The impact of EVs on auto insurance and auto safety

Casualty Actuarial and Statistical Task Force
May 28, 2024
Saving lives. Preventing harm.

IIHS-HLDI mission:
To reduce deaths, injuries and property damage from motor vehicle crashes through research and evaluation and through education of consumers, policymakers and safety professionals.
IIHS and HLDI are wholly supported by these auto insurers and insurance associations:

Member groups

Acceptance Insurance
Acuity Insurance
Allstate Insurance Group
American Family Insurance
American National
AmericanAg
Amica Mutual Insurance
AmShield Insurance
AssuranceAmerica
Auto Club Enterprises
Auto Club Group
Auto-Owners Insurance
Celina Insurance Group
CHUBB
The Cincinnati Insurance Companies
Clearcover Insurance Company
Colorado Farm Bureau Insurance Company
Commonwealth Casualty Company
Concord Group Insurance
CONNECT, powered by American Family Insurance
Co-operators Financial Services Limited
COUNTRY Financial
CSAA Insurance Group
CSE Insurance Group
Desjardins Insurance
Donegal Insurance Group
DTRIC Insurance
ECM Insurance Group
Elephant Insurance Company
EMC Insurance Group
Encova Insurance
Erie Insurance Group
Farm Bureau Financial Services
Farm Bureau Insurance Company of Michigan
Farm Bureau Insurance of Tennessee
Farm Bureau Mutual Insurance Company of Idaho
Farmers Insurance Group
Farmers Mutual of Nebraska
FBAlliance Insurance Company
Florida Farm Bureau Insurance Companies
Frankenmuth Insurance
Gainsco Insurance
GEICO Corporation
The General Insurance
Georgia Farm Bureau Mutual Insurance Company
GoodVille Mutual Casualty Company
Gore Mutual
Grange Insurance
Hallmark Financial Services, Inc.
The Hanover Insurance Group
The Hartford
Haulers Insurance Company, Inc.
Horace Mann Insurance Companies
Indiana Farm Bureau Insurance
Indiana Farmers Insurance
Just Auto Insurance
 Kemper Corporation
Kentucky Farm Bureau Mutual Insurance Companies
Lemonade, Inc.
Liberty Mutual Insurance
Louisiana Farm Bureau Insurance Company
Main Street America Insurance
MAPFRE Insurance Group
Mercury Insurance Group
Mississippi Farm Bureau Casualty Insurance Company
MMG Insurance
Munich Reinsurance America, Inc.
Mutual Benefit Group®
Mutual of Enumclaw Insurance Company
National General Insurance
Nationwide
NJM Insurance Group
Nodak Insurance Company
North Carolina Farm Bureau Mutual Insurance Company
North Star Mutual Insurance Company
Northern Neck Insurance Company
NYCM Insurance
Ohio Mutual Insurance Group
PEMCO Mutual Insurance Company
Plymouth Rock Assurance
Progressive Insurance
Redpoint County Mutual Insurance Company
The Responsive Auto Insurance Company
Rider Insurance
Rockingham Insurance
Root Insurance Co
Safe Auto Insurance Company
Safeco Insurance®
Samsung Fire & Marine Insurance Company
SECURA Insurance
Selective Insurance
Sentry Insurance
Shelter Insurance®
Sompo International
South Carolina Farm Bureau Mutual Insurance Company®
Southern Farm Bureau Casualty Insurance Company
State Auto Insurance Companies
State Farm Insurance Companies
Swiss Reinsurance Company Ltd
Texas Farm Bureau Insurance
The Travelers Companies, Inc.
United Auto
USAA
Virginia Farm Bureau Mutual Insurance
West Bend Mutual Insurance Company
Westfield
Zurich North America

Funding associations

American Property Casualty Insurance Association
National Association of Mutual Insurance Companies
Electric vehicle intro
2008 Tesla Roadster

- First Tesla EV
- Based on the Lotus Elise
- $109,000 base price
- 2,900 lbs. curb weight
- 248 horsepower
1996 General Motors EV1

- First mass-produced EV
- $33,995 base price
- 3,000 lbs. curb weight
- 137 horsepower
1914 Detroit Electric Model 47 Brougham

- Personal car of Clara Ford
- $3,730 base price (in 1914)
- 3,600 lbs. curb weight
2010 Tesla Roadster
The first years of EVs
Electric vehicles vs. conventional counterparts with mileage
# Electric vehicles and their conventional counterparts

## Exposure summary

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Model years</th>
<th>Total exposure</th>
<th>Percent electric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ford Focus 5dr</td>
<td>2012-18</td>
<td>2,873,525</td>
<td>1%</td>
</tr>
<tr>
<td>Kia Soul station wagon</td>
<td>2015-19</td>
<td>2,264,787</td>
<td>1%</td>
</tr>
<tr>
<td>Toyota RAV4</td>
<td>2012-14</td>
<td>1,339,701</td>
<td>1%</td>
</tr>
<tr>
<td>Fiat 500 2dr</td>
<td>2013-19</td>
<td>560,040</td>
<td>15%</td>
</tr>
<tr>
<td>Chevrolet Spark 5dr</td>
<td>2014-16</td>
<td>473,342</td>
<td>6%</td>
</tr>
<tr>
<td>Volkswagen Golf</td>
<td>2015-19</td>
<td>349,785</td>
<td>17%</td>
</tr>
<tr>
<td>Hyundai Kona 4dr</td>
<td>2019-22</td>
<td>195,632</td>
<td>10%</td>
</tr>
<tr>
<td>Smart ForTwo 2dr</td>
<td>2013-17</td>
<td>159,051</td>
<td>12%</td>
</tr>
<tr>
<td>Volvo XC40</td>
<td>2021-22</td>
<td>30,710</td>
<td>16%</td>
</tr>
<tr>
<td>Mini Cooper 2dr</td>
<td>2020-22</td>
<td>22,963</td>
<td>16%</td>
</tr>
<tr>
<td>Smart ForTwo convertible</td>
<td>2013-15, 2017</td>
<td>13,033</td>
<td>13%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>8,282,569</strong></td>
<td><strong>3%</strong></td>
</tr>
</tbody>
</table>
Average base price

$0
$10,000
$20,000
$30,000
$40,000

Electric
Conventional
Average curb weight

<table>
<thead>
<tr>
<th>Weight (lbs.)</th>
<th>Electric</th>
<th>Conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td>1,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Average miles per day
Mileage data provided by CARFAX

- Electric: 20 miles per day
- Conventional: 30 miles per day
Miles per day distribution

Electric vs. conventional counterpart

- Electric
- Conventional counterpart
Estimated collision and PDL losses
Electric vs. conventional counterparts

-30%  -20%  -10%  0%  10%

Collision  PDL

Claim frequency  Claim severity  Overall losses
Estimated collision losses over time
Electric vs. conventional counterparts

Claim frequency
Claim severity
Overall losses
Estimated PDL losses over time
Electric vs. conventional counterparts

-30%
-20%
-10%
0%
10%
20%


Claim frequency

Claim severity

Overall losses
Estimated collision and PDL claim severities by vehicle age

Electric vs. conventional counterparts

-20%  -10%  0%  10%  20%
-1 to 0  1 to 2  3 to 4  5 to 6  7+

Collision  PDL
Distribution of collision claims
By point of impact

Electric

Conventional counterpart

Rear Right Left Front

0% 20% 40% 60% 80% 100%
Average collision dollars paid

By point of impact

- Front: $6,000
- Left: $4,000
- Right: $4,000
- Rear: $3,000

Electric | Conventional counterpart
Ford F-150
Gas vs electric parts prices

$1,083
$1,667
$764
$941
$1,220
Estimated injury coverage claim frequencies
Electric vs. conventional counterparts

- 50%
- 40%
- 30%
- 20%
- 10%
  0%

[Graph showing comparison of BI, PIP, and MedPay claim frequencies for electric vs. conventional vehicles, with negative percentages indicating lower claim frequencies for electric vehicles.]
Estimated difference in the injury rate of electric vehicles and their conventional counterparts

- PIP: -40%
- MedPay: -30%
Electric vehicles theft
Estimated theft losses
Electric versus conventional

Claim frequency  
Claim severity  
Overall losses
Loss results for purpose-built EVs
Chevrolet Bolt relative collision and PDL losses

2020-22 Chevrolet Bolt
2020-22 Small 4-door cars

Collision
PDL

Claim frequency
Claim severity
Overall losses

2022 Claim frequency
2022 Claim severity
2022 Overall losses
Porsche Taycan relative collision and PDL losses

- **Porsche Taycan 4WD**
- **2020-22 Large sport cars**

### Claim Frequency
- **Collision**
- **PDL**
- **Overall losses**

### Claim Severity
- **Collision**
- **PDL**
- **Overall losses**

### Overall losses
- **Claim frequency**
- **Claim severity**
- **Overall losses**

Data comparison between 2020-22 Porsche Taycan 4WD and 2020-22 Large sport cars.
Rivian R1T relative collision and PDL losses

Claim frequency
Claim severity
Overall losses

Collision

2022 Rivian R1T
2020-22 Large pickups

PDL

2022 Rivian R1T
2020-22 Large pickups

Overall losses
Ford Mustang Mach-E relative collision and PDL losses

- Claim frequency
- Claim severity
- Overall losses

2021-22 Mustang Mach-E 4dr
2021-22 Mustang Mach-E 4dr 4WD
2020-22 Midsize SUVs

Collision

PDL

Overall losses
Tesla Model 3
VIN counts for 2018-19 electric vehicles
By series, as of May 2022

- Tesla Model 3
- Tesla Model X
- Chevrolet Bolt
- BMW I3
- Volkswagen E-Golf
- Hyundai Kona
- Hyundai Ioniq
- Fiat 500
- Karma Automotive Revero
VIN counts for 2018-19 midsize luxury four-door vehicles
By make, as of May 2022

- Tesla Model 3
- Mercedes-Benz
- Lexus
- Audi
- BMW
- Infiniti
- Acura
- Lincoln
- Volvo
- Alfa Romeo
- Cadillac
- Jaguar
Estimated differences in claim frequency
2018-2019 Tesla Model 3 vs. different control groups

A: 2018–19 midsize luxury four-door vehicles
B: A between $35,000 and $60,000
C: B with AEB standard

-45% -40% -35% -30% -25% -20% -15% -10% -5% 0% 5%
Estimated differences in claim frequency
2019 Tesla Model 3 vs. different control groups, data since 4/11/2019

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collision</td>
<td>-45%</td>
</tr>
<tr>
<td>PDL</td>
<td>-40%</td>
</tr>
<tr>
<td>BIL</td>
<td>-35%</td>
</tr>
<tr>
<td>MED</td>
<td>-30%</td>
</tr>
<tr>
<td>PIP</td>
<td>-25%</td>
</tr>
<tr>
<td>Steering</td>
<td>-20%</td>
</tr>
<tr>
<td>AEB</td>
<td>-15%</td>
</tr>
<tr>
<td>ALC + LDP</td>
<td>-10%</td>
</tr>
</tbody>
</table>

I: 2019 midsize luxury four-door vehicles
II: I between $35,000 and $60,000
III: II with AEB standard
IV: III with ALC and LDP (steering) not available
Total losses for electric vehicles
Total losses as a percentage of collision claims
By calendar year

Electric
Conventional counterpart
Average dollars paid for total losses
By calendar year

Electric

Conventional
Total losses as a percentage of all collision claims

Electric vehicles vs. conventional counterparts

Average result for conventionals = 23.9%
Average result for EVs = 18.3%

- Ford F-150
- Volvo XC40
- Toyota RAV4
- Hyundai Kona
- Mini Cooper
- Volkswagen Golf
- Kia Soul
- Ford Focus
- Fiat 500
- Chevrolet Spark
- Smart ForTwo
- Smart ForTwo convertible
- Nissan Leaf
Percentage of collision dollars paid for total losses

Electric vehicles vs. conventional counterparts

Electric

Conventional

Average result for conventionals = 52.9%

Average result for EVs = 48.4%
Average payment for total losses
Electric vehicles vs. conventional counterparts

- $0
- $40,000
- $80,000
- $120,000
- $160,000

Electric vs. Conventional payments for various models:
- Ford F-150
- Volvo XC40
- Toyota RAV4
- Hyundai Kona
- Mini Cooper
- Volkswagen Golf
- Kia Soul
- Ford Focus
- Fiat 500
- Chevrolet Spark
- Smart ForTwo
- Smart ForTwo convertible
- Nissan Leaf
Average salvage recovery amount
Electric vehicles vs. conventional counterparts

- Ford F-150
- Volvo XC40
- Toyota RAV4
- Hyundai Kona
- Mini Cooper
- Volkswagen Golf
- Kia Soul
- Ford Focus
- Fiat 500
- Chevrolet Spark
- Smart ForTwo
- Smart ForTwo convertible
- Nissan Leaf
Tesla total losses
## Summary of study vehicles

<table>
<thead>
<tr>
<th>Study vehicle</th>
<th>Base prices</th>
<th>Size and class</th>
<th>Control vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-21 Tesla Model S</td>
<td>$61,850-$91,190</td>
<td>Large luxury sedan</td>
<td>Large luxury conventional four-door vehicles between $57,000 and $96,000</td>
</tr>
<tr>
<td>2016-21 Tesla Model X</td>
<td>$76,500-$86,700</td>
<td>Large luxury SUV</td>
<td>Large luxury conventional SUVs between $71,000 and $92,000</td>
</tr>
<tr>
<td>2017-21 Tesla Model 3</td>
<td>$35,000-$54,200</td>
<td>Midsize luxury sedan</td>
<td>Midsize luxury conventional four-door vehicles between $30,000 and $60,000</td>
</tr>
<tr>
<td>2020-21 Tesla Model Y</td>
<td>$40,990-$52,990</td>
<td>Midsize luxury SUV</td>
<td>Midsize luxury conventional SUVs between $36,000 and $58,000</td>
</tr>
</tbody>
</table>
Total losses as a percentage of all collision claims by model year
Calendar year 2021, Tesla Model S vs. control vehicles

- Tesla Model S
- Large luxury conventional four-door vehicles
Total losses as a percentage of all collision claims by model year

Calendar year 2021, Tesla Model X vs. control vehicles

- Tesla Model X
- Large luxury conventional SUVs
Total losses as a percentage of all collision claims by model year

Calendar year 2021, Tesla Model 3 vs. control vehicles

- Tesla Model 3
- Midsize luxury conventional four-door vehicles
Total losses as a percentage of all collision claims by model year

Calendar year 2021, Tesla Model Y vs. control vehicles

- Tesla Model Y
- Midsize luxury conventional SUVs

2020
- Tesla Model Y: 12%
- Midsize luxury conventional SUVs: 8%

2021
- Tesla Model Y: 10%
- Midsize luxury conventional SUVs: 8%
FMVSS No. 141
Minimum sound requirements for hybrid and electric vehicles
Percent change in BI-only and BI with vehicle damage claim frequency

April 2018 report: Hybrids vs. their conventional counterparts

- BI-only: 9%
- BI with associated vehicle damage: 3%
Estimated relative animal strike claim frequency
December 2014 report: Hybrids vs. their conventional counterparts
What vehicles can make noise

▸ All hybrid and electric passenger cars, multi-purpose passenger vehicles, trucks or buses with a GVWR of 10,000 pounds or less

Noise activation threshold

▸ Sound can change with speed or direction
▸ Neutral, reverse, and speeds up to 32 kph (20 mph)

How loud

▸ Up to 60+ decibels
<table>
<thead>
<tr>
<th>Federal Register updates</th>
<th>50% phase-in schedule</th>
<th>Deadline for 100% compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 2016</td>
<td>9/1/2018 - 8/31/2019</td>
<td>9/1/2019</td>
</tr>
<tr>
<td>Feb 2018</td>
<td>9/1/2019 - 8/1/2020</td>
<td>9/1/2020</td>
</tr>
<tr>
<td>Jul 2022 (final rule)</td>
<td></td>
<td>No changes</td>
</tr>
</tbody>
</table>
EV atypical brake light behaviors
Distribution of struck vehicle damage estimates
By brake light behavior

- Brake lights not illuminating when decelerating: 58.2%
- Comparison vehicles: 60.8%
Distribution of struck vehicle damage estimates
By brake light behavior

Brake lights off at complete stop

Distribution of struck vehicle damage estimates
By brake light behavior

Comparison vehicles
Noncrash fires for electric vehicles
Percent of total comprehensive claims by loss type
Calendar year 2020

- Glass
- Other
- Weather
- Animal
- Vandalism
- Theft
- Fire
Comprehensive claim severity by loss type
Calendar year 2020

- Fire
- Theft
- Weather
- Animal
- Other
- Vandalism
- Glass

$0 $1,000 $2,000 $3,000 $4,000 $5,000 $6,000 $7,000 $8,000 $9,000 $10,000
Noncrash fire and collision claim frequency indexed to vehicle age 0

Calendar year 2020

Vehicle age

Noncrash fires
Collision
## Electric vehicles and their conventional counterparts

Noncrash fire claims and claim frequencies

<table>
<thead>
<tr>
<th>Model years</th>
<th>Make</th>
<th>Electric series</th>
<th>Conventional series</th>
<th>Electric claims</th>
<th>Conventional claims</th>
<th>Electric claim frequency</th>
<th>Conventional claim frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014-16</td>
<td>Chevrolet</td>
<td>Spark EV electric 5dr</td>
<td>Spark 5dr</td>
<td>3</td>
<td>86</td>
<td>0.9</td>
<td>1.8</td>
</tr>
<tr>
<td>2013-19</td>
<td>Fiat</td>
<td>500 electric 2dr</td>
<td>500 2dr</td>
<td>20</td>
<td>118</td>
<td>2.2</td>
<td>2.3</td>
</tr>
<tr>
<td>2012-18</td>
<td>Ford</td>
<td>Focus electric 5dr</td>
<td>Focus 5dr</td>
<td>7</td>
<td>548</td>
<td>2.1</td>
<td>1.8</td>
</tr>
<tr>
<td>2022-23</td>
<td>Ford</td>
<td>F-150 Lightning EV CR 4x4</td>
<td>F-150 crew cab 4x4</td>
<td>0</td>
<td>6</td>
<td>0.0</td>
<td>1.1</td>
</tr>
<tr>
<td>2013</td>
<td>Honda</td>
<td>Fit EV station wagon</td>
<td>Fit station wagon</td>
<td>0</td>
<td>52</td>
<td>0.0</td>
<td>0.9</td>
</tr>
<tr>
<td>2019-23</td>
<td>Hyundai</td>
<td>Kona electric 4dr</td>
<td>Kona 4dr</td>
<td>3</td>
<td>16</td>
<td>1.2</td>
<td>0.7</td>
</tr>
<tr>
<td>2015-19</td>
<td>Kia</td>
<td>Soul electric station wagon</td>
<td>Soul station wagon</td>
<td>4</td>
<td>1,008</td>
<td>1.6</td>
<td>4.1</td>
</tr>
<tr>
<td>2020-23</td>
<td>Mini</td>
<td>Cooper electric 2dr</td>
<td>Cooper 2dr</td>
<td>1</td>
<td>0</td>
<td>1.6</td>
<td>0.0</td>
</tr>
<tr>
<td>2013-17</td>
<td>Smart</td>
<td>Electric drive 2dr</td>
<td>ForTwo 2dr</td>
<td>4</td>
<td>47</td>
<td>2.0</td>
<td>3.1</td>
</tr>
<tr>
<td>2013-15, 2017</td>
<td>Smart</td>
<td>Electric drive convertible</td>
<td>ForTwo convertible</td>
<td>0</td>
<td>3</td>
<td>0.0</td>
<td>2.5</td>
</tr>
<tr>
<td>2012-14</td>
<td>Toyota</td>
<td>RAV4 EV 5dr 2WD</td>
<td>RAV4 4dr 2WD</td>
<td>1</td>
<td>235</td>
<td>0.8</td>
<td>1.7</td>
</tr>
<tr>
<td>2015-19</td>
<td>Volkswagen</td>
<td>E-Golf electric 4dr</td>
<td>Golf 4dr</td>
<td>12</td>
<td>40</td>
<td>1.8</td>
<td>1.3</td>
</tr>
<tr>
<td>2021-23</td>
<td>Volvo</td>
<td>XC40 recharge EV</td>
<td>XC40</td>
<td>1</td>
<td>4</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>56</strong></td>
<td><strong>2,163</strong></td>
<td><strong>1.7</strong></td>
<td><strong>2.3</strong></td>
</tr>
</tbody>
</table>

*Claims per 10,000 insured vehicle years*
## Electric vehicles and their counterparts

Noncrash fire claims and claim frequencies

<table>
<thead>
<tr>
<th>Model years</th>
<th>Make</th>
<th>Electric series</th>
<th>Conventional series</th>
<th>Electric claims</th>
<th>Conventional claims</th>
<th>Electric claim frequency</th>
<th>Conventional claim frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-23</td>
<td>Nissan</td>
<td>Leaf EV 5dr</td>
<td>Versa</td>
<td>112</td>
<td>347</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>2012-18</td>
<td>Tesla</td>
<td>Model S EV 5D 2WD</td>
<td>Large luxury cars</td>
<td>55</td>
<td>2,272</td>
<td>1.7</td>
<td>2.1</td>
</tr>
<tr>
<td>2014-23</td>
<td>Tesla</td>
<td>Model S EV 5D 4WD</td>
<td>Large luxury cars</td>
<td>66</td>
<td>1,361</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>2017-23</td>
<td>Tesla</td>
<td>Model 3 EV 4D 2WD</td>
<td>Midsize luxury cars</td>
<td>47</td>
<td>1,013</td>
<td>0.8</td>
<td>1.3</td>
</tr>
<tr>
<td>2018-23</td>
<td>Tesla</td>
<td>Model 3 EV 4D 4WD</td>
<td>Midsize luxury cars</td>
<td>52</td>
<td>642</td>
<td>0.9</td>
<td>1.2</td>
</tr>
<tr>
<td>2016-23</td>
<td>Tesla</td>
<td>Model X EV 4D 4WD</td>
<td>Large luxury SUVs</td>
<td>43</td>
<td>653</td>
<td>1.4</td>
<td>1.5</td>
</tr>
<tr>
<td>2021-23</td>
<td>Tesla</td>
<td>Model Y EV 4D 2WD</td>
<td>Midsize luxury SUVs</td>
<td>2</td>
<td>194</td>
<td>1.8</td>
<td>0.9</td>
</tr>
<tr>
<td>2020-23</td>
<td>Tesla</td>
<td>Model Y EV 4D 4WD</td>
<td>Midsize luxury SUVs</td>
<td>39</td>
<td>376</td>
<td>1.0</td>
<td>0.9</td>
</tr>
</tbody>
</table>

*Claims per 10,000 insured vehicle years
Engine changes in vehicle fleet
Proportion of vehicles with turbo/supercharged, hybrid or electric engines in 2023

By model year
Actual vs. predicted proportion of vehicle registrations
By engine type and calendar year

- 100%
- 80%
- 60%
- 40%
- 20%
- 0%


- Turbo/supercharged
- Turbo/supercharged predicted
- Hybrid
- Hybrid predicted
- Electric
- Electric predicted
- Conventional gas
- Conventional gas predicted
New Biden administration pollution rules would require almost 10 times as many EV sales in 2032 as today

(Fortune, Apr. 12, 2023)

Ford On Track To Build 2 Million EVs Per Year By 2026, Become Carbon Neutral By 2050

(InsideEVs, Apr. 4, 2023)

Nissan Accelerates Electrification: 19 New BEVs By 2030

(InsideEVs, Feb. 28, 2023)

Honda to Spend $40 Billion on EV Push, Plans 30 Models

(Bloomberg, Apr. 11, 2022)

Volvo Reportedly Plans Turning All Its Core Models Into EVs By 2026

(InsideEVs, Feb. 2, 2023)

BMW to release six BEVs by 2025

(Electrive, Mar. 15, 2023)

Toyota to launch 10 new battery EV models by 2026

(Reuters, Apr. 7, 2023)

GM’s Electric Car Line Will Be Profitable in 2025, Barra Says

(Bloomberg, Nov. 14, 2022)

Stellantis Plans to Launch 25 EVs by 2030, Be Carbon Neutral by 2038

(Kelley Blue Book, Mar. 2, 2022)
Biden Administration Is Said to Slow Early Stage of Shift to Electric Cars
(The New York Times, Feb.17, 2024)

Ford will postpone about $12 billion in EV investment as buyers become more cautious
(CNBC, Oct. 26, 2023)

Nissan delays production of 2 EVs again in Mississippi
(Automotive News, Jan. 15, 2024)

Mazda taps EV brakes, outlines its 2030 lineup
(Automotive News, Dec. 11, 2023)

Volvo Pulls Funding From Polestar, Marking Latest Setback for EV Industry
(Investopedia, Feb. 01, 2024)

Maserati delays flagship EV
(Automotive News, Jan. 20, 2024)

PHEVs might be best near-term plan for Volvo
(Automotive News, Jan. 29, 2024)

GM Abandons Goal Of Building 400,000 EVs In North America By Mid-2024
(Bloomberg, Nov. 14, 2022)

Leader anticipates a ‘bumpy’ transition to EVs
(Automotive News, Dec. 11, 2023)
Actual vs. predicted proportion of electric vehicle registrations
By calendar year and 2030 new electric vehicle share

- 34% (current growth rate)
- 40%
- 50%
- 60%
- 70%
- Actual
Electric vehicles across the U.S.
EV percentage of collision exposure
Calendar year 2013

<0.5%
≥0.5% and <1%
EV percentage of collision exposure
Calendar year 2014

- <0.5%
- ≥0.5% and <1%
- ≥1% and <3%
EV percentage of collision exposure
Calendar year 2015

- <0.5%
- ≥0.5% and <1%
- ≥1% and <3%
EV percentage of collision exposure
Calendar year 2016

- <0.5%
- ≥0.5% and <1%
- ≥1% and <3%
EV percentage of collision exposure
Calendar year 2017

- <0.5%
- ≥0.5% and <1%
- ≥1% and <3%
EV percentage of collision exposure
Calendar year 2018

- <0.5%
- ≥0.5% and <1%
- ≥1% and <3%
- ≥3% and <5%
EV percentage of collision exposure
Calendar year 2020
EV percentage of collision exposure
Calendar year 2021

- <0.5%
- ≥0.5% and <1%
- ≥1% and <3%
- ≥3% and <5%
## Collision exposure (insured vehicle years)

**Calendar years 2013-22**

<table>
<thead>
<tr>
<th>Calendar year</th>
<th>Electric</th>
<th>Total</th>
<th>Electric exposure as percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>63,329</td>
<td>119,061,269</td>
<td>0.05%</td>
</tr>
<tr>
<td>2014</td>
<td>120,411</td>
<td>125,224,585</td>
<td>0.10%</td>
</tr>
<tr>
<td>2015</td>
<td>186,689</td>
<td>130,204,124</td>
<td>0.14%</td>
</tr>
<tr>
<td>2016</td>
<td>252,702</td>
<td>134,570,243</td>
<td>0.19%</td>
</tr>
<tr>
<td>2017</td>
<td>329,481</td>
<td>137,099,866</td>
<td>0.24%</td>
</tr>
<tr>
<td>2018</td>
<td>431,854</td>
<td>139,414,938</td>
<td>0.31%</td>
</tr>
<tr>
<td>2019</td>
<td>617,446</td>
<td>142,395,112</td>
<td>0.43%</td>
</tr>
<tr>
<td>2020</td>
<td>767,631</td>
<td>146,163,989</td>
<td>0.53%</td>
</tr>
<tr>
<td>2021</td>
<td>1,009,106</td>
<td>149,585,411</td>
<td>0.67%</td>
</tr>
<tr>
<td>2022</td>
<td>1,399,573</td>
<td>152,677,775</td>
<td>0.92%</td>
</tr>
</tbody>
</table>
Pickups relative to other vehicles
Collision exposure for calendar year 2023, model years 1981-2024
Electric exposure
Model year 2021 VIN counts by vehicle type
Electric versus conventional

- Electric
- Other

- Luxury Cars
- Non Luxury Cars
- Pickups
- Luxury SUVs
- Non Luxury SUVs
Percent distribution of collision estimates and average damage amounts by point of impact and vehicle type

1981-2020 model years, 2019 calendar year

<table>
<thead>
<tr>
<th>Impact Location</th>
<th>Passenger cars (N= 3,022,514)</th>
<th>Pickups (N= 631,901)</th>
<th>SUVs (N= 1,924,498)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front</td>
<td>11.0% $4,491</td>
<td>16.7% $3,657</td>
<td>20.8% $3,614</td>
</tr>
<tr>
<td>Front Driver</td>
<td>10.1% $5,371</td>
<td>7.6% $3,529</td>
<td>5.8% $3,285</td>
</tr>
<tr>
<td>Rear Driver</td>
<td>3.3% $4,751</td>
<td>10.5% $5,637</td>
<td>12.6% $4,784</td>
</tr>
<tr>
<td>Side</td>
<td>3.6% $4,178</td>
<td>9.0% $5,637</td>
<td>11.3% $5,048</td>
</tr>
<tr>
<td>Front Passenger</td>
<td>3.0% $3,901</td>
<td>3.4% $4,984</td>
<td>5.6% $3,387</td>
</tr>
<tr>
<td>Front Left</td>
<td>28.0% $5,528</td>
<td>5.0% $4,984</td>
<td>4.4% $3,416</td>
</tr>
<tr>
<td>Front Right</td>
<td>10.5% $4,503</td>
<td>3.4% $4,761</td>
<td>4.1% $3,901</td>
</tr>
<tr>
<td>Rear</td>
<td>4.1% $4,185</td>
<td>3.0% $3,901</td>
<td>5.8% $3,285</td>
</tr>
<tr>
<td>Left Driver</td>
<td>3.3% $3,901</td>
<td>7.1% $3,680</td>
<td>6.5% $3,373</td>
</tr>
<tr>
<td>Right Driver</td>
<td>16.0% $3,518</td>
<td>5.0% $4,793</td>
<td>20.8% $3,614</td>
</tr>
<tr>
<td>Right Passenger</td>
<td>5.6% $3,387</td>
<td>16.7% $3,657</td>
<td>3.9% $3,810</td>
</tr>
</tbody>
</table>
2023 Hyundai IONIQ 5

- Small SUV
- $41,450 base price
- 3,968 lbs. curb weight
- 225-320 horsepower
- E-Corner system prototyped
Ultimate Driving Motion

e-Corner System

Crab Driving
GMC Hummer EV pickup

- 1,000 horsepower and 11,500 lb-ft torque
- 9,046 lbs. curb weight
- Watts To Freedom 0-60 in 3 sec.
- Super Cruise
- Infinity roof with modular sky panels
- Crabwalk
GMC Hummer EV taillights cost

- $3,045.48 per light
- $7,000+ including labor
Crashworthiness
## Electric vehicle ratings

### Crashworthiness
- Small overlap front: driver-side: G
- Small overlap front: passenger-side: G
- Moderate overlap front: original test: G
- Moderate overlap front: updated test: M
- Side: original test: G
- Side: updated test: G
- Head restraints & seats: G

### Crash avoidance & mitigation
- Headlights: G
- Front crash prevention: vehicle-to-vehicle:
  - Standard system: 
- Front crash prevention: vehicle-to-pedestrian (day):
  - Standard system: 
- Front crash prevention: vehicle-to-pedestrian (night):
  - Standard system: 

### Seat belts & child restraints
- Seat belt reminders: P
- LATCH ease of use: G