

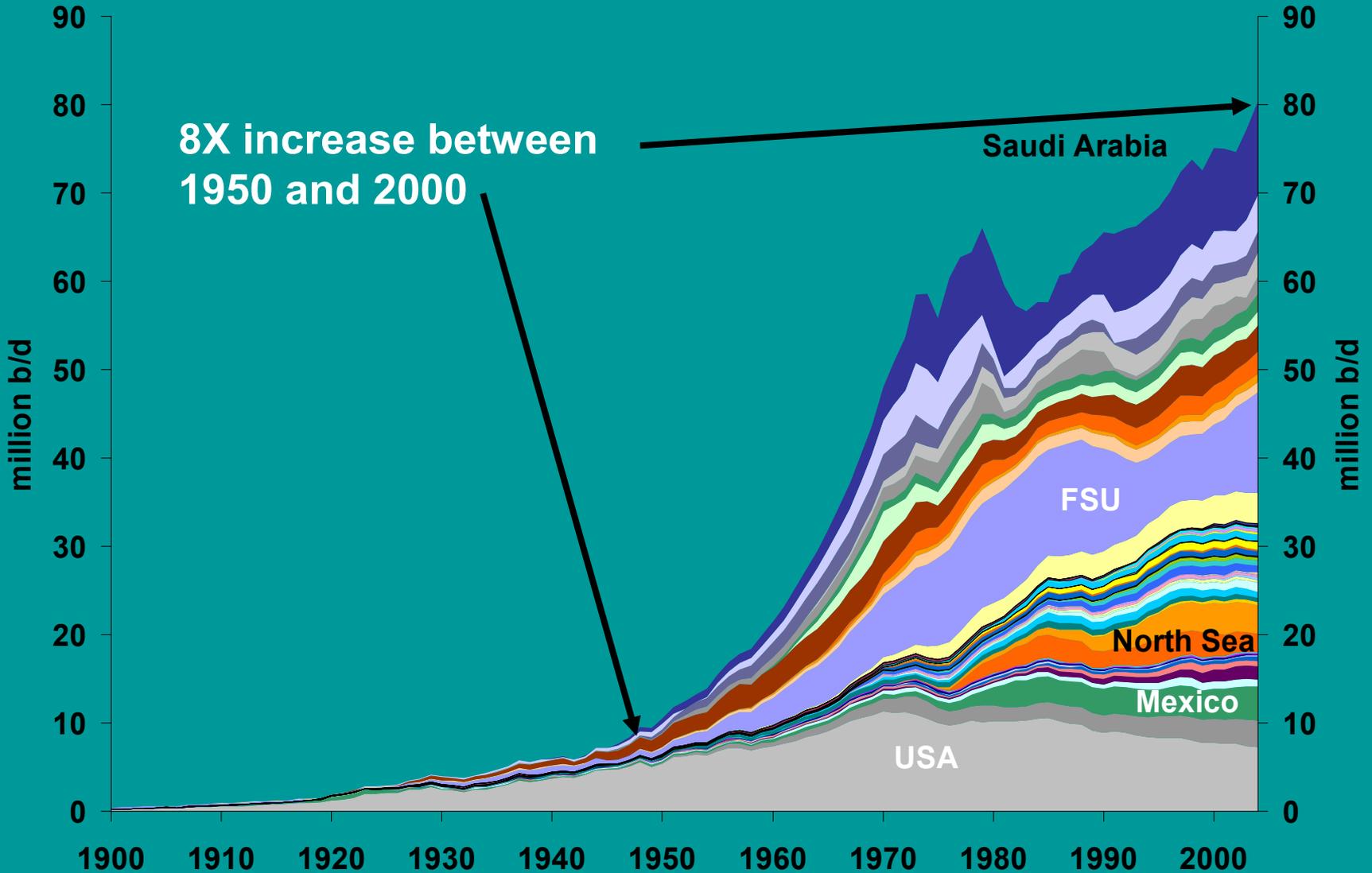
The Oil Supply Challenge

Peak Oil & The Future of Liquid Fuels

Randy Udall, Co-founder
ASPO-USA



Global Oil Supply: 1900 to 2000

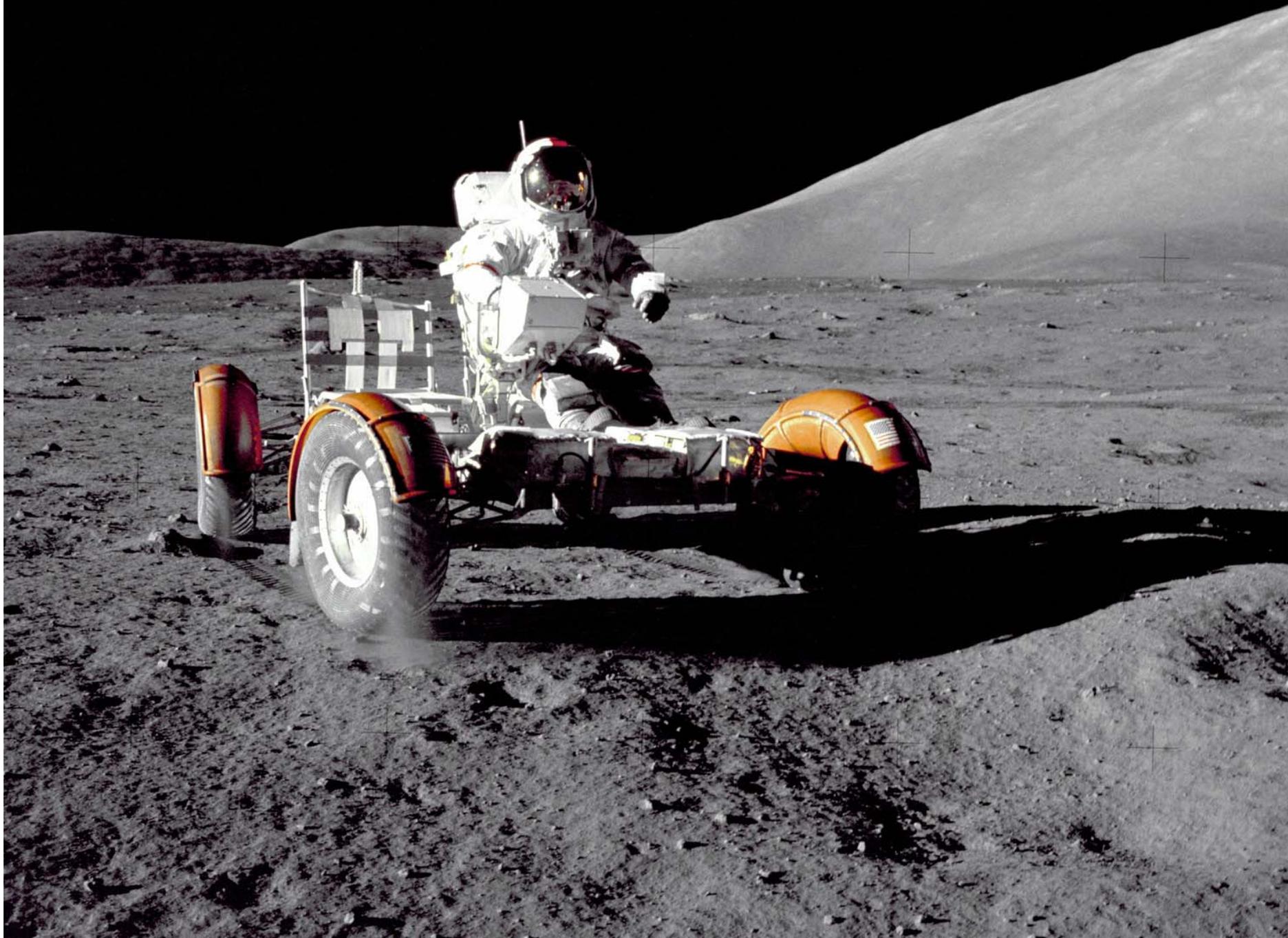


Source: Dr. Peter Wells, Neflex (11/05)—Toyota 's peak oil consultant

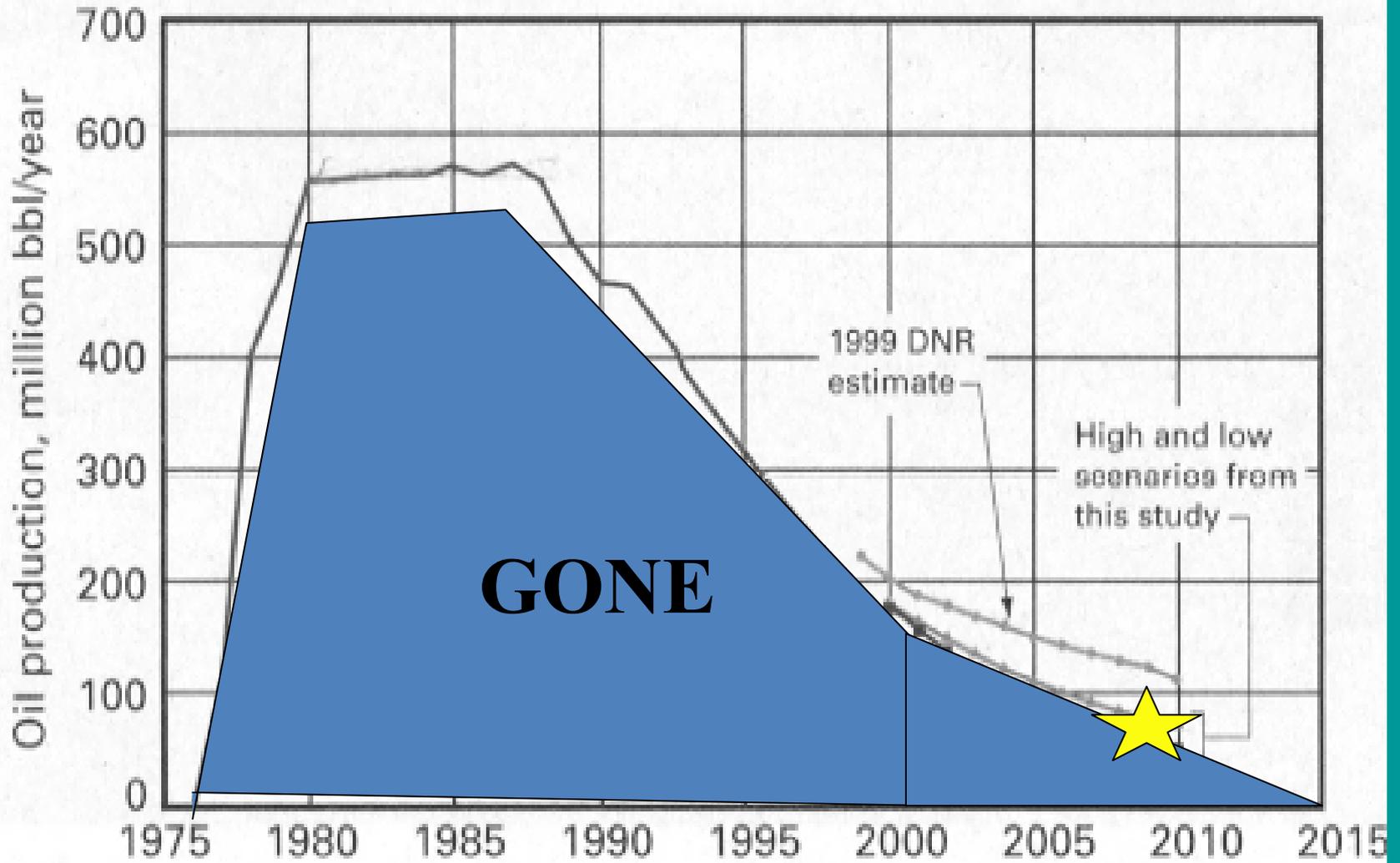
Drowning in oil



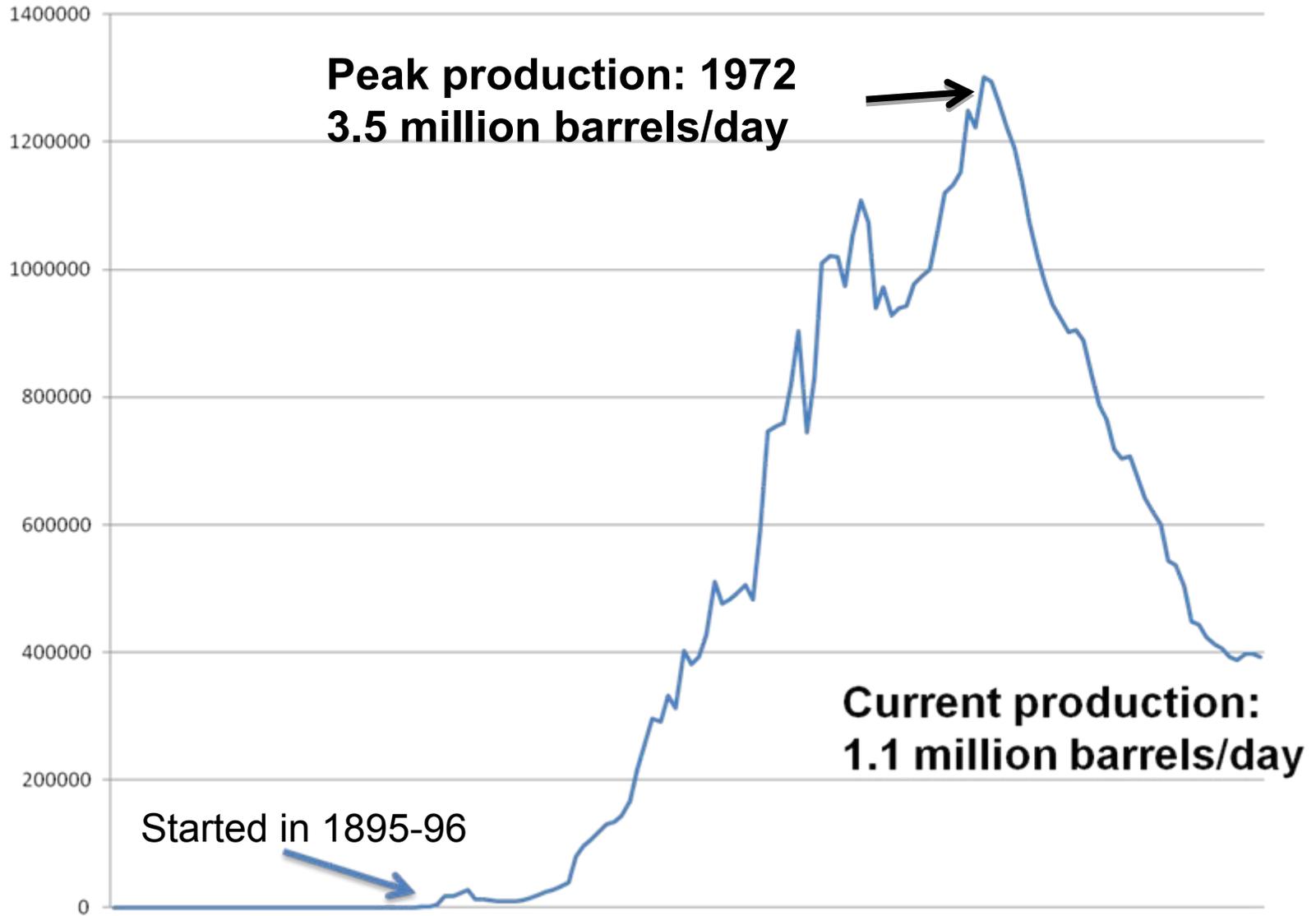




PRUDHOE BAY PRODUCTION



Texas Peaked in 1972



**Peak production: 1972
3.5 million barrels/day**



**Current production:
1.1 million barrels/day**

Started in 1895-96

Source: US Energy Information Administration



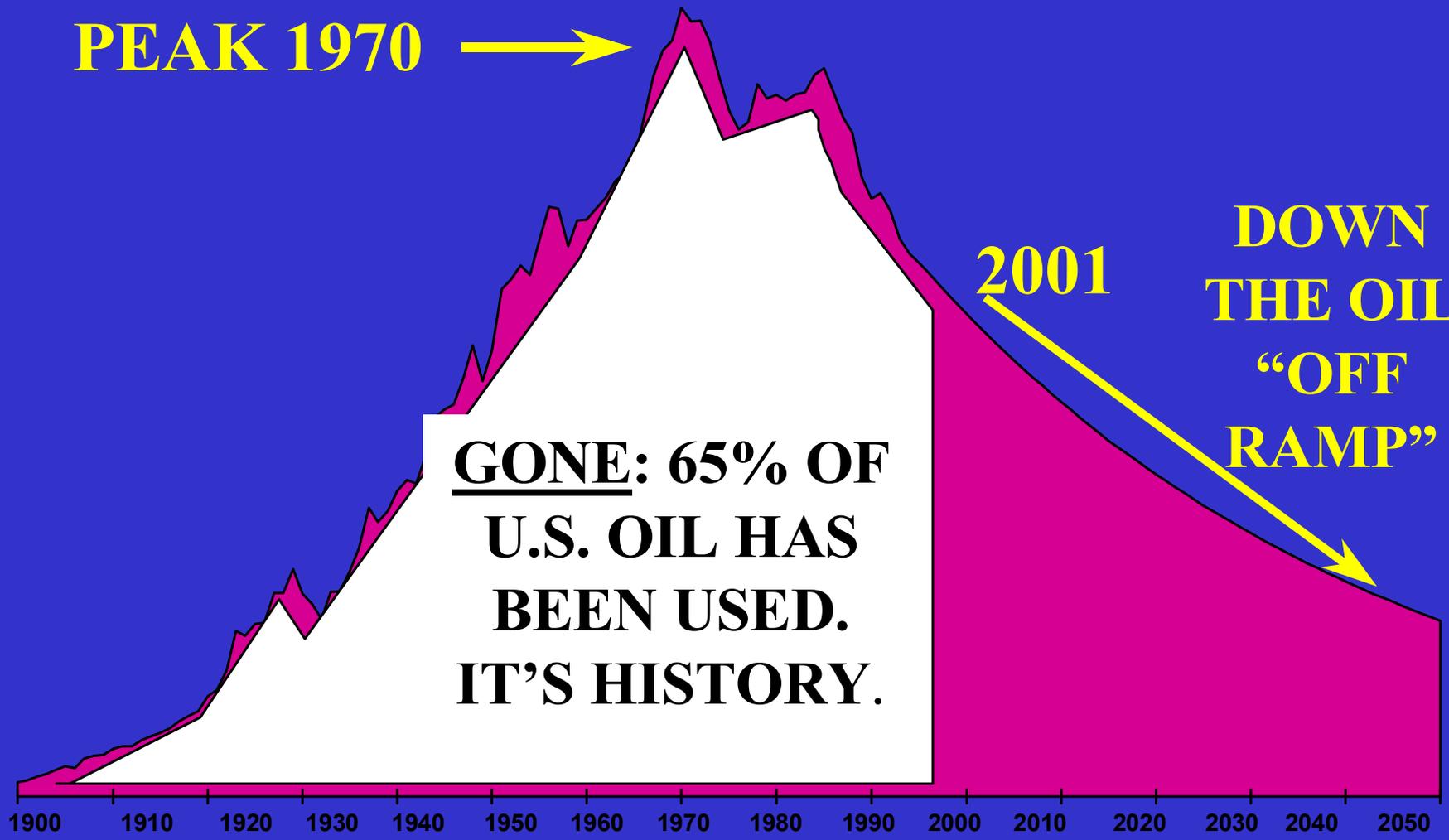
U.S. OIL PRODUCTION 1900 TO 2050

PEAK 1970 →

**GONE: 65% OF
U.S. OIL HAS
BEEN USED.
IT'S HISTORY.**

2001

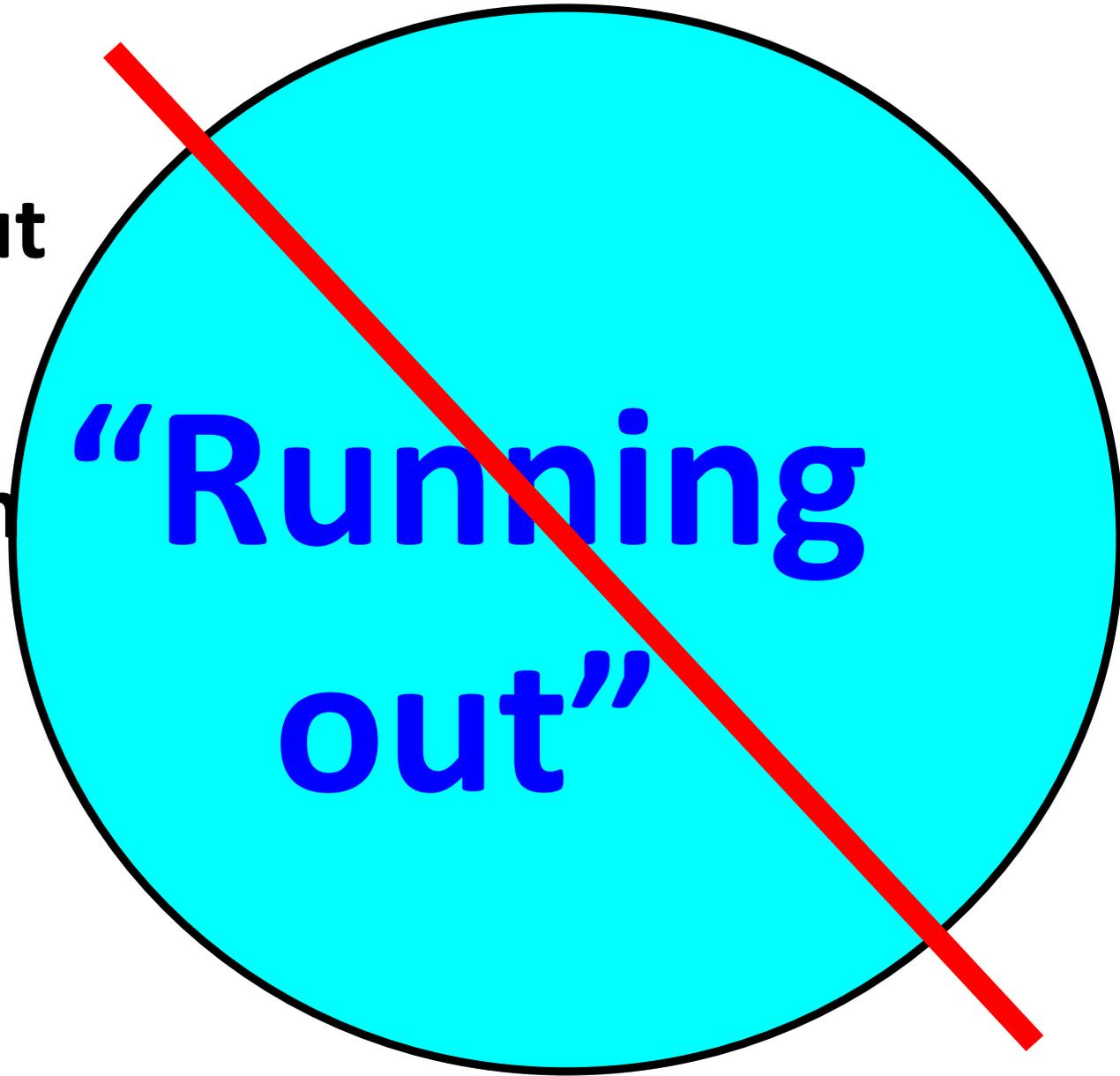
DOWN
THE OIL
"OFF
RAMP"





**Peak oil is not
about
running out**

**It's about
"maximum
flows"**

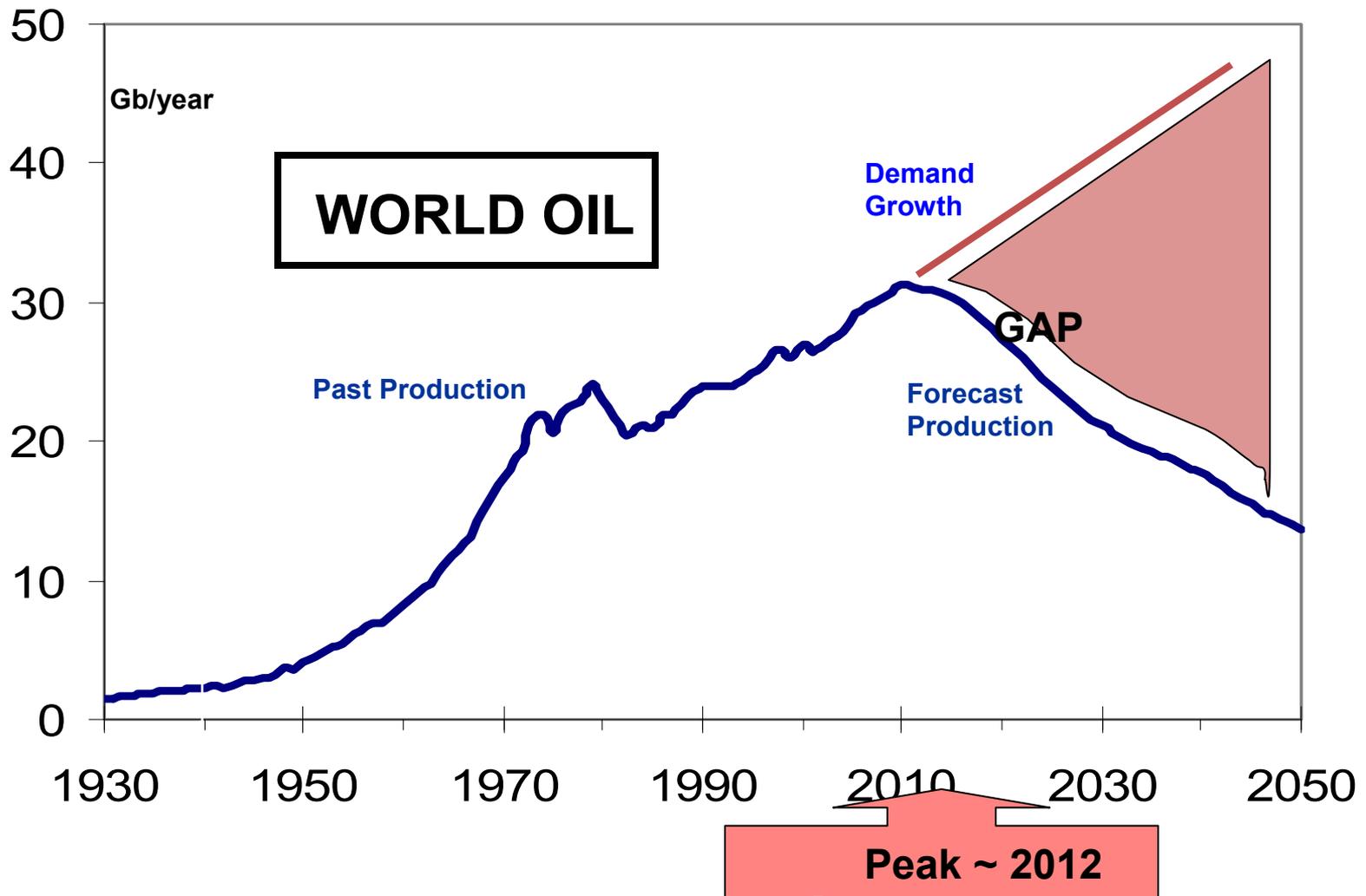


**"Running
out"**

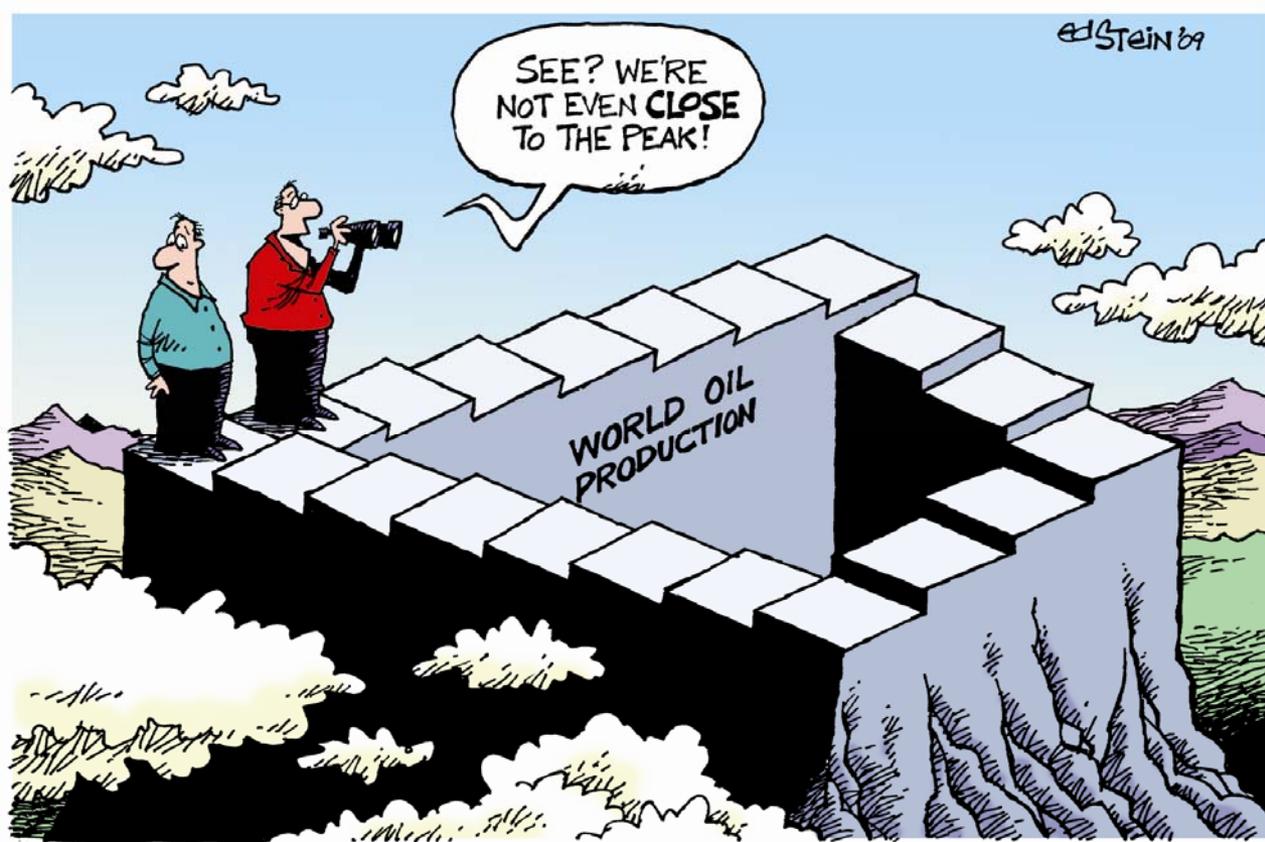
Peak Oil matters because 'The flows matter'

- **Consumers Need Flows**
- **Reserves are only useful as flows**
- **Peak oil is when flows can't meet demand**
- **Flows can be geologically, politically, physically, or capital constrained**
- **Many experts: peak oil flows will occur no later than 2015**

A Chinese View on Peak Oil



China is moving aggressively to secure oil supply. New deals with Iran, Venezuela, Canada...



Peak oil?

Contrary to the theory, oil production shows no sign of a peak.

Will we soon reach a point when the world's oil supply begins to decline? Yes, according to so-called "peak oil" proponents. They theorize that, since new discoveries have not kept up with the pace of production in recent years, we will soon reach a point when oil production starts going downhill. So goes the theory.

The theory does not match reality, however. Oil is a finite resource, but because it is so incredibly large, a peak will not occur this year, next year or for decades to come.

According to the U.S. Geological Survey, the Earth was endowed with over 3.3 trillion barrels of conventional recoverable oil. Conservative estimates of heavy oil and shale oil push the total resource well over four trillion barrels. To put these amounts in perspective, consider this: Since the dawn of human history, we have used a total of about one trillion barrels of oil.

Moreover, new technologies — such as multidimensional mapping tools and advanced drilling techniques — have improved our ability

to recover oil from previously discovered fields. Because of such technology gains, estimates of how much recoverable oil remains have consistently *increased* over time. Oil production and production capacity have increased, too.

So there is a lot of oil yet to be tapped. And we are getting better — technically and environmentally — at tapping it every day.

As a large scale, broad-based transportation fuel, oil currently has no equal. Demand for it is increasing to support economic growth worldwide. Thankfully, there is enough potential supply to meet this demand.

Realizing this potential, however, means we all must do our part. Energy companies help through investment and technology. Governments help by providing an attractive business environment. And we all can help by using energy more efficiently.

With abundant oil resources still available — and industry, governments and consumers doing their share — peak production is nowhere in sight.

Exxon: there's nothing to worry about

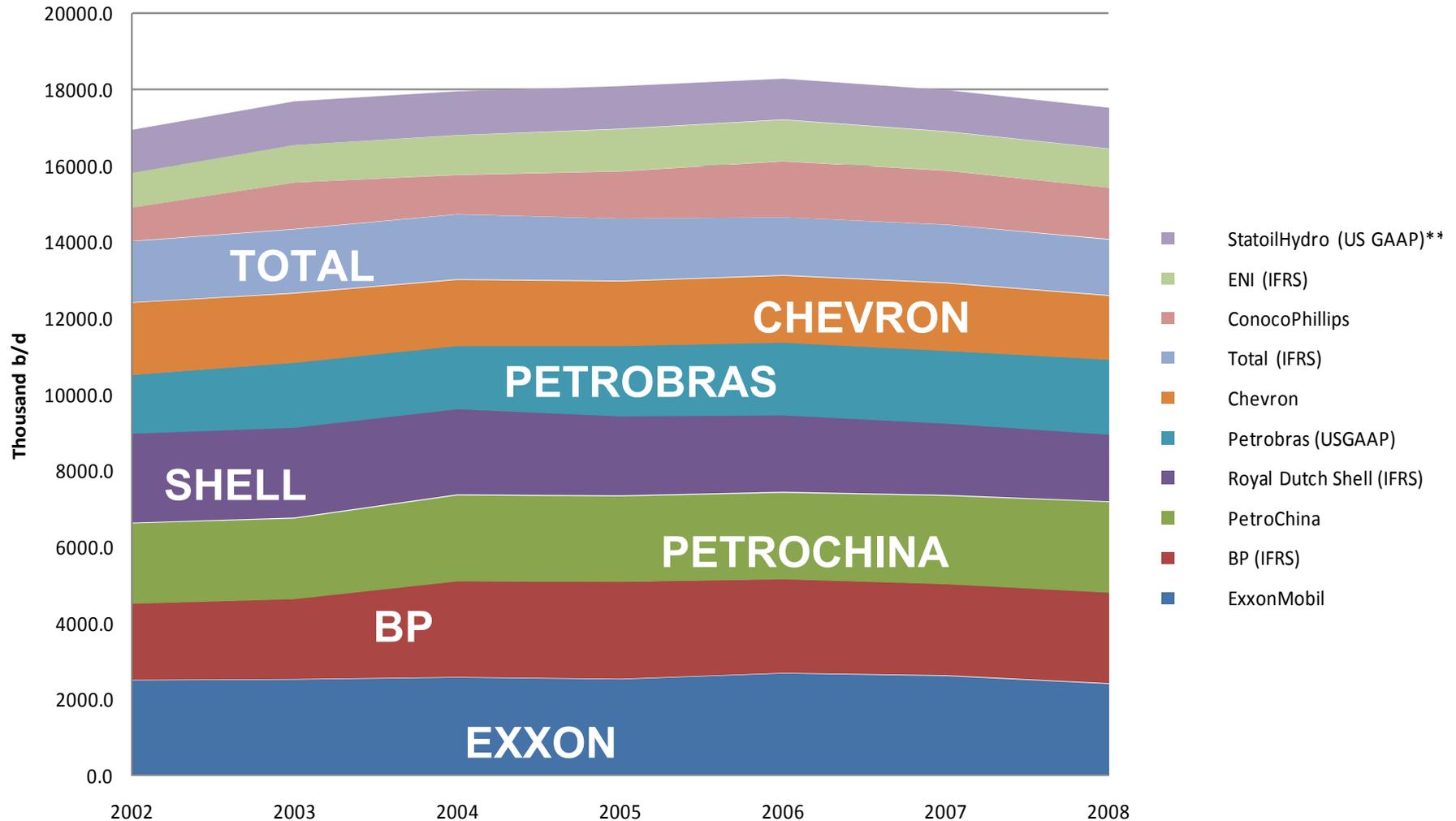
“A peak will not occur this year, next year, or for decades to come”

ExxonMobil

Taking on the world's toughest energy challenges.®

Visit www.exxonmobil.com

Peak or Plateau? Output of ten largest companies is slowly falling



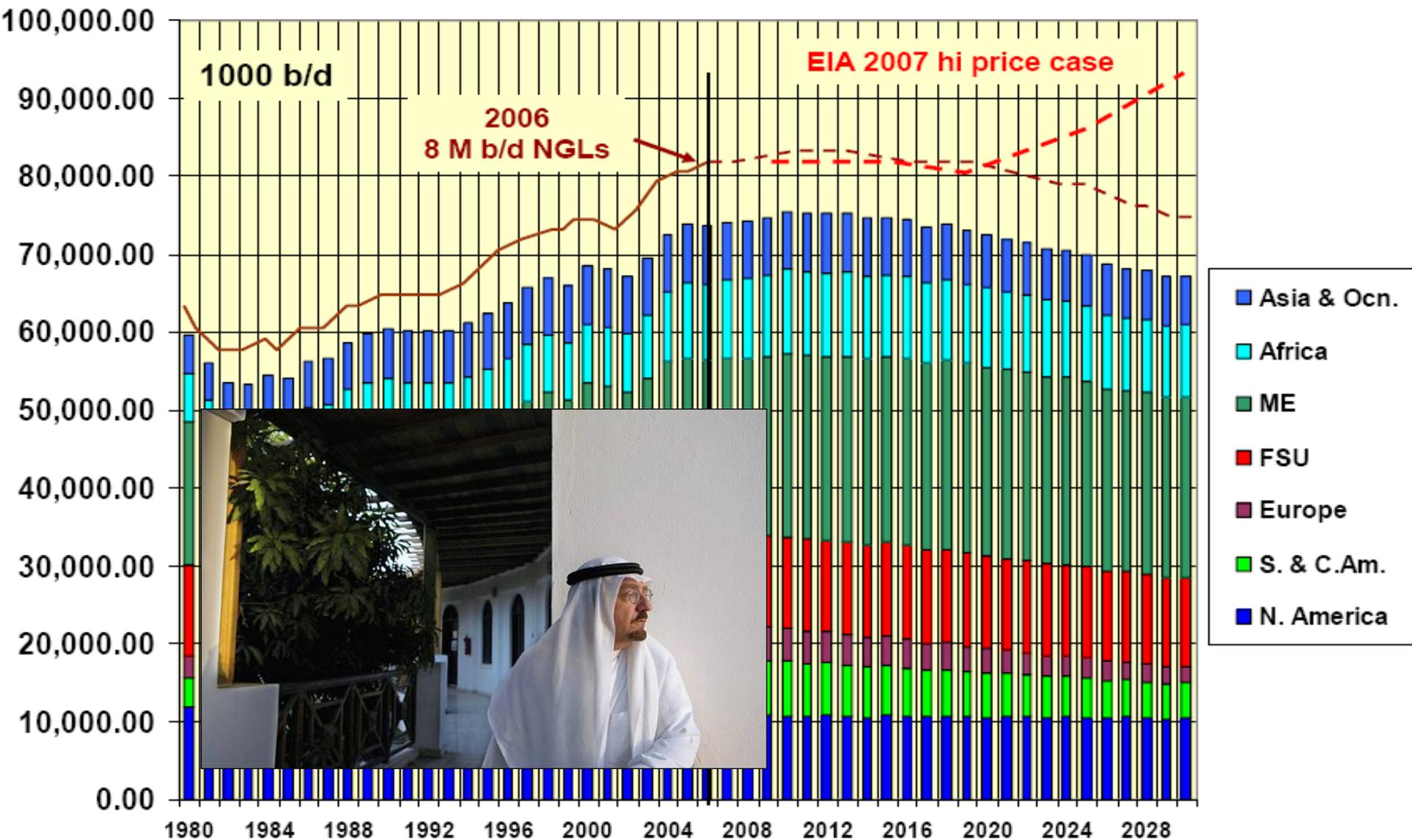


*“World will peak soon,
if not already,” says
de Margerie, CEO of
Total, SA*



- In Oct 2007: “Production of **100 million barrels a day** will be difficult.”
- In 2008: “World production will peak at or below **95 mmb/day**”
- In Feb 2009: “Production may plateau below **90 mmb/day**”
- Other oil companies: Hess, Marathon, Conoco, Shell, Chevron

Saudi Outlook

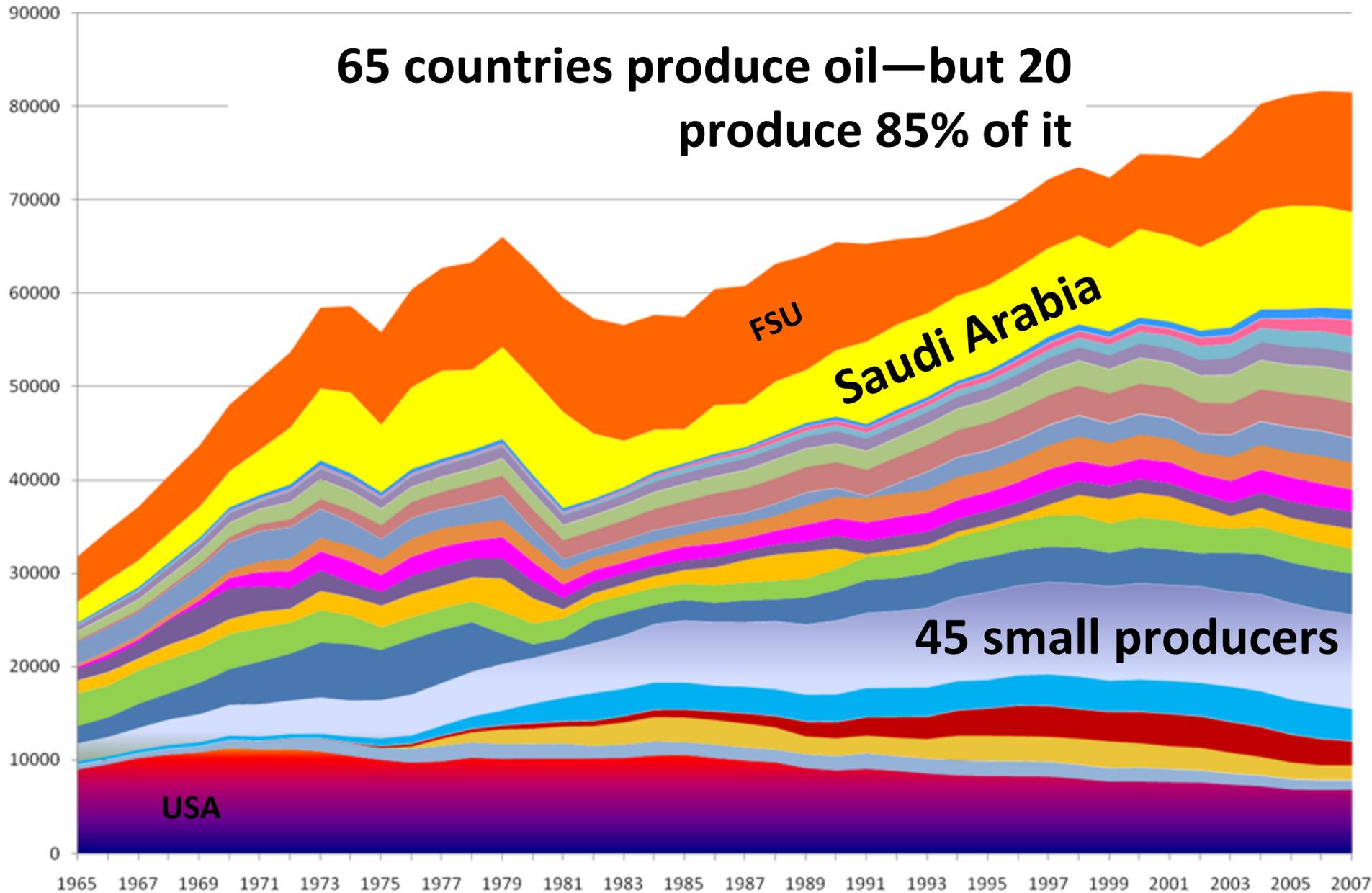


Dr. Sadad Al Husseini, Saudi Aramco

<http://www.youtube.com/watch?v=VUVY2qrEfd8>

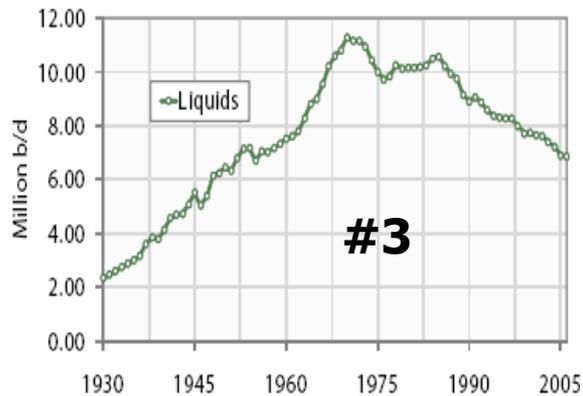
Supply Fundamentals

**65 countries produce oil—but 20
produce 85% of it**



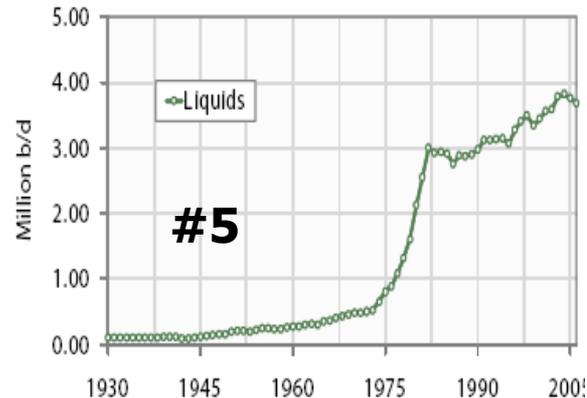
Top 21 countries: decreasing

Chart 78: United States Production 1930 - 2006



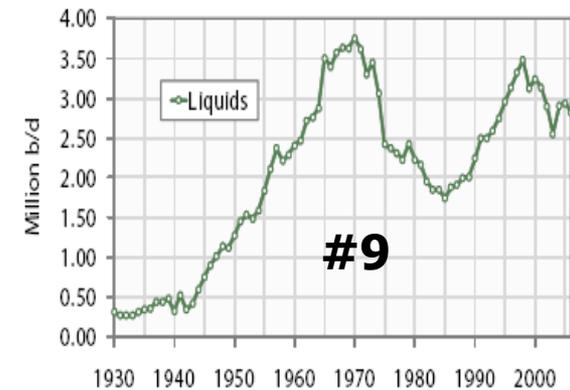
Source: ASPO Ireland & BP Statistical Review

Chart 82: Mexico Production 1930 - 2006



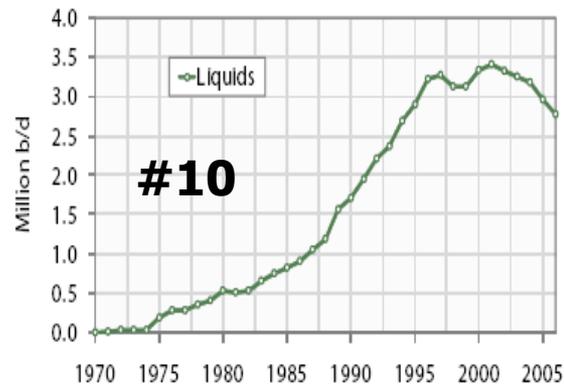
Source: ASPO Ireland & BP Statistical Review

Chart 92: Venezuela Production 1930 - 2006



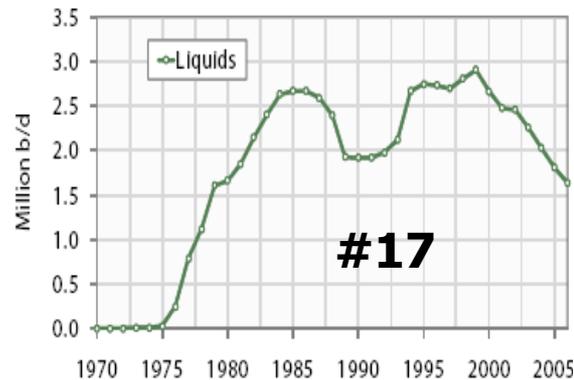
Source: ASPO Ireland & BP Statistical Review

Chart 45: Norway Production 1970 - 2006



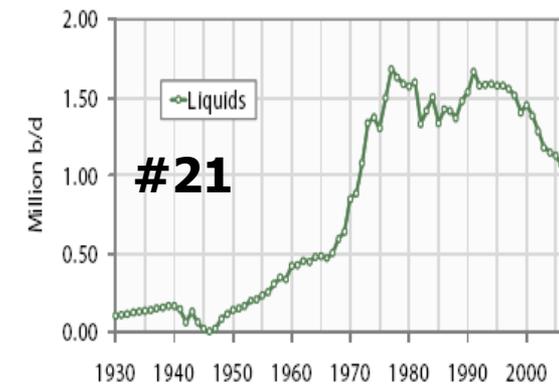
Source: ASPO Ireland & BP Statistical Review

Chart 47: United Kingdom Production 1970 - 2006



Source: ASPO Ireland & BP Statistical Review

Chart 97: Indonesia Production 1930 - 2006



Source: ASPO Ireland & BP Statistical Review



Jump Back Jack

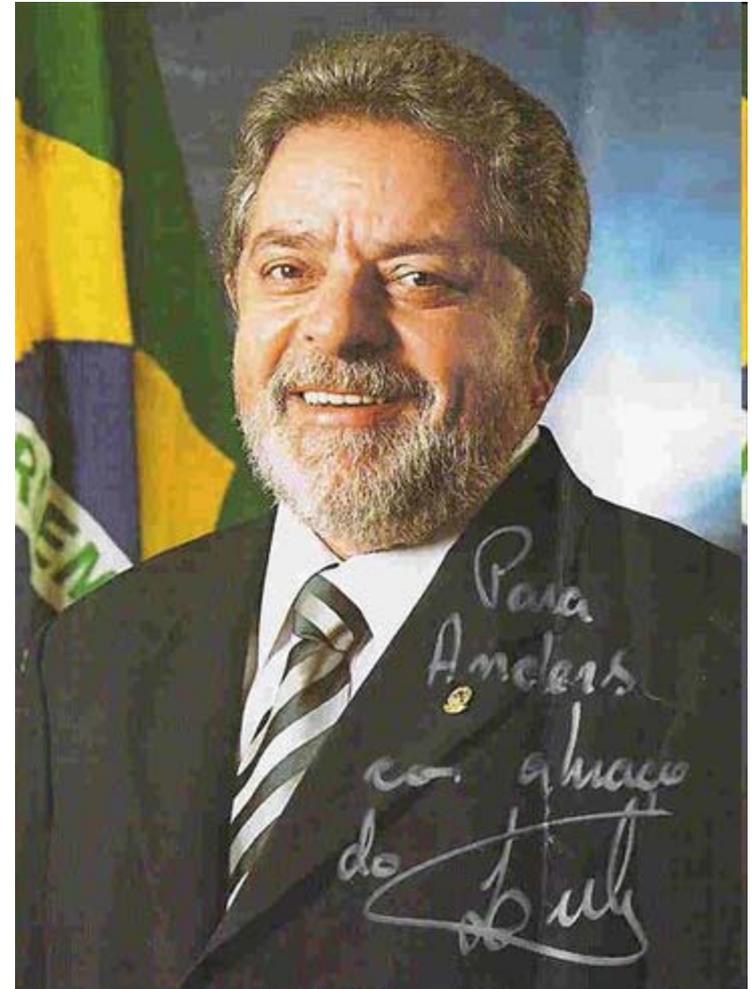
**Deepwater
discoveries in
Brazil, Angola,
Gulf of Mexico**

**Single well costs
\$100 million;
typical field takes
5 to 10 years to
develop; rapid
decline rates**

Is God Brazilian?

Brazil's President announces that new deepwater find at Tupi confirms that "God is Brazilian"

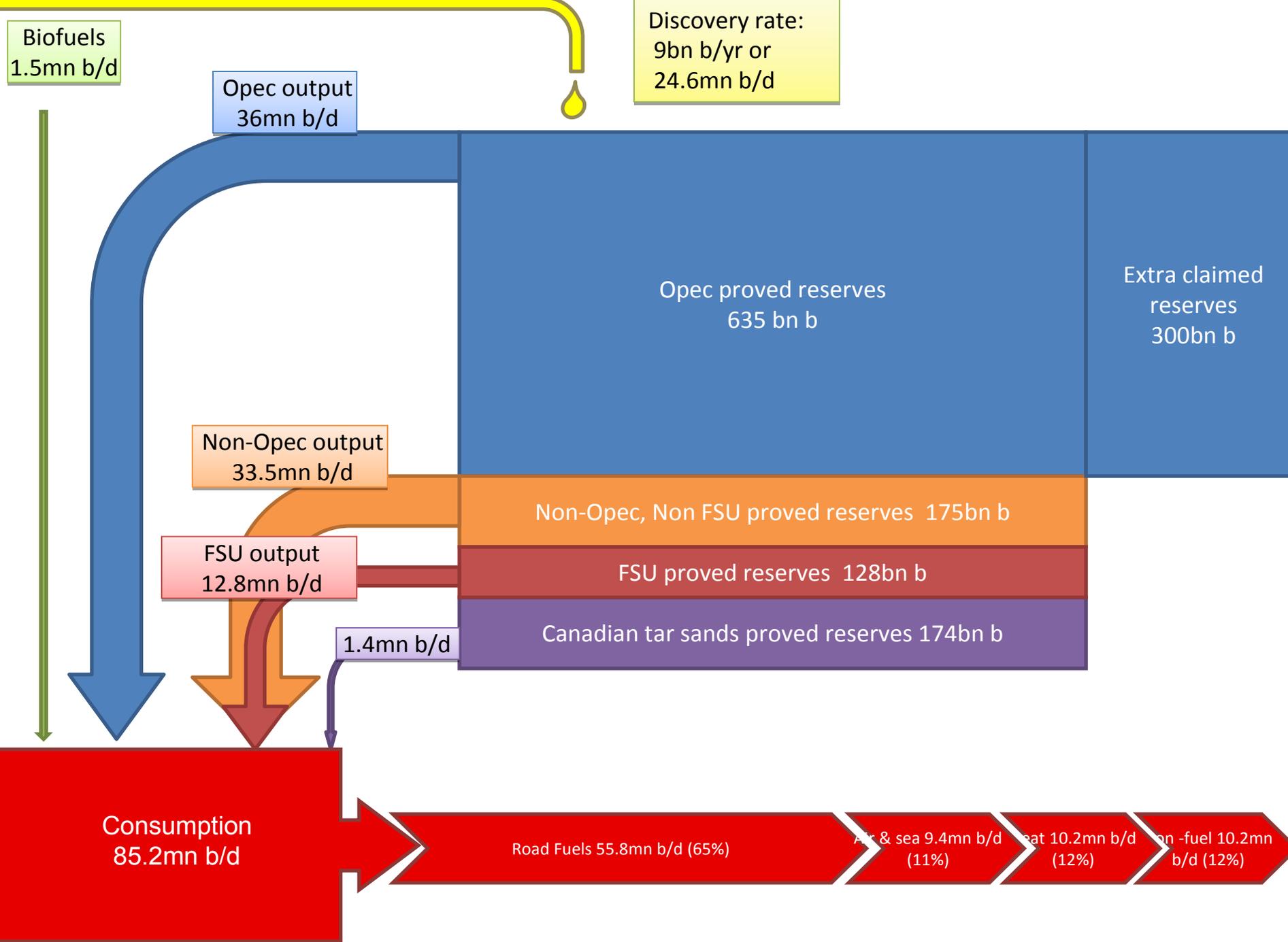
Other positive developments: Bakken Shale in North Dakota, Canadian tar sands



2005 – 2008 Crude Oil Change

- Largest crude increases offset by 8 largest declines:

<u>Best Performers:</u>	<u>MMB/D</u>	<u>Biggest Declines:</u>	<u>MMB/D</u>
Angola	+590	Mexico	(542)
Azerbaijan	+437	Norway	(516)
Russia	+314	Nigeria	(462)
Canada	+181	United Kingdom	(259)
Sudan	+171	USA	(223)
UAE	+146	Venezuela	(166)
30 "Other Countries"	+313	Iran	(114)
	<u>+2,152</u>	Yemen	(102)
			<u>(2,384)</u>



Biofuels
1.5mn b/d

Discovery rate:
9bn b/yr or
24.6mn b/d

Opec output
36mn b/d

Non-Opec output
33.5mn b/d

FSU output
12.8mn b/d

1.4mn b/d

Opec proved reserves
635 bn b

Extra claimed
reserves
300bn b

Non-Opec, Non FSU proved reserves 175bn b

FSU proved reserves 128bn b

Canadian tar sands proved reserves 174bn b

Consumption
85.2mn b/d

Road Fuels 55.8mn b/d (65%)

Air & sea 9.4mn b/d (11%)

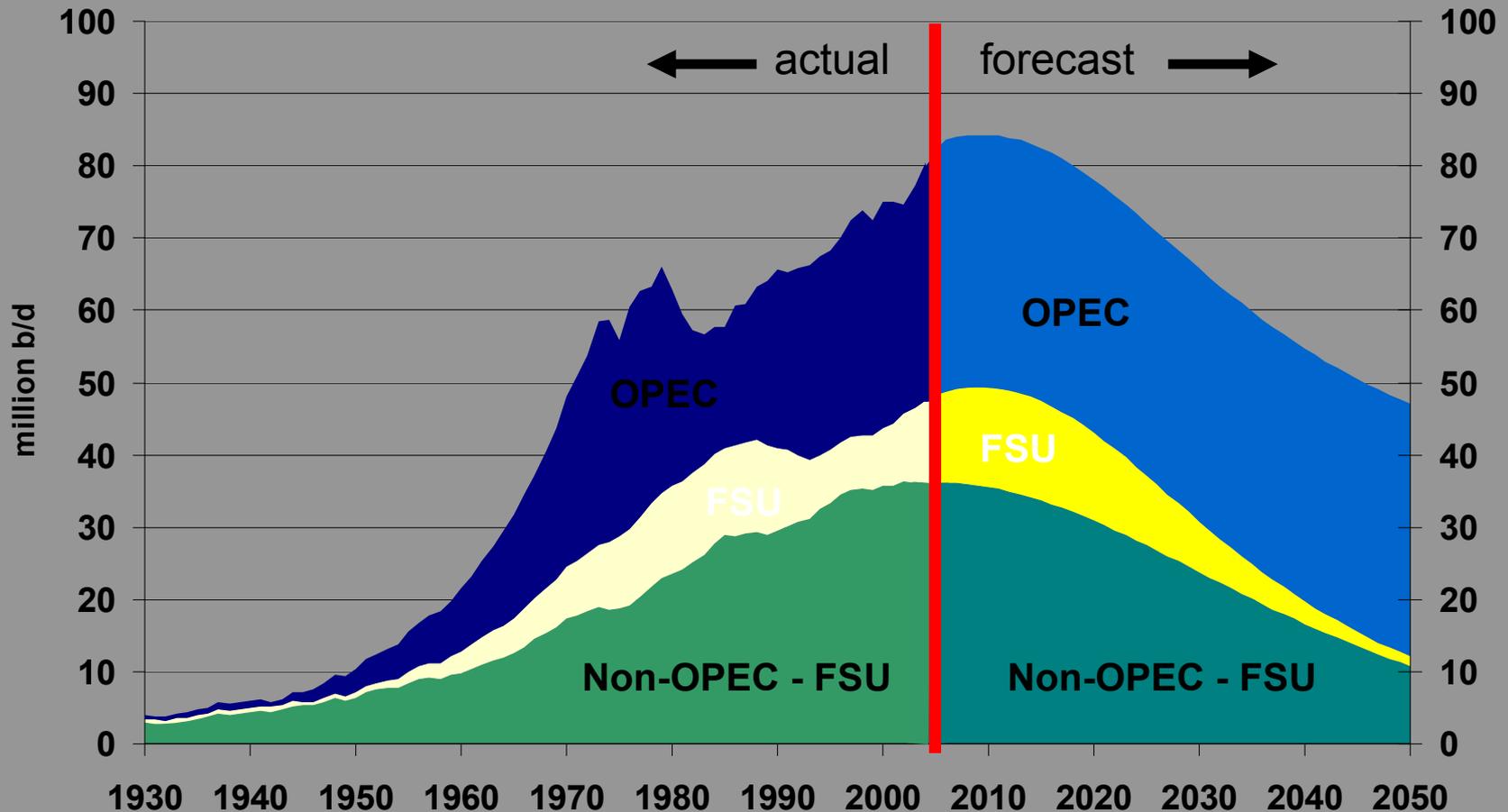
Heat 10.2mn b/d (12%)

Non-fuel 10.2mn b/d (12%)

Steady State Scenario

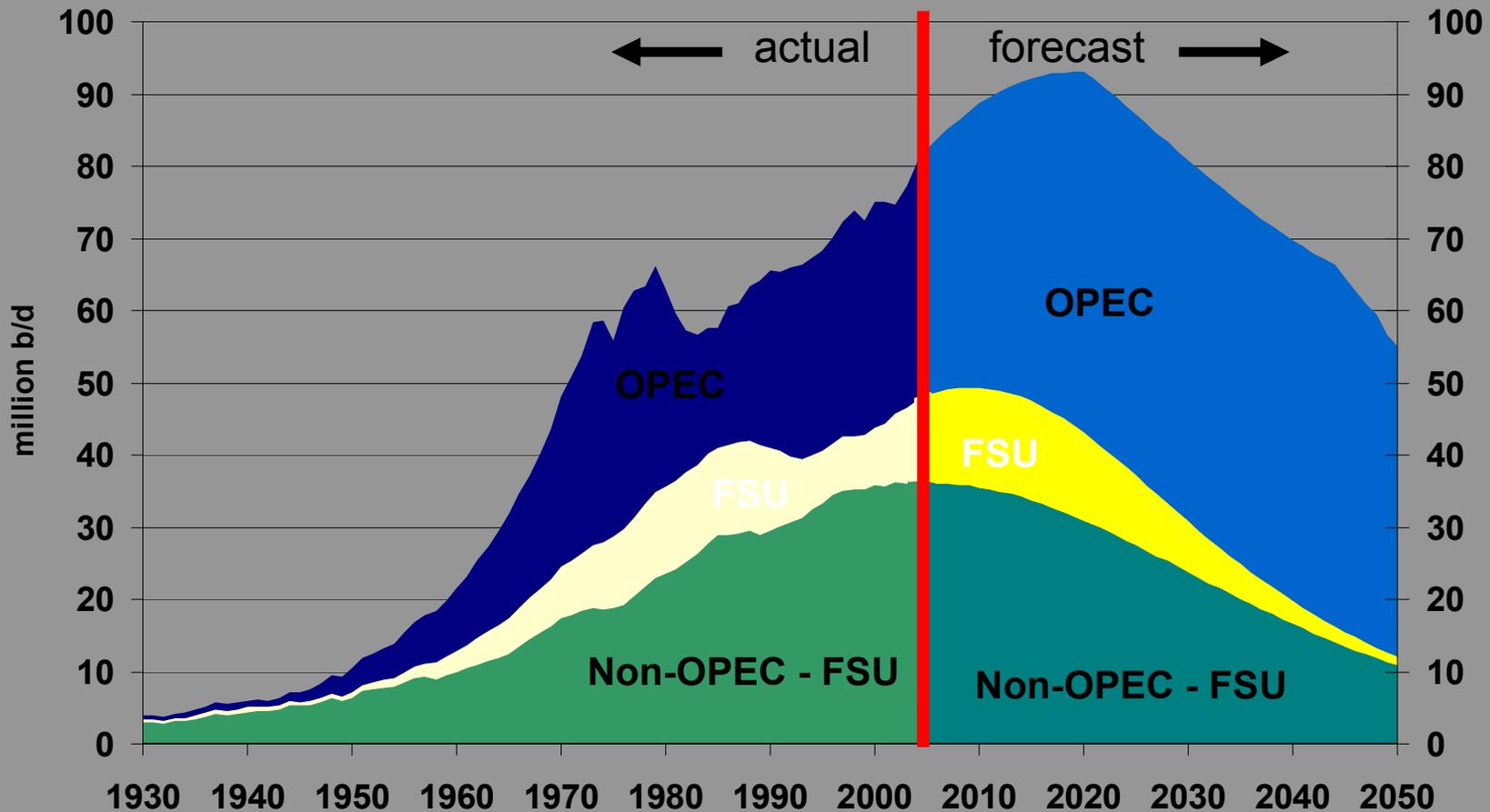
OPEC stays ~35 million b/d

World peaks at 86 million b/d in 2011



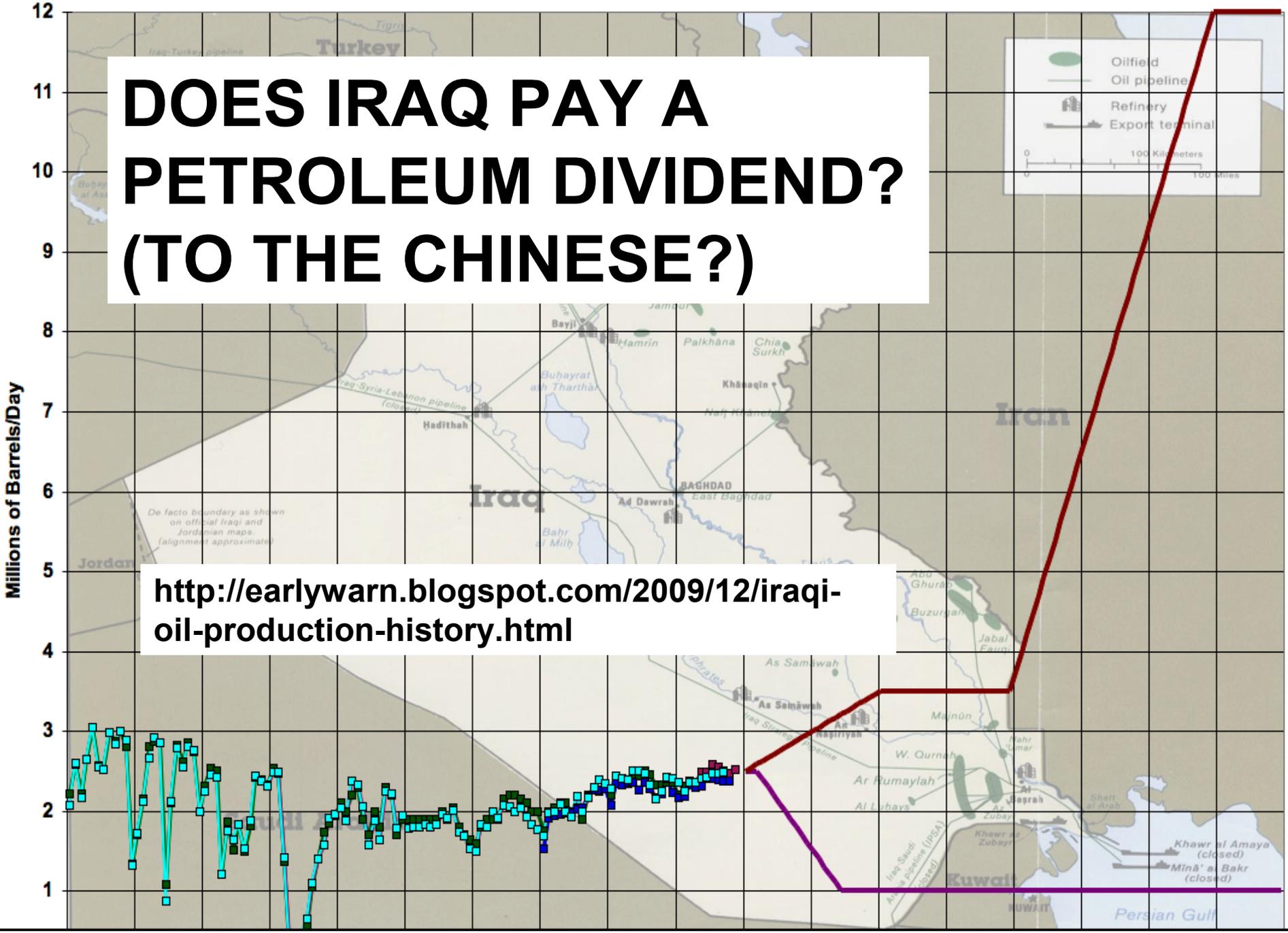
OPEC does a very heavy lift

World peaks at 93 million b/d in 2020

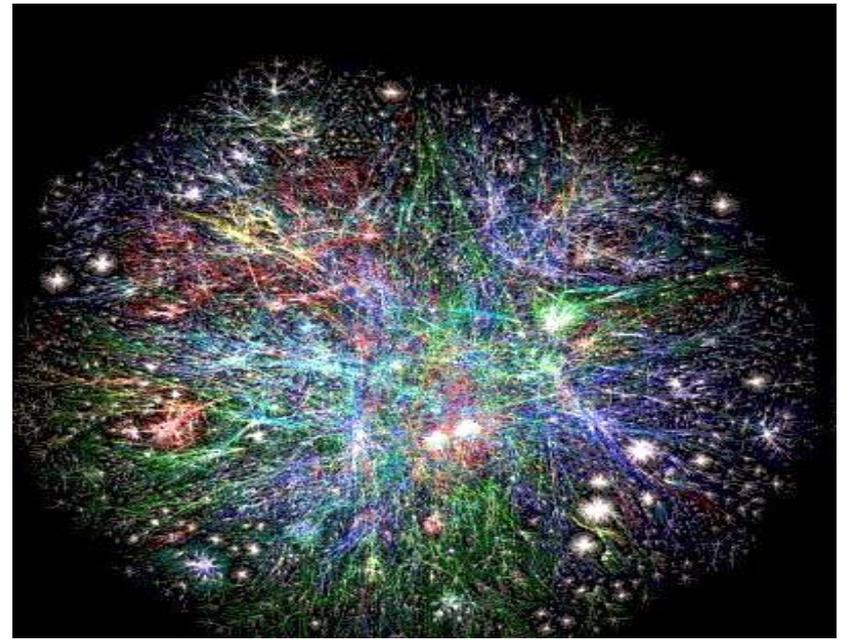
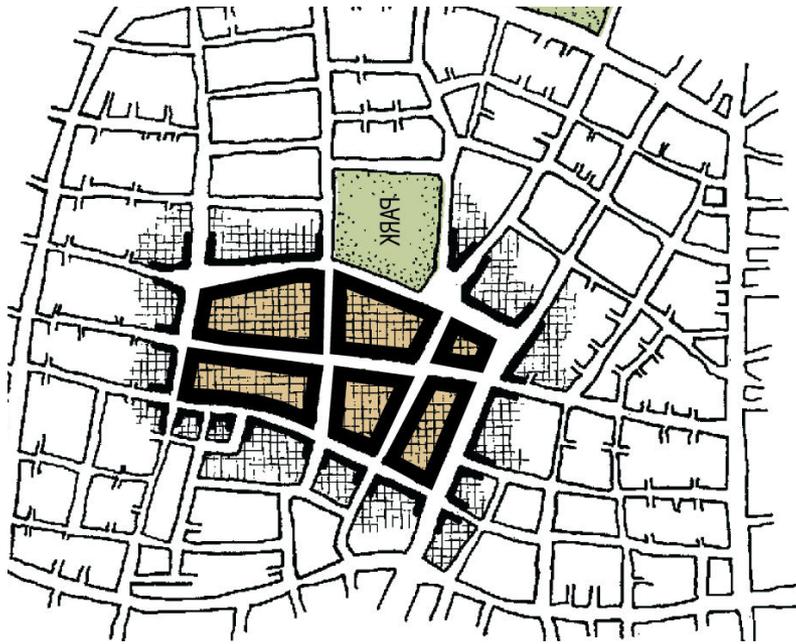


DOES IRAQ PAY A PETROLEUM DIVIDEND? (TO THE CHINESE?)

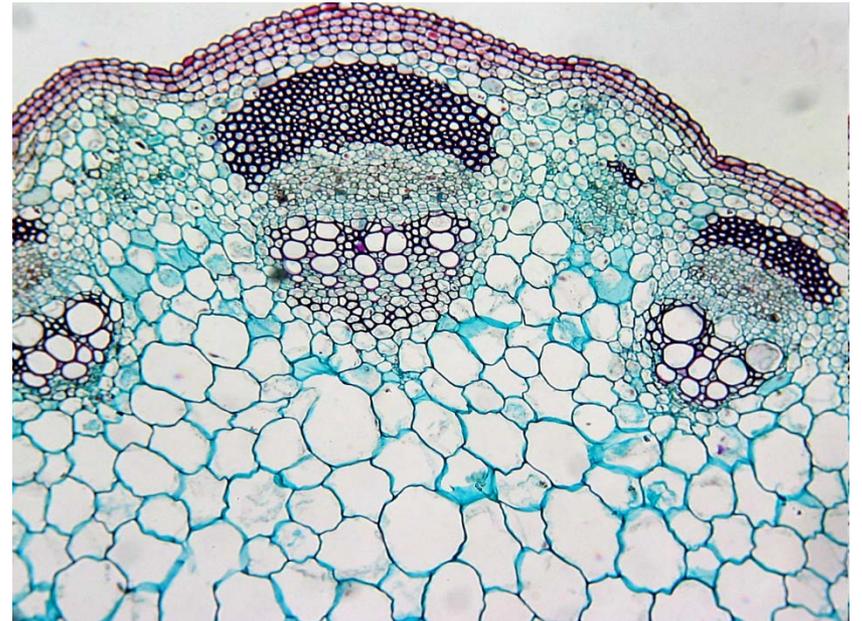
<http://earlywarn.blogspot.com/2009/12/iraqi-oil-production-history.html>

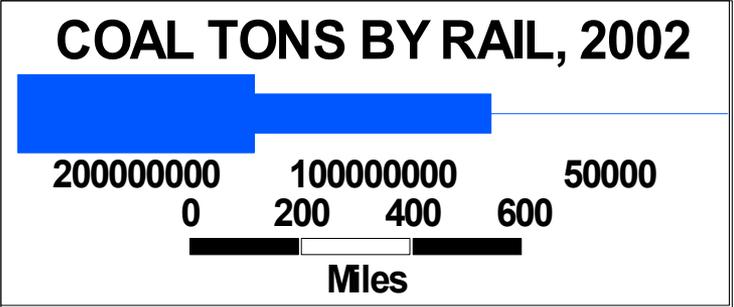
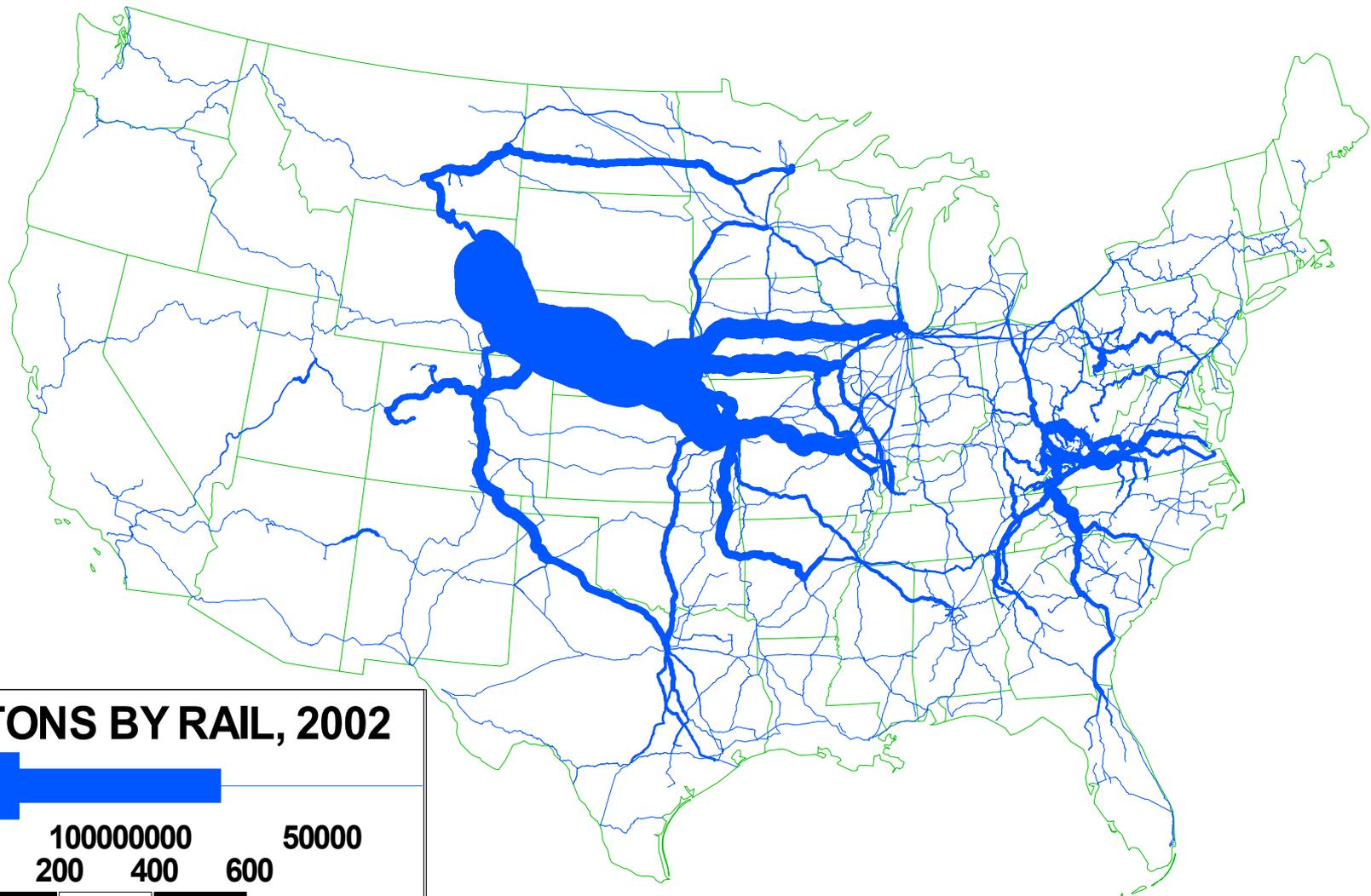




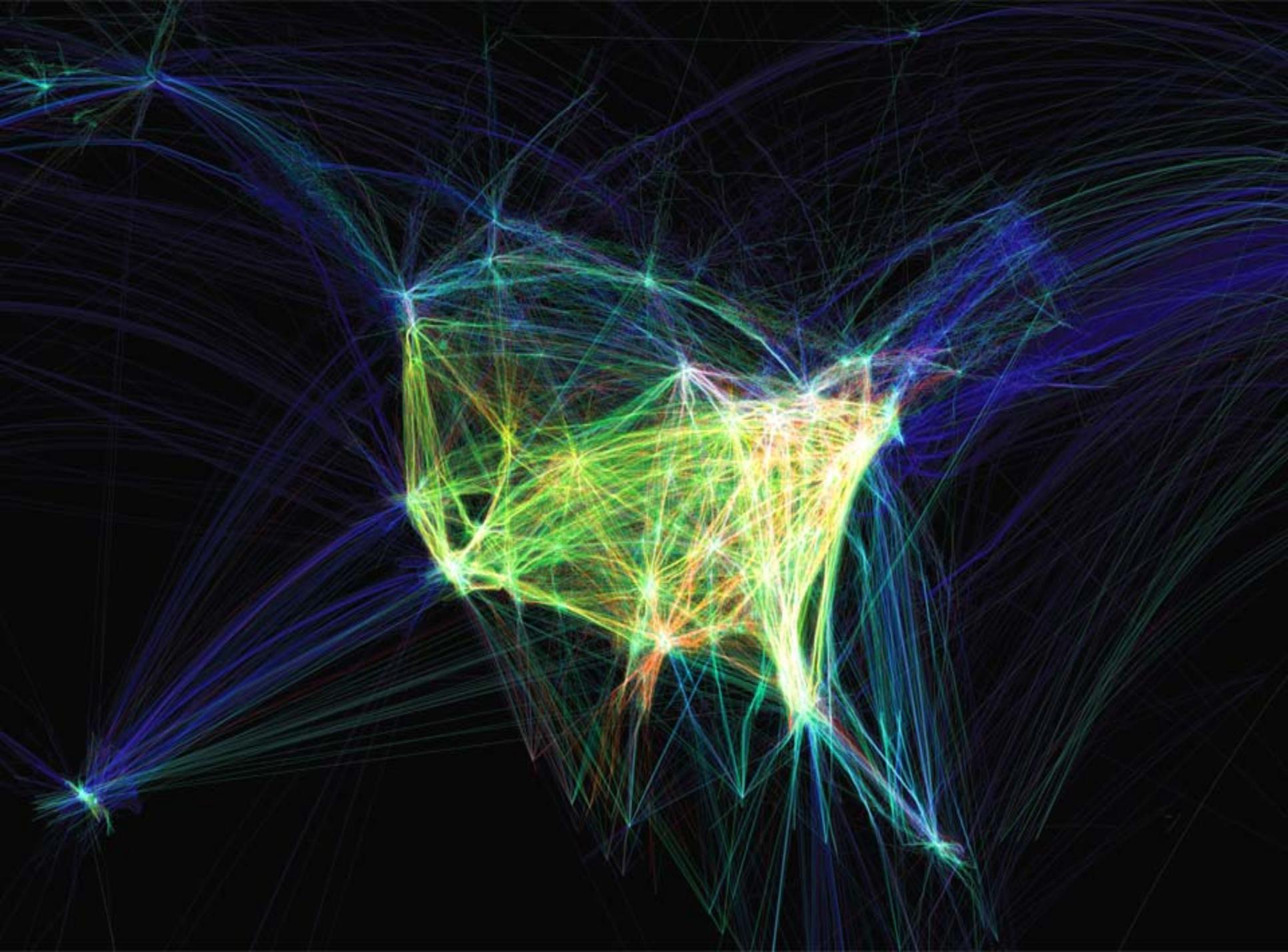


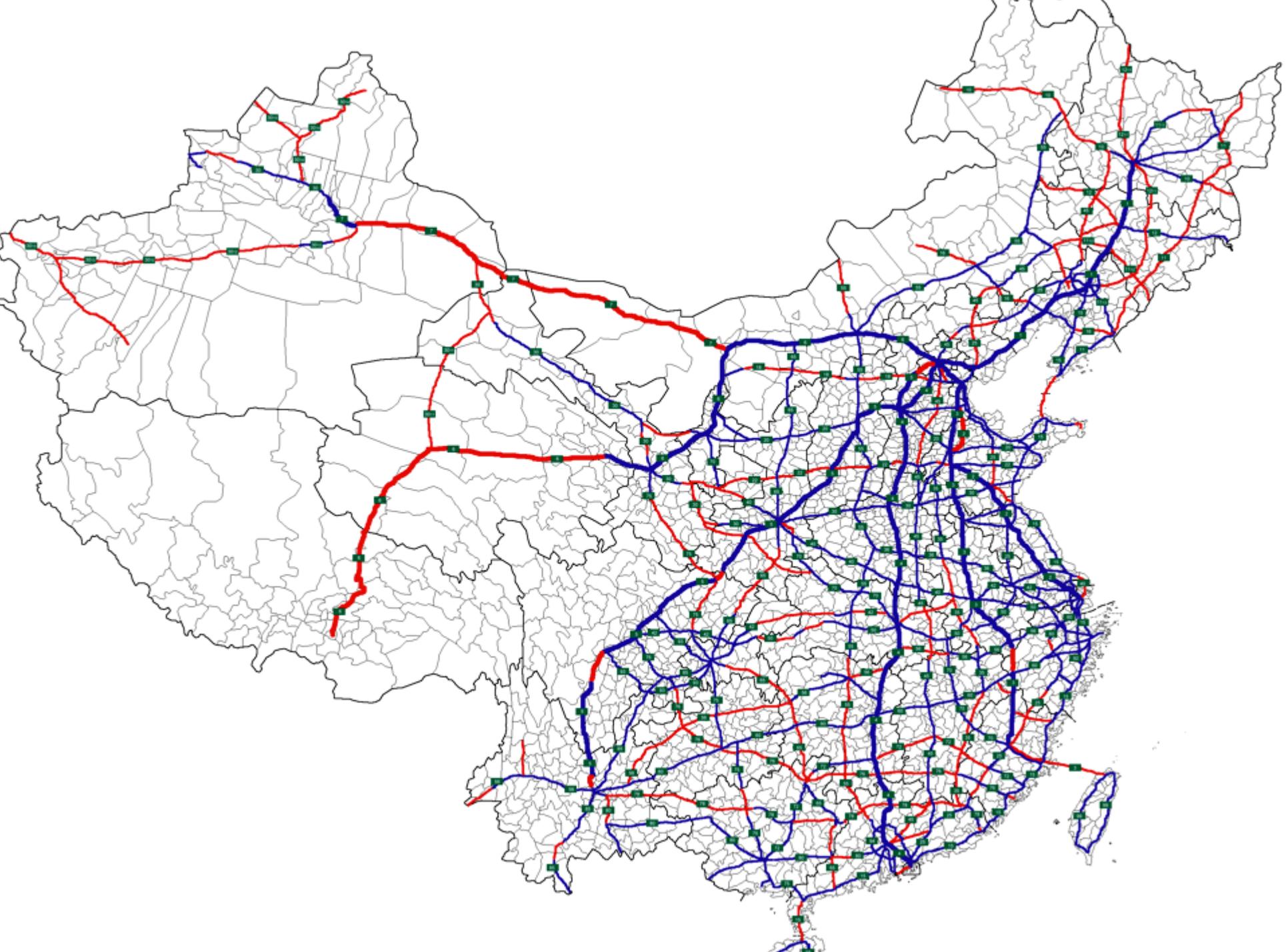
All organisms evolve networks to distribute energy



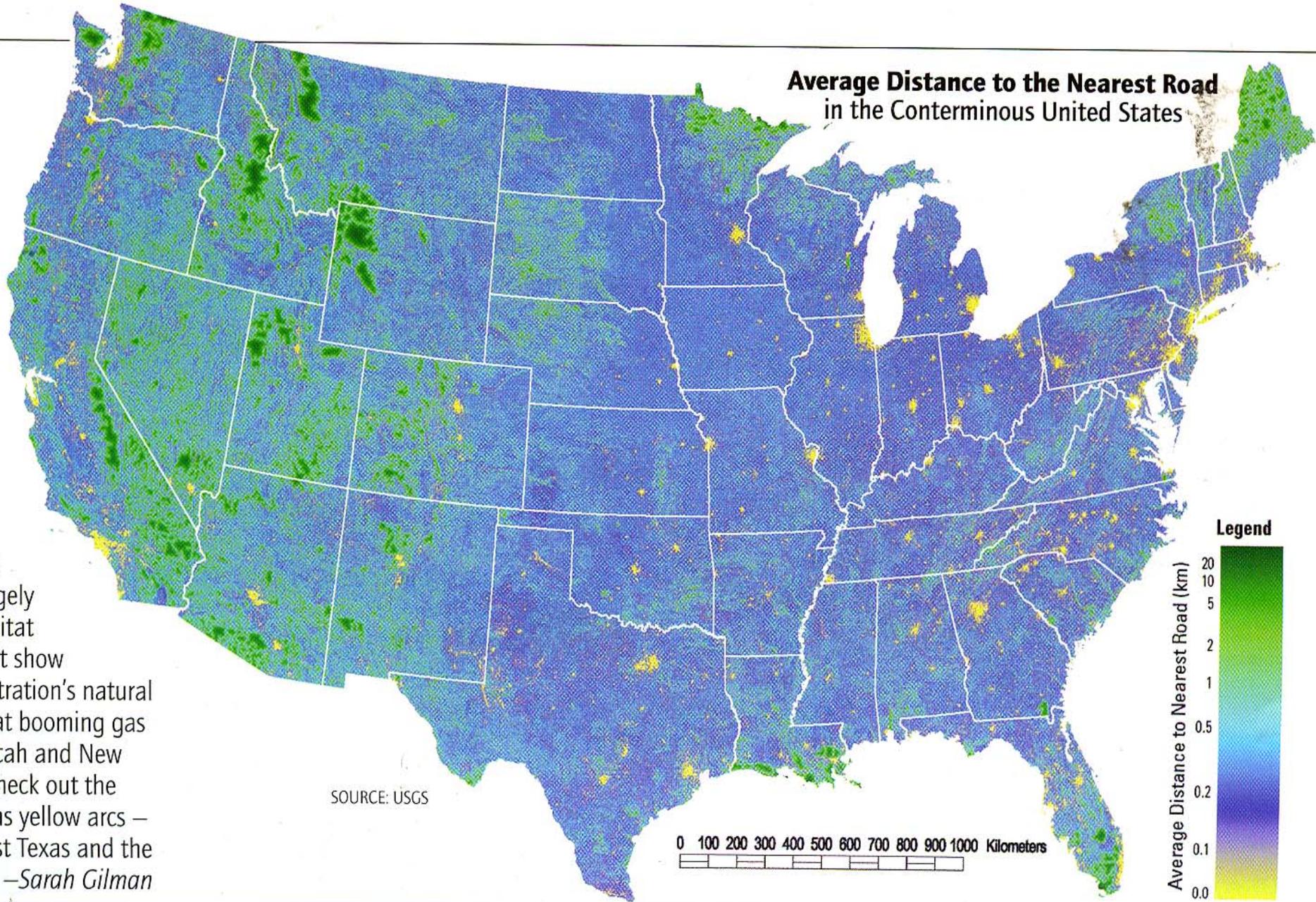


Source: Oak Ridge National Laboratory





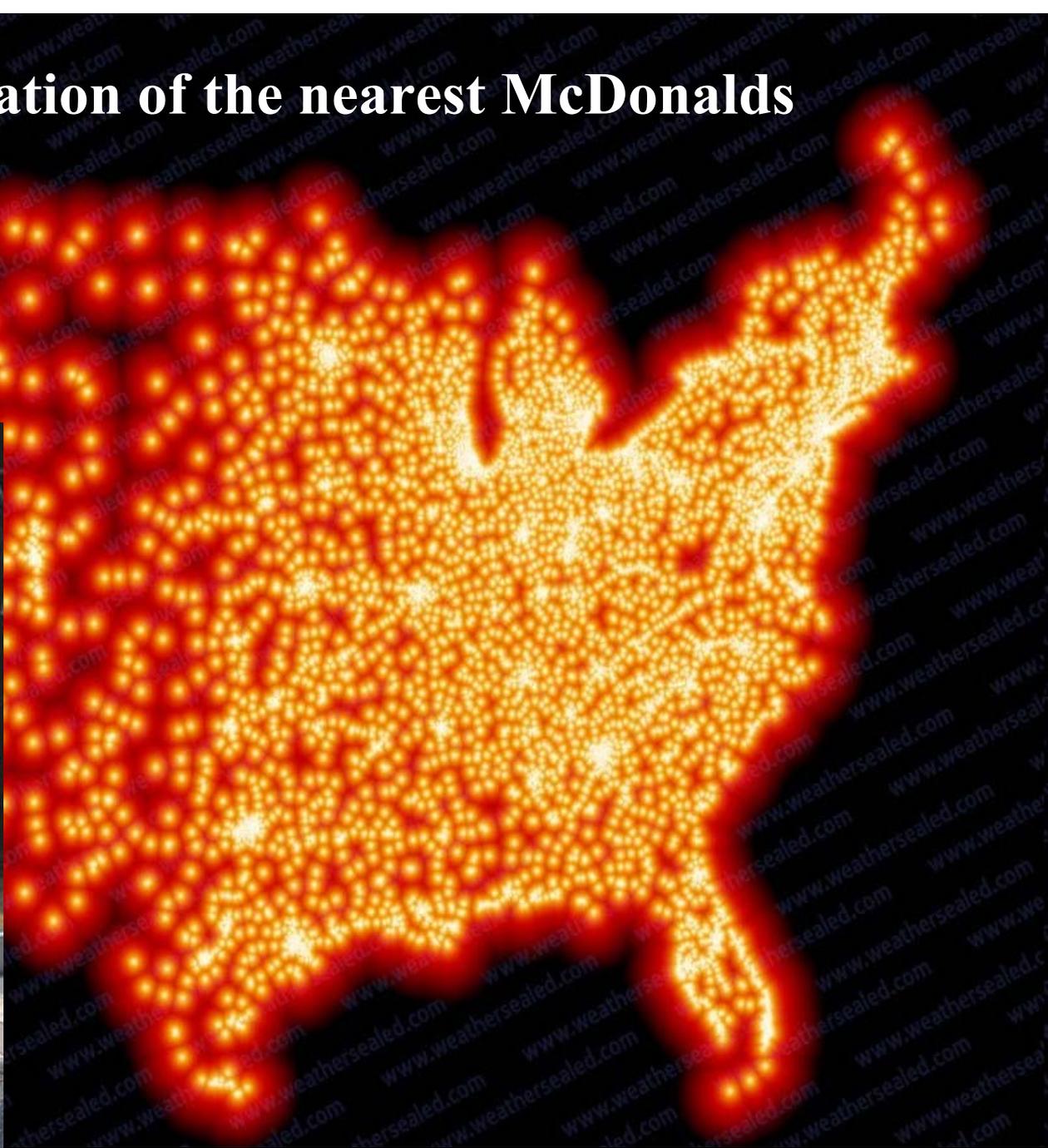
Average Distance to the Nearest Road in the Conterminous United States



SOURCE: USGS

s
gely
nitat
't show
stration's natural
at booming gas
tah and New
heck out the
as yellow arcs –
st Texas and the
–Sarah Gilman

Location of the nearest McDonalds



HOT GROWTH COMPANIES

BusinessWeek

WHY HOUSING
& OIL DON'T MIX

SPECULATION OR
MANIPULATION?

SHOCK WAVES
FOR AIRLINES

OIL IN THE ERA OF
GRAND THEFT AUTO

OIL & THE ECONOMY



Phillips

Regular

442⁹

Diesel

509⁹

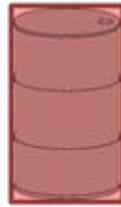
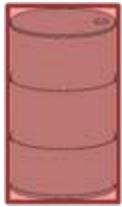
What Oil Price “Breaks the Machine?”

Auto

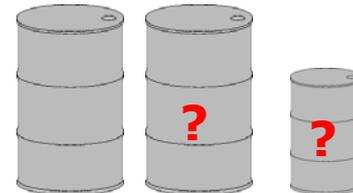
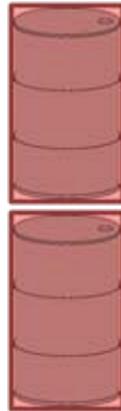
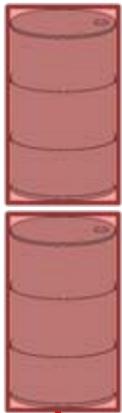
Liquid Alternatives tend to be carbon-intensive and low net energy

Input

Output



U.S. oil industry today

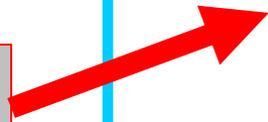


Oil from oil sands; maybe oil shale



Ethanol from corn

Impacts and form matter



Pickens Plan?

- 1990 target: 10 million natural gas vehicles by 2000
- 1994 revised target: 600,000
- Today, U.S. has 110,000 CNG vehicles & 1100 fueling stations
- Leaders: Pakistan, Argentina, Brazil and Iran over 1 million NGVs; 9.6 million in world (of 825 million total vehicles)



Honda Civic GX, only light duty vehicle that is NGV



100+ MPG

**If energy invented
prosperity...**

**Then efficiency,
conservation, and
renewables are
essential.**

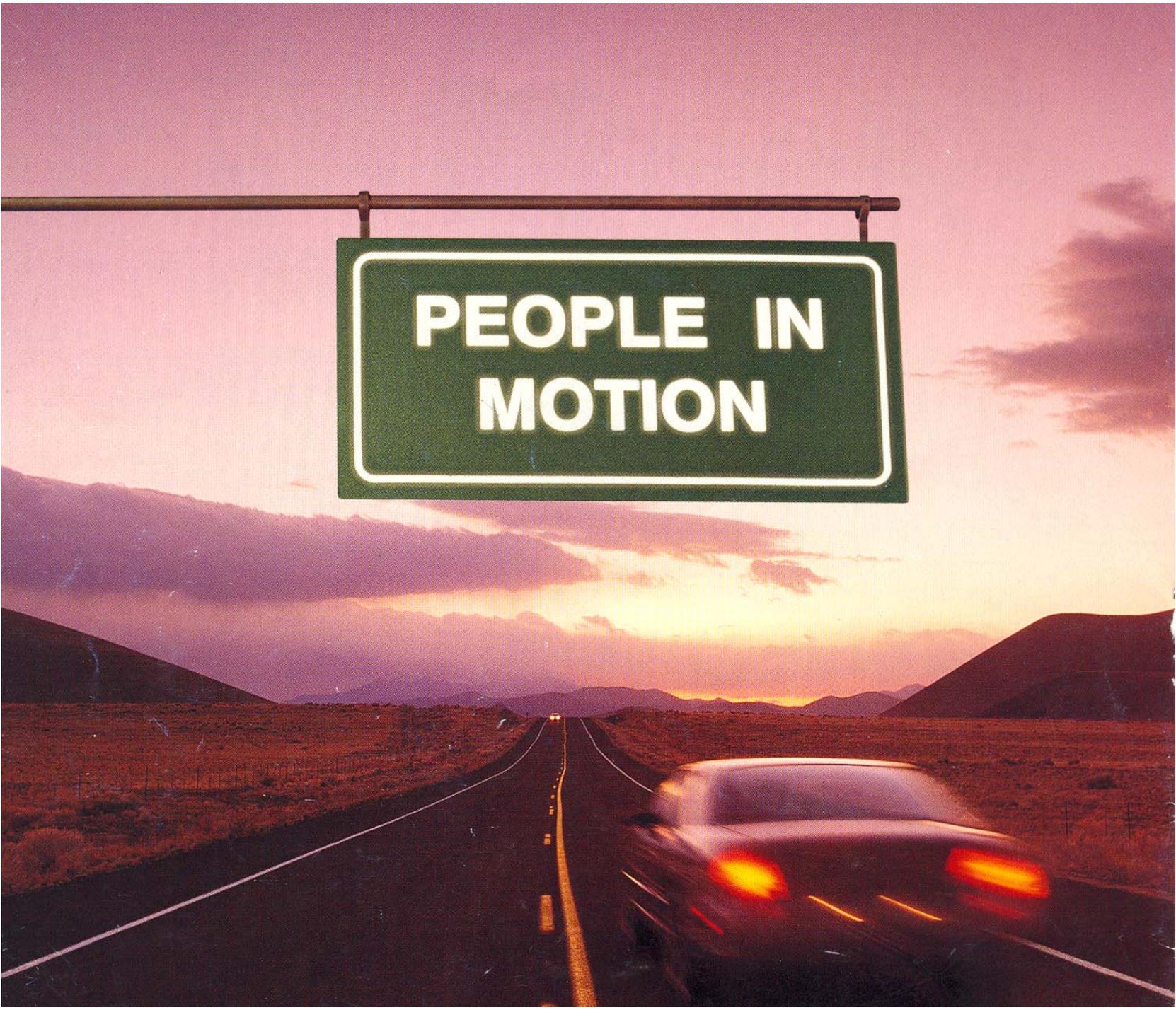
**Does wind power equal
“homeland security”**



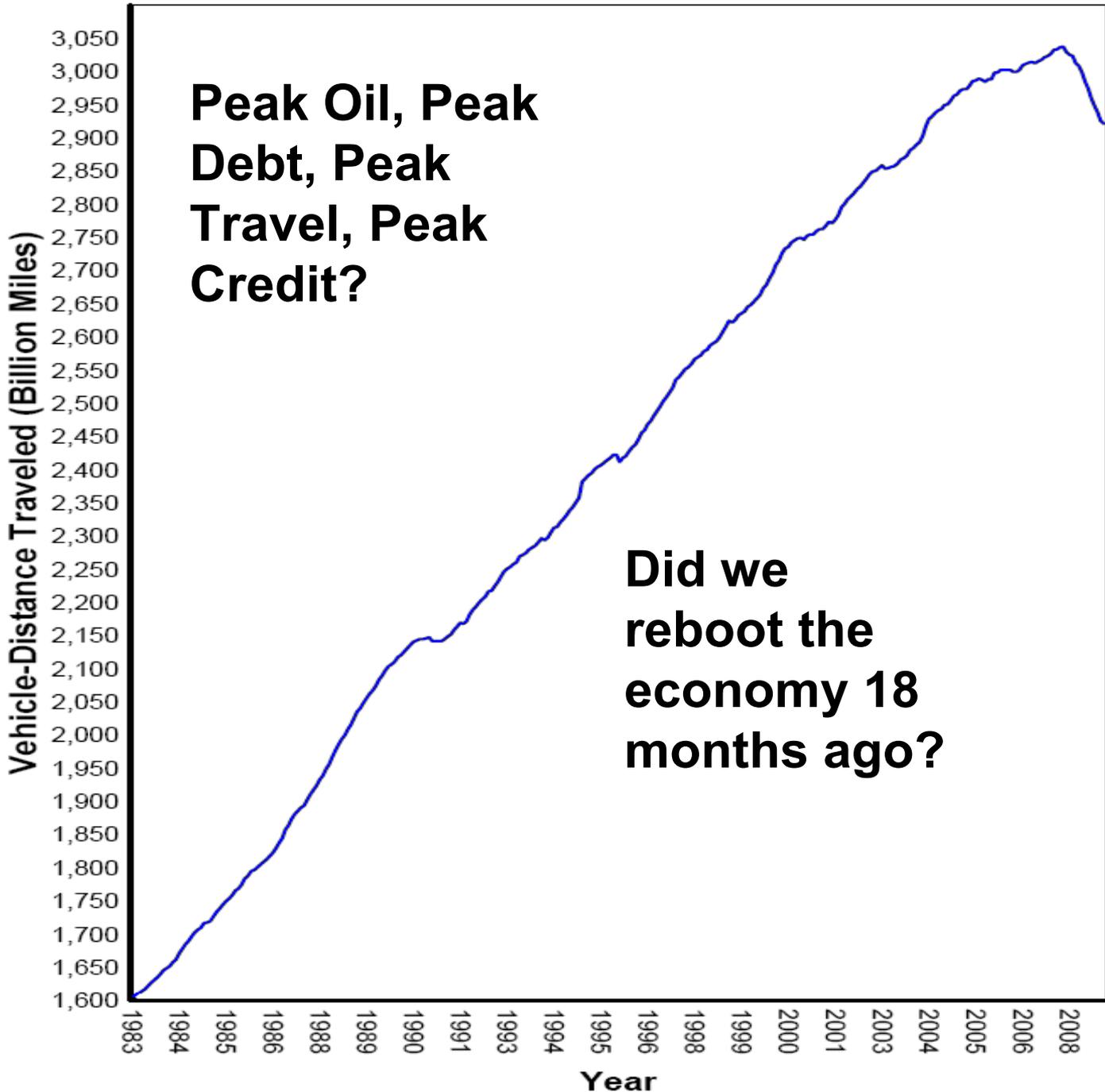
The Future of the Oil Tribe

Americans
consume their
body weight in
petroleum every
8 days



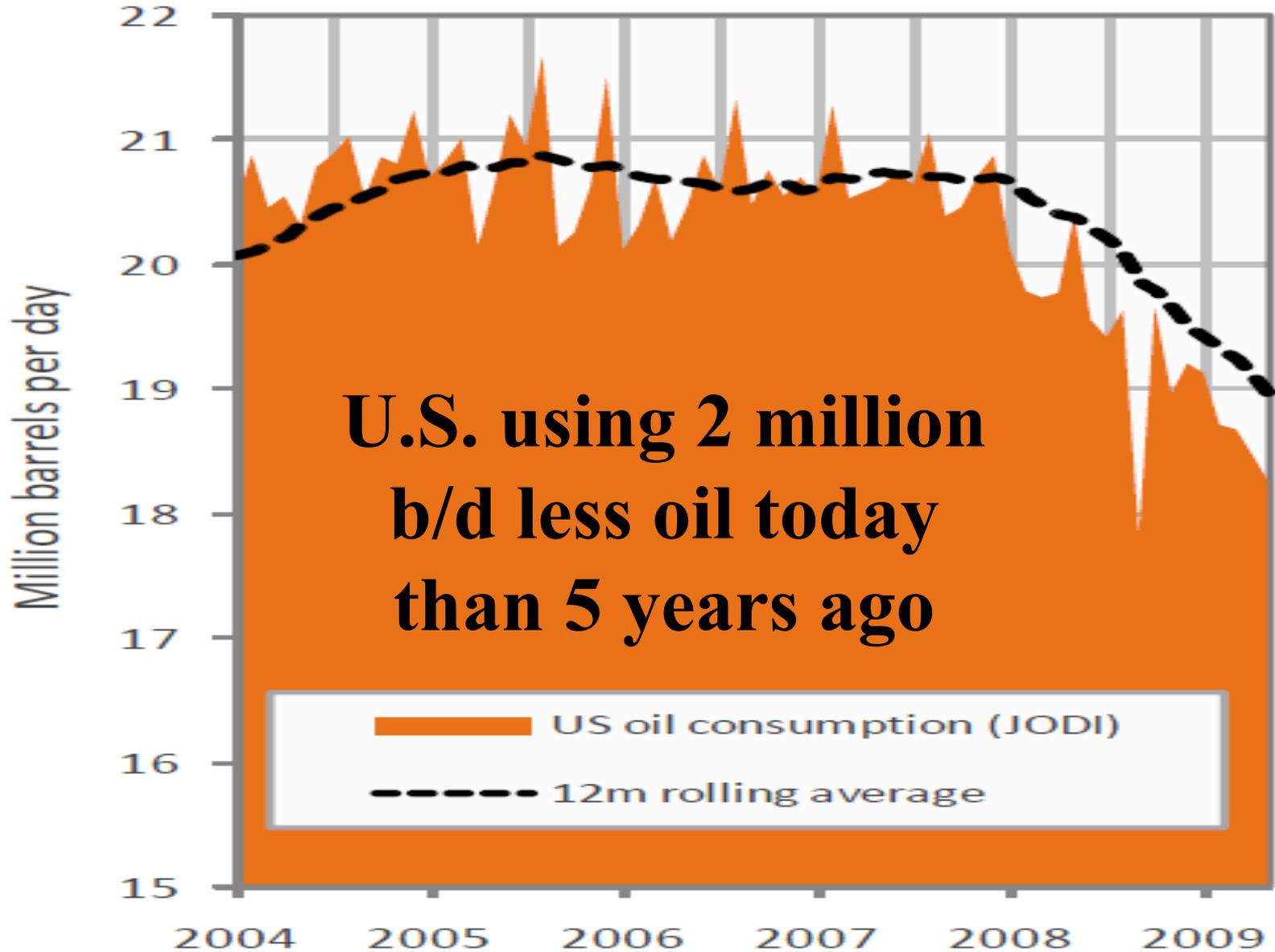


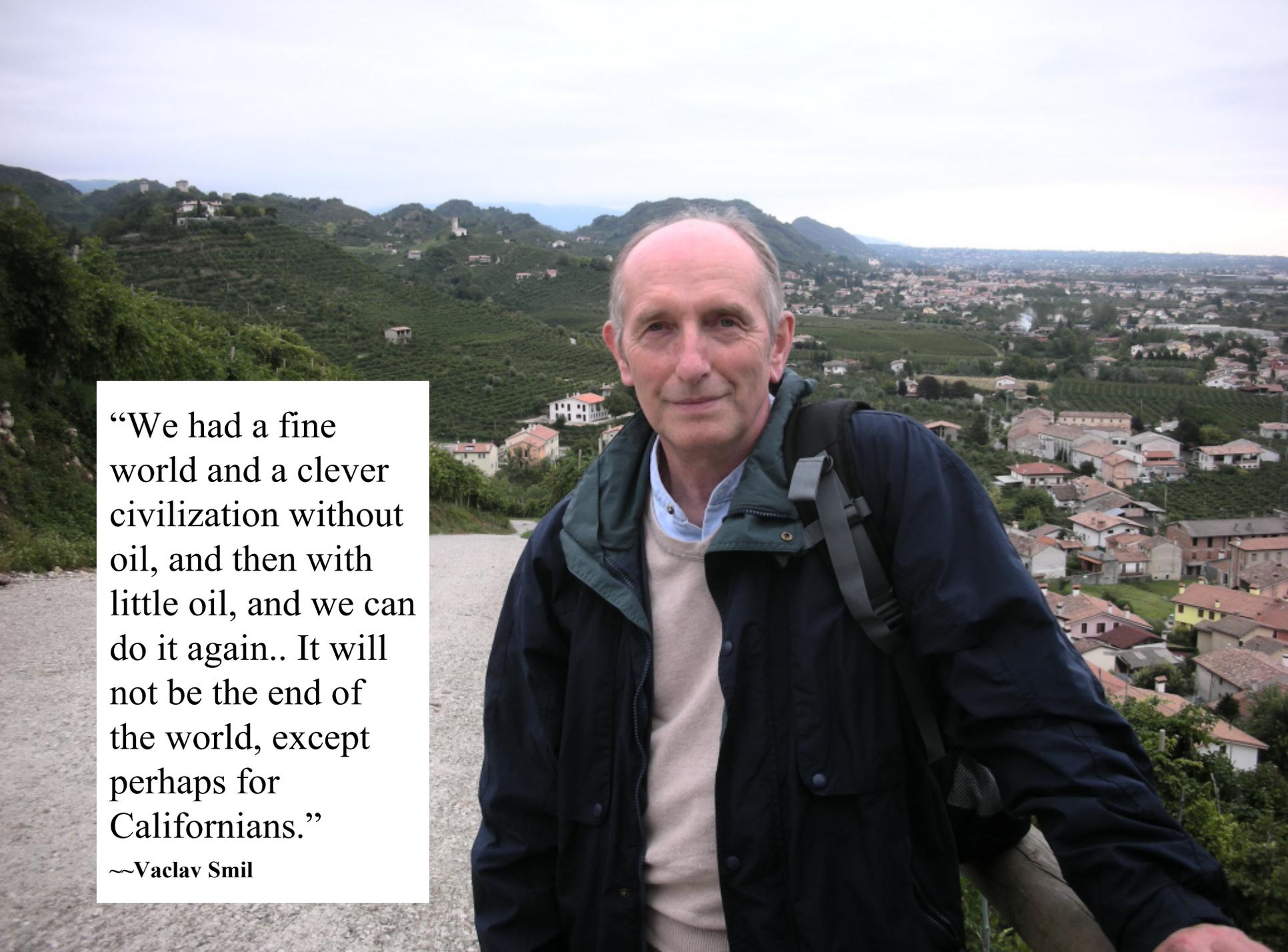
**PEOPLE IN
MOTION**





We have *already* begun an energy transition



A man with thinning hair, wearing a dark blue jacket over a light-colored sweater, stands on a gravel path. He has a backpack on his back. The background shows a scenic view of a town with red-tiled roofs and vineyards on a hillside under a cloudy sky.

“We had a fine world and a clever civilization without oil, and then with little oil, and we can do it again.. It will not be the end of the world, except perhaps for Californians.”

~Vaclav Smil

Additional Resources

- Sign-up for a free, weekly compendium of peak oil-related news <http://www.aspo-usa.org/index.php/newsletters/peak-oil-review/subscribe-peak-oil-review/>
- www.aspo-usa.com
- www.theoildrum.com
- Numerous books: The Last Oil Shock, A Thousand Barrels a Second, and Oil on the Brain are recommended