blink website



Digital Screens

SCHLEP WEIGHTS.
NOT WATER.

Poland Spring
Eco-Shape

Poland Spring direct
TRY OUR HOME DELIVERY SERVICE.
1.866.889.3456
PolandSpringDeliveryNYC.com

CAR 2GO | **blink**

Member ID
000123456789



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Wraps

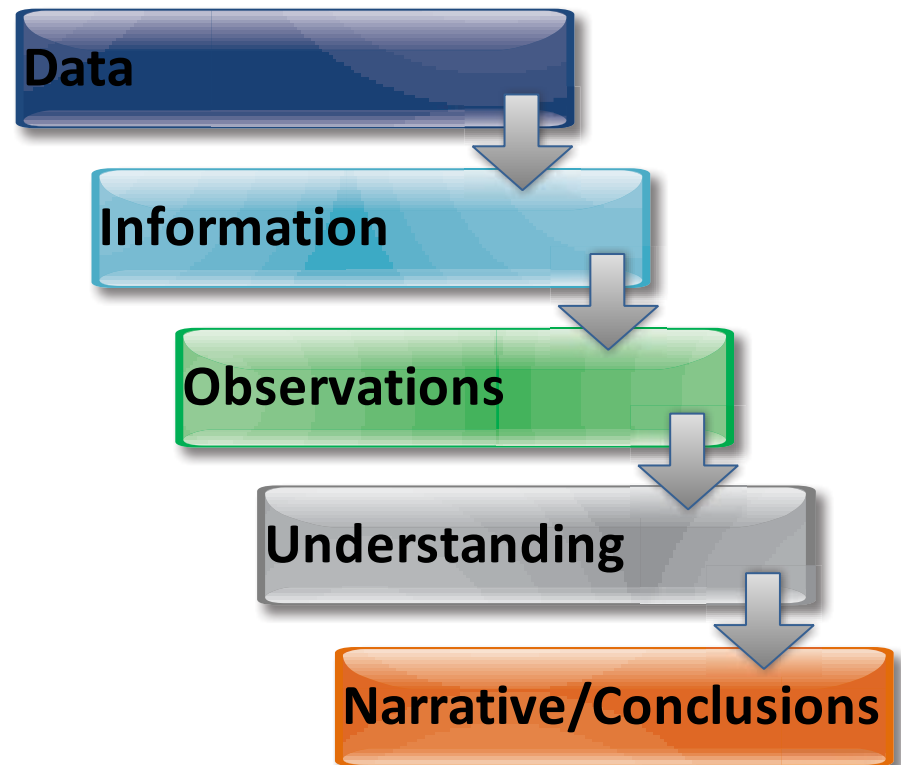


Remaining Work

- **Complete Remaining Installations**
- **Continue Data Collection**
 - Vehicle utilization
 - Charger utilization
- **Evaluate Business Models**
- **Develop Information Dissemination Plan**

Information Dissemination Plan

- Plan Requirements
 - Handle multiple data types
 - Electronic
 - Vehicle
 - Charger
 - Manual
 - Experiential
 - Survey
 - Address multiple audiences
 - Vehicle owners
 - Charger hosts
 - Electric utilities
 - Government
 - EVSPs
 - PEV Industry



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Peer Review**

**Dissemination
Strategy**

**Tom Garetson
March 6 , 2013**



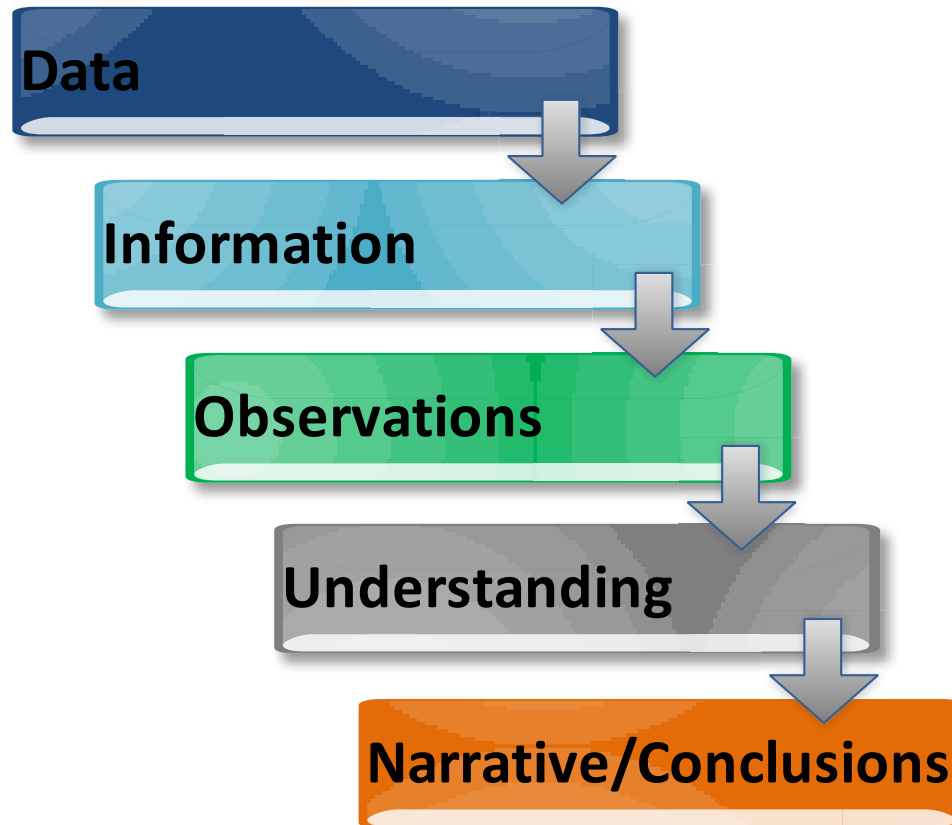
- Project Objectives (aka Requirements)
 - Data
 - Narrative/Conclusions

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 - Narrative/Conclusions
- Information Dissemination
 - Information
 - Observations
 - Understanding

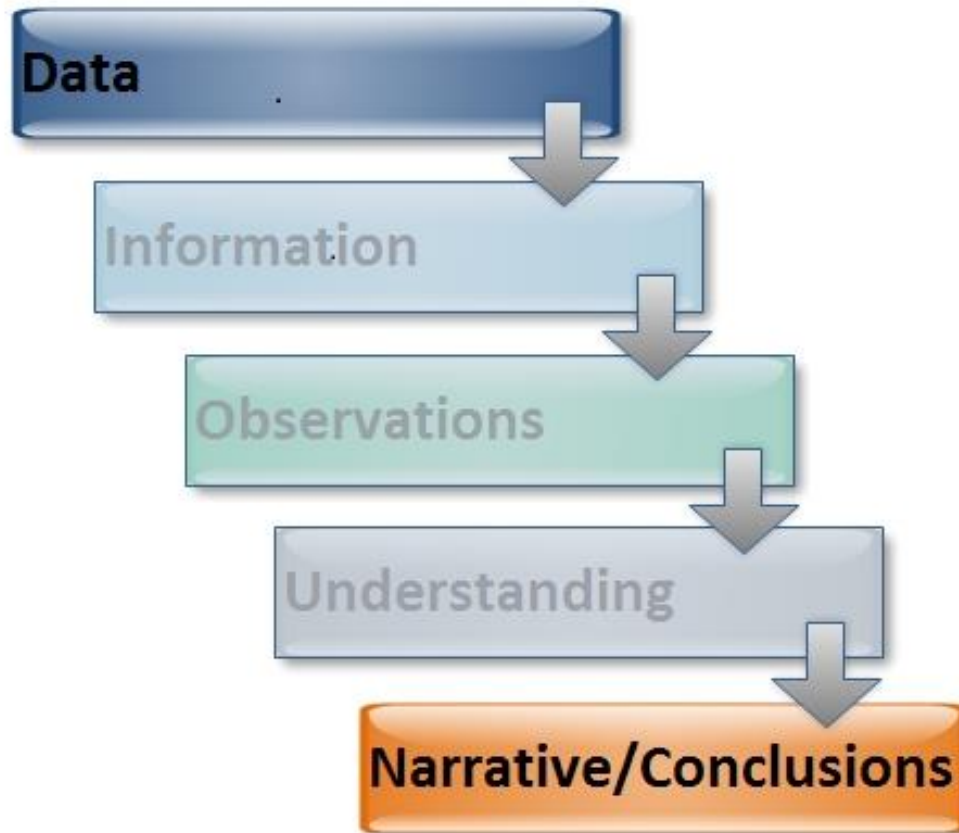
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- Audience
- Implementation
 - Reports
 - Papers
 - Presentations
 - Publication

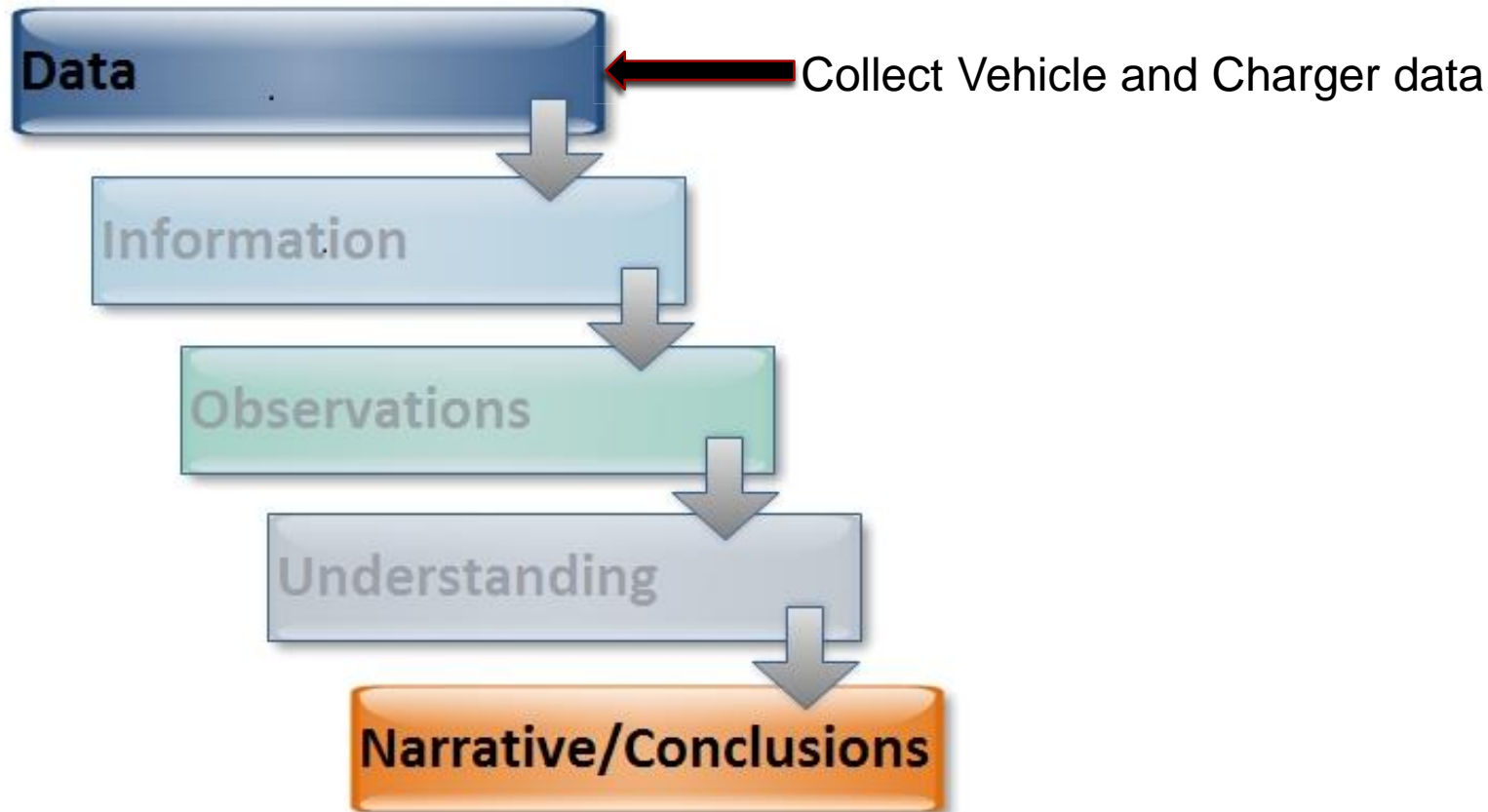
Information Dissemination



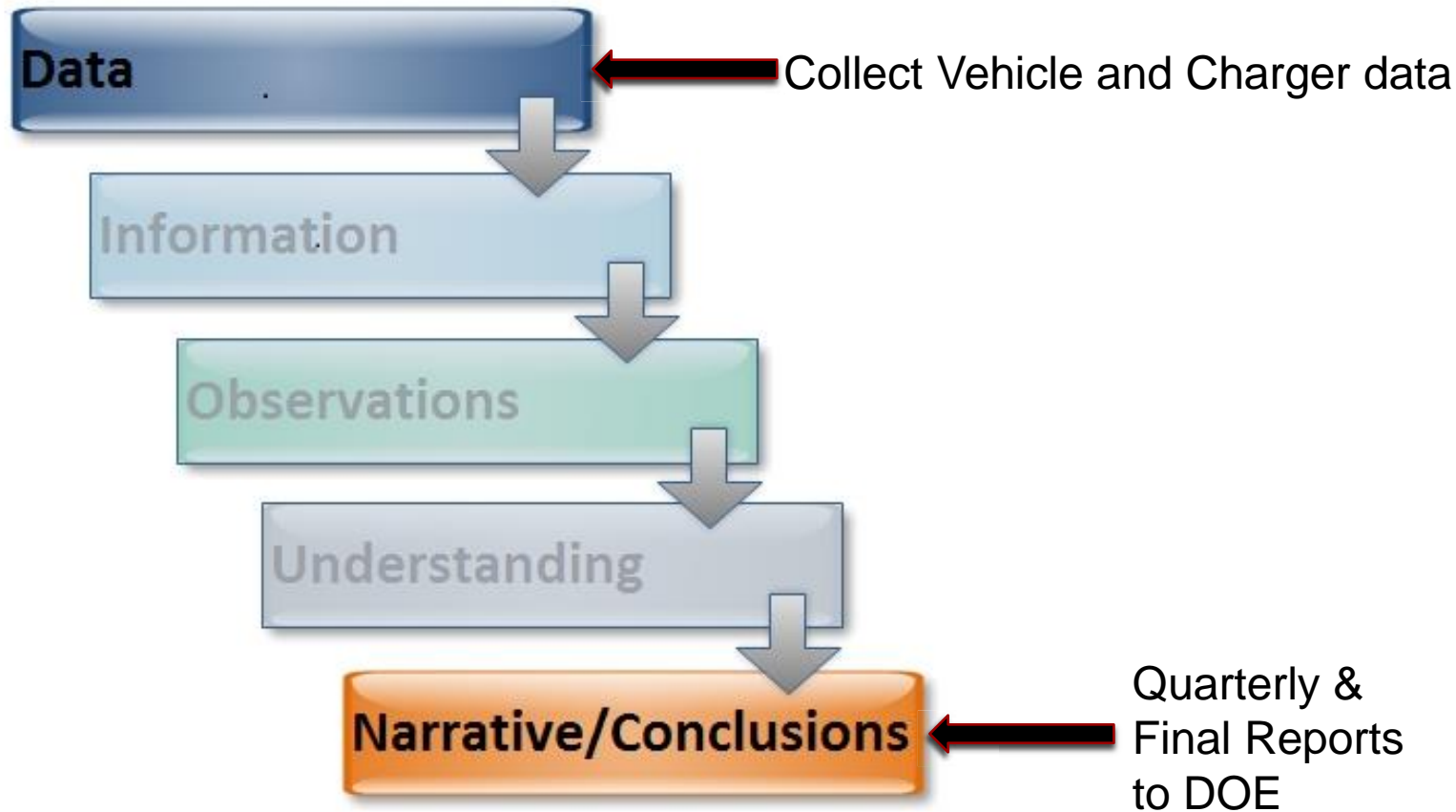
Project Objectives



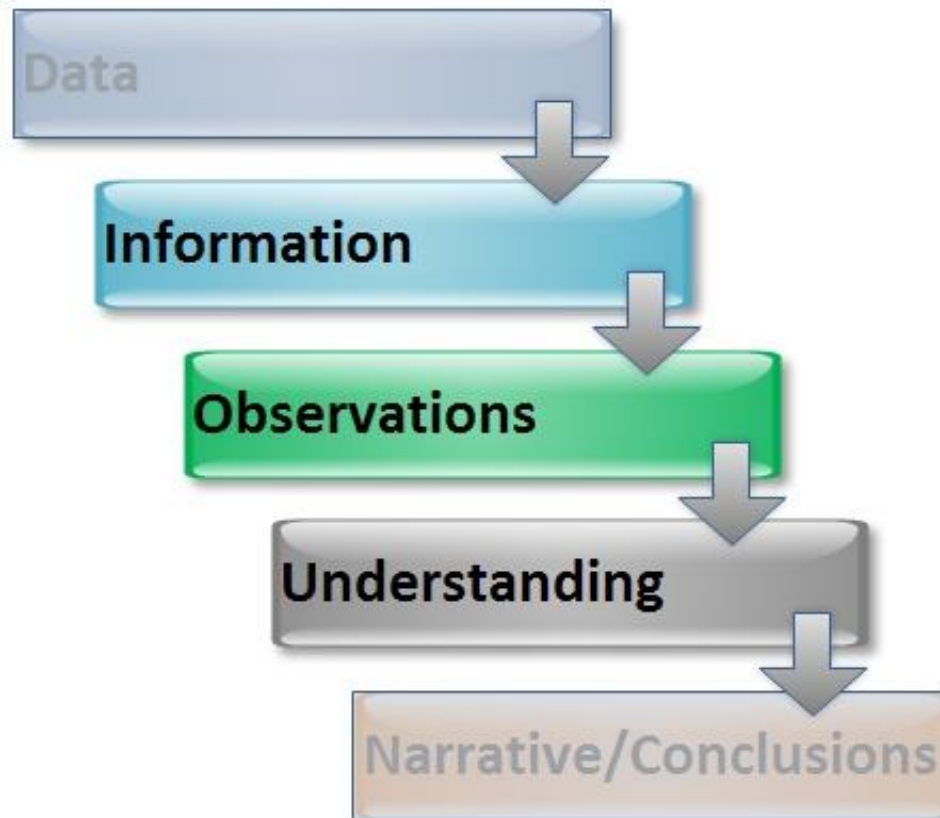
Project Objectives



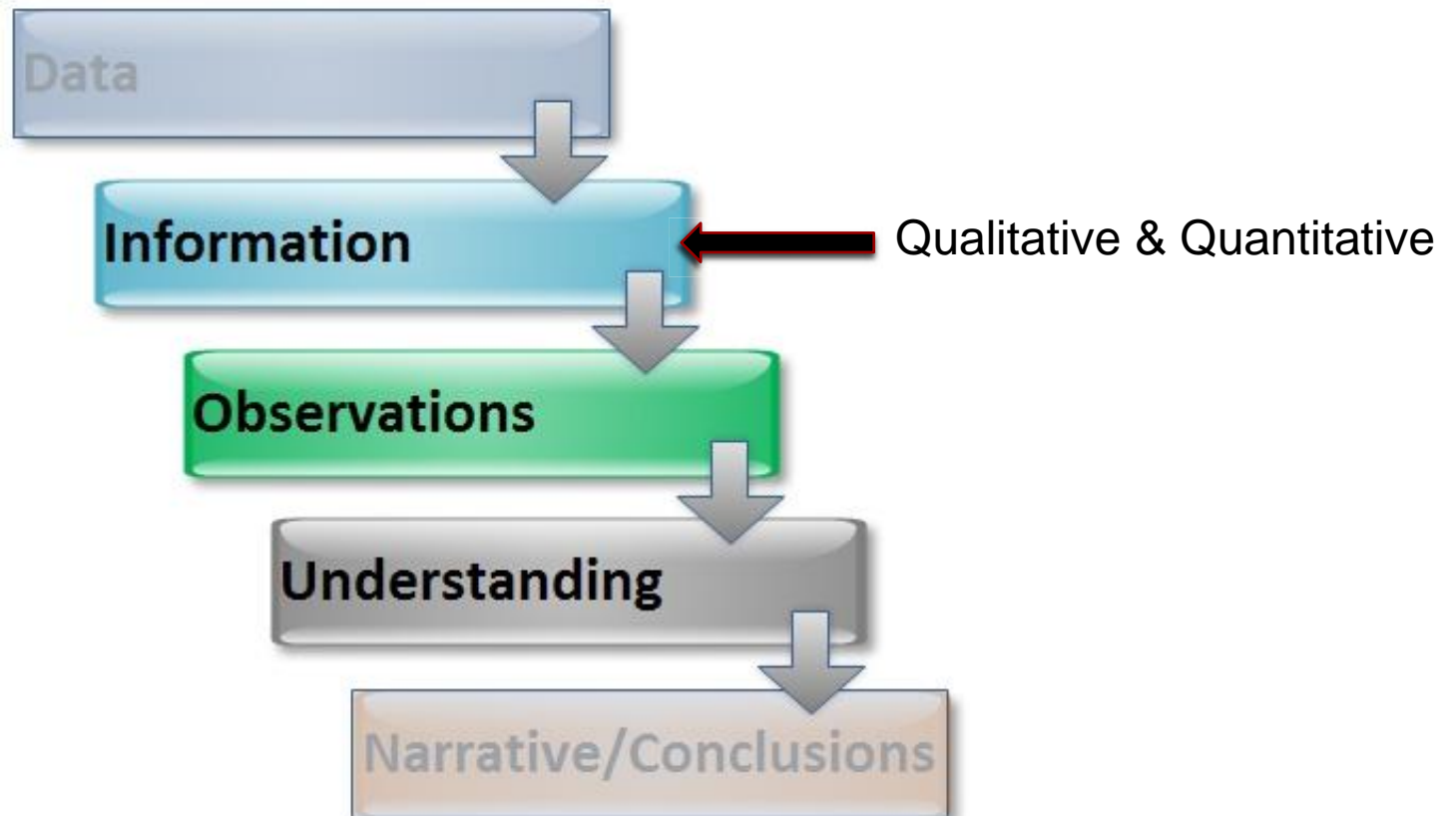
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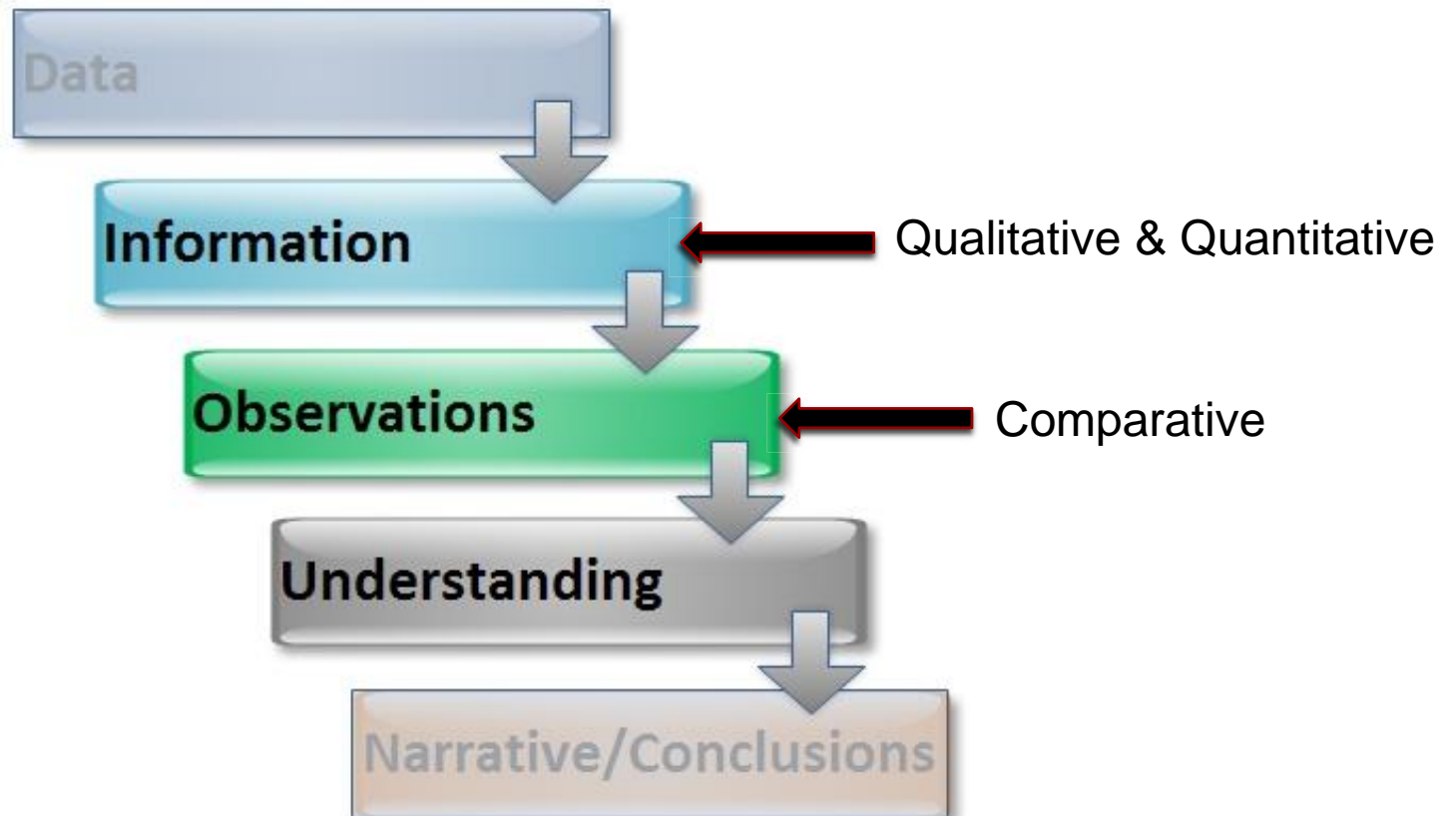
Information Dissemination



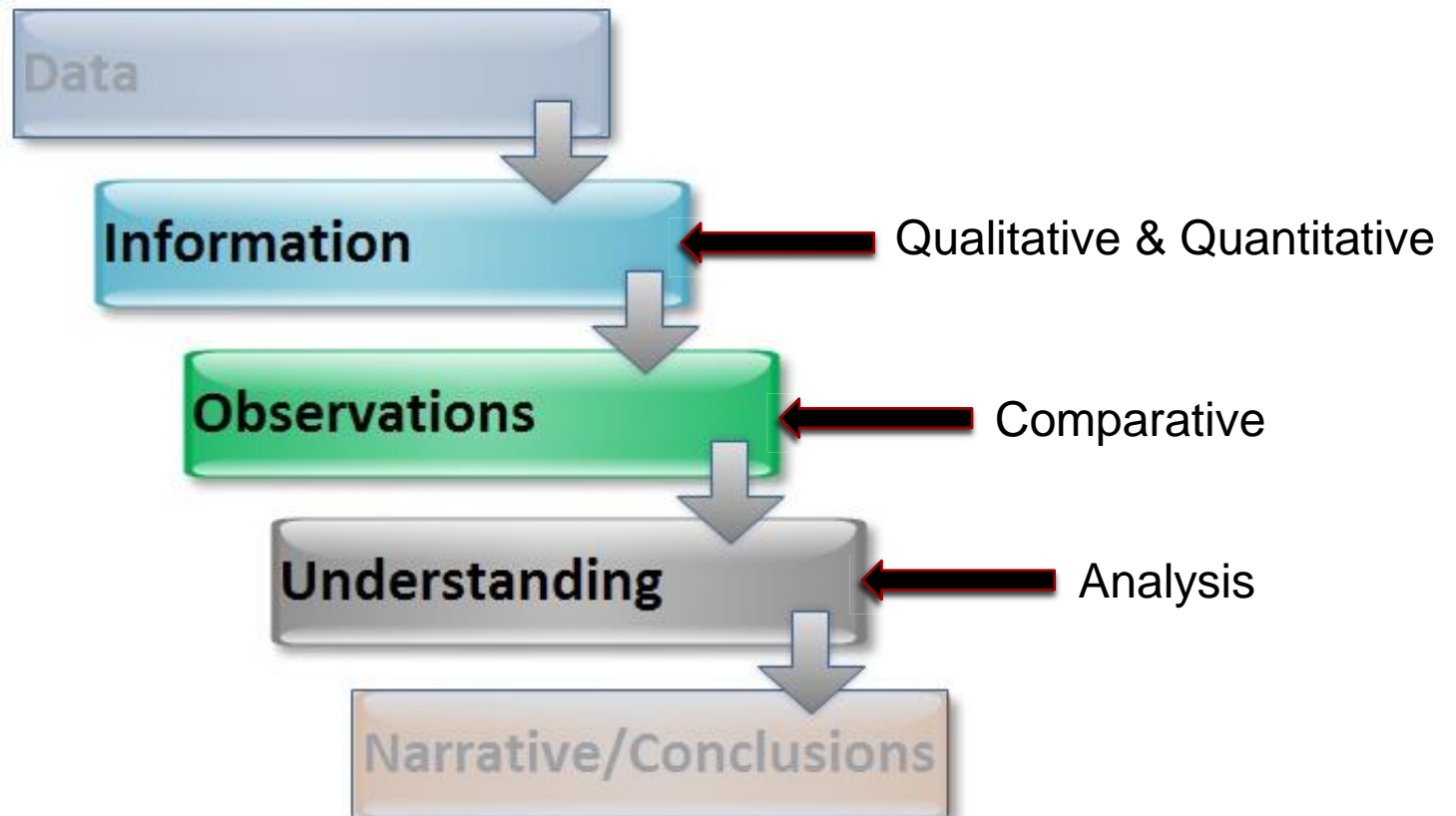
Information Dissemination



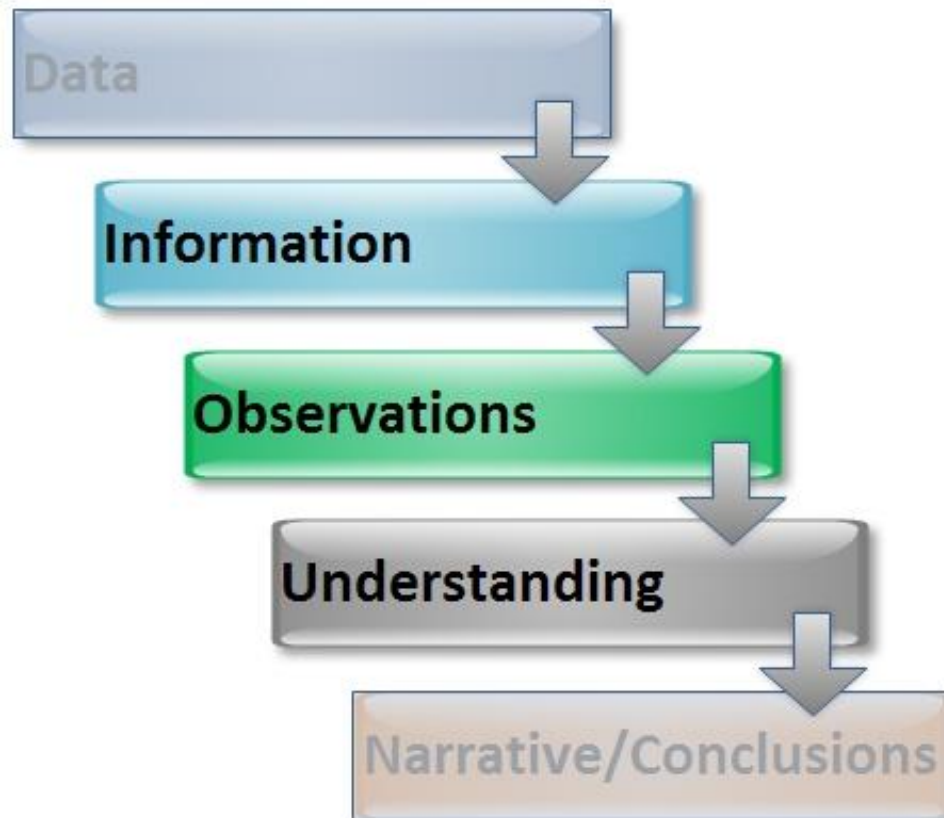
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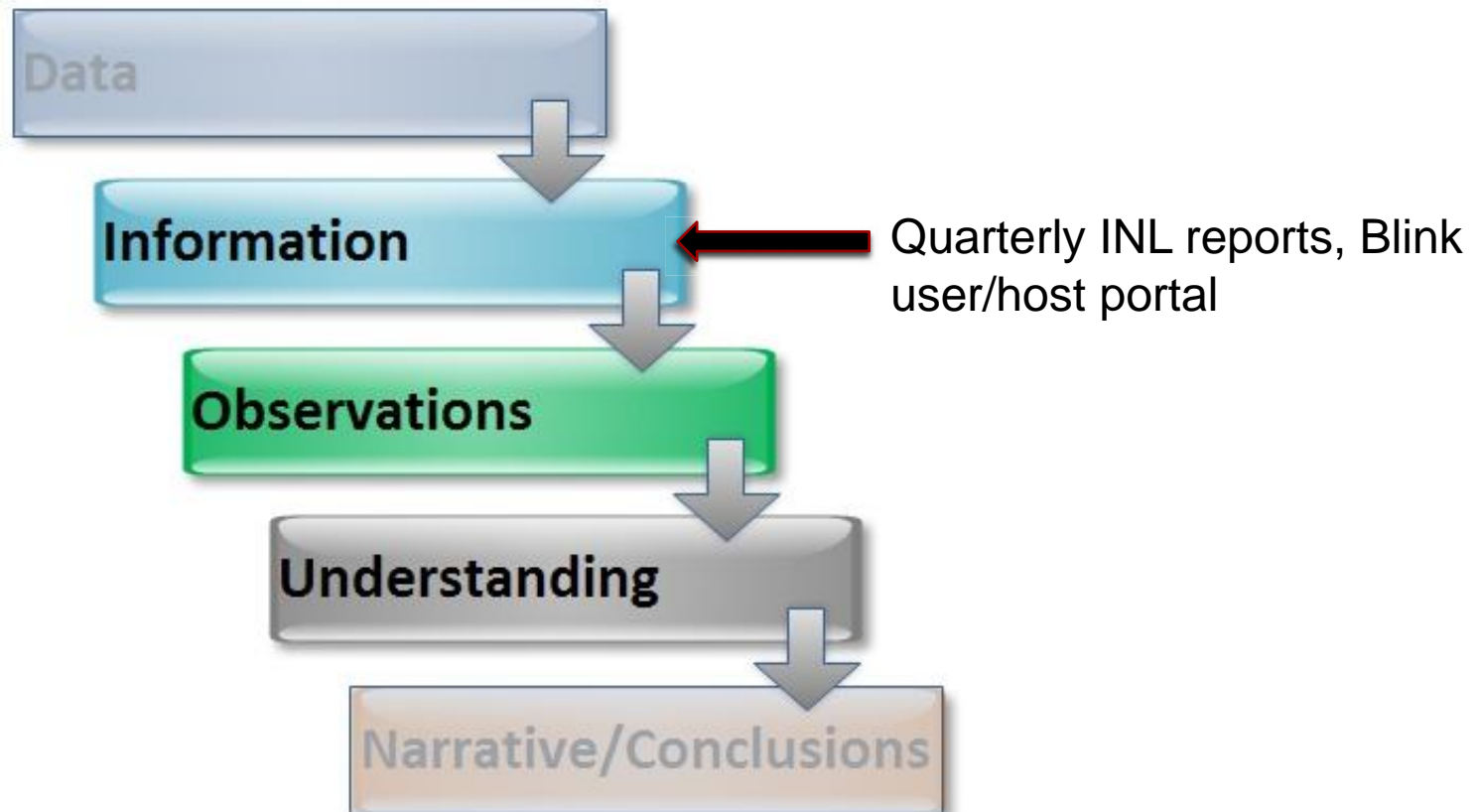
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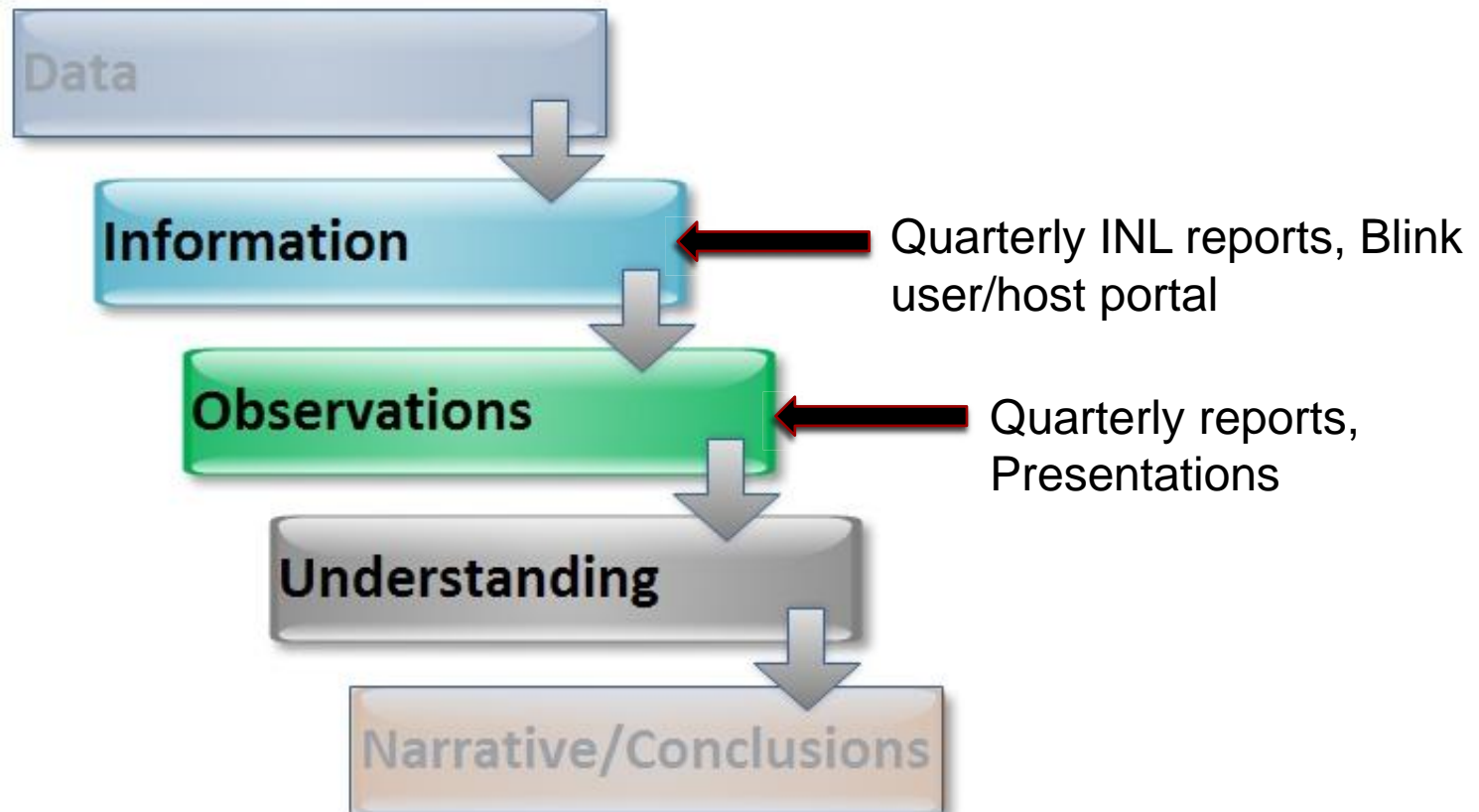
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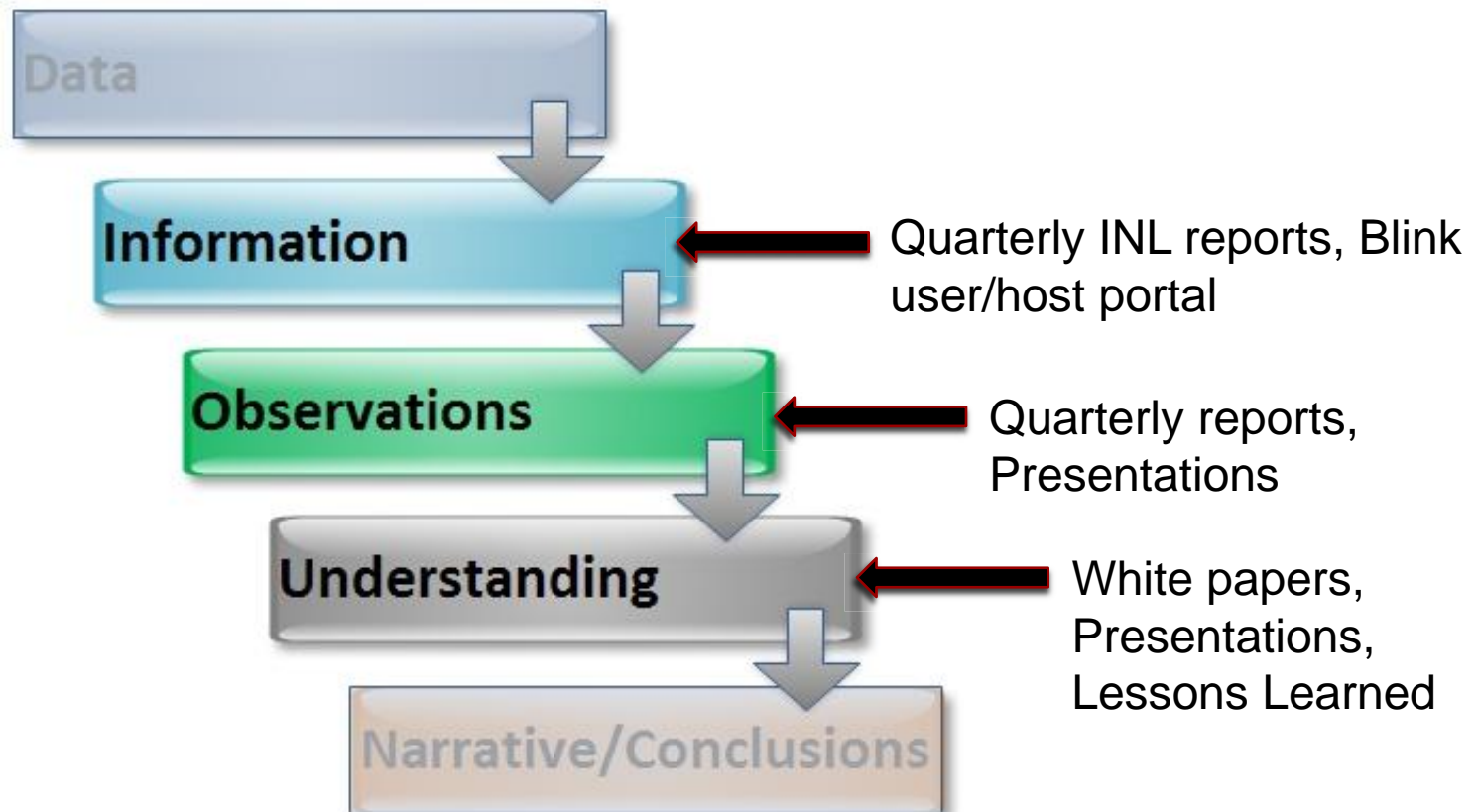
Information Dissemination



Information Dissemination



Information Dissemination



Audience

- EV drivers and supporters
 - Market & industry information source

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- Electric Utilities
 - Inform regarding magnitude, time, and location for load

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- EVSPs
 - Effective siting
 - Pricing effects
 - Factors affecting use

Information Dissemination

www.theevproject.com

THE EV Project

eco²otality eco²otality NORTH AMERICA NISSAN CHEVROLET U.S. DEPARTMENT OF ENERGY INL

The largest deployment of EVs and charge infrastructure

home overview charging maps partners education learn more media contact

Miles driven:

by EV Project participants

67023074

⌚ Around the earth 6 times each day ⚡ Over 11,043 MWhrs of energy delivered by our network

* Estimated projections based upon data collected February 22, 2011 through November 13, 2012.

news: • Nov 19 ECOtality Reports Third Quarter 2012 Results

who?

Project Supporter

Project Manager

Project Partners

what?

- The largest deployment of electric vehicle charge infrastructure in history
- More than 50 million miles of data collected to date...and counting
- Thousands of grid-connected vehicles including Nissan LEAF and Chevrolet Volt
- 60+ project partners
- 21 major cities and metropolitan areas in 9 states and the District of Columbia

when?

Winter 2010: Initial infrastructure deployment began.

Nissan launched the Nissan LEAF, a zero emission pure electric vehicle. GM launched the Chevrolet Volt, an electric vehicle with extended range.

[LEARN MORE](#)

where?

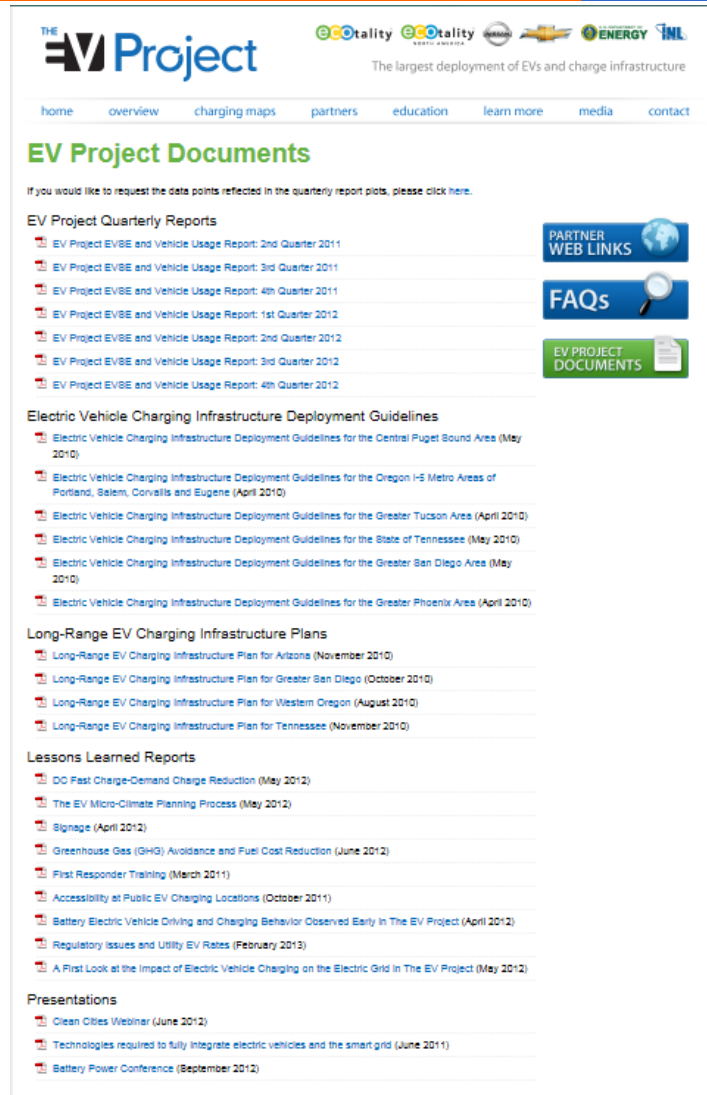
The EV Project is deploying charge infrastructure in major cities in nine states and the District of Columbia.

The EV Project is paving the way for the successful rollout of electric transportation across America.

Copyright © 2013 ECOtality, Inc. All rights reserved. partner login
All charge station designs are conceptual, final designs may differ.
Site by Tornado

home overview charging maps partners documents sign up media contact

Information Dissemination



The screenshot displays the website for 'THE EV Project'. At the top, it features logos for 'ecoTotality NORTH AMERICA', 'ENERGY INL', and 'The largest deployment of EVs and charge infrastructure'. A navigation bar includes links for 'home', 'overview', 'charging maps', 'partners', 'education', 'learn more', 'media', and 'contact'. The main content area is titled 'EV Project Documents' and includes a link for users to request data points. It lists several categories of documents:

- EV Project Quarterly Reports:** A list of reports from the 2nd Quarter of 2011 to the 4th Quarter of 2012.
- Electric Vehicle Charging Infrastructure Deployment Guidelines:** A list of guidelines for various regions, including the Central Puget Sound Area, Oregon I-5 Metro Areas, Greater Tucson Area, State of Tennessee, Greater San Diego Area, and Greater Phoenix Area.
- Long-Range EV Charging Infrastructure Plans:** A list of plans for Arizona, Greater San Diego, Western Oregon, and Tennessee.
- Lessons Learned Reports:** A list of reports on topics such as DC Fast Charge-Demand Charge Reduction, EV Micro-Climate Planning, Signage, Greenhouse Gas Avoidance, First Responder Training, Accessibility at Public EV Charging Locations, Battery Electric Vehicle Driving and Charging Behavior, Regulatory Issues, and the impact of EV charging on the electric grid.
- Presentations:** A list of presentations including 'Clean Cities Webinar', 'Technologies required to fully integrate electric vehicles and the smart grid', and 'Battery Power Conference'.

On the right side of the document list, there are three call-to-action buttons: 'PARTNER WEB LINKS' with a globe icon, 'FAQs' with a magnifying glass icon, and 'EV PROJECT DOCUMENTS' with a document icon.

www.theevproject.com

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**Information
Dissemination
Peer Review**

**Data Collection
Mechanics**

**Jim Francfort
March 6 , 2013**

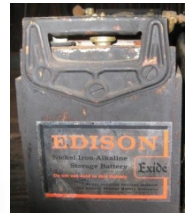


Presentation Outline

- **Data Collection and Security History**
- **Today's Vehicle/EVSE Data Management Process**
- **Today's Data Collection Security**
- **EVSE Data Parameters Collected per Charge Event**
- **Vehicle Data Parameters Collected per Start/Stop Event**
- **EV Project Data Management Systems**
- **EV Project Databases**
- **Data Handling Requirements**
- **Data Collection Summary**

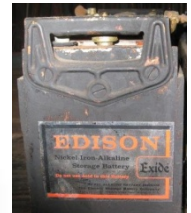
Data Collection and Security History

- In 1993 the AVTA used then state-of-art 386 PCs and the USPS to collect data from 300 EVs
- In 1994 hand-held, optical probes (with lithium batteries) connected to laptops read ABB meters on vehicles and EVSE (electric vehicle supply equipment)
- Since 1994, reporting has never identified PII and no secondary raw data has been released outside the AVTA test partners



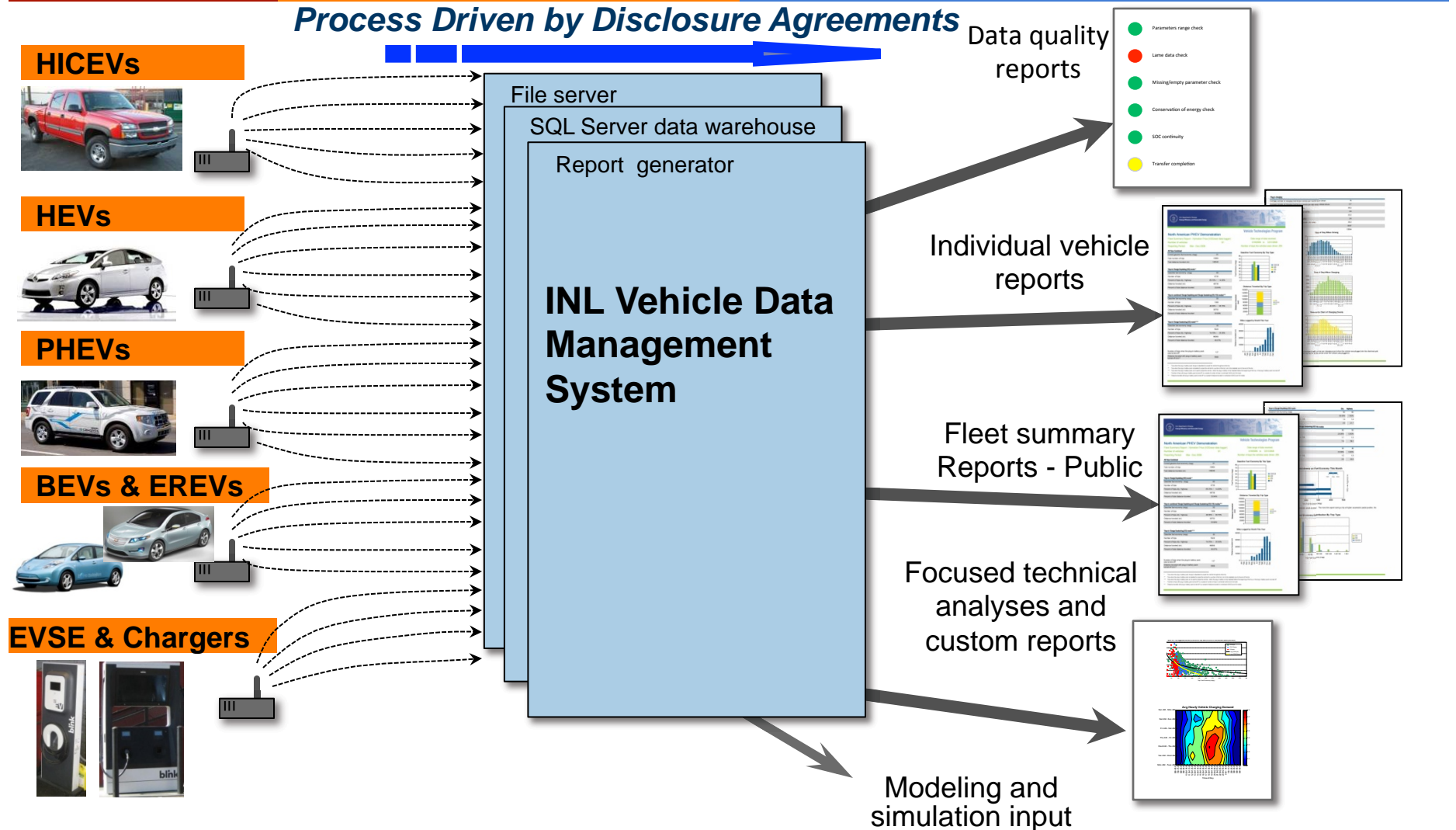
Data Collection and Security History – cont' d

- 2007 data downloading starts via the www for 44 PEVs
- Major 2008 data collection advancement with use of cellular onboard vehicle data loggers in 28 states and three countries for 200 PEVs
 - NDAs continue to protect PII and raw data
- Twenty year history of data security



Today's Vehicle/EVSE Data Management Process

Process Driven by Disclosure Agreements



Today's Data Collection Security

- **All vehicle, EVSE (electric vehicle supply equipment), and PII (personally identifiable information) data is legally protected by NDAs (Non Disclosure Agreements)**
 - **Limitations on how proprietary and personally identifiable information can be stored and distributed**
 - **Raw data, in both electronic and printed formats, is not shared with DOE in order to avoid exposure to FOIA**
- **Vehicle and EVSE data collection would not occur unless the data collection partners trust (and have legal assurance) that ECOtality North American (ECOtality) and the Idaho National Laboratory (INL) will strictly adhere to all NDAs and confidentially agreements regarding the non-release of data**

Today's Data Collection Security – cont'd

- EV Project NDAs are required between
 - ECOtality
 - INL
 - OnStar
 - Nissan
 - Car2Go
- 11,000 vehicle owners, and public EVSE and DC fast charger hosts have signed confidentiality agreements
- **Vehicle and EVSE data collection would not occur unless the data collection partners trust (and have legal assurance) ECOtality and INL will strictly adhere to all NDAs and confidentiality agreements regarding the non-release of data**

Data Parameters Collected per Charge Event

➤ Data from ECOTality's Blink EVSE network

- Connect and Disconnect Date/Time
- Start and End Charge Date/Time
- Maximum Instantaneous Peak Power
- Average Power
- Total energy (kWh) per charging event
- Rolling 15 Minute Average Power
- Unique ID for Charging Event
- Unique ID Identifying the EVSE
- And other non-dynamic EVSE information (GPS, ID, type, contact info, etc.)



Data Parameters Collected per Start/Stop Event

➤ Vehicle data is received via telematics providers from Chevrolet Volts and Nissan Leafs

- Odometer
- Battery state of charge (Indicated)
- Date/Time Stamp
- Vehicle ID
- Event type (Key on / Key off)
- Electric-only odometer (Volt only)
- Gasoline consumption (Volt only)
- GPS (longitude and latitude)
- Recorded for each Key-on and Key-off event

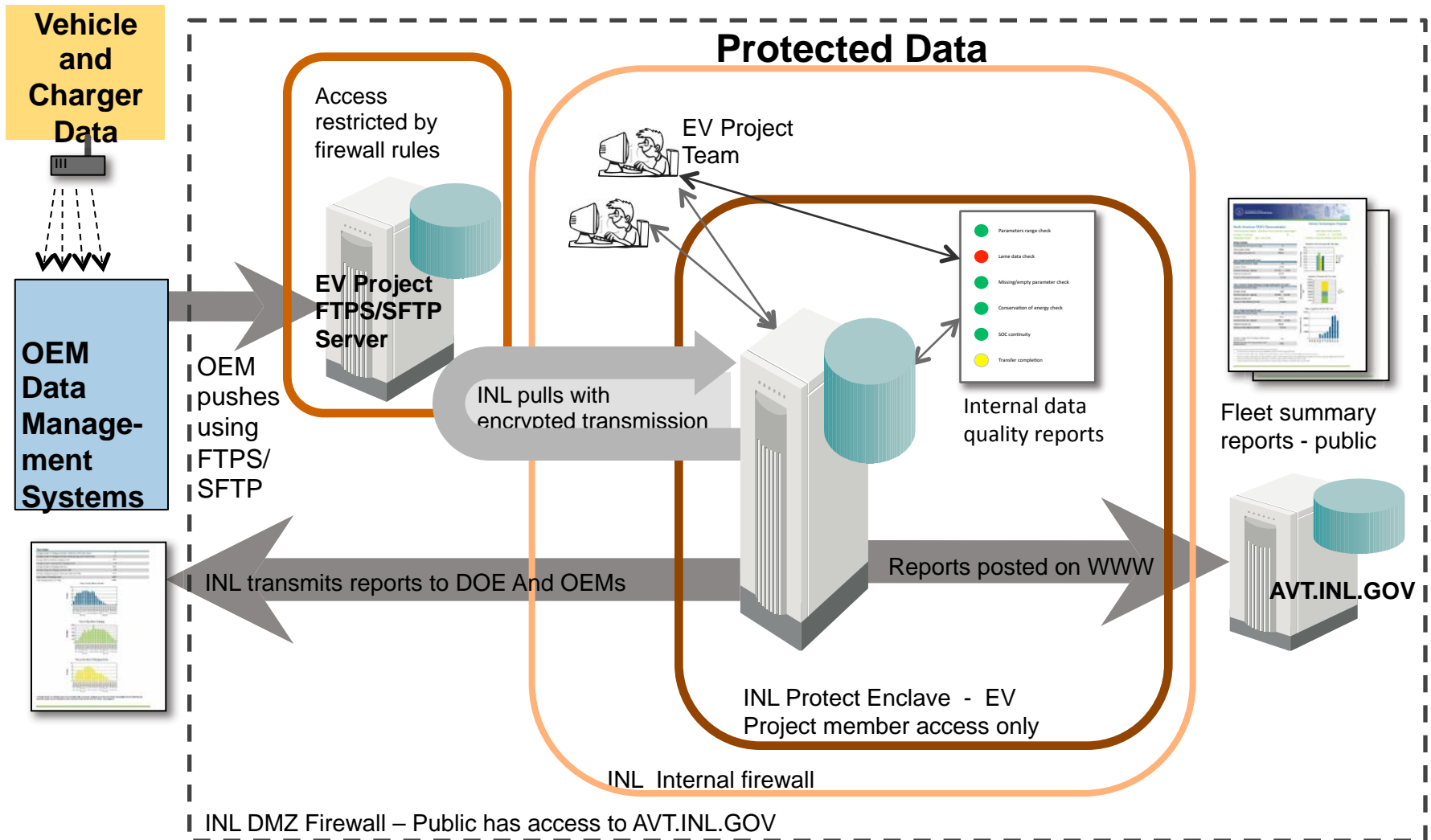


➤ Data is received monthly from Car2go for the Smart EVs

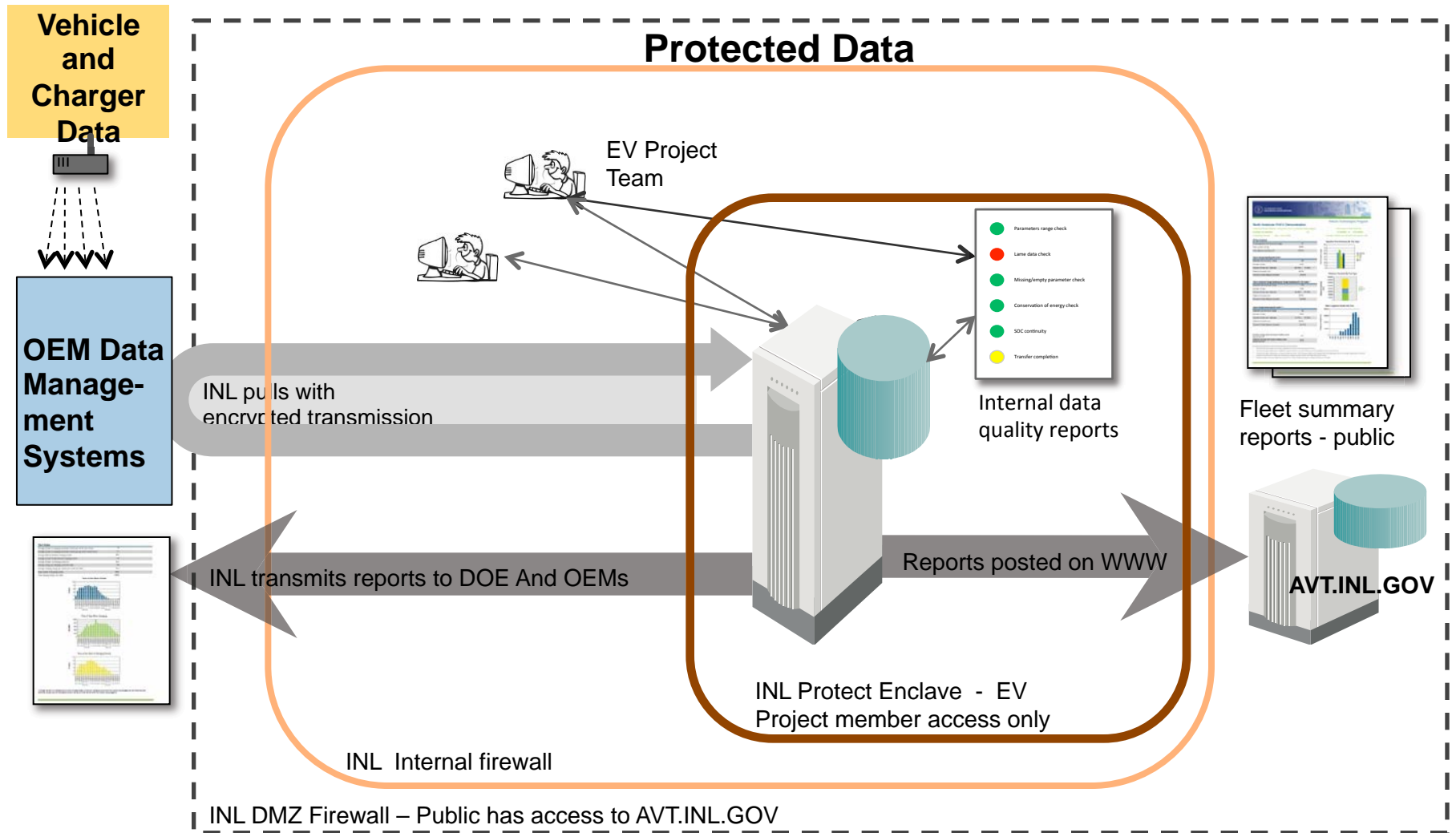
- Odometer reading, date and VIN

EV Project Data Management System – Push

(Nissan, GM/OnStar, ECOtality, EPRI, Car2Go)



EV Project Data Management System – Pull (Aerovironment)



EV Project Databases

- **The EV Project has 44 Databases (DB)**
 - Nissan Leaf
 - GM/OnStar Volt
 - ECOtality Blink EVSE
 - Aerovironment EVSE
 - EPRI EVSE
 - Admin (look up tables, territories, zips codes, QA parameters, etc.)
 - Each of the above six DBs has three versions (process, stage & production) = 18 DBs
 - Four GIS DBs for the Leafs, Volts, Blink EVSEs, and Base (streets, utility service territory areas, etc.)
 - The above 22 (18 + 4) DBs exist on two systems = 44 DBs
- **This is not a flat file experience = this is NOT a simple task**

Data Handling Requirements

- **Hundreds of Algorithms are required to process incoming data from all sources and generate reports**
- **EVSE data has approximately 60 QA checks. Examples include:**
 - **Checking for empty events**
 - **Duplicate records**
 - **Time stamps misordered**
 - **Nesting - second events must start after prior event completes**
 - **Missing energy**
 - **Inaccurate load factors**
 - **Is the new EVSE and PEV owner showing off how to insert the J1772 connector over beers in the driveway? Is each one a new charge event?**

Data Handling Requirements – cont' d

➤ Vehicle data has approximately 15 QA checks. Examples include:

- Minimum trip distances
- Miles missing
- Mileage gaps
- Erroneous miles
- State of charge jumps and spikes (up and down)
- Nested trips
- If you “Key On” to roll up the vehicle windows, the data logger records a new “Trip”. What should the minimum trip distance be?

Data Handling Requirements – cont' d

- **Data completeness must be checked. Examples include:**
 - How many vehicles and EVSE don't send or stop sending data
 - Vehicles must be successfully paired with “at home” EVSE at the same locations to generate the quarterly Infrastructure Report
 - EVSE cannot be sited in Spain or vehicles parked west of California
 - Problems of unknown PEVs at home charging locations
- **In-house GIS mapping service has been developed for territory reporting**
- **Clustering algorithms developed to pair vehicles and EVSE**
- **Reporting algorithms generate more than 56,000 parameters that populate the four quarterly reports (120 pages)**
 - Accomplished via the use of several thousand lines of code
- **Multiple raw data streams allow for data quality comparisons**

Data Collection Summary

- Requires reporting quarterly results and trends before completing the EV Project data collection process
- The EV Project requires obtaining data from sources that never shared or even stored data before
- Required signing up 11,000 data partners that agreed to pay for data collection channels and provide PII
- The INL builds nuclear reactors, depleted uranium armor, and plutonium batteries
 - All are data and process dependent processes
 - It is this legacy for quality and excellence of data collection, analysis and reporting that drives the EV Project process

Data Collection Summary – cont' d

- The EV Project would never fly if we did not legally promise our partners that we would control and not release the raw data
- Legal restrictions on releasing PII and propriety raw data will always be adhered to by the EV Project partners. So, please don' t ask (again)
- The EV Project has not been for the *faint of heart*



What I looked like at the EV Project start

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**Information
Dissemination
Peer Review –
Quarterly
Reporting**

**John Smart
March 6 , 2013**



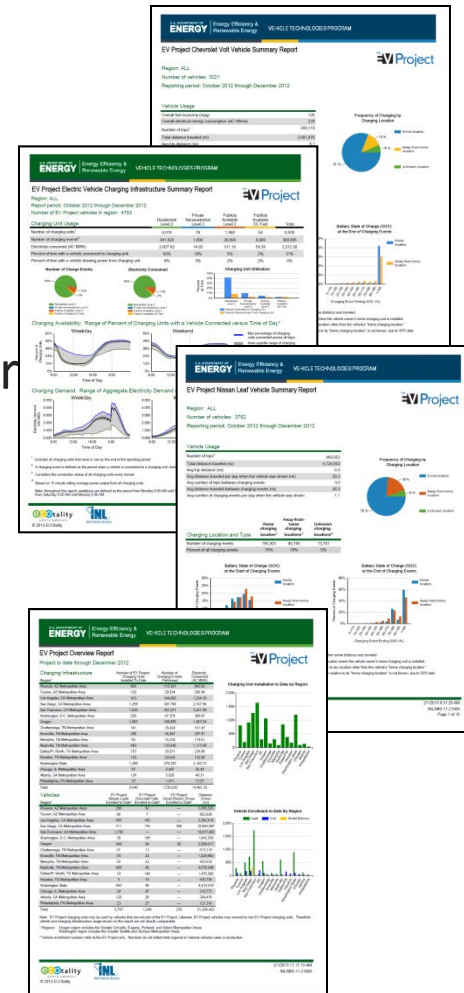
Dissemination of *Information*

The EV Project committed to provide quarterly reports to disseminate low-level summary information about:

- Project deployment status
- Plug-in electric vehicle driving and charging behavior
- Electric vehicle supply equipment (EVSE) usage and grid impact

The quarterly reports provide a foundation to a much larger scope of work

- The EV Project will also be publishing white papers and technical reports to share lessons learned from infrastructure deployment and focused analyses of usage data



Quarterly Report Walk-through

1. Overview report and maps
2. Infrastructure usage summary report
3. Nissan Leaf usage summary report
4. Chevrolet Volt usage summary report

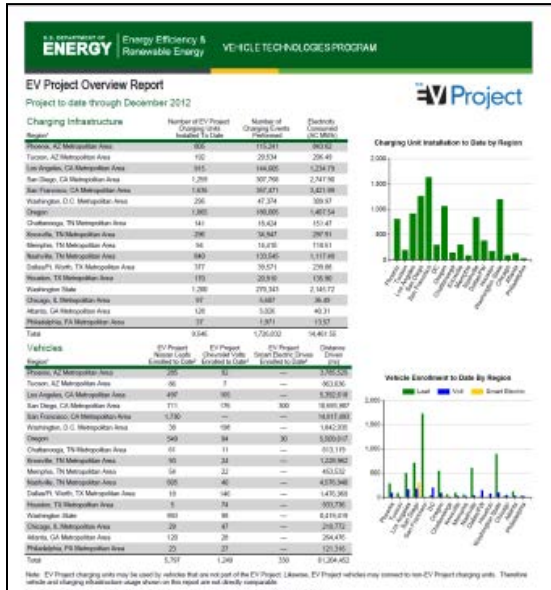
Published to the following websites by the last day of the month following the quarter:

www.theevproject.com/documents.php

avt.inl.gov/evproject.shtml

CSV files with underlying “plot points” are available at www.theevproject.com/documents.php

Overview Report

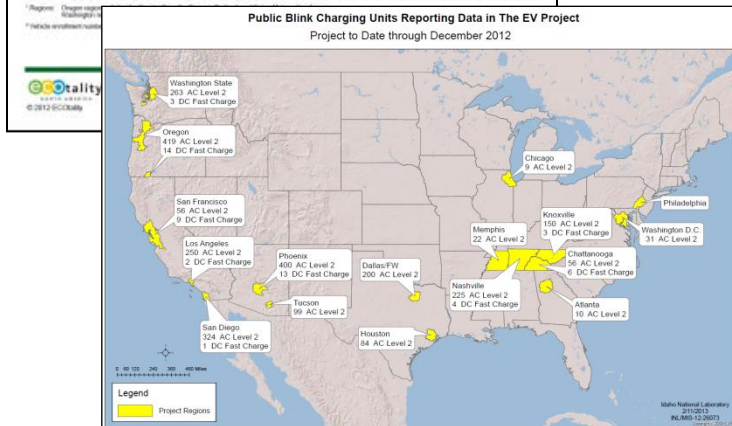


Overview report provides at-a-glance project status update

➔ Number of EVSE installations and vehicle enrollments by EV Project market region

➔ High-level usage by region

Maps show number of EVSE by type and vehicles by model in each EV Project market region



EVSE and Vehicle Usage Reports

EVSE and vehicle behavior is studied from 2 perspectives

- By monitoring stationary electric vehicle supply equipment (EVSE) as vehicles come to them
- By following vehicles as they travel between EVSE



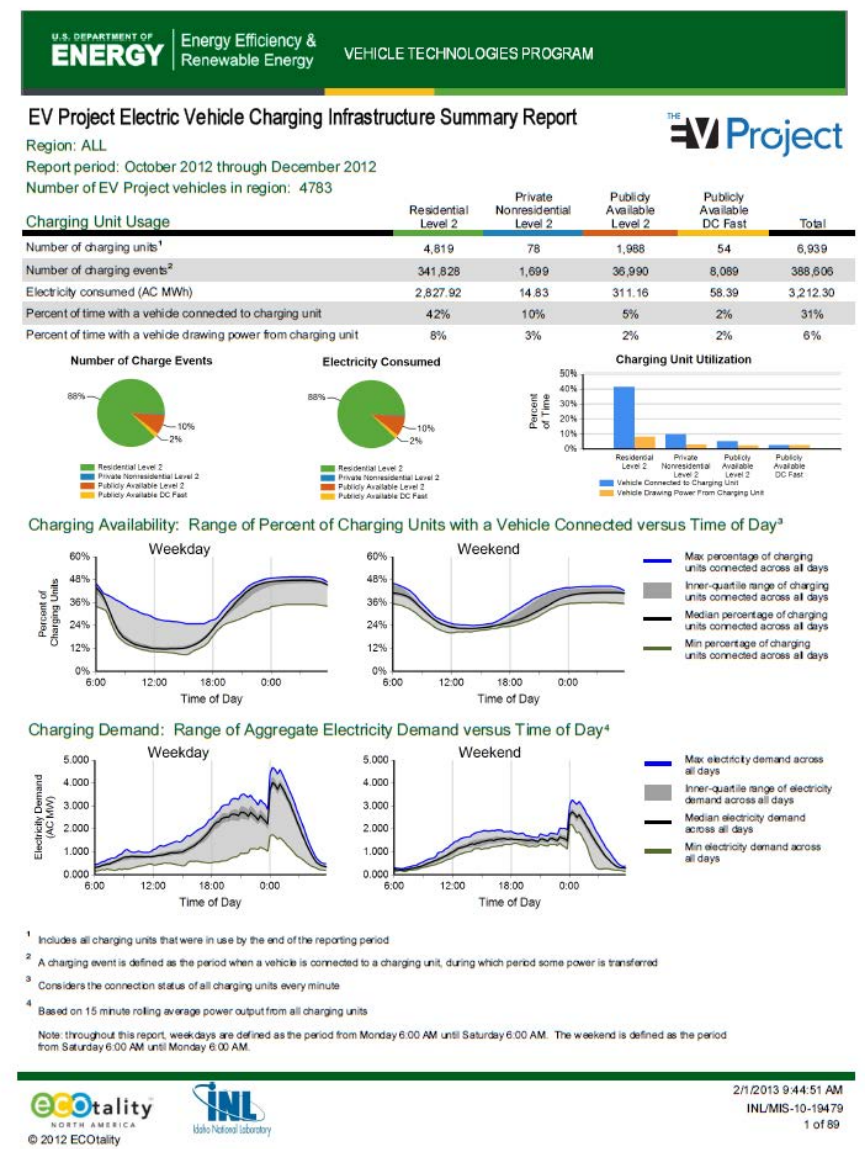
EVSE and Vehicle Usage Reports

Aggregation rules

- EV Project regions are broken out into separate sections if there are 10 or more EVSE or vehicles in a region
- EVSE types are broken out into separate sections if there are more than 10 EVSE of the same type
 - Residential
 - Private non-residential
 - Public level 2
 - Public DC fast charger

Infrastructure Usage Summary Report

- Provides aggregate metrics and distributions for EVSE usage by type, charging level, and region
- 120 pages and counting
- Answers the questions
 - Who... uses them?
 - What... kind are they?
 - When... are they used?
 - Where... are they located?
 - How... much, how often are they used?



Infrastructure Report cont.

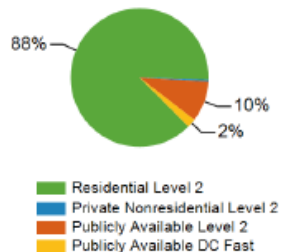
Up to 9 pages for each region and nation

➤ How many of which kind? ➤ How much?

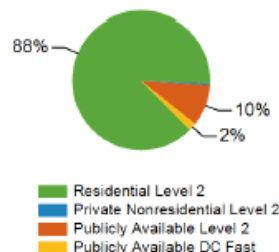
Number of EV Project vehicles in region: 4783

Charging Unit Usage	Residential Level 2	Private Nonresidential Level 2	Publicly Available Level 2	Publicly Available DC Fast	Total
Number of charging units ¹	4,819	78	1,988	54	6,939
Number of charging events ²	341,828	1,699	36,990	8,089	388,606
Electricity consumed (AC MWh)	2,827.92	14.83	311.16	58.39	3,212.30
Percent of time with a vehicle connected to charging unit	42%	10%	5%	2%	31%
Percent of time with a vehicle drawing power from charging unit	8%	3%	2%	2%	6%

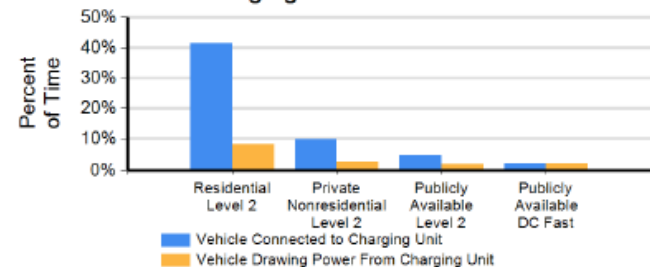
Number of Charge Events



Electricity Consumed



Charging Unit Utilization



Infrastructure Report cont.

Up to 9 pages for each region and nation

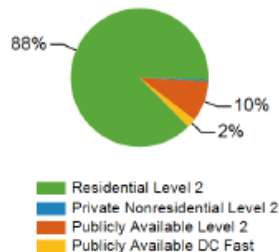
➤ How many of which kind? ➤ How much?

Number of EV Project vehicles in region: 4783

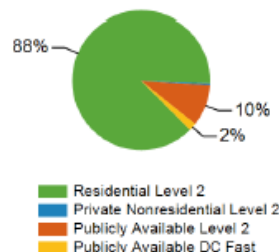
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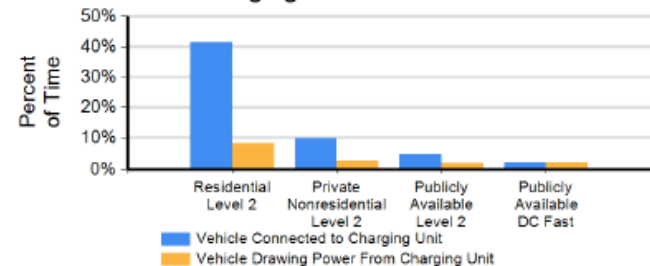
Number of Charge Events



Electricity Consumed



Charging Unit Utilization



Infrastructure Report cont.

Up to 9 pages for each region and nation

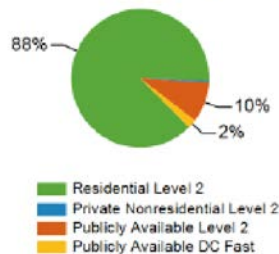
➤ How many of which kind? ➤ How much?

Number of EV Project vehicles in region: 4783

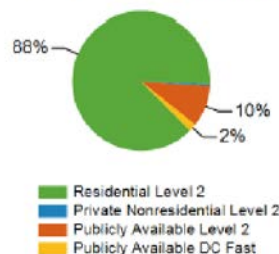
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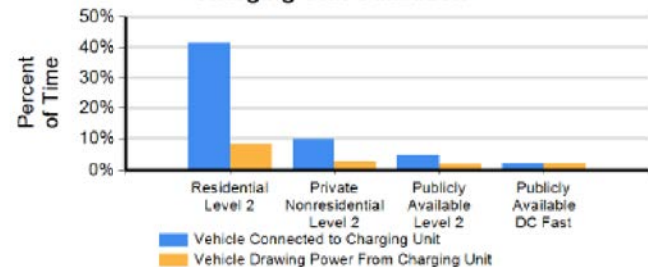
Number of Charge Events



Electricity Consumed



Charging Unit Utilization



Infrastructure Report cont.

For each region and EVSE type/level

When connected?

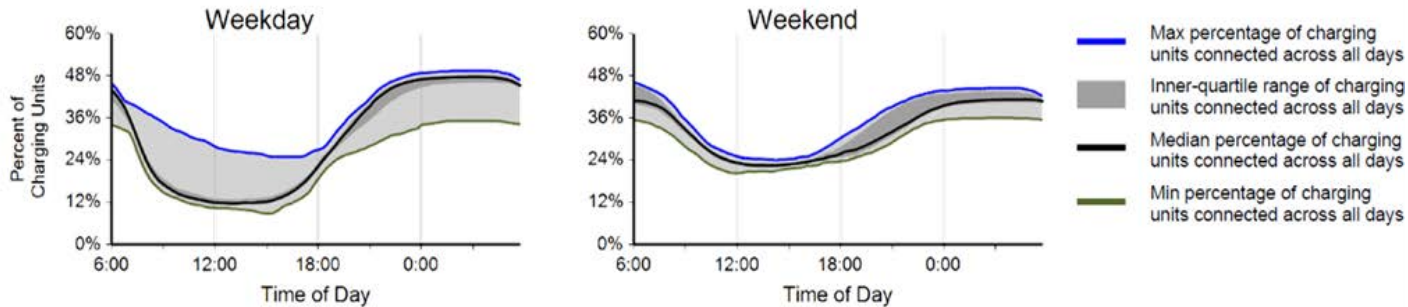
➔ Percent of vehicles connected by time of day, day of week

How much demand?

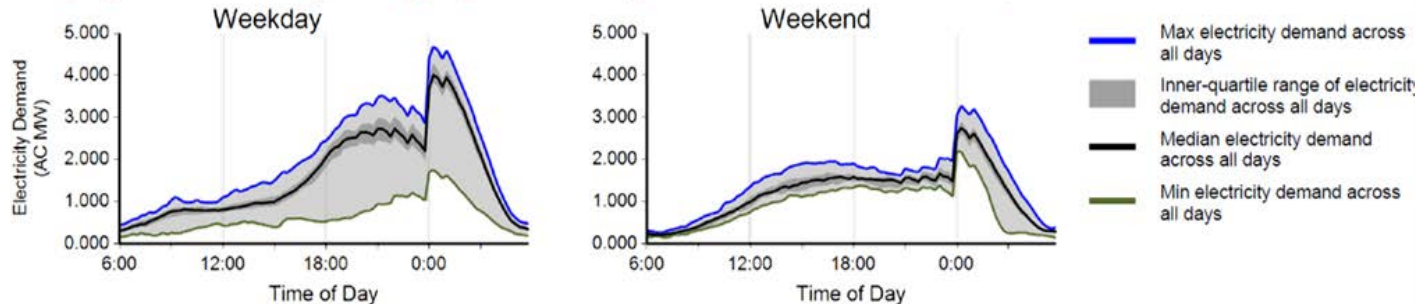
➔ Aggregate load shapes by time of day, day of week

ALL EVSE

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



Infrastructure Report cont.

For each region and EVSE type/level

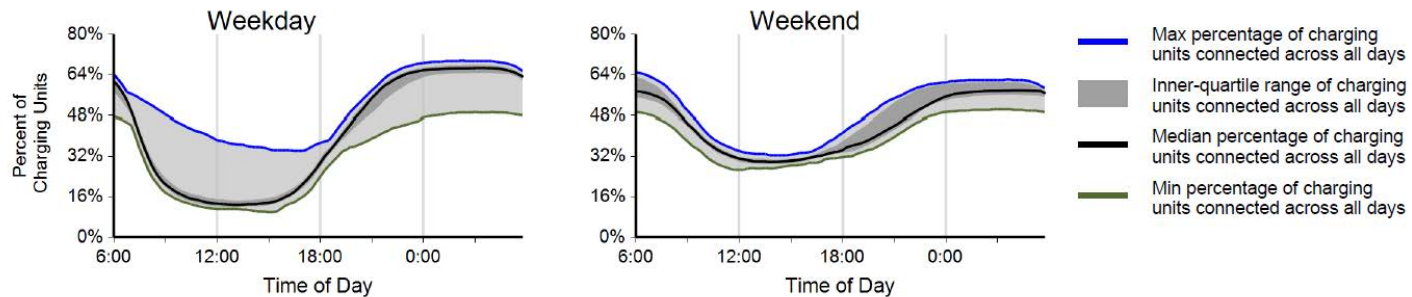
When connected?

➔ Percent of vehicles connected by time of day, day of week

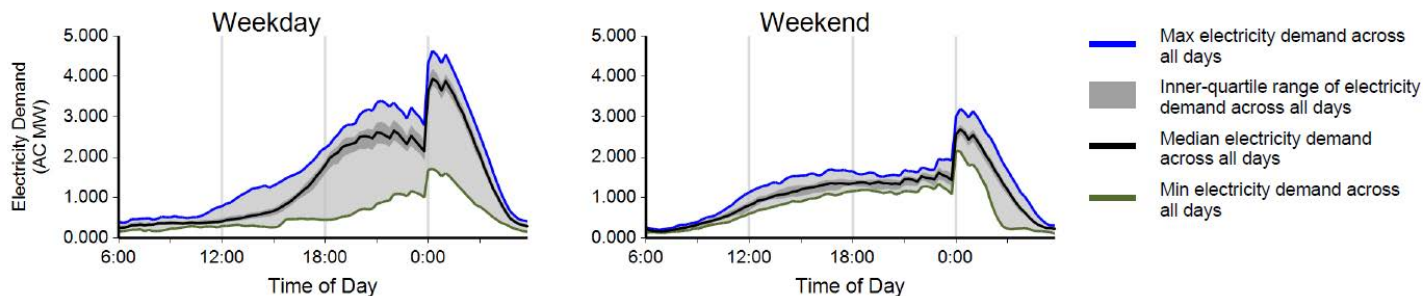
How much demand?

➔ Aggregate load shapes by time of day, day of week

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



Residential EVSE

Infrastructure Report cont.

For each region and EVSE type/level

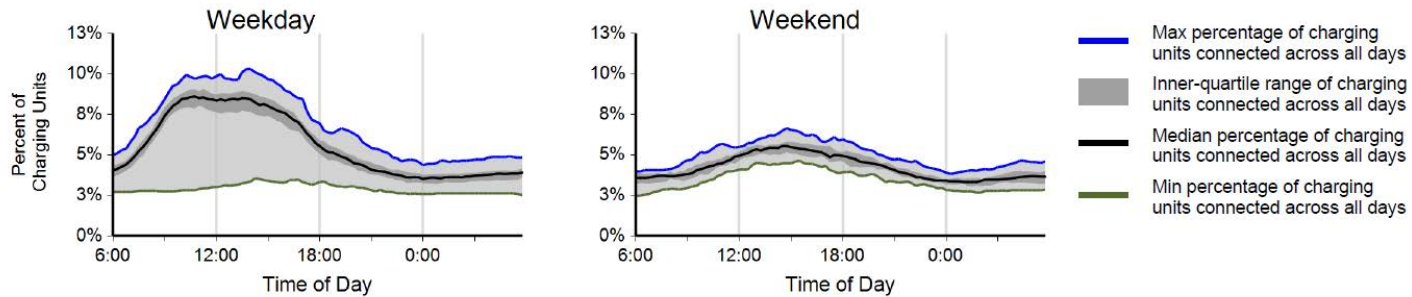
When connected?

➤ Percent of vehicles connected by time of day, day of week

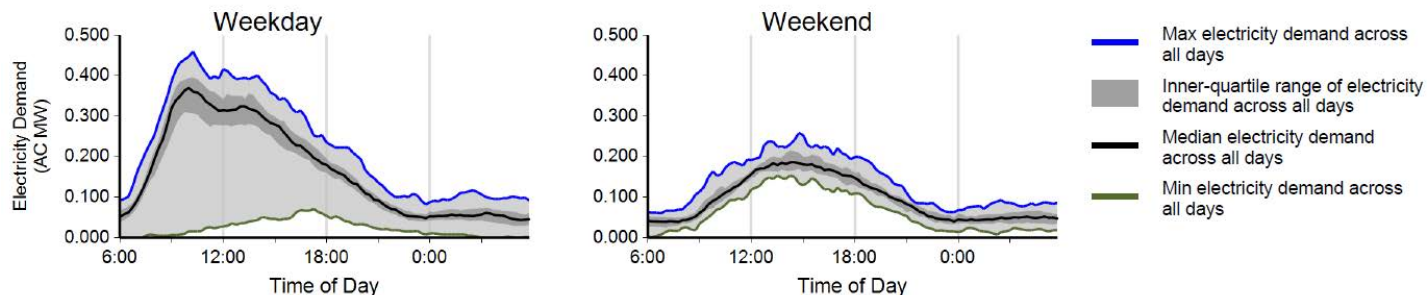
How much demand?

➤ Aggregate load shapes by time of day, day of week

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



Public
Level 2 EVSE

Infrastructure Report cont.

For each region and EVSE type/level

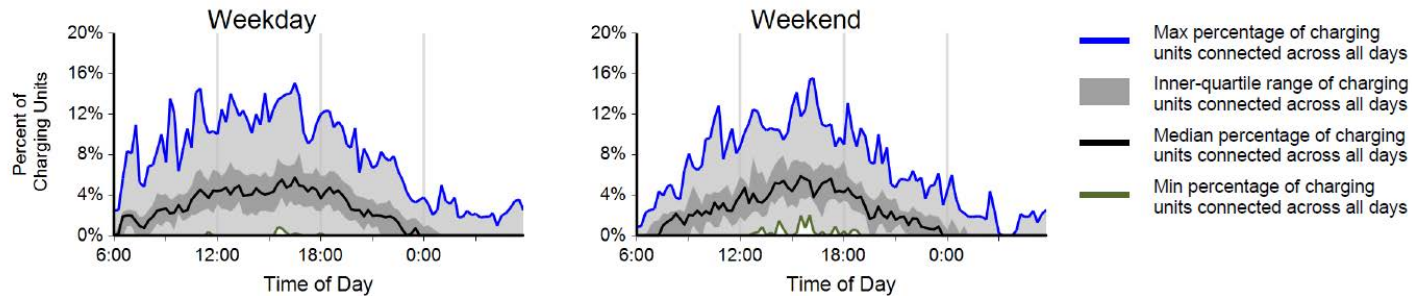
When connected?

➔ Percent of vehicles connected by time of day, day of week

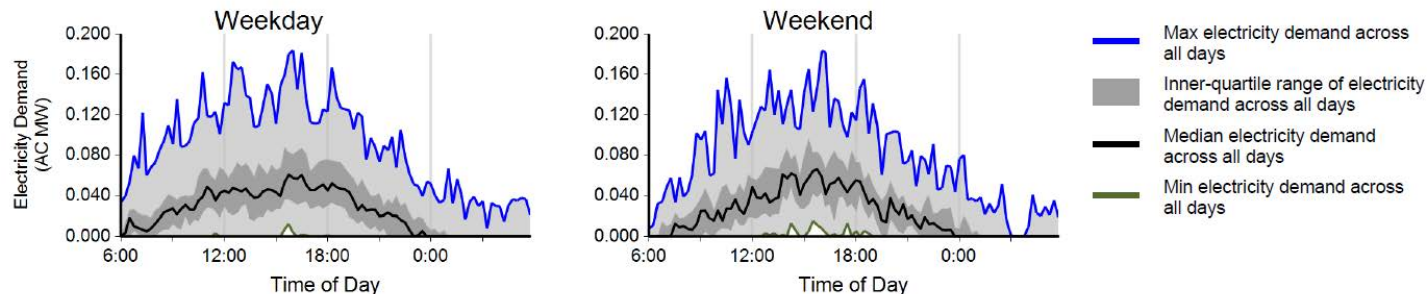
How much demand?

➔ Aggregate load shapes by time of day, day of week

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



Infrastructure Report cont.

For each region and EVSE type/level

➤ How much and how often by day of week

EVSE Usage	Weekday	Weekend	Overall
Number of charging events	251,657	90,171	341,828
Electricity consumed (AC MWh)	2,161.64	666.29	2,827.92
Percent of time with a vehicle connected to EVSE	40%	45%	42%
Percent of time with a vehicle drawing power from EVSE	9%	7%	8%
Average number of charging events started per EVSE per day	0.86	0.77	0.83

➤ Who uses them

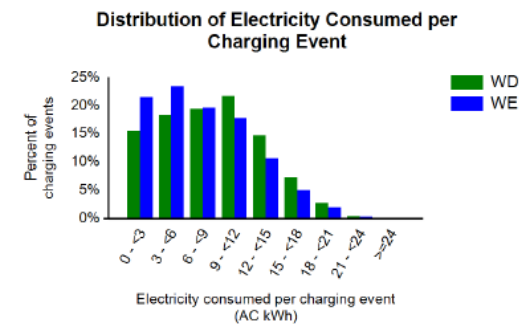
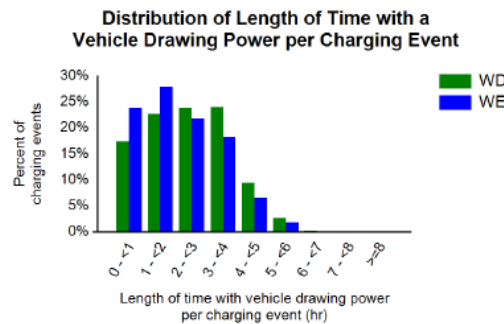
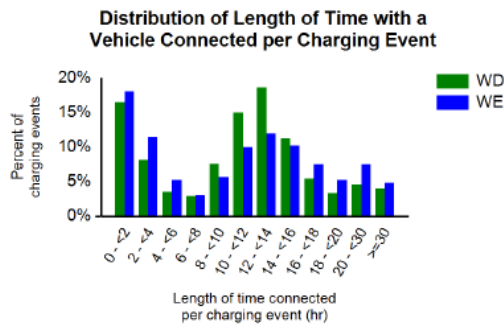
Vehicles Charged	Nissan Leaf	Chevrolet Volt	Unknown
Percent of charging events	73%	27%	0%
Percent of electricity consumed	79%	21%	0%

Infrastructure Report cont.

For each region and EVSE type/level

- How much and how long per charging events on average by day of week
- and as distributions by day of week

Individual Charging Event Statistics	Weekday (WD)	Weekend (WE)	Overall
Average length of time with vehicle connected per charging event (hr)	12.1	12.2	12.1
Average length of time with vehicle drawing power per charging event (hr)	2.4	2.1	2.4
Average electricity consumed per charging event (AC kWh)	8.6	7.4	8.3

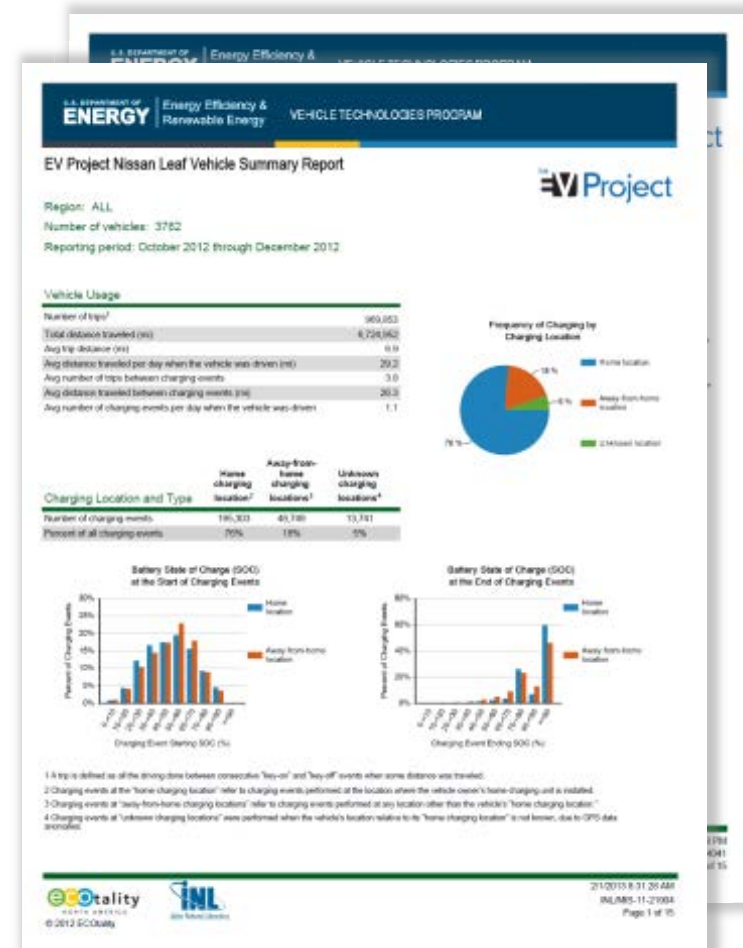


Vehicle Usage Summary Reports

Nissan Leaf and Chevrolet Volt Usage Summary Reports provide aggregate metrics and distributions by region and nationally

Answer the question:

- ➔ How do drivers use infrastructure relative to how they drive to achieve their desired results?

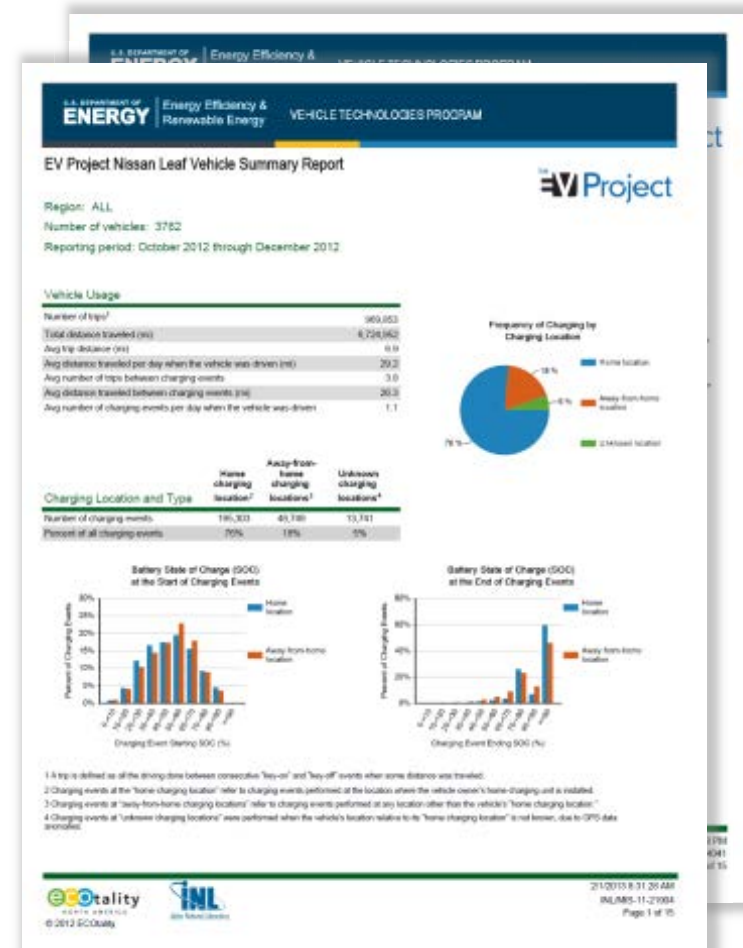


Vehicle Usage Summary Reports

Nissan Leaf and Chevrolet Volt Usage Summary Reports provide aggregate metrics and distributions by region and nationally

Answer the question:

- Where... are they charging?
- When... are they charged relative to battery pack state of charge?
- How much and how often... driving?
- How much and how often... charging?
- How complete is the charging?
- How much... Volt driving in electric-only mode as a result of the driving/charging mix



Nissan Leaf Usage Summary Report

One page for each region and nation

➤ How much and how often driving and charging?

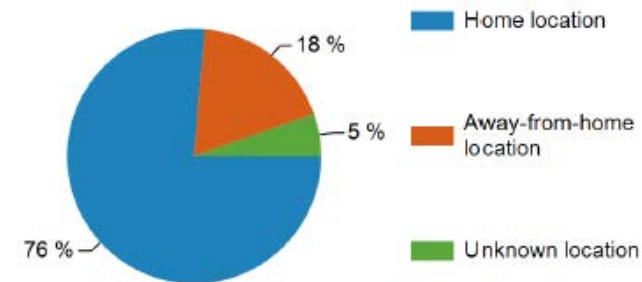
➤ Per trip, per day, per charge

➤ Where charging?

Vehicle Usage

Number of trips ¹	969,853
Total distance traveled (mi)	6,724,952
Avg trip distance (mi)	6.9
Avg distance traveled per day when the vehicle was driven (mi)	29.2
Avg number of trips between charging events	3.8
Avg distance traveled between charging events (mi)	26.3
Avg number of charging events per day when the vehicle was driven	1.1

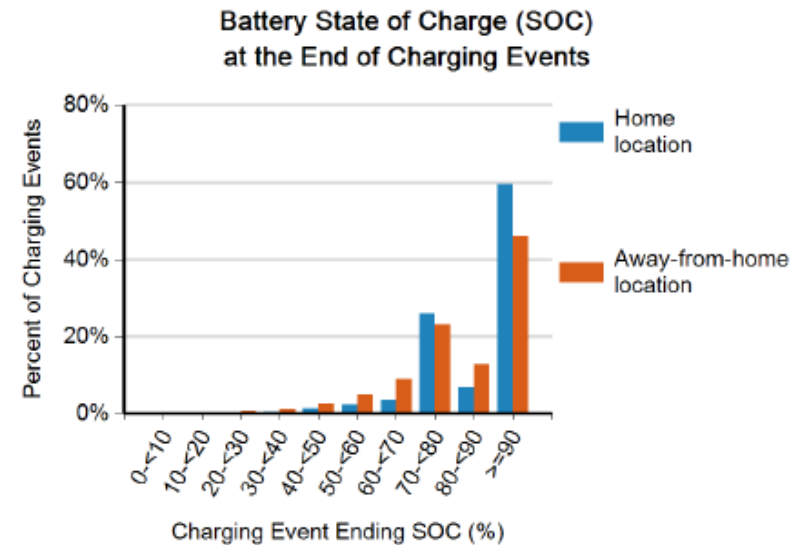
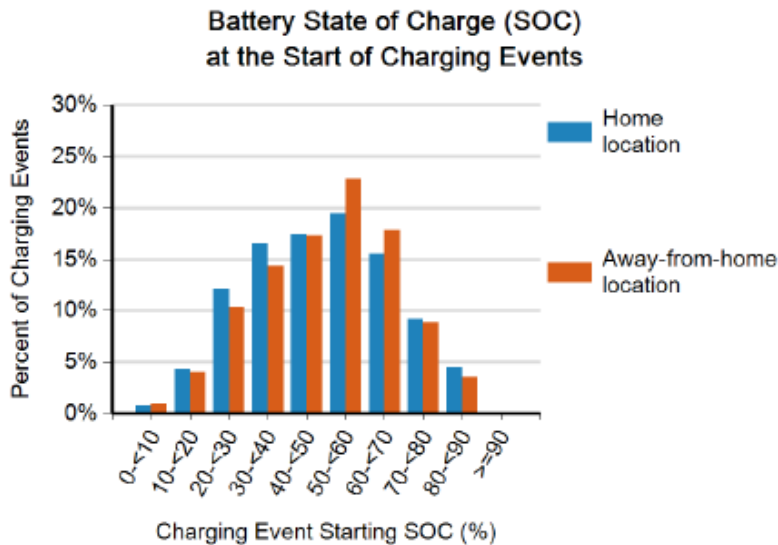
Frequency of Charging by Charging Location



Nissan Leaf Report cont.

For each region and nationally

- When charging with respect to battery pack state of charge?
 - How empty is the pack at the start of charging?
 - How full is the pack at the end of charging?



Chevrolet Volt Usage Summary Report

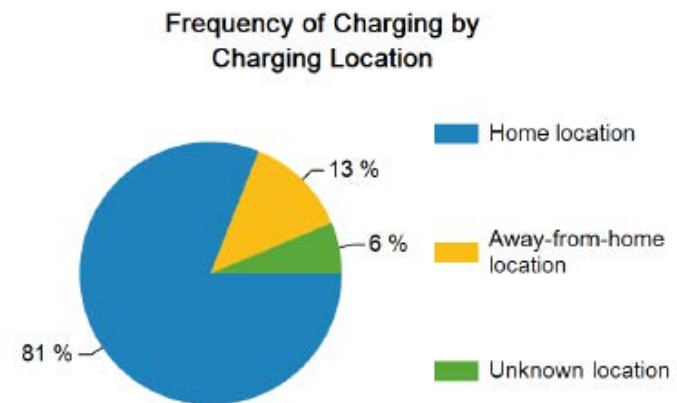
One page for each region and nation

- How much driving and charging and how often?
- How much gas vs. electricity?

Vehicle Usage

Overall fuel economy (mpg)	126
Overall electrical energy consumption (AC Wh/mi)	229
Number of trips ¹	369,118
Total distance traveled (mi)	3,001,976
Avg trip distance (mi)	8.1
Avg distance traveled per day when the vehicle was driven (mi)	40.5
Avg number of trips between charging events	3.5
Avg distance traveled between charging events (mi)	28.2
Avg number of charging events per day when the vehicle was driven	1.4

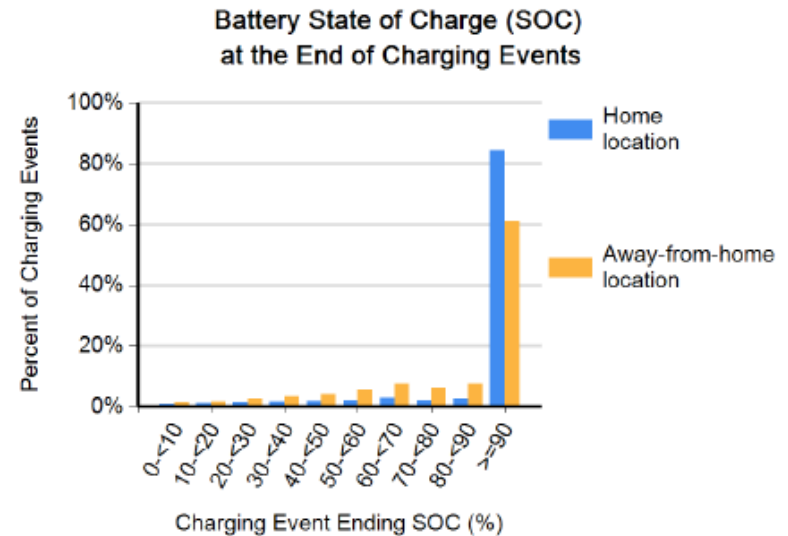
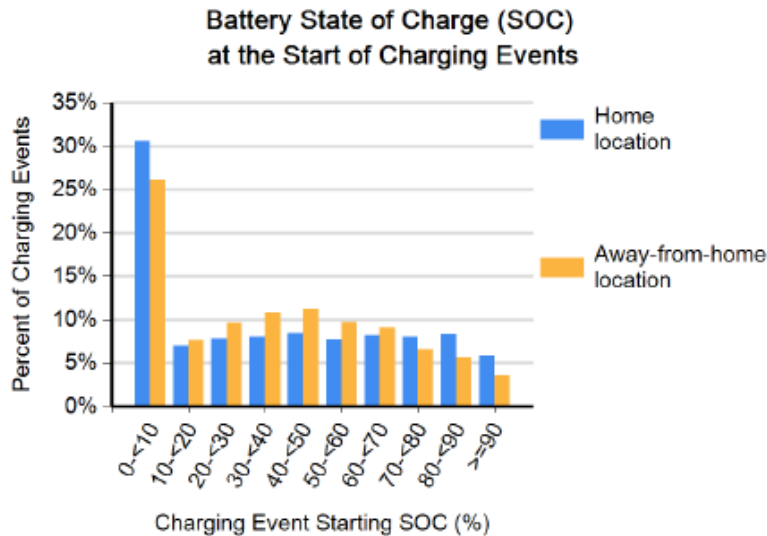
- Where charging?



Chevrolet Volt Report cont.

For each region and nationally

- When charging with respect to battery pack state of charge?
 - How empty is the pack at the start of charging?
 - How full is the pack at the end of charging?



Chevrolet Volt Report cont.

Coming soon for Volt report:

- Percent of miles traveled in EV-only versus extended-range mode
- Percent of charging events at level 1 versus level 2 charge rate

Remember quarterly reports are summaries

- Must be automatable and robust to changes as project evolves
- Look to white papers and technical reports for additional answers to your burning questions

THE
EV Project

**Information
Dissemination
Peer Review**

**Observations
Stephen Schey**

March 6 , 2013



Development of Understanding

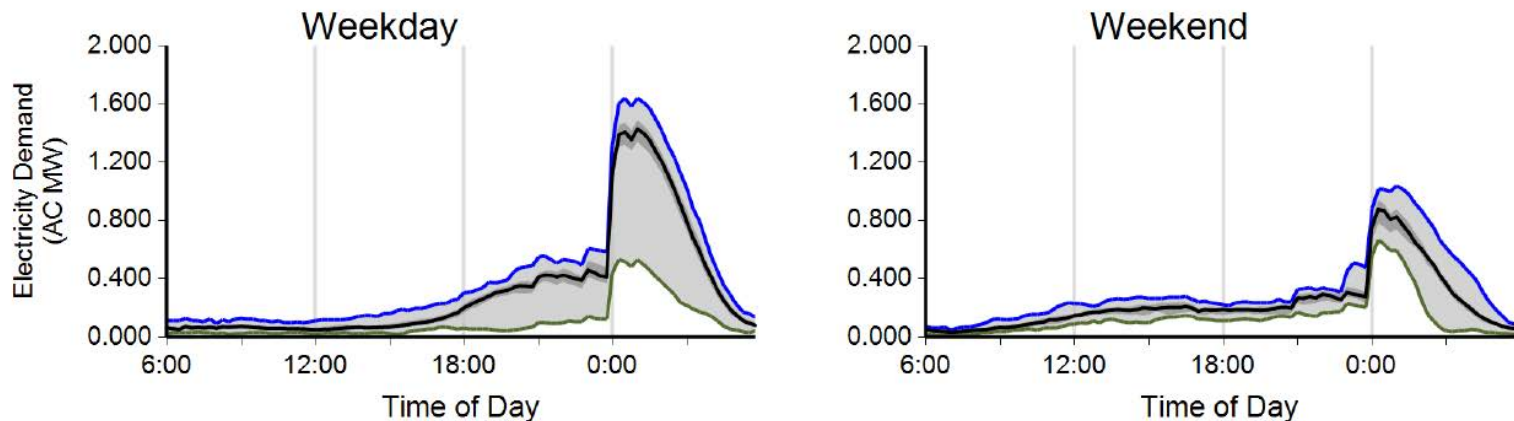


Dissemination Plan – Observations

➤ Observations

- What do I “see” in the information?
- What questions does it raise?
- What hypotheses does it generate?
- How can we test/resolve these hypotheses?
- What “understanding” can be reported?
- How will this add to the body of knowledge?

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



Residential EVSE San Francisco Region

Dissemination Plan – Observations

INPUT for EV Project Observations

➤ I. The EV Project Quarterly Reports

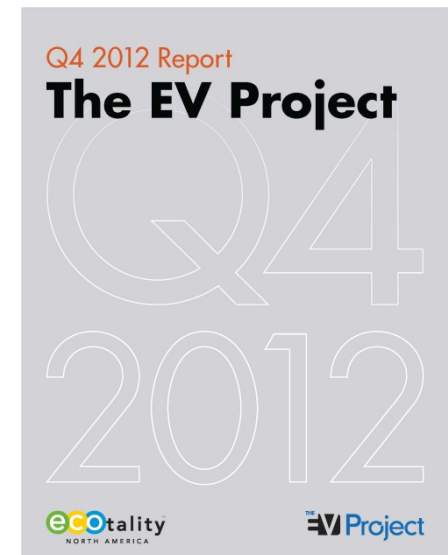
- Aggregates major data collection categories
- Provides significant quantities of information by region, vehicle type, EVSE type, etc.
- Plots and Graphs aid understanding

➤ II. Experience

- Planning Process
- Deployment Activities
- Installation Work

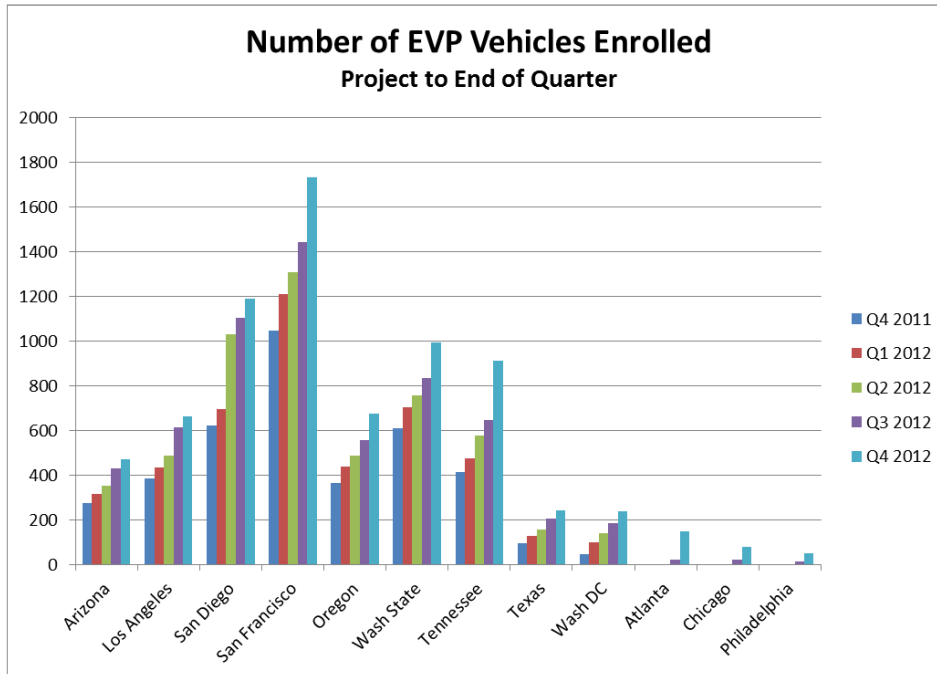
➤ III. Data Analytics

- Observing Data/Information
- Searching data for answers to questions
- Asking questions and experimentation



Dissemination Plan – Observations

Observations on Quarterly Reports



➔ Fast Facts – Through 4th Qtr 2012

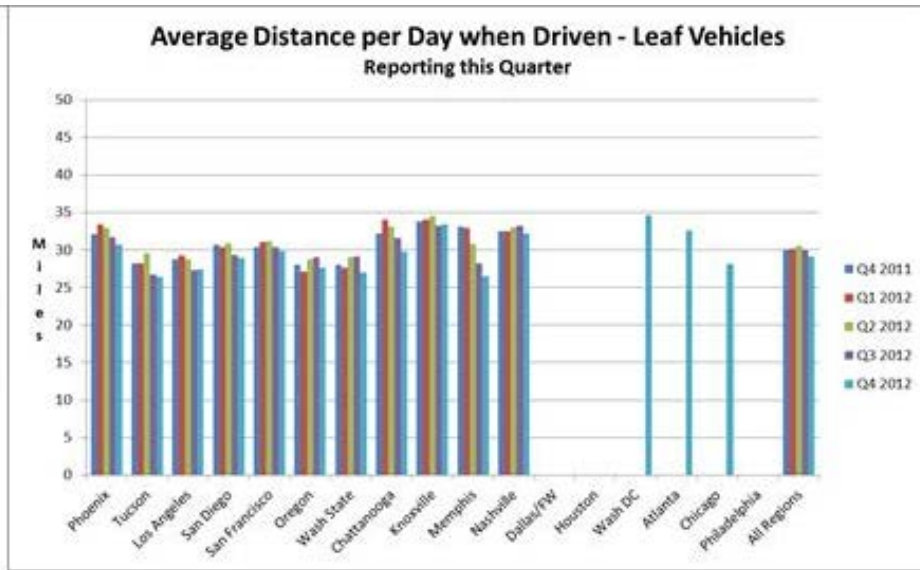
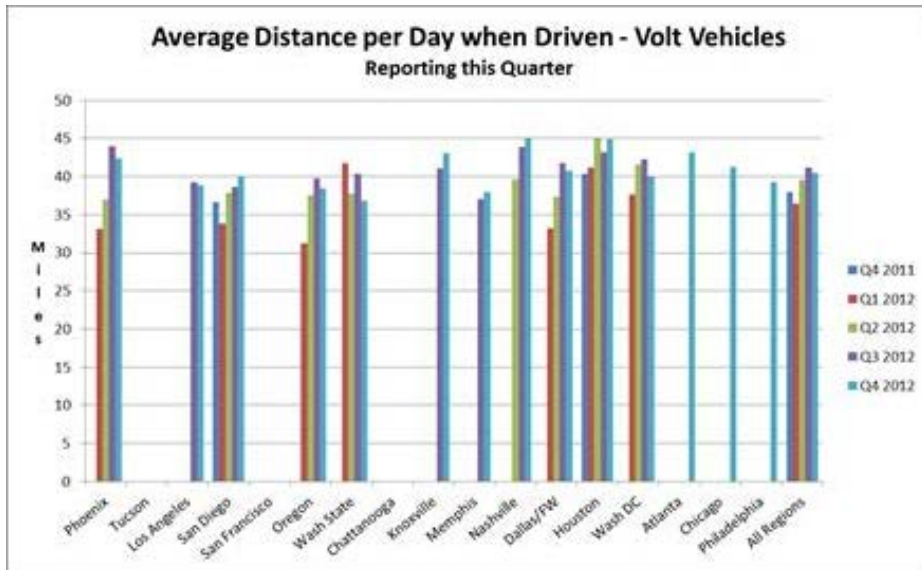
- ➔ Nearly 60 million miles recorded on EV Project vehicles to date
- ➔ Over 1.6 million charging events recorded to date
- ➔ Over 14,100 Megawatt hours of energy delivered to Project vehicles thus far
- ➔ 7,376 Nissan Leafs, Chevrolet Volts and Smart ForTwo vehicles participating
- ➔ Over 1.9 million gallons of gasoline avoided by EV Project vehicles to date
- ➔ Nearly 4500 metric Tons CO₂e avoided

Dissemination Plan – Observations

Observations on Vehicle Utilization

➤ Typical Questions:

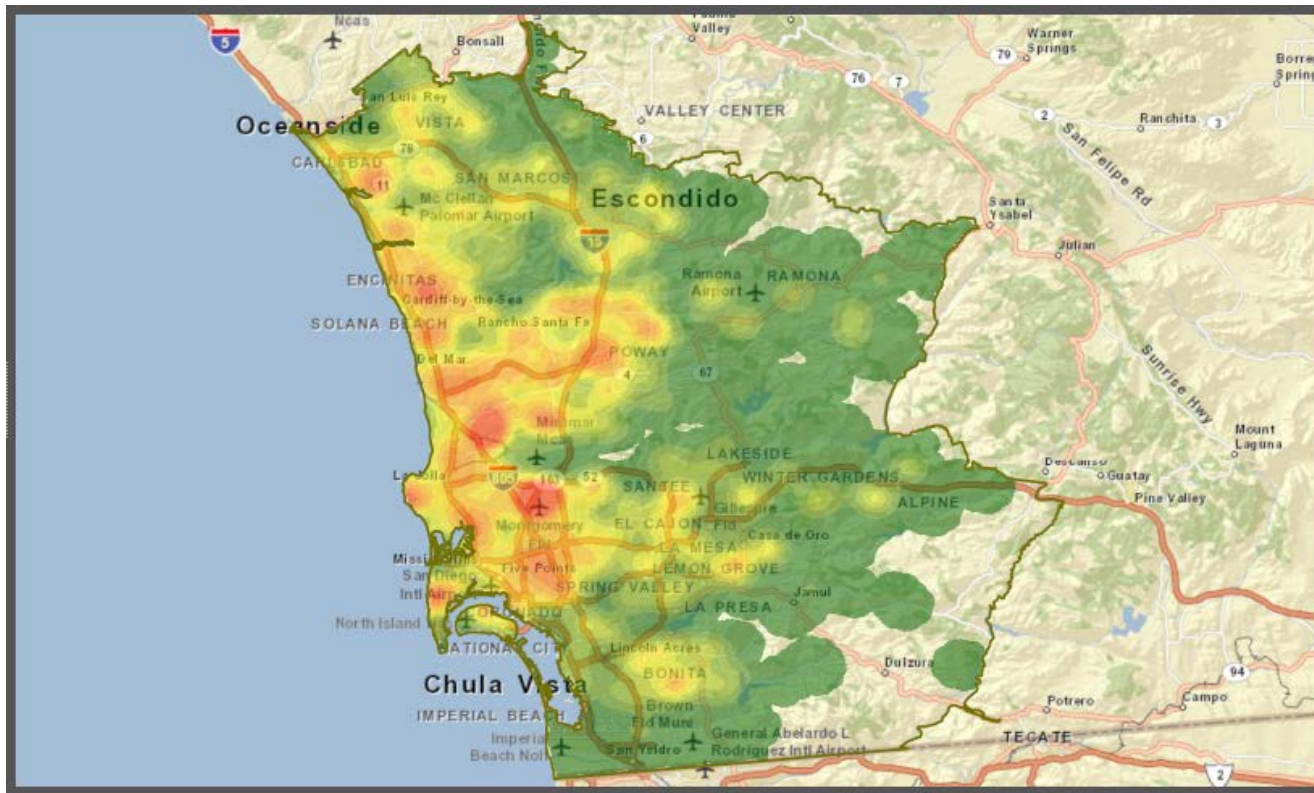
- How do Project participants use their vehicles?
- How does usage vary between Leaf and Volt?



Dissemination Plan – Observations

Observations on Vehicle Utilization

- How can trip end points tell us infrastructure needs? (Compare against participant's reported desires, view SOC at end of trip, distance traveled to get there, etc.)

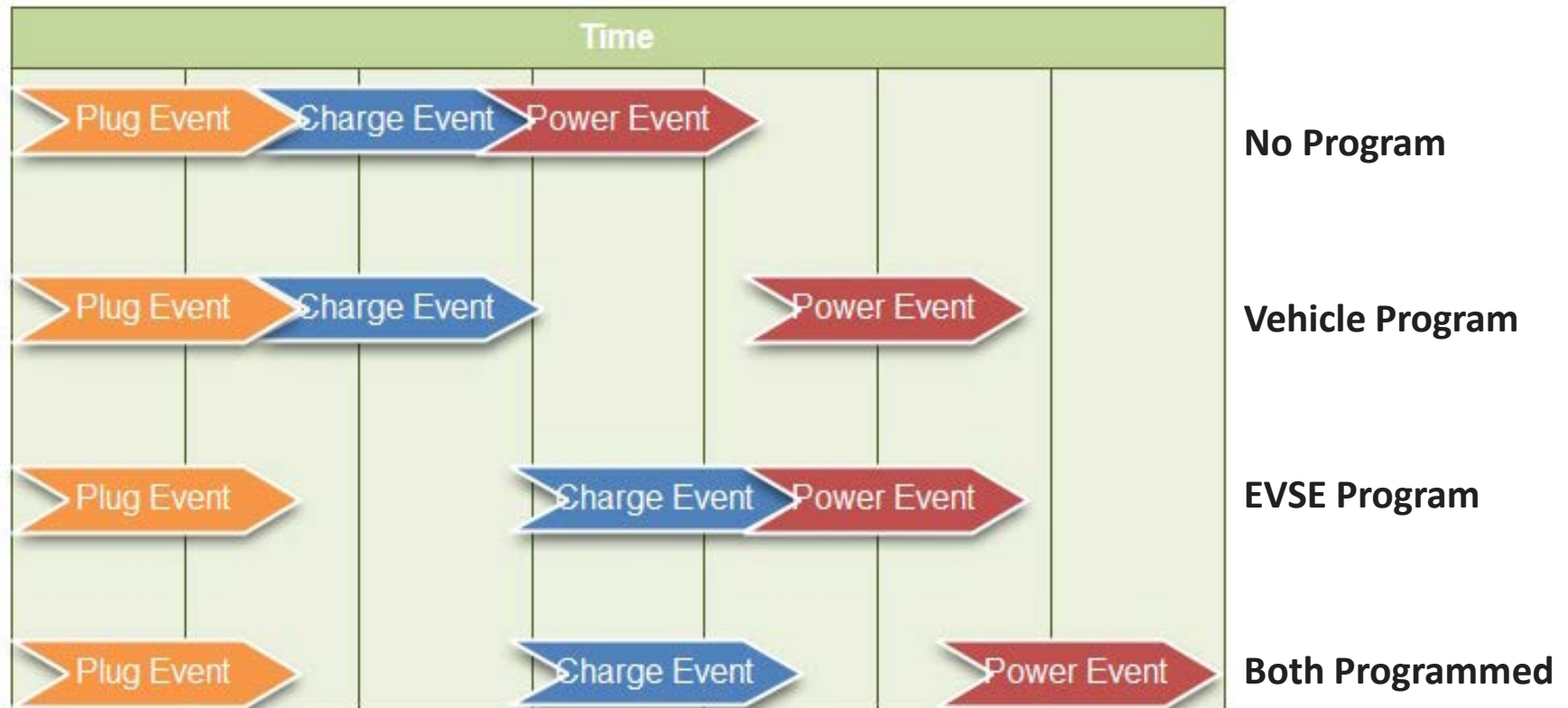


San Diego Leaf Trip End Points

Dissemination Plan – Observations

Observations on Vehicle Utilization

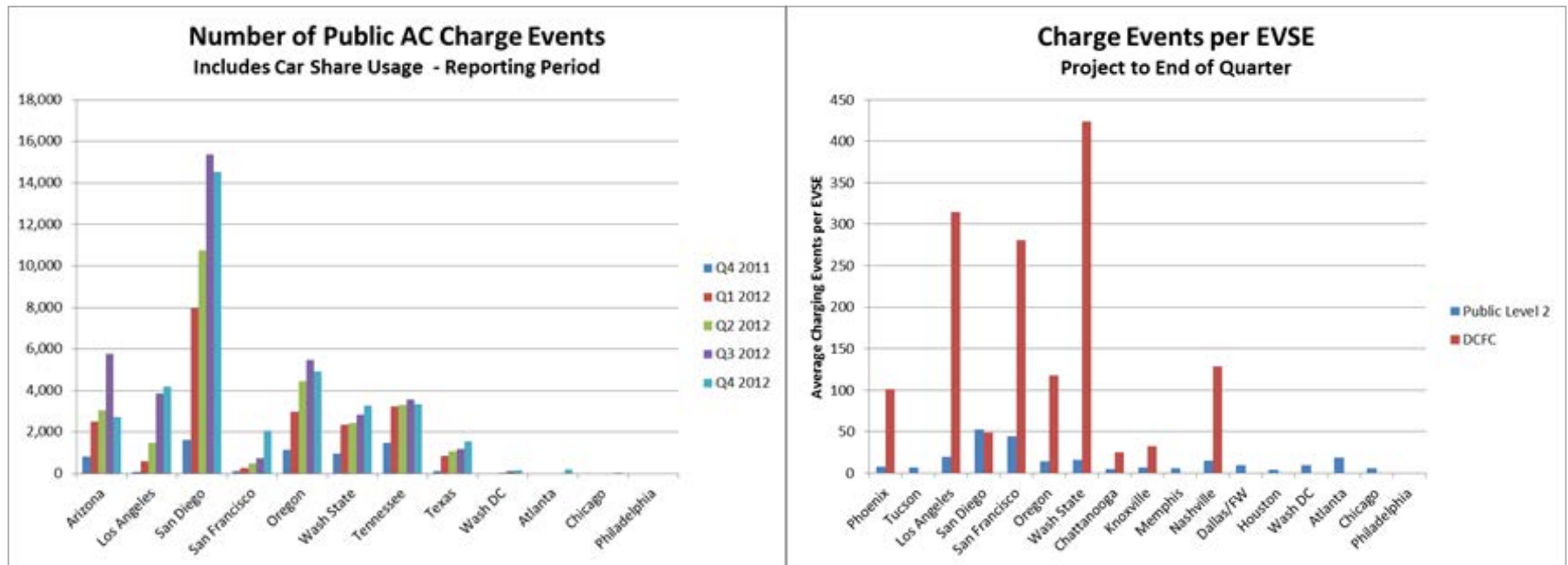
➔ Do drivers program their EVSE, their vehicle, both or neither?



Dissemination Plan – Observations

Observations on Charge Infrastructure Utilization

- What are the best venues for public infrastructure? What is the metric for “best”? Utilization in time connected, connect events, kWh dispensed, location?
- How do Car Sharing programs affect public infrastructure utilization?

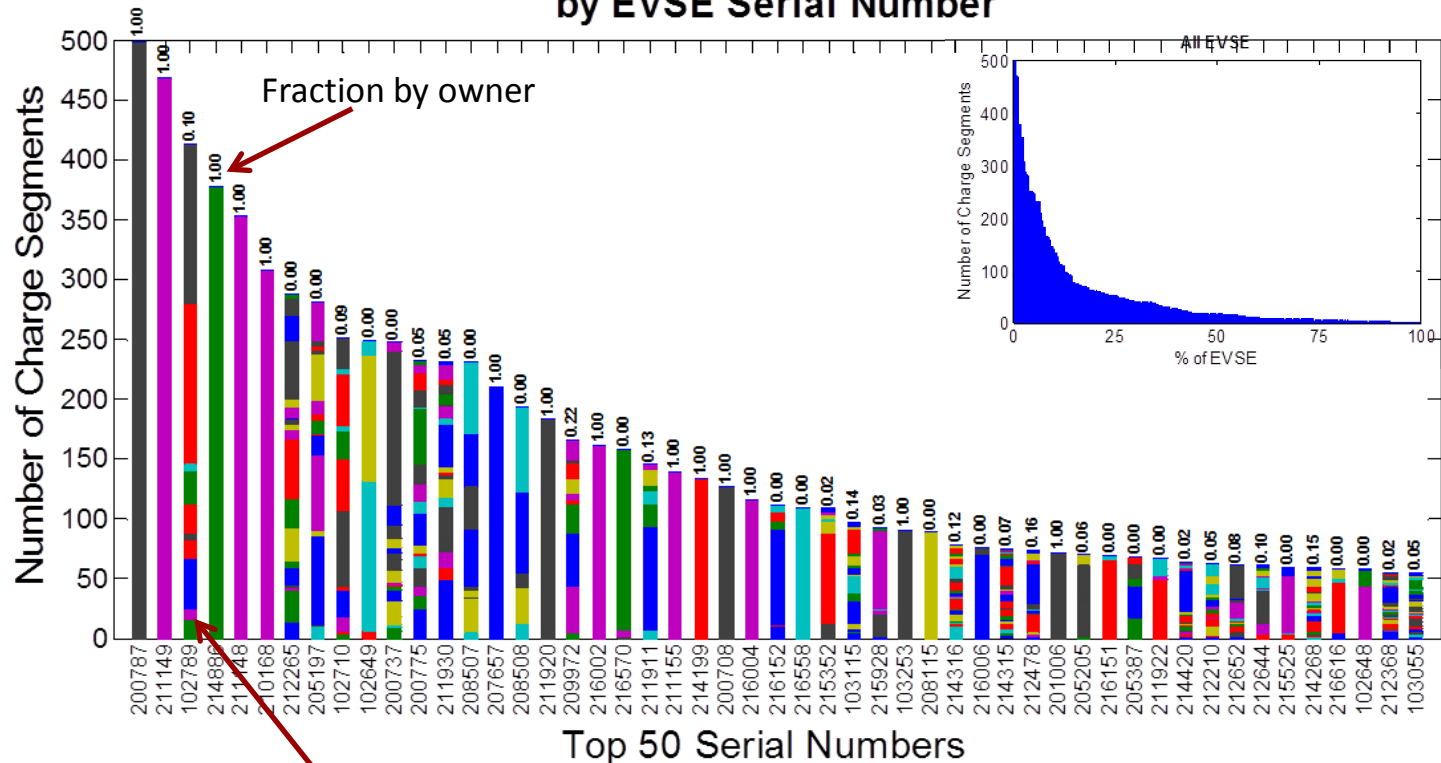


Dissemination Plan – Observations

Observations on Charge Infrastructure Utilization

➔ When, where, how often are participants using the public infrastructure?

Number of Charge Segments on Commercial Level 2 EVSE
by EVSE Serial Number



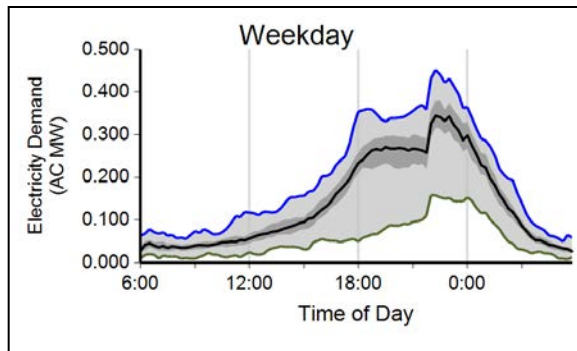
Highest number of charge events

Dissemination Plan – Observations

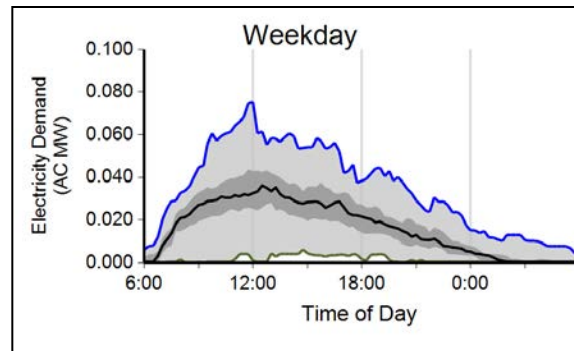
Observations on Infrastructure Operational Impacts

- What are potential load impacts on electric utilities?
- What are the downsides for hosts in providing public infrastructure?

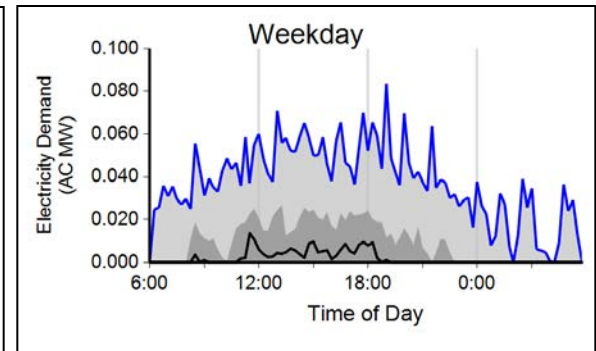
Oregon Charging Demand: Range of Aggregate Electricity Demand versus Time of Day



Residential



Publicly Accessible AC Level 2



DCFC

Dissemination Plan – Observations

Observations on Infrastructure Operational Impacts

➤ How can Charging Site Hosts benefit from public infrastructure?

Data Summary				
<i>Currently have 15 locations with a total of 29 L2 chargers.</i>				
<i>Total of 2,033 charge events occurred from 377 different Member Numbers (Consumers) over a 10 month period.</i>				
<i>On a per month basis this data would equate to 203 charge events from 37 different Member Numbers (Consumers) that connected 5.59 times per month.</i>				
<i>Total of 6,490.86 kwh were dispensed at the chargers. The Avg charge event was 3.19 kwh</i>				
<i>Avg. connection time was 1 hr and 12 min</i>				

ECotality/EVP National Account Host

Dissemination Plan – Observations

Observations on Infrastructure Deployment Issues

➤ Typical Questions

- How will the final infrastructure deployment compare to the EV Micro-Climate plan? What difficulties were encountered in trying to meet the plan?
- Installation costs by labor, materials, taxes, permits?



Dissemination Plan – Observations

Observations on Infrastructure Deployment Issues

- How does lack of national guidance on ADA compliance affect installations?
- What challenges are encountered with a lack of signage standardization?



Dissemination Plan – Observations

➤ **What effects may be anticipated by the maturing EV Infrastructure?**

➤ **Early**

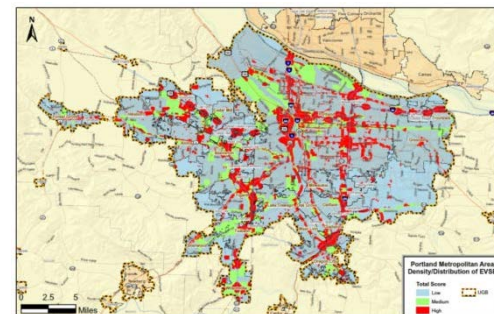
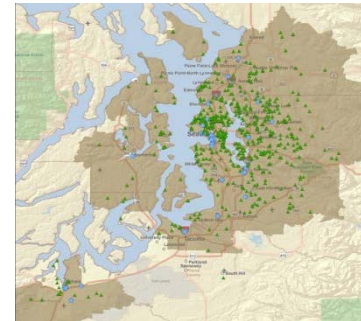
- Beginning stages 2010 – 2013
- EVP Micro-Climate Plan (two year development)

➤ **Transitional**

- Building on initial deployment
- Years 2013 – 2018

➤ **Mature**

- 2018 +
- EVP Long Range Plan



Dissemination Plan – Observations

- **Now is the Time for Identify Questions/Hypotheses for EVP**
- **Rich Data Set**
 - Full Deployment of Assets nearly complete
 - Vast Regional Deployment and Results
 - Data Collection since 2009 (Start of Planning Process)
 - Mature Data Collection and Analysis Systems in Place
- **ECOtality and INL Team**
 - Experience from Planning, EVSE Design, EVSE Deployment and Data Collection
 - Vehicle testing experience
- **Ideas for Questions/Hypotheses to be addressed Desired from Industry Leaders**

THE
EV Project

**Information
Dissemination
Peer Review**

**Understanding
Dissemination**

**Donald Karner
March 6 , 2013**



Overview

- **Plan Requirements**
- **Questions & Uses**
- **Understanding**
- **Examples**
- **Break Out Sessions**

Information Dissemination

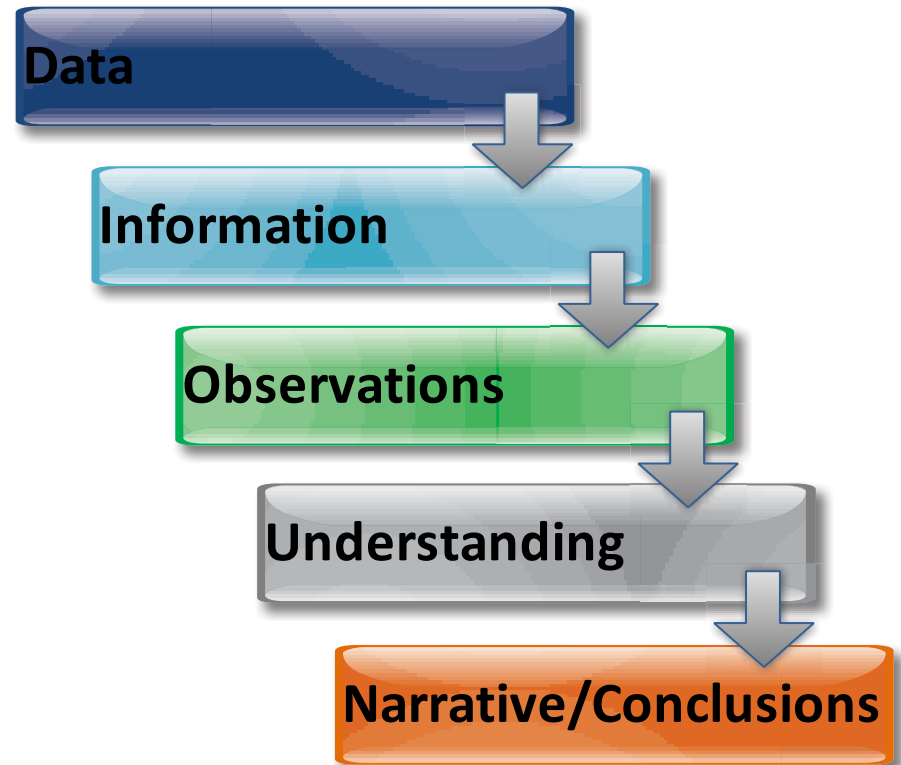
➤ Plan Requirements

➤ Handle multiple data types

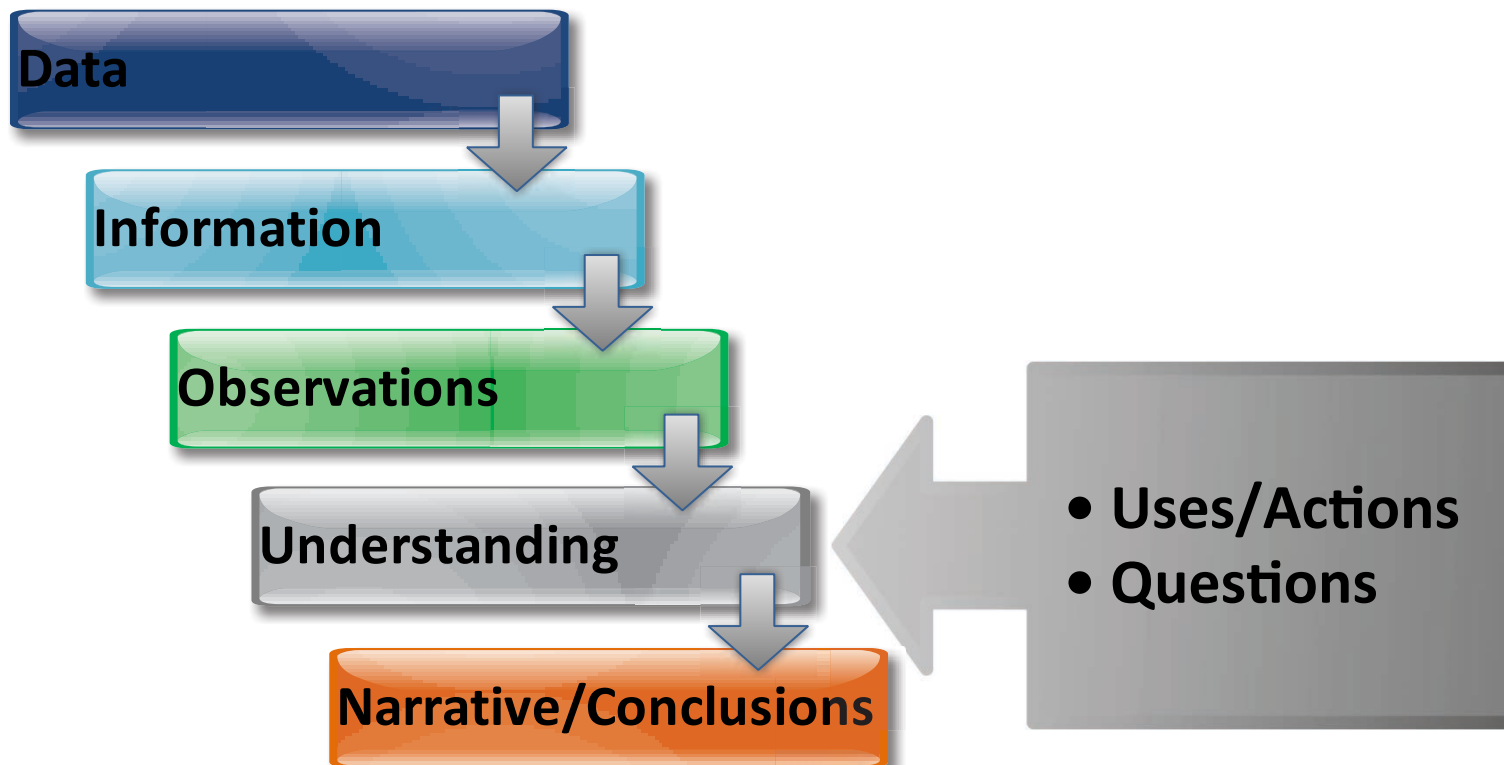
- Electronic
 - Vehicle
 - Charger
- Manual
 - Experiential
 - Survey

➤ Address multiple audiences

- Vehicle owners
- Charger hosts
- Electric utilities
- EVSPs
- Government



Developing Understanding



Uses/Actions & Questions

➤ **Look From Bottom Up**

- Search Observations, Information & Data
- Look for a specific understanding
- Facilitate a specific action to be taken

➤ **Start With An Information Use/Action**

- What will the understanding be used for
- How will the understanding guide action

➤ **Frame The Use With A Question**

- What needs to be specifically known to gain understanding
- What is the time frame of the understanding

Bottom Up Approach

- **Independent of**
 - Data
 - Information
 - Observations
- **Driven By Action**



Uses & Questions

Bottom Up Approach

➤ EV Project Dependent

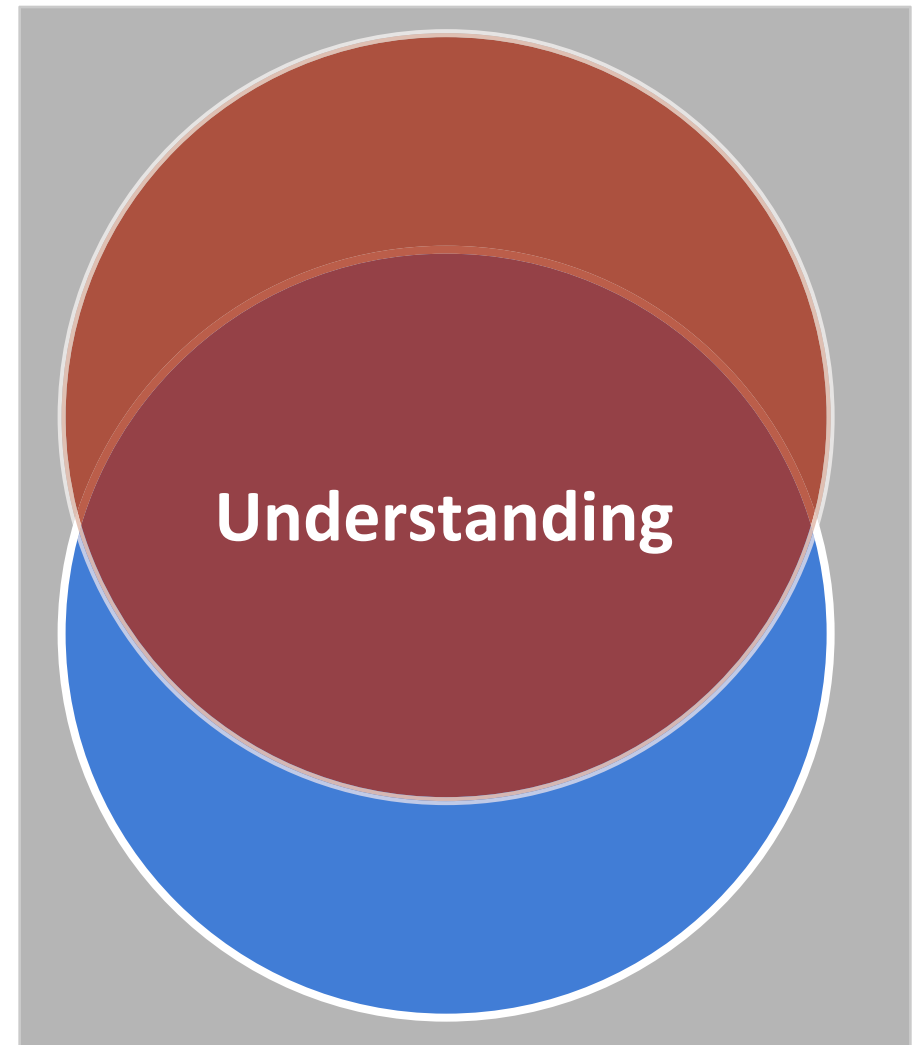
- Electronic data
- Manual data



**Data, Information
& Observations**

Bottom Up Approach

- **Crosses Multiple Data Sets**
 - Electronic data
 - Experiential data
- **Prioritize Analysis**
 - Broadly applicability
 - Specific EV Project activities
- **Applicable Data Resources**
 - May not be know a priori
 - Understanding of data sets
 - Previous experience
 - Data
 - EV Project activities
 - Transition to maturity



Example Questions & Uses

➤ Vehicle Utilization

- Use/Action – Evaluate the benefit of public infrastructure
- Question – Does daily VMT differ between those who regularly use public infrastructure and those who do not?

➤ Charger Utilization

- Use/Action – Set access fees for public charging
- Questions – Did imposition of EV Project access fees impact long term utilization of EVSE?

Example Questions & Uses

➤ **Deployment Issues**

- Use/Action – EVSE installation cost reduction
- Question - What design and site layout options can be implemented to reduce installation costs?

➤ **Operational Impacts**

- Use/Action – Evaluate non-revenue benefits of EVSE to host
- Question - How does the presence of EVSE influence in-store stay time?

Breakout Sessions

- **Stakeholder Uses/Actions & Questions**
 - Develop clear definition of use/action
 - Stay within EV Project scope
 - Establish participant priorities
- **Session Topics**
 - Vehicle and charger utilization
 - Deployment issues and operational impacts
- **Follow On Actions**
 - ECOtality/INL team evaluate Uses & Questions
 - Establish priorities for analyses
 - Determine methods for documenting analyses
 - Present final Information Dissemination Plan

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