



Alternative fuels and vehicles

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Clean Cities portfolio of alternative fuels

Alternative Fuels

- Electricity
- Biodiesel B100
- Ethanol (E85)
- Hydrogen
- Natural gas
- Propane (autogas)

Fuel Blends – commonly used

- Biodiesel/diesel blends (B2, B5, B20)
- Ethanol/gasoline blends (E10)
- Hydrogen/natural gas blends (HCNG)

- Soy Plant



Clean Cities portfolio of technologies

- **Fuel Economy**
 - Fuel efficiency
 - Behavioral changes
 - Vehicle maintenance initiatives
 - Vehicle miles traveled (VMT)

- **Hybrids**
 - Light- and Heavy-duty HEVs
 - PHEVs

- **Idle Reduction**
 - Heavy-duty trucks
 - School buses
 - Truck stop electrification



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Electric vehicles the future plans:

EV Market Launch

Nissan Leaf



Chevy Volt



Ford production PHEV



& Market Launch PHEV SUV

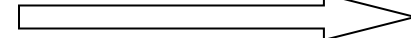
Smith electric: All electric trucks



Transit Connects fall 2011 Ford focus

Mitsubishi Production EV

More Models



BMW 1 series



Mercedes E Smart cars Fall 2010 (demo)

June 2011 MA look for PHEV Dodge Ram truck Demo's



PHEV's for Toyota

1 Mil. EV's on the road by 2015

2010

2011

2012

2013

2014



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Battery electric Facts

- 100 MILE RANGE
- Battery Charging:
 - Level 1: 120 volts - 12 to 14 hours for full charge
 - Level 2: 240 volts(dryer plug) 4 to 6 hours for full charge J1772 plug now the standard.
 - Level 3 Fast charge 10 to 15 minutes (no standard yet)
 - Charging stations will come with various levels of intelligence.

The battery electric car and truck



Biodiesel

- What is Biodiesel?
 - Biodiesel is a diesel fuel substitute.
 - Produced from Domestic Renewable Resources:
any fat or oil, like vegetable oil, waste greases, animal fat or virgin Soy oil.
 - Meets health effect testing (CAA)
 - Lower emissions
 - High flash point (>300F), Safe
 - B 100 is biodegradable, Essentially non-toxic.
- It is blended with petroleum Diesel at various % levels
B-5 B-10 or B-20.



The reasons:

All biodiesel blends:

- Run in Existing, unmodified engines
- Integrates with existing fuel infrastructure
- Increases lubricity
- Cuts exhaust emissions, eliminates black smoke and odor – Just ask the mechanics!
- No loss of power
- Increase in fuel mileage reports of 1 to 2 additional miles per gallon running B- 20
- With proper fuel additive no problems with gelling reported.
- Warranties are not voided despite all the rumors
- Manufacturers warranty their parts and workmanship - not FUEL!

What is the biodiesel used in?

International

Case New Holland

Cat John Deere

Cummins Detroit

& Kohler



from a 1969 Ingram roller to a 2011 Ford F450

The Entire Fleet runs on biodiesel



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Hydrogen

- Many challenges technical and otherwise must be overcome before fuel cell vehicles become successful.
- Hydrogen powered vehicles can operate two ways 1. Fuel cells 2. Internal combustion engine



Natural gas/Propane

- These are some of the cleanest burning alternative fuels. These vehicles can be dedicated to one fuel or they can be bi fuel . CNG/LNG or LPG require special engines and special tanks to hold the fuel.

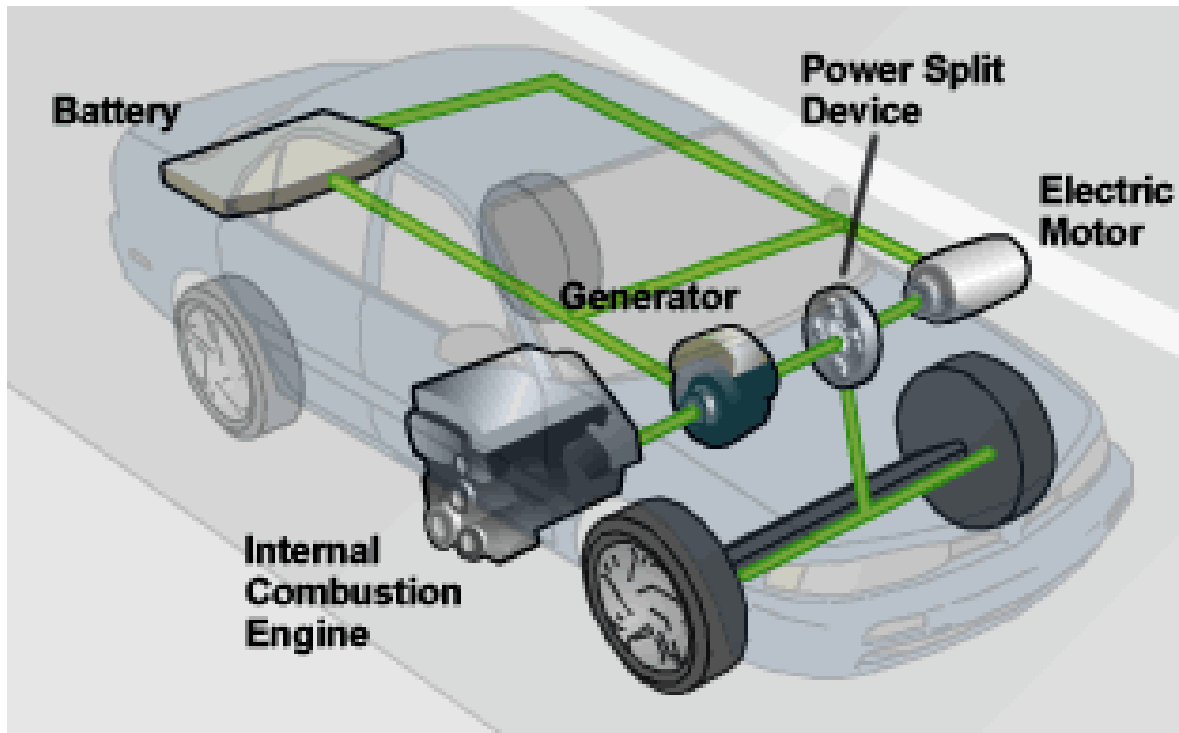


Ethanol

- Currently made from corn it is blended with gasoline we all now have a E-10 in our fuel.
- There are 30 vehicles in the 2011 model year line up that take E 85.
- While the food for fuel debate rages on keep in mind that for every 3 bushels of corn that are used for fuel 1 bushel is leftover for food.
- 85% reduction of petroleum certainly has some merit if you have the availability to get the fuel

Hybrids

- Plan on at least a 30% savings on fuel with this drive train. Light or heavy duty application.



So how do I choose a fuel?

- CNG is now costs less per gallon equivalent Than Diesel.
- Hybrids – in the right application can mean a fuel savings of over 30%. ROI is 3 to 4 years
- Battery electric vehicles will operate at \$1.00 per gallon equivalent
- Biodiesel (B20) can increase MPG by 1 to 2 miles

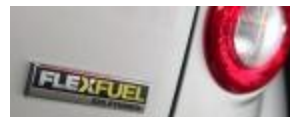
CNG VEHICLES

Medium-duty: Vans and Shuttles.



Alternative fueled vehicles

- Wheel Loader using biodiesel, Propane lawnmower, symbols on vehicles that can use E-85 & a Hybrid Ford Fusion



No silver bullet

Take a look at fleet and find the operations that alternative fueled vehicles will work and

GO FOR IT!

And when prices of fuel gets to \$6.00 issue bikes!

