Electric Autos and West Virginia Energy
Electric Autos are not a New Concept
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1909 Baker Electric

That’s over ONE HUNDRED Years Ago
Even in the Modern Era…

GM EV-1

1996-1999

They’ve been around for OVER TWENTY YEARS

Toyota RAV4 EV

1997-2003
Now they are becoming among the BEST CARS on the Road

Elon Musk and Bob Lutz
Elon Musk – Tesla Creator

Tesla Model S

Best selling US plug in car 2015 - BEV
Bob Lutz – Father of the Chevrolet Volt

Chevy Volt
First Delivery December 2010 - PHEV
Best Selling Plug-In in USA

Nissan Leaf
Best selling US plug-in car 2010-2015 - BEV
Europeans coming in a BIG WAY

BMW i3 - BEV or PHEV

BMW i8 - PHEV

Volvo xc90 - PHEV
Even Trucks are coming soon…

VIA Motors VTRUX
PHEV
So, Why is Electric Making a Comeback?
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- Advances in Electrical Drive Systems and Batteries
So, Why is Electric Making a Comeback?

- Advances in Electrical Drive Systems and Batteries
- Electric is very Convenient – especially for Urban Commuters
Most EVs are Charged at Home

Level 1 (L1) \( (110 \text{ v AC}) \)
Most EVs are Charged at Home

**Level 1 (L1) (110 v AC)**

Charges at 4 Miles of Range/Hour (mrph)

*Typical Volt charges overnight for about $1.30*
Most EVs are Charged at Home

Volt Level 2 (L2) Charging Station
Most EVs are Charged at Home

240v/13a
8 mrph

Volt charges in
Four Hours

Volt Level 2 (L2) Charging Station
Most EVs are Charged at Home

Tesla L2 Charging Station
Most EVs are Charged at Home

Tesla L2 Charging Station – 240v/80a & 60 mrph

*Tesla full charge in 4 Hours at about $10.00*
So, Why is Electric Making a Comeback?

- Advances in Electrical Drive Systems and Batteries
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- Very Affordable on a Day-to-Day Basis
So, What’s It Cost to Operate?

Running Costs per 1,000 miles

Chevy Volt:
- Power: $15 - $30
- Gasoline: $10 - $30

Tesla or Nissan Leaf:
- Power: $40 - $50
So, What’s It Cost to Operate?

Running Costs per 1,000 miles

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- Gasoline: $10 - $30

Tesla or Nissan Leaf:
- Power: $40 - $50

Marty's September Gasoline Bill

$12.36
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So, Why is Electric Making a Comeback?

Nearly all current Super Cars deploy Electric Drive Capabilities

The 1500 hp Koenigsegg Regera is a hybrid with an 18 mile all-electric range
Why should We care about electric cars?
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  • Reduce Imported Oil
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EVs typically avoid burning One Gallon (or more) of gasoline a day

That’s about 500 gallons of gasoline per year.
Why should We care about electric cars?

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That is *imported oil* which has been *eliminated*!
Why should We care about electric cars?

- Positive for US & W.Va. Economics
  - Reduce Imported Oil – Eliminate 500 gals gas per EV/yr
  - Powered by COAL
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Electric cars use power from the electrical grid

In W.Va. they are Powered by COAL!
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An EV in W.Va. consumes 8 to 11 pounds of coal per day
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100,000 EVs in W.Va. would consume 150K – 200K tons/year of coal
Say What? 100K EVs in our Region?
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- There are **375,000** plug-in cars **NOW** in USA
- 24 models across 15 brands – **Today**
- More than 50 new models in pipeline
  - From GM, Ford, Nissan, BMW, Audi, VW, Mitsubishi, Volvo, Apple and others
Say What? 100K EVs in our Region?

- There are 375,000 plug-in cars NOW in USA
- 24 models across 15 brands – Today
- More than 50 new models in pipeline
  - From GM, Ford, Nissan, BMW, Audi, VW, Mitsubishi, Volvo, Apple and others

One Million EVs will consume 1.5MM – 2MM tons/year of Coal and save 500MM gals of gas
Why should We care about electric cars?

• Positive for US & W.Va. Economics
  • Reduce Imported Oil – Eliminate 500 gals gas per EV/yr
  • Powered by COAL – Soon 1.5MM-2MM tons per year

• Limited Effect on Existing Power Grid
Most EVs are Charged at Home

At NIGHT!

Electric car charging can be programmed to fill this dip

And miss this peak

Electric load curve: New England, 10/22/2010

- Electric power demand (gigawatts)
  - morning ramp
  - hourly peak demand

WEST VIRGINIA ELECTRIC AUTO ASSOCIATION
Why should We care about electric cars?

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• Market Drivers are Appealing
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  • EVs are a Boost for Retail Sales
Why should We care about electric cars?

A study showed an Average Shopper spent 12 Minutes in a Retail Store
Why should We care about electric cars?

A study showed an Average Shopper spent 12 Minutes in a Retail Store

Add a Charge Station and the Study showed the Average EV Shopper spent 45 Minutes in the same Retail Store
Why should We care about electric cars?

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• Limited Effect on Power Grid – Most Charging at Night

• Market Drivers are Appealing
  • EVs are a Boost for Retail Sales – Shoppers stay longer
  • W.Va. Tourism needs to “Be Prepared”
Why should We care about electric cars?

Tourism is a Driver in West Virginia
Why should We care about electric cars?

Tourism is a Driver in West Virginia

Public Charging Stations will bring Drivers to W.Va.’s Tourism Destinations
Public EV Charging

L2
Most Common Public Station

240 volts
13 to 70 amps

Charges at 8 to 55 mrph
Charging fees vary (zero and up)

ChargePoint Public Station
Public EV Charging

L3 Stations – Faster Charge at 480v DC

Charging fees vary (zero and up)

Charges at 25 to 150+ mrph
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• Limited Effect on Power Grid – Most Charging at Night

• Market Drivers are Appealing
  • EVs are a Boost for Retail Sales – Shoppers stay longer
  • W.Va. Tourism – Boosted by Public Charging
IN SUMMARY

EVs are Here & More are On the Way
• Advances in Electrical Drive Systems and Batteries
• Electric is very Convenient – especially for Job Commuting
• Very Affordable on a Day-to-Day Basis
• Much Reduced Vehicle Maintenance
• REALLY, REALLY FUN to DRIVE!

West Virginia stands to benefit:
• Increased Coal Usage
• Reduced Oil Imports
• Grid Friendly Electrical Consumption
• Market Boosts Available for Tourism and Retail Sales
IN CLOSING

The West Virginia Electric Auto Association is a ready resource for Information and Policy Development

Contact us via the Internet at

www.WVEAA.org

or directly at

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Electric Autos and West Virginia Energy

Questions or Comments?
Electric Autos and West Virginia Energy
Background Slides
So, Why is Electric Making a Comeback?

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West Virginia Electric Auto Association
Analysis

Engineering assumptions:
Coal heating value – 13,000 BTU/lb (S. WV Steam)
Power plant heating value – 0.67 lb coal / kwh
Electric car mileage – 3 miles / kwh
US car average miles driven – 37 miles/day
Coal Market Share – 70.2% - (from Midwest ISO)
Coal Market Share – 95% - (West Virginia only)
West Virginia Electric Auto Association Analysis

**Question:** Why should West Virginia care about electric cars?

**Answer:** *Imported Oil* Electric cars use electricity from the US grid. Based on average assumptions, electric cars avoid burning more than 1 gallon of gasoline a day, or about 500 gallons a year. Because the US is a net oil importer, this avoided fuel is imported oil.

What if we replaced oil imported from our enemies with West Virginia coal?
West Virginia Electric Auto Association
Analysis

Question: Why should West Virginia care about electric cars?

Answer: US Economics One million electric cars will defer burning 500,000,000 gallons of gasoline per year. Based on $40 / barrel oil, that reduction in oil imports will reduce the US balance of payments more than $0.5 billion per year.
West Virginia Electric Auto Association
Grid Analysis

**Question:** Won't electric cars overwhelm the electric grid, requiring huge new investments?

**Answer:** Not necessarily. Think of an EV as a computer with wheels. Every EV can be programmed for at least charging in 3 modes:

1) Set charge start time.
2) Set charge completion time.
3) Set time of day charge cost table, and the car software optimizes charging times.
West Virginia Electric Auto Association
Market Analysis

Electric Car Market Share Barriers

- Cost of Cars
  - Declining – think computers & flat screen TVs

- Availability of public car charging stations
  - Most charging is at home but public charging is needed for long trips

- Political opposition
  - Electric cars have a “green” tint

- Most gas cars work well
West Virginia Electric Auto Association
Retail Charging Analysis

What benefits can go to retail business for public charging?

- At a California department store chain the average shopper stays 12 minutes.
- At the same chain the average EV owner stays 45 minutes.
- EV owners are loyal retail customers, and will drive out of their way to find merchants that provide public charging.
- EV owners are willing pay for the power, as long as they don't feel gouged.
West Virginia Electric Auto Association

Public Charging

- Although EV's are mostly charged at home, most owners (especially battery only owners) want the assurance they can charge away from home if they need to charge to get home.
- Home charging is unlikely to meet all EV owner needs.
- West Virginia and the region have experienced very slow rollout of public charging stations compared other parts of the US.
West Virginia Electric Auto Association
SUMMARY

Policy Analysis

**WVEAA** has policy recommendations to help the electric car market.

- Build-out of networked charging stations
- Time-of-use electric power pricing
- Auto Dealers need to sell electric vehicles