PHI - Electric Transportation

Presented to:

Metropolitan Washington Council of Governments

April 29, 2011

Barbara M. Gonzalez
Manager, Special Projects, NERC

Pepco Holdings, Inc.

3 states and Washington DC in mid-Atlantic US

Transmission & Distribution – 90% of Revenue

atlantic city electric
A PHI Company

delmarva power
A PHI Company

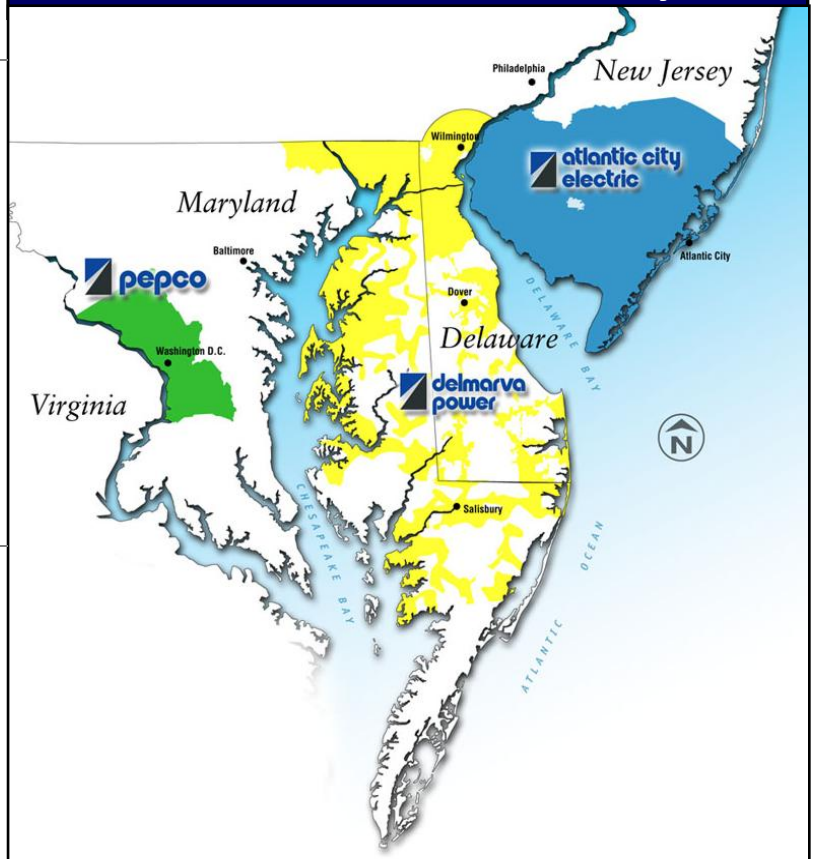
pepco
A PHI Company

Competitive Energy / Other

pepco Energy Services

PHI Investments

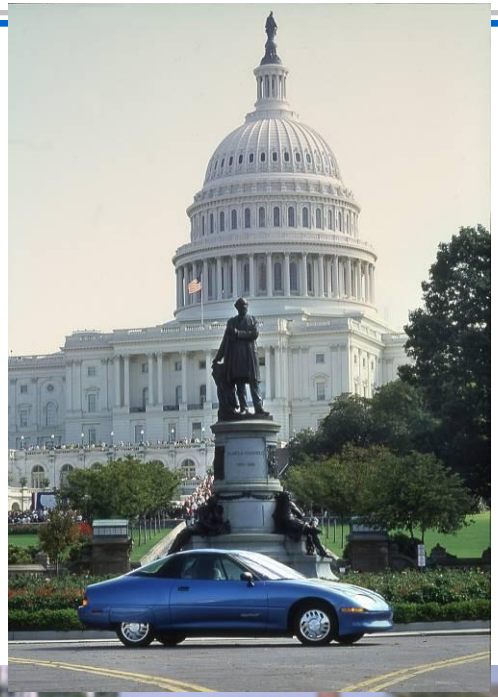
Combined Service Territory



Regulated transmission and distribution is PHI's core business.

PHI has a rich history in Electric Vehicles

- Member of DOE Site Operator Program
  - Maintained a fleet of 6 all-electric conversion vehicles
- Founding Member of EV America
  - Developed first utility standards for electric vehicles
  - Later turned over to DOE
- GM PrEView Drive Program
  - 60 customer drivers for two weeks at a time
  - Installed over 75 Level 2 chargers
- Toyota RAV4 EV Program
- Ford Ranger EV Program



Outreach Activities

- Institutions:
  - EPRI, EEI, PJM, University of Delaware, BEVI
- OEM's: Ford, General Motors, Fisker, BMW, etc
- Agencies:
  - COG
  - Maryland Energy Administration
  - NJ Economic Development Authority
  - Architect of the Capitol
  - GSA, NIH, DOT,DOE
  - DC DOT
  - Delaware Transportation Council
  - Metro (WMATA)
- Other Utilities
  - Dominion, BGE, Progress Energy, SCE, DTE, etc

PHI Fleet Deployment (YTD)

Vehicle Type	ACE	DPL	Pepco	*Total*
Hybrid Cars	8	30	34	72
Hybrid SUV's	20	47	34	101
Hybrid Buckets	5	6	10	21
Total	33	83	78	***194***

Short Term Plan

- Participating in EPRI/Ford Escape PHEV Program
- Will deploy 10 Chevy Volts in fleet by Q2 2011
- PHEV Trucks:
  - Gas Compressor 2011
  - EPRI Bucket Truck 2012
- EVSE Charging Stations Installed
  - 2 Edison Place
  - 1 NCRO
  - Bay Region and ACE (Planned)

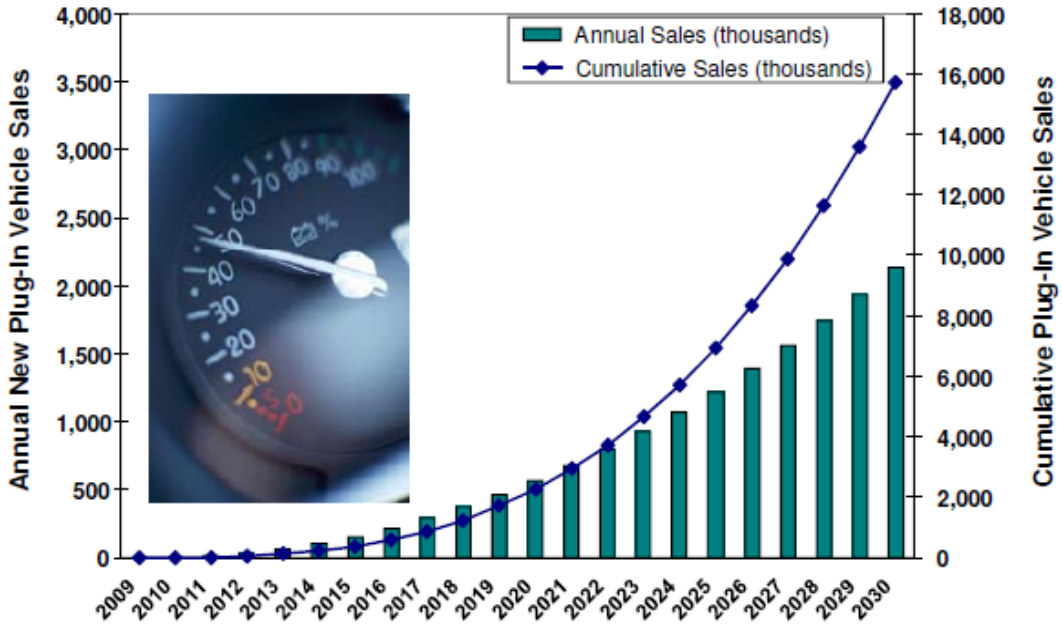
Our Landscape

- Penetration projections are inconsistent
- Initial Impacts to infrastructure will be due to clustering
- Significant penetration is still years away
- Washington, DC region is expected to be any early target market for several manufacturers

OEM Deployment in the Pepco Region

• Ford Transit Connect	2010
• Chevy Volt	2011
• Nissan Leaf	2011
• Ford Focus	2011
• Ford PHEV	2012
• Fisker Nina PHEV	2012
• Tesla	2012
• BMW Megacity	2013

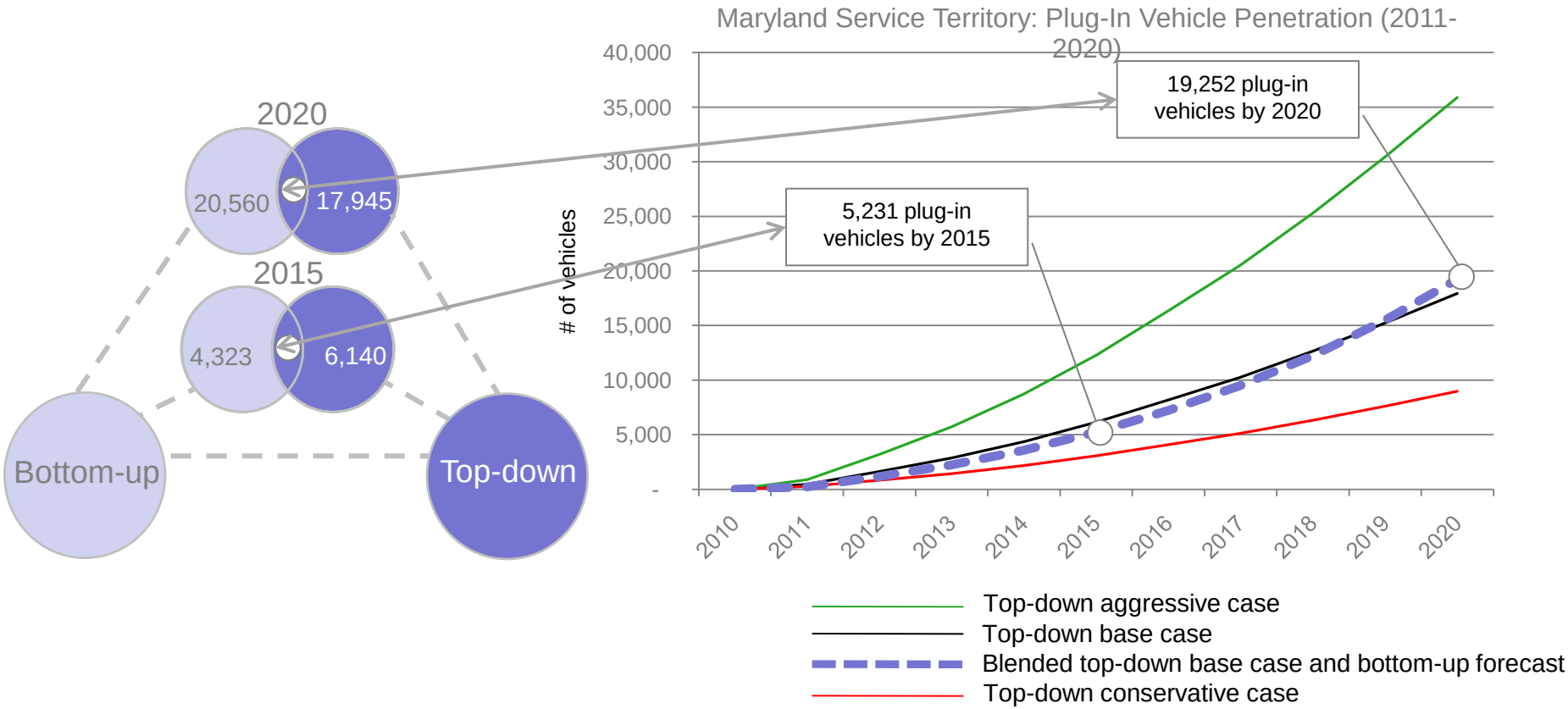
EPRI National Projection for Plug-In Vehicle Penetration



Projecting PEV Growth

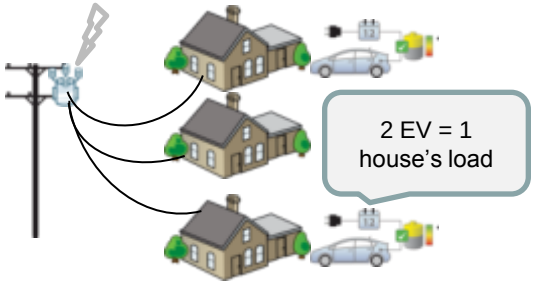
Triangulating Between Top-Down and Bottom Up Forecasts

PHI has built a set of projections covering PEV take-up in each of its jurisdictions, using both top-down and bottom up techniques. In this example, the forecast covers the Maryland service territory.



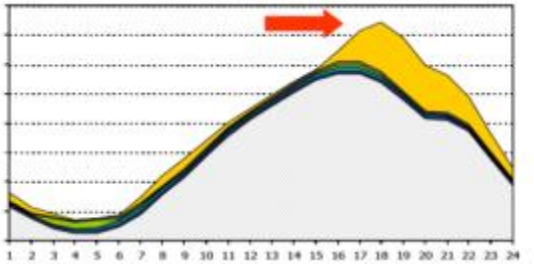
Triangulating both forecasts reveals very similar projections. Taking the mid-point between the two yields 5,231 plug-in vehicles in 2015 and 19,252 in 2020.

Unmanaged EV charging can create problems for utilities…..



Local Distribution System Impact

- EV load is equivalent to ½ to full home load, so adding EVs may overload local transformers
- Older, more affluent neighborhoods with higher concentrations of EVs will be particularly at risk (e.g., Washington, DC & Maryland Suburbs)



Peak Load Increase

- Most drivers will return home and plug in between 4-8 PM, resulting in an increased afternoon peak
- Uncontrolled will create need for additional Infrastructure and result in longer and higher peak demand
- Impact to EmPower Maryland goals

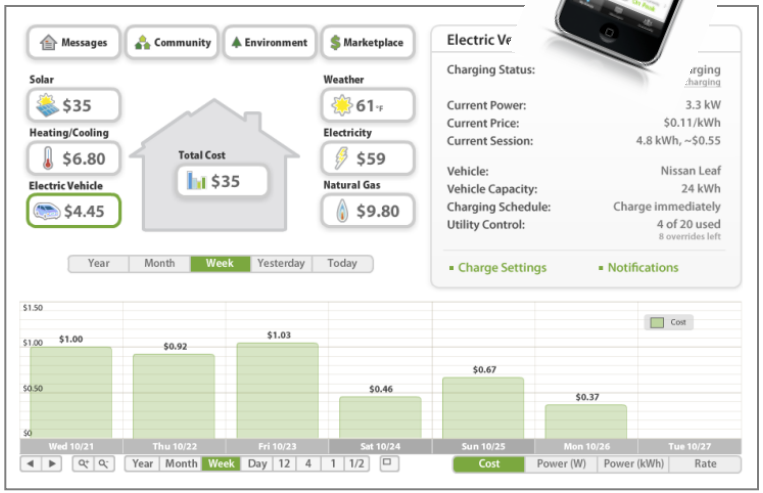
Operational Needs

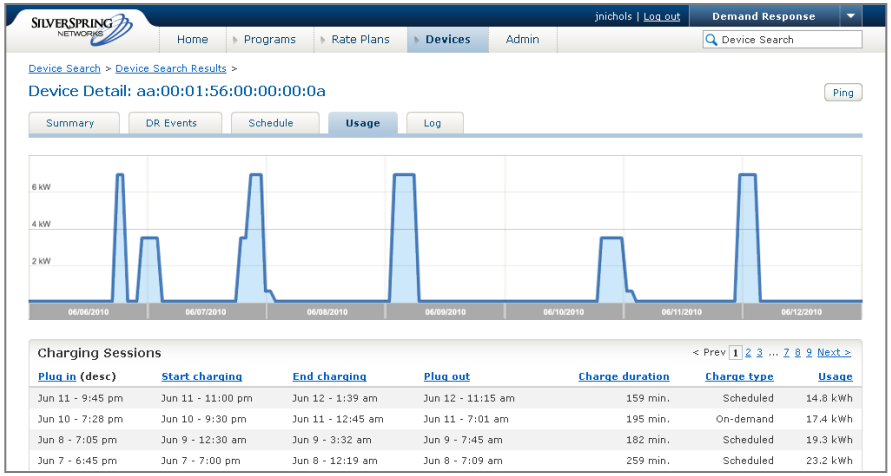
- Metering EVSE as separate load for billing, GHG credits
- Back-office integration of EVSE for control, billing
- Remote diagnostics for lower maintenance costs
- ***Need to avoid the need for installing a second meter by certifying the metrology in the chargers***

8

EV Charging managed by a Smart Grid….

- EV Control and Monitoring Features:
  - EVSE device management (import/search/view/edit)
  - View EVSE usage data (plug in/out, charge start/stop)
  - Direct control of EVSE (start/stop charging)
  - Basic charge scheduling (static schedules)
  - Aggregated load impacts by transformer, feeder and substation





Moving Forward…..

Public Education

- Continue to reach out to local stakeholders
- Continue to participate in Customer Education programs and outreach to industry and research organizations

OEMs

- Continue vehicle demonstration / evaluation programs
- Continue to work collaboratively to integrate Plug-in Vehicles with the Smart Grid

Technology Readiness

- Integrate EV charger monitoring and control into existing Smart Grid Deployment
- Further evaluate system impacts of EV and charging
- Evaluate vehicle batteries in stationary applications
- Evaluate how EV's and other distributed resources will change the distribution system

Questions???

Appendix

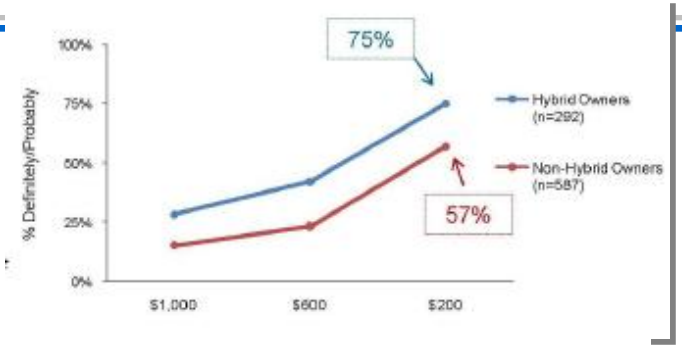
Further consideration…..

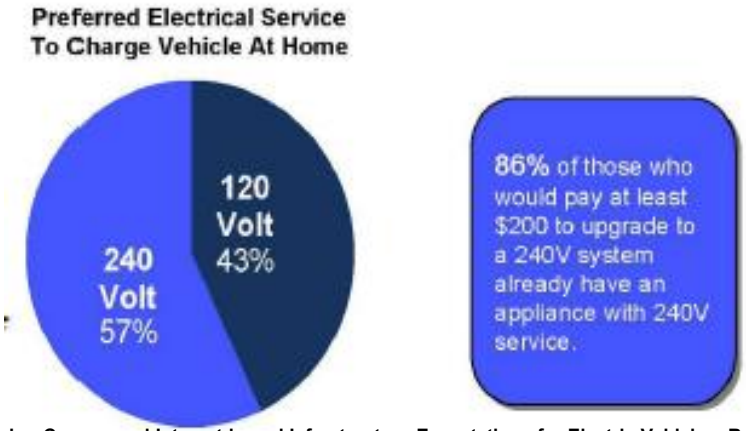
- Further infrastructure reviews need to be conducted to model the distribution system impacts of vehicle charging
- We need to combine this with more comprehensive/actual information on vehicle penetration into each region
- A rate structure needs to be developed that will properly incentivize EV ownership and charging (Off peak)
- We need to educate customers and key stakeholders on the benefits of off-peak charging of electric vehicles

EVs Need High-Powered Chargers

(2) EV's = 1 Residential Load

- Most vehicles will come with a Level 1 charger (120V home outlet)
- Level 2 charging required for overnight charging of larger batteries
- Faster charging also allows higher efficiency, smaller battery
- Customers surveyed preferred Level 2 chargers
- Cost of installation is a potential issue
  - 75% of existing hybrid owners would pay at least $200
  - PrEView Program showed $1200 average installation cost
  - ***May require installation incentive.***

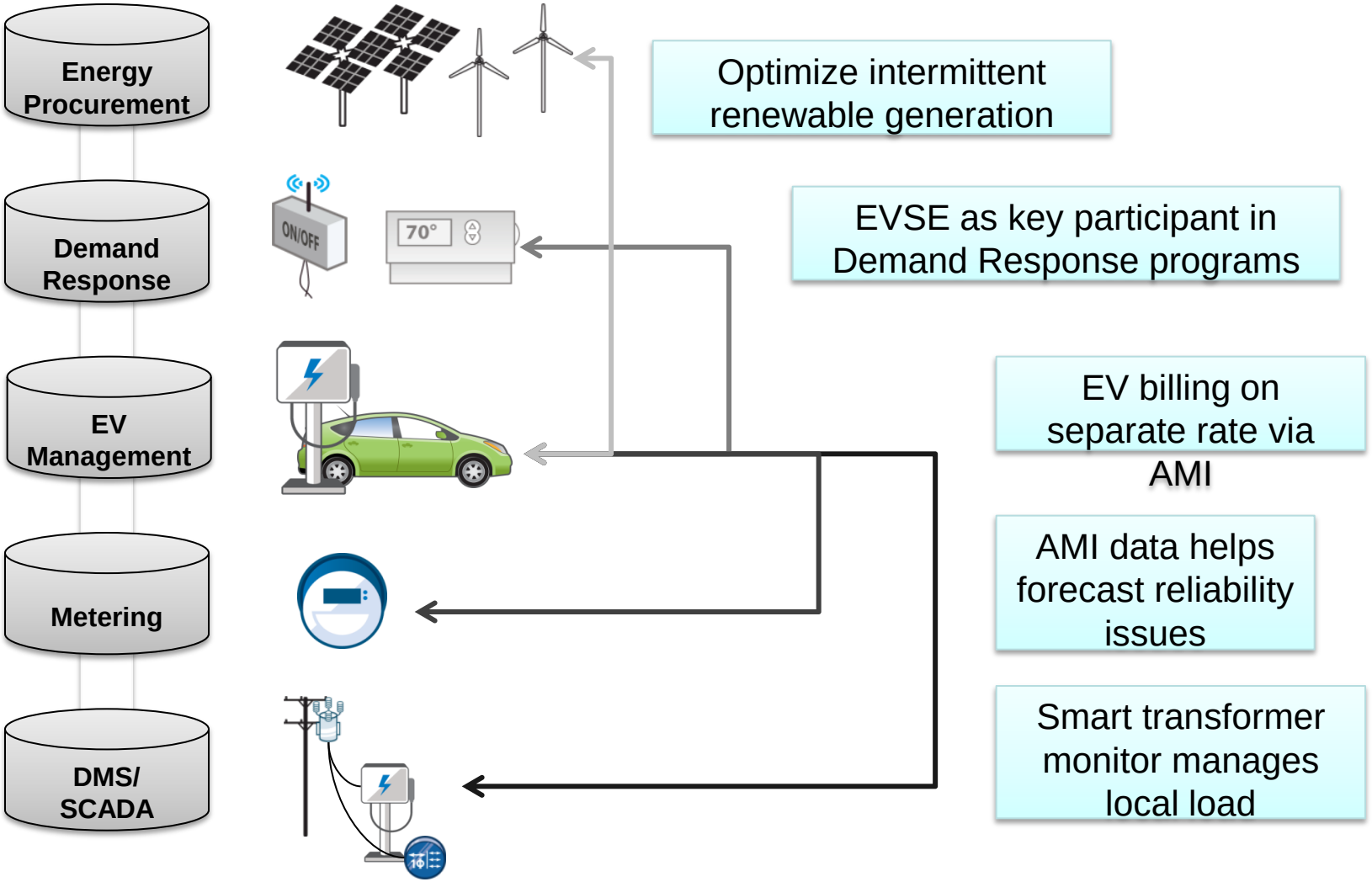




Characterizing Consumers' Interest in and Infrastructure Expectations for Electric Vehicles: Research Design and Survey Results, EPRI, May 2010

	Voltage / Current	Power	Chevy Volt (8 kWh)	Nissan Leaf (24 kWh)
Level 1 	120V @ 12A	1.4 kW	6 hours	17 hours
Level 2 	240V @ 32A	7.7 kW	4 hours	3 hours
	240V @ 70A	16.8 kW	½ hour	1.5 hours

Integration of EVs into the Smart Grid



ClipperCreek EVSE Overview

Power
- Level 2: 240V, 30A

Communications
- Silver Spring Networks comms module
- 900MHz RF mesh radio, 2.4GHz HAN radio

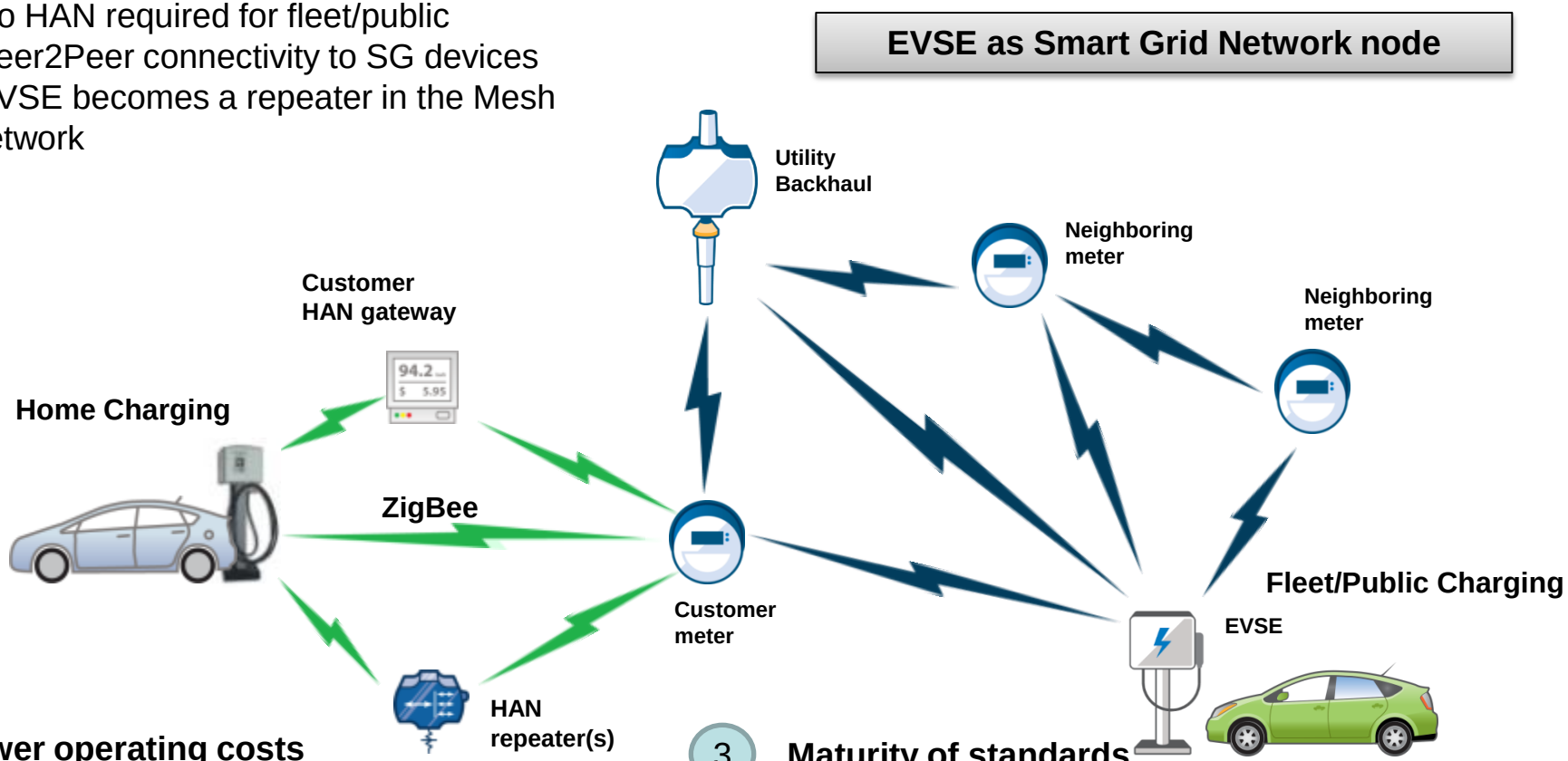
Metrology
- ***Revenue-grade meter from TransData***
- Meets ANSI accuracy standards

User interface
- SAE-J1772™ Coupler
- Button for on-demand charging
- Charge indicator light
- Error indicator light

Charging features
- Charge on/low/off (low is configurable)
- In case of a fault, unit will auto-restart if possible

Benefits of EVSE as Smart Grid Node

1 **Robust, reliable communications**
- Multiple connectivity paths
- No single point of failure
- No HAN required for fleet/public
- Peer2Peer connectivity to SG devices
- EVSE becomes a repeater in the Mesh Network



2 **Lower operating costs**
- SG is utility controlled
- Charger integrated with existing SG Communications network

3 **Maturity of standards**
- Unaffected by ZigBee SEP upgrade issues
- Future-proofing with OTA upgrades