EV Purchasing 101
Brown Bag

September 12th, 2018
Zero Emission Vehicle Executive Order

By 2030
5 million ZEVs on California roads

By 2025
$2.5 billion to install
240,000 L2 charging stations
10,000 L3 charging stations
200 hydrogen fueling stations
Types of Zero Emission Vehicles (ZEV)

Battery Electric Vehicle
A battery electric vehicle (BEV) operates entirely on electricity and needs to be plugged in to be recharged.
Types of Zero Emission Vehicles (ZEV)

Plug-in Hybrid
A plug-in hybrid (PHEV) is powered by an electric motor that receives assistance from a gasoline (or diesel) engine. PHEVs can be plugged in to be recharged. PHEVs are considered ZEVs by the State of California.
Types of Zero Emission Vehicles (ZEV)

Fuel Cell Electric Vehicle
A hydrogen fuel cell (FCEV) runs on an electric motor that is powered through a chemical reaction between hydrogen and oxygen. This car must be refueled with liquid hydrogen.
Types of Zero Emission Vehicles (ZEV)

Standard Hybrid
A standard hybrid engine is powered by both a gasoline or electric motor that is recharged by the engine. This car can only be fueled by gas and cannot be plugged in.
Types of Zero Emission Vehicles (ZEV)

Standard Hybrid
A standard hybrid engine is powered by both a gasoline or diesel engine and an electric motor that is recharged by the engine. This car can only be fueled by gas and cannot be plugged in.
# Battery Electric Vehicles (BEV)

<table>
<thead>
<tr>
<th>Model</th>
<th>MSRP/Lease (Manufacturers Suggested Sale Price)</th>
<th>Battery (kWh)</th>
<th>Range (miles)</th>
<th>Cost to Fuel ($/mile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018 Nissan Leaf</td>
<td>$29,990</td>
<td>40</td>
<td>150</td>
<td>0.05 $ / mile</td>
</tr>
<tr>
<td></td>
<td>$229/mo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018 Tesla Model3</td>
<td>$49,000 - $77,500</td>
<td>75</td>
<td>310</td>
<td>0.05 $ / mile</td>
</tr>
<tr>
<td>2018 Chevy Bolt</td>
<td>$37,495</td>
<td>60</td>
<td>238</td>
<td>0.05 $ / mile</td>
</tr>
</tbody>
</table>
## Plug-in Hybrids (PHEV)

<table>
<thead>
<tr>
<th>Model</th>
<th>MSRP</th>
<th>Battery Capacity</th>
<th>Range (miles)</th>
<th>Cost to Fuel ($/mile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018 Kia Niro</td>
<td>$27,900-$29,000</td>
<td>8.9 kWh</td>
<td>110</td>
<td>0.07$ /mile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.3 gallons</td>
<td>511 - 595</td>
<td></td>
</tr>
<tr>
<td>2018 Honda Clarity</td>
<td>$33,400</td>
<td>17 kWh</td>
<td>47</td>
<td>0.10$ /mile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.0 gal</td>
<td>340</td>
<td></td>
</tr>
<tr>
<td>2018 Prius Prime</td>
<td>$27,300-$33,300</td>
<td>8.6 kWh</td>
<td>25</td>
<td>0.07$/mile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.3 gal</td>
<td>594</td>
<td></td>
</tr>
</tbody>
</table>
# Internal Combustion Engine Vehicles (ICE)

<table>
<thead>
<tr>
<th></th>
<th>MSRP</th>
<th>Tank Ave. mpg</th>
<th>Range (miles)</th>
<th>Cost to Fuel ($/mile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019 Kia Sportage</td>
<td>$23,750</td>
<td>16.4</td>
<td>426</td>
<td>0.15 $ / mile</td>
</tr>
<tr>
<td>2018 Honda Accord</td>
<td>$23,570</td>
<td>14.8</td>
<td>503</td>
<td>0.12 $ / mile</td>
</tr>
<tr>
<td>2018 Toyota Camry</td>
<td>$23,645</td>
<td>16</td>
<td>512</td>
<td>0.12 $ / mile</td>
</tr>
</tbody>
</table>
“2019 is the Year of the E-SUV”
Used ZEV Options

2013 Nissan LEAF

Mileage: 39,396 miles
Range: 84 miles
Location: Healdsburg, CA
Discount Available
$7,495

• Used EV Buyers’ Guide
• Search for Used Evs
• $13.5K is average used car price (2017)

Re-fabricated 40 kwh battery: $2,850
Brand new battery: $7,800
Dealer Tips

• Generally better to lease than buy, due to obsolescence and faster-than-usual depreciation
• If secondary car, buying is more feasible
• Check for overall battery capacity when buying used (dealers often won’t know)
• Single pay up front for lease is cheaper
Dealer Tips Cont’d

• Get quotes via e-mail from out of area first, then use to negotiate with local dealers

• **Tips for getting the best deal on a lease** (for all cars and includes math that will be the key to great negotiation skills; especially relevant to an EV)

• **Tips from a Driver Who has Leased 4 Evs**

• **Consumer Reports tips**
Perceived Barriers

- EVs cost more
- Range anxiety
- Charging is time-intensive
- Reliability of technology
- Quality of performance
- May produce more GHGs
Solutions
NEXT EXIT
Incentives to Lower Capital Costs

• **Federal tax credit**
  $2,500 - $7500
Incentives to Lower Capital Costs

• **Federal tax credit**
  $2,500 - $7,500

• **State Incentives**
  • **EV**: $2,500 - $3,500
  • **PHEV**: $1,500 - $3,500
CVRP Income Caps
November 1st, 2016-Present

• $150,000 for single filers
• $204,000 for head–of–household filers
• $300,000 for joint filers
Incentives to Lower Capital Costs

- **Federal tax credit**
  - $2,500 - $7,500

- **State Incentives**
  - EV: $2,500 - $3,500
  - PHEV: $1,500 - $3,500

- **PG&E**
  - $500
Incentives to Lower Capital Costs

- **Federal tax credit**
  - $2,500 - $7,500

- **State Incentives**
  - EV: $2,500 - $3,500
  - PHEV: $1,500 - $3,500

- **PG&E**
  - $500

- **CCA**
  - $500? (TBD)
Incentives for Low-Income Communities

*Source: GRID One-Stop-Shop Project*

- Increased rebates for low-income consumers through the [Clean Vehicle Rebate Project](#);
- Low-cost loans and grants for used and new hybrid and electric vehicles through the [Clean Vehicle Assistance Program](#);
- Projects to scrap and replace your vehicle in Southern California ([Replace Your Ride](#)), San Joaquin Valley ([Drive Clean in the San Joaquin Replacement Program](#)), and the Bay Area and Sacramento (coming soon); and
- Car-sharing projects in the Los Angeles area ([BlueLA](#)) and Sacramento ([Our Community CarShare Sacramento](#)), and coming soon to the Bay Area, San Joaquin Valley, and Watsonville.
Insurance Discounts

• Insurance Discounts (10%)
Carpool Lane Access

• HOV Access Decal
  • Active: January 1, 2018 – 2022
  • DMV Application
Maintenance Savings

Gas Car
~2,000 moving parts

Electric Car
~20 moving parts
Fuel Savings

Chevy 2018 Bolt

$0.18\ \text{1 kWh} \times 60\ \text{kWh} = 3.80\ \text{1 gallon} \times 238\ \text{miles} = 15,000\ \text{miles} = 1,219

64\%\ \text{Savings} = \$680.67\ \text{Per year}

2006 Honda Accord

$3.80\ \text{1 gallon} \times 15.3\ \text{gallons} = 15,000\ \text{miles} = 15,000\ \text{miles} = 1,900

\text{Per year}
Fuel Savings

Chevy 2018 Bolt

$0.18
1 kWh

$0.18
238 miles

60 kWh
15,000 miles

15,000 miles
1 year

$680
Per year

60 % Savings = $1,048

2018 Chevy Malibu

$3.80
1 Gallon

$3.80
521 miles

15.8 gallons
15,000 miles

15,000 miles
1 year

$1,728
Per year
## Total Cost Savings

<table>
<thead>
<tr>
<th>Cost</th>
<th>EV 2018 Bolt</th>
<th>Gas 2018 Malibu</th>
<th>2006 Honda</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start-up</strong></td>
<td>$36,700.00</td>
<td>$21,680</td>
<td>$7,500</td>
</tr>
<tr>
<td></td>
<td>$7,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$2,500.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- $500.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$26,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unique maintenance per year</strong></td>
<td>$0.00</td>
<td>Oil +$64.00</td>
<td>Oil +$64.00</td>
</tr>
<tr>
<td></td>
<td>Oil +$64.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oil +$664.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fuel (15,000 miles/year)</strong></td>
<td>+ $680</td>
<td>+ $1,728</td>
<td>+ $1,900</td>
</tr>
<tr>
<td><strong>One year</strong></td>
<td>$26,880</td>
<td>$23,472</td>
<td>$9,601</td>
</tr>
<tr>
<td><strong>8 year</strong></td>
<td>Oil $0.00</td>
<td>Oil $512</td>
<td>Oil $512</td>
</tr>
<tr>
<td></td>
<td>Battery $0.00</td>
<td>Battery $300</td>
<td>Battery $300</td>
</tr>
<tr>
<td></td>
<td>Fuel + $5,440</td>
<td>Fuel + $13,824</td>
<td>Fuel + $15,200</td>
</tr>
<tr>
<td></td>
<td>$31,690</td>
<td>$36,316</td>
<td>$24,176</td>
</tr>
</tbody>
</table>
Net Present Value

If you purchase today you gain $3,255 on your investment

In this equation:

\[ \text{NPV} = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_o \]

- \( C_t = $1,500 \) cash flow for a year period
- \( C_o = $5,000 \) total initial investment costs (after rebate)
- \( r = 0.03 \) discount rate
- \( t = 8 \) year time period

Read more: Net Present Value (NPV) Definition | Investopedia https://www.investopedia.com/terms/n/npv.asp#ixzz5PgxGyME
Follow us: Investopedia on Facebook
Payback Period

• If you buy a Chevy Bolt instead of a Chevy Malibu, the payback period is **12 ½ years** before incentives.

• **10 years** after incentives (no federal tax credit)

• **4 years** after incentives (w/FTC)
Charging Stations

The Charging Pyramid

<table>
<thead>
<tr>
<th>Power Level</th>
<th>Vehicle Dwell Time</th>
<th>Cost to Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Fast Charging</td>
<td>Travel 30-90 min</td>
<td>$$$$$</td>
</tr>
<tr>
<td>High Power AC</td>
<td>Public 0.5 - 3 hours</td>
<td>$$</td>
</tr>
<tr>
<td>Mid Power AC</td>
<td>Workplace 4 - 8 hours</td>
<td>$</td>
</tr>
<tr>
<td>Low Power AC</td>
<td>Residential 8 - 10 hours</td>
<td>$</td>
</tr>
</tbody>
</table>

Charging Stations:

- **Low Power AC (Level 1)**
  - 120 Volts AC, 12-16 A
  - 2-5 miles of range per hour of charge
  - Typical EVC cost: a few hundred dollars
  - Typical installation cost: $0

- **Mid-High Power AC (Level 2)**
  - 208/240 Volts AC, up to 80 Amps
  - 10-20 miles of range per hour of charge
  - Typical EVC cost: $500 - $8,000
  - Typical installation cost: $600 - $13,000 per charger

- **DC Fast Charging (DCFC)**
  - 200 - 500 VDC, up to 350 A
  - 60-80 miles of range per hour of charge
  - Typical EVC cost: $15,000 - $40,000
  - Typical installation cost: $8,000 - $50,000 per charger
Charging Station Maps
Current Local Fast Charge Network
2019
Fast Charge Network:

Leaf the range anxiety behind!
Current Fast Charge Network: Travelling Outside of Northern CA
EV Charging Convenience

Workplace Charging

Strategic placement
EV Charging Stations in Our Region

- RCEA map
- Humboldt Insider Map
Performance

Instant peak torque

GREAT handling
Increasing Efficiency in all Climates

External cooling

NREL
NATIONAL RENEWABLE ENERGY LABORATORY
EV Innovations Means a Greater Range

2019 Nissan Leaf! 
Soon to be released

2018: 150 miles
2019 Expected: 200+
Is my clunker cleaner than a new EV?
Greenhouse Gas Life Cycle

EV long-range (265 miles)

- manufacturing emissions ↑ 68%
- Overall emissions ↓ 53%

pay back = 19,000 miles
Greenhouse Gas Life Cycle

EV Midrange (84 miles)

• manufacturing emissions ↑ 15 %
• Overall emissions ↓ 51 %

pay back = 4,900 miles

(Union of Concerned Scientists 2015)
RCEA Advanced Fuels & Transportation Website
Important Alerts and Updates

Application for the Fleet Conference Scholarship - Deadline has been extended

Here is the link for the Announcement and the Application.

Apply for the ZEV Enthusiasts Group

RCEA is currently recruiting members for our Zero Emission Vehicle Enthusiasts Group. This group is for community members who are excited about ZEVs and would like to get involved with ZEV education, outreach, and planning. Whether you drive a ZEV yourself and want to share your experience, or are simply motivated to promote local clean transportation, you can help RCEA by providing feedback about local ZEV infrastructure and spreading the word about our ZEV services.

Please see the ZEV Enthusiasts Group Application (PDF) for more details.

Advanced Fuels and transportation Summer Newsletter

Please click here to read our summer newsletter.
FAQs

What is the difference between a conventional hybrid, a plug-in hybrid, and a battery electric vehicle?

How far will an EV go on a charge?

What if I need to travel further?

How much does it cost to charge an EV?

How long does it take to charge an EV?

How long do EV batteries last? Do they have warranties?

How do you find EV charging stations?

What incentives are available?

What happens when your EV runs out of battery "juice"?

How much does it cost to install a home charger?

When can I purchase and EV with more cargo space?
### 2018 Vehicles Specs

<table>
<thead>
<tr>
<th>Fuel/Powertrain Type</th>
<th>Make</th>
<th>Model</th>
<th>Vehicle Type</th>
<th>Propulsion; Battery</th>
<th>Transmission</th>
<th>Fuel Economy, City/Combined/Highway (miles per gallon of gasoline equivalent, MPGe)</th>
<th>All-Electric Range (mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEV</td>
<td>BMW</td>
<td>i3 (94 Ah)</td>
<td>Sedan</td>
<td>125 kW electric motor; 94 Ah battery</td>
<td>Auto</td>
<td>129/118/106</td>
<td>114</td>
</tr>
<tr>
<td>BEV</td>
<td>BMW</td>
<td>i3s (94 Ah)</td>
<td>Sedan</td>
<td>125 kW electric motor; 94 Ah battery</td>
<td>Auto</td>
<td>126/112/99</td>
<td>107</td>
</tr>
<tr>
<td>BEV</td>
<td>BYD Motors</td>
<td>e6</td>
<td>Wagon</td>
<td>75 kW electric motor; 270 Ah battery</td>
<td>Auto</td>
<td>73/72/71</td>
<td>187</td>
</tr>
<tr>
<td>BEV</td>
<td>Chevrolet</td>
<td>Bolt EV</td>
<td>Wagon</td>
<td>150 kW electric motor; 171 Ah battery</td>
<td>Auto</td>
<td>128/119/110</td>
<td>238</td>
</tr>
<tr>
<td>BEV</td>
<td>Fiat</td>
<td>500e</td>
<td>Sedan</td>
<td>82 kW electric motor; 63 Ah battery</td>
<td>Auto</td>
<td>121/112/103</td>
<td>84</td>
</tr>
<tr>
<td>BEV</td>
<td>Ford</td>
<td>Focus Electric RWD</td>
<td>Sedan</td>
<td>107 kW electric motor; 105 Ah battery</td>
<td>Auto</td>
<td>118/107/96</td>
<td>115</td>
</tr>
<tr>
<td>BEV</td>
<td>Honda</td>
<td>Clarity</td>
<td>Sedan</td>
<td>120 kW electric motor; 82 Ah battery</td>
<td>Auto</td>
<td>126/114/103</td>
<td>89</td>
</tr>
<tr>
<td>BEV</td>
<td>Hyundai</td>
<td>Ioniq Electric</td>
<td>Sedan</td>
<td>88 kW electric motor; 78 Ah battery</td>
<td>Auto</td>
<td>150/136/122</td>
<td>124</td>
</tr>
</tbody>
</table>
Charging Station Options and Pricing
Potential and Planned Upcoming Projects

- RCEA Rebate Catalog
- PG&E Cluster Cost-Share RFQ
- Center for Sustainable Energy California Electric Vehicle Infrastructure Projects (CaleVIP; charging station incentives)
- HTA E-Bus Climate Adaptation Plan
- Group buy project proposal
- Dealer Education Workshop
- Permitting Workshop
- Green fleet policies for local governments
- Fleet analyses
- Pursuit of Redding hydrogen station development
- Complete 2015 GHG Inventory for Humboldt County
Other Services

• Consulting for residents and organizations interested in hosting/owning charging stations
• EV ombudsman: answer any questions from general public related to EVs and their infrastructure
• Ride-and-drives and expo grant requirements complete
• Presentations for community groups, elected officials, etc.
• Newsletters
Q&A/Return to Staff ?s
Thank You
Extra Slides
Cost to Fuel: Nissan Leaf

$0.18

1 kWh
Cost to Fuel: Nissan Leaf

$0.18 \times 40 \text{ kWh} = \text{Cost to Fuel}
Cost to Fuel: Nissan Leaf

$0.18 \times 40 \text{ kWh} = 150 \text{ miles}
Cost to Fuel: Nissan Leaf

- $0.18 per kWh
- 40 kWh = 150 miles
- $0.05 per mile
Interior Dimensions
Charging Pyramid

Level 3: Travel
- 50 kW to 150 kW
- 1 to 1.5 hours

Level 2: Public or Home
- 24 kW to 60 kW
- 4 to 8 hours

Level 1: Residential
- 15 kW to 60 kW
- 10 to 40 hours to recharge
Battery Technology

A graph showing the relationship between operating temperature (°F) and average range (miles) is displayed. The graph indicates that the average range increases as the operating temperature increases from -10°F to approximately 50°F, reaching a maximum at around 50°F to 60°F, and then decreases as the temperature continues to rise. The vertical axis represents the average range in miles, while the horizontal axis represents the operating temperature in °F. The graph also shows the percentage of maximum range on the right vertical axis, indicating how the range compares to the maximum possible range at different temperatures.