

# Ford EcoBoost Technology

EcoBoost combines direct injection with turbocharging that uses waste energy from the exhaust gas, delivering the power and performance of a larger engine with up to a 20% increase in fuel economy and a 15% reduction in CO<sub>2</sub> emissions.

Ford Explorer America concept



The Ford Explorer America concept delivers an approximately 20 to 30 percent fuel-economy improvement, while providing room for six and their gear plus moderate towing and off-roading capabilities.

Ford's approach to sustainable vehicles in this concept includes:

- A 4-cylinder 2-liter EcoBoost engine delivering 275 hp and 280 lb.-ft. of torque, or a premium 3.5-liter V-6 with 340 hp. Fuel-efficiency improves 20 to 30 percent versus today's V-6 Explorer
- Migration from current body-on-frame to unibody construction, reducing weight and delivering superior driving dynamics
- A fuel-efficient 6-speed transmission with auto shift control, so the driver can select and hold a lower gear at the turn of a dial
- Weight reduction of 150 pounds for the V-6 version with its new lighter but more powerful engine plus more lightweight materials, suspension and chassis components
- Electric power assisted steering (EPAS) and other engine actions that deliver fuel savings of about 5 percent. 80 to 90 percent of Ford vehicles will have EPAS by 2012
- Aerodynamic and parasitic improvements that add up to a 5 percent fuel economy

**F**ord is preparing to equip half a million vehicles with its new EcoBoost engine technology. EcoBoost is a new, affordable high-volume engine technology slated for a range of global vehicles, from small cars to large trucks.

EcoBoost uses gasoline turbocharged direct-injection technology for up to 20 percent better fuel economy, 15 percent lower CO<sub>2</sub> emissions and superior driving performance compared to traditional larger displacement engines.

The Ford Explorer America concept, revealed at the North American International Auto Show in Detroit last winter, showcases EcoBoost combined with other sustainability features. The EcoBoost family of 4-cylinder and 6-cylinder engines features turbocharging and direct injection technology. Unlike more expensive hybrids and diesel engines, EcoBoost builds upon today's gasoline engine.

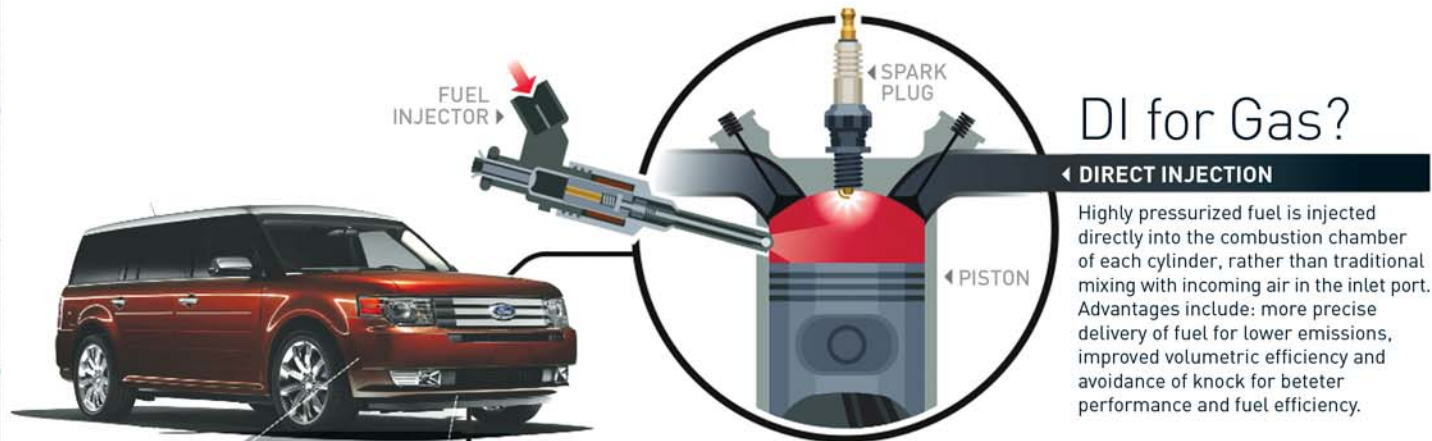
Ford will introduce EcoBoost on the new Lincoln MKS flagship in 2009, followed by the Ford Flex and other vehicles. By 2013, Ford will have more than half a million EcoBoost-powered vehicles on the road annually in North America. For 2009, EcoBoost on the Lincoln MKS will feature a 3.5-liter twin-turbocharged V-6. It will

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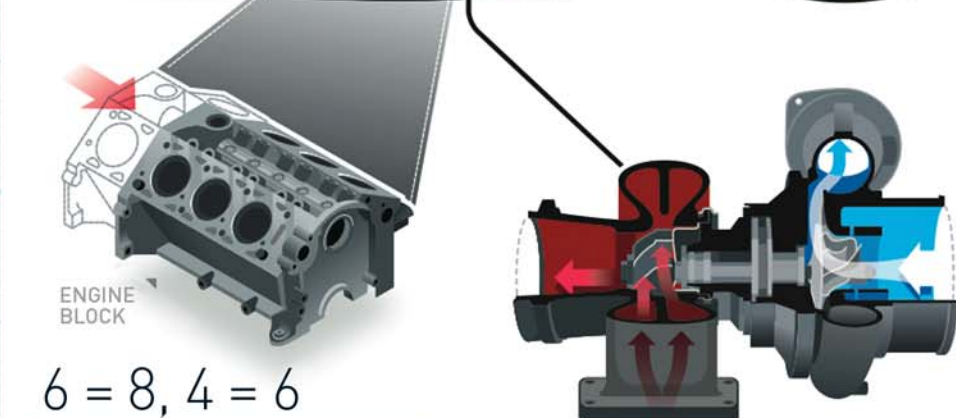
# MORE WITH LESS

Better fuel economy? Up to 20%. And more power. Even with advanced technologies, Ford anticipates the majority of vehicles worldwide will be gasoline powered. That's millions. Ford's new gas-turbo direct-injection engines can help. Here's how Ford's **EcoBoost** does more with less:



## DI for Gas?

Highly pressurized fuel is injected directly into the combustion chamber of each cylinder, rather than traditional mixing with incoming air in the inlet port. Advantages include: more precise delivery of fuel for lower emissions, improved volumetric efficiency and avoidance of knock for better performance and fuel efficiency.



## Turbo: Power for the People

Energy from the engine's exhaust, which would otherwise be wasted, is utilized to rotate a turbine wheel. The turbine is coupled to a compressor which pressurizes incoming air, significantly increasing the output per liter of the engine. The traditional disadvantages of "boosting"—turbo lag and knock—are mitigated by the synergy with direct injection.

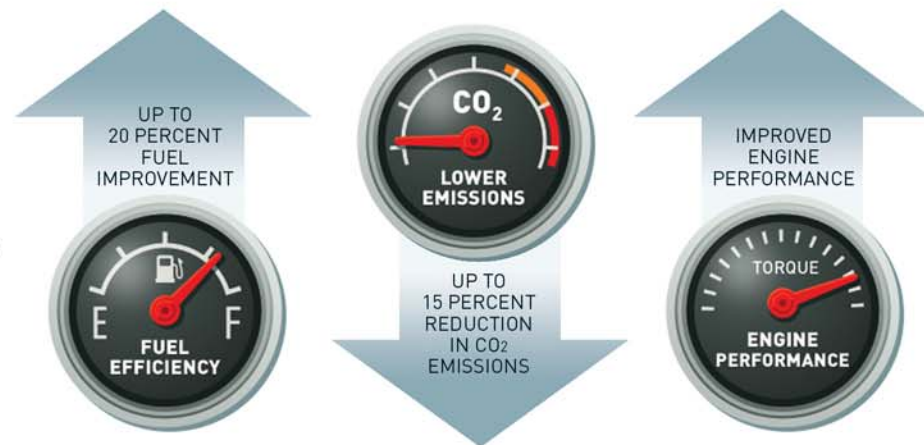
$$6 = 8, 4 = 6$$

### SMALLER ENGINE BLOCK

With both factors in the equation, the EcoBoost 6-cylinder engine can produce like an 8; a 4, like a 6. In addition, Ford's 6-speed transmission (available on Ford Edge, and first-in-class for Fusion, Taurus and Taurus X) promises smoother acceleration and better economy. Go farther. Use less.

## Fatter Wallet

With EcoBoost's more efficient use of fuel, drivers should experience fewer trips to the gas pump, while not having to sacrifice performance in order to make the world a better place for all of us.



With Ford EcoBoost direct injection, fuel is injected into each cylinder of an engine in small, precise amounts. Compared to conventional port injection, direct injection produces a cooler, denser charge, delivering higher fuel economy and performance.

produce the power and torque of a V-8 engine with the fuel efficiency of a V-6. With an estimated 340-horsepower and more than 340 lb.-ft. of torque, the Lincoln MKS will be the most powerful and fuel-efficient all-wheel-drive luxury sedan in the market.

EcoBoost's combination of direct injection and turbocharging mitigates the traditional disadvantages of downsizing and boosting 4- and 6-cylinder engines, giving customers both superior performance as well as fuel economy. With direct injection, fuel is injected into each cylinder of an engine in small, precise amounts. Compared to conventional port injection, direct injection produces a cooler, denser charge, delivering higher fuel economy and performance.

Ford's 3.5-liter EcoBoost V-6, for example, can deliver about 340-plus lb.ft. of torque across a wide engine range—2,000 to 5,000 rpm—versus 270 to 310 lb.ft. of torque for a conventional naturally-aspirated 4.6-liter V-8 over the same speed range. At the same time, this V-6 gives an approximate 2 mpg improvement and emits up to 15 percent less CO<sub>2</sub>.

Direct injection coupled with turbocharging allows for the downsizing of engines, as well. A small 4-cylinder EcoBoost engine produces more torque than a conventional 4-cylinder engine nearly an entire liter larger in displacement—with better fuel efficiency.

The real-world fuel economy benefit is consistent no matter the drive cycle, meaning the engine is efficient in the city as well as on the highway—unlike hybrids, which are most efficient in stop-and-go traffic. In addition, customers who tow and haul—and have long turned to expensive diesel powertrains for their superior towing capabilities—can find the torque they seek from this powertrain.

Combined with multi-speed transmissions, advanced electric power steering, weight reductions and aerodynamic improvements, EcoBoost is part of Ford's strategy. Despite the comparisons just made, Ford has additional hybrids and diesels planned. Longer term, Ford plans to remain aggressive in the development of plug-in hybrids and hydrogen fuel cell-powered vehicles.

"We know that what will make the biggest difference is applying the right technology on volume vehicles that customers really want and value and can afford," says Derrick Kuzak, Ford's group vice president of Global Product Development. "EcoBoost puts an affordable technology within reach for millions of customers." ■

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