

# Electrifying Transportation in Virginia

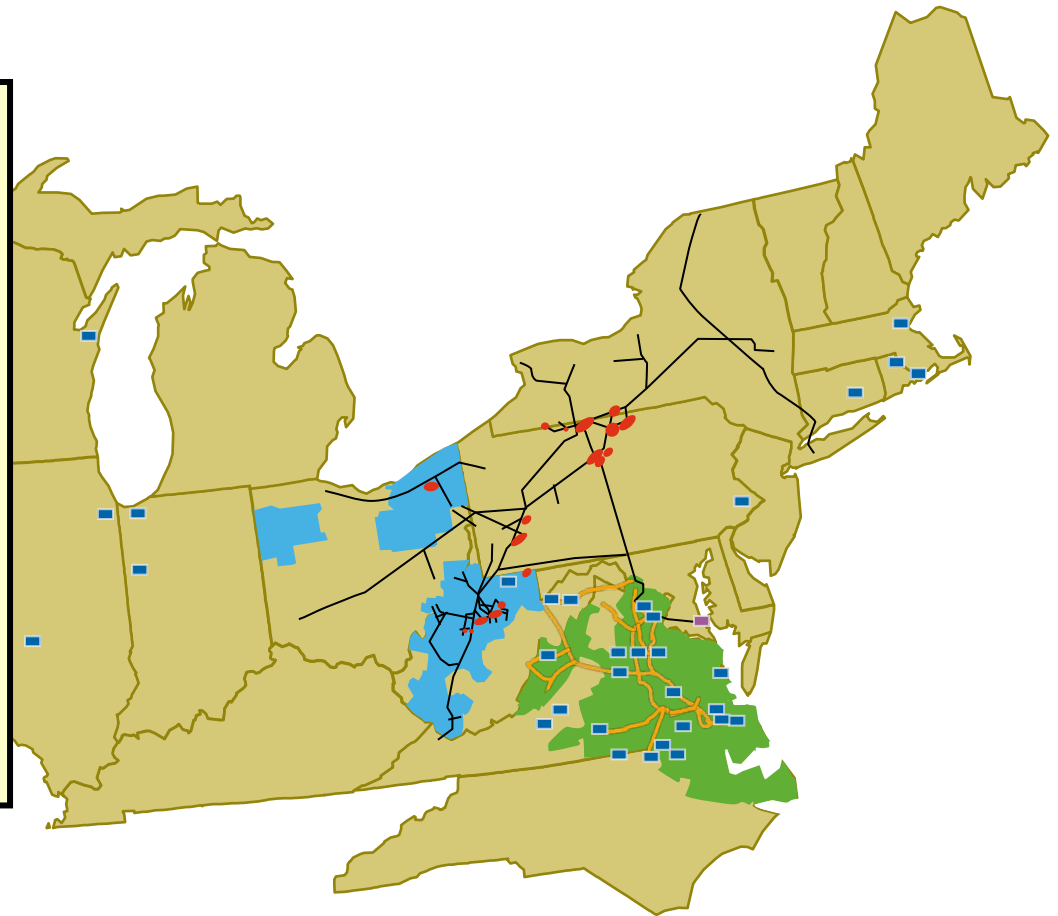
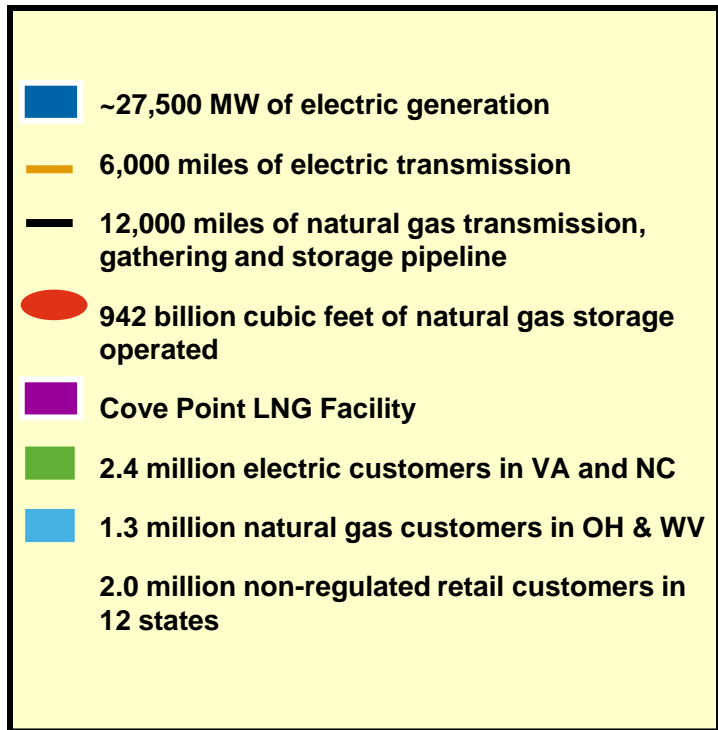
**Andy Flavin**  
**Alternative Energy Policy Research Analyst**  
**Alternative Energy Solutions**  
**Dominion Resources, Inc.**

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# Dominion: One of America's Leading Energy Companies



# Electric Vehicles

## Types



**Hybrid Electric Vehicle (HEV)**

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- Primarily an internal combustion engine car with some electric vehicle functionality
- Gasoline and electric power sources, and two parallel paths to power the wheels
- Example: Toyota Prius



**Plug-In Hybrid Electric Vehicle (PHEV)**

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- Uses both gasoline and electricity
- Rechargeable batteries allow longer electric-only drive distance
- 40 mile electric range/400 miles total
- Example: Chevy Volt



**Electric Vehicle (EV)**

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- Also called Pure EV (PEV), Full EV (FEV), or Battery EV (BEV)
- No use of gasoline
- Electric motor powered by large, rechargeable battery 100-200 mile range per charge
- Example: Nissan LEAF, Tesla Roadster

# Load Impacts of EV Charging

|                       | All-Electric Range | Level 1 Charging |               | Level 2 Charging |              | DC Fast Charging |              |
|-----------------------|--------------------|------------------|---------------|------------------|--------------|------------------|--------------|
|                       |                    | Demand           | Charge Time   | Demand           | Charge Time  | Demand           | Charge Time  |
| <b>Chevy Volt</b>     | 40 miles           | 0.96 – 1.4 kW    | 5 - 8 hours   | 3.8 kW           | 2 - 3 hours  | N/A              | N/A          |
| <b>Nissan Leaf</b>    | 100 miles          | 1.8 kW           | 12 - 16 hours | 3.3 kW           | 6 - 8 hours  | 50+ kW           | 15 - 30 mins |
| <b>Tesla Roadster</b> | 245 miles          | 1.8 kW           | 30+ hours     | 9.6 - 16.8 kW    | 4 - 12 hours | N/A              | N/A          |
| <b>Ford Focus EV</b>  | 100 miles          | 1.8 kW           | 12 – 16 hours | 6.6 kW           | 3 – 4 hours  | N/A              | N/A          |

## Potential Grid Impacts May Arise Due to the “Clustering” Effect

- Multiple customers within a subdivision or neighborhood may purchase EVs and charge at the same time
- This could impact local distribution infrastructure (i.e., distribution transformers)
- Plans to equip 2011 Ford Focus and 2012 Nissan Leaf with a 6.6 kW on-board charger – roughly equivalent to a modestly sized house load

# Charging Equipment

## Connecting to the Vehicle

Electric Vehicle Supply Equipment (EVSE) supplies power to the vehicle through a standardized SAE J1772 Connector....



[currentevtech.com/top\\_sellers.html](http://currentevtech.com/top_sellers.html)

...that plugs into the inlet located on the car. The Nissan Leafs two charging inlets are located on the front of the car. (Level 1 and 2 Compliant J1772 Inlet is located on the right). The DC Fast Charge inlet is on the left.



<http://www.flickr.com/photos/nostrimago/4303885101/in/photostream/>

## Charge Points

Residential  
Level 2  
EVSE



<http://www.coulombtech.com/products-photos.php>

Public Level  
1 or 2 EVSE



DC Fast Charge  
Stations



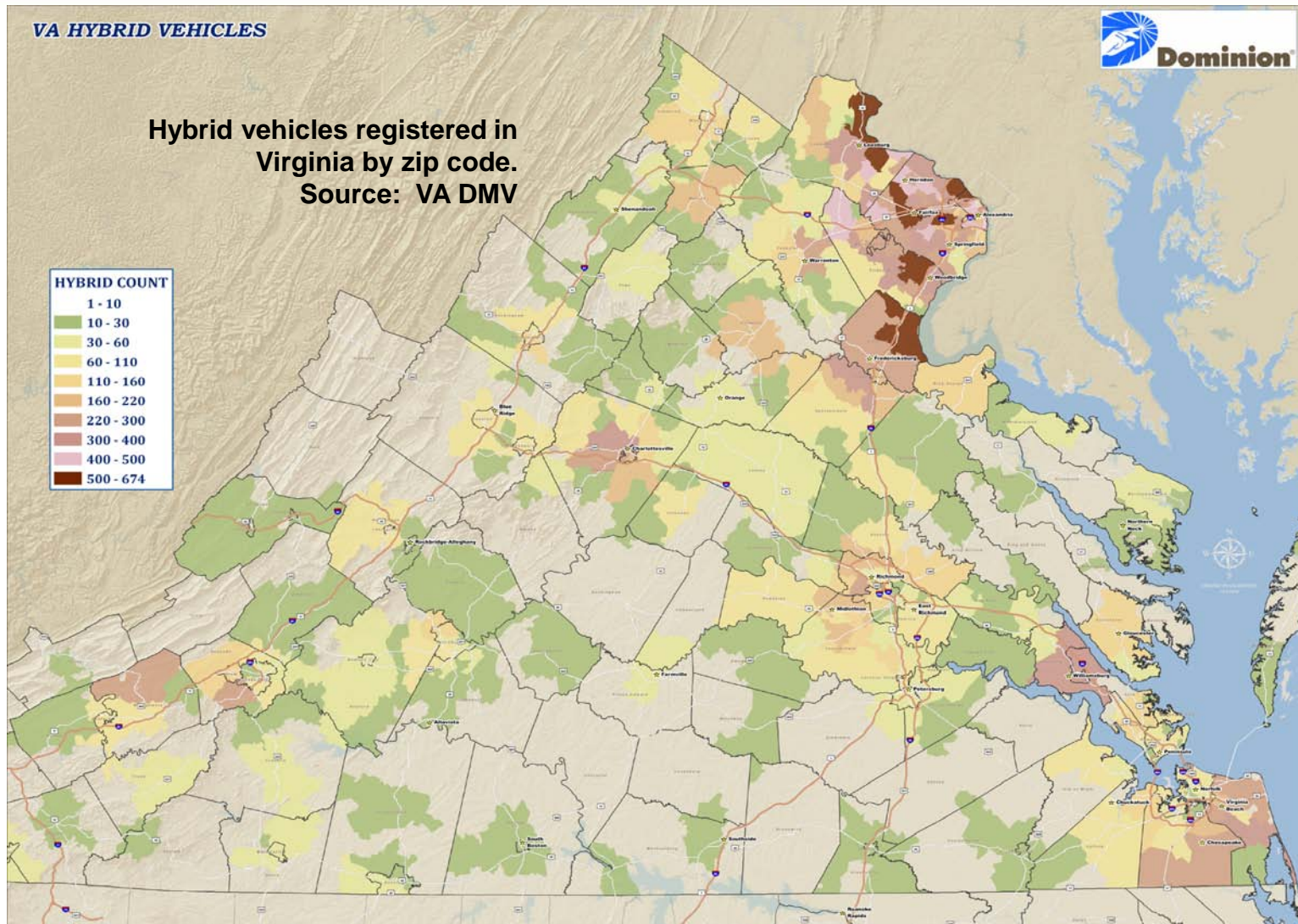
<http://www.pr-inside.com/tokyo-electric-power-company-tepco-licenses-r1670968.htm>

For Level 1 and 2 (AC Level 1 and AC Level 2) charging, the chargers contained within the vehicle convert AC power to DC power to charge the batteries.

DC Fast Charging Stations (DC Level 2), sometimes called Level 3 Charging Stations, utilize an off-board charger to provide the AC to DC conversion.

DC Fast Charge Stations are likely to mirror gas station model.

# Concentration of Hybrid Vehicles



# What's Happening at Dominion? Projects and Partnerships

- Current company owned EVs

- 3 converted Toyota Prius sedans
- 4 bucket trucks (EPRI Eaton Study)

- Dominion will lease three Chevy Volts for research and interoperability assessment

- Track usage of PHEVs to validate loading model
- Recently purchased Nissan LEAF

- DVP has installed public charging units at New Kent County West Bound 64 Rest Area

- EPRI Study Completed on Glebe Road - Circuit 328

- Determine whether T&D capacity will be sufficient to supply the increased demand of PHEV charging

- Participated in *Virginia Project Get Ready* Initiative to educate the public about vehicle electrification and make recommendations for Virginia

- Participating in *EEI Transportation Electrification Task Force*



Source: Ford – [www.ford.com](http://www.ford.com)



Sustainable Transportation Initiative of Richmond

Source: STIR –  
[www.projectstir.com](http://www.projectstir.com)



Source: [VirginiaEV.org](http://VirginiaEV.org)



Source: EPRI -  
<http://my.epri.com/portal/server.pt?>

# Legislation and Regulation

## *Virginia*

- **Regulation of EV Charging Services and Authorization of Pilot Programs (HB2105)**
  - Excludes EV charging service providers from state regulation prohibiting resale of electricity and from utility regulation provided that (1) the electricity is used solely for transportation and (2) the electricity is procured from the public utility serving the territory.
  - Deems provision of EV charging service to be a permitted utility activity
  - Authorizes EV off-peak charging pilot programs and annual EV pilot cost recovery
- **Extension of Sunset on HOV Lane Use by Clean Special Fuel Vehicles to July 2012 (HB1432)**

## *Federal Government*

- **\$7,500 tax credit for qualified plug-in electric motor vehicles**
- **30% tax credit for charging infrastructure ( $\leq$  \$30,000 for businesses/  $\leq$  \$1,000 for residences)**
- **Proposed “Charging America Forward Act”** – (S.298 Stabenow-D-MI) – would change EV tax credit to instant rebate, would increase limitation number of vehicles eligible for tax credit, and would extend and increase charging infrastructure tax credit

# Dominion Virginia Power's EV Pilot Program

- Pilot program offering time-of-use pricing options
- DVP will learn about EV penetration, customer charging patterns, and impacts on the grid
- Supports customers' adoption of EVs while attempting to minimize grid modifications by encouraging off-peak charging
  - EV-only rate: 54 cents/night for 40-mile commute
  - Whole-house rate: 51-61 cents/night for 40-mile commute
  - Compares to \$1.10 cents/night using standard residential rate
  - Up to 750 participants in each rate option

# DOE Grant

## Richmond Electric Vehicle Initiative (REVi)

- **Clean Cities Community Readiness and Planning for Plug-in Electric Vehicles and Charging Infrastructure (DE-FOA-0000451)**
  - Key partners: VA DMME (lead), Dominion, VA Clean Cities, Richmond Regional Planning District Commission, J. Sargeant Reynolds CC, City of Richmond, Sustainable Transportation Initiative of Richmond, and VCU
  - Regional strategic plan to identify and foster policies to expedite EV infrastructure implementation and vehicle adoption
  - Total budget is \$1.9M
    - Non-federal cost share is \$1.5M
    - Grant award of \$429K to be used over one year

# Infrastructure Needs

- Inventory of existing public EVSE locations
- Accurate database for new EVSE installations
  - Electric permitting/inspection likely to catch most new stand-alone locations
  - Residential installations should not be made public, but utilities should have access to certain information for reliability reasons
- Pre-wiring and pre-installation of conduit for new construction

# Infrastructure Needs

- How do individuals without their own garages charge their EVs?
- It is technically feasible to install EVSE pedestals/bollards in many of these areas, but usually is expensive
- Need to utilize existing infrastructure in a way that reduces the need for new construction and/or trenching



Source: Coulomb Technologies -  
<http://www.coulombtech.com/>



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