EMGT 535/635 Engineering Economics Analysis
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The Oil Economy

How an Oil Crisis Impact the U.S. Economy

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The US Economy: How vulnerable to Oil supply?

The US is the world's largest single oil consumer in the World.

Most people believe and claim that the World is less oil dependent than in the 1970s. However, **world oil consumption has risen by about 48% or 20 Million barrels/day since 1983, and by about 17% since 1990** .

In the US oil needs had a 2.9% growth since December 2002, and a year-on-year growth rate of 2%. Lets not forget we are coming from an economic downturn. Growth is expected to continue at around 2% year.

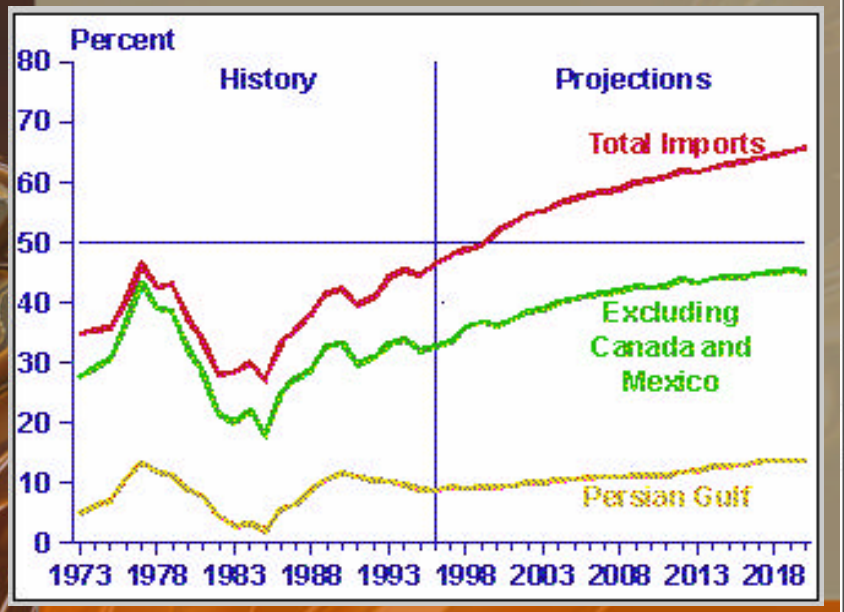
"The world excess capacity today is similar to that of the first energy crisis in 1973, substantially lower than the capacity during the second energy crisis in 1979-1980, and slightly lower than excess capacity in 1990 when Iraq invaded Kuwait."

(Source: "Investing on the Hubbert curve", Oil and Gas investor magazine, editorial, 2004)

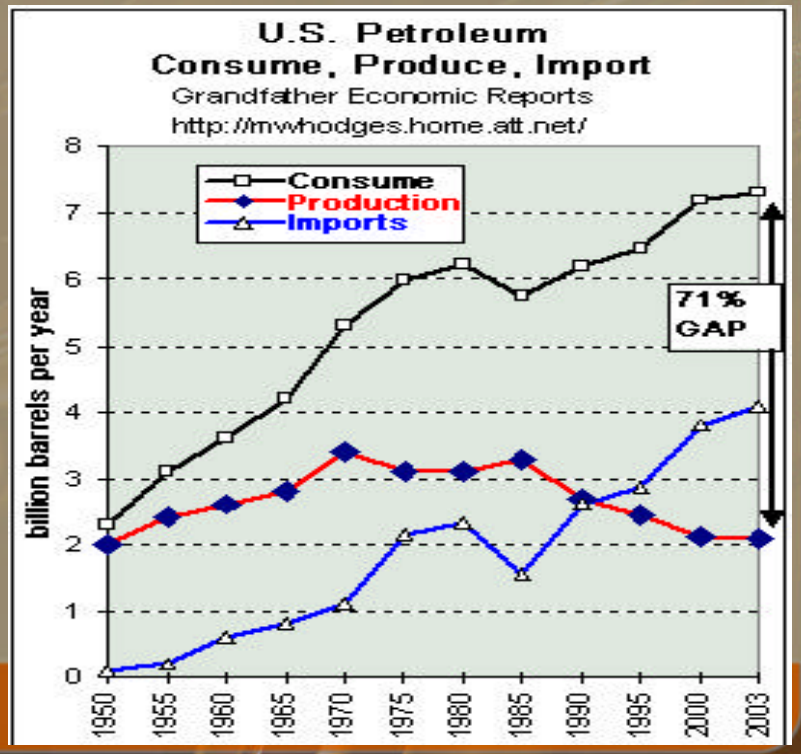
The US Economy: How vulnerable to Oil supply?

- The US dependence on foreign oil reached a record high during 2000 and declined slightly after September 11.
- The US dependency on foreign oil has increased steadily since 1986. **Dependence on imports grew faster than consumption.**

US crude oil imports as percentage of total consumed (total and differentiated by origin).



Graphic showing the evolution from 1950 to 2003, of crude oil consumed, produced and imported.



Both figures obtained from the Grandfather Economic Reports.
http://mwhodges.home.att.net/energy/energy.htm

World Oil demand – some thoughts

Surge in demand result of the convergence of two phenomena

- Return of economic growth in the nations which rank first and second in oil consumption, the United States and Japan. U.S.GDP seems destined to grow by at least 4 percent this year. During the first quarter of this year, Japan's GDP was increasing at an annual rate of 5.6 percent. (Source: Business Week magazine, May 2004)

- The appearance on the world scene of two new major consumers of oil: China (and its satellites in Asia) and India.

World production expected to peak during next decade.

Supply will be limited, entering in decline onwards

(Hubbert, Campbell, Youngquist, WEO)

World Oil demand – some thoughts

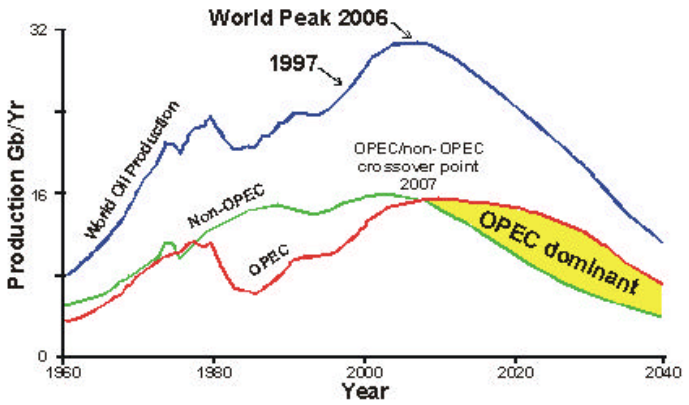


Figure 1. World, OPEC, and non-OPEC Oil Production Life Cycles. Oil production curves for years 1960-2040 are graphed. Years 1960-1997 are historic data. Years 1998-2040 are forecast by use of the World Oil Forecasting Program. World production peaks in 2006, key to this study (curve 1, a k a the 'base-line' curve), OPEC and non-OPEC production are shown (curves 2 and 3) for comparison to the world curve. The cross-over point when OPEC production exceeds non-OPEC production is 2007 (discussed later in Section 4 and detailed in Figure 10).

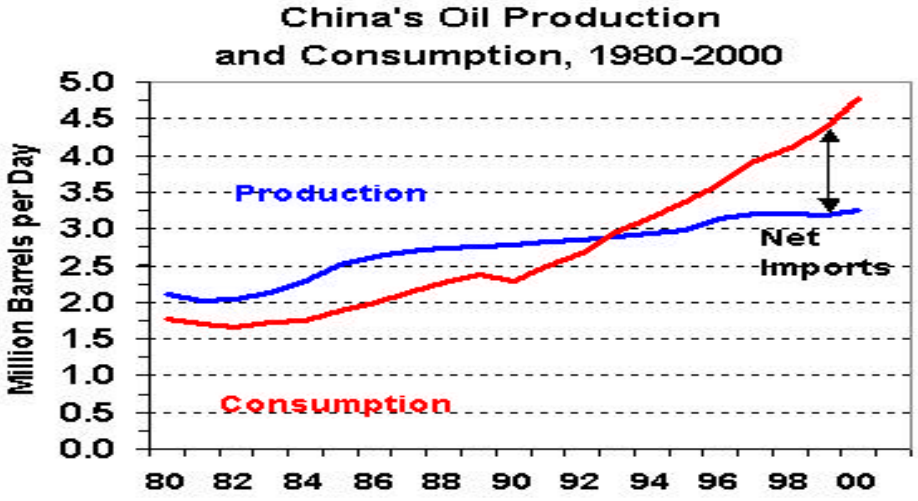
Oil production life cycle (World)

Source: Youngquist, Walter, and Richard Duncan "The World petroleum life cycle", PTTC Workshop "OPEC oil pricing and independent oil producers", Petroleum Technology Transfer Council, October 1998

http://www.dieoff.com/page133.pdf

Evolution of China's crude oil consumption and production. It is show how China's own production can no longer supply their demand.

Source: US Department of Energy web site.

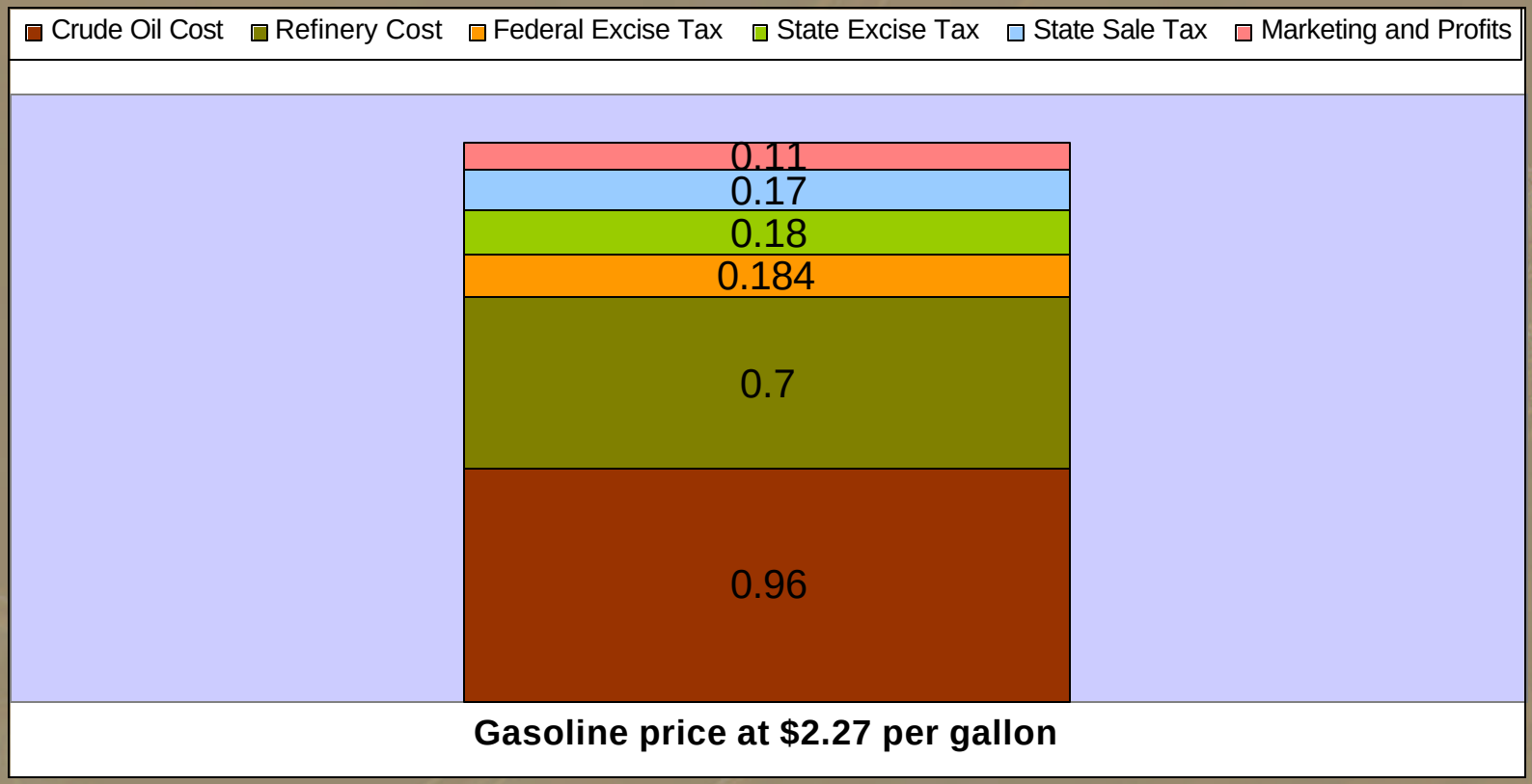


Note: Production includes crude oil, natural gas liquids and refinery gain.

[U.S. Department of Energy]

Gasoline Price Components

- **Gas dollar breakdown**



Source: California Energy Commission, May 2004 data.

Gasoline Tax History

Rate of Tax (cents per gallon)	Period to Which is Applied	President Serving & Party
1	6/21/1932 – 6/16/1933	Herbert Hoover (D)
1.5	6/17/1933 – 12/31/1933	"
1	1/1/1934 – 6/30/1940	Franklin D. Roosevelt (D)
1.5	7/1/1940 – 10/31/1951	"
2	11/1/1951 – 6/30/1956	Harry Truman (R)
3	7/1/1956 – 9/30/1959	Dwight Eisenhower (R)
4	10/1/1959 – 3/31/1983	Mostly (D)
9	4/1/1983 – 12/31/1986	Ronald Reagan (R)
9.1	1/1/1987 – 8/31/1990	"
9	9/1/1990 – 11/30/1990	George Bush (R)
14.1	12/1/1990 – 9/30/1993	Bill Clinton (D)
18.4	10/1/1993 – 12/1/1995	"
18.3	1/1/1996 – 9/30/1997	"
18.4	10/1/1997 – 3/31/2005	"
18.3	4/1/2005 – 9/30/2005	?
4.3	10/1/2005 and thereafter	?

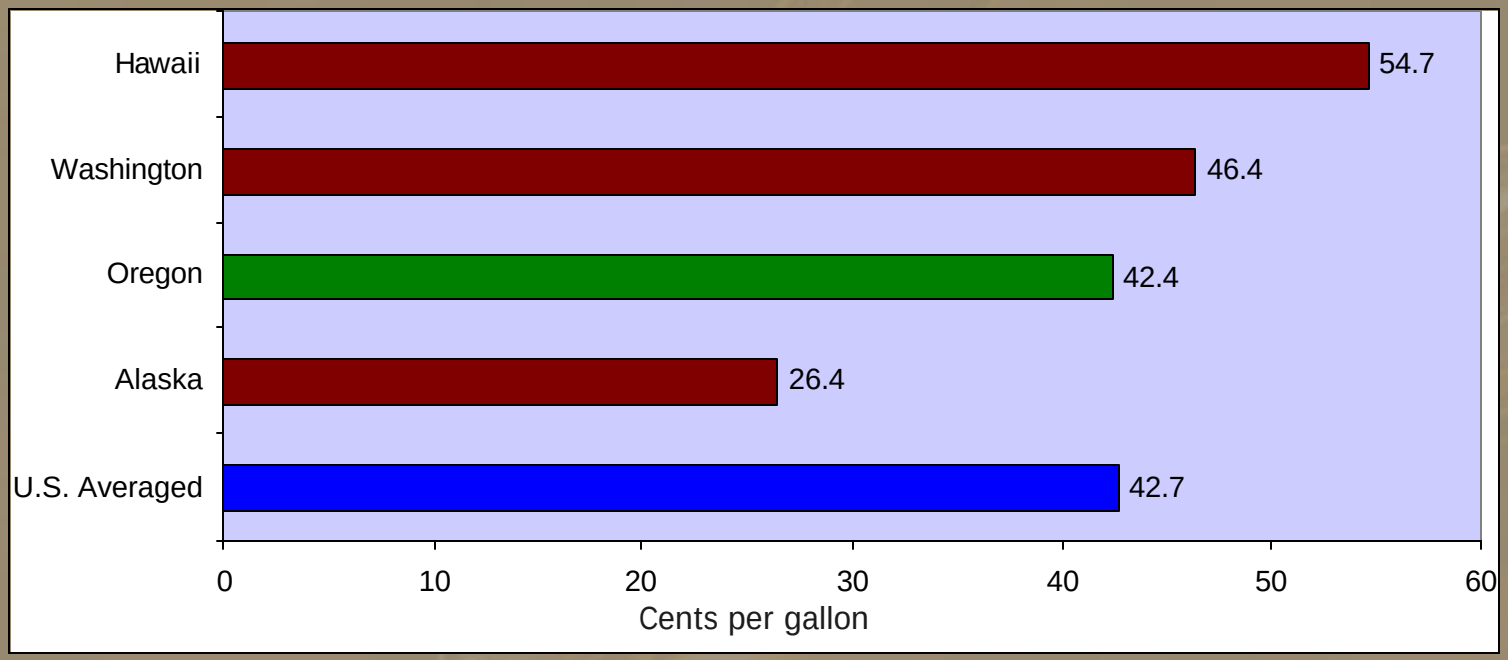
Nationwide Gasoline Taxes of 2004

- **Estimate of State and Federal Gasoline as Taxes of January 2004 (cents per gallon)**

State	State Excise	Other State Taxes	Federal Taxes	Total Federal & State Taxes
Hawaii	16	20.3	18.4	54.7
Washington	28	-	18.4	46.4
Oregon	24	-	18.4	42.4
Alaska	8	-	18.4	26.4
U.S. Average	18.4	5.9	18.4	42.7

Nationwide Gasoline Taxes of 2004

- **Example on gasoline taxes across U.S. in 2004**



Source: U.S. Department of Energy, U.S. Department of Labor, and American Petroleum Institute

Average Inflation Rate of Gasoline vs. Milk, 1971-2003

$$CPI_n = CPI_0(1+\overline{f})^n$$

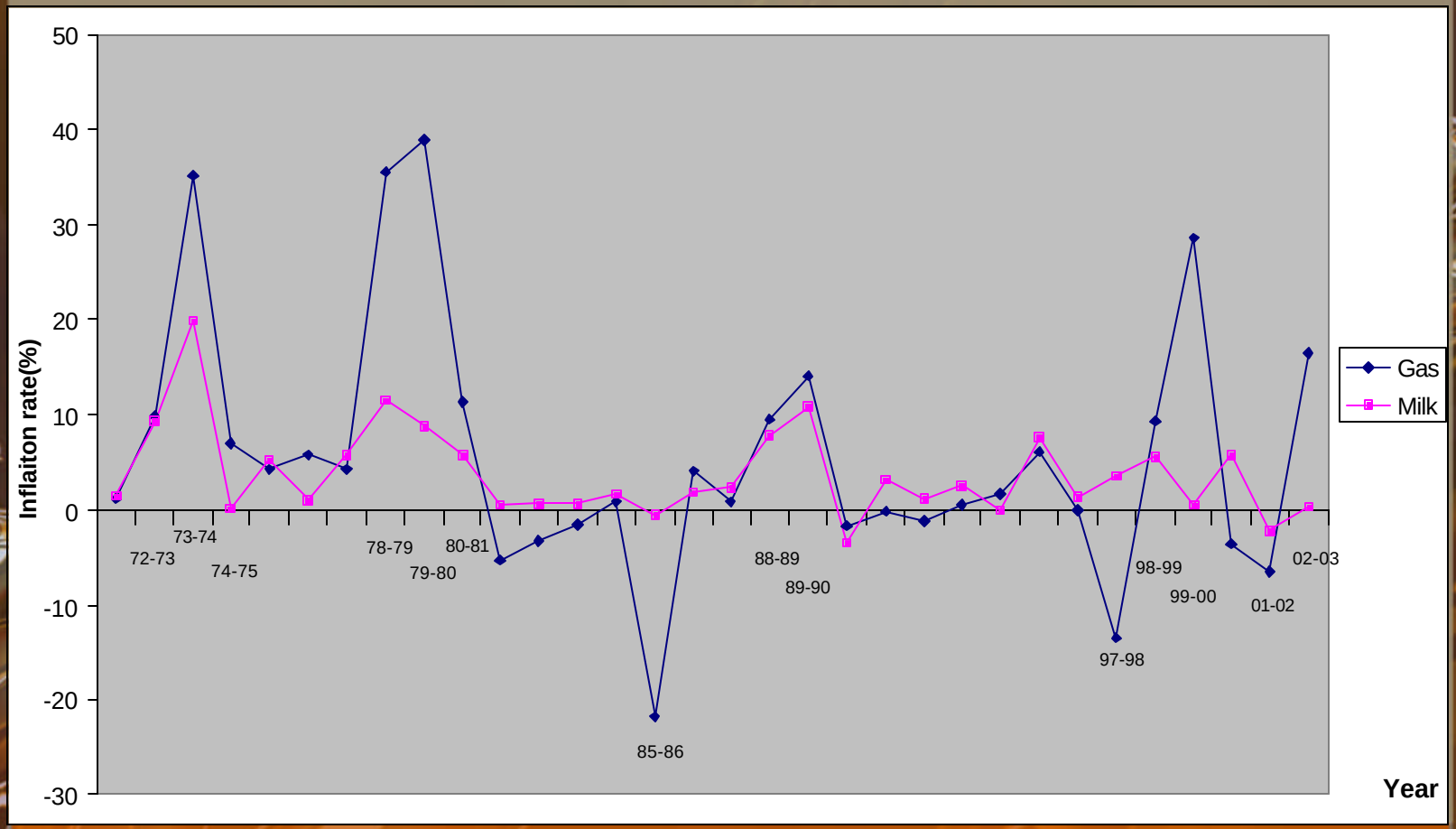
$$\overline{f} = \left[\frac{CPI_n}{CPI_0}\right]^{1/n} - 1$$

- **Gasoline** $\overline{f} = \left[\frac{135.1}{28.1}\right]^{1/32} - 1$ **= 5.03%**

- **Milk** $\overline{f} = \left[\frac{162.5}{51.4}\right]^{1/32} - 1$ **= 3.66%**

Specific Inflation Rate of Gasoline vs. Milk, 1971-2003

$$\overline{f} = \frac{CPI_n - CPI_{n-1}}{CPI_{n-1}}$$



The VMT Selection Model

- **Assumptions in this model**
  - Same revenue among three selected scenarios $390M @ 1st year [1]. Assuming that each system has 100% reliability for revenue collection.
  - The revenue for the following years will increase upon the fixed increase rate of vehicles @ 150k / year instantly at the beginning of each year
  - 3 million vehicles in Oregon @ 1st year [1]
  - Mileage fees are collected at 1.25 cent/mile [2]
  - MARR at 15%
  - The revenue will be collected at the end of each period for three scenarios.
  - Three scenarios have equal lifetime of 10 years.

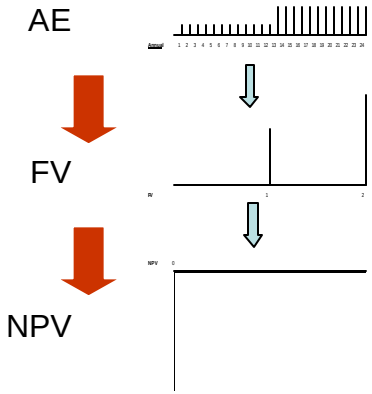
[1]: Bertini Robert L. et al, "Data transmission options for VMT data and fee collection centers", Portland State University and Oregon Department of Transportation, November 2002.
[2]: Whitty James, "Oregon DOT's Office of Innovative Partnerships & Alternative Funding: before the transportation research board's committee for the study of the long-term viability of fuel taxes for transportation finance", Oregon Department of Transportation, March 8, 2004. [Presentation file]

The VMT Selection Model

average miles / vehicle / day	28.49
Annual average travel-miles	10,400
Mileage fee (cents/mile)	1.25
MARR	15%
Average annual payment per vehicle	$130
Total car at year 1	3,000,000
Annual expected revenue from Road Users fee*	$390,000,000
# of vehicles increase each year	150,000

Three selected scenarios: tech, initial and annual cost

						^Initial investment breakdown*			Annual cost
Scenario*	Technology	Payment scheme	i	n	A	A	B	C	D
Actual VMT at pump	Odometer & RF-AVI	Weekly	0.29%	52	$2.50	525,000,000	70,000,000	840,000	49,050,000
Fee collection center (FCC)	GPS & RF-AVI	Monthly	1.25%	12	$10.83	1,500,000,000	9,000,000	840,000	49,050,000
DMV/Other public collection center	Odometer & RF-AVI	Yearly	15.00%	1	$130.00	450,000,000	680,000	840,000	49,050,000



2 steps of cash flow conversion from AE to FV and to NPV

NPV Results: Choose 1st scenario

*revenue increase by the assumption of 150,000 new vehicles annually purchased in Oregon

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Innitial investment^	Even periodic revenue for each scenario at year 1 to 10*									
	1	2	3	4	5	6	7	8	9	10
595,840,000	7,500,000	7,875,000	8,250,000	8,625,000	9,000,000	9,375,000	9,750,000	10,125,000	10,500,000	10,875,000
1,509,840,000	32,500,000	34,125,000	35,750,000	37,375,000	39,000,000	40,625,000	42,250,000	43,875,000	45,500,000	47,125,000
451,520,000	390,000,000	409,500,000	429,000,000	448,500,000	468,000,000	487,500,000	507,000,000	526,500,000	546,000,000	565,500,000

	FV at the end of each year										NPV
Revenue	$420,116,824	$441,122,665	$462,128,506	$483,134,347	$504,140,189	$525,146,030	$546,151,871	$567,157,712	$588,163,553	$609,169,395	**$1,623,126,733**
	$417,961,746	$438,859,833	$459,757,921	$480,656,008	$501,554,095	$522,452,183	$543,350,270	$564,248,357	$585,146,445	$606,044,532	**$696,481,292**
	$390,000,000	$409,500,000	$429,000,000	$448,500,000	$468,000,000	$487,500,000	$507,000,000	$526,500,000	$546,000,000	$565,500,000	**$1,590,728,966**
Annual cost	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	
	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	
	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	($49,050,000)	
Road maintenance cost	**This model would be more completed if the annual costs of road maintenance in Oregon are included in this model.**										

Recommendation & Conclusion

- Raising tax or a different method to generate tax revenue
- Researching and considering the potential future negative impacts to the overall economy and end consumers
- Invest in new alternative energy / fuel
- More fuel efficient vehicles standards
- Prepare / educate consumers

References

[1]. American Road & Transportation Builders Association

[2]. American Petroleum Institute

[3]. Office of Oil and Gas Energy Information Administration U.S. Department of Energy

[4]. Bertini Robert L. et al, “Data transmission options for VMT data and fee collection centers”, Portland State University and Oregon Department of Transportation, November 2002.

[5]. Oregon Department of Transportation, March 8, 2004.

Question??