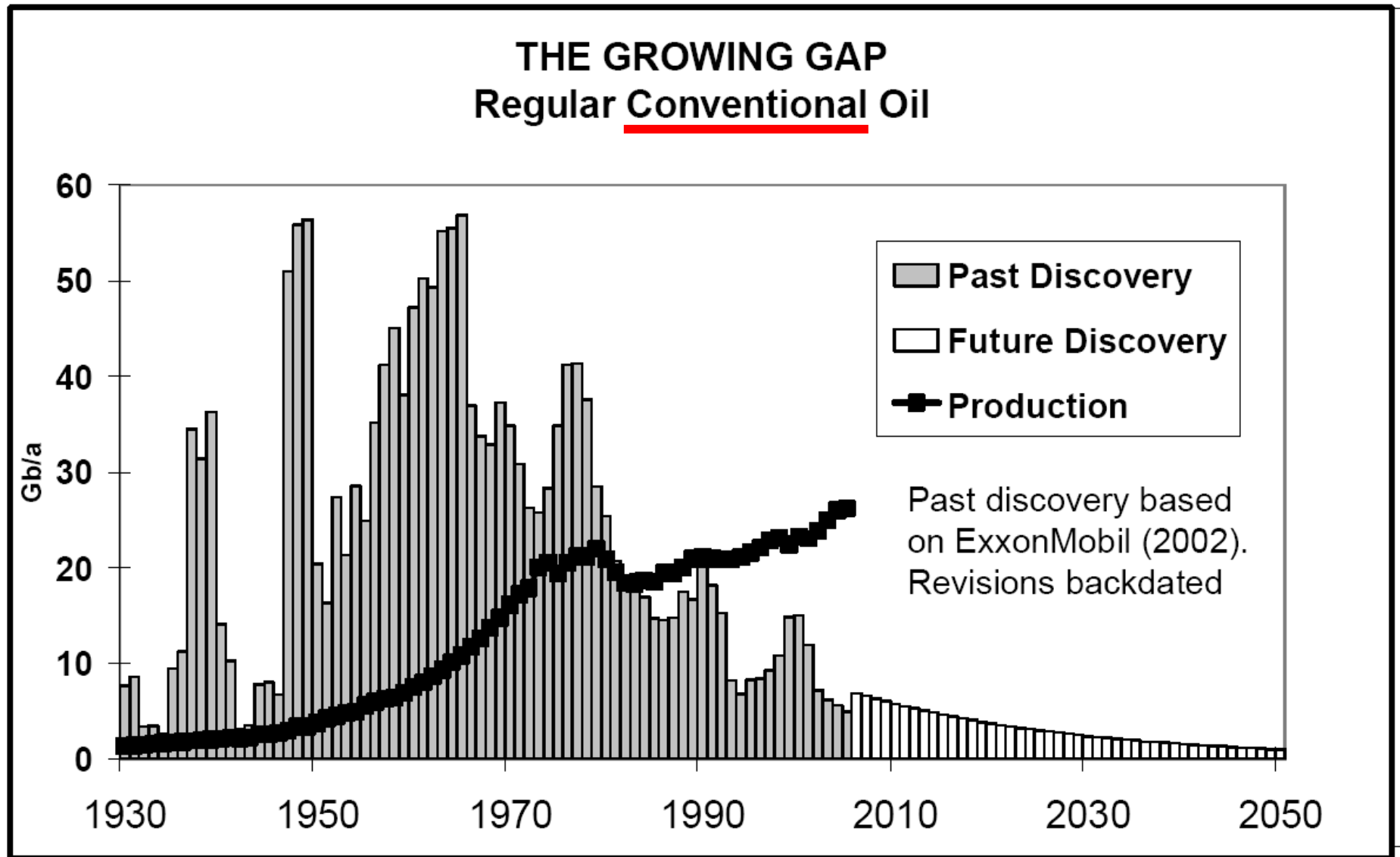


# Alternative Fuels

Prepared by Mike LaBonte  
for the Haverhill, MA City Council  
29 June 2006

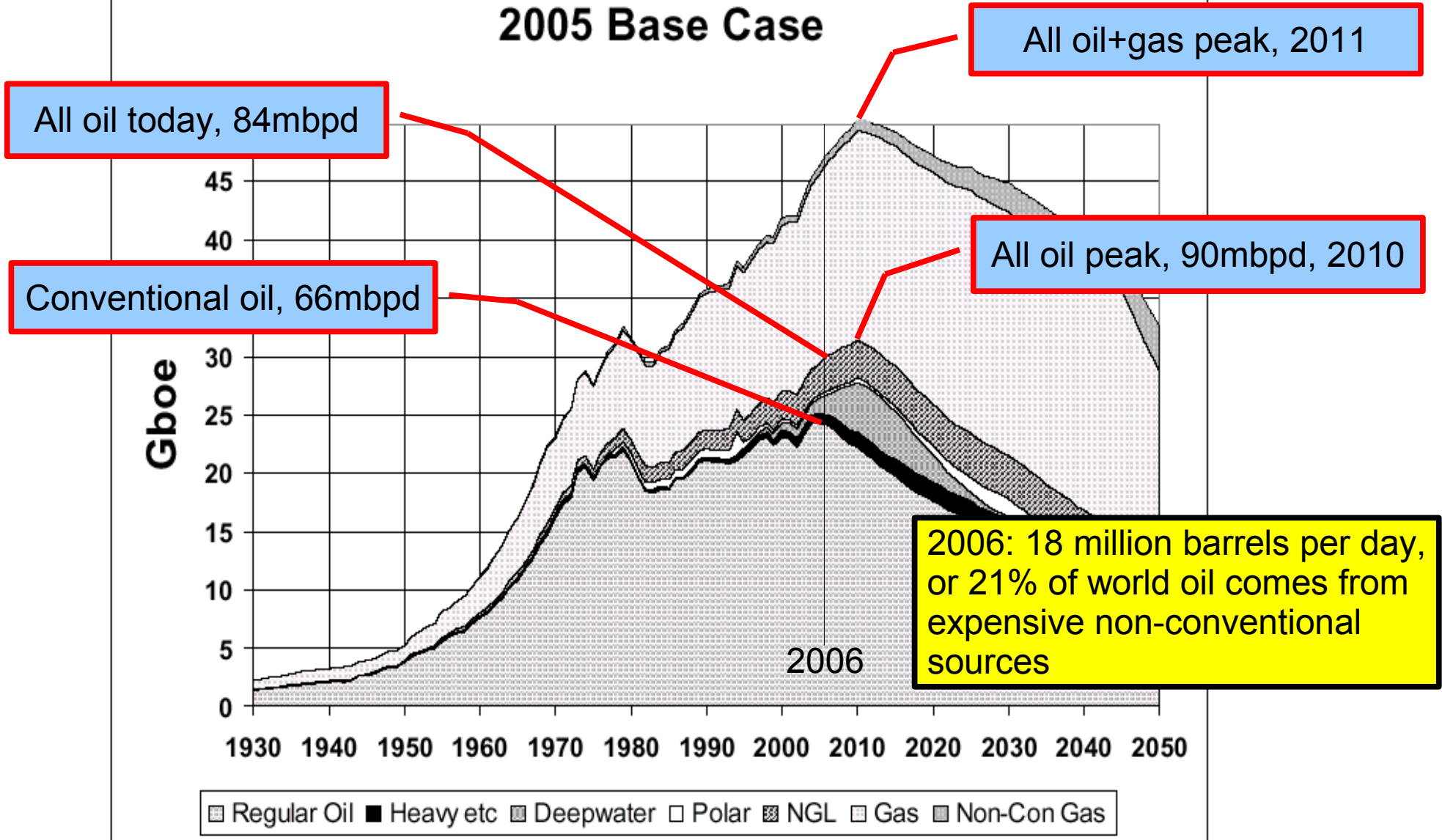
# Why We Need Alternative Fuels



Source: ASPO Ireland Newsletter, May 2006, <http://www.peakoil.ie>  
ASPO: Association for the Study of Peak Oil

# The General Depletion Picture

## OIL & GAS PRODUCTION PROFILES 2005 Base Case



# Vehicle Fuel Properties

	Gasoline	No. 2 Diesel	Biodiesel (B20)	Compressed Natural Gas CNG	Electricity	Ethanol (E85)	Hydrogen
<b>Energy Content per Gallon</b>	109,000 - 125,000 Btu	128,000 - 130,000 Btu	117,000 - 120,000 Btu (compared to diesel #2)	33,000 - 38,000 Btu @ 3000 psi; 38,000 - 44,000 @ 3600 psi	N/A	~ 80,000 Btu	Gas: ~6,500 Btu@3,000 psi; ~16,000 Btu@10,000 psi
<b>Energy Ratio Compared to Gasoline</b>			1.1 to 1 or 90% (relative to diesel)	3.94 to 1 or 25% at 3000 psi; 3.0 to 1 @ 3600 psi		1.42 to 1 or 70%	
<b>Fuel Availability</b>	Available at all fueling stations.	Available at select fueling stations.	Available in bulk from an increasing number of suppliers. There are 22 states that have some biodiesel stations available to the public.	More than 1,100 CNG stations can be found across the country. California has the highest concentration of CNG stations. Home fueling will be available in 2003.	Most homes, government facilities, fleet garages, and businesses have adequate electrical capacity for charging, but, special hookup or upgrades may be required. More than 600 electric charging stations are available in California and Arizona.	Most of the E-85 fueling stations are located in the Midwest, but in all, approximately 150 stations are available in 23 states.	There are only a small number of hydrogen stations across the country. Most are available for private use only.
<b>Safety Issues (Without exception, all alternative fuel vehicles must meet today's OEM Safety Standards)</b>	Gasoline is a relatively safe fuel since people have learned to use it safely. Gasoline is not biodegradable though, so a spill could pollute soil and water.	Diesel is a relatively safe fuel since people have learned to use it safely. Diesel is not biodegradable though, so a spill could pollute soil and water.	Less toxic and more biodegradable than conventional fuel, can be transported, delivered, and stored using the same equipment as for diesel fuel.	Pressurized tanks have been designed to withstand severe impact, high external temperatures, and automotive environmental exposure.	OEM EVs meet all the same vehicle safety standards as conventional vehicles.	Ethanol can form an explosive vapor in fuel tanks. In accidents; however, ethanol is less dangerous than gasoline because its low evaporation speed keeps alcohol concentration in the air low and non explosive.	Hydrogen has an excellent industrial safety record; codes and standards for consumer vehicle use are under development.

# Ethanol Stations and Vehicles

## E85 Compatible

(5 million vehicles)



- DaimlerChrysler: Sebring, Caravan, Durango, Ram, Stratus
- Ford: Crown Victoria, F-150, Grand Marquis, Lincoln Town Car, Taurus
- GM: Avalanche, Impala, Monte Carlo, Silverado, Suburban, Tahoe, Sierra
- Nissan: Titan

Miles	Name	City	State	Type of Access
192	Vogelbilt Corporation	West Babylon	NY	PLANNED - not yet accessible
205	DSNY Manhattan - 12	New York	NY	Private - government only
207	DSNY Queens - 7	College Point	NY	Private - government only
208	DSNY Bronx - 6A	New York	NY	Private - government only
212	DSNY Queens - 5A	Masapeth	NY	Private - government only
222	DSNY Brooklyn - 11	Brooklyn	NY	Private - government only
229	DSNY Staten Island - 2	Staten Island	NY	Private - government only

# Natural Gas Stations and Vehicles



## CNG Compatible (130,000 vehicles)

- GM: Silverado, Sierra
- Honda: Civic GX
- Buses & Coaches

Miles	Name	City	State	Type of Access
16	AVSG -Tewksbury	Tewksbury	MA	Public - card key at all times
22	University of New Hampshire	Durham	NH	Private - government only
23	AVSG - Stoneham	Stoneham	MA	Public - card key at all times
26	AVSG - Lexington	Lexington	MA	Public - card key at all times
27	AVSG - Everett	Everett	MA	Public - card key at all times
29	AVSG - Logan International Airport	East Boston	MA	Public - card key at all times
33	AVSG - Newton	Newton	MA	Public - card key at all times

# Biodiesel Stations and Vehicles



## B20 Compatible

- Most existing diesel vehicles

## B100 Compatible

- Some vehicles need a few modifications eg. New fuel filter

Miles	Name	City	State	Type of Access
23	Pease Air National Guard Base	Pease ANGB	NH	Private - government only
27	Dennis K. Burke, Incorporated	Chelsea	MA	Public - credit card after hours
42	Rymes Propane & Oil – Speedway	Loudon	NH	Public - see hours
45	Rymes Propane & Oil - Greenfield	Greenfield	NH	Public - credit card at all times
49	Rymes Propane & Oil - Peterborough	Peterborough	NH	Public - credit card at all times
51	Rymes Propane & Oil - Antrim	Antrim	NH	Public - see hours
51	Solar Market	Arundel	ME	Public - see hours
67	City of Keene	Keene	NH	Private - government only

# New England and National Fuel Price Changes (Feb 2006)

Fuel	NE Sep 2005	NE Feb 2006	NE Change	Nat Sep 2005	Nat Feb 2006	Nat Change
Gasoline	\$3.03	\$2.26	-\$0.77	\$2.77	\$2.23	-\$0.54
E85	-	-	-	\$2.41	\$1.98	-\$0.43
Diesel	\$2.98	\$2.64	-\$0.34	\$2.81	\$2.56	-\$0.25
B20	\$2.93	\$2.80	-\$0.13	\$2.91	\$2.64	-\$0.27
B100	\$3.82	\$3.33	-\$0.49	\$3.40	\$3.24	-\$0.16
CNG	\$1.57	\$1.63	\$0.06	\$2.12	\$1.99	-\$0.13

- E85 \$1.89 in Midwest, \$2.77 on West Coast
- B20 price relatively stable in New England
- CNG Price in \$/gallon-gasoline-equivalent
- CNG relatively cheap in New England

# Ethanol Production Plants

- Lots of ethanol activity these days, but most of it is in the Midwest
- Proposed Fuel Ethanol Plant, Jasper County, IN:
  - Consumes 14.3 million bushels of corn, 210 million gallons of water per year, plus other chemicals
  - Produces 40 million gallons of ethanol, 128,600 tons of corn waste, 121,000 tons of CO<sub>2</sub> per year
- Masada Resource Group is building a waste-to-ethanol plant in Middletown, NY

# New England Interstate Water Pollution Control Commission

## HEALTH, ENVIRONMENTAL, AND ECONOMIC IMPACTS OF ADDING ETHANOL TO GASOLINE IN THE NORTHEAST STATES

Volume 3, JULY 2001

### MEETING INCREASED DEMAND

Because of trends that indicate a growth in the demand for ethanol as an alternative fuel and the potential for us resources are a feedstocks for the

**... 684 MILLION GALLONS PER YEAR WOULD BE NEEDED ...**

about 31 million gallons per year. **An estimated 684 million gallons per year would be needed in the region to meet the total demand for oxygenated fuel** (NESCAUM, 1999). However, the current U.S. production capacity of ethanol is not enough to meet the total demand for oxygenated fuels. Furthermore, **transporting ethanol to the Northeast from the midwest would significantly increase its costs** (Womach, 2000).

Given these cost considerations, **regional biomass ethanol production would benefit the east and west coasts of the United States.** Demand could be met through the utilization of local feedstock and cellulosic feedstock technology, allowing non-corn producing areas of the country to produce ethanol for local use. **Biomass ethanol plants in the Northeast could utilize feedstocks such as forestry and municipal wastes to meet the regional demand.** In New York, plans are underway for the development of a facility to produce ethanol from (Womach, 2000). Increased demand could (Womach, 2000).

**... REGIONAL BIOMASS ETHANOL PRODUCTION ...**

# E85 Ethanol Costs

- Energy: 1.483 gal. of E85 = 1 gal. gasoline
- Estimated cost of ethanol with subsidies, April 25, 2006:

**\$2.75 Price at the pump**

**\$0.51 Federal subsidies to ethanol plants.**

**\$0.18 Federal corn subsidy**

**–\$0.13 state & federal excise tax bias against ethanol**

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**\$3.31 Total cost of 1 gallon ethanol**

**\$4.91 Total cost of 1.483 gallons ethanol (1 gal. Gasoline equiv.)**

# Ethanol Price News

Increased demand from oil refiners raising ethanol prices to record high

Bloomberg News

Published June 24, 2006

U.S. ethanol prices extended a surge to all-time highs this week as fuel companies increased use of the grain-based additive in gasoline.

Oil refiners and fuel blenders this year shifted to making reformulated gasoline with ethanol after dropping an additive known as MTBE. Ethanol prices are highest in reformulated markets in the Northeast and South, partly because of long distances to ship the fuel, most of which is made in the Midwest.

"You've got a significant amount of demand [for ethanol] that has moved into the market over the last couple of months," said Chad Martin, a broker with FCStone Group Inc. in Des Moines. "The market looks to be tight for the next several months with this phaseout" of MTBE.

**U.S. ethanol averaged \$3.6714 a gallon** Friday, up 1.5 percent from a week ago, according to data compiled by Bloomberg.

That average, based on ethanol traded in Des Moines and almost 30 other Midwest locations, was up from \$1.4876 a year earlier. It's the highest since at least 1997, based on Bloomberg data.

The U.S. average has increased for 12 consecutive weeks and is up 54 percent since the end of March.

**... ethanol averaged \$3.6714 a gallon ...**

# Natural Gas

- Requires special vehicle, few available
- Low emissions
- Low operating cost, but some diesel buses cost less per mile than CNG buses
- Some CNG stations within reach

# Biodiesel

- B20 works in any diesel engine, some need modifications
- Significantly lower emissions
- Cleans the fuel system, may clog filters
- Torque, HP, and mileage similar to petro-diesel
- Affected slightly more by cold temperatures
- Can be stored up to 6 months, no tank changes required
- Supplier: Dennis K. Burke, Chelsea
  - B20 \$2.88/gal (1000 gallon delivery 19-may-2006)
  - B20 \$2.98/gal (1000 gallon delivery 26-jun-2006)
- Solar Market, Arundel ME
  - B100 \$4.27/gal (26-jun-2006)

# Recommendations

- B20 Biodiesel for our diesel truck fleet
- Conservation for gasoline vehicles
  - We are already using ethanol
  - Choose more efficient vehicles
- Preserve farmland
  - The future of energy is mostly solar
  - Fuel will be grown