Raising Economy
Project Goals

- To reduce the fuel consumed while maintaining the same output.
- To reduce the CO2 produced while maintaining the same performance...
End of the Gasoline V8?

- “Ford bets on direct injection and turbos.”
  - First with a V8, first to take them away.
  - In 5 years expect a 3.5 GTDI (gas turbo direct injection) to replace the 4.6 V8 with 2 mpg increase.

- GM decides not to start production of a “high-feature” DOHC V8 in favor of direct injection V6 with the same power.

- (Motor Trend March 2008)
2010 Chevrolet Camaro 3.6 liter diV6 w302 hp, 17/29 mpg
How is economy raised?

- Carburetors replaced with fuel injection
- **Computer speed faster than PCs**
- Tuned exhaust
- Tuned intake
- VVTi
- VVT
- [http://www.youtube.com/watch?v=6AXh8O7hWU4](http://www.youtube.com/watch?v=6AXh8O7hWU4)
- Direct injection of fuel like a diesel
- Heated intake
- Cylinder Deactivation (Displacement on Demand)
- Heat risers to heat intake air
- Smaller clearances (reduce blow-by)
- Industry headed toward AF ratio sensors instead of heated oxygen sensors.
- Enhanced EVAP systems
- Additional spark plugs (coil over plug instead of alternatives)
- Ion-current sensing ignition
- Raising compression ratio while maintaining knock sensors
- MAP sensitive to differences in atmospheric pressure
- **Forced induction (of course)**
Wait Wait, there’s more

- COP ignition
  http://www.youtube.com/watch?v=KWEaWaX0CYc
- CVT Transmission
  http://www.subaru.com/engineering/transmission.html
- 8 Speed Transmissions
  http://www.youtube.com/watch?v=JXrHDjcQIIU
- Low backpressure Exhaust
  http://www.youtube.com/borla
- Low Restriction Intakes/Velocity stacks
  http://www.youtube.com/watch?v=SiJBU9tl-Go
One more…

- **BMW Thermoelectric Generator:**
  - [http://www.youtube.com/watch?v=yY0SAzs1LJw](http://www.youtube.com/watch?v=yY0SAzs1LJw)
I lied, Aerodynamics

- 911 Engineering dynamics:
  - http://www.youtube.com/watch?v=z_wgbrTc8tU

- E Class
  - http://www.youtube.com/watch?v=jd71qpfUfEg
Variable Valve Timing

Also called variable valve actuation (VVT), variable-cam timing and variable valve timing and lift electronic control (VTEC®)... http://www.youtube.com/watch?v=GfToilocVpyQ

- Valves control the flow of air and fuel, into the cylinders and exhaust out of them. When and how long the valves open (timing) and how much the valves move (lift) both affect engine efficiency.

- Optimum timing and lift settings are different for high and low engine speeds. Traditional designs, however, use fixed timing and lift settings, which are a compromise between the optimum for high and low speeds. VVT&L systems automatically alter timing and lift to the optimum settings for the engine speed.

- Potential Efficiency Improvement: 5% Savings Over Vehicle Lifetime: $1,400*

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Variable Valve timing
Cylinder Deactivation (Displacement on Demand)

- This technology merely deactivates some of the engine's cylinders when they are not needed. This temporarily turns a 8- or 6-cylinder engine into a 4- or 3-cylinder engine. This technology is not used on 4-cylinder engines since it would cause a noticeable decrease in engine smoothness.

- Potential Efficiency Improvement: 7.5% Savings Over Vehicle Lifetime: $2,000*
Supercharging and Turbocharging

- Turbochargers and superchargers are fans that force compressed air into an engine’s cylinders. A turbocharger fan is powered by exhaust from the engine, while a supercharger fan is powered by the engine itself.

- Both technologies allow more compressed air and fuel to be injected into the cylinders, generating extra power from each explosion. A turbocharged or supercharged engine produces more power than the same engine without the charging, allowing manufacturers to use smaller engines without sacrificing performance. http://www.youtube.com/watch?v=xfU8t6P9zmQ

- Potential Efficiency Improvement: 7.5% Savings Over Vehicle Lifetime: $2,000
Direct Injection

- In conventional multi-port fuel injection systems, fuel is injected into the port and mixed with air before the air-fuel mixture is pumped into the cylinder. In direct injection systems, fuel is injected directly into the cylinder so that the timing and shape of the fuel mist can be precisely controlled. This allows higher compression ratios and more efficient fuel intake, which deliver higher performance with lower fuel consumption.

- Potential Efficiency Improvement: 12% Savings Over Vehicle Lifetime: $3,200
Integrated Starter/Generator

These systems automatically turn the engine off when the vehicle comes to a stop and restart it instantaneously when the accelerator is pressed so that fuel isn't wasted for idling. In addition, regenerative braking is often used to convert mechanical energy lost in braking into electricity, which is stored in a battery and used to power the automatic starter.

Potential Efficiency Improvement:
8% Savings Over Vehicle Lifetime: $2,200