

Effects of Lifestyle Choices on Energy Use

Choong-Fai Too

The University of Texas at Austin

ChE 379/384 Energy Technology and Policy

November 10, 2005

Outline

- Introduction
- Topics of Interest
 - Trucks/SUVs
 - Public Transportation/Carpooling
 - Disposable Economy
 - Other
- Conclusions

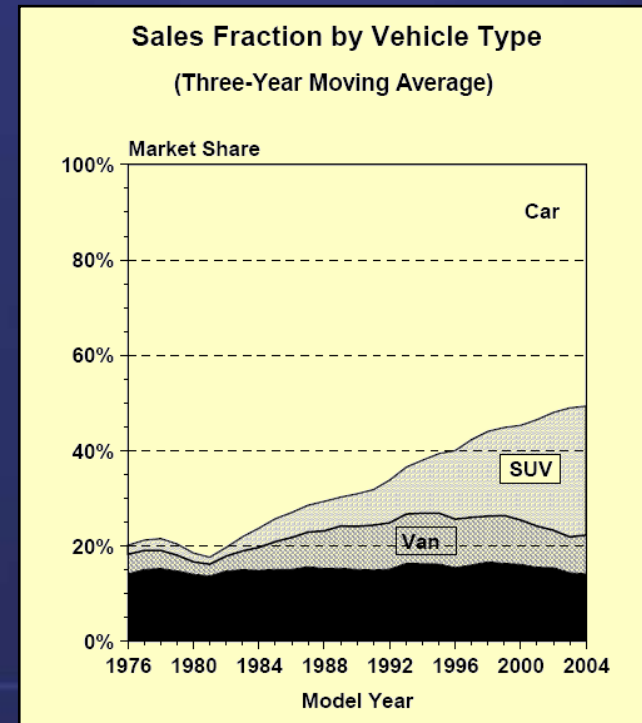
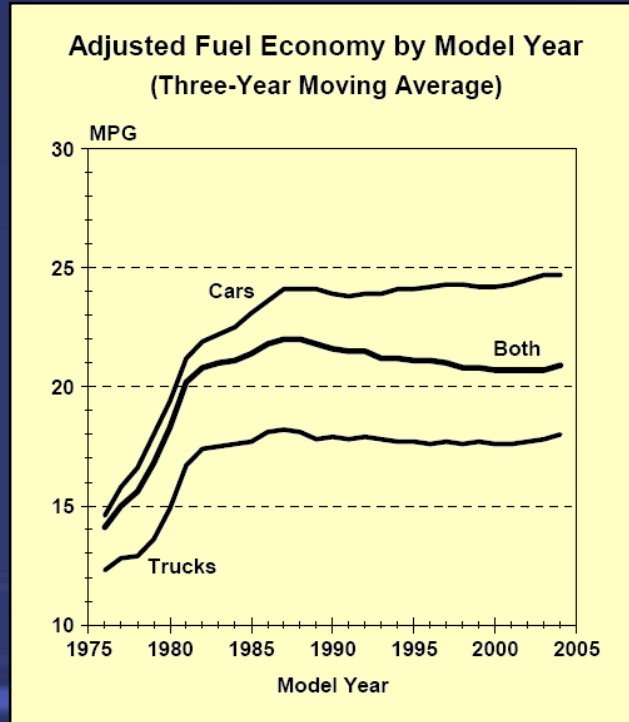
Introduction/Scope

- Focus on personal (consumer) not industrial or commercial sector
- Luxury/convenience vs. responsibility
- Increasing dependence on fossil fuels

Trucks/SUVs vs. Cars

- Basic assumptions
 - Neglect hybrid technology
 - Neglect super-guzzlers (ie. Hummer)
 - All pickup trucks and SUVs referred to as “trucks”
 - Focus on gasoline-based (not diesel-based)

Sales and Fuel Economy



Source: EPA – Light Duty Automotive Technology and Fuel Economy Trends (1975-2005)

Expense of a Truck

Assumptions:

10000 miles per year average

50% highway/50% city driving miles

\$2.50 per gallon of gasoline

-----Truck-----				-----Car-----				Savings		
Model	Cost	Fuel Eco.		Model	Cost	Fuel Eco.		Capital	Per Annum	
F-150	\$25,000	15	19	Focus	\$15,000	25	34	\$10,000	249 gal	\$623.13
Tahoe	\$35,000	15	19	Impala	\$22,000	20	29	\$13,000	180 gal	\$450.18
Tundra	\$25,000	17	20	Camry	\$23,000	22	31	\$2,000	163 gal	\$407.96
Ridgeline	\$29,000	16	21	Civic	\$16,000	30	39	\$13,000	251 gal	\$626.71

Alternatives

- U-Haul cost: \$20~\$30 per rental plus \$0.69 per mile
- Given
 - Capital savings of \$10000
 - 40 miles moving intra-city
- Affords 173~210 rentals (capital) and an additional 7~12 rentals (annually)
- Borrow from a friend

Impacts of Reduction

Assumptions

Average Truck Gas Mileage(mpg) 18

Average Car Gas Mileage(mpg) 27

19.8% of total CO₂ emissions are from gasoline motor vehicles

68.8% of total NO_x emissions are from gasoline motor vehicles

~40% trucks

	% reduction per annum for x% reduction in trucks				
	0%	25%	50%	75%	90%
CO ₂ Emission	0	1.65%	3.30%	4.95%	5.94%
NO _x Emission	0	5.73%	11.47%	17.20%	20.64%
Gasoline Use	0	4.17%	8.33%	12.50%	15.00%

PT/Carpooling

- Recent suburban sprawl
- Assuming 10-mile commute/21 mpg
- Per person added to a carpool:
 - 5200 miles per year
 - 248 gallons of gasoline
 - 10.4% of total CO₂ emissions
 - 35% of total NO_x emissions

Public Transportation

Mode	Fuel/Electricity Use	# Commuters	Energy Use
	(L/100km)		(MJ/person-km)
Automobile	15	1	4.74
		6	0.79
	10	1	3.16
	[23.5 mpg Vehicle]	4	0.79
	7	1	2.21
Van		4	0.55
	20	15	0.42
	10	7	0.45
Diesel Bus	56	40	0.52
Subway	2.61kWh/km	75 (per car)	0.13
GO Rail	761	810	0.35

Source: Vancouver Community Network – Transport 2000 BC

Disposable Economy

- Ziploc™ bags
- Saran Wrap™
- Aluminum cans
- Fast food
- Grocery bags
 - Reusable cloth or heavy plastic bags

Recycling

- Energy saved per pound recycled
- Simple, do it



Material	btu/lb
LDPE	12050
PETE	11100
HDPE	9500
Mixed Plastics	10250
Newspaper	8250
Cardboard	6500
Office Paper	5050
Mixed Paper	3350
Glass Bottles	1050

Source: Utah State University

Aluminum

Assumptions

10000 btu per lb of coal

Aluminum Production		
Source	btu used per lb	lbs coal burned
From Ore	507160	50.716
Recycled	41300	4.13

Source: Aluminum Association

- ~500 MJ per lb Al
- Average household (500kWh/mo) uses 500MJ in 8~9 days
- Recycling reduces by factor of 12

Other (Tree Beautification)

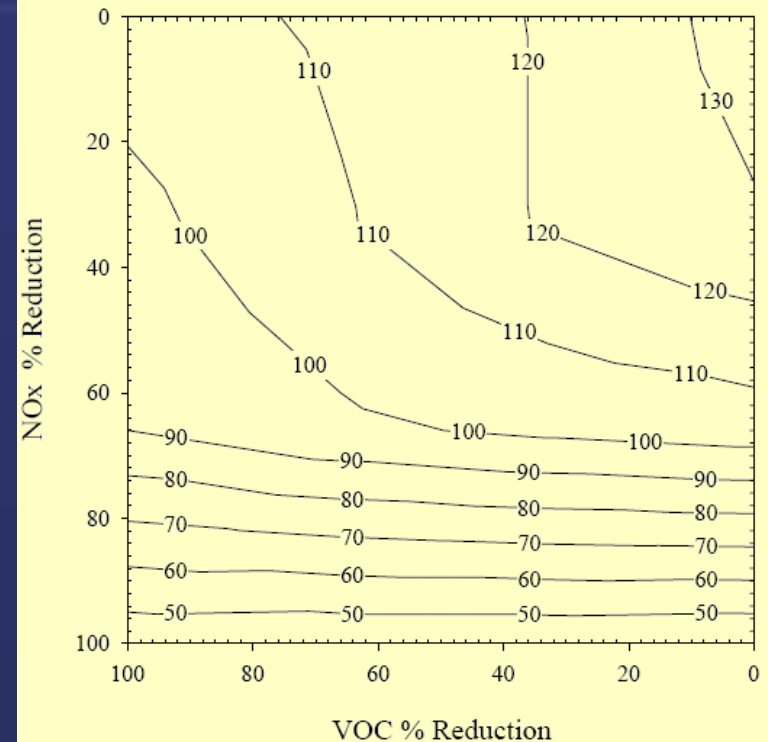
- 60% VOC emissions are biogenic
- Primarily hardwoods, especially oaks
 - 3.108mg isoprene/m²h
 - For cities struggling with attainment, added VOC emissions from oaks results in energy expenditure to lower VOC/NO_x from anthropogenic sources

Austin

Austin Area Emissions for 1999

Source Category	Nox (t/d)	VOC (t/d)
Anthropogenic Emissions		
On-road Mobile	96	48
Non-road Mobile	48	23
Point	48	4
Area	5	83
<i>Total</i>	<i>197</i>	<i>158</i>
<i>Biogenics</i>	<i>25</i>	<i>394</i>

Austin Area Maximum Ozone Concentrations (1 Hour Average)



Conclusions

- If you don't need a truck, don't buy one
 - You will save a lot of gas
 - You will not emit as many pollutants
- Carpool, take the bus, or ride a subway
- Recycle! It's not that hard
- Even oaks, as trivial as they sound, play a role in the energy game

References

[cars.com](http://www.cars.com). 6 Nov. 2005 <<http://www.cars.com>>.

“The Changing Face of Ozone Management.” [Tennessee Valley Authority](http://www.tva.gov/environment/air/ontheair/ozone_management.htm). 6 Nov. 2005 <http://www.tva.gov/environment/air/ontheair/ozone_management.htm>.

[Emissions of Greenhouse Gases in the United States 2003](http://www.eia.doe.gov/oiaf/1605/ggrpt/index.html). 6 Nov. 2005 <<http://www.eia.doe.gov/oiaf/1605/ggrpt/index.html>>.

“Energy efficiency of different modes of transport.” [Energy Efficiency](http://www.vcn.bc.ca/t2000bc/debate/issues/efficiency.html). 7 Nov. 2005 <<http://www.vcn.bc.ca/t2000bc/debate/issues/efficiency.html>>.

“Energy Policy Position.” [Aluminum Association - Energy](http://www.aluminum.org/Content/NavigationMenu/The_Industry/Government_Policy/Energy/Energy.htm). The Aluminum Association, Inc. 6 Nov. 2005 <http://www.aluminum.org/Content/NavigationMenu/The_Industry/Government_Policy/Energy/Energy.htm>.

[Recycling Center](http://www.usu.edu/recycle/FAQs.htm). Utah State University. 6 Nov. 2005 <<http://www.usu.edu/recycle/FAQs.htm>>.

[U-Haul](http://www.uhaul.com). 6 Nov. 2005 <<http://www.uhaul.com>>.

United States. Department of Commerce - US Census Bureau. [2002 Economic Census: Vehicle Inventory and Use Survey](http://www.census.gov/prod/ec02/ec02tv-us.pdf). 2004. 6 Nov. 2005 <<http://www.census.gov/prod/ec02/ec02tv-us.pdf>>.

---. Environmental Protection Agency. [Biogenic Sources Preferred Methods](http://www.epa.gov/ttn/chief/eiip/techreport/volume05/v01.pdf). May 1996. 6 Nov. 2005 <<http://www.epa.gov/ttn/chief/eiip/techreport/volume05/v01.pdf>>.

---. ---. [Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2005](http://www.epa.gov/otaa/cert/mpg/fetrends/420r05001.pdf). 2005. 7 Nov. 2005 <<http://www.epa.gov/otaa/cert/mpg/fetrends/420r05001.pdf>>.

[US Bureau of Transportation Statistics](http://www.bts.gov/publications/national_transportation_statistics/2002/html/table_01_11.html). 6 Nov. 2005 <http://www.bts.gov/publications/national_transportation_statistics/2002/html/table_01_11.html>.