

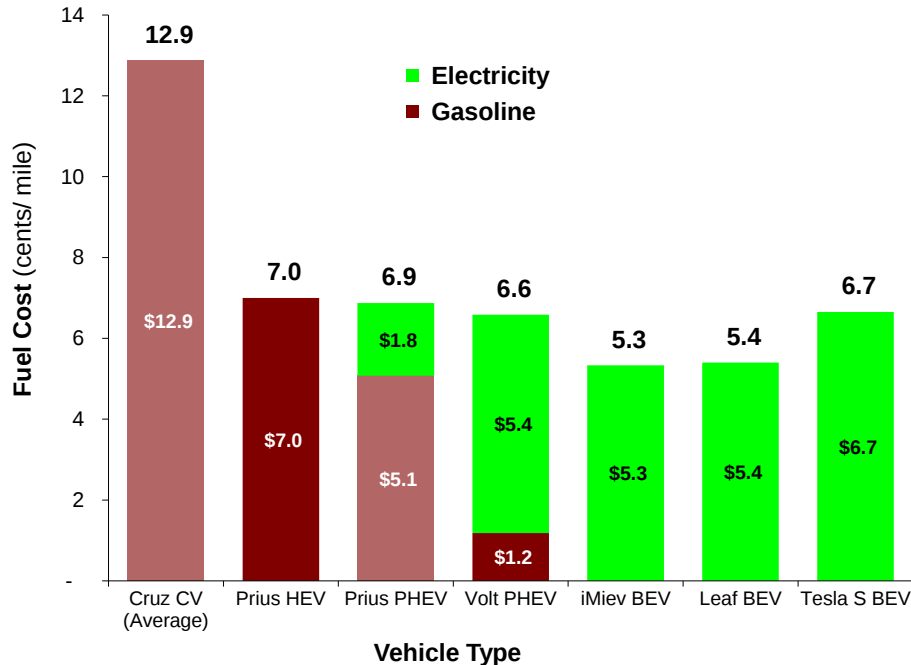
New Jersey Clean Air Council: Alternative Fuel Vehicle Strategies

April 8, 2014

Rob Gibbs, Manager – Market Strategy & Development

AFVs offer lower fuel costs, but at a higher initial price.

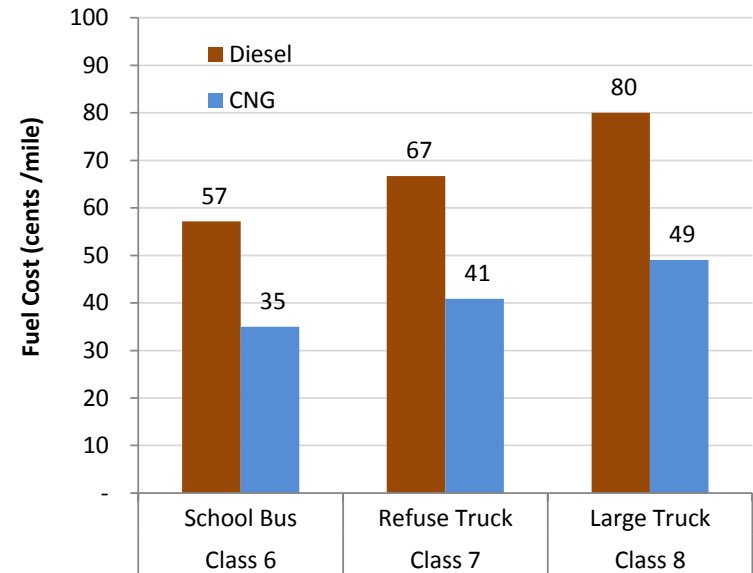
EVs



Assumptions:

Trip Length = 40 miles; \$3.50 gasoline; 18 cents/ KWh; ICE MPG: CV Cruz CV (Average); 30; Prius HEV and PHEV; 50; Volt PHEV; 45

NGVs



Assumptions:

Diesel Cost = \$4; CNG gasoline gallon equivalent cost = \$2.15

- EVs have ~40-60% cheaper fuel costs
- Price of EVs are ~25% to 60% higher

- NGVs have ~40% cheaper fuel costs compared to diesel
- Price of NGVs is ~25% to 50% higher

EVs and NGVs will penetrate different markets.

Under current market conditions, EVs are expected to be the predominant AFV in the light duty vehicle market:

- Cheaper and better-performing batteries have made cars more affordable and increased their range to cover the distance traveled by most consumers
- No/limited infrastructure costs make economics for light duty EVs superior to NGVs; EVs also have \$7,500 federal tax credit to offset purchase price
- Most major auto manufacturers now offer EV passenger cars, while only one offers an NGV passenger car

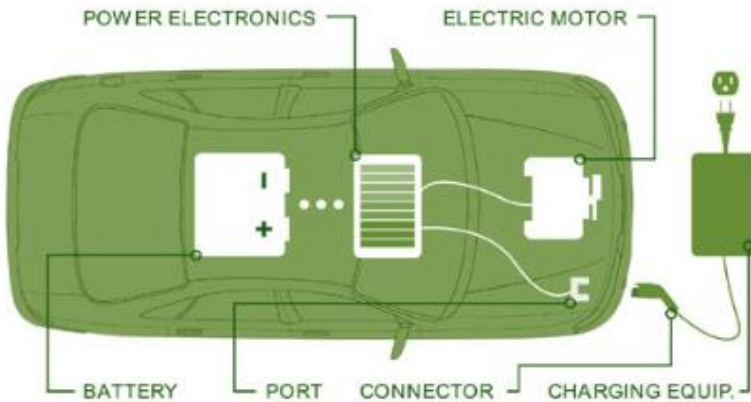
NGVs are expected to penetrate the medium/heavy duty market

- Power requirements cannot be effectively met by batteries
- Higher NGV infrastructure costs can be spread across fleets
- Some large fleets already converting

Electric Vehicles

There are a two main kinds of plug-in vehicles, each with different driving and charging characteristics.

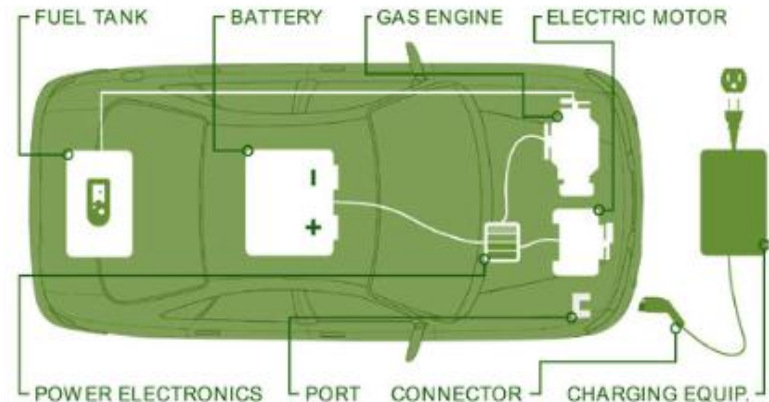
Battery Electric Vehicles (BEVs) are powered solely by energy stored in the vehicle's battery system, and have no gasoline back-up..



Charging Level	Charging Times
Level 1, 120V	~17 hours
Level 2, 240 V	3.5 – 7 hours
DC Fast Charge, 200-450 VDC	30 – 45 minutes

BEVs expected to charge primarily at 240V

Plug-in Hybrid Electric Vehicles (PHEVs) is a hybrid vehicle that obtains energy from two sources; a) hydrocarbon-based fuel and b) an onboard battery.



Charging Level	Charging Times
Level 1, 120V	~7 hours
Level 2, 240 V	1.4 – 3 hours
DC Fast Charge, 200-450 VDC	10 minutes

PHEVs expected to charge primarily at 120V

In the past two years, many new EVs have hit the market and sales have increased significantly.

Available EV Passenger Cars

Vehicle	Type	Range	MPGe	Price	Debut
Nissan Leaf	BEV	75	115	\$28,800	2010
Chevrolet Volt	PHEV	38	98	\$34,995	2010
Smart ForTwo	BEV	68 mi	107	\$25,750	2011
Mitsubishi i	BEV	62	112	\$29,975	2011
Ford Focus EV	BEV	76	105	\$35,995	2011
Honda Fit*	BEV	82	118	\$259/mo	2012
Toyota RAV4	BEV	103	76	\$50,645	2012
Tesla Model S	BEV	265	89	\$91,070	2012
Toyota Prius Plug-in	PHEV	11	95	\$32,975	2012
Ford C-Max Energi	PHEV	21	100	\$33,745	2012
Chevrolet Spark	BEV	82	119	\$27,495	2013
Fiat 500e	BEV	87	116	\$31,800	2013
Ford Fusion Energi	PHEV	21	100	\$39,495	2013
Honda Accord Plug-in	PHEV	13	115	\$40,570	2013

All prices are before federal/state rebates

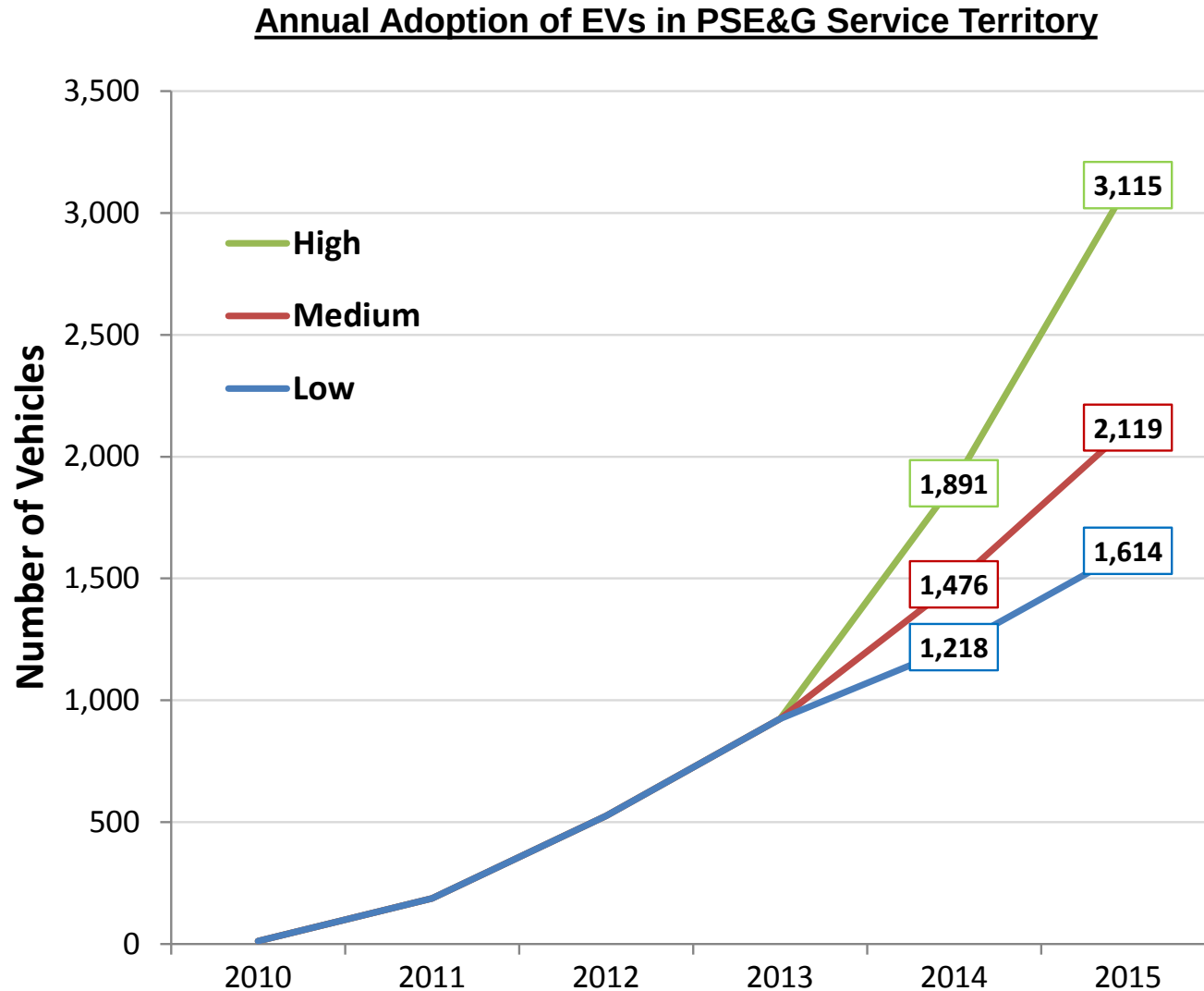
*Lease only

National EV Sales Trends

Year	EVs sold nationally	EV sales as % of all cars	YoY Increase in % of EV sales
2011	19,073	0.14%	
2012	55,362	0.37%	164%
2013	97,207	0.62%	67%

Source: EPRI, Electric Drive Transportation Association

However, the ramp up is expected to be slow, with ~1,500 EV sales projected in PSE&G service territory this year.



Consumer education is a key component to getting buyers to purchase, or even consider, EVs.

- The single largest factor favorably influencing customers to purchase an EV is fuel savings (91%), well above the second reason, environmental impact (63%)
- The largest factors negatively impacting the decision to purchase an EV are:
 - Battery range / access to charging stations (75%)
 - Price (74%)
 - Reliability (57%)
 - Performance and handling (49%)
 - Lack of clear understanding of cost advantage (49%)
- Most of these negative factors stem from a lack of information, as each is addressable with current car offerings. For example, PHEVs like the Chevy Volt have no requirement for charging stations and pose no range issues.
- As EVs penetrate deeper into the market, beyond a niche of green buyers, fuel savings and economics will become even more important.

Charging behaviors are likely to influence which EVs consumers consider.

Expected EV Charging Topology

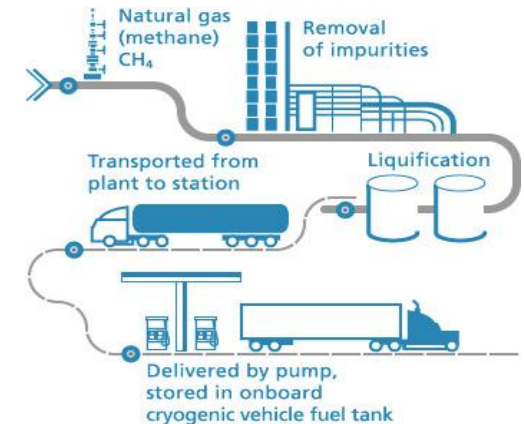
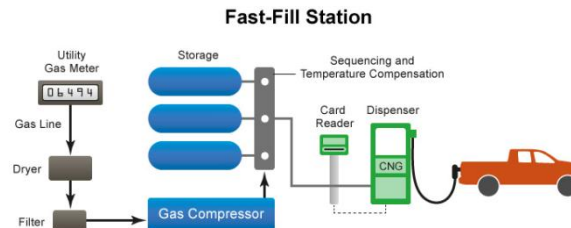
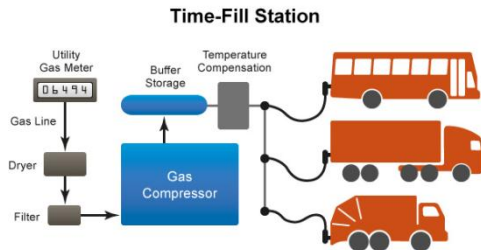


~90% of charging is expected to occur at home and workplace

Source: PlugInsights, U.S. PEV Charging Study, Q4 2013

Natural Gas Vehicles

CNG is better for smaller fleets with localized traffic, whereas LNG is appropriate for long-haul trucking.



Compressed Natural Gas (CNG)

- Time fill requires no storage; designed to refuel overnight.
- Fast fill requires storage; designed to refuel quickly. Storage tanks operate at higher service pressure (4300 psi) so it can deliver fuel faster than fuel coming directly from the compressor
- Lower infrastructure costs make CNG more applicable for most non-long-haul vehicles than LNG

Liquefied Natural Gas (LNG)

- CNG cryogenically stored at <160°C;
- 1/600th the volume of CNG:
 - Smaller storage tanks/lighter trucks
 - Longer mileage
 - Like CNG, will evaporate into the air in the event of a leak or rupture
- Perfect for long-haul trucking or marine applications
- LNG infrastructure more expensive than CNG
- Must be used quickly or will “boil off” unless cooled constantly

The NGV market can be broken down into three main types of potential fleets.

NGV Market Segments

Market Segment	Characteristics	Examples
Large, well-capitalized companies	• Have capital to invest in NGV infrastructure • Have scale and mileage to make paybacks work • Want turnkey solutions; work with private developers and/or government/utility programs where available	• UPS • Pepsi/Frito-Lay • Waste Management
Government fleets	• Budget constraints limit capital availability • Fleet size/mileage vary • Often have sustainability motives in addition to economics • Bureaucratic hurdles (e.g., NJ school buses need legislative change to use CNG)	• Port Authority • Municipal waste • School and municipal bus fleets
Small and mid-sized fleet owners	• Limited capital for infrastructure investments • Scale and mileage typically can't sustain infrastructure on their own • Often unwilling to enter into long-term refueling contracts due to uncertain future revenues	

The cost of NGV infrastructure is the major impediment to customer adoption, particularly for small and medium-sized fleets.

Economics of CNG Purchases for Customer with 10-Vehicle Fleet

Type	Total vehicle incremental cost	VMT per vehicle*	Simple Payback Incremental Vehicle Cost Only	Simple Payback Incl. Fast-Fill Infrastructure Cost**	Simple Payback Incl. Time-Fill Infrastructure Cost***
Class-3 Ford F-350	\$90,000	20,000	4 years	87 years	35 years
Class-5 Walk-in Delivery Truck	\$400,000	20,000	18 years	107 years	51 years
Class-7 Dump Truck	\$300,000	25,000	2 years	14 years	7 years
Class-8 Tractor	\$500,000	68,000	2 years	12 years	6 years

* NREL's "Business Case for Compressed Natural Gas in Municipal Fleets", June 2010 and USDOT figures

**Assumes \$2M fast-fill station cost, national VMT averages, and fuel price differential of \$1.80 per DGE

***Assumes \$750K time-fill station cost, national VMT averages, and fuel price differential of \$1.80 per DGE

- Without large fleets and/or high annual VMT, the payback on the infrastructure is prohibitive for most small/mid-sized fleet owners.
- Other factors delaying conversion:
 - Inertia for fleet owners (what they have works)
 - Existing fleet purchasing commitments
 - Available footprint for CNG refueling infrastructure

New Jersey has less NGV infrastructure than other states that have more active utility involvement and government incentives.

NGV Refueling Stations

State	Total Stations	Open to the Public
CA	256	141
NY	111	36
OK	93	73
UT	88	43
TX	63	36
PA	51	27
IL	40	10
CO	36	17
NC	35	19
FL	32	11
NJ	29	5
OH	25	14
GA	24	10
MA	23	11
VA	19	5
CT	16	7
MD	9	2
RI	6	3

- **New Jersey Stations** - 13 installed in past 3 years; 15 in PSE&G territory:
 - Governmental entities (12 sites)
 - Private (8 sites – all Clean Energy)
 - Gas utilities (9 sites) – note PSE&G has 5 sites, but all but 1 are no longer compatible with current CNG vehicle standards.
- **Reasons NJ Lags Other States**
 - Gas quality in northern PSE&G service territory
 - Lack of utility & state investments
 - No meaningful state incentives for NGV's

Source: U.S. Dept. of Energy

Barriers to Broader Consumer Adoption: *Up front Costs* But Government incentives are available . . .

- Federal
 - Up to \$7,500 tax credit toward purchase of EV or PHEV
 - Tax credit goes to dealer who passes the savings to buyer
 - NGV tax credit of up to \$4,000 expired in 2010
 - Various tax credits for infrastructure and fuel (some expired in 2013)
- New Jersey
 - EV purchases are exempt from state sales tax (does not apply to HEV, PHEV, or NGV)
 - 10% discount on EZ-Pass off-peak toll rates for vehicles with fuel economy >45 mpg and meet the CA Super Ultra Low Emission Vehicle standard
 - Propane is taxed at half the rate as that of gasoline if used to operate a motor vehicle

Other Barriers to broader consumer adoption . . .

- EV “Range anxiety”
- Lack of public charging/fill stations, and cost of the same
 - CNG fill station ~\$500K to \$2M
 - EV charge station ~\$3K to \$150K (depending on Level 2 or DC fast charge)
- Uncertain financing and revenue models
- Potential grid impacts
 - Clusters potentially can overload distribution circuits
 - High charging demand during peak hours (especially w/fast charging)
- Quality of CNG supply (refinery gas, presence of other trace elements)
- Permanency of federal/state incentives
- Lack of clear state policy/support for AFV’s

How PSE&G can help . . .

- For Electric Vehicles
 - Educate customers (online tools, etc.)
 - Help bring costs down with available rate options
 - Provide financial incentives to promote EVs
 - Potentially fill gaps in refueling infrastructure
- For Natural Gas Vehicles
 - Educate customers
 - Work to address gas quality issues
 - Utilities can provide refueling infrastructure

Enablers to help NJ achieve increased AFV growth ...

- Incentivize utilities to invest in AFV's to help reduce the existing barriers – through the establishment of cost recovery mechanisms that encourage investment and cost recovery
- Ensure streamlined procedures are in place to consider and approve utility filings
- Enable Utilities to offer AFV installation and maintenance services through competitive offerings
- Extend sales tax exemption to a broader range of AFV's other than just BEV
- Provide a NJ state income tax credit or rebate to purchasers of BEV's or PHEV's
- Establish a Alternative Fuels Incentive Grant (AFIG) Program similar to PA's.