



**From families to farmers, drivers across the nation have been waiting for “no compromises” vehicles—cars and trucks that can help keep America running strong while countering the health, economic, and environmental threats posed by global warming pollution.**

Existing technology and fuels make it possible for us to enjoy cleaner but still affordable cars, pickup trucks, SUVs, and minivans today. The global warming emission reduction law for vehicles adopted by California and 10 other states actually requires automakers to start making these cleaner vehicles. Unfortunately, automakers are attempting to block these laws, and refuse to make the clean and affordable vehicles Americans want. That’s why the vehicle engineers at the Union of Concerned Scientists set out to show what you’re missing.

The Vanguard is a minivan blueprint developed by UCS engineers that meets California’s global warming emission standards simply by using existing technologies and fuels, saving money at the pump while maintaining the levels of safety and performance that drivers expect. Many cars and trucks on the road today already use at least one of the climate-friendly components used in the Vanguard, but none come close to matching the potential benefits of the full Vanguard package.

**For more information about the UCSVanguard or how it was designed, go to [www.ucsusa.org/UCSVanguard](http://www.ucsusa.org/UCSVanguard) or call 510-843-1872.**



## “So why can’t I get a Vanguard right now?”

Instead of employing their talented engineers to install the Vanguard’s full complement of cost-effective global warming reduction features on their own vehicles, automakers are relying on lawyers and lobbyists to thwart consumer and government demand for cleaner vehicles. Their strategy—overturning existing laws intended to reduce global warming pollution in California and 10 other states—would deny drivers the “no compromises” vehicles we all desire.

It’s time for automakers to stop spinning and suing, and instead create safe, affordable, and cleaner cars and trucks (and the manufacturing and farming jobs that come with them).

**Send a message to the manufacturers directly from the UCS website at:**

<http://www.ucsusa.org/UCSVanguard>

### Just some of the vehicles using components in the UCSVanguard package

#### Flex Fuel

Buick Terraza  
Dodge Caravan  
Dodge Durango  
Dodge Ram Pickup  
Chevrolet Avalanche  
Chevrolet Express  
Chevrolet Impala  
Chevrolet Monte Carlo  
Chevrolet Silverado  
Chevrolet Suburban  
Chevrolet Tahoe  
Chevrolet Uplander  
Chevrolet Van  
Chrysler Aspen  
Chrysler Dakota  
Chrysler Durango  
Chrysler Sebring  
Ford Crown Victoria  
Ford F-150  
GMC Savana  
GMC Sierra  
GMC Yukon  
Jeep Commander  
Jeep Grand Cherokee  
Lincoln Town Car  
Mercedes Benz C230  
Mercury Grand Marquis  
Nissan Armada  
Nissan Titan  
Pontiac Montana  
Saturn Relay

#### Cylinder Deactivation

Buick Rainier  
Chevrolet Avalanche  
Chevrolet Impala  
Chevrolet Monte Carlo  
Chevrolet Silverado  
Chevrolet Suburban  
Chevrolet Tahoe  
Chevrolet Trailblazer

#### Chrysler 300

Chrysler Aspen  
Dodge Charger  
Dodge Durango  
Dodge Magnum  
GMC Envoy  
GMC Sierra  
GMC Yukon  
Honda Odyssey  
Honda Pilot  
Jeep Commander  
Pontiac Grand Prix

#### Variable Valve Lift and Timing

Chrysler 300C  
Ford (many vehicles)  
GMC Yukon  
Honda (most vehicles)  
Infiniti G35  
Jeep Grand Cherokee  
Lexus IS  
Toyota (most vehicles)

#### Stoichiometric Direct Injection

Acura RDX  
Audi A3, A4, A6, A8, RS, S6, S8  
BMW 760Li  
Chevrolet Express  
Chevrolet Silverado  
Dodge Ram  
Ford Econoline  
Ford F-Series  
GMC Savana  
GMC Sierra  
Jeep Cherokee  
Lexus GS, DI, IS  
Mazda CX-7  
Mazda Mazdaspeed  
Mercedes E320  
Pontiac Solstice

#### Saturn Ion

Saturn Sky  
Volkswagen Eos  
Volkswagen GTI  
Volkswagen Jetta  
Volkswagen Passat  
Volkswagen Touareg

#### Turbocharging

Acura RDX  
Audi A3, A4  
BMW 330  
Chevrolet Express  
Chevrolet Silverado  
Chrysler PT Cruiser  
Dodge Caliber  
Dodge Ram  
Ford Econoline  
Ford F-Series (250, 350)  
GMC Savana  
GMC Sierra  
Jeep Grand Cherokee  
Mazda CX-7  
Mazda Mazdaspeed  
Mercedes E320  
Mercedes ML320  
Mercedes R350  
Porsche 911  
Saab 9-3 Series  
Subaru Forester  
Subaru Impreza  
Subaru Legacy  
Subaru Outback  
Volkswagen Beetle  
Volkswagen GTI  
Volkswagen Jetta  
Volkswagen Passat  
Volkswagen Touareg  
Volvo 40, 50, 60, 70, R Series  
Volvo XC70

#### Automatic Manual Transmissions

Audi A3  
BMW M-Series  
Volkswagen Eos, GTI, Jetta

#### 6 Speed Transmission

Audi A3, A4, A6, A7, RS, S4, Q7  
BMW 3-Series, 5-Series, 7-Series, M-Series, Z4-Series  
BMW X5  
Cadillac Escalade, SRX  
Cadillac STS, XLR  
Chevrolet Corvette  
Chevrolet Silverado  
Chrysler Sebring  
Dodge Ram Pickup  
Ford 500  
Ford Edge  
Ford Expedition  
Ford Explorer  
Ford Fusion  
GMC Acadia  
GMC Sierra  
GMC Yukon  
Jaguar S-Type, XJ-Series, XK-Series  
Land Rover LR3, Range Rover  
Lexus GS, IS, LS460, SC430  
Lincoln MKX  
Lincoln Mark MKZ  
Lincoln Navigator  
Mazda6, MX-5 Miata, RX8  
Mazda CX-7, CX-9  
Mercedes G-Class, GL-Class, M-Class,

#### R-Class, C-Class, CL, CLK, CLS, E-Class, S-Class, SL, SLK

Mercury Milan  
Mercury Montego  
Mercury Mountaineer  
Mitsubishi Outlander  
Saab 9-3 Series  
Saturn Aura  
Saturn Outlook  
Toyota Camry  
Volkswagen Beetle  
Volkswagen Jetta  
Volkswagen Passat  
Volkswagen Touareg  
Volvo 80 Series, R-Series  
Volvo XC90

#### Electric Power Steering

Acura NSX  
Fiat (most vehicles)

Protecting Families from Global Warming Using Today’s Technology



A new vehicle design from the Union of Concerned Scientists




[www.ucsusa.org](http://www.ucsusa.org)  
Berkeley, CA: 510-843-1872  
Cambridge, MA: 617-547-5552  
Washington, DC: 202-223-6133



By applying the Vanguard's features to each of these vehicle classes, we can save money while reducing our global warming emissions.

**UCSVanguard:** Performance. Safety. Affordability. Lower emissions. We can have it all—with technologies available today.

**Minivan\* (UCSVanguard)**




**Example Vehicle: Chrysler Town & Country**

Flexible fuel: E85  
Stoichiometric direct injection  
Dual cam phasing  
Turbocharging  
Automated manual transmission  
Electric power steering  
Improved efficiency alternator  
Improved efficiency, low leak AC

Increase in Purchase Price \$299  
Lifetime Consumer Savings \$1,333  
Payback Time 1.6 Years

**Global Warming Emission Reduction 43%**

**Small Car\***




**Example Vehicle: Chevrolet Cavalier**

Flexible fuel: E85  
Discrete variable valve lift  
Dual cam phasing  
Automatic manual transmission  
Electric power steering  
Improved efficiency alternator  
Improved efficiency, low leak AC

Increase in Purchase Price \$180  
Lifetime Consumer Savings \$809  
Payback Time 1.6 Years

**Global Warming Emission Reduction 42%**

**Large Car\***




**Example Vehicle: Ford Taurus**

Flexible fuel: E85  
Continuous variable valve lift  
Dual cam phasing  
Automated manual transmission  
Electric power steering  
Improved efficiency alternator  
Improved efficiency, low leak AC

Increase in Purchase Price \$543  
Lifetime Consumer Savings \$552  
Payback Time 5 Years

**Global Warming Emission Reduction 42%**

**Compact Pickup Truck\***




**Example Vehicle: Toyota Tacoma**

Flexible fuel: E85  
Cylinder deactivation  
Discrete variable valve lift  
Coupled cam phasing  
Automated manual transmission  
Electric power steering  
Improved efficiency alternator  
Improved efficiency, low leak AC

Increase in Purchase Price \$298  
Lifetime Consumer Savings \$1,317  
Payback Time 1.7 Years

**Global Warming Emission Reduction 42%**

**Large Truck\***



**Example Vehicle: GMC Sierra**

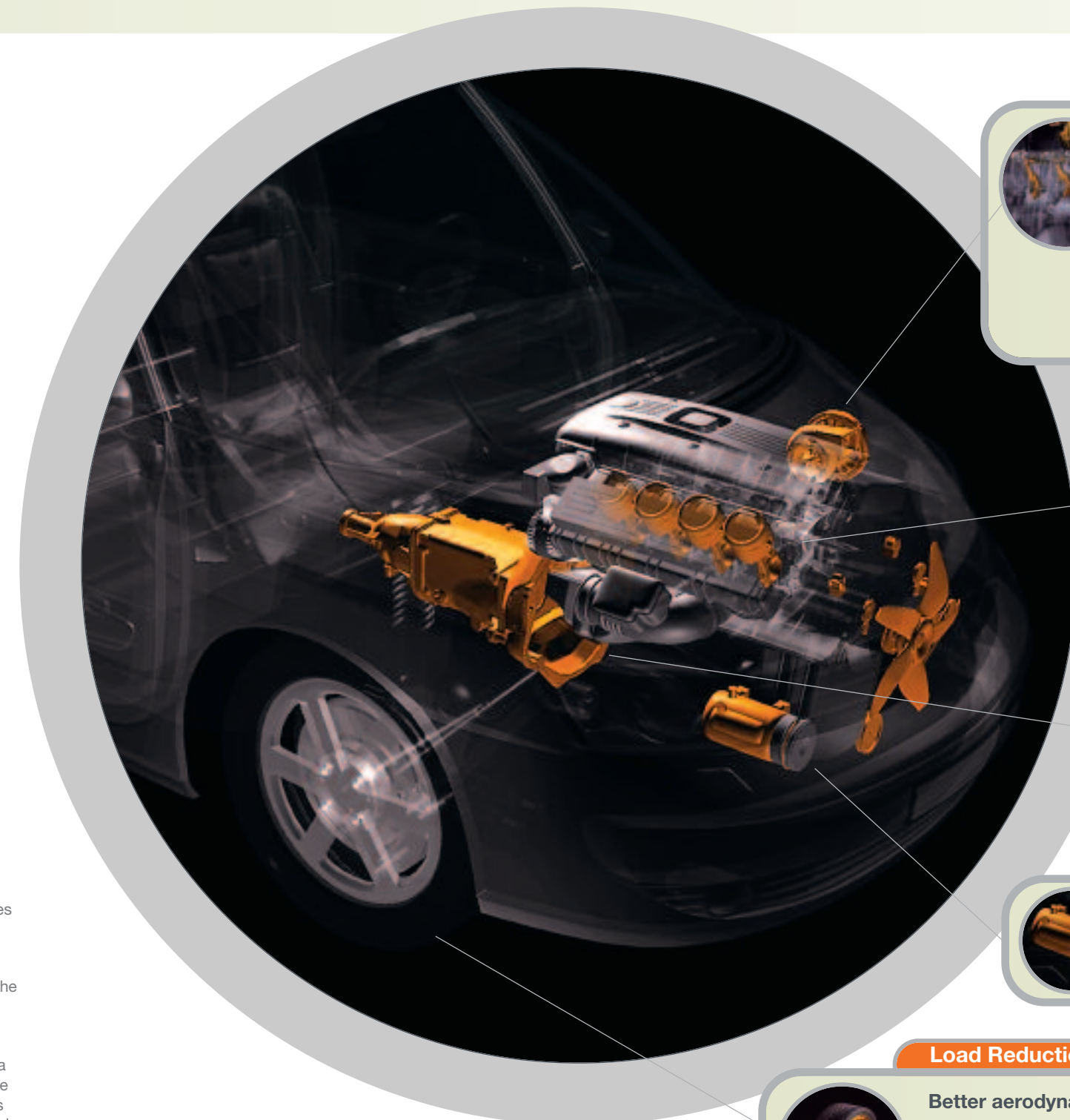
Flexible fuel: E85  
Cylinder deactivation  
Discrete variable valve lift  
Coupled cam phasing  
Automated manual transmission  
Electrohydraulic power steering  
Improved efficiency alternator  
Improved efficiency, low leak AC

Increase in Purchase Price \$670  
Lifetime Consumer Savings \$1,096  
Payback Time 3.7 Years

**Global Warming Emission Reduction 42%**

\* Other models in these vehicle classes could expect similar savings with the Vanguard package

The calculations in this analysis use the October 2006 retail prices for regular gasoline sold in California (\$2.55 per gallon) and E85 produced in the Midwest and transported to California (\$2.11 per gallon). These prices come from the U.S. Department of Energy's Energy Information Administration and Alternative Fuel Price Report. Vehicle technology packages, their global warming emission reductions, and associated costs are based on studies published by the California Air Resources Board.



**Engine**



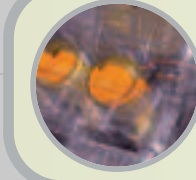
**Cylinder deactivation** shuts down half the cylinders in a large engine when full power is not needed.

**Stoichiometric direct injection** places the gasoline directly into the combustion chamber, thereby allowing better mixing of the fuel and air and improved control over the combustion process.

**Turbocharging** uses the waste heat from the vehicle's exhaust to compress the air entering the engine's combustion chamber. This boosting of the inlet air pressure results in higher engine power output, which allows the vehicle designers to select a smaller engine with less global warming emissions.

**Variable valve lift and timing** reduces engine losses by better controlling the flow of the air and fuel into the engine—leading to more efficient combustion and better performance.

**Fuel System**



Flexible fuel components allow the vehicle to run on either pure gasoline or a mixture of gasoline and ethanol up to 85% ethanol. Using 85% corn-based ethanol instead of gasoline can reduce global warming emissions about 10% to 20% per unit of energy delivered. Using more environment-friendly, higher-yield "cellulosic" ethanol sources could potentially deliver as much as an 80% to 90% reduction in heat-trapping emissions for the same amount of energy.

**Transmission**



The transmission propels a vehicle forward by transferring power from the engine to the wheels. The addition of more gears (six in this case) allows the engine to operate near its optimal performance level a greater percentage of the time.

Automatic manual transmissions allow the direct transfer of power from the engine to the transmission without interruption, combining the efficiency of a manual transmission with the convenience of an automatic transmission.

**Improved Air Conditioning**



Improved hoses and better connections can significantly reduce the amount of hydrofluorocarbons—concentrated global warming pollutants—that leak from a vehicle's air conditioning system. Switching to a less harmful refrigerant will also help; HFC-152a, for example, has a much lower global warming potential than common hydrofluorocarbon refrigerants.

**Load Reduction**



**Better aerodynamics**

**Tires with low rolling resistance** use improved materials and tread design to reduce the amount of energy wasted as a vehicle's tires roll down the road.

Upgrading mechanical components such as power steering with more **energy-efficient electrical components** can reduce engine load and, in turn, global warming emissions. When this electrification of components is coupled with a high-efficiency advanced alternator, global warming emissions can be reduced even further.