Charging Electric Cars

PHEV = Plug-in Hybrid Electric Vehicle
BEV = Battery Electric Vehicle
EV = PEV = PHEV or BEV
ICE = Internal Combustion Engine vehicle

L. David Roper
ROPERLD@VT.EDU

tinyurl.com/ChargingElectricCars
PHEVs available in U.S.

**Chevrolet Volt**

- **52 miles electric range** and **420 miles** total range
- **42 MPG** in hybrid mode and **106 MPGe in electric mode** \((33.7 \text{ kWh in a gallon of gasoline})\)
- **18.4 kWh battery**
- **240-volts charging power = 7.2 kW**
- Electric motor power = 101 hp
- Gasoline engine power = 149 hp
- Length = 180.4" , width = 71.2" , height = 56.4"
- Base price =$32,520
- Federal tax credit = $7,500 (until April 2019)
PHEVs available in U.S.

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Honda Clarity Plug-In Hybrid

• **47 miles electric range** and **340 miles** total range
• **42 MPG** in hybrid mode and **110 MPGe in electric mode**
• 17 kWh battery
• **240-volts charging power = 6.6 kW**
• Electric motor power = 181 hp
• Gasoline engine power = 103 hp
• Length = 192.7", width = 73.9", height = 58.2"
• Base price = **$33,400**
• Federal tax credit = **$7,500**
PHEVs available in U.S.

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PHEVs available in U.S.

Chrysler Pacifica Plug-In Hybrid

- **33 miles electric range** and **570 miles** total range
- **32 MPG** in hybrid mode and **84 MPGe in electric mode**
- 16 kWh battery
- **240-volts charging power = 6.6 kW**
- AWD: Two electric motors' power = 114 hp and 84 hp
- Gasoline engine power = 220 hp
- Length = 203.8", width = 79.6", height = 69.9"
- Base price = **$41,995**
- Federal tax credit = **$7,500**
PHEVs available in U.S.

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- **16 kWh** battery
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- Base price = $41,995
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PHEVs available in U.S.

Hyundai Ioniq Plug-In Hybrid

- **29 miles electric range** and **630 miles** total range
- **52 MPG** in hybrid mode and **119 MPGe in electric mode**
- 8.9 kWh battery
- **240-volts charging power = 3.3 kW**
- Electric motor power = 60 hp
- Gasoline engine power = 105 hp
- Length = 176.0“, width = 71.7“, height = 56.9“
- Base price = $24,950
- Federal tax credit = $4,500
PHEVs available in U.S.

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- Federal tax credit = **$4,500**
PHEVs available in U.S.

**Toyota Prius Prime**

- **25 miles electric range** and **640 miles** total range
- **54 MPG** in hybrid mode and **133 MPGe in electric mode**
- 8.8 kWh battery
- **240-volts charging power = 3.3 kW**
- Electric motor power = 121 hp
- Gasoline engine power = 95 hp
- Length = 182.9“, width = 69.3“, height = 57.9“
- Base price = **$27,300**
- Federal tax credit = **$4,500**
PHEVs available in U.S.

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- **25 miles** electric range and **640 miles** total range
- **54 MPG** in hybrid mode and **133 MPGe** in electric mode
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PHEVs available in U.S.

Mitsubishi Outlander AWD PHEV

• **23 miles electric range** and **310 miles** total range
• **25 MPG** in hybrid mode and **74 MPGe in electric mode**
• 12 kWh battery
• **240-volts charging power** = 6.6 kW
• **Fast CHAdeMO charging** = 35 kW
• AWD: Two electric motors' power = 80 hp each
• Gasoline engine power = 117 hp
• Base price = $33,590
• Federal tax credit = $5,836
PHEVs available in U.S.

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- 23 miles electric range and 310 miles total range
- 25 MPG in hybrid mode and 74 MPGe in electric mode
- 12 kWh battery
- 240-volts charging power = 6.6 kW
- Fast CHAdeMO charging = 35 kW
- AWD: Two electric motors' power = 80 hp each
- Gasoline engine power = 117 hp
- Base price = $33,590
- Federal tax credit = $5,836
Midsize BEVs available in U.S.

**Tesla Model 3 Mid-Range RWD**

- **260 miles range**; 63 kWh battery
- **130 MPGe**; Base price = $46,000
- Federal tax credit = $7,500 (until Jan 2019)

**Tesla Model 3 Long-Range AWD**

- **310 miles range**, 75 kWh battery
- **130 MPGe**; Base price = $53,000
- Federal tax credit = $7,500 (until Jan 2019)
- Also, an AWD version and a 220-miles version
Midsize BEVs available in U.S.

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- Also, an AWD version and a 220-miles version
Midsize BEVs available in U.S.

**Chevrolet Bolt EV**
- **238 miles range**; 60 kWh battery
- **119 MPGe**; Base price = $37,495
- Federal tax credit = $7,500 (until April 2019)

**Nissan LEAF II**
- **151 miles range**, 40 kWh battery
- **112 MPGe**; Base price = $30,000
- Federal tax credit = $7,500
- 220-miles-range version in 2019
Midsize BEVs available in U.S.

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- 238 miles range; 60 kWh battery
- 119 MPGe; Base price = $37,495
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**Nissan LEAF II**
- 151 miles range, 40 kWh battery
- 112 MPGe; Base price = $30,000
- Federal tax credit = $7,500
- 220-miles-range version in 2019
Midsize BEVs available in U.S.

**Jaguar i-Pace**

- **234 miles range**; 90 kWh battery, AWD
- **76 MPGe**; Base price = $69,500
- Federal tax credit = $7,500
Charging Types

• **Level-1**: Standard **120-volts AC** outlet (**1.4 kW**)
• **Level-2**: **240-volts AC** (**3.3 to 9.6 kW, J1772 plug**)
  • Tesla **Destination Chargers** (**19 kW**)
• **Level-3**: **480-volts DC** (**35 to 150 kW**)
  – **CHAdeMO** for Asian BEVs (Bburg Town Hall)
  – **CSS/SAE** for U.S. & European BEVs (Bburg Town Hall)
  – Tesla **Superchargers** (**120 kW, soon 150 kW**)

• Different networks and payment methods!
• Plugs:
  
  ![J1772 Plug](image1)
  ![CHAdeMO Plug](image2)
  ![CSS/SAE Plug](image3)
  ![Tesla Plug](image4)
Roper Level-2 Charging Station

Tesla portable charging station:
- Adaptor for Level-2 charging cord
- Pigtail for Level-1 120-volts outlet
- Pigtail for Level-2 240-volts outlet

https://www.openevse.com
25-feet cord
Level-2 Charging Stations in Blacksburg (13)

- Campus Automotive (2)
- Kroger (2)
- Residence Inn (2)
- VT ROTC
- Bburg Courtyard (2)
- WHV

plugshare.com
Two Level-2 Charging Stations

Residence Inn
850 Prices Fork Rd,
Blacksburg, VA
Tesla Charging Partners

Tesla Destination Chargers & standard level-2 chargers installed at no cost by Tesla at hotels, parks, shopping centers, multi-family places and work places.

tesla.com/destination-charging
Tesla Charging Partners

Courtyard Blacksburg VA (2 Tesla DT & 2 level-2)

Holiday Inn Christiansburg VA (1 Tesla DT & 1 level-2)
Tesla Superchargers

Superchargers at Hotels (Marriott), shopping centers and gasoline stations (Sheetz)

tesla.com/supercharger

4 on Virginia I-81
6 in 2019
Strasburg
Mt. Jackson
Staunton
Lexington
Roanoke
Wytheville

Open now
Opening soon
Tesla Superchargers

Lexington VA (6 stalls)

Glen Allen VA (20 stalls)

644 Superchargers in U.S. on 1 Nov 2018 with an average of 11 stalls/Supercharger.

11,295 Superchargers in the world on 1 Nov 2018.

Both Superchargers in Richmond have 20 stalls.
Tesla Superchargers

Shanghai China (50 stalls, solar/battery powered)

Kettleman CA (40 stalls, solar/battery powered)
July 2018 Tesla Model 3 Long-Range Trip from Blacksburg to Granbury TX.

1260 miles one way
Planned Tesla Model 3 Long-Range Trip from Blacksburg to Key West FL.

1270 miles one way
Electrify America (CHAdeMO/CSS)
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electrifyamerica.com
Brugh’s Mill Country Store, Fincastle VA
1 CHAdeMO, 4 CCS/SAE stations
CHAdeMO/CSS (35-kW) Charging Station

Blacksburg VA Town Hall
greenlots.com

CHAdeMO adapter for Tesla Model S and X
Charging Speed Versus Time

Fastest to charge no more than 80% at a stop when on a trip.

For example, instead of charging once to 100%, stop to charge twice to less than 80%.
Charging with Solar Power

• Example of a modern solar car
  – **Sono Motors’ Sion**: 1.2-kW solar panels on all 5 surfaces; **18 miles/day** from solar in Germany; **155 miles range**
Solar Power for Roper Tesla Model 3 Long Range

7.7 kW => ~34 kWh/day => ~136 miles/day