Transportation Electrification in Nevada

Will Toor

Southwest Energy Efficiency Project (SWEEP)
1. EV 101: Vehicles, charging & Nevada adoption
2. EV Benefits: Environmental and Economic Benefits
3. EV Mythbusting: Getting your EV facts straight
4. EV Policy Driving Adoption: Local and State Action
5. Utility Role in Transportation Electrification
6. EV Fees: funding road infrastructure
1. EV 101

Two types of EVs:

1. **Battery Electric Vehicles (BEV):** electric motor
2. **Plug-in Hybrid Electric Vehicles (PHEV):** electric motor + gasoline engine

- **2018 Nissan LEAF (BEV):**
  - 151 miles electric range
  - $29,990 MSRP

- **2018 Toyota Prius Prime (PHEV):**
  - 25 miles electric range, then 54 mpg gasoline
  - $27,300 MSRP
Automaker Investment in Electric Vehicle Development

- **Ford** will invest $4.5 billion in electrified vehicles by 2020: including a 300 mile range fully electric SUV and a F-150 hybrid.
- **GM** recently laid out a bold vision for a “zero crashes, zero emissions, and zero congestion” future, announced plans for 20 new electric vehicles by 2023 – including two by 2019, and rolled out the acclaimed Chevy Bolt across the U.S.
- **Toyota** committed to having at least 10 new models of all-electric vehicles by the early 2020’s.
- **Daimler AG** announced a billion dollar investment to build electric vehicles in the U.S. with production starting in the early 2020’s.
- **BMW** reached 100,000 in global electric vehicle sales while promising a dozen new models of electric vehicles by 2025.
- **Fiat-Chrysler** to electrify portfolio ([Wards Auto, July 2017](https://wardsauto.com/)).
- **Volvo** announced that “all the models it introduces starting in 2019 will be either hybrids or powered solely by batteries” ([New York Times, July 2017](https://www.nytimes.com/)).
Nearly 100 electrified models by 2022
EV battery prices falling

Getting Competitive
Battery prices seen reaching key level of $100 per kilowatt hour by 2026

Actual lithium-ion prices  BNEF projections

Source: Bloomberg New Energy Finance
EV sales in Nevada

- 5,100 EVs sold in NV to date
- Growing EV markets across the Southwest:

<table>
<thead>
<tr>
<th>EV market share</th>
<th>2017</th>
<th>2018</th>
<th>YOY growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nevada</td>
<td>0.68%</td>
<td>1.20%</td>
<td>75%</td>
</tr>
<tr>
<td>Utah</td>
<td>0.78%</td>
<td>1.22%</td>
<td>56%</td>
</tr>
<tr>
<td>Colorado</td>
<td>1.53%</td>
<td>1.94%</td>
<td>26%</td>
</tr>
<tr>
<td>Arizona</td>
<td>0.66%</td>
<td>1.62%</td>
<td>144%</td>
</tr>
<tr>
<td>New Mexico</td>
<td>0.35%</td>
<td>0.66%</td>
<td>89%</td>
</tr>
</tbody>
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Where Are EVs Taking Off?
While California remains the country’s largest EV market in terms of cars on the road, it is no longer the fastest-growing. More states are encouraging EV driving by offering incentives such as tax credits, HOV lane access, utility rebates and special rate plans for EV charging.

Top 10 States
1. California
2. Nevada
3. North Carolina
4. Colorado
5. Kansas
6. New Hampshire
7. Pennsylvania
8. Virginia
9. Florida
10. Arizona

Top 10 Metro Areas
1. Los Angeles
2. Kansas City
3. Raleigh/Durham
4. Denver
5. Miami
6. Phoenix
7. Philadelphia
8. Portland
9. San Diego
10. Las Vegas
Types of EV Charging

Level 1 charging (1-2 kw) – just plug into a regular wall outlet. Can be used for overnight home charging, all day workplace charging.

Level 2 chargers (4-22 kW) are inexpensive and can provide grid services with managed charging.

Level 2 is appropriate anywhere vehicles can stay a few hours:
• residences
• workplaces
• shopping areas
• charging depots

DCFC (50-350+ kW) are very expensive and can’t easily provide grid services with managed charging.

DCFC is appropriate for:
• high-traffic urban centers
• commuting corridors
• stops on interstate highways
• charging depots for TNC fleets
• mass transit
2. **EV Benefits:** Environmental and Economic Benefits

1. **State economic benefits:** locally produced electricity versus imported oil
2. **Consumer savings:** $900-1,220 per year in fuel & maintenance savings
3. **Air quality benefits:** Emissions reductions for all 6 criteria pollutants
4. **Climate benefits:** As the electricity sector gets cleaner, so do EVs
5. **Energy savings:** EVs are 3x as efficient as gas
6. **Benefit to utilities and ratepayers:** increased load that is easily managed, revenues exceed costs = downward pressure on electricity rates
State economic benefits: sourcing transportation fuel

Nevada: $5.5 Billion of Imported Oil vs Local Renewables

Nevada imports 99.5% of the oil it consumes.

Geothermal (#2 installed capacity)

Solar (#1 solar resource)
Consumers savings & job growth

- EV fuel and maintenance savings
  - Fuel savings: EV charging is equivalent to $1.00/gallon
  - Maintenance: 10-25% cost reduction
  - $720 million annual savings by 2030 if 26% of cars are electric

- CA study: 15% EV market share goal creates 50,000 new jobs.
Clark County’s Air Quality

- Clark County got an ‘F’ for smog in the 2016 State of the Air
- Clark County 15th most polluted county in U.S. for smog (ground-level Ozone)
- Over half of smog forming pollutants are from transportation
- Low-income communities are often most impacted by highway pollution
EVs benefit local air quality

How do EVs compare to gas cars on local air pollutants?

<table>
<thead>
<tr>
<th>POLLUTANT</th>
<th>PHEV</th>
<th>BEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC*</td>
<td>-63%</td>
<td>-99%</td>
</tr>
<tr>
<td>CO</td>
<td>-49%</td>
<td>-99%</td>
</tr>
<tr>
<td>NOx*</td>
<td>-47%</td>
<td>-84%</td>
</tr>
<tr>
<td>PM 10</td>
<td>-18%</td>
<td>-34%</td>
</tr>
<tr>
<td>PM 2.5</td>
<td>-31%</td>
<td>-58%</td>
</tr>
<tr>
<td>SO2</td>
<td>-26%</td>
<td>-51%</td>
</tr>
<tr>
<td>GHG</td>
<td>-44%</td>
<td>-74%</td>
</tr>
</tbody>
</table>

*VOCs and NOx combine to create ground-level Ozone or “smog”, which causes major respiratory issues.
Transit Bus Emissions Comparison

- Electric Bus: 77% Reduction
- Diesel Bus: 82% Reduction

Graph showing grams per mile for VOC and NOx emissions, comparing electric and diesel buses.
Bus electrification – cleaner air and cost savings

"We see electric vehicles as being the future, replacing conventional gasoline and diesel vehicles," David Jickling, director of public transportation and operations at RTC Washoe

Source – US PIRG, Electric Buses Study, May, 2018
Transportation now largest source of GHGs in U.S.

Nevada: CO2 emissions by sector (2016)
EVs are only as clean as their electricity grids

How Green is Your Electric Vehicle? Check The Fuel Source
Cleaner power grids mean cleaner electric cars

China
Germany
Japan
U.S.
Netherlands
U.K.
France
Norway

Nevada
Natural gas: 70%
Renewables: 20%
Hydroelectric: 5%
Coal: 5%

Note: Renewables include geothermal, solar, wind, biomass and waste, large and small hydro sources
Source: Bloomberg New Energy Finance
EV Climate Benefits

How do EVs compare to gas cars on GHG emissions?

- EVs get cleaner each year alongside the electricity grid

- PHEV: Toyota Prius Prime GHGs:
  - -44% in 2017 (= 46 mpg gas car)
  - -55% in 2030 (= 78 mpg gas car)

- BEV: Tesla Model 3 GHGs:
  - -74% in 2017 (= 101 mpg gas car)
  - -83% in 2030 (= 207 mpg gas car)
Getting EVs on the road benefits all utility customers

1. Enough spare capacity to power all cars off-peak.
2. Charging is flexible and can be managed to absorb variable renewable generation.
3. Greater grid efficiency puts downward pressure on electric rates leads to reduced electric bills and savings for all electricity customers.
Example: Cost benefit analysis of EVs to Colorado grid

Source: MJ Bradley cost benefit study, 2017
Who opposes EVs?

- **EV Revolution Could Wipe Out $21 Trillion In Oil Revenue**
  - Irina Slav - May 23, 2018, from oilprice.com

- **Utilities, oil interests clash over EV policy at conservative policy summit**
  - Utility Dive, April 30, 2018

- Big oil and the Koch affiliated groups like Americans for Prosperity have begun significant efforts to spread anti EV myths and oppose state and federal EV policy
### 3. Misinformation on EVs

- **MYTH:** “EVs just substitute dirty coal for gasoline”
  
  **TRUTH:** EVs are cleaner than gas vehicles everywhere in the US. In Nevada, EVS are far cleaner - 99% lower VOC, 84% lower NOx, GHG emissions = car getting 101 mpg in 2017 and increases to 207 mpg in 2030.

- **MYTH:** EVs are just a toy for the rich
  
  **TRUTH:** Many EVs cost less than the average new car sold. Average new vehicle is $36,000+. Prius Prime PHEV, Nissan Leaf around $20,000 - 22,500 after federal tax credit.
## Affordable EVs on the market (2018)

<table>
<thead>
<tr>
<th>EV Model</th>
<th>Price after tax credit</th>
<th>Incremental Cost*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Chevrolet Bolt (BEV)</td>
<td>$29,995</td>
<td>$5,395</td>
</tr>
<tr>
<td>2  Chevrolet Volt (PHEV)</td>
<td>$26,595</td>
<td>$1,995</td>
</tr>
<tr>
<td>3  Fiat 500e (BEV)</td>
<td>$25,495</td>
<td>$895</td>
</tr>
<tr>
<td>4  Ford Focus Electric (BEV)</td>
<td>$21,620</td>
<td>$(2,980)</td>
</tr>
<tr>
<td>5  Ford Fusion Energi (BEV)</td>
<td>$23,900</td>
<td>$(700)</td>
</tr>
<tr>
<td>6  Honda Clarity (PHEV)</td>
<td>$25,900</td>
<td>$1,300</td>
</tr>
<tr>
<td>7  Hyundai Ioniq (BEV)</td>
<td>$22,000</td>
<td>$(2,600)</td>
</tr>
<tr>
<td>8  Hyundai Ioniq (PHEV)</td>
<td>$17,450</td>
<td>$(7,150)</td>
</tr>
<tr>
<td>9  Kia Soul EV (BEV)</td>
<td>$26,450</td>
<td>$1,850</td>
</tr>
<tr>
<td>10 Kia Niro (BEV)</td>
<td>$20,400</td>
<td>$(4,200)</td>
</tr>
<tr>
<td>11 Kia Optima (PHEV)</td>
<td>$27,710</td>
<td>$3,110</td>
</tr>
<tr>
<td>12 Mini Cooper SE Countryman (PHEV)</td>
<td>$29,400</td>
<td>$4,800</td>
</tr>
<tr>
<td>13 Mitsubishi Outlander (PHEV)</td>
<td>$27,095</td>
<td>$2,495</td>
</tr>
<tr>
<td>14 Nissan LEAF (BEV)</td>
<td>$22,490</td>
<td>$(2,110)</td>
</tr>
<tr>
<td>15 Toyota Prius Prime (PHEV)</td>
<td>$19,800</td>
<td>$(4,800)</td>
</tr>
<tr>
<td>16 Volkswagen e-golf (BEV)</td>
<td>$23,845</td>
<td>$(755)</td>
</tr>
</tbody>
</table>

*Incremental cost compared to the average gas-powered vehicle price in 2018 = $24,600
More Myths

- **MYTH:** EVs are just for small sedans.
  
  **TRUTH:** There are already SUVs available (Chrysler Pacifica, Mitsubishi Outlander PHEV, Hyundai Kona BEV), will be 19 more models by 2021

- **MYTH:** EVs are responsible for declining gas tax revenues

  **FACT:** EVs in Nevada have had less than one tenth of one percent (<0.1%) impact on gas tax; inflation and fuel economy have much larger impact
Major barriers to EV adoption

1. The upfront cost is coming down, but still more expensive than gasoline vehicles
2. People need to know that charging infrastructure is available
3. Automakers provide limited model availability, many dealers discourage EV buyers
4. There is a huge gap in consumer awareness of EVs (though AAA surveys shows that more than 20% want to buy one)
4. Policy Driving Adoption!

- Zero emission vehicle standards and ICE bans
- Purchase incentives: national and state
- Infrastructure investments
- EV building codes
- Utility EV programs
- HOV/HOT lane incentives
- State and local fleet procurement
- Education/outreach efforts
China has first national ZEV standard; GM has proposed a US national standard

Chinese new energy vehicle mandate is modeled after California ZEV
Countries planning to ban ICE vehicles (17 countries, 22 cities)

<table>
<thead>
<tr>
<th>Country</th>
<th>Ban announced</th>
<th>Ban commences</th>
<th>Scope</th>
<th>Selectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>2018</td>
<td>2030[^a] 2035[^b][^14]</td>
<td>Gasoline and diesel</td>
<td>New vehicle sales</td>
</tr>
<tr>
<td>Germany</td>
<td>2016</td>
<td>2030[^16]</td>
<td>Combustion engine</td>
<td>New vehicle sales</td>
</tr>
<tr>
<td>India</td>
<td>2017</td>
<td>2030[^17]</td>
<td>Gasoline and diesel</td>
<td>New vehicle sales</td>
</tr>
<tr>
<td>Ireland</td>
<td>2018</td>
<td>2030[^18]</td>
<td>Gasoline and diesel</td>
<td>New vehicle sales</td>
</tr>
<tr>
<td>Portugal</td>
<td>2010</td>
<td>Ongoing[^4]</td>
<td>Incentives</td>
<td>New vehicle sales</td>
</tr>
<tr>
<td>South Korea</td>
<td>2016</td>
<td>2020[^4]</td>
<td>Incentives</td>
<td>New vehicle sales</td>
</tr>
<tr>
<td>Spain</td>
<td>2017</td>
<td>Ongoing[^4]</td>
<td>Incentives</td>
<td>New vehicle sales</td>
</tr>
<tr>
<td>Taiwan</td>
<td>2018</td>
<td>2040[^22]</td>
<td>Non-electric</td>
<td>New vehicle sales</td>
</tr>
</tbody>
</table>
Nevada opportunity to consider ZEV

● Clean Air Act allows states to adopt CA ZEV standards – 10 other states have done so; Colorado is considering
● Requires automakers to gradually increase sales of EVs
● Can be adopted by administrative rule-making or legislation
● Practical impact – more models of EVs, more marketing, more automaker support for pro EV state policies

VW eGolf (BEV) is one of several EVs that are only available in ZEV states.
EV Purchase incentives

- **$7,500 federal tax credit**
  - Federal tax credits begin to phase out after 200k vehicles sold (Tesla, Chevy, Nissan)

- State rebates and tax credits

<table>
<thead>
<tr>
<th>State</th>
<th>Maximum Rebate</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>$5,000</td>
<td>California Clean Vehicle Rebate Project; subject to an income cap of $204,000 for individuals and $300,000 for joint filers. No current expiration date</td>
</tr>
<tr>
<td>Colorado</td>
<td>$5,000</td>
<td>Refuel Colorado. Program expires: 1/1/2022</td>
</tr>
<tr>
<td>Louisiana</td>
<td>$2,500</td>
<td>Alternative Fuel Vehicle Tax Credit. (Up to 10% of purchase price.) No current expiration date</td>
</tr>
<tr>
<td>Maryland</td>
<td>$3,000</td>
<td>Maryland Excise Tax Credit. Limited to vehicles costing less than $60,000. Program expires: 6/30/2020</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>$2,500</td>
<td>MOR-EV Program. Total program budget $12.5 million</td>
</tr>
<tr>
<td>New York</td>
<td>$2,000</td>
<td>Drive Clean New York. Total program budget $70 million</td>
</tr>
<tr>
<td>Oregon</td>
<td>$2,500</td>
<td>Zero Emission Vehicle Program. Limited to vehicles costing less than $50,000. Additional “Charge-Ahead” rebate of up to $2,500 for low-income residents scrapping a vehicle at least 20 years old. Start date: 1/1/2018</td>
</tr>
</tbody>
</table>
Nevada state purchasing incentive

- States with incentives have higher EV adoption
- Most effective incentives are “cash on the hood” – rebates or sales tax credits
- Most effective incentives are $2,500 or more
- Rebate on state general fund sales tax would be $600-$1,000 for most EVs
- A poll for the Nevada Conservation League found 61% support for sales tax incentive
REV West Plan

MOU between governors of Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming

- Interstates 25, 70 and 76 in Colorado;
- Interstates 15, 84, 86, and 90 in Idaho;
- Interstates 15, 90 and 94 in Montana;
- Interstates 15 and 80 in Nevada;
- Interstates 10, 25 and 40 in New Mexico;
- Interstates 15, 70, 80 and 84 in Utah; and
- Interstates 25, 80 and 90 in Wyoming.
Highway Charging Infrastructure

- Network of DCFC charging stations to be completed by 2020
- VW fund (Electrify America) investments and NV Energy investments
Nevada VW fund allocations

• Nevada will receive $25 million
• 15% ($3.75 million) allocated to EV charging
• 80% allocated to trucks, buses, airport equipment
• First round of funding: $6.6 million, 81% to electric airport ground support equipment
Multifamily charging

- About half Americans live in multifamily housing
- Home charging is key: >80% of charging
- Very challenging to get charging in existing MFU, especially low-income
- Most successful programs are turnkey utility programs, with chargers owned/operated by utility
- Currently in Nevada, there are small rebates for multifamily from NV Energy
5. EV Utility Activity in 2018
Current Nevada utility programs

- Electric Vehicle Infrastructure Demonstration Program, pursuant to SB 17-145
- $15 million allocated over 3 years
- Rebates for chargers for fleets, workplaces, multifamily housing
- Custom grant program for projects like electric bus charging
- Support for electric highway program
- Some customer education and outreach
- Potential opportunity – bill to allow/require larger scale utility programs to support electrification
Examples of what utilities could do

- TOU rates/ EV tariffs
- Commercial tariff/demand charge optimization
- Utility rebates for charging infrastructure
- Investment in charging infrastructure where market is not providing
- Investment in electrical service to support charging
- Investment to support electrification of public transit and of ridesharing
- Utility rebates for vehicles; midstream incentives for dealers
- Customer education & outreach
6. EV Fees
How should EVs pay into road funds?

A Range of EV Fees
What states are charging to drive an electric vehicle, at a glance

Notes: *States that assess a separate fee on PHEVs or HEVs. Georgia’s PHEV fee applies only if the owner purchases an alternative fuel license plate.
Source: NCSL, 2018
Impacts on Nevada Highway Funding

- Inflation: $172 million
- Fuel Economy Standards: $33 million
- Electric Vehicles: $155,000
EV Fee: Key principles

- EVs should pay a fair share – but right now this is a new technology, in the very early days
- Currently, EVs have no material impact on gas taxes
- EVs should not pay more than efficient gasoline vehicles
- Fees should not be so high that they strangle the market (See: Georgia)
- One approach – energy equivalent fees (pay the same amount/BTU as a gas car does)
- Couple fee with incentives to increase EV sales
Takeaways

- We can’t solve climate change without electrifying transportation
- Market is headed the right direction, but moving way too slow
- Government policy support is essential to speed the transition
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