Electric vs. Diesel and Hybrid Vehicles

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Outline

- Problem Definition
- Introduction
- Society
- Diesel Vehicles
- Electric Vehicles
- Hybrid Vehicles
- Economic Comparison
- Environmental Comparison
- Recommendations

Problem Definition

- Which alternative to gas vehicle is the best?
- Our compared models
  - Nissan Leaf as the Electric Vehicle (EV)
  - Honda Civic Hybrid as the Hybrid
  - Volkswagen Jetta TDI as the Diesel

Introduction

- First EV appear early 1820-1830's
  - Peaked out 1912 – died out 1920's
- Rudolf Diesel 1894 filed patent
  - First successful engine was 1897
- Hybrid by Dr. Ferdinand Porsche 1898
  - Ran pure EV as well

Source: http://www.circuitstoday.com/working-of-hybrid-cars

Social

- Personal vehicles changed how we live
  - Expansion of society
  - Free to travel
- Cars now ingrained in our society
- Average distance travelled per year in personal vehicles Canada is 15 366 km
- Problems with gasoline powered vehicles
  - Cost of fuel
  - Emissions

Social

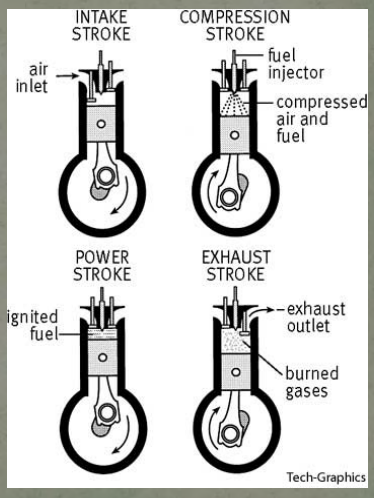
- Hybrid-Electric
  - Initial cost vs gasoline
  - Lower resale value
  - Better fuel economy
  - No need for charging
- Electric Vehicles (EVs)
  - Charging time
  - Distance capabilities
  - No tailpipe emissions
  - Noise reduction

Social

- Hold-ups from change
  - Range Anxiety
  - Charging stations
  - People that drive more than average
- Government Effect
  - Dependance on importing gasoline

DIESEL - ENGINE

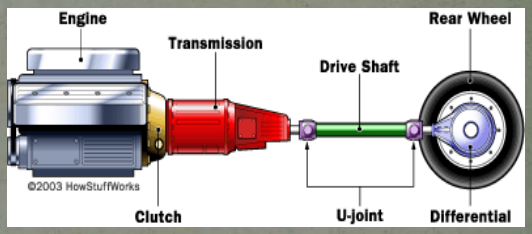
- Four stroke engine
- Requires a drive train to transmit power to the wheels
- Fuel injected directly into the cylinder
- Higher compression ratio for increase efficiency



DIESEL - DRIVETRAIN

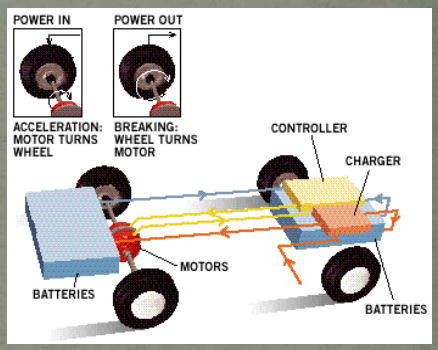
- Clutch
- Transmission
- Differential

- Available in automatic and standard



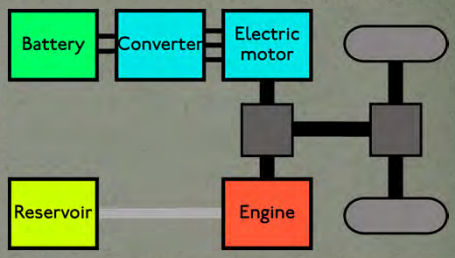
ELECTRIC – MOTOR & DRIVETRAIN

- Electric motor powered by batteries
- Motor is coupled directly to the driveshaft
- Regenerative braking is available



HYBRID – Engine & Motor

- Smaller engine and electric motor
- Parallel system
- Regenerative braking available



Diesel: Volkswagen Jetta 2.0 TDI

Source : VW.ca

Volkswagen Jetta 2.0 TDI(cont'd)

Type	4 Door Sedan
Motor	2.0L, 140 HP, 320 Nm
Transmission	6 speed auto/manual
Battery	540A , run down protection
Range	1000 km+

Electric: Nissan Leaf

Source: http://www.automotiveaddicts.com/wp-content/uploads/2010/03/nissan-leaf-ev-6.jpg

Nissan Leaf (cont'd)

Type	5 Door Hatchback
Motor	80 kW (110 HP) synchronous AC motor
Transmission	Single speed direct drive
Battery	24 kWh lithium ion
Range	160 km

Hybrid: Honda Civic Hybrid

Honda Civic Hybrid (cont'd)

Type	4 Door Sedan
Motor	1.5L, 110HP, 172 Nm (gas) 23HP, 106 Nm (electric)
Transmission	CVT
Battery	20 kW lithium-ion, 144V
Range	950 km

	2012 Honda Civic Hybrid	2012 Nissan Leaf	2012 Volkswagen Jetta 2.0 TDI
Fuel Rate (L/100Km)	4.3	2.4	6.7
MSRP (CDN)	$24,990	$38,395	$23,990
Range (Km)	935	160	1000
Power (HP)	110	110	140
Torque (Nm)	172	280	320
Top speed (km/h)	190	144	209
Time 0-100km/hr (s)	11.7	7.5	9.1
Fuel cost in NS	$1.279/ L	$0.16 /kWh	$1.327/ L
Fuel ($/yr)	$884.90	$550.00	$1,430.55
Watt hours per Km	/	119 @80% discharge	/
CO_2 emissions *** (tonnes/yr)	2.15	0	6.3
Hours to Full Charge	/	8 (@110V)	/
Energy Storage kWh	/	24	/
Fuel tank size (L)	50	/	55
Engine Lifetime (km)	160000	160000	480000
Battery Value	$1,800	$9,000	$200.00
brakes change (life)	$1,400	$1,000	$2,400
powertrain repairs (life)	$1,400	$1,000	$2,400

Environmental Comparison

- Diesel is ample
- Increase battery size Hybrids not dramatic
- Lithium supply insufficient to change over cars
- Lithium sources are delicate ecosystems

Environmental Comparison

Sector	TWh	% Market
Hydro	375.0	61.68
Wind, Tidal, Solar	10.3	1.69
Other	3.7	0.61
Thermal	129.0	21.22
Nuclear	90.0	14.80
Total	608.0	100.00

Environmental Comparison

Dirty Energy Source	% CO_2 emissions	CO_2 emitted (Megatonnes)
Coal	78.74	79.14
Natural Gas	18.35	18.44
Diesel/Oil/Bunker C	2.38	2.39
Biomass	0.53	0.53
Total	100.00	100.50

Environmental Comparison

	CO_2 emissions / year
Diesel	2870.8
Electric	0*
Hybrid	1583.7

- Canada is ~20% "dirty energy"
- CO_2 induced by electricity is 165.3g CO_2/kWh
- For electricity for a year, (165.3g CO_2/kWh)*(3437.5 kWh) = **568.2 kg CO_2/year**

Recommendations

- EV is best idea; not real solution currently
- Diesel is good alternative to gasoline
- Hybrid Vehicle is the way to go
  - Viable
  - Competitive range, cost

Questions?