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http://www2.lut.fi/kete/teke/teke/kklemola
Foreword

Ethanol flexible-fuel vehicles, FFVs, are designed to operate on gasoline, E85 (a mixture of 85% ethanol and 15% gasoline) or any mixture of the two fuels.


Carbon dioxide emissions presented are for US corn ethanol production. The average of the results of six studies reviewed by Hammerschlag was used in the calculation of specific carbon dioxide emissions. The credits were given for the animal fodder side product.

Carbon dioxide emissions were calculated for manufacture and maintenance of a car and for the infrastructure.

The lifetime driving distance of an average US light-duty vehicle is 304 732 km.

The total life-time carbon dioxide emissions are:
- 53.4 tonnes CO₂ for an average EU15 new light-duty vehicle
- 122.8 tonnes CO₂ for an average US new light-duty vehicle
- 124.7 tonnes CO₂ for an average US new ethanol flexible-fuel light-duty vehicle
Average US model year 2007 FFV vehicle

- Fuel economy E85: 12.7 mpg
- Fuel economy E85: 18.6 L/100 km
- Curb weight: 2160 kg
- Engine displacement: 4.8 L

Life-cycle carbon dioxide emissions, g CO2/km

![Graph showing life-cycle carbon dioxide emissions for EU15 new light-duty vehicle, US new light-duty vehicle, and Average US model year 2007 FFV vehicle.](chart.png)
Compact cars
Mercedes Benz C230 A-7 2.5L FFV

- Fuel economy E85: 15.6 mpg
- Fuel economy E85: 15.1 L/100 km
- Curb weight: 1510 kg
- Engine displacement: 2.5 L

Life-cycle carbon dioxide emissions, g CO2/km

- Manufacture, maintenance and infrastructure
- Fuel: well-to-wheel

![Diagram showing life-cycle carbon dioxide emissions for different vehicles: EU15 new light-duty vehicle, US new light-duty vehicle, and Mercedes-Benz C230 A-7 2.5L FFV. The emissions are compared across different categories and show varying levels of CO2 emissions.]
Mercedes Benz C230 M-6 2.5L FFV

- Fuel economy E85: 15.6 mpg
- Fuel economy E85: 15.1 L/100 km
- Curb weight: 1490 kg
- Engine displacement: 2.5 L
Midsize cars
Chevrolet Monte Carlo A-4 3.5L FFV

- Fuel economy E85: 18.5 mpg
- Fuel economy E85: 12.7 L/100 km
- Curb weight: 1540 kg
- Engine displacement: 3.5 L
Chrysler Sebring A-4 2.7L FFV

- Fuel economy E85: 17.5 mpg
- Fuel economy E85: 13.4 L/100 km
- Curb weight: 1540 kg
- Engine displacement: 2.7 L

Life-cycle carbon dioxide emissions, g CO2/km

- EU15 new light-duty vehicle
- US new light-duty vehicle
- Chrysler Sebring A-4 2.7L FFV

![Car Image]

[Graph showing life-cycle carbon dioxide emissions with categories for manufacture, maintenance and infrastructure, and fuel: well-to-wheel.]
Large cars
Chevrolet Impala A-4 3.5L FFV

- Fuel economy E85: 18.5 mpg
- Fuel economy E85: 12.7 L/100 km
- Curb weight: 1613 kg
- Engine displacement: 3.5 L

Life-cycle carbon dioxide emissions, g CO2/km
Ford Crown Victoria A-4 4.6L FFV

- Fuel economy E85: 14.5 mpg
- Fuel economy E85: 16.2 L/100 km
- Curb weight: 1860 kg
- Engine displacement: 4.6 L

Life-cycle carbon dioxide emissions, g CO2/km

- EU15 new light-duty vehicle
- US new light-duty vehicle
- Ford Crown Victoria A-4 4.6L FFV
Lincoln Town Car A-4 4.6L FFV

- Fuel economy E85: 14.5 mpg
- Fuel economy E85: 16.2 L/100 km
- Curb weight: 1999 kg
- Engine displacement: 4.6 L

Life-cycle carbon dioxide emissions, g CO2/km

![Bar chart showing life-cycle carbon dioxide emissions for different vehicles.](image-url)
Mercury Grand Marquis A-4 4.6L FFV

- Fuel economy E85: 14.5 mpg
- Fuel economy E85: 16.2 L/100 km
- Curb weight: 1877 kg
- Engine displacement: 4.6 L

Life-cycle carbon dioxide emissions, g CO2/km
Standard pickup trucks 2WD
Chevrolet C15 Silverado 2WD A-4 5.3L FFV

- Fuel economy E85: 13.5 mpg
- Fuel economy E85: 17.4 L/100 km
- Curb weight: 2018 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km
Chevrolet C1500 Silverado Classic 2WD A-4 5.3L FFV

- Fuel economy E85: 13.5 mpg
- Fuel economy E85: 17.4 L/100 km
- Curb weight: 2018 kg
- Engine displacement: 5.3 L
Dodge Ram 1500 Pickup 2WD A-5 4.7L FFV

- Fuel economy E85: 10.5 mpg
- Fuel economy E85: 22.5 L/100 km
- Curb weight: 2101 kg
- Engine displacement: 4.7 L
Ford F-150 Pickup 2WD FFV A-4 5.4L FFV

- Fuel economy E85: 12.2 mpg
- Fuel economy E85: 19.3 L/100 km
- Curb weight: 2115 kg
- Engine displacement: 5.4 L

![Ford F-150 Pickup 2WD FFV A-4 5.4L FFV](image)

Life-cycle carbon dioxide emissions, g CO2/km

- EU15 new light-duty vehicle
- US new light-duty vehicle
- Ford F-150 Pickup 2WD FFV A-4 5.4L FFV

![Life-cycle carbon dioxide emissions chart](chart)

- Manufacture, maintenance and infrastructure
- Fuel: well-to-wheel
Ford STX Pickup 2WD FFV A-4 5.4L FFV

- Fuel economy E85: 12.2 mpg
- Fuel economy E85: 19.3 L/100 km
- Curb weight: 2115 kg
- Engine displacement: 5.4 L
GMC C15 Sierra 2WD A-4 5.3L FFV

- Fuel economy E85: 13.5 mpg
- Fuel economy E85: 17.4 L/100 km
- Curb weight: 2126 kg
- Engine displacement: 5.3 L
GMC C1500 Sierra Classic 2WD A-4 5.3L FFV

- Fuel economy E85: 13.5 mpg
- Fuel economy E85: 17.4 L/100 km
- Curb weight: 1910 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km

- EU15 new light-duty vehicle
- US new light-duty vehicle
- GMC C1500 Sierra Classic 2WD A-4 5.3L FFV

Manufacture, maintenance and infrastructure
Fuel: well-to-wheel
Nissan Titan 2WD A-5 5.6L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 21.1 L/100 km
- Curb weight: 2193 kg
- Engine displacement: 5.6 L

Life-cycle carbon dioxide emissions, g CO2/km

<table>
<thead>
<tr>
<th>EU15 new light-duty vehicle</th>
<th>US new light-duty vehicle</th>
<th>Nissan Titan 2WD A-5 5.6L FFV</th>
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<tbody>
<tr>
<td>Manufacture, maintenance and infrastructure</td>
<td>Fuel: well-to-wheel</td>
<td>Manufacture, maintenance and infrastructure</td>
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</table>
Standard pickup trucks 4WD
Chevrolet K15 Silverado 4WD A-4 5.3L FFV

- Fuel economy E85: 13.2 mpg
- Fuel economy E85: 17.8 L/100 km
- Curb weight: 2126 kg
- Engine displacement: 5.3 L
Chevrolet K1500 Silverado Classic 4WD A-4 5.3L FFV

- Fuel economy E85: 12.2 mpg
- Fuel economy E85: 19.3 L/100 km
- Curb weight: 2018 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km
Dodge Ram 1500 Pickup 2WD A-5 4.7L FFV

- Fuel economy E85: 10.5 mpg
- Fuel economy E85: 22.5 L/100 km
- Curb weight: 2101 kg
- Engine displacement: 4.7 L
Ford F-150 Pickup 4WD FFV A-4 5.4L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 21.1 L/100 km
- Curb weight: 2115 kg
- Engine displacement: 5.4 L
GMC K15 Sierra 4WD A-4 5.3L FFV

- Fuel economy E85: 13.2 mpg
- Fuel economy E85: 17.8 L/100 km
- Curb weight: 2126 kg
- Engine displacement: 5.3 L
GMC K1500 Sierra Classic 4WD A-4 5.3L FFV

- Fuel economy E85: 12.5 mpg
- Fuel economy E85: 18.8 L/100 km
- Curb weight: 2045 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km

![Graph showing life-cycle carbon dioxide emissions for EU15 new light-duty vehicle, US new light-duty vehicle, and GMC K1500 Sierra Classic 4WD A-4 5.3L FFV. The graph includes bars for manufacture, maintenance and infrastructure (yellow) and fuel well-to-wheel (teal).]
Nissan Titan 4WD A-5 5.6L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 21.1 L/100 km
- Curb weight: 2312 kg
- Engine displacement: 5.6 L

Life-cycle carbon dioxide emissions, g CO2/km

- EU15 new light-duty vehicle
- US new light-duty vehicle
- Nissan Titan 4WD A-5 5.6L FFV

<table>
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<tr>
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<th>EU15 new light-duty vehicle</th>
<th>US new light-duty vehicle</th>
<th>Nissan Titan 4WD A-5 5.6L FFV</th>
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<tr>
<td>Manufacture, maintenance and infrastructure</td>
<td>250.0</td>
<td>450.0</td>
<td>500.0</td>
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<tr>
<td>Fuel: well-to-wheel</td>
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<td>200.0</td>
<td>300.0</td>
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</table>
Vans, passenger type
Chevrolet G1500/2500 Express 2WD A-4 5.3L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 23.5 L/100 km
- Curb weight: 2465 kg
- Engine displacement: 5.3 L
Chevrolet H1500/2500 Express 2WD A-4 5.3L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 23.5 L/100 km
- Curb weight: 2465 kg
- Engine displacement: 5.3 L
GMC G1500/2500 Savana 2WD A-4 5.3L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 23.5 L/100 km
- Curb weight: 2537 kg
- Engine displacement: 5.3 L
GMC H1500/2500 Savana Van AWD A-4 5.3L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 23.5 L/100 km
- Curb weight: 2537 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km

![Graph showing life-cycle carbon dioxide emissions for different vehicles.](image-url)
Minivans 2WD
Buick Terraza FWD A-4 3.9L FFV

- Fuel economy E85: 15.2 mpg
- Fuel economy E85: 18.1 L/100 km
- Curb weight: 2028 kg
- Engine displacement: 3.9 L
Chevrolet Uplander FWD A-4 3.9L FFV

- Fuel economy E85: 15.2 mpg
- Fuel economy E85: 15.5 L/100 km
- Curb weight: 1920 kg
- Engine displacement: 3.9 L

Life-cycle carbon dioxide emissions, g CO2/km

[Image of bar chart showing emissions for EU15 new light-duty vehicle, US new light-duty vehicle, and Chevrolet Uplander FWD A-4 3.9L FFV. The chart includes bars for manufacture, maintenance, and infrastructure and fuel well-to-wheel.]
Dodge Caravan 2WD A-4 3.3L FFV

- Fuel economy E85: 14.5 mpg
- Fuel economy E85: 16.2 L/100 km
- Curb weight: 1897 kg
- Engine displacement: 3.3 L

Life-cycle carbon dioxide emissions, g CO2/km
Saturn Relay FWD A-4 3.9L FFV

- Fuel economy E85: 15.2 mpg
- Fuel economy E85: 15.5 L/100 km
- Curb weight: 1936 kg
- Engine displacement: 3.9 L

Life-cycle carbon dioxide emissions, g CO2/km
Sport utility vehicles
2WD
Chevrolet C1500 Avalanche 2WD A-4 5.3L FFV

- Fuel economy E85: 13.5 mpg
- Fuel economy E85: 17.4 L/100 km
- Curb weight: 2605 kg
- Engine displacement: 5.3 L
Chevrolet C1500 Suburban 2WD A-4 5.3L FFV

- Fuel economy E85: 13.5 mpg
- Fuel economy E85: 17.4 L/100 km
- Curb weight: 2543 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km

- EU15 new light-duty vehicle
- US new light-duty vehicle
- Chevrolet C1500 Suburban 2WD A-4 5.3L FFV
Chevrolet C1500 Tahoe 2WD A-4 5.3L FFV

- Fuel economy E85: 13.5 mpg
- Fuel economy E85: 17.4 L/100 km
- Curb weight: 2388 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km

![Bar chart showing life-cycle carbon dioxide emissions for EU15 new light-duty vehicle, US new light-duty vehicle, and Chevrolet C1500 Tahoe 2WD A-4 5.3L FFV. The chart compares emissions from manufacture, maintenance, and infrastructure, as well as fuel well-to-wheel emissions.]
Chrysler Aspen 2WD A-5 4.7L FFV

- Fuel economy E85: 11.5 mpg
- Fuel economy E85: 20.5 L/100 km
- Curb weight: 2204 kg
- Engine displacement: 4.7 L
Dodge Durango 2WD A-5 4.7L FFV

- Fuel economy E85: 11.5 mpg
- Fuel economy E85: 20.5 L/100 km
- Curb weight: 2108 kg
- Engine displacement: 4.7 L

Life-cycle carbon dioxide emissions, g CO2/km

- EU15 new light-duty vehicle
- US new light-duty vehicle
- Dodge Durango 2WD A-5 4.7L FFV
GMC C1500 Yukon 2WD A-4 5.3L FFV

- Fuel economy E85: 13.5 mpg
- Fuel economy E85: 17.4 L/100 km
- Curb weight: 2388 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km
GMC C1500 Yukon XL 2WD A-4 5.3L FFV

- Fuel economy E85: 13.5 mpg
- Fuel economy E85: 17.4 L/100 km
- Curb weight: 2543 kg
- Engine displacement: 5.3 L
Jeep Commander 2WD A-5 4.7L FFV

- Fuel economy E85: 11.5 mpg
- Fuel economy E85: 20.5 L/100 km
- Curb weight: 2106 kg
- Engine displacement: 4.7 L
Jeep Grand Cherokee 2WD A-5 4.7L FFV

- Fuel economy E85: 11.5 mpg
- Fuel economy E85: 20.5 L/100 km
- Curb weight: 1951 kg
- Engine displacement: 4.7 L
Nissan Armada 2WD A-5 5.6L FFV

- Fuel economy E85: 11.5 mpg
- Fuel economy E85: 20.5 L/100 km
- Curb weight: 2106 kg
- Engine displacement: 5.6 L

Life-cycle carbon dioxide emissions, g CO2/km

- EU15 new light-duty vehicle
- US new light-duty vehicle
- Nissan Armada 2WD A-5 5.6L FFV

![Graph showing life-cycle carbon dioxide emissions](image)
Sport utility vehicles
4WD
Chevrolet C1500 Avalanche 4WD A-4 5.3L FFV

- Fuel economy E85: 12.5 mpg
- Fuel economy E85: 18.8 L/100 km
- Curb weight: 2659 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km

- EU15 new light-duty vehicle
- US new light-duty vehicle
- Chevrolet C1500 Avalanche 4WD A-4 5.3L FFV

[Diagram showing life-cycle carbon dioxide emissions]
Chevrolet C1500 Suburban 4WD A-4 5.3L FFV

- Fuel economy E85: 12.5 mpg
- Fuel economy E85: 18.8 L/100 km
- Curb weight: 2605 kg
- Engine displacement: 5.3 L
Chevrolet C1500 Tahoe 4WD A-4 5.3L FFV

- Fuel economy E85: 12.5 mpg
- Fuel economy E85: 18.8 L/100 km
- Curb weight: 2506 kg
- Engine displacement: 5.3 L
Chrysler Aspen 4WD A-5 4.7L FFV

- Fuel economy E85: 10.5 mpg
- Fuel economy E85: 22.5 L/100 km
- Curb weight: 2287 kg
- Engine displacement: 4.7 L

![Life-cycle carbon dioxide emissions, g CO2/km](image-url)
Dodge Durango 4WD A-5 4.7L FFV

- Fuel economy E85: 10.5 mpg
- Fuel economy E85: 22.5 L/100 km
- Curb weight: 2276 kg
- Engine displacement: 4.7 L

Life-cycle carbon dioxide emissions, g CO2/km
GMC C1500 Yukon 4WD A-4 5.3L FFV

- Fuel economy E85: 12.5 mpg
- Fuel economy E85: 18.8 L/100 km
- Curb weight: 2556 kg
- Engine displacement: 5.3 L
GMC C1500 Yukon XL 4WD A-4 5.3L FFV

- Fuel economy E85: 12.5 mpg
- Fuel economy E85: 18.8 L/100 km
- Curb weight: 2605 kg
- Engine displacement: 5.3 L

Life-cycle carbon dioxide emissions, g CO2/km

[Bar chart showing emissions for EU15 new light-duty vehicle, US new light-duty vehicle, and GMC C1500 Yukon XL 4WD A-4 5.3L FFV. The chart includes categories for manufacture, maintenance and infrastructure, and fuel well-to-wheel.]
Jeep Commander 4WD A-5 4.7L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 21.1 L/100 km
- Curb weight: 2189 kg
- Engine displacement: 4.7 L
Jeep Grand Cherokee 4WD A-5 4.7L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 21.1 L/100 km
- Curb weight: 2035 kg
- Engine displacement: 4.7 L

Life-cycle carbon dioxide emissions, g CO2/km
Nissan Armada 4WD A-5 5.6L FFV

- Fuel economy E85: 11.2 mpg
- Fuel economy E85: 21.1 L/100 km
- Curb weight: 2537 kg
- Engine displacement: 5.6 L
References


5. lipasto.vtt.fi, 2005.


