

# Peak Oil:

and

## *The Community Response*



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- Evidence that have reached the peak of production
- The inadequacy of alternatives
- The process of adaptation

- Oil is a finite, non-renewable resource that is rapidly depleting.



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- Oil is THE transportation fuel used worldwide.



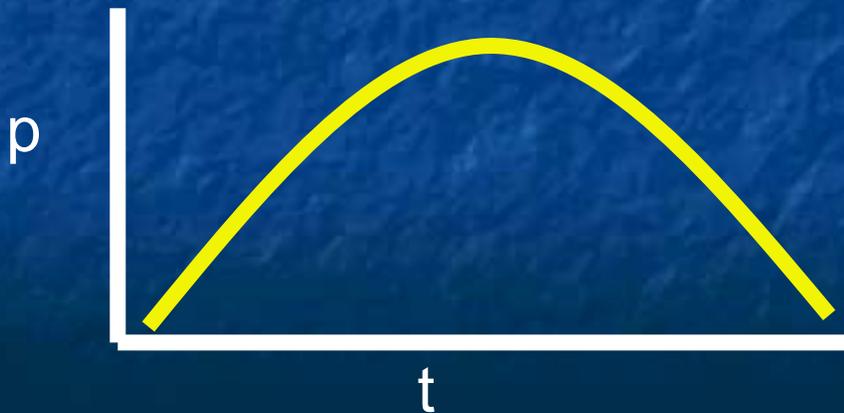
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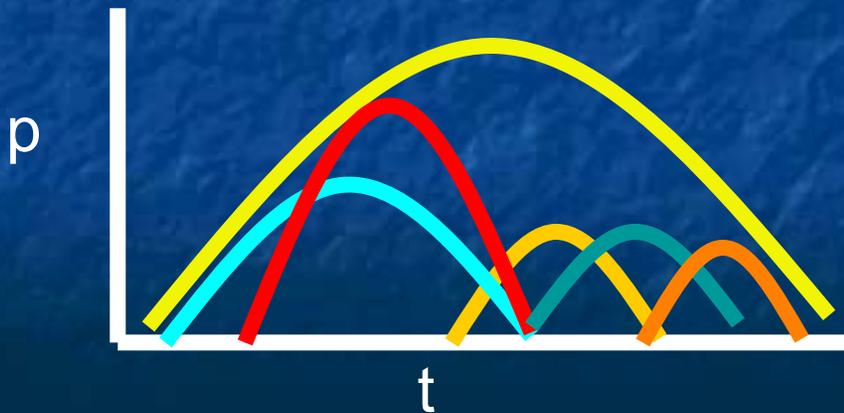
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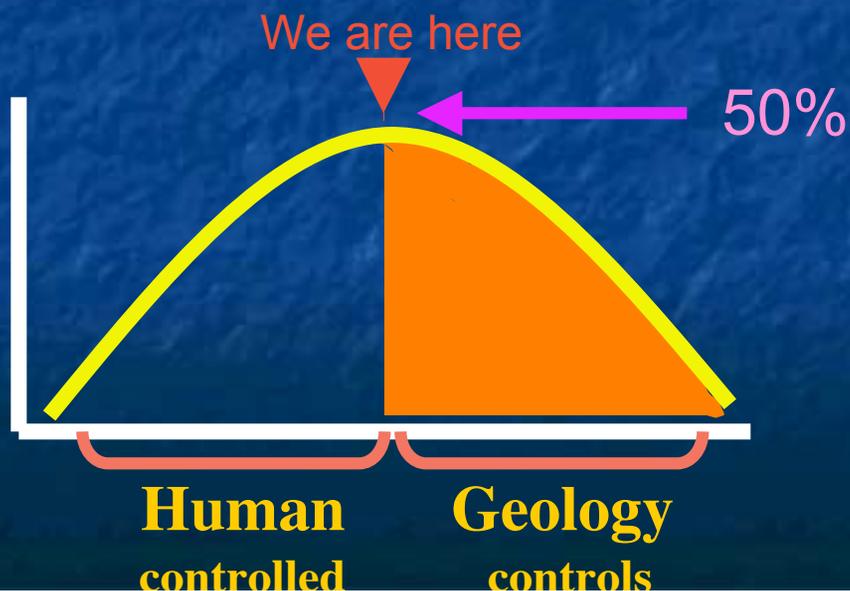
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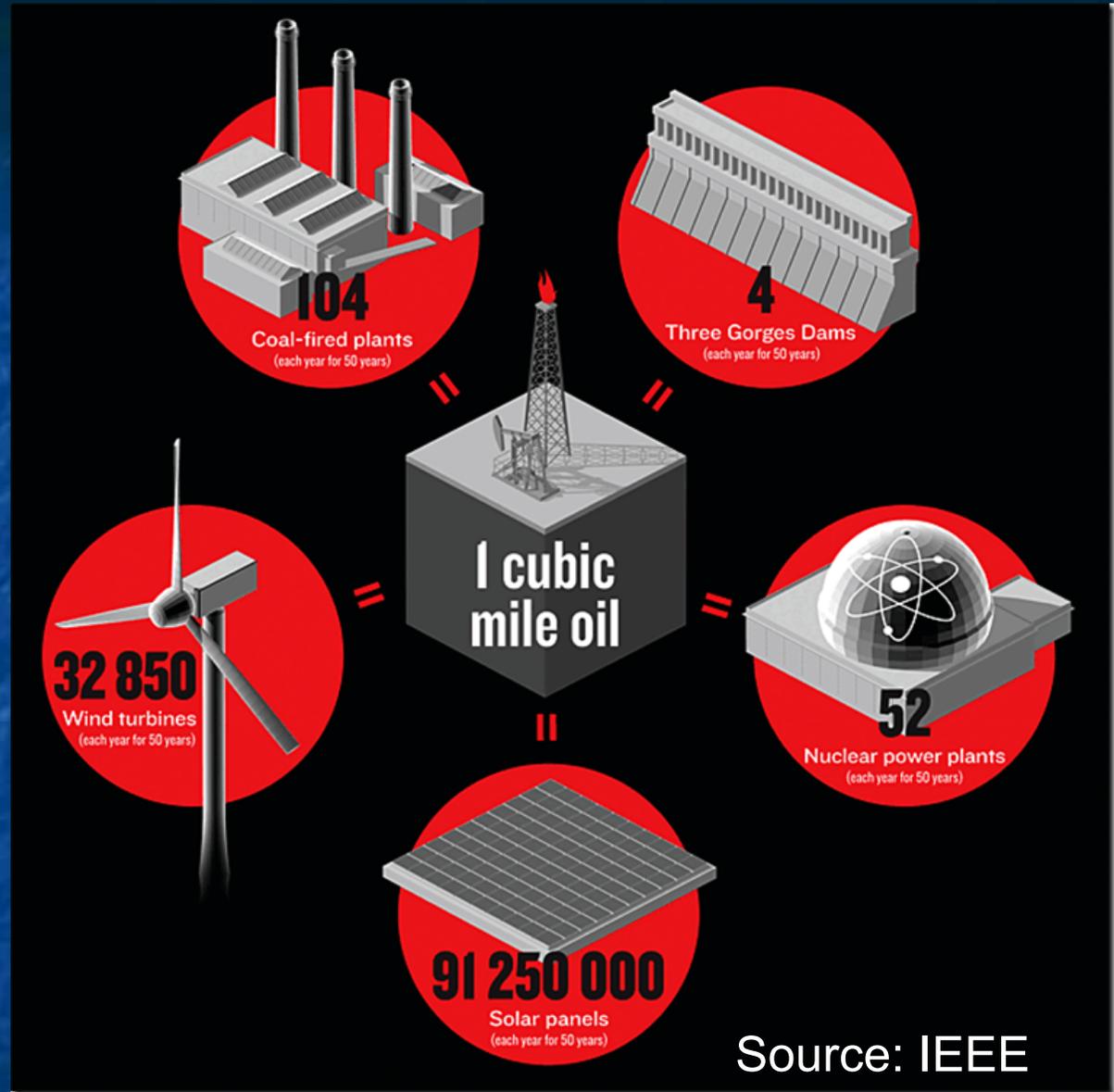
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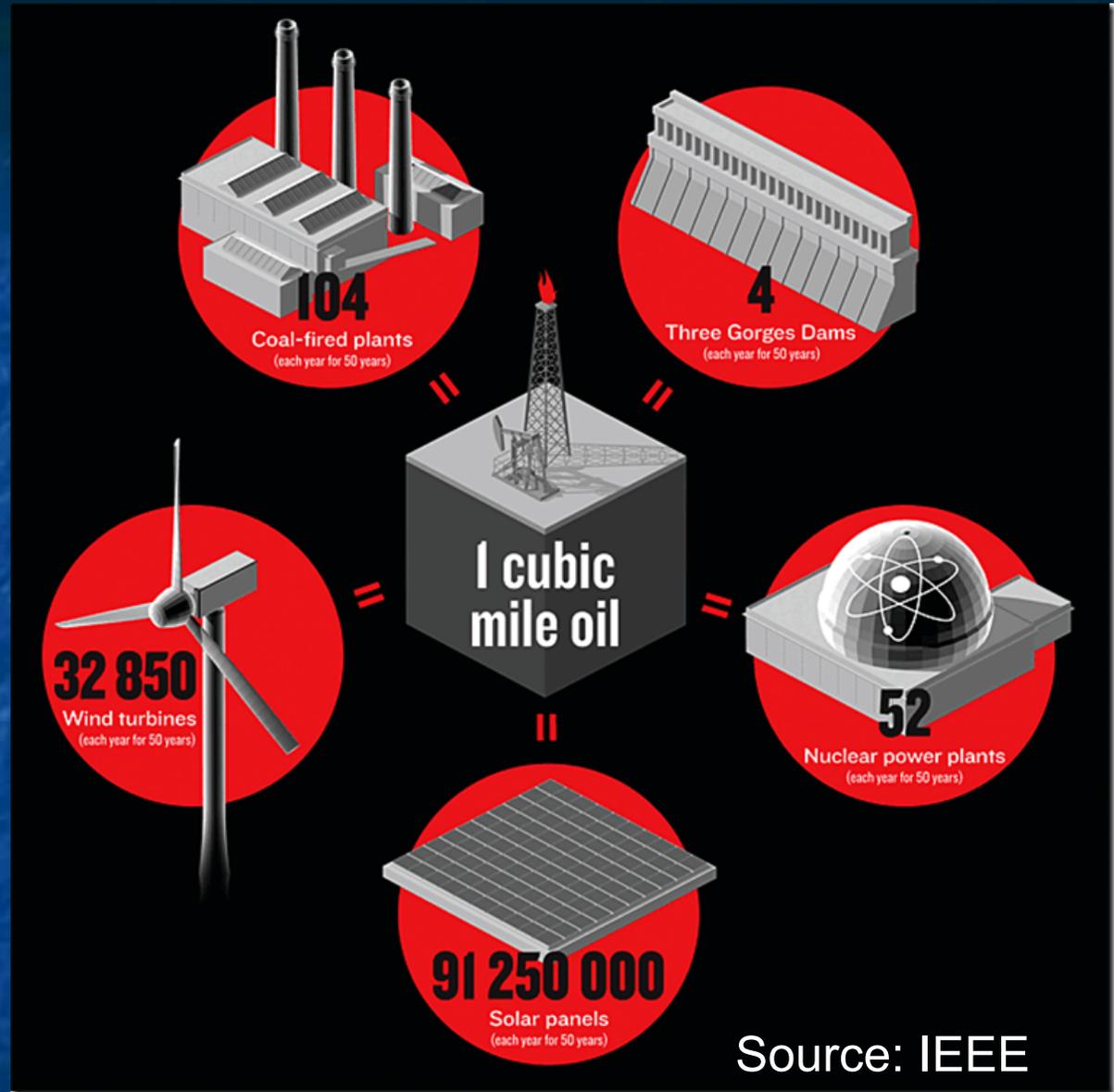
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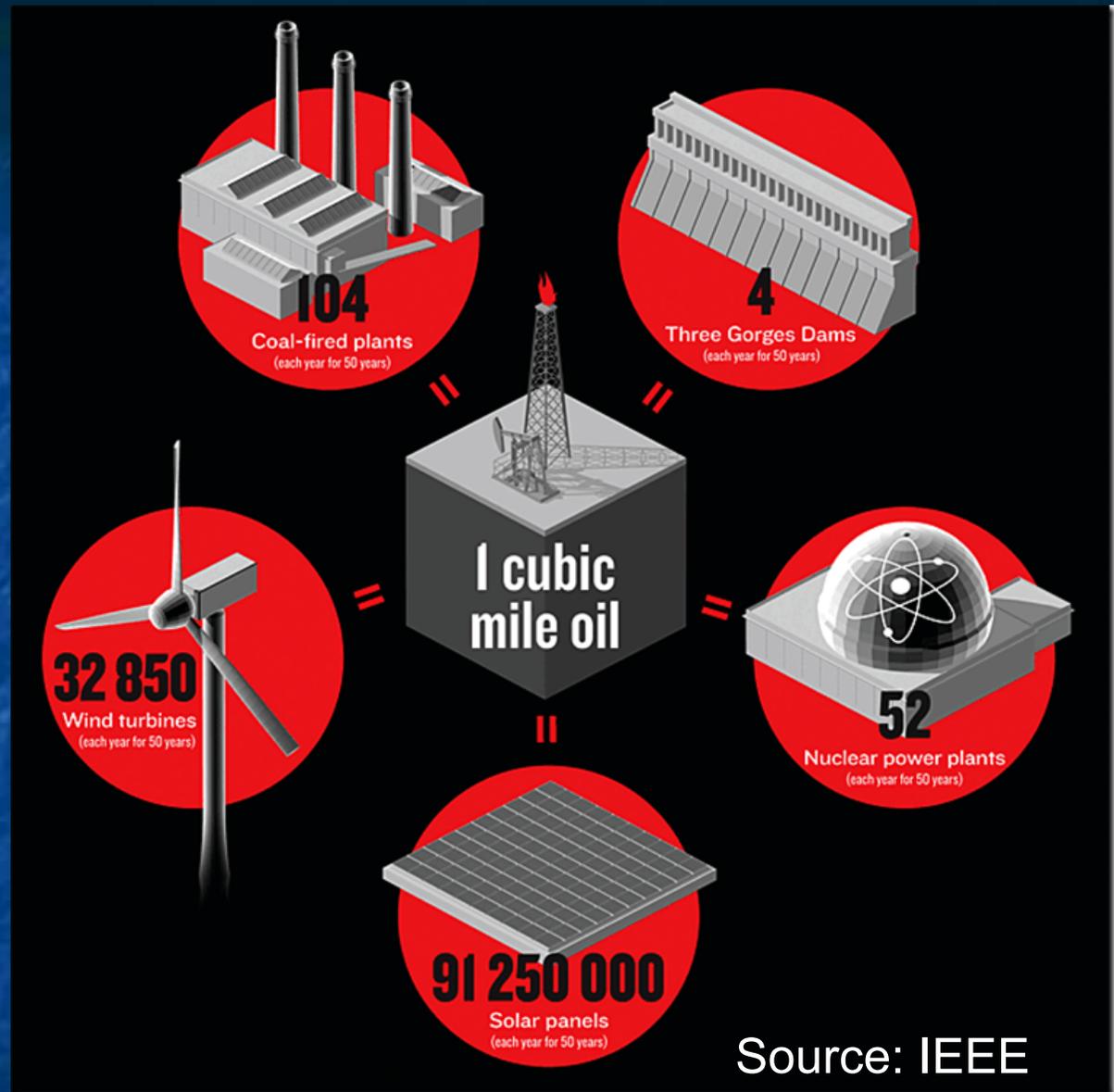
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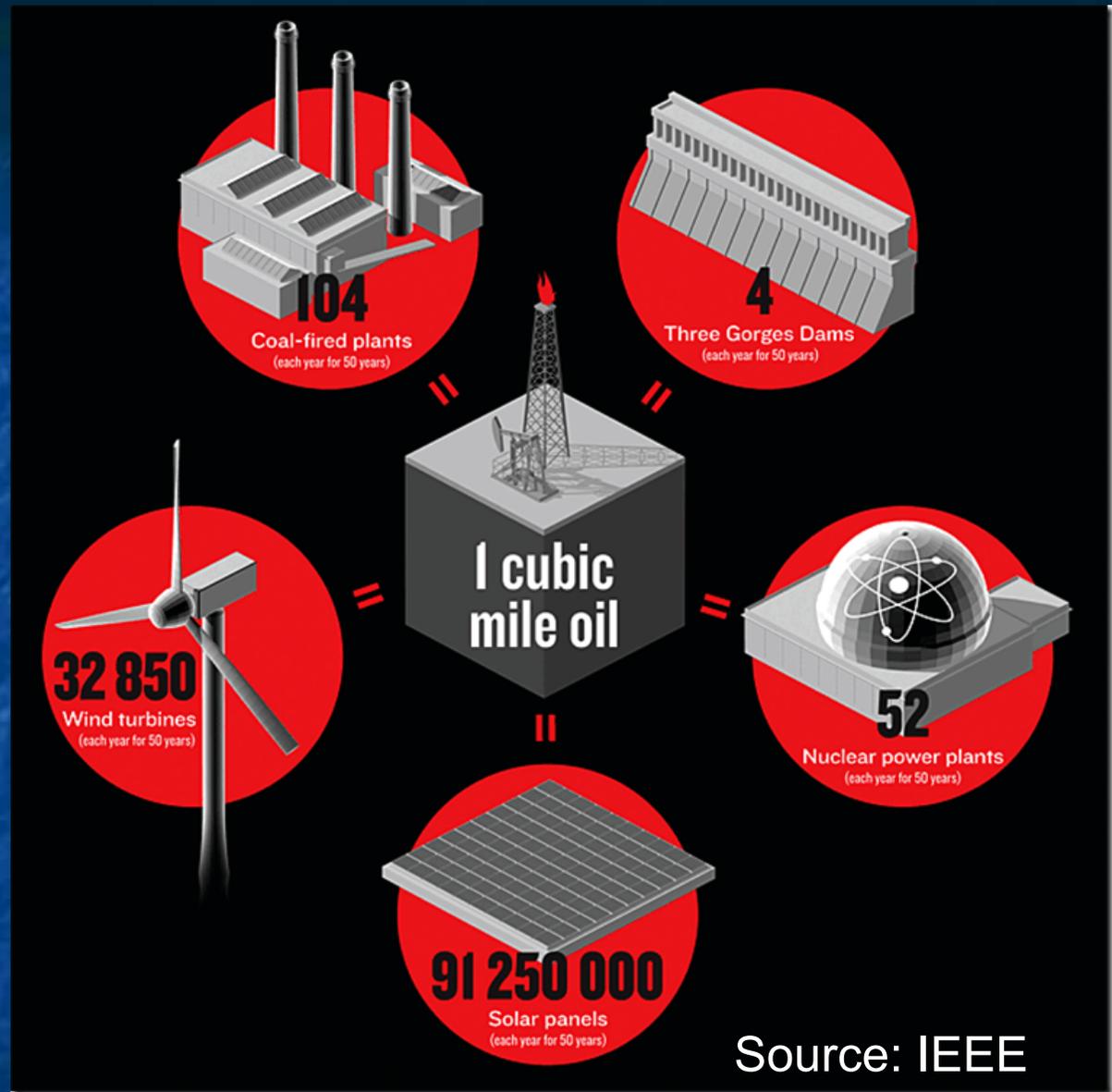


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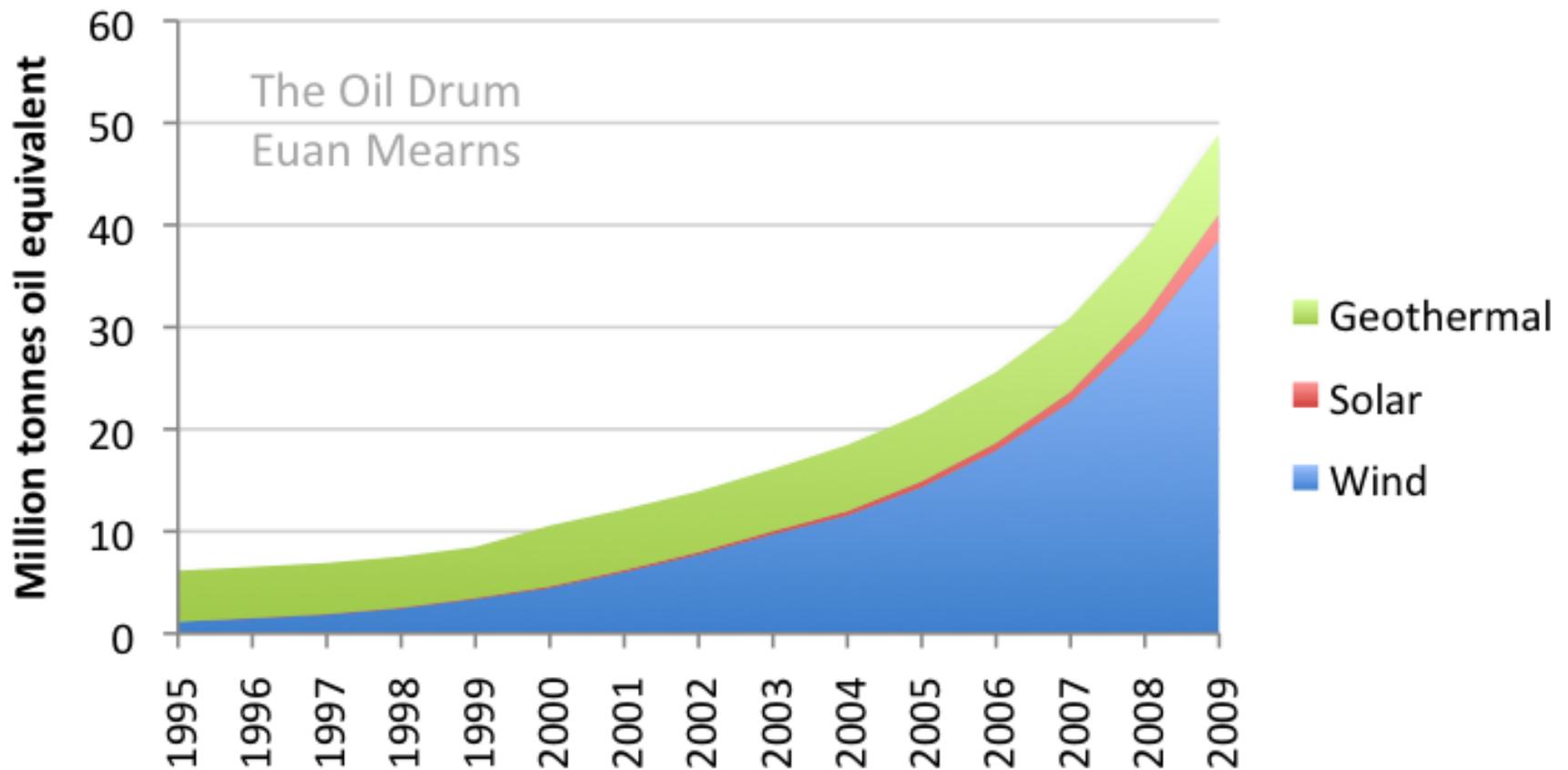


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Energy  
Return  
On  
Energy  
Invested = Energy Profit

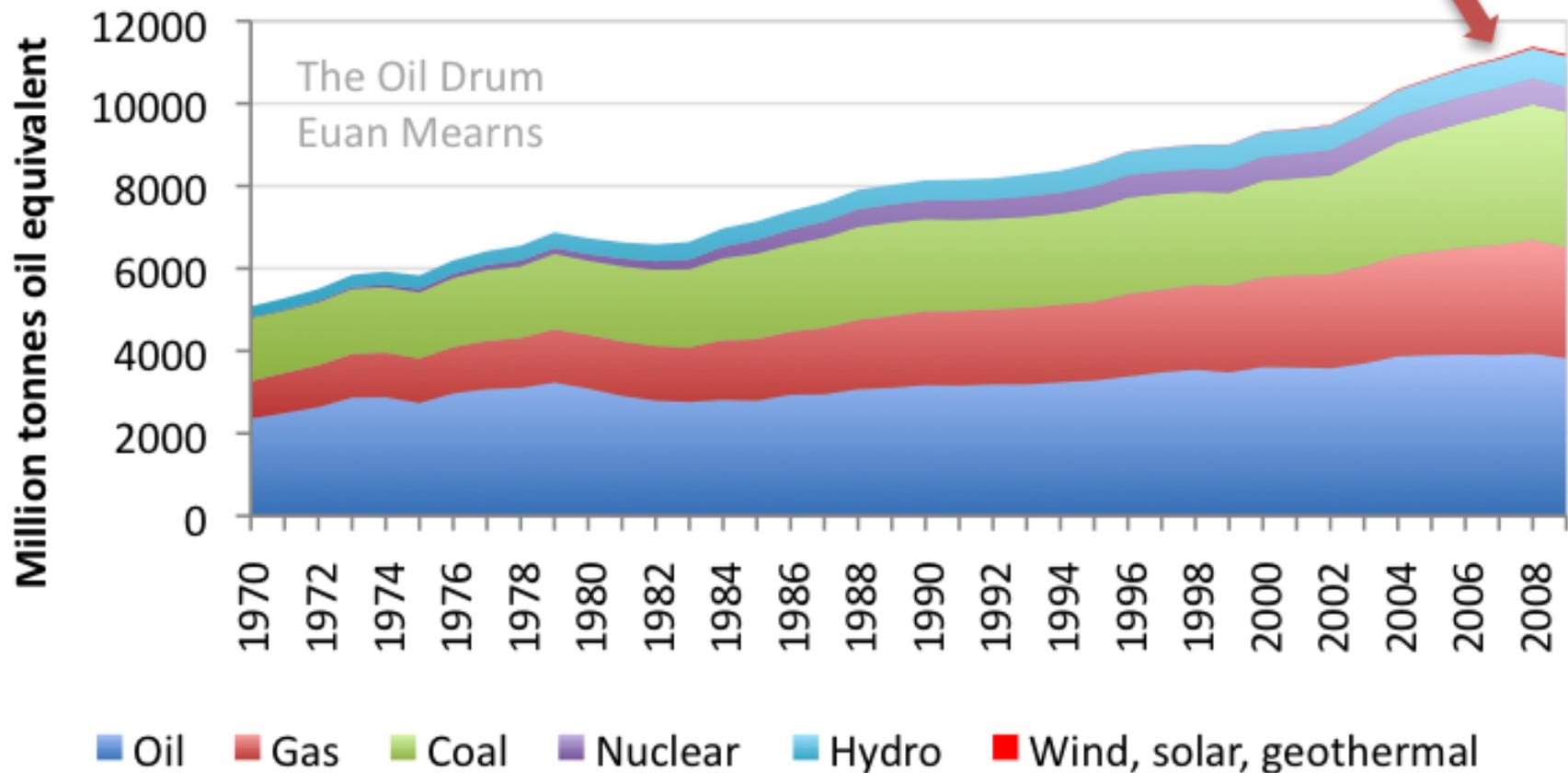


# World renewable energy production



The challenge of scale

# World primary energy production



The challenge of scale

## Energy Profit Ratio Values (EROEI)

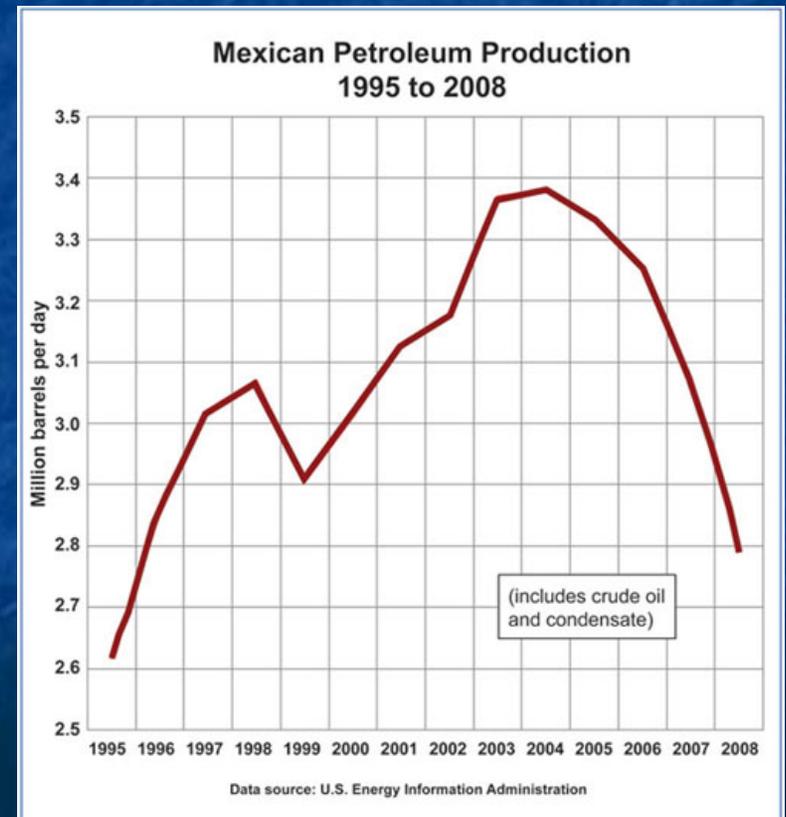
<u>Fuel Source</u>	<u>Energy Profit Ratio*</u>
1970 U.S. oil production	30
Today's U.S. oil production	15
Oil sands oil production	3
Corn ethanol	1-1.5
Hydrogen from Water	<<1

\*Source: Cutler Cleveland, Energy Analyst, Boston University

# Peak Oil

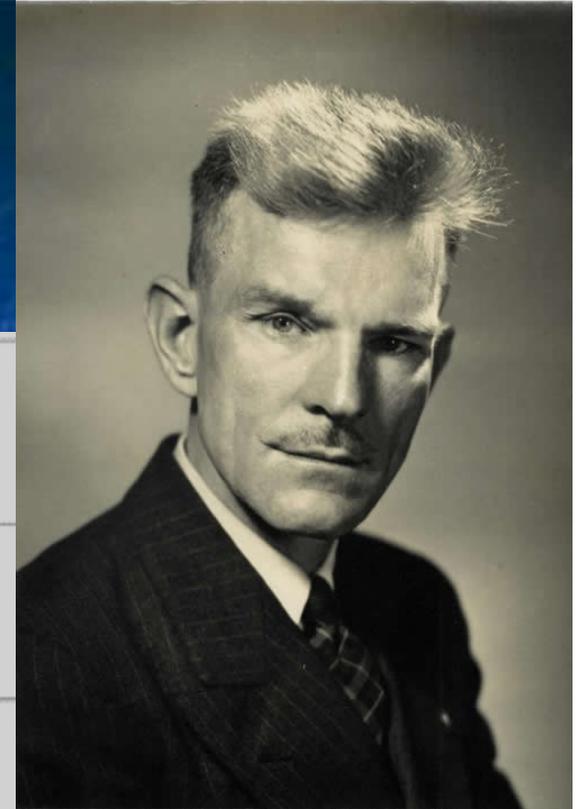
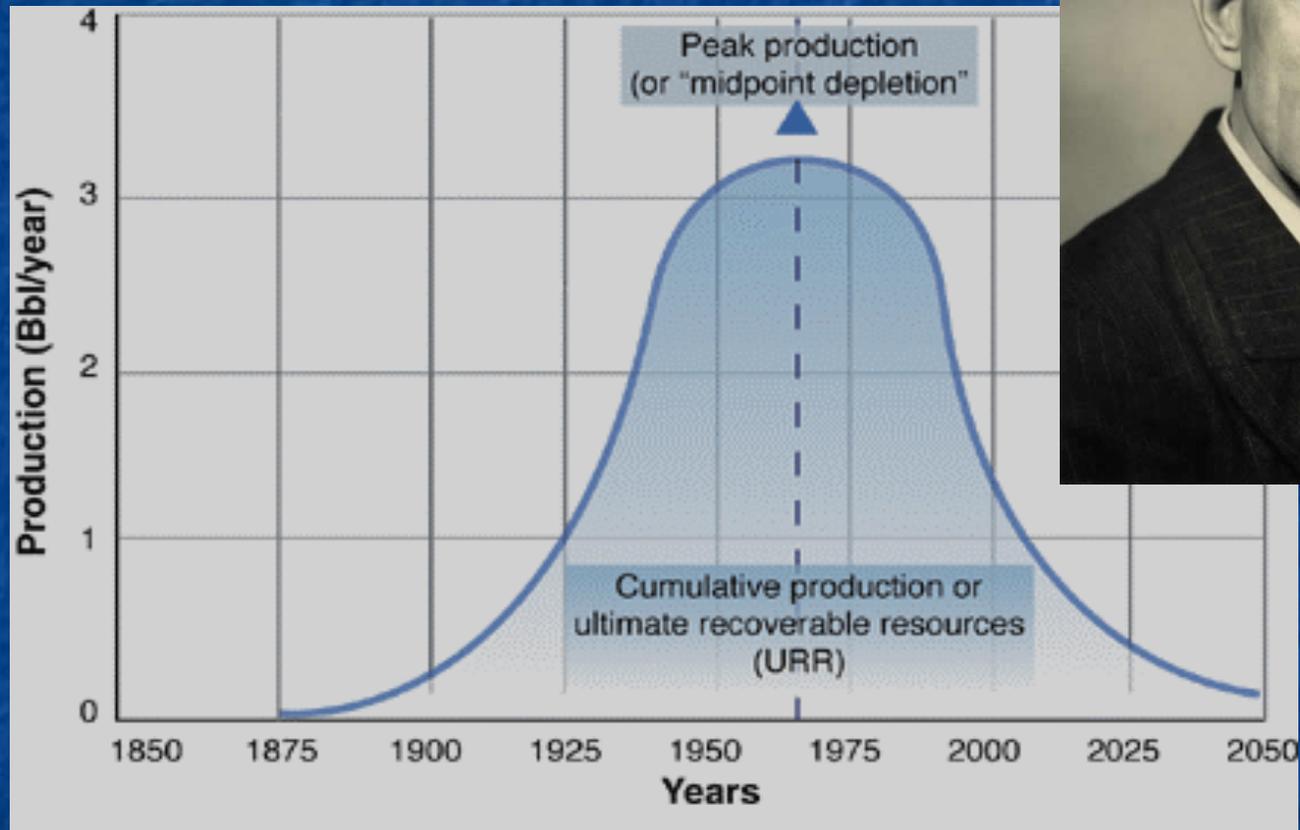
Or Hubbert's Curve

Is there a historical basis for anticipating the global peak?



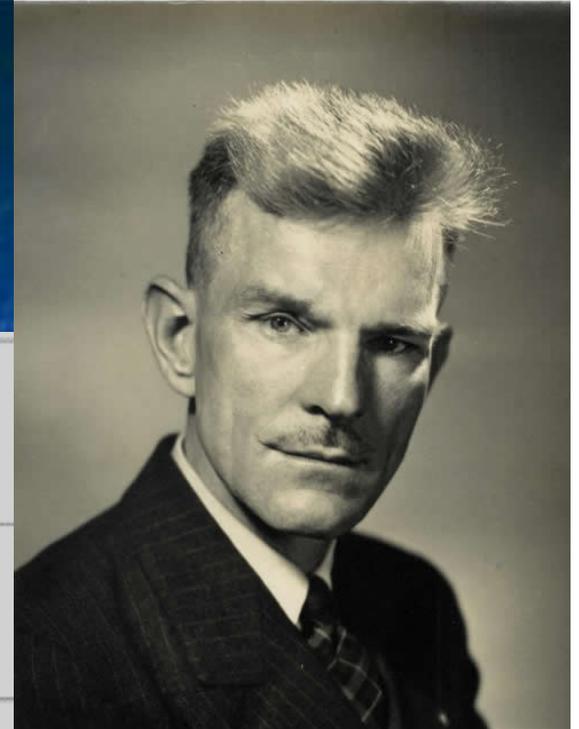
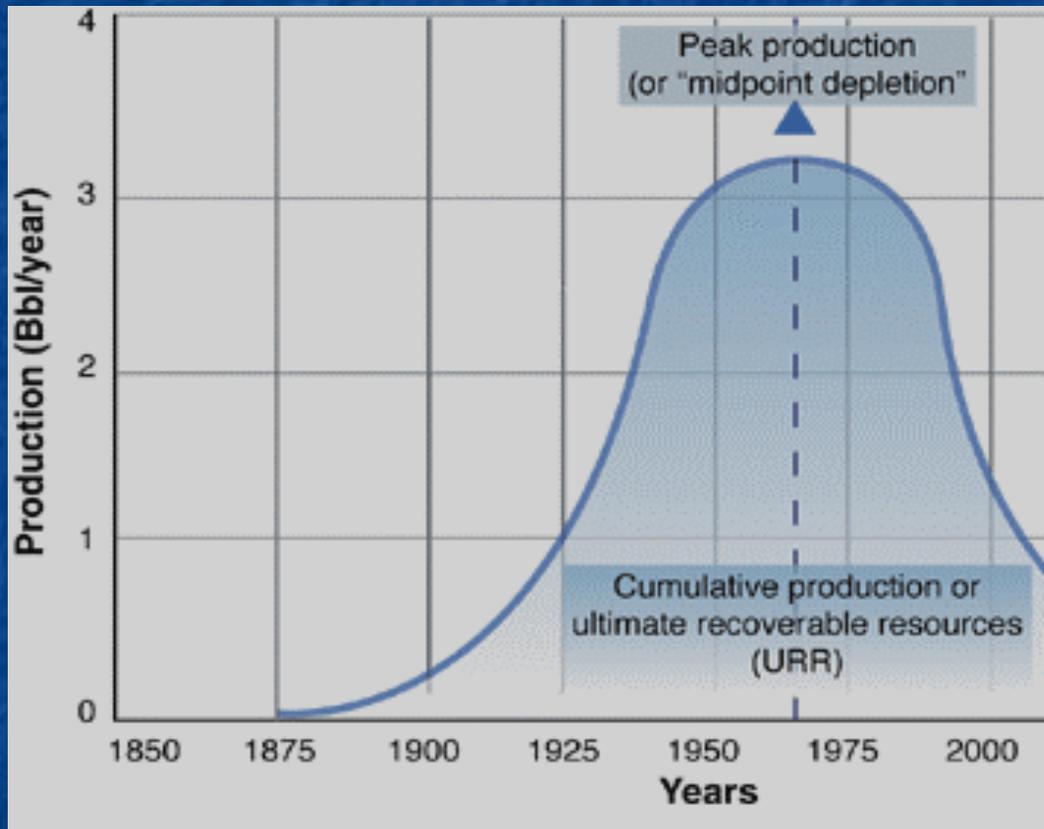
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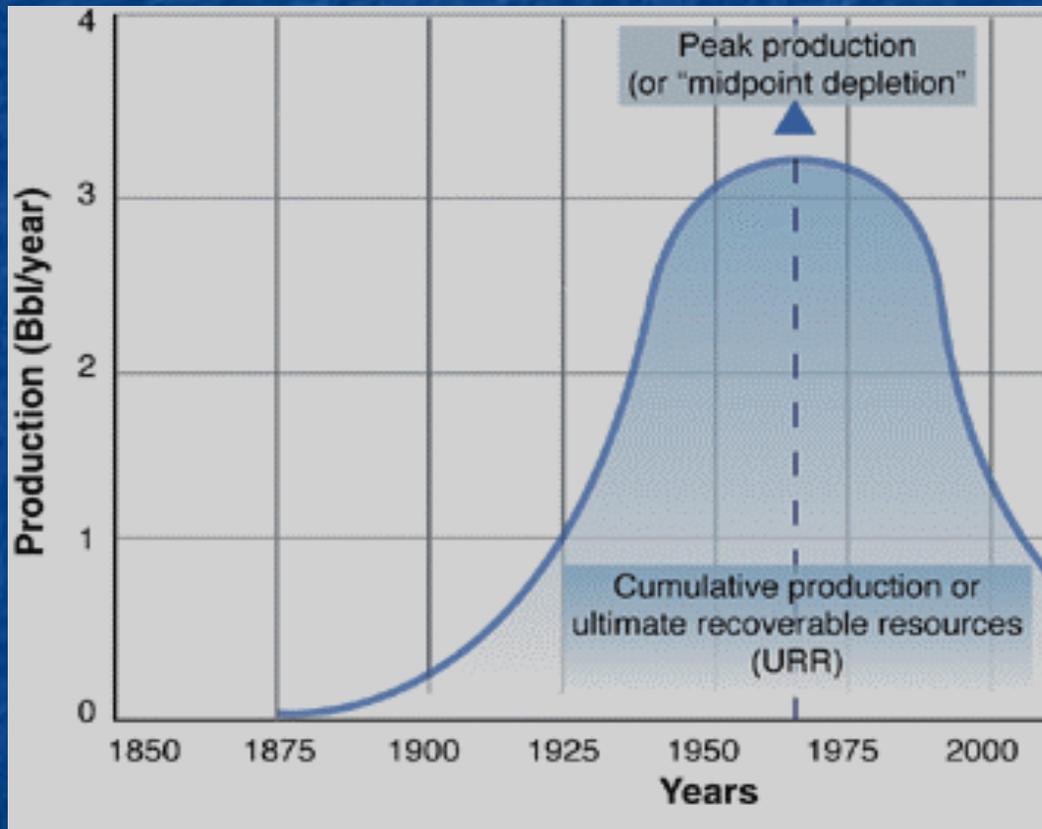
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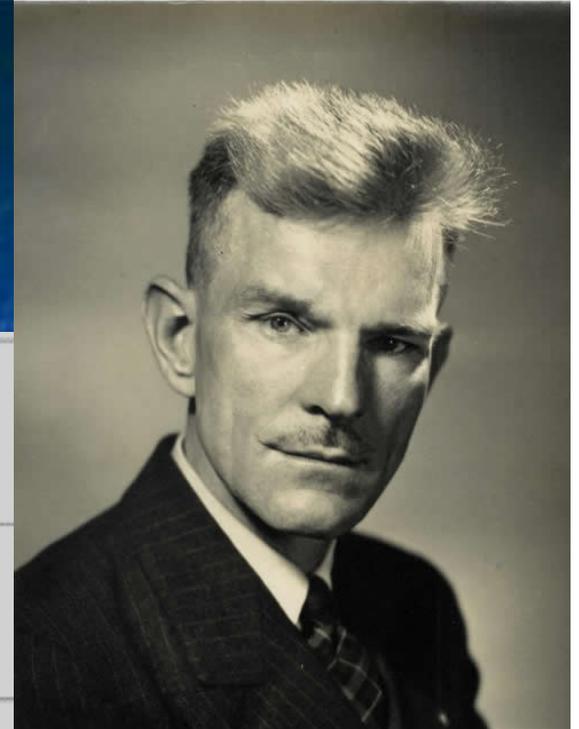


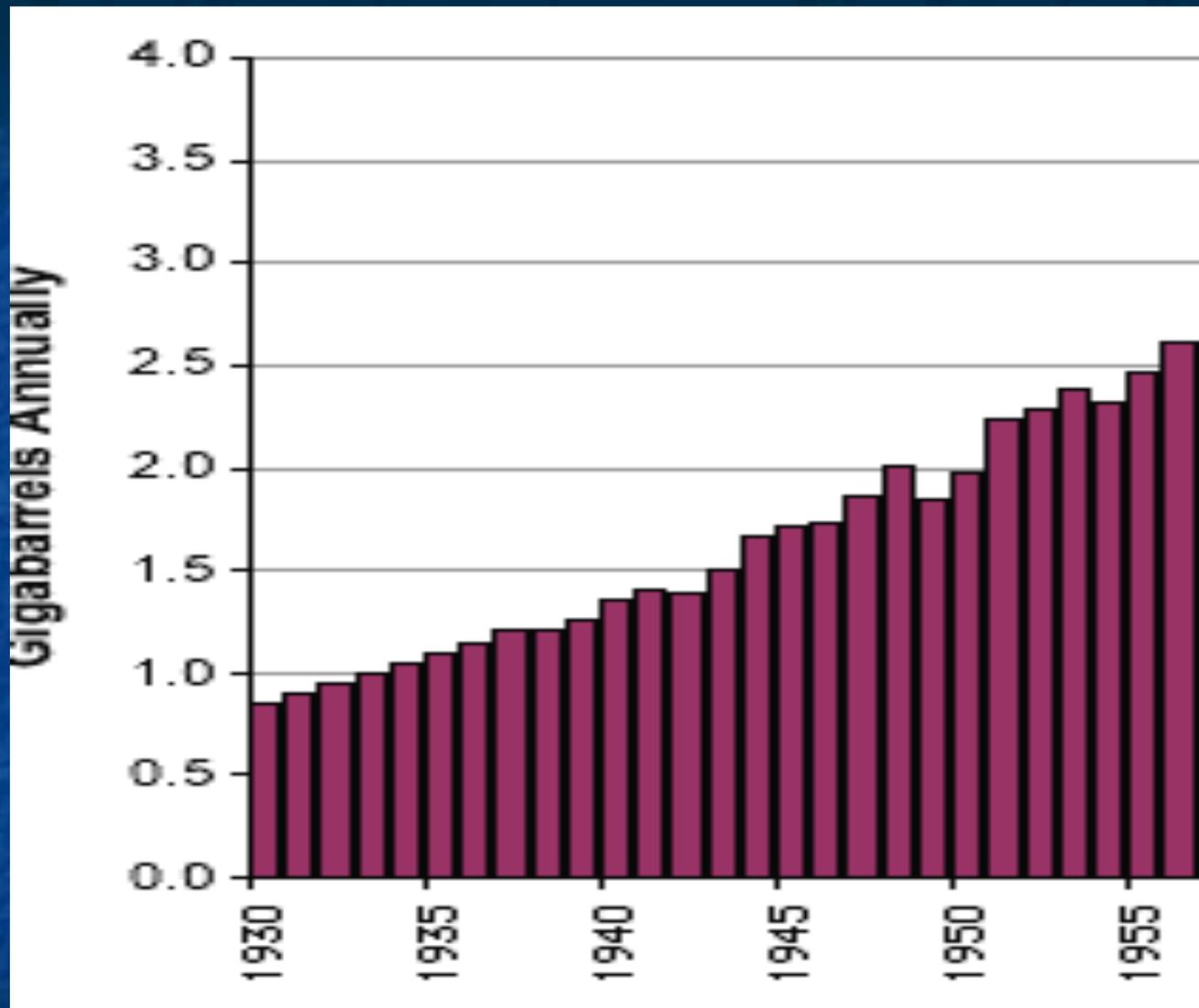
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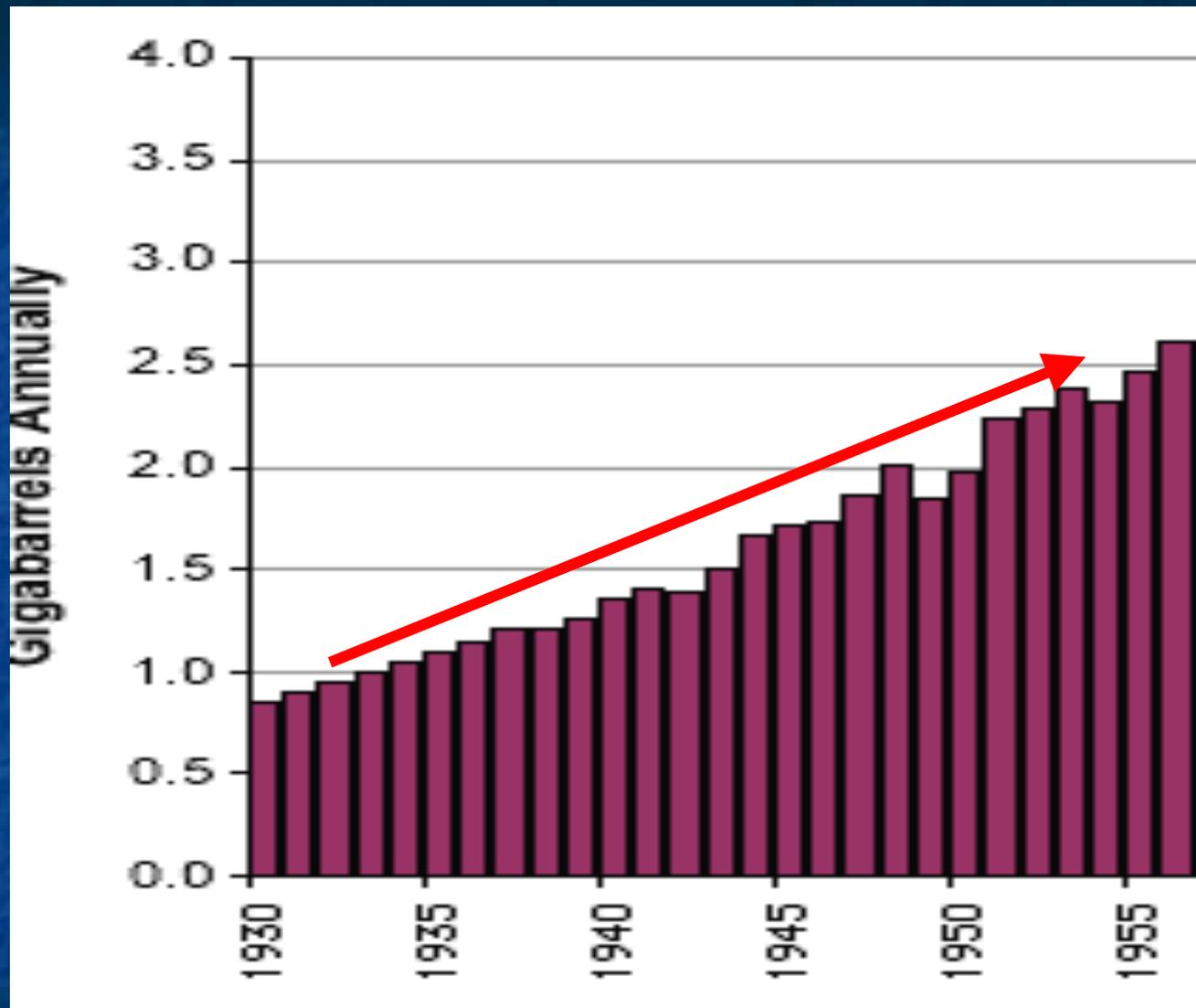


Founder: ASPO

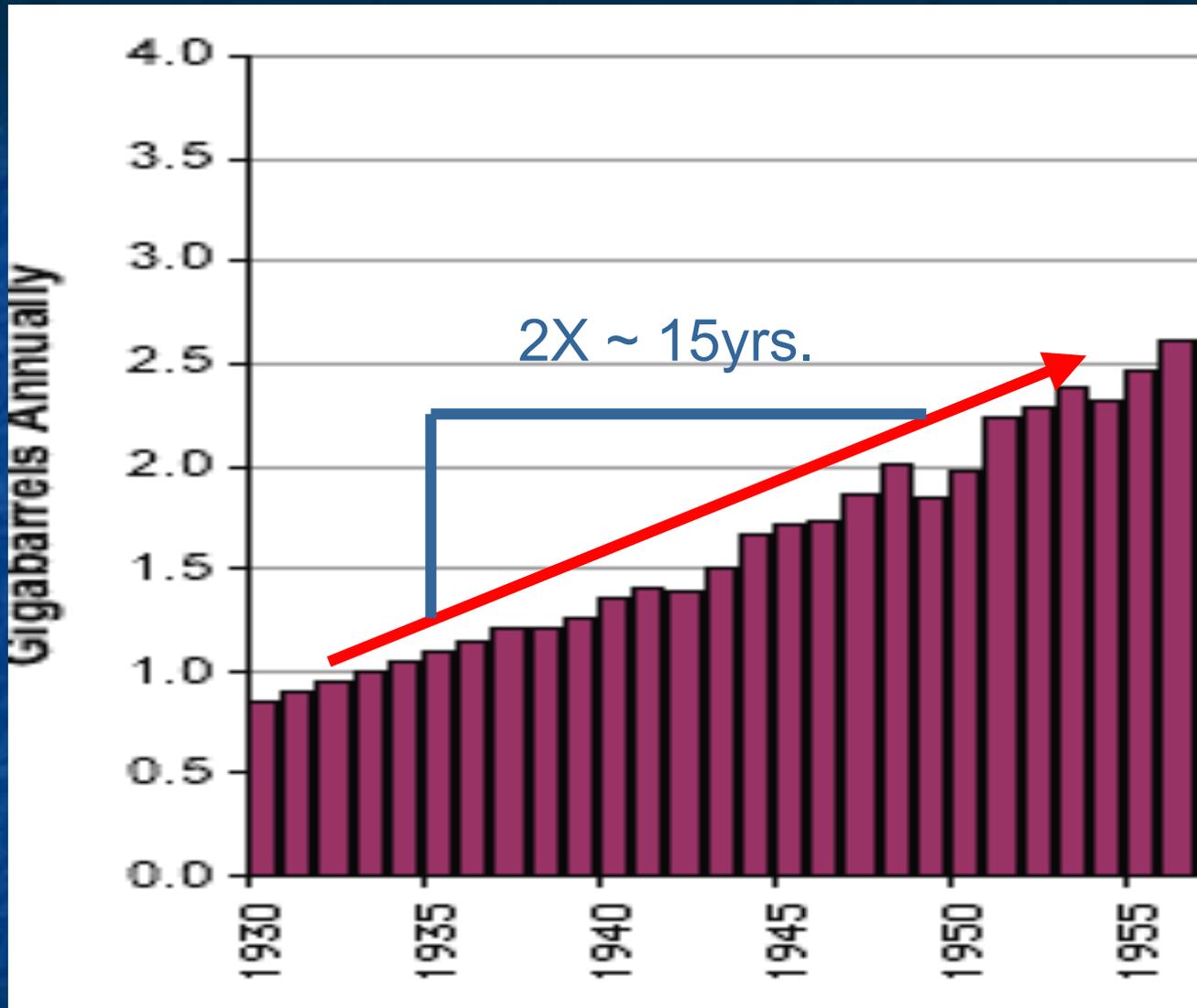




U.S. oil production 1930 - 1957



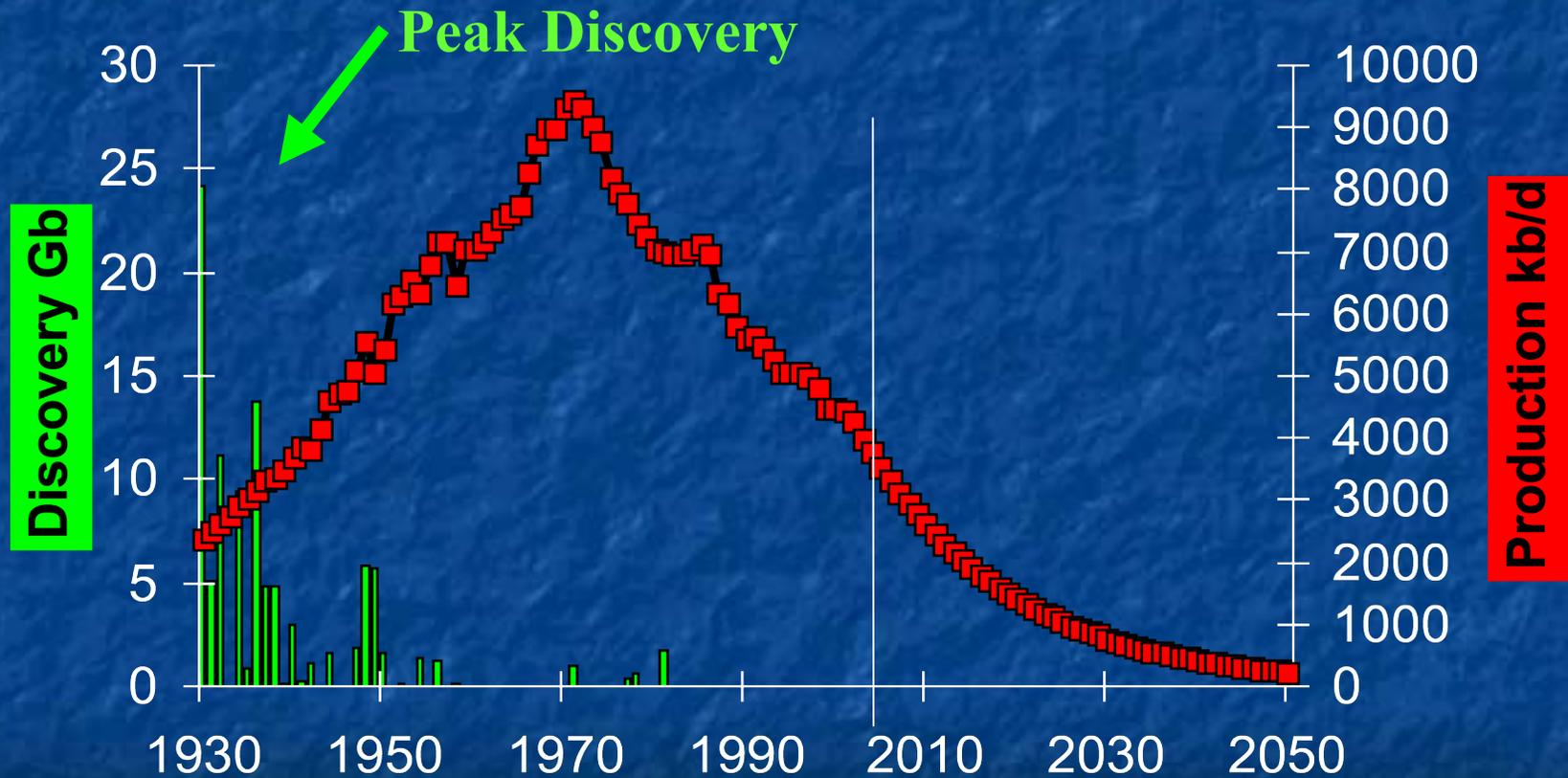
U.S. oil production 1930 - 1957



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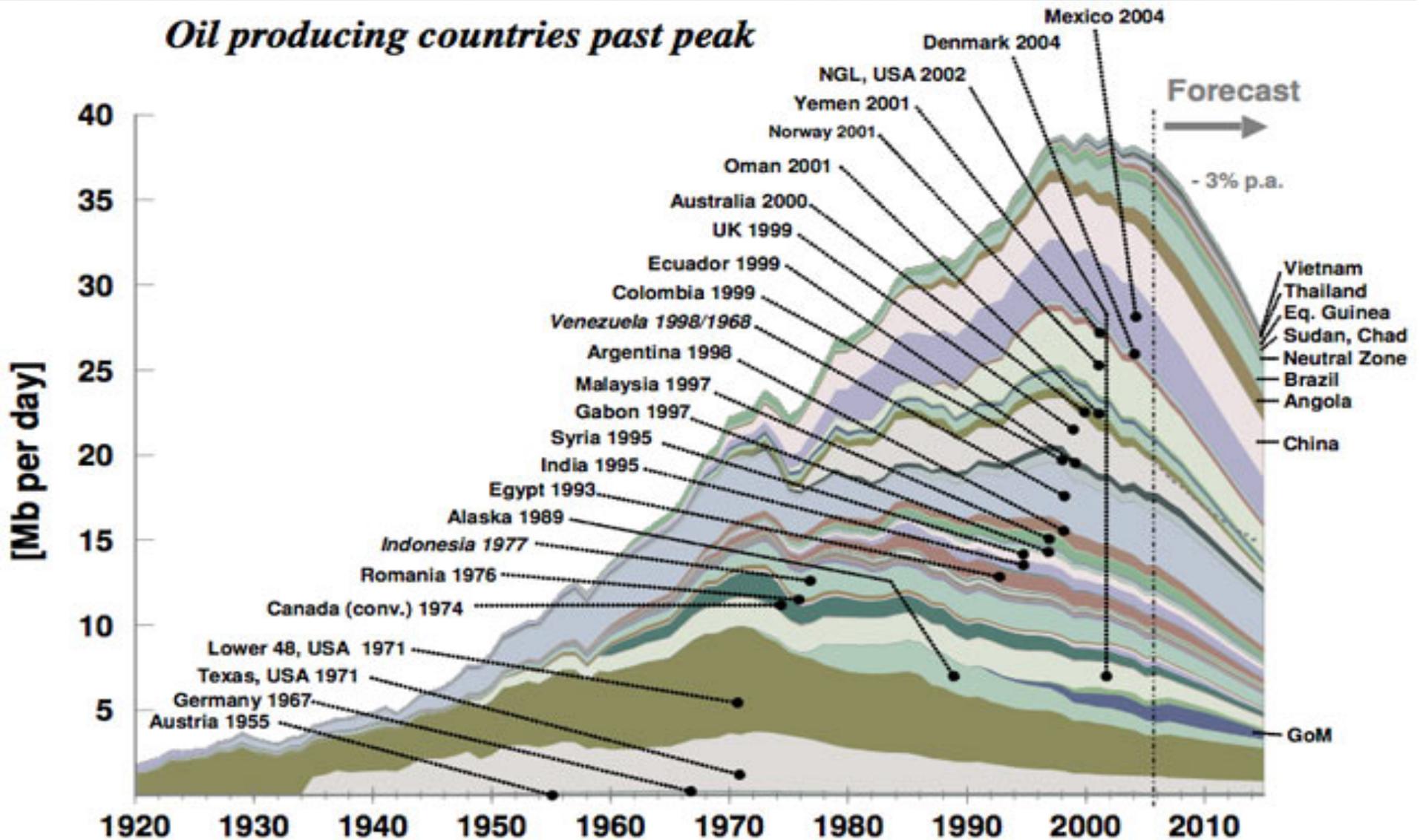
# US-48

Peak to Peak 40 years

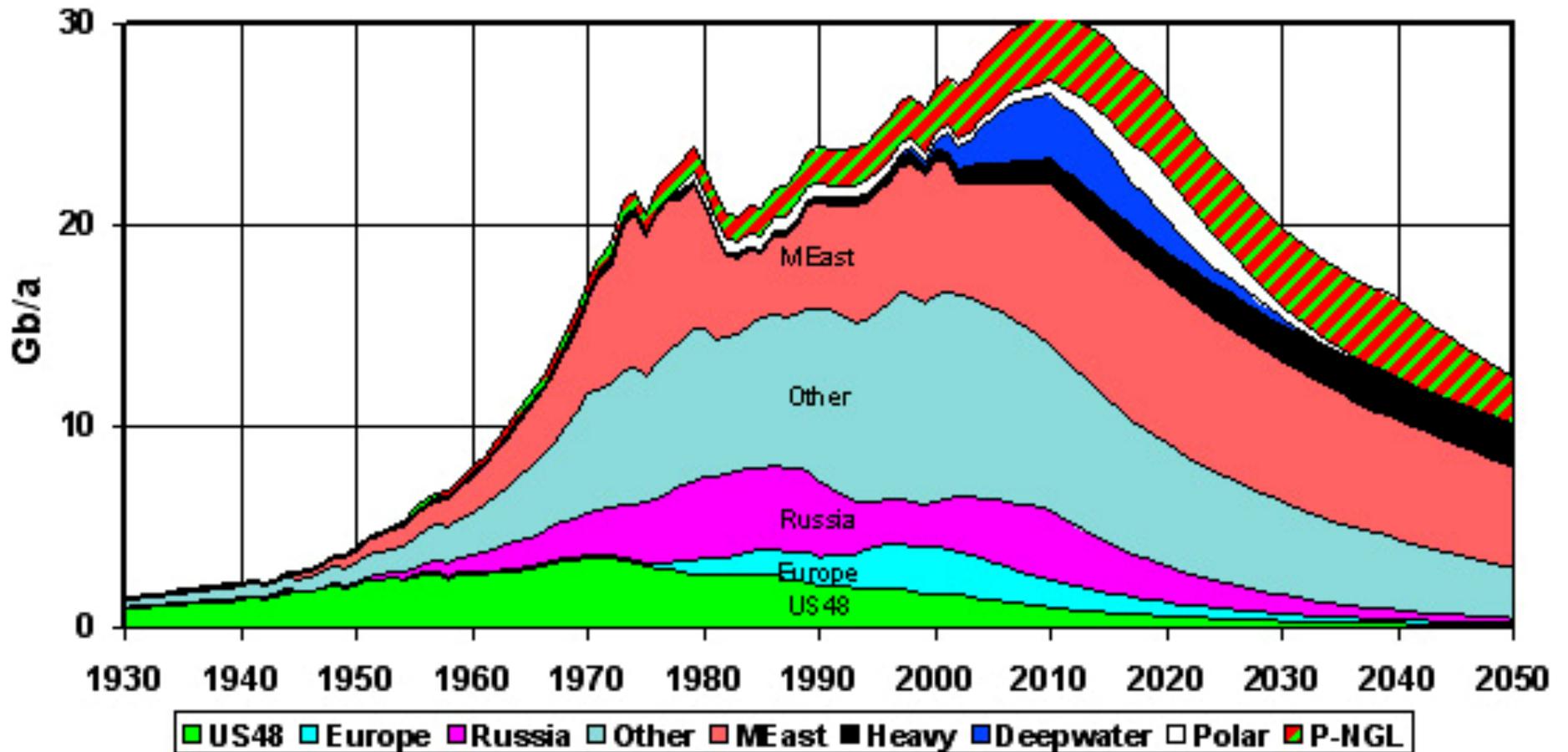


Source: ASPO/ Colin Campbell

Peak Oil: 54 of the 65 most important oil- producing countries are now past peak.

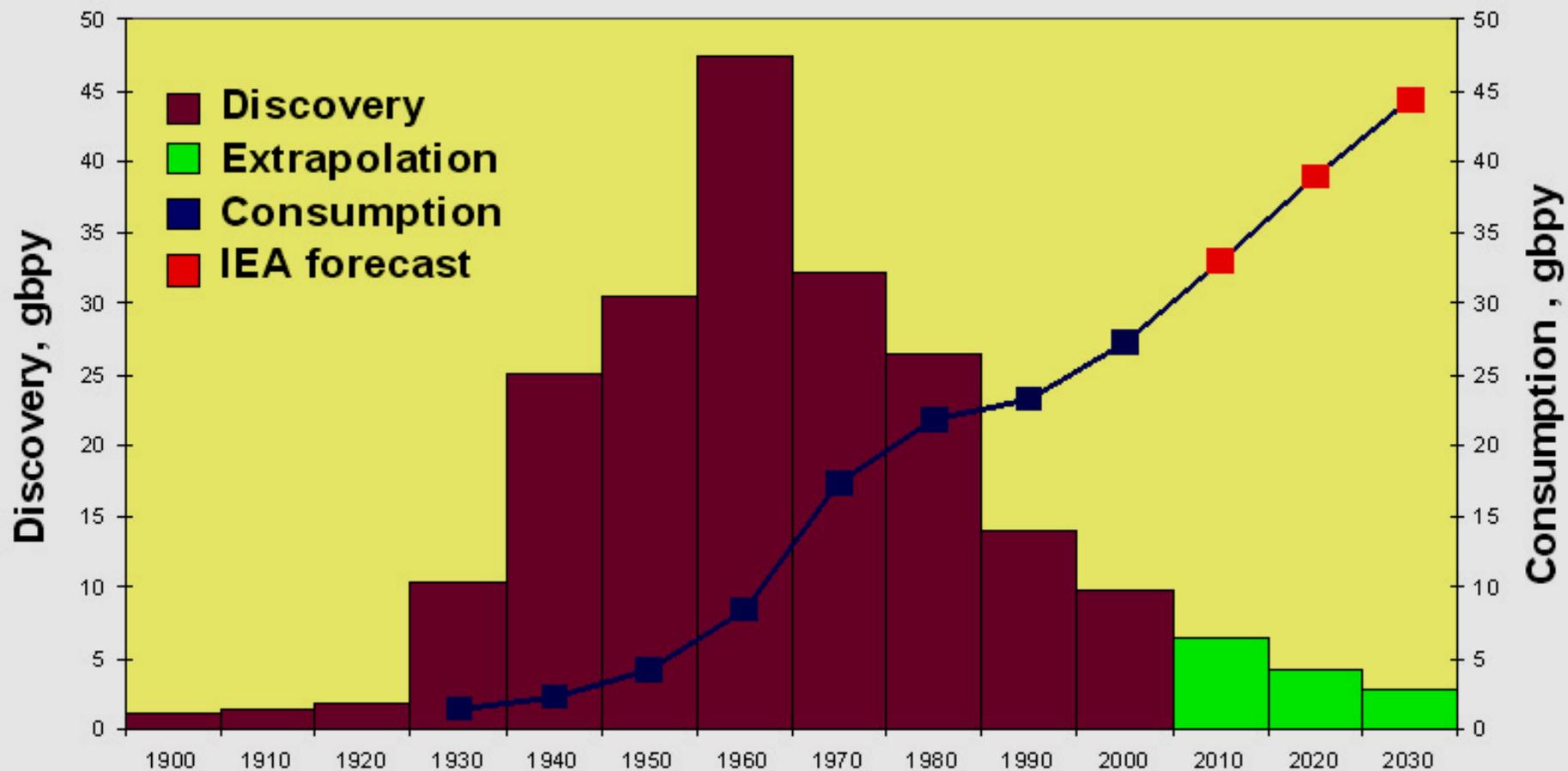


## Regular Oil & Natural Gas Liquids 2003 Base Case Scenario



Source: The Association for the Study of Peak Oil (ASPO)

## Comparison between discovery and consumption

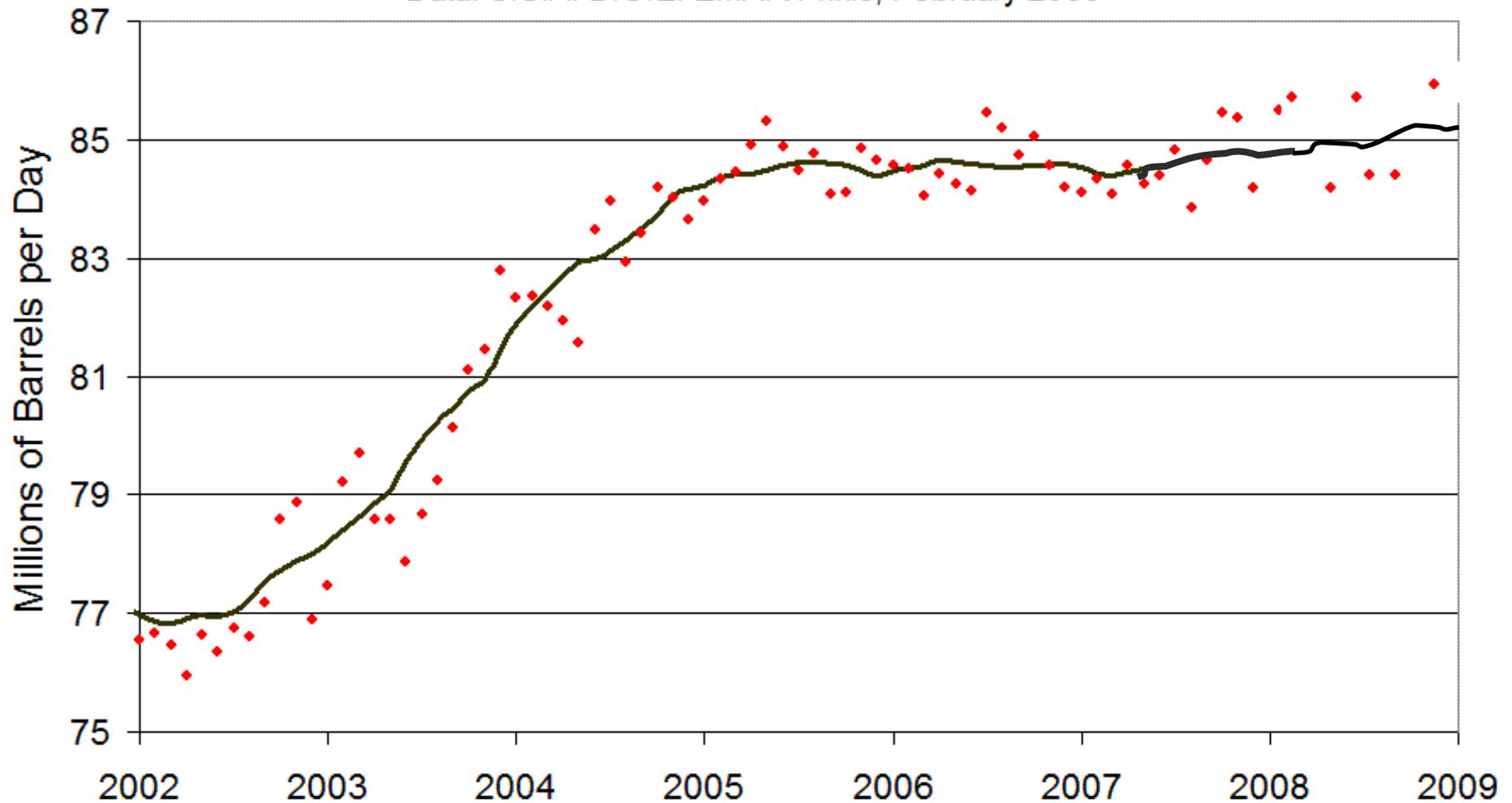


Source: ASPO

# Total World Oil Production

12 Month Centered Moving Average

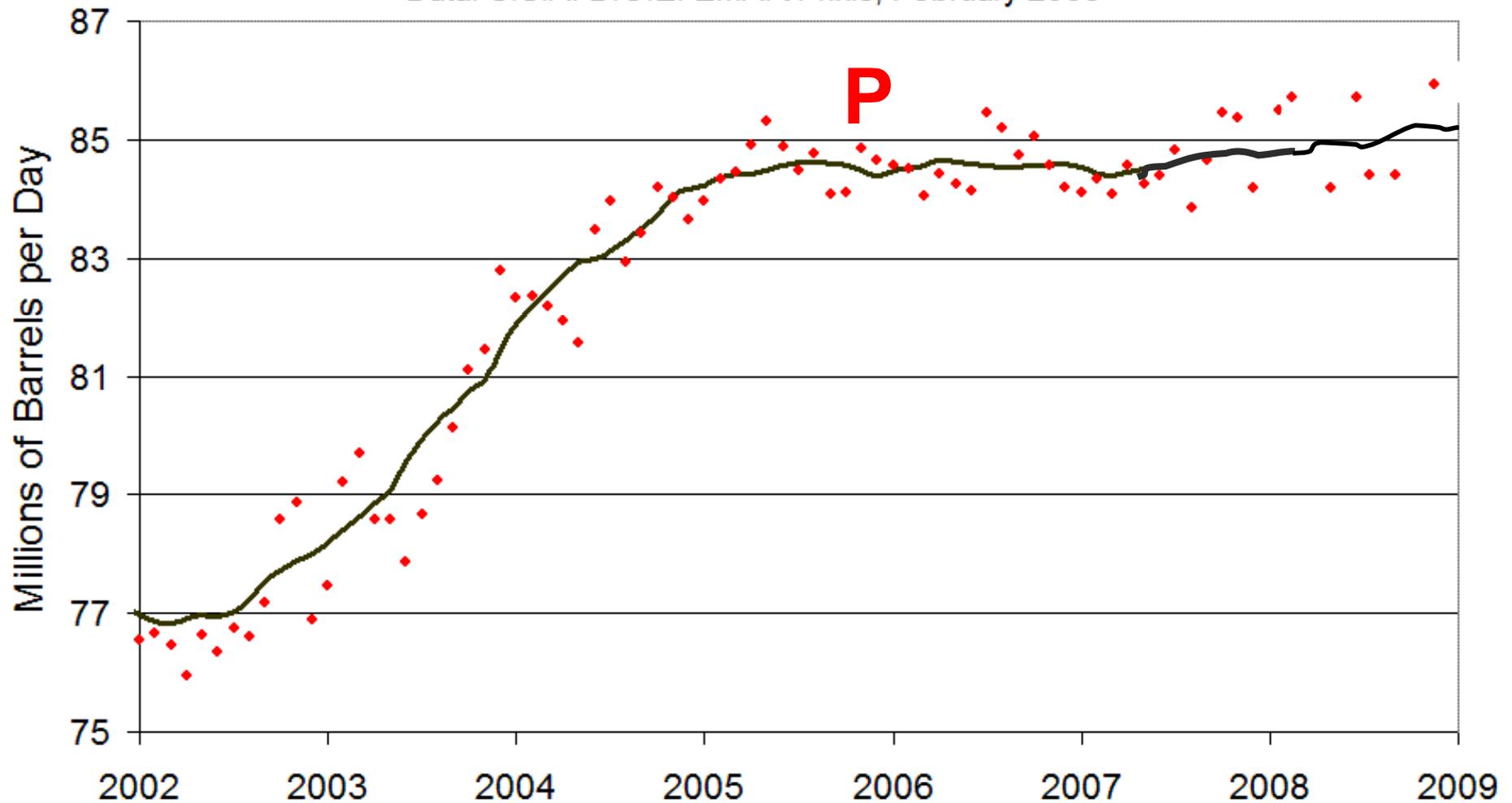
Data: U.S.A. D.O.E. E.I.A. t14.xls, February 2008



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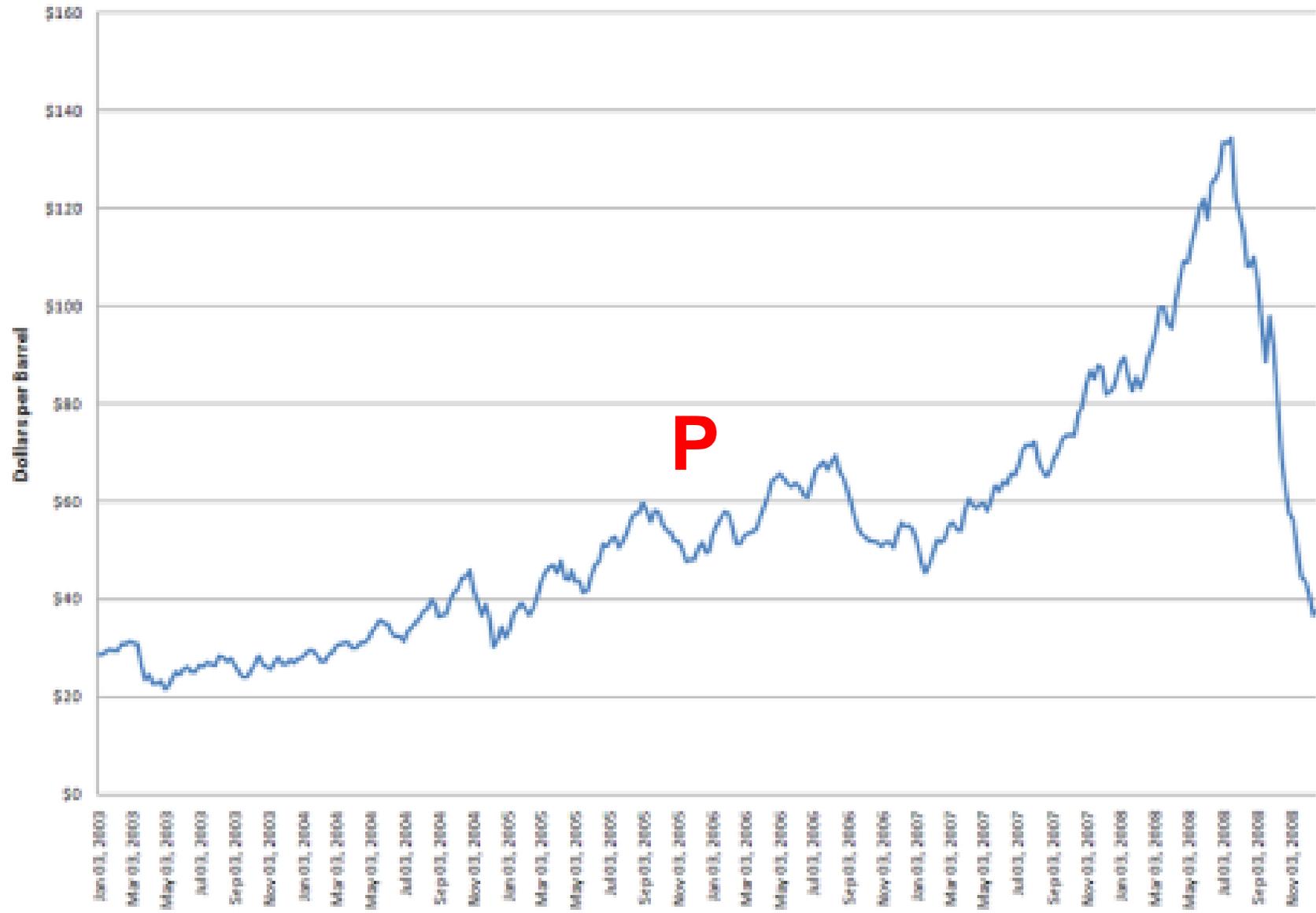
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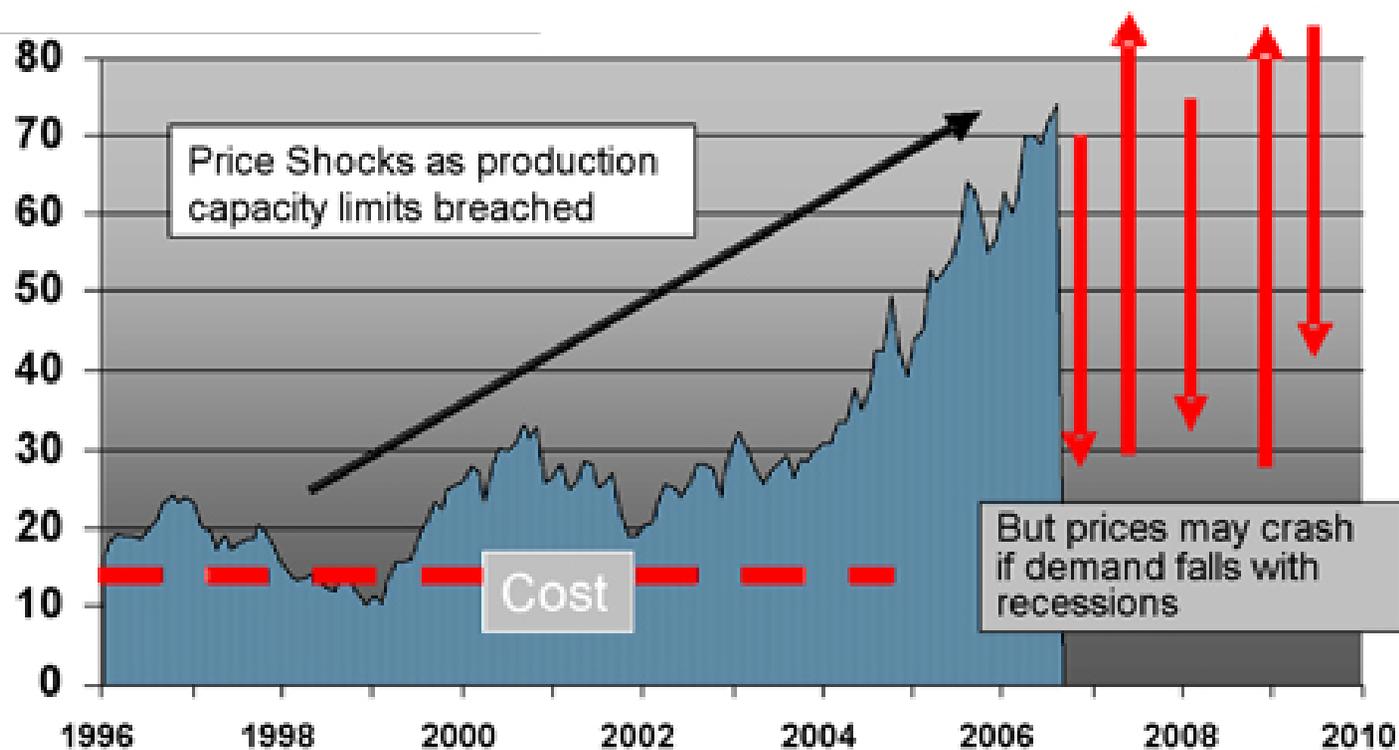
# Oil Price, January 2003 - December 2008

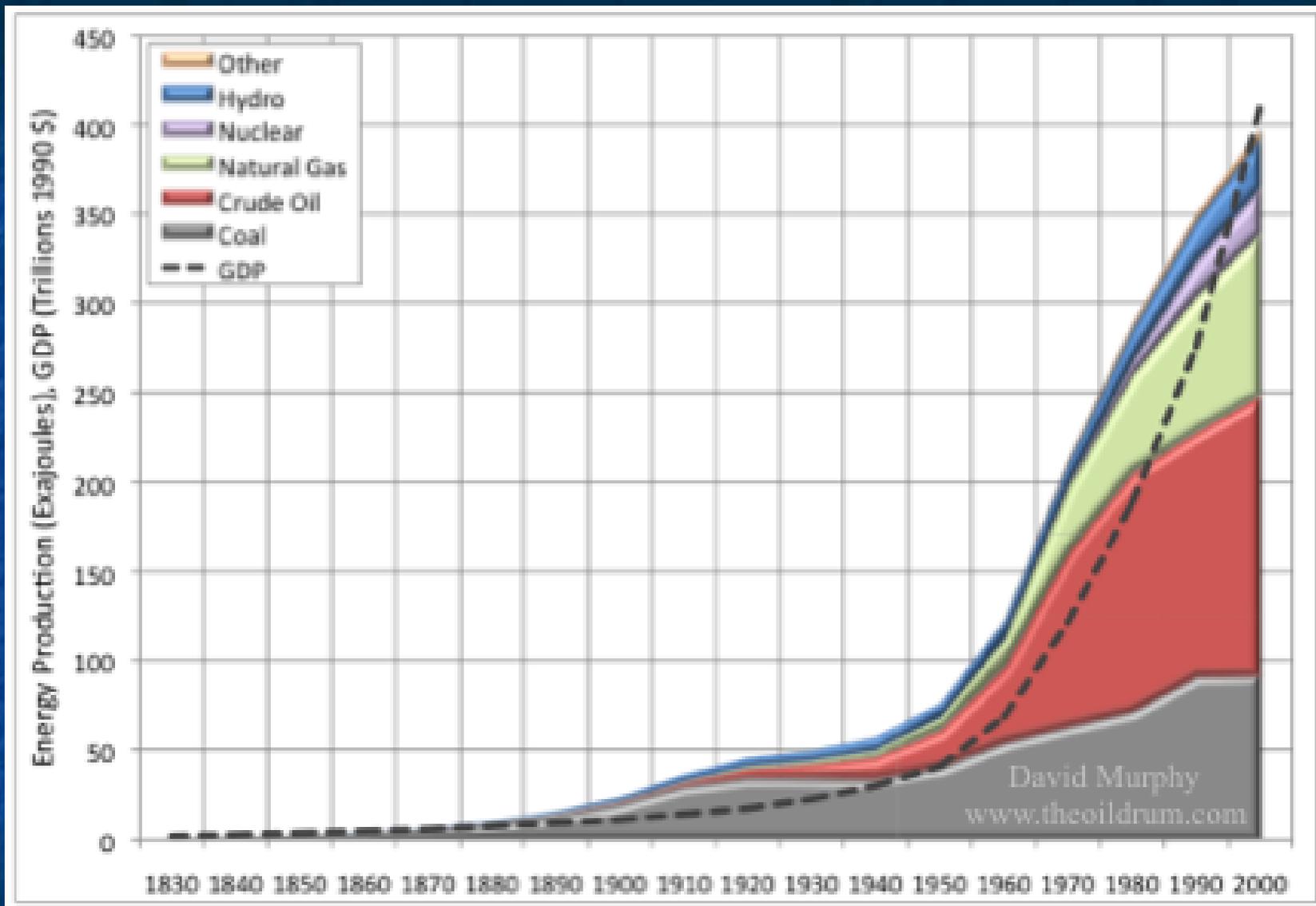
Weekly United States Spot Price Weighted by Import Volume (Dollars per Barrel)



# Oil Price Shocks

## First Signs of Crisis

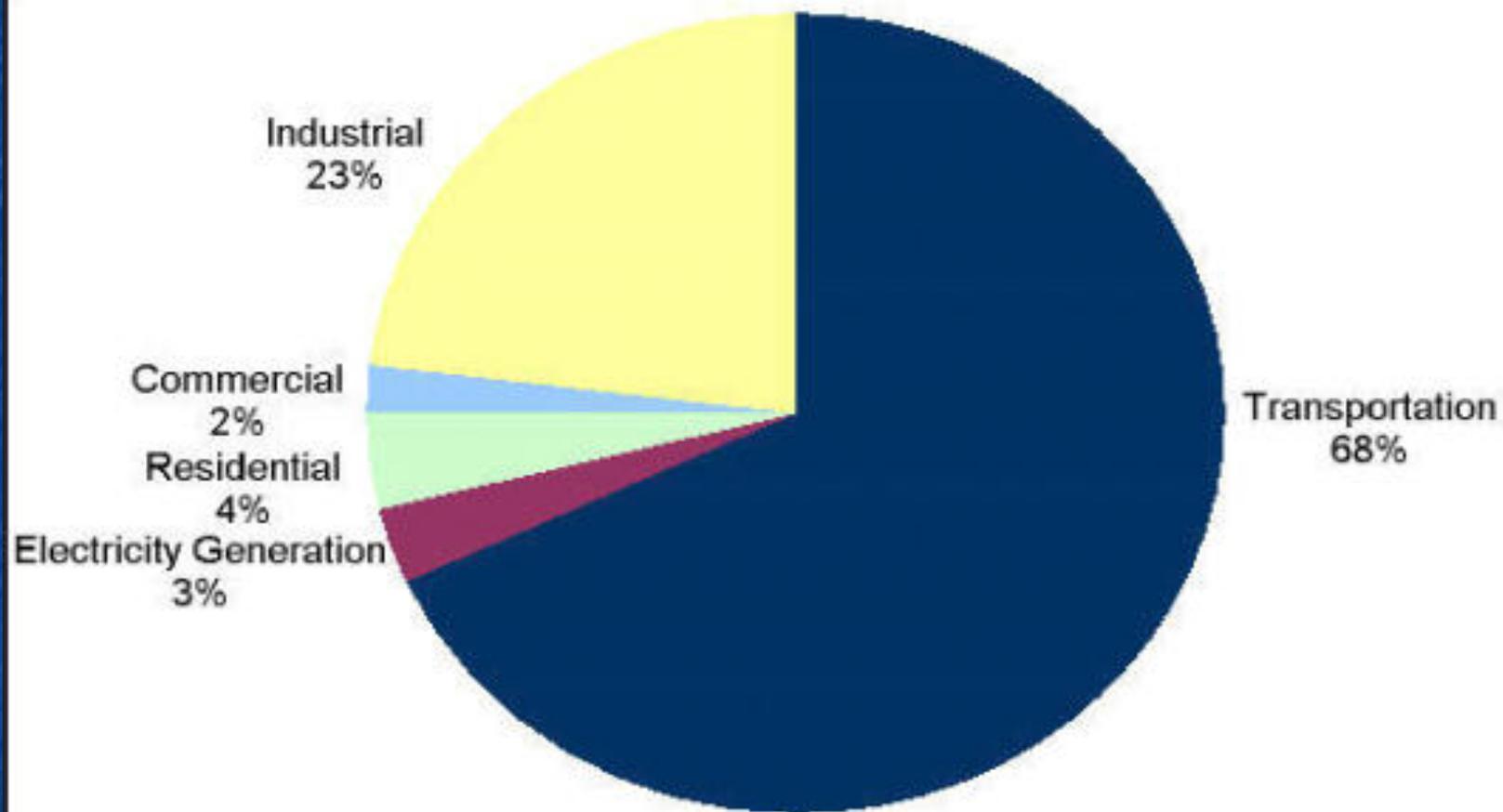




Correlation between net primary energy production and Economic Growth (GDP).

Besides economic risks (high price and volatility), what other vulnerabilities are apparent to determine a course of community action?

## U.S. Oil Demand by Sector

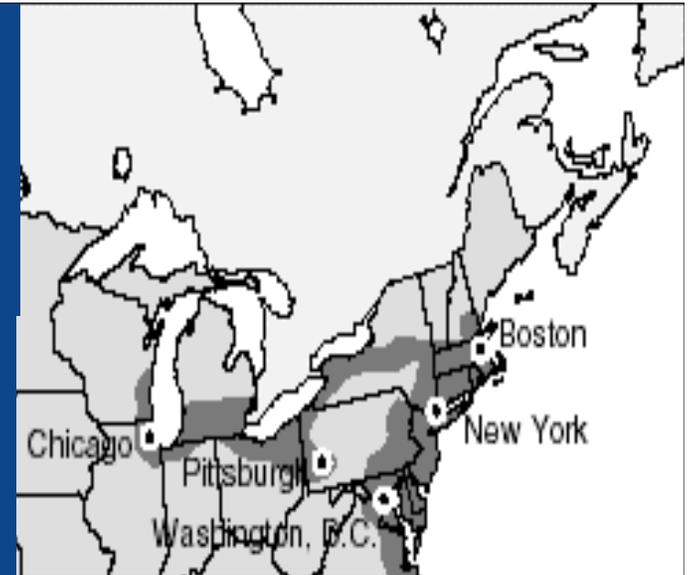


Source: Annual Energy Outlook 2003, Energy Information Administration, Department of Energy

## Vulnerabilities:

### Transportation:

- Food travels 1400 miles on average from origin to consumer.
- In the 20 largest cities, 40% are urban, 60% are suburbanites.
- Suburbs are oil intensive living arrangements.





# Vulnerabilities:

- Plastics.
- Medicines, and medical equipment.
- Chemical feedstocks.
- Paints.
- High tech devices.
- Lubricants.
- Numerous industries (e.g., mining, metal smelting, glass manufacture, timber industry).  
Oil “pervades the U.S. economy.”



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# Vulnerabilities:

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## Food production:

- For every 1 kCal of energy from food, 10-14 kCal are used as inputs.
  - tilling, sowing seeds.
  - Pumping water for irrigation.
  - Herbicides, pesticides from chemical manufacture
  - Nitrogen fertilizers.
  - Cultivating and harvesting.
  - Processing, packaging, refrigeration, and transportation to market.

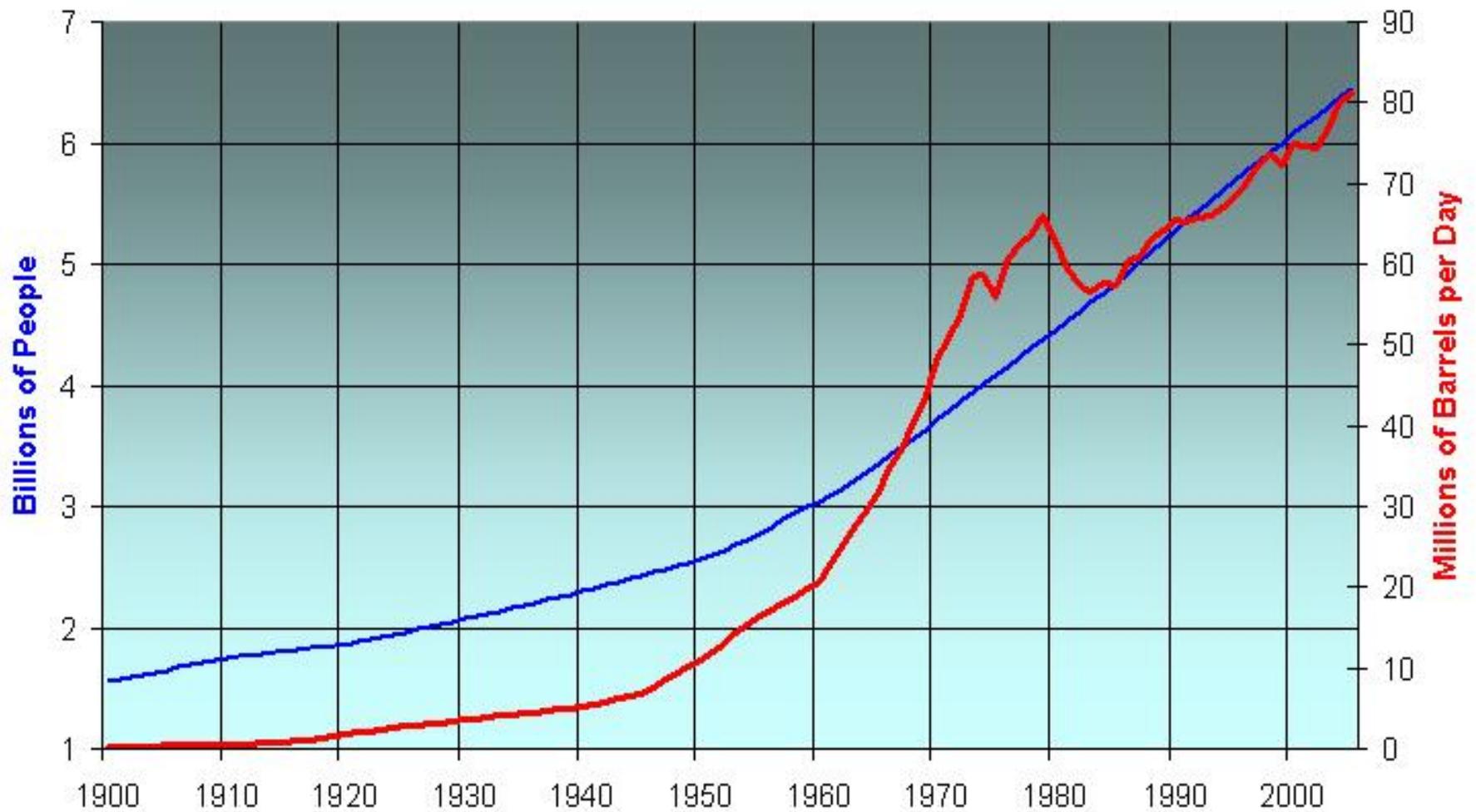
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## World Oil Production and Population 1900-2005



## Do other forms of oil fill the gap?

- oil sands (maximum production ~ 2% of global needs).
- offshore/deepwater expensive and inadequate.
- biofuels: net energy loser - competes with food production.
- oil shale: worse than tar sands - little production likely.
- oil “fracking” brings some online: vulnerable to price fluctuations, rapid depletion, and groundwater pollution.
- Iraq: last frontier of terrestrial oil production. Will need to double or triple oil production by 2020 in order to meet demand.

## Electric vehicles, fuel cells, etc.

Fleet	Size	Median Lifetime (years)	Cost to Replace Half of Fleet (2006 \$)
Automobiles	140 million	17	\$1.6 trillion
Light Trucks, SUVs, etc.	60 million	16	\$1.3 trillion
Heavy Trucks, Busses	7.5 million	28	\$1.7 trillion
Aircraft	8,500	22	\$0.3 trillion

Source: Management Information Services

Who else is currently warning that oil production may be in short supply in the near future?

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- industry
- academia
- government
- military

# The Oil Crunch

## Securing the UK's energy future

Final report of the UK Industry Taskforce on Peak Oil & Energy Security (TPOES)



10 February 2010  
at the Royal  
Society

Comprised top  
UK executives

Arup, Foster +  
Partners, Scottish  
and Southern  
Energy,  
Solarcentury,  
Stagecoach  
Group and Virgin  
International.

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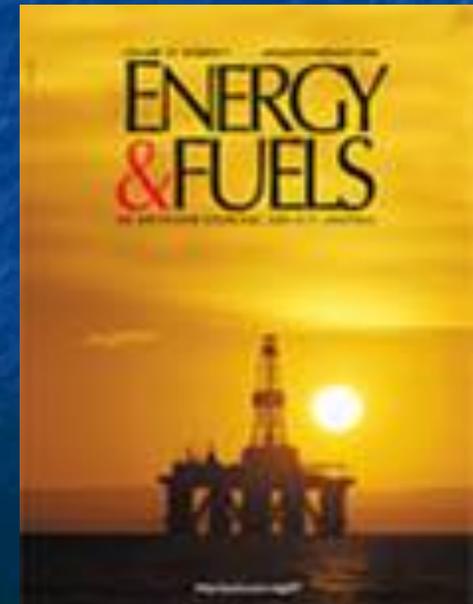
Oil shortages, insecurity of supply and price volatility will destabilize economic, political, and social activity potentially by 2015.

## **Kuwait Report: Peak by 2014** **March 12, 2010.**

College of Engineering and Petroleum at Kuwait University.

Paper published in *Energy and Fuels*.

Forecast that world production would peak in 2014.  
The annual depletion rate of around 2.1%



## Oxford Report: Reserves Exaggerated by One Third March 22, 2010

UK chief scientist David King and researchers from Oxford University.

Paper published in journal Energy Policy.

showed that conventional oil reserves stand at just 850-900 billion barrels, not the 1,150-1,350 billion barrels that are officially claimed by oil producers



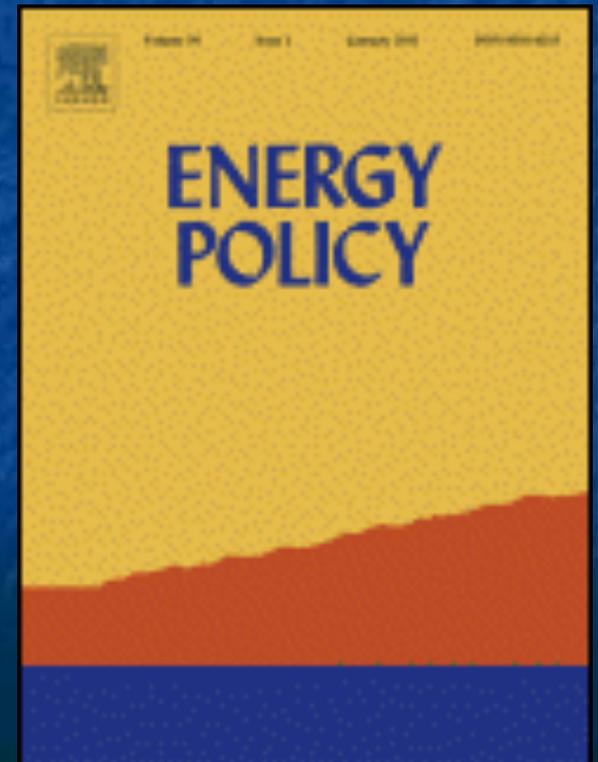
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**Le Monde.fr**

**March 25, 2010**

## **Washington considers a decline of world oil production as of 2011**

The U.S. Department of Energy admits that *“a chance exists that we may experience a decline”* of world liquid fuels production between 2011 and 2015 *“if the investment is not there”*, according to an exclusive interview with Glen Sweetnam, main official expert on oil market in the Obama administration.

**Le Monde.fr**

**March 25, 2010**

**Washington considers a decline of world  
oil production as of 2011**

*“undulating plateau.”*

**Le Monde.fr**

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*"Once maximum world oil production is reached, that level will be approximately maintained for several years thereafter, creating an undulating plateau. After this plateau period, production will experience a decline."*

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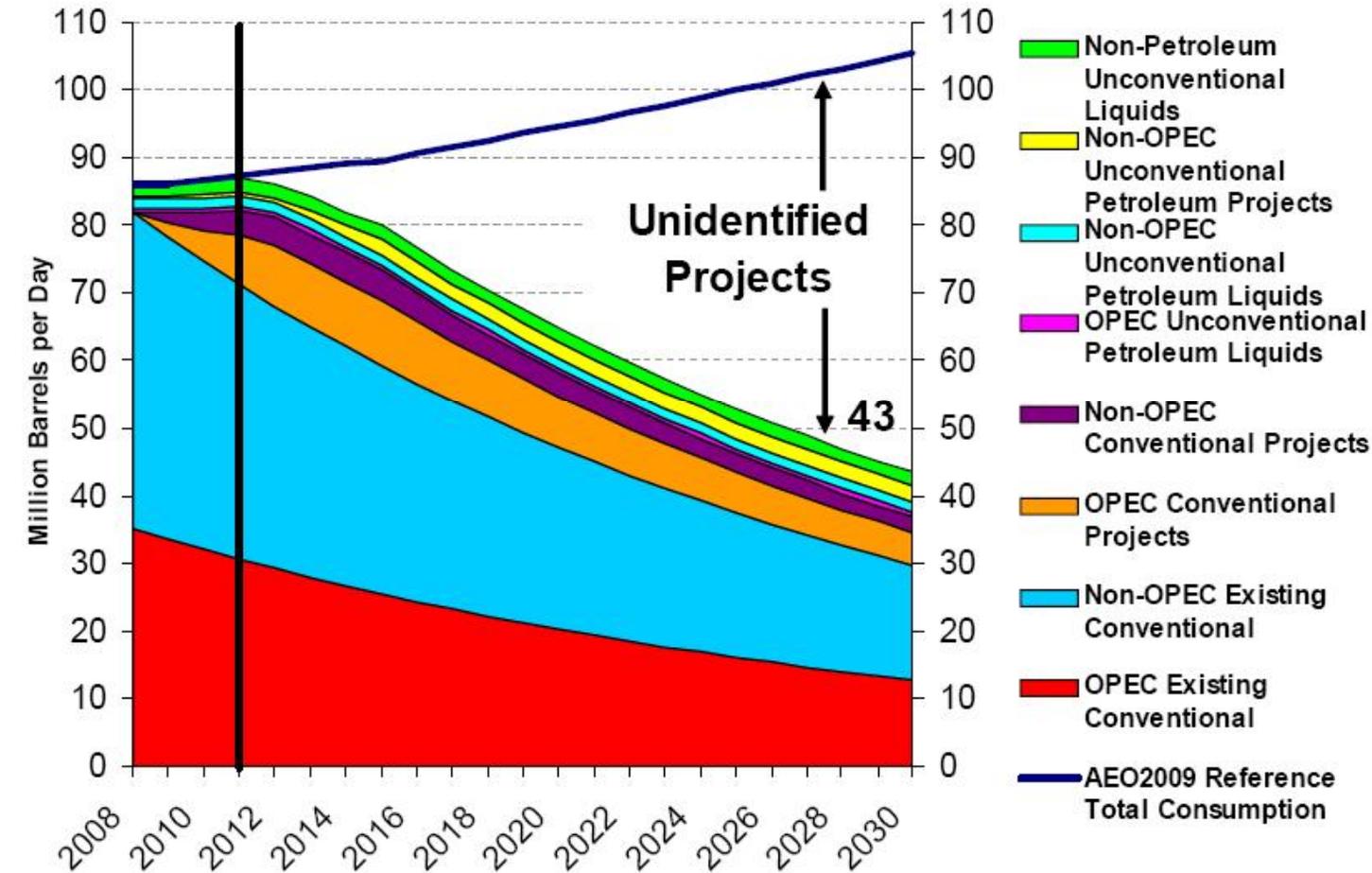
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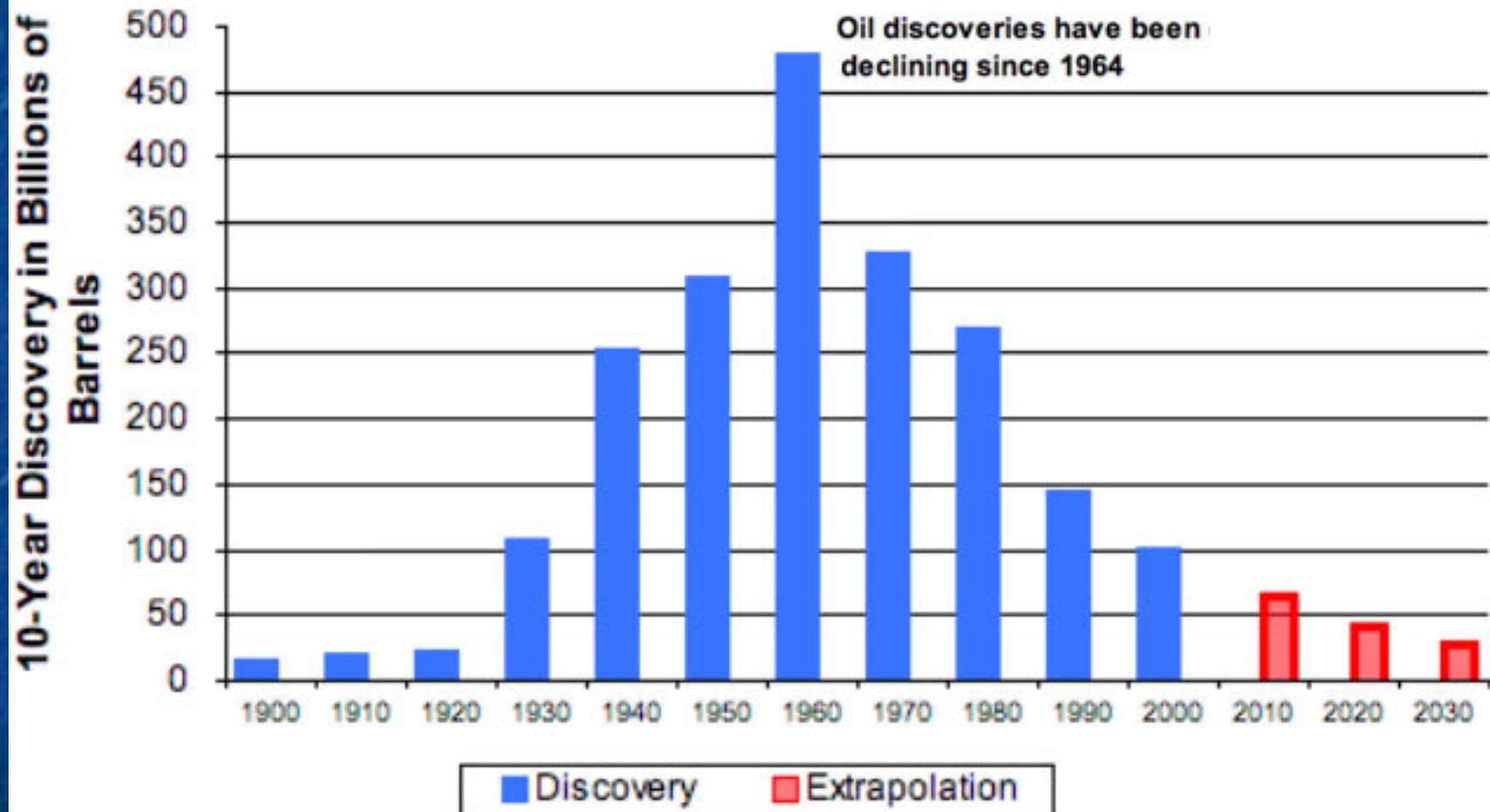
*“... production will experience a decline.”*

## World's Liquid Fuels Supply



Source: EIA, AEO2009

## World oil discovery over 10-years periods (source ASPO)



**The JOE  
Joint Operating  
Environment**

**2010**



A report from the American Joint Forces Command published March 15 predicts that in 2015, the world capacity for petroleum production could be 10 million barrels per day less than the demand.

# The JOE Joint Operating Environment

2010



A report from the American Joint Forces Command published March 15 predicts that in 2015, the world capacity for petroleum production could be 10 million barrels per day less than the demand.

10 million barrels per day (MBD), that represents the production of Saudi Arabia (>10% of WP).



Streitkräfte, Fähigkeiten und Technologien im 21. Jahrhundert

- Umweltdimensionen von Sicherheit -

Teilstudie 1:

## PEAK OIL

**Sicherheitspolitische Implikationen  
knapper Ressourcen**



Zentrum für Transformationsstudien der Bundeswehr  
Deutsches Zentrum für Zukunftsanalyse  
Prof. Dr. Christian Hopmann  
12205 Berlin, Germany  
July 2010

[www.zentrum-fuer-transformationstudien.bundwehr.de](http://www.zentrum-fuer-transformationstudien.bundwehr.de)  
[zentrumsfuerzukunftsanalyse@bundeswehr.de](mailto:zentrumsfuerzukunftsanalyse@bundeswehr.de)

German Military  
(Bundeswehr) study  
on Peak Oil, leaked  
to the press in August  
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“Warns of potentially  
drastic oil shortage...”  
- Der Spiegel



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Zentrum für Transformationsstudien der Bundeswehr  
Bismarck-Kulturforum  
Platz der Chaussee 25  
12205 Berlin  
Juli 2010

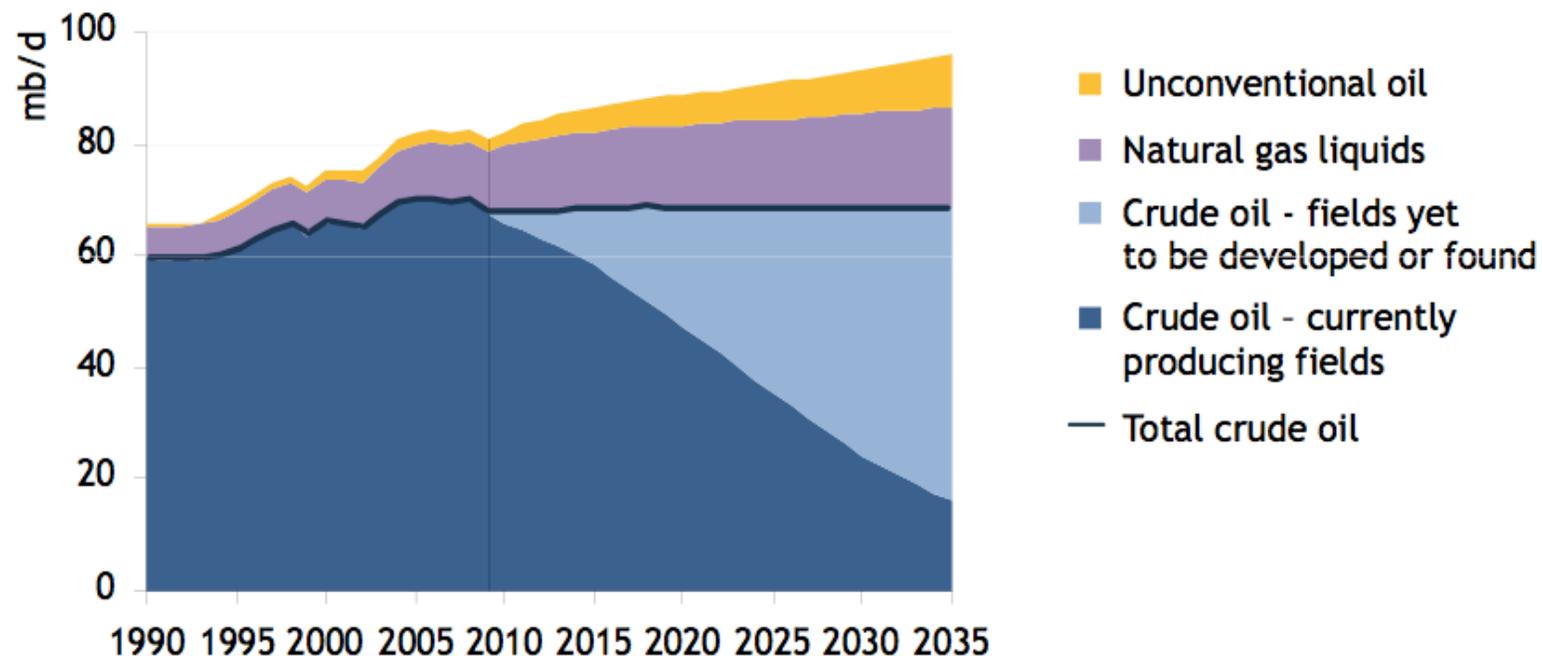
[www.zentrum-transformationstudien.bundwehr.de](http://www.zentrum-transformationstudien.bundwehr.de)  
[zentrums@transformationstudien.bundwehr.de](mailto:zentrums@transformationstudien.bundwehr.de)

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Recommends  
development of  
EDAPs.  
Includes Bloomington's  
RP report's Executive  
Summary.

## World oil production by type in the New Policies Scenario



***Global oil production reaches 96 mb/d in 2035 on the back of rising output of natural gas liquids & unconventional oil, as crude oil production plateaus***

© OECD/IEA 2010

**IEA World Energy Outlook, 2010**

Why haven't you been informed?  
(by government, or the press)

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Inertia: Humans are linear thinkers, we extrapolate the past into the future.



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Inertia: Humans are linear thinkers, we extrapolate the past into the future.

But, we have been on an *exponential* trajectory of growth, of economic output, population, and resource depletion.



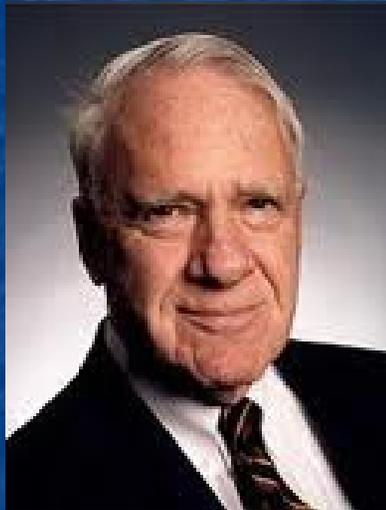
## Why haven't you been informed? (by government, or the press)

If you cannot place this information (evidence) within the existing paradigm (continued energy resource expansion), and all that it entails.

Is it the fault of the evidence?

Or, is it the paradigm that is incommensurate with the evidence, and therefore requires revision or must be discarded to be compatible with reality?

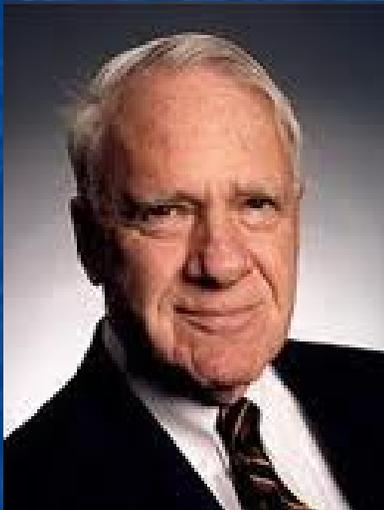
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“The Peak Oil debate is over...  
The peakists have won”.

October 8, 2010, ASPO-USA conference

## Why haven't you been informed? (by government, or the press)



“The political order *should* respond. Nonetheless, our willingness, let alone our ability, to do anything serious about the impending inability to increase oil output is still a long way off. *The political order responds to what the public believes today, not to what it may come to believe tomorrow.* It is also resistant to any action that inflicts pain or sacrifice on those who vote”.

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Can we produce oil locally? (Supply)

Probably not (or just marginal amounts).

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Probably not (or just marginal amounts).

But, much of energy descent adaptation **MUST**  
begin at the local level.

- we can best assess what are needs are.
- households, neighborhoods and communities  
bring the problem into manageable scale.
- higher levels of government are less accessible.

OK, Now What?!

Can we produce oil locally? (Supply)

Probably not (or just marginal amounts).

There many opportunities to work on  
Demand side measures.

OK, Now What?!

Energy  
Descent  
Action  
Plan

OK, Now What?!

Energy  
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“We cannot control the speed of the energy decline, nor can we predict it accurately at this point.

However, we can choose how quickly and effectively to prepare and respond”.

- Richard Heinberg

OK, Now What?!

Energy  
Descent  
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BERKELEY ENERGY DESCENT 2009-2020:  
TRANSITIONING TO THE POST CARBON ERA  
*FINAL REPORT*  
April, 2009



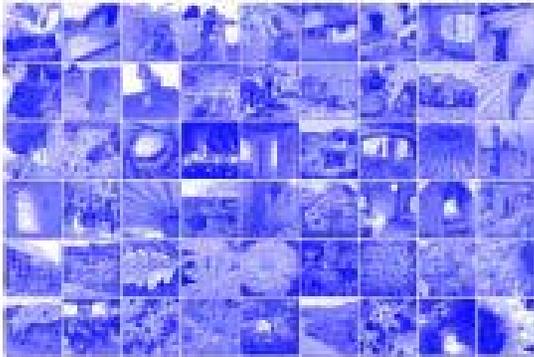
Descending the Oil Peak:  
Navigating the Transition  
from Oil and Natural Gas

Report of the City of Portland  
Peak Oil Task Force

March 2007

**Kinsale 2021**

An Energy Descent  
Action Plan – Version 1, 2005

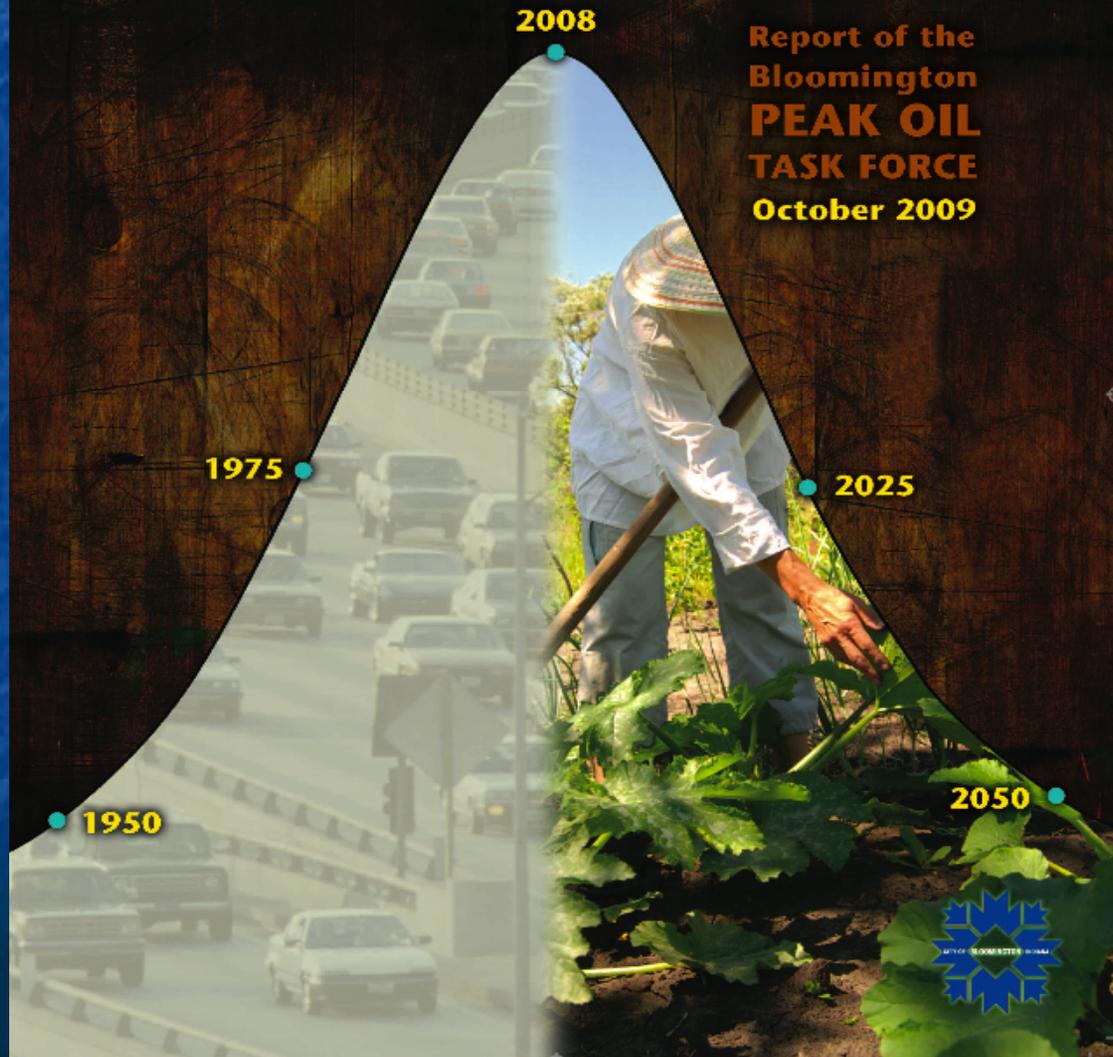


By Students of  
Kinsale Further Education College  
Edited by Rob Hopkins



# Redefining Prosperity:

Energy Descent and Community Resilience



Resolution 2006:  
Acknowledging  
Peak Oil.

Resolution 2007:  
To create a Task  
Force.

2009:  
Report to Mayor and  
City Council.  
Accepted as an  
Advisory document.

POTF Report:

Primary topics:

Sustenance

Transportation

Housing

Land use

Economy

Municipal Services

## POTF Report:

### Primary considerations:

Proximity matters.

Plan for expediting re-localization.

Plan for failure, or interruption of vital services  
(concentrate on back-ups, resilience).

Plan for retrofitting the existing built environment  
for oil shortages and high prices.

Plan for economic shocks (i.e., better to plan for a  
year early, than a day late).

## POTF Report:

### Municipal Services:

Economic dislocation: increase of vulnerable populations.

Shortages in fuel may threaten police and fire response.

Exposure to solid waste and recycling fuel costs.

Grid vulnerability and blackouts.

Water production problems with coincident electricity and liquid fuel shortages.

Wastewater relies on high energy use.

Difficulties with general infrastructure.

City personnel vulnerable to commutes.

## POTF Report:

### Transportation:

Residents drove 2.8 million miles/day.

Increase in fuel prices has disproportionate effect on low income residents.

Higher proportion of all budgets will go to fuel.

Volatility sends mixed signals.

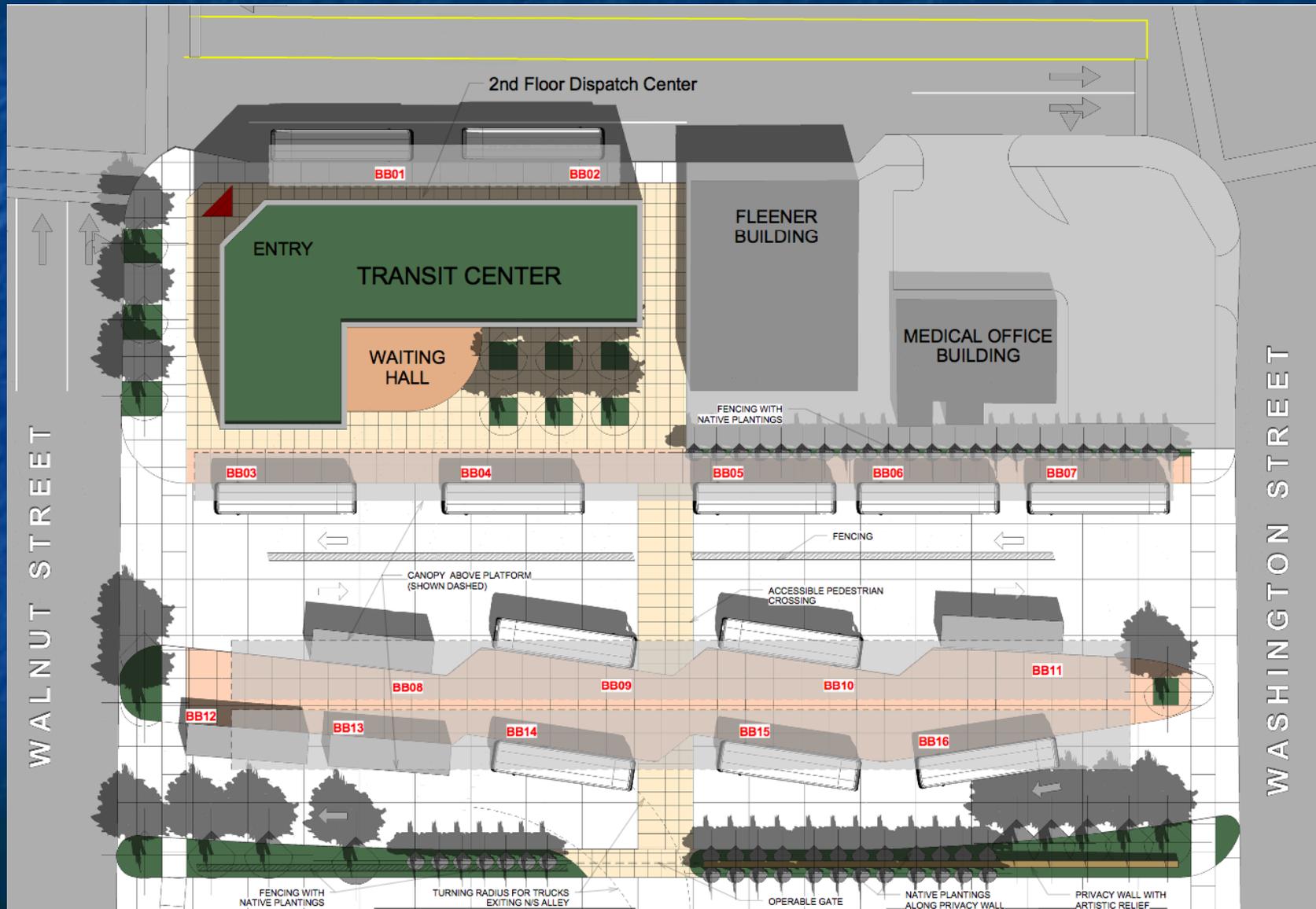
BT has little storage capacity in case of shortages.

MCCSC runs 11,000 miles/day (larger than BTs transit line).

20.3 average mpg. 67% single occupancy,  
2.8% use public transportation.

19% of workforce commutes from outside county.

# POTF Report: Transportation: mitigation

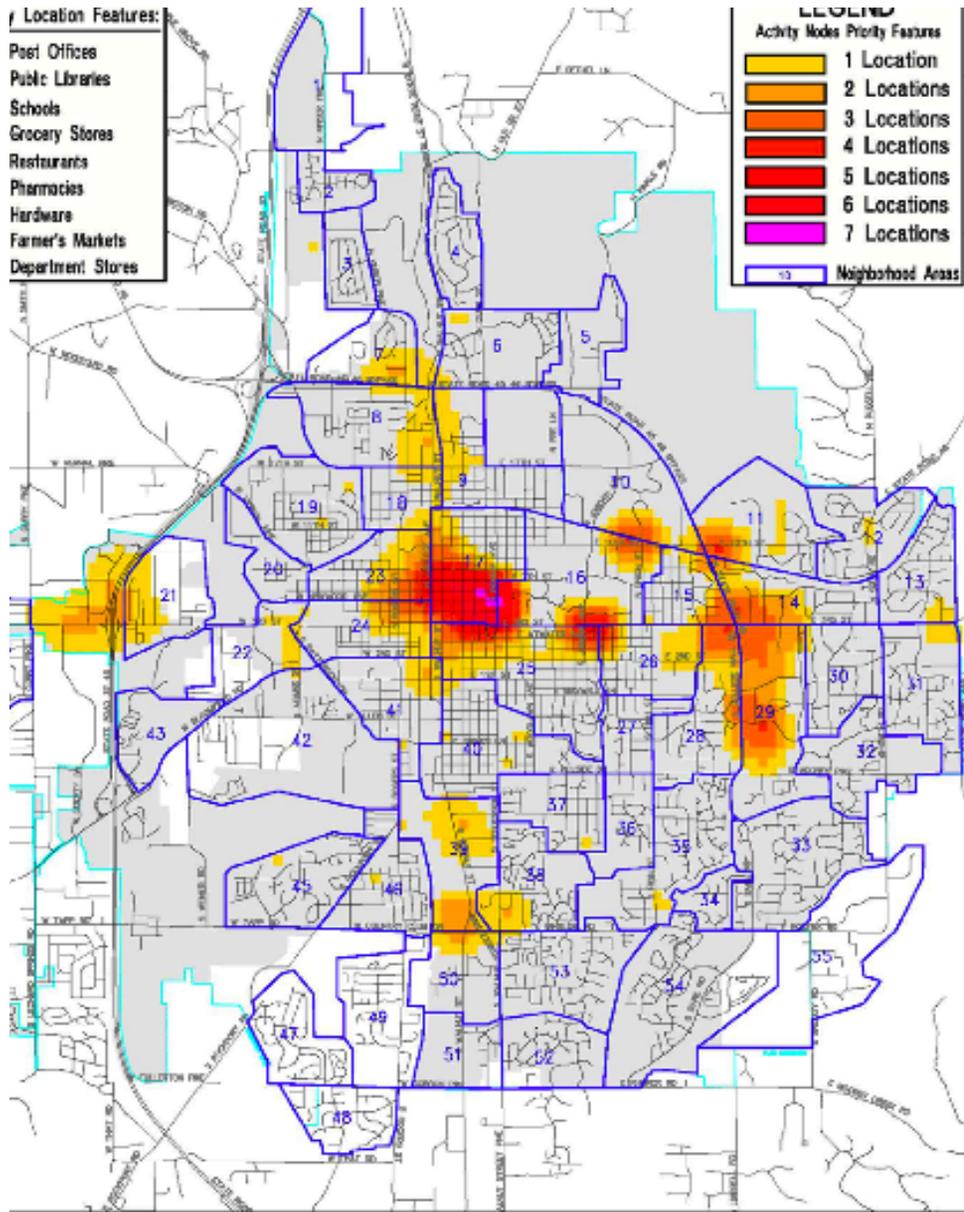


Location Features:

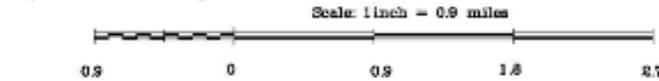
- Post Offices
- Public Libraries
- Schools
- Grocery Stores
- Restaurants
- Pharmacies
- Hardware
- Farmer's Markets
- Department Stores

**LEGEND**  
Activity Nodes Priority Features

Yellow	1 Location
Orange	2 Locations
Red-Orange	3 Locations
Red	4 Locations
Dark Red	5 Locations
Red-Black	6 Locations
Black	7 Locations
Blue outline	Neighborhood Areas



Bloomington Peak Oil Task Force  
Activity Node Priority Features



12, 2009

For use as map information only, information is NOT warranted.



TacticalGP

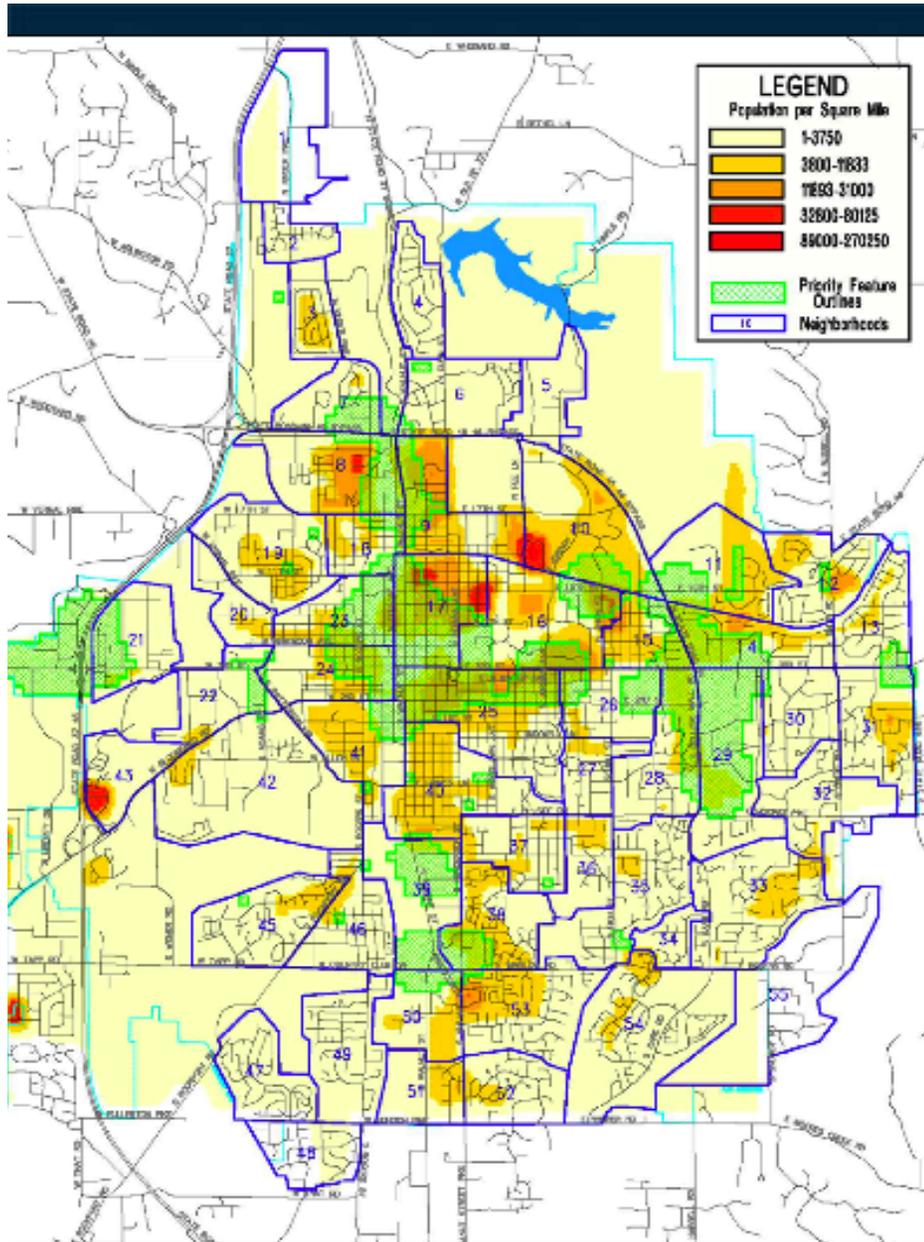
City of Bloomington  
ITS Department



Geographic  
Information System

# Bloomington Community Activity Nodes Map:

GIS based  
Commercial,  
Retail,  
Public Services  
Data.



Bloomington Peak Oil Task Force  
 Population Densities and Priority Features Overlay

Scale: 1 inch = 0.9 miles

0.9 0 0.9 1.8 2.7

City of Bloomington  
 ITS Department

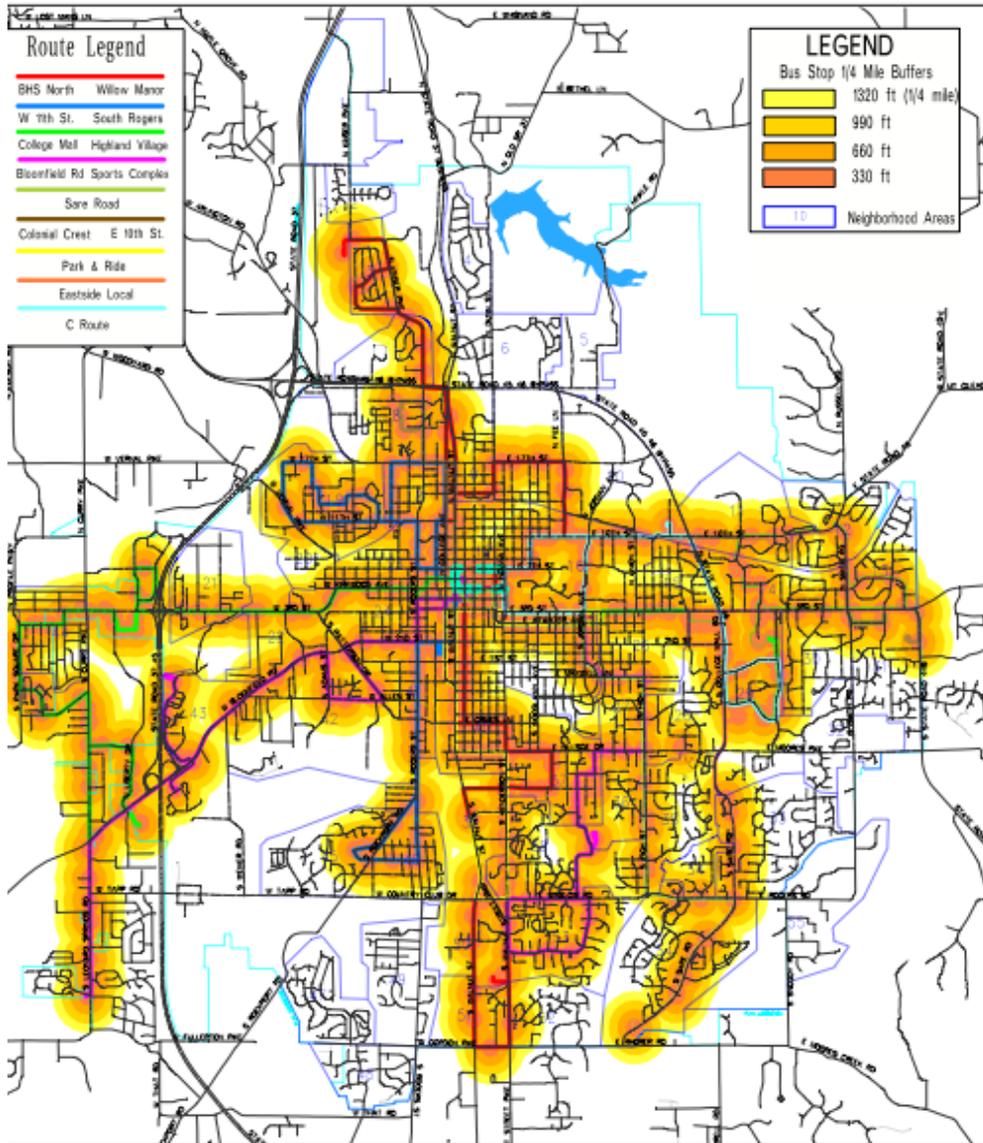


Geographic

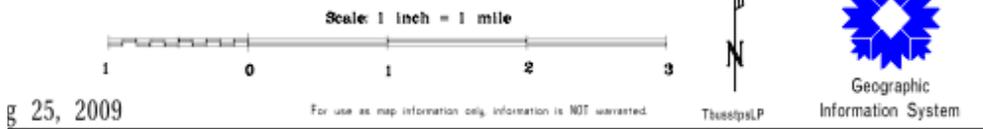
# Bloomington Community Activity Nodes Map:

GIS based  
 Commercial,  
 Retail,  
 Public Services  
 Data.

With Population  
 Density Overlay.



Bloomington Transit Bus Stops  
with Incremental 1/4 mile Buffers



August 25, 2009

For use as map information only, information is NOT warranted.

TbusstpsLP

**MAP F: Walkability of Bloomington Transit Bus Stops**

Bloomington  
Community  
Walkability to  
Public Transit.

## POTF Report:

### Land use:

Cheap energy has encourage sprawl, especially in the past three decades.

While the built environment has spread, farmland has been lost.

Use-based zoning has been to our detriment.

Food gardening, forage planting has been discouraged.

Road construction emphasizes car based transportation.

Uncoordinated planning between city/county.

## Questions for Planners:

Is there an recognition of Peak Oil in your comprehensive plan?

Is there adequate acknowledgement of future fuels supplies within your Transportation Plan?

Is there a recognition of energy shortages and food security within your city policy initiatives?

Are you still compelled to implement curvilinear roads with dead-ends, or massive expansion of arterials in anticipation of future traffic that will likely not happen?

What obstacles exist that prevent mixed use, or form-based zoning?

## POTF Report:

### Principle conclusions:

The world reached peak oil production (total liquids) in July of 2008.

The economic crisis was triggered by the consequences of reaching peak.

Production (decline) will again meet demand, with another price spike, and economic contraction will recur (or continue in an accelerated fashion).

Oil production will act as a “ceiling” on economic recovery.

Why haven't you been informed?  
(by government, or the press)

guardian.co.uk

Monday, November 9,  
2009

KEY OIL FIGURES WERE  
DISTORTED BY US PRESSURE,  
SAYS WHISTLEBLOWER

Exclusive: Watchdog's estimates  
of reserves inflated says top  
official

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Monday, November 9,  
2009

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SAYS WHISTLEBLOWER

Exclusive: Watchdog's estimates  
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official

The world is much closer to  
running out of oil than official  
estimates admit, according to  
a whistleblower at the  
International Energy Agency

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guardian.co.uk

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official

“there are fears that  
panic could spread on  
the financial markets”

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“And the Americans fear  
the end of oil supremacy  
because it would  
threaten their power  
over access to oil  
resources.”

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Exclusive: Watchdog's estimates  
of reserves inflated says top  
official

"We have [already]  
entered the 'peak oil'  
zone. I think that the  
situation is really bad..."

“We need to leave oil, before it leaves us”.

- Dr. Fatih Birol, Chief Economist and Head  
of the Economic Analysis Division of the  
International Energy Agency.

“We need to leave oil, before it leaves us”.

- Dr. Fatih Birol, Chief Economist and Head of the Economic Analysis Division of the International Energy Agency.



Source: UK Daily Mail

“We need to leave oil, before it leaves us”.

Thank You!

“We need to leave oil, before it leaves us”.

Thank You!

<http://bloomington.in.gov/peakoil>

<http://www.postcarbon.org/>

<http://energybulletin.net/>

<http://theoildrum.com/>

<http://postpeakliving.com/preparing-post-peak-life>