

# Skilling Up For Powerdown.

A 10 Week evening class.



Session 1.

Peak Oil and Climate Change.

# An illustration of the problem



# The Petroleum Interval

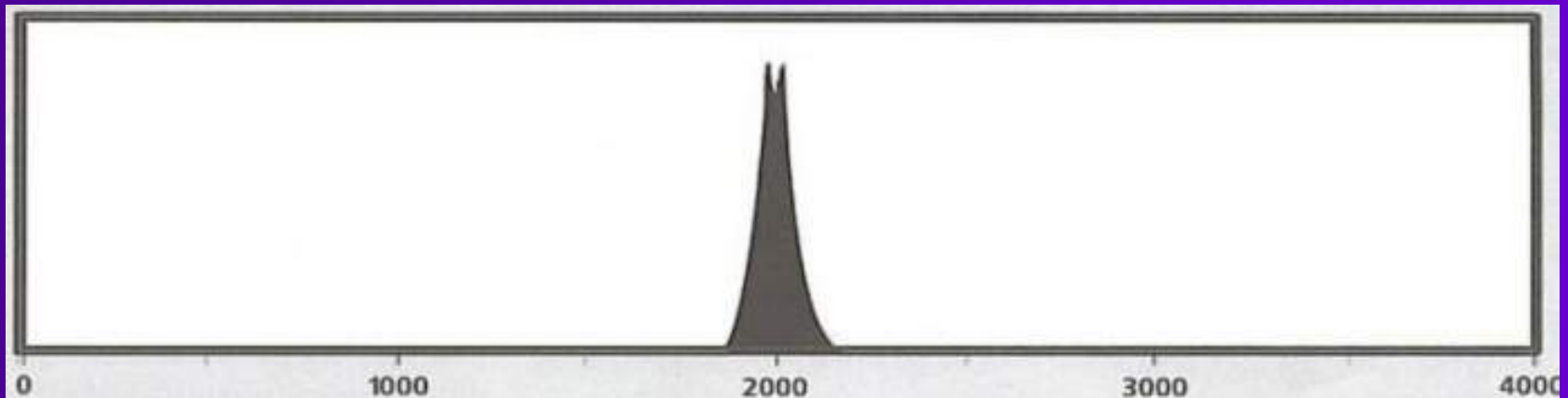
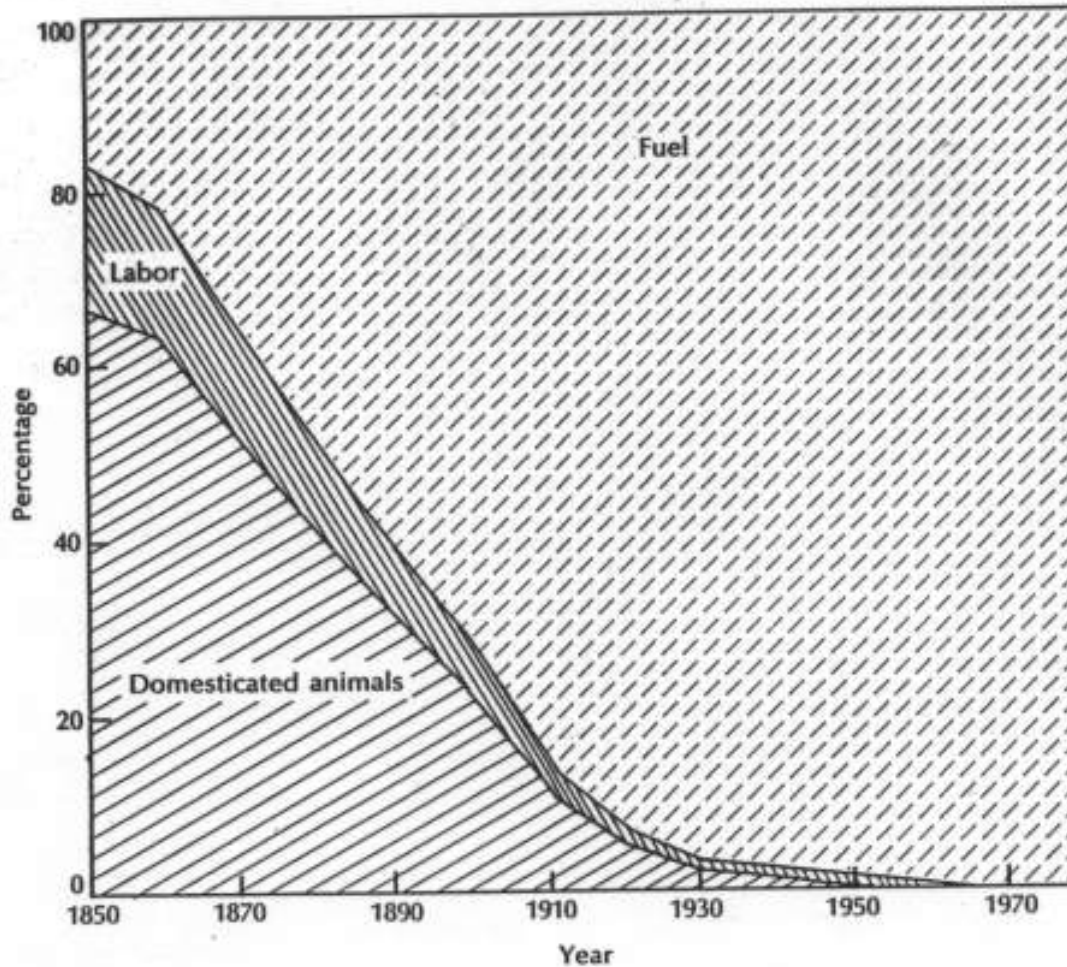


Figure 3-1. Stacked Representation of Work Done over Time in the United States by Humans, Domesticated Animals, and Machines, as a Percentage of the Total Horsepower in the Economy



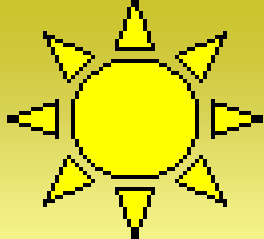
Source: C.A.S. Hall, C.J. Cleveland, and R. Kaufmann, *Biophysical Economics: The Ecology of the Industrial Process* (New York: John Wiley & Sons, 1985).

The  
Energy  
Slaves.

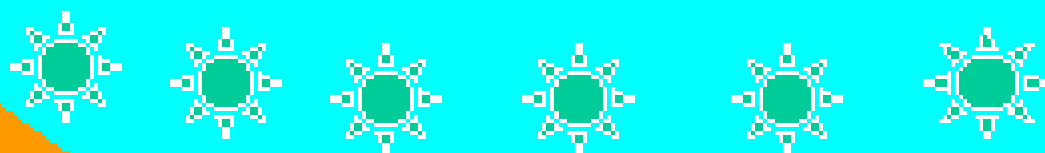
# What's so great about oil?

- Incredibly energy dense.
- One gallon of oil (3.2kg) produces energy equivalent to:
  - **5kg** of coal
  - **10kg** of wood
  - **50** people toiling all day
- Stable at room temperature
- Easily stored and transported
- Low cost of extraction (initially)
- Versatile.
- Abundant.

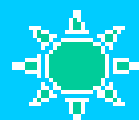
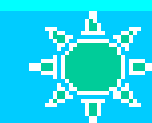




# Extreme Global Warming gave excessive Algal Growths



90 & 150 million  
years ago

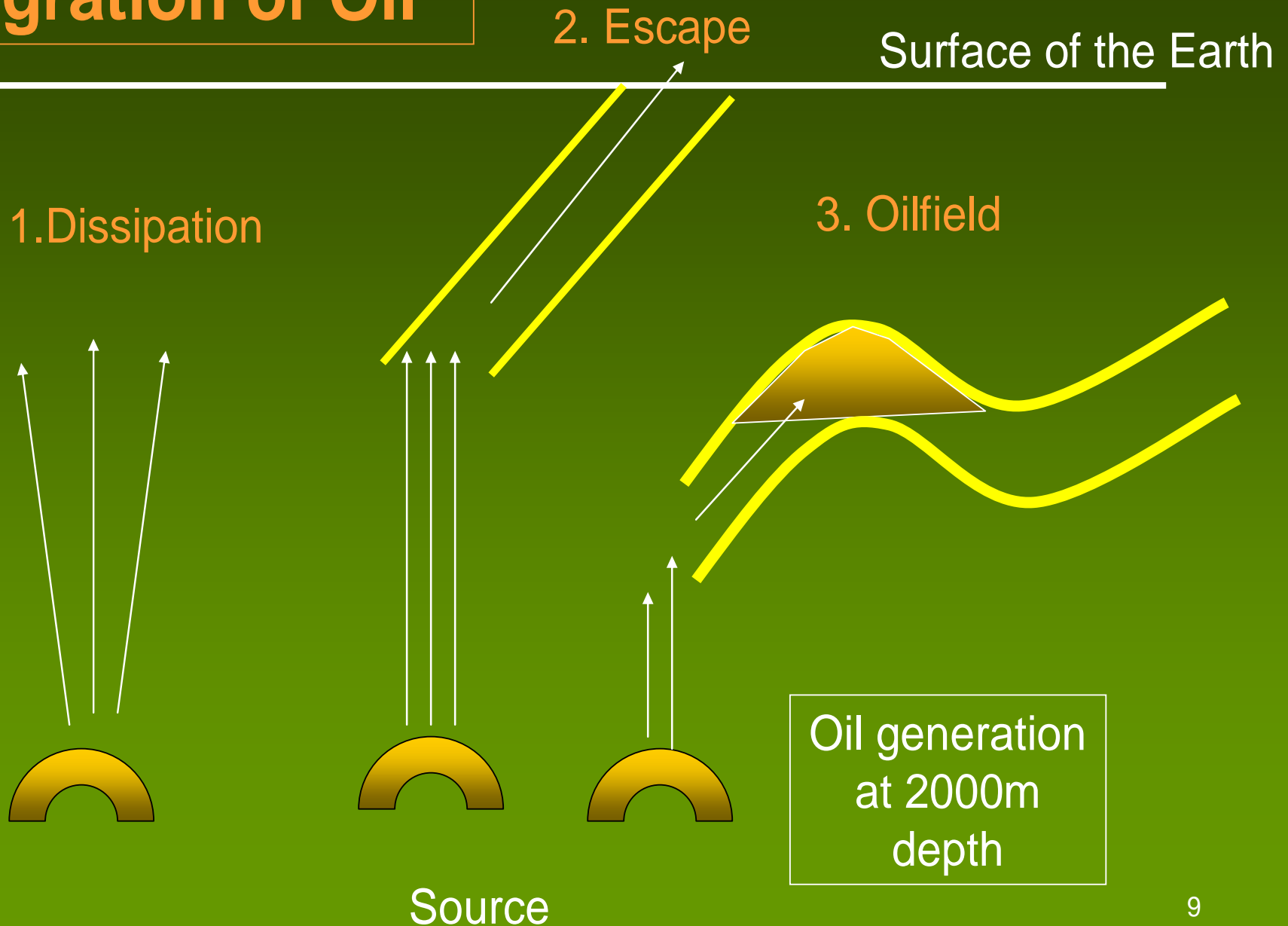


Organic debris

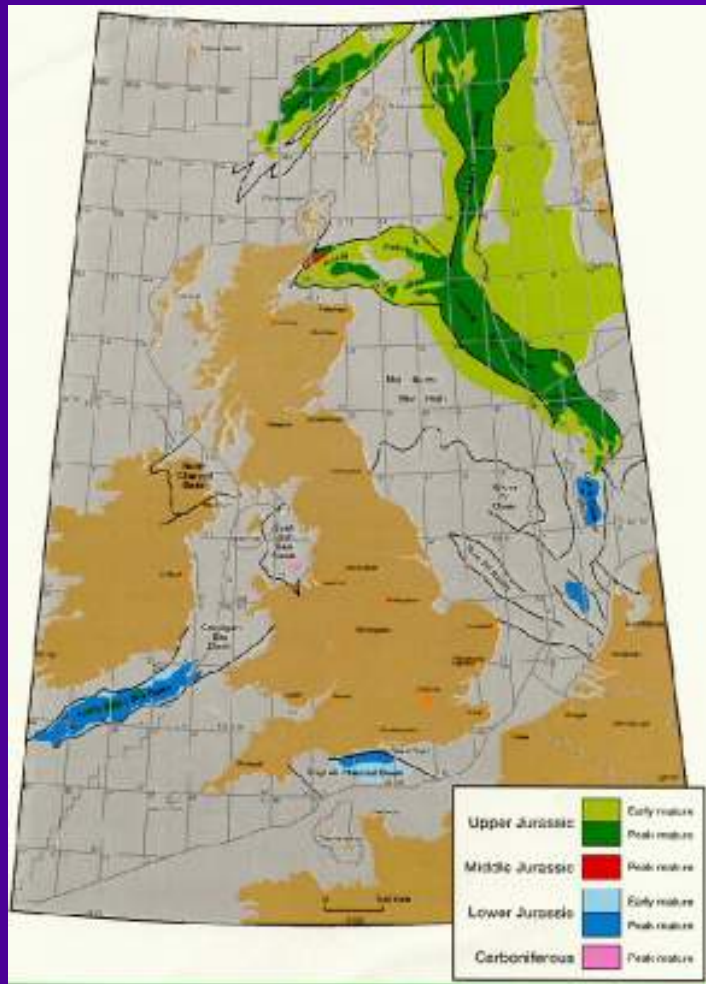


Rifts formed as  
the Continents  
moved apart

# Migration of Oil



# N.W Europe Oil Generating Zones



Where oil is  
and  
where it is not

# Living the Oil Age in an Irish pub

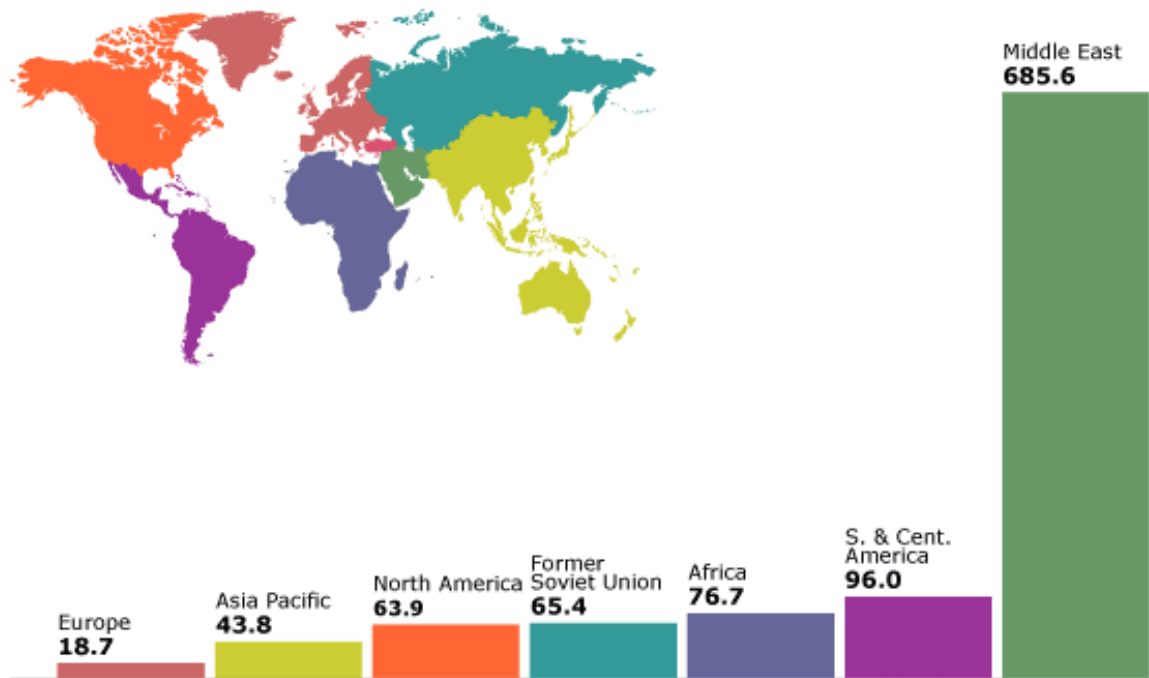


# Where is it?

## Regular Oil

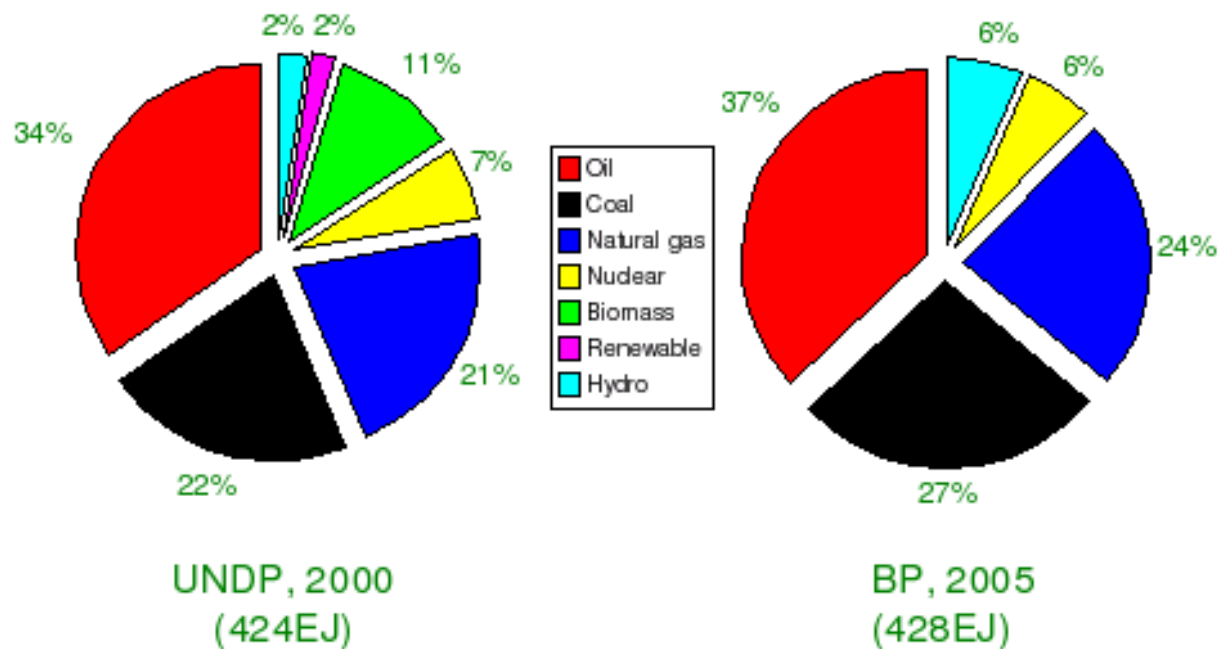
map of proved oil reserves at end 2001

Thousand million barrels

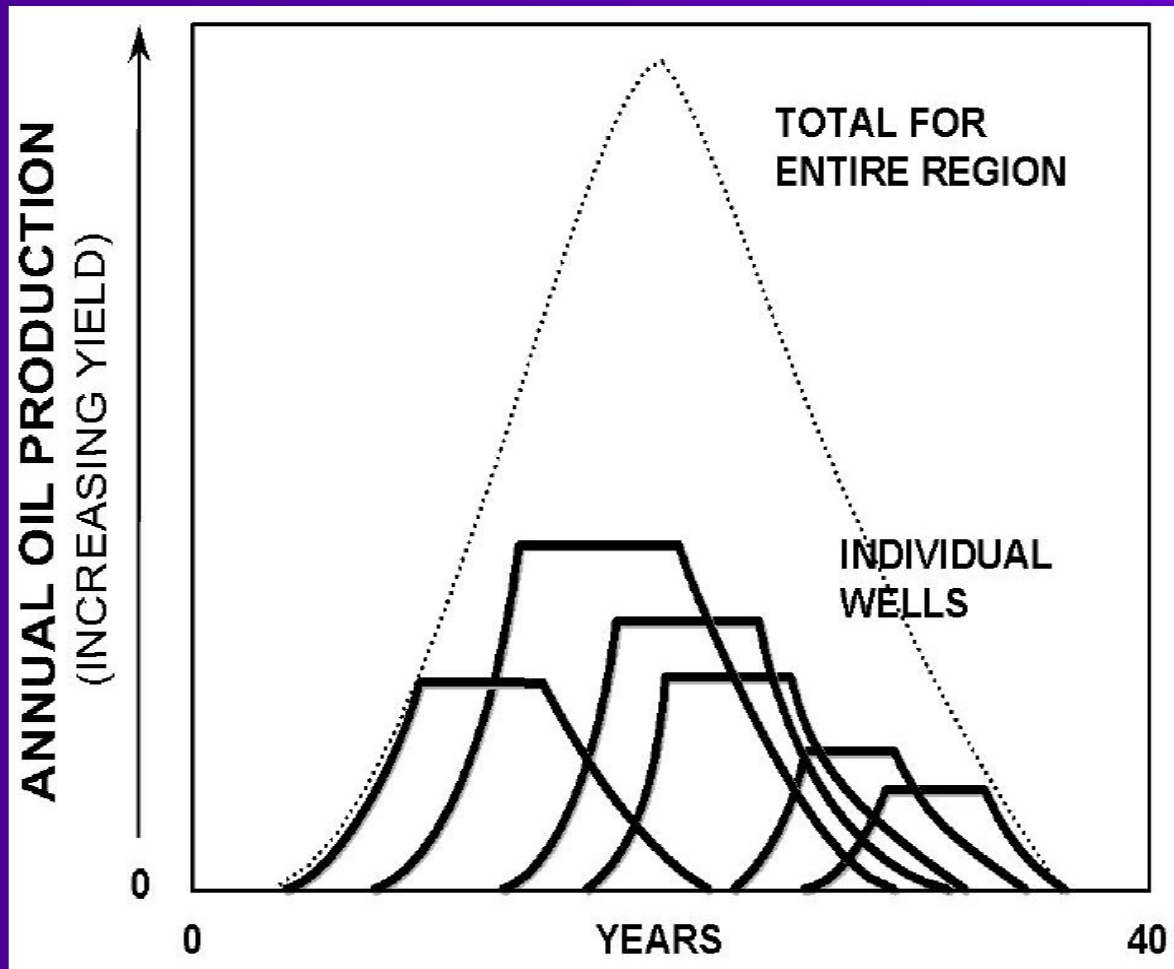


# Where Does It Go?

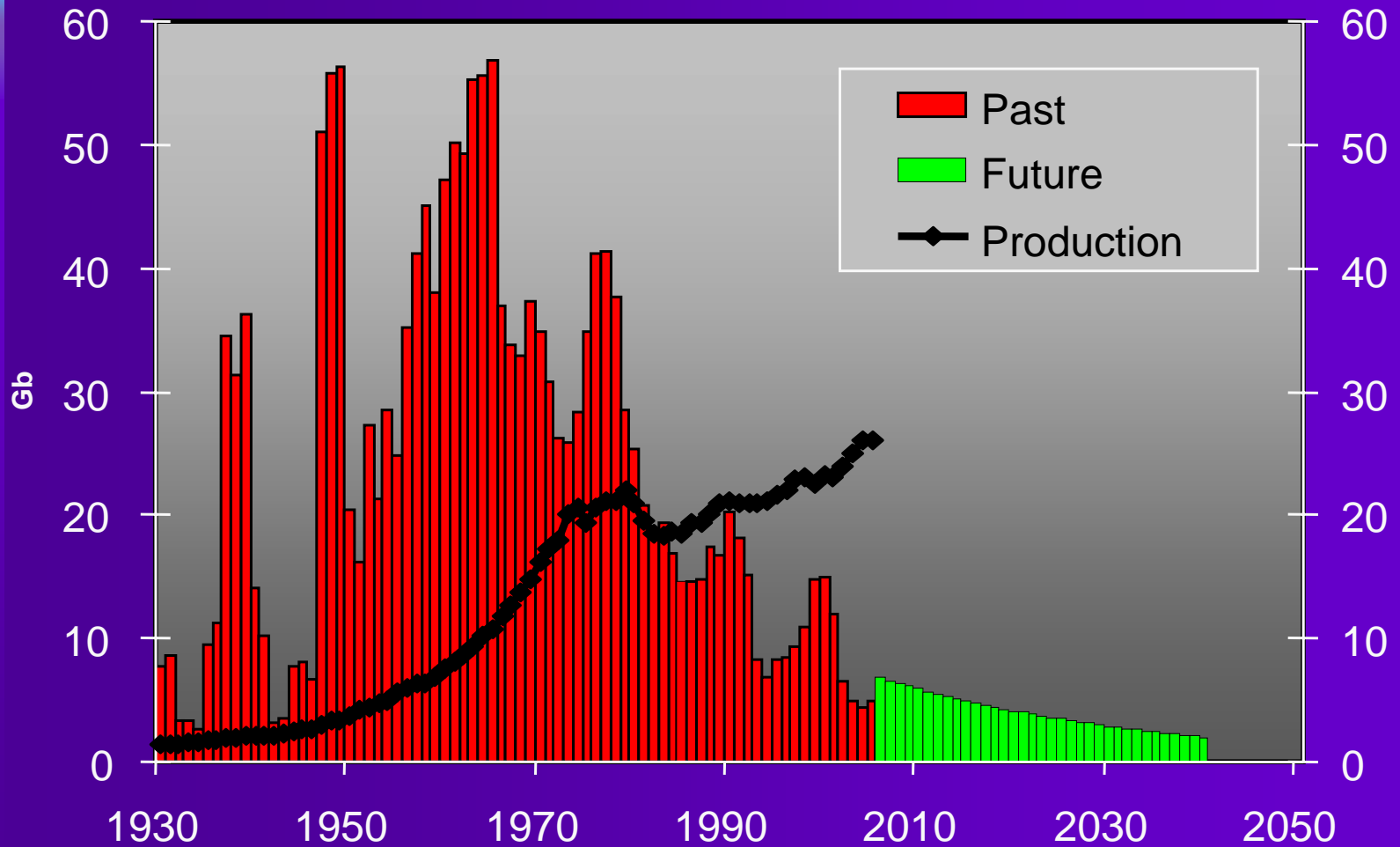
## Global primary energy consumption



# Peak Oil.

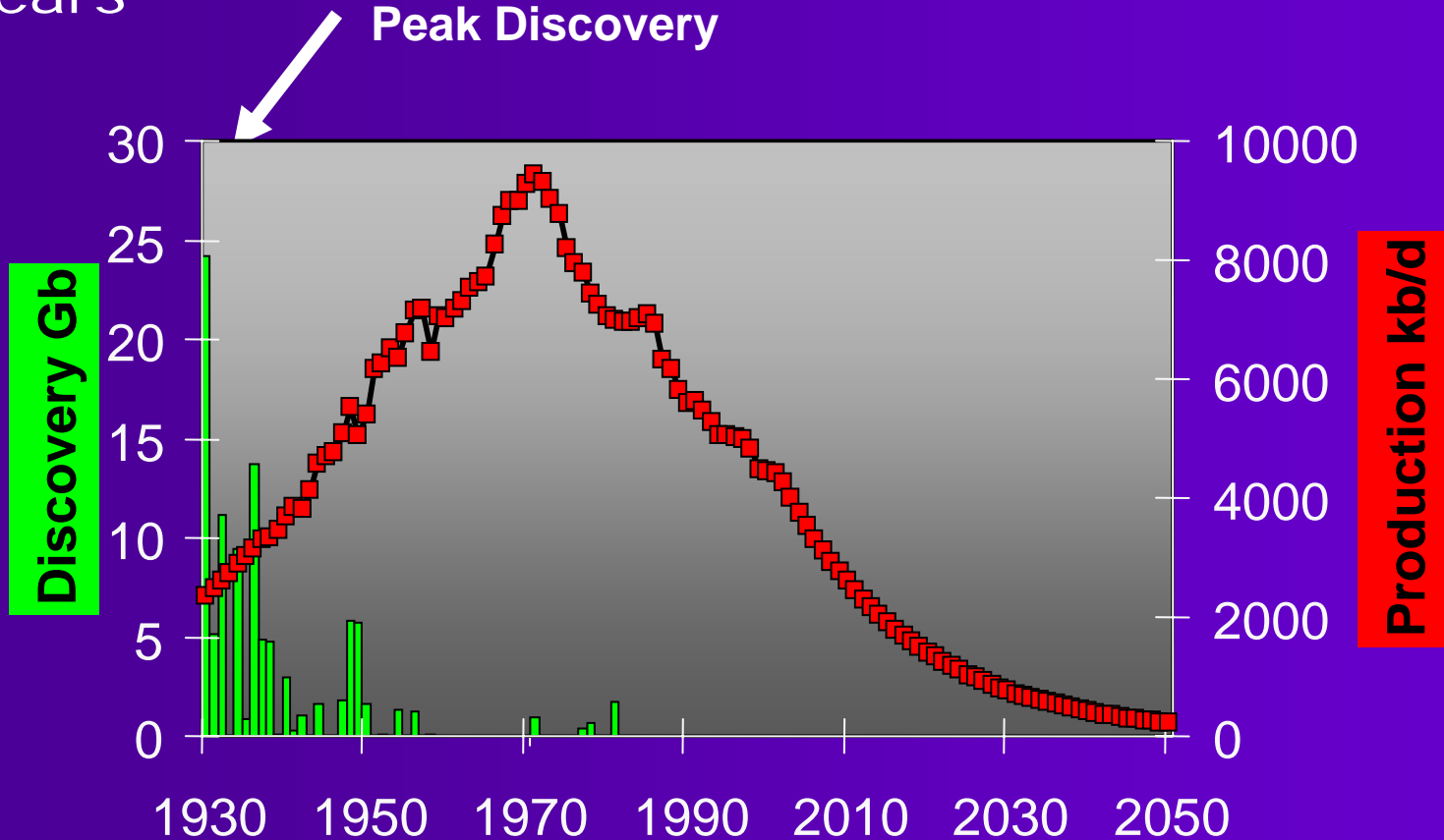


# Discovery peaked 40 years ago



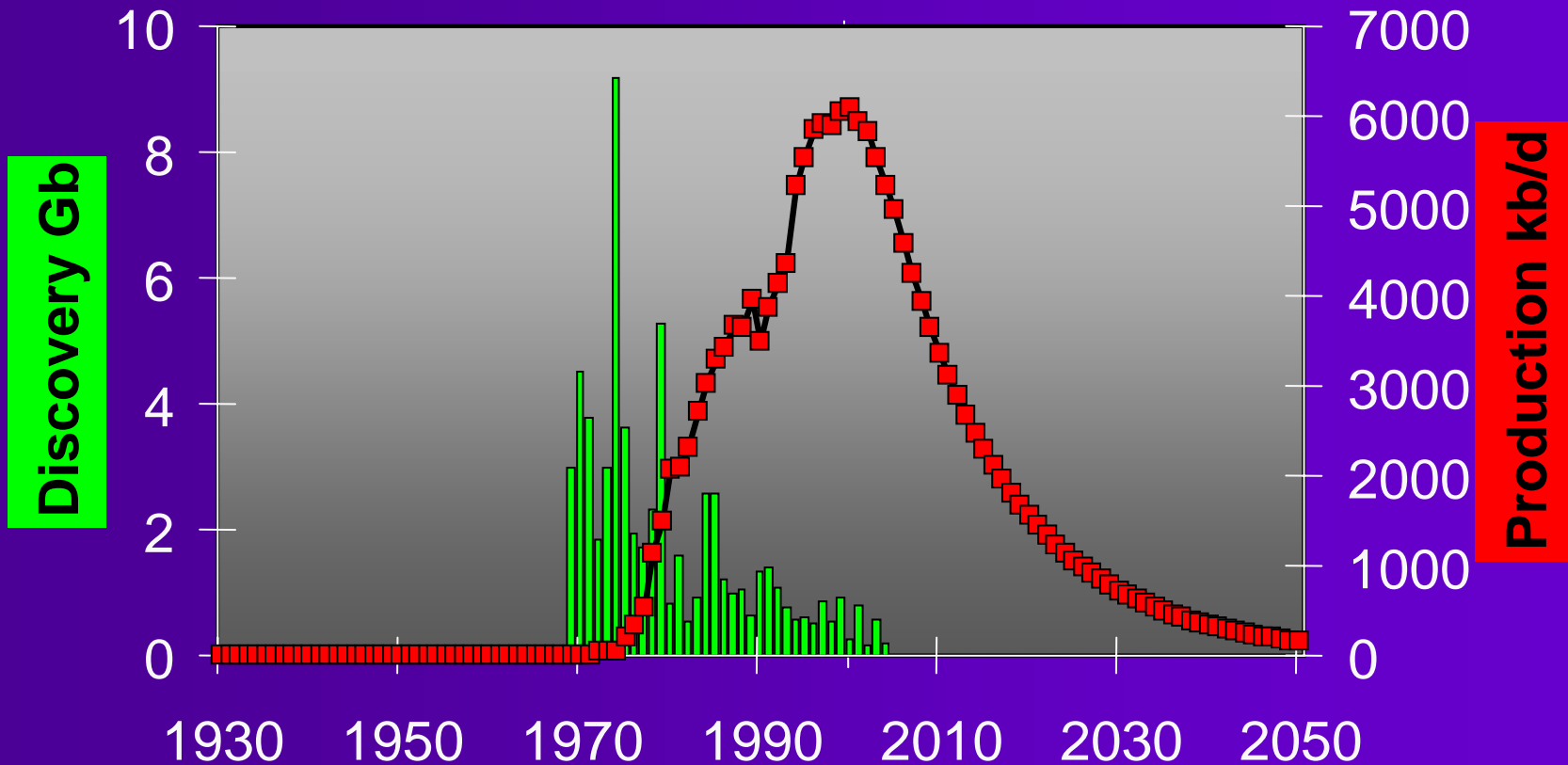
# US-48 Oil Discovery Peaked in 1930, Production in 1970

Peak to Peak - 40 years



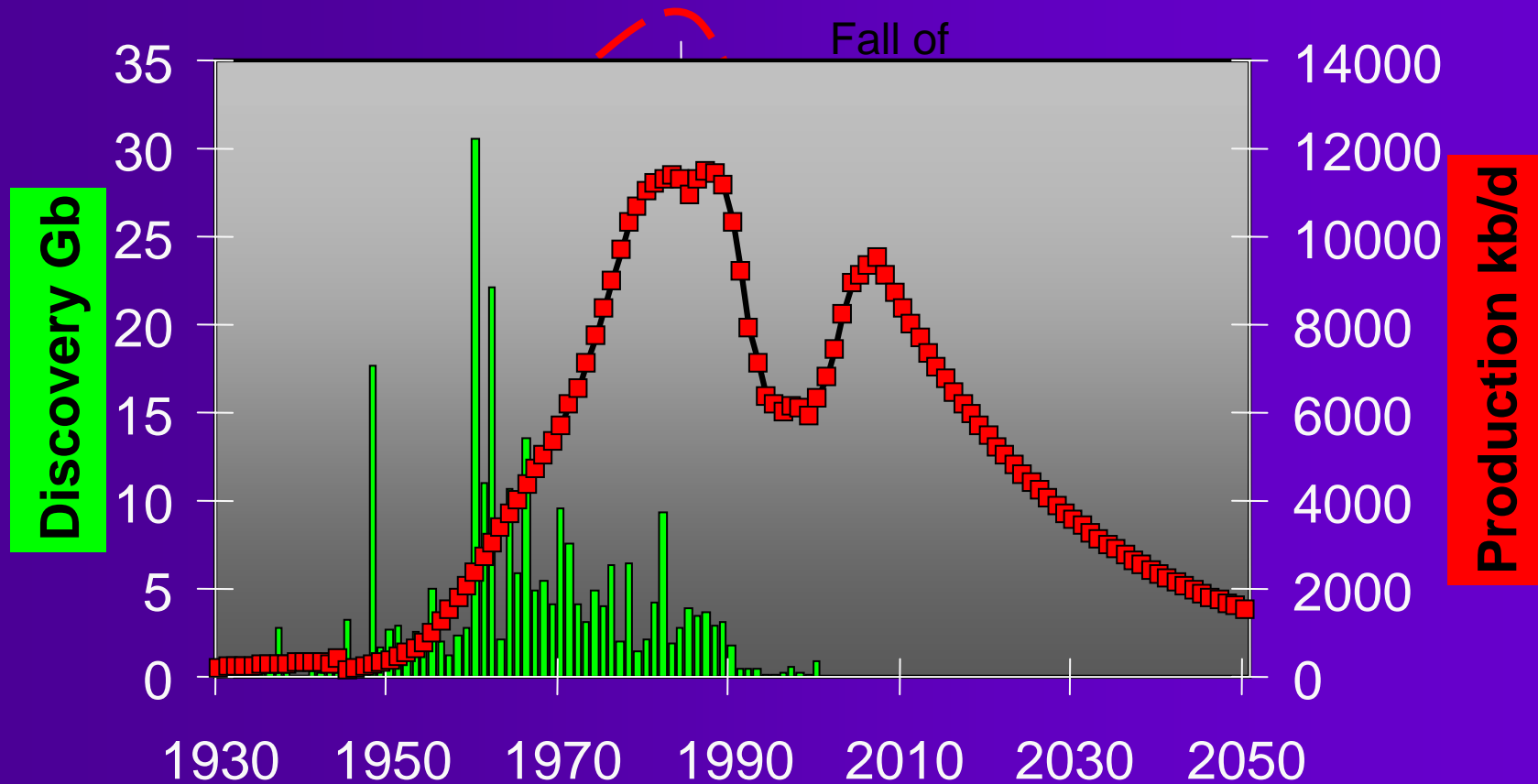
# The North Sea

Peak to Peak - 27 years

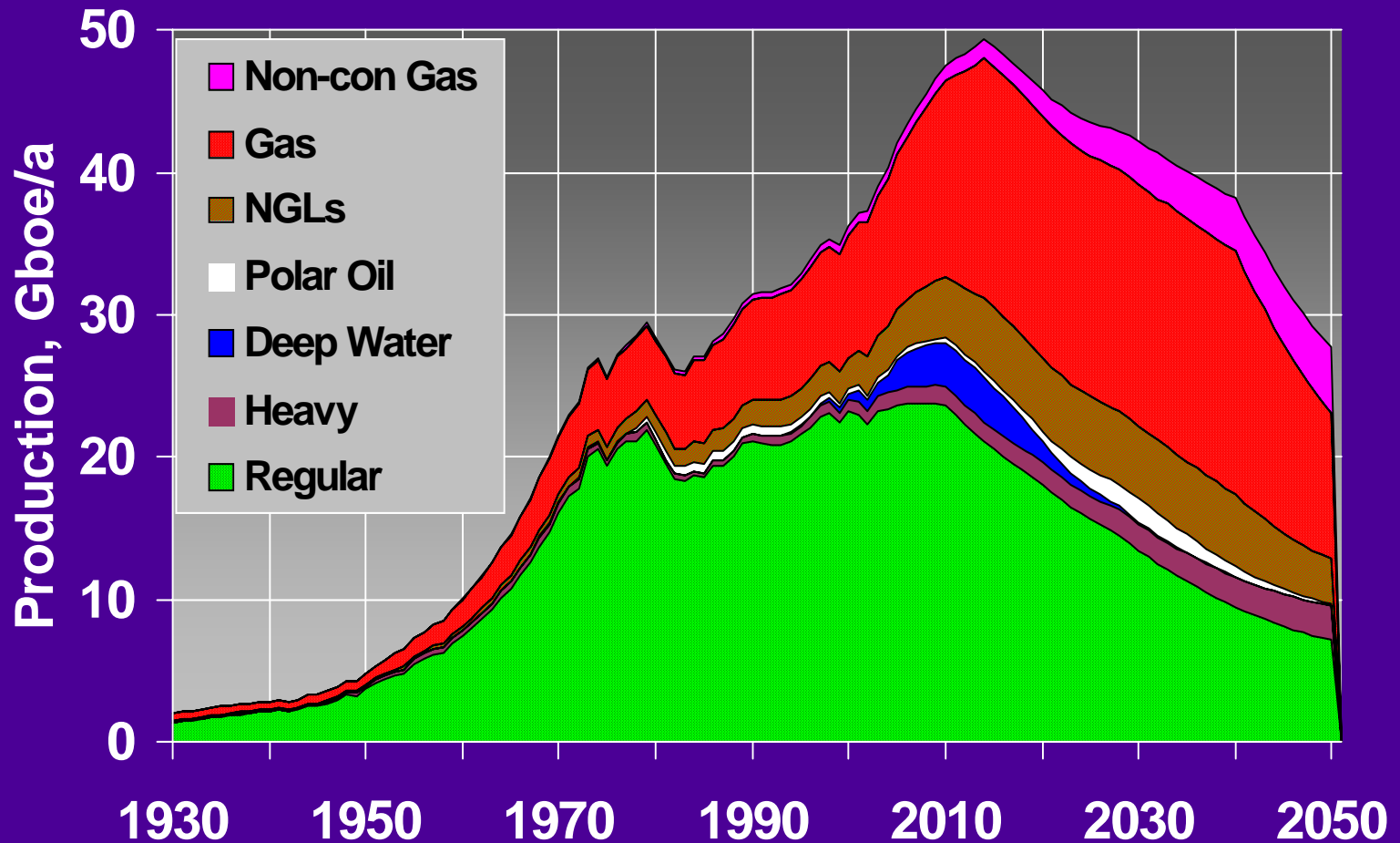


# Russia

Peak to Peak ~ 40 years

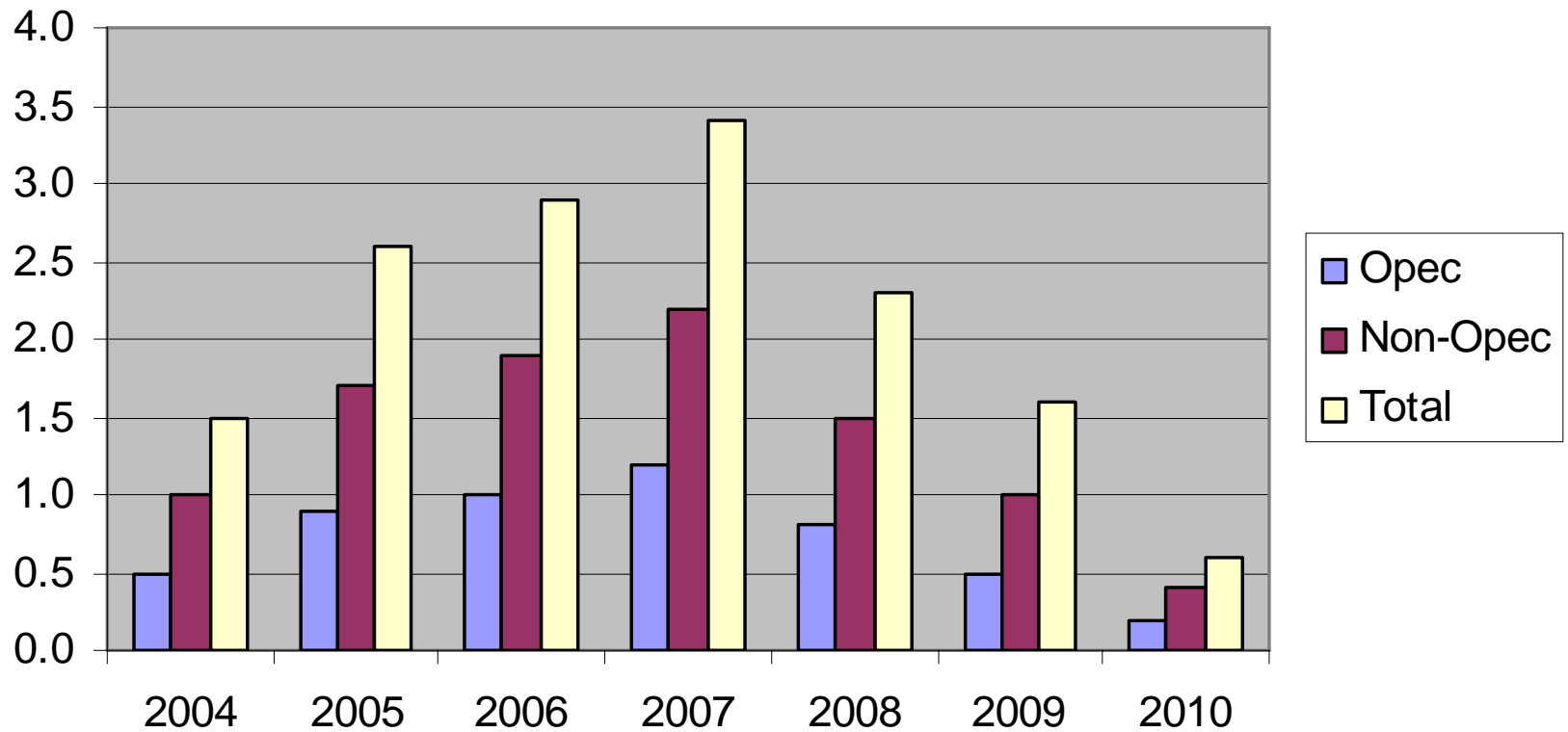


**Production peaks follow discovery.**  
(You have to find it before you can produce it).

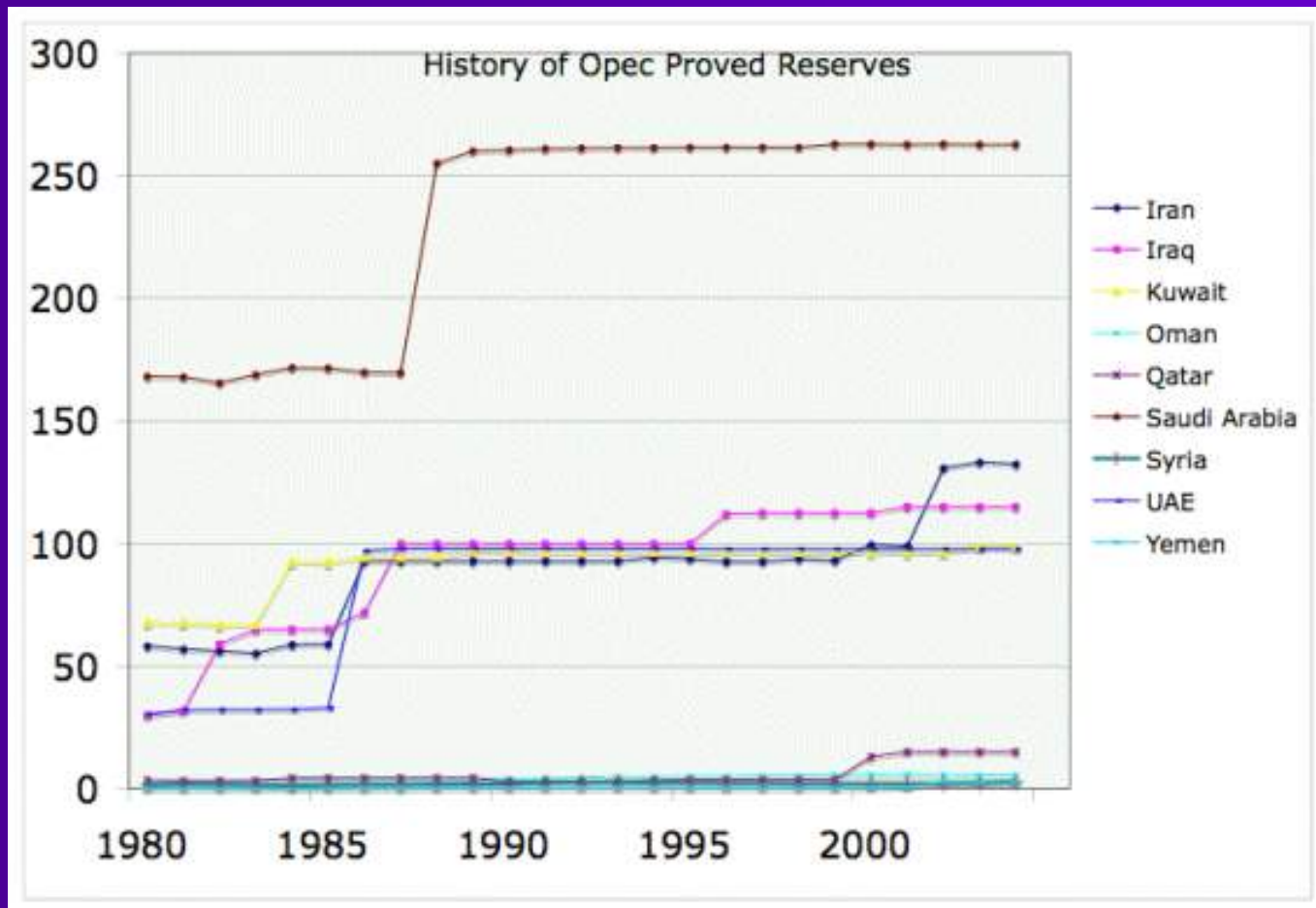


# Chris Skrebowski

## Petroleum Review

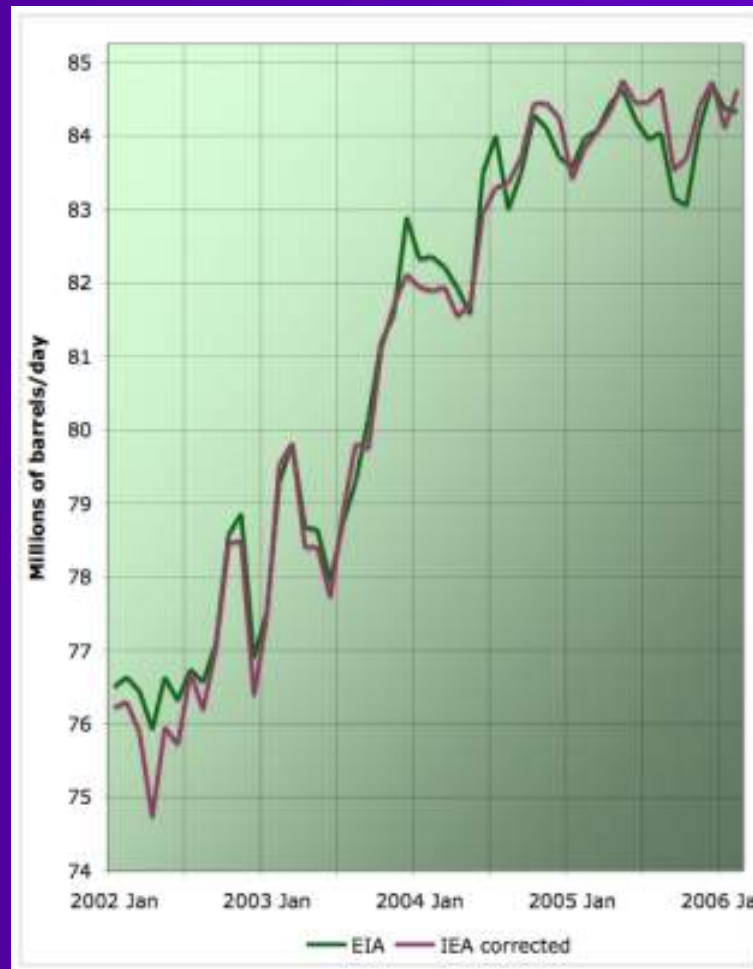


# Exaggerated OPEC Oil Reserves...



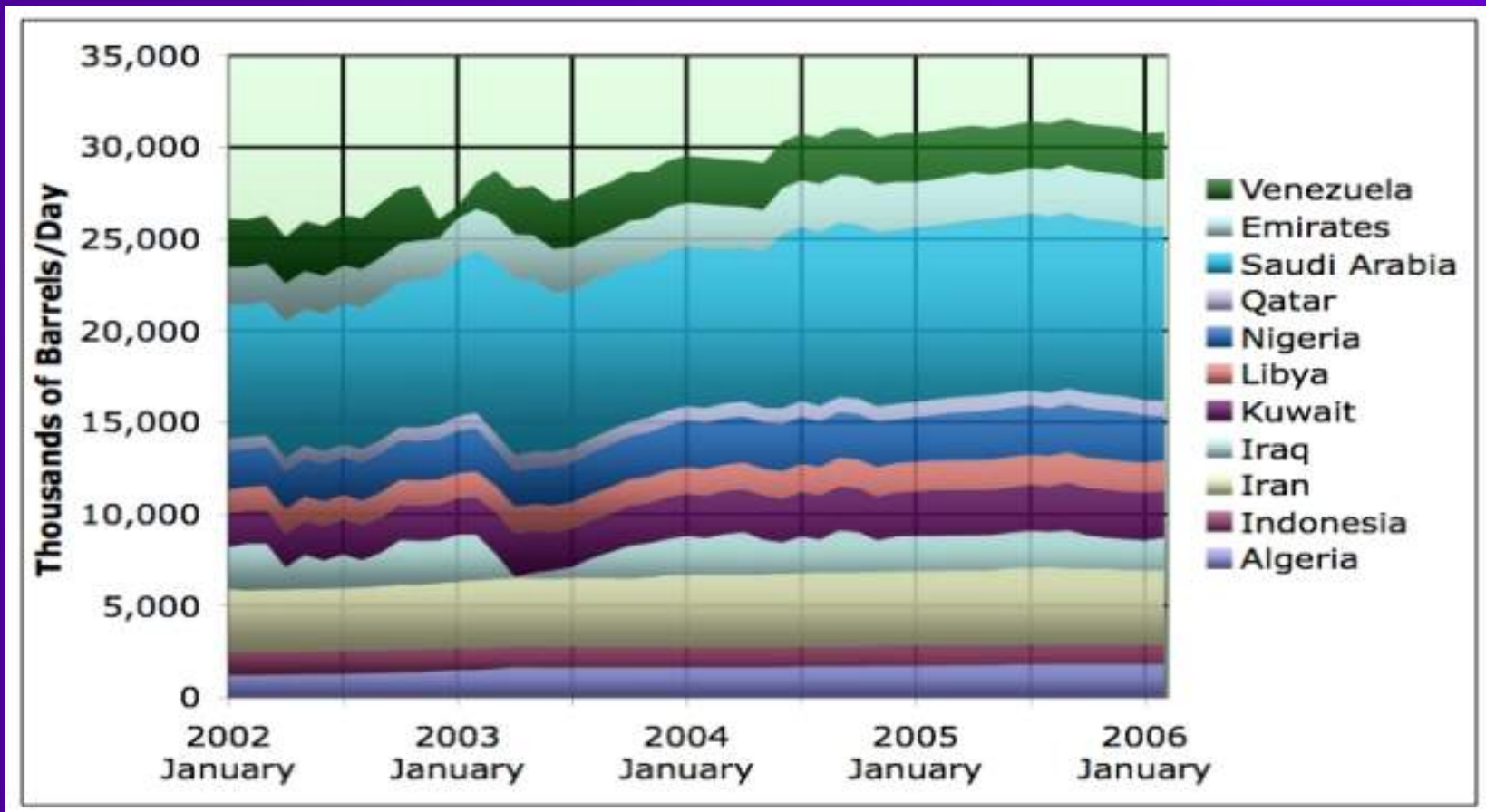
Source: BP Statistical Review of World Energy.

# World Production Stopped Increasing in late 2004.



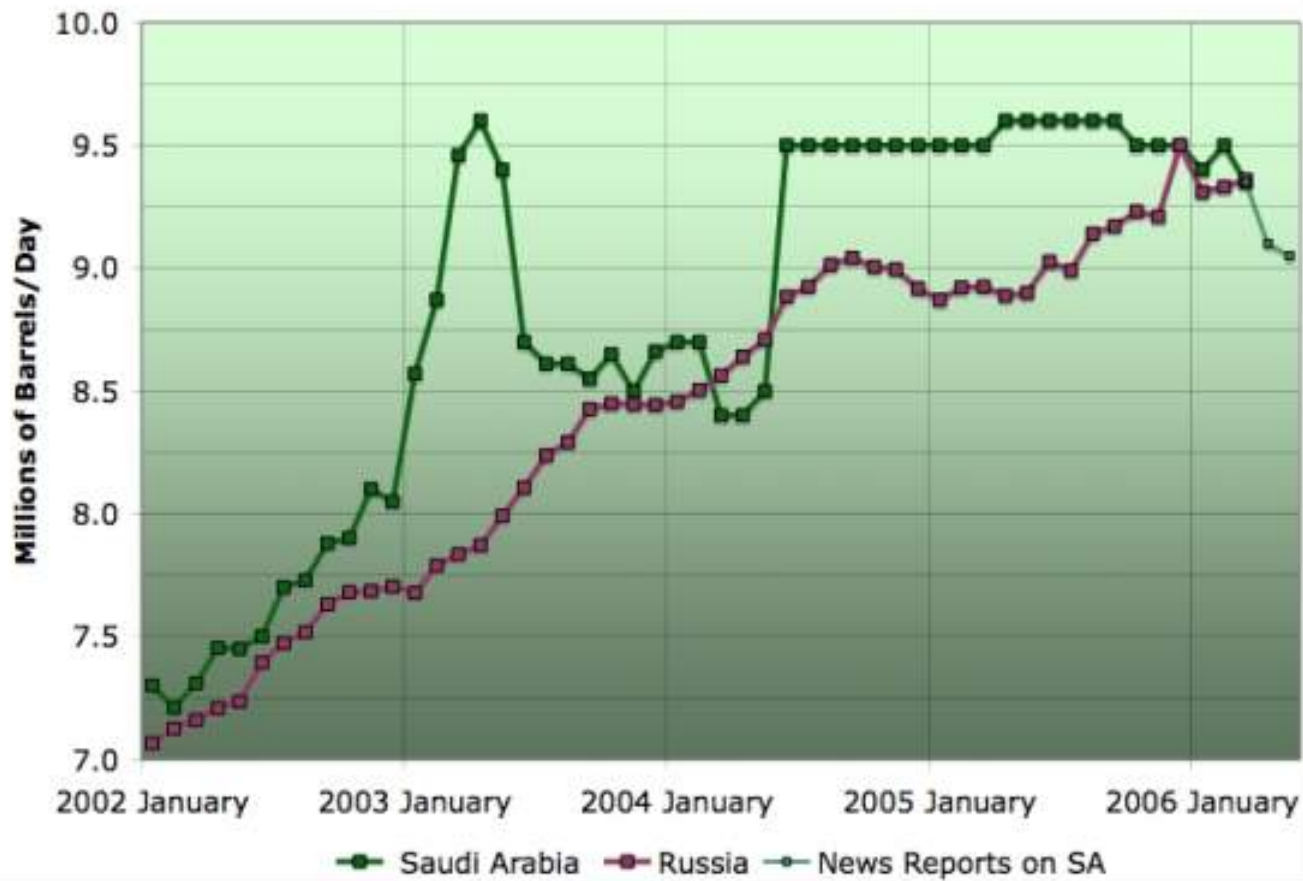
Source - IEA.

# Average Daily production from OPEC countries



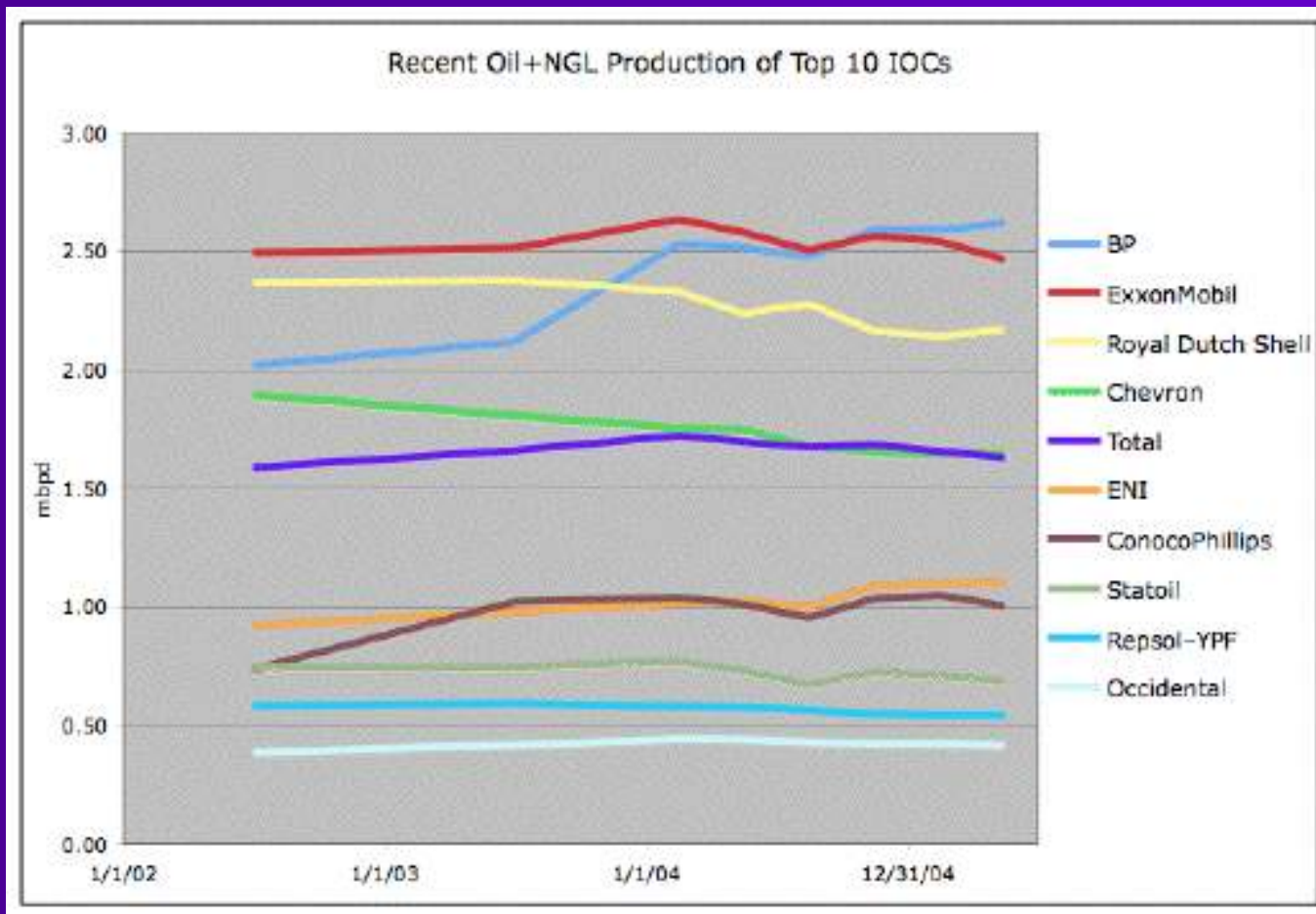
Source EIA

# No Spare Saudi Capacity...



Source - EIA

# Existing Production in Decline...



Source: [BP Statistical Review of World Energy](#).

# And also...

- Oil Prices are rising and are very volatile
- Geopolitical and climate risks
- Falling discovery



# Gas prices...

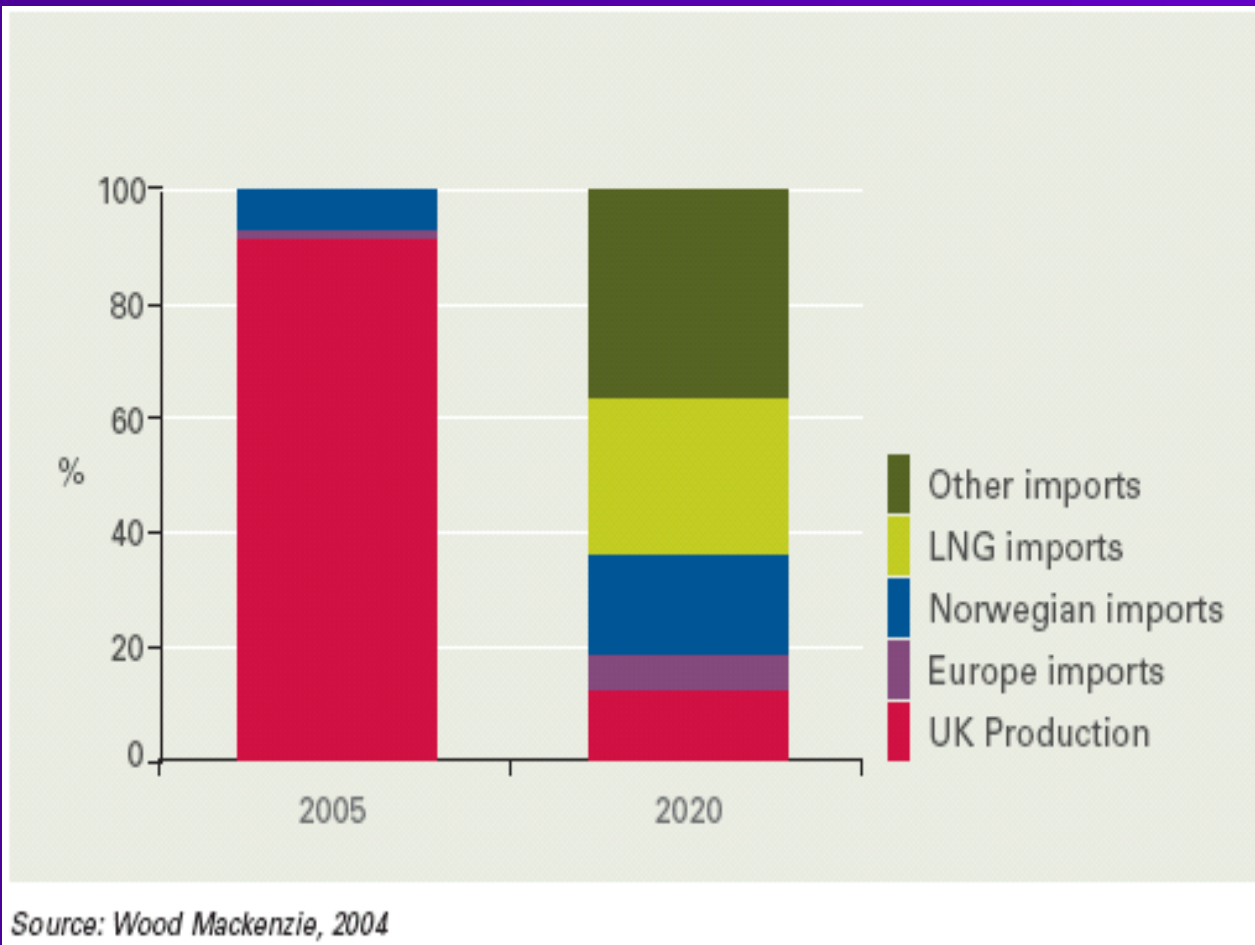
## UK WHOLESALE GAS PRICE

Pence per therm



SOURCE: Bloomberg

# Peak Gas?



UK Energy  
Review 2006

# Lord Browne - BP



*“the world isn’t running out of oil”*

*“next 30 years will be just as successful (as the last)”.*

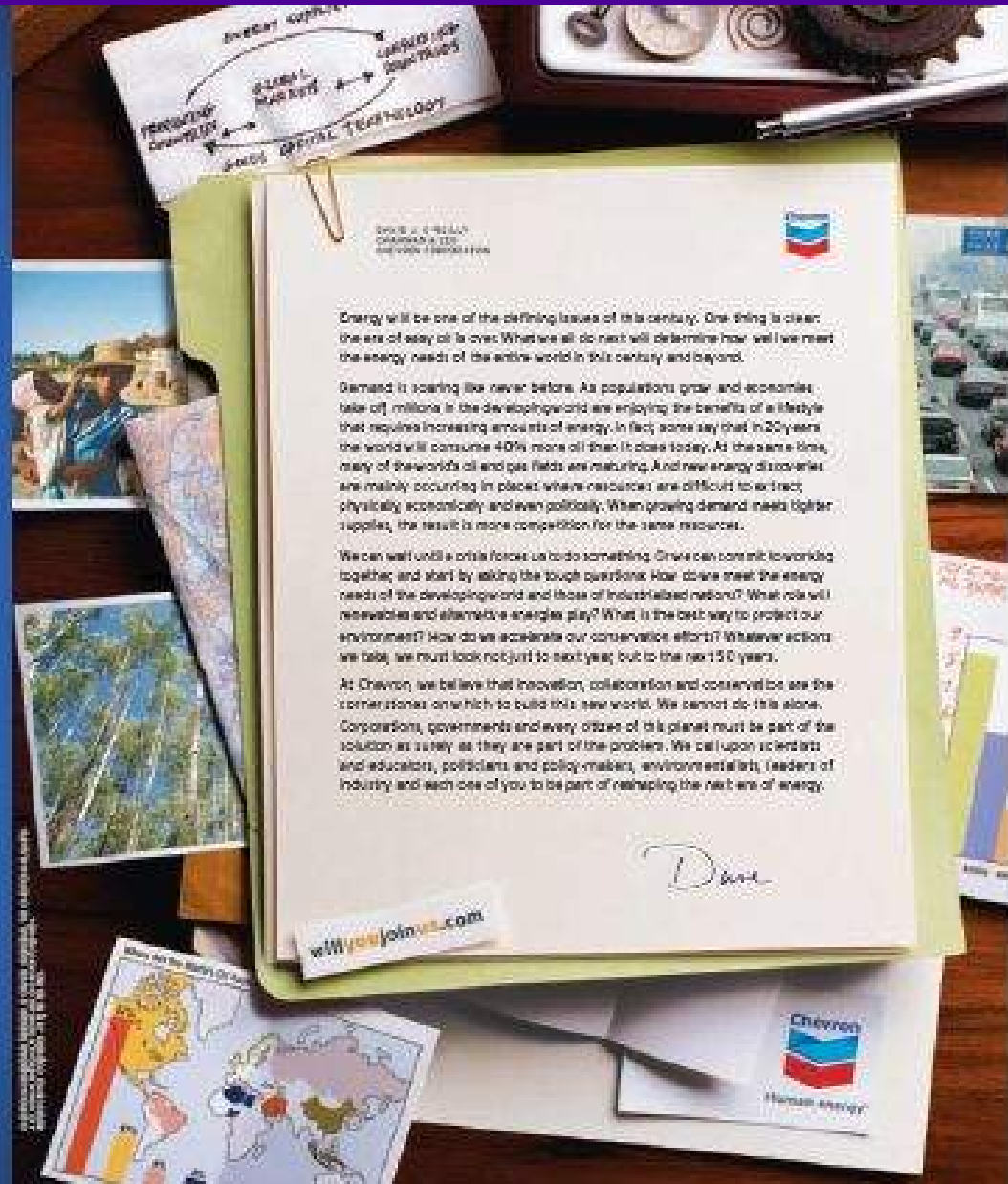
*“enormous scope for optimism”.*

Speech to World Petroleum Conference Sept. 05

It took us 125 years to use  
the first trillion barrels of oil.

We'll use the next trillion in 30.

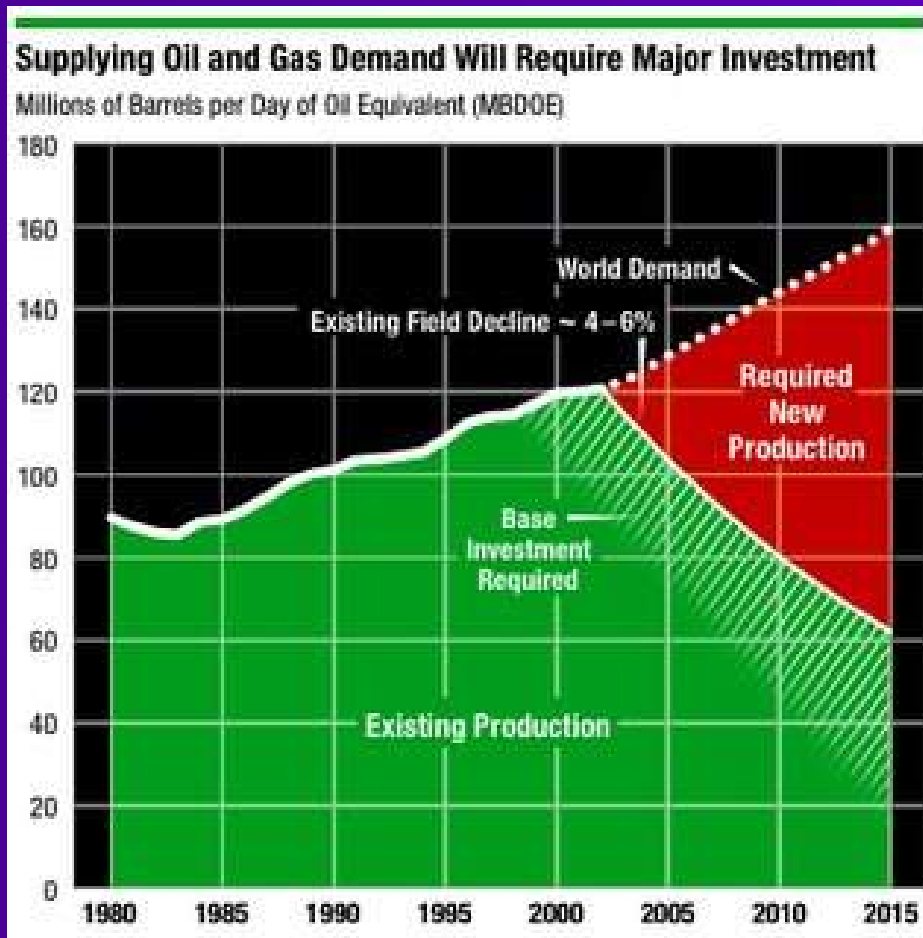
So why should you care?



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# Exxon Mobil

ExxonMobil



4 New Saudi Arabias!

# When?

<u>Projected Date</u>	<u>Source of Projection</u>	<u>Background &amp; Reference</u>
2006-2007	Bakhitari, A.M.S.	Oil Executive (Iran) <sup>1</sup>
2007-2009	Simmons, M.R.	Investment banker (U.S.) <sup>2</sup>
After 2007	Skrebowski, C.	Petroleum journal editor (U.K.) <sup>3</sup>
Before 2009	Deffeyes, K.S.	Oil company geologist (ret., U.S.) <sup>4</sup>
Before 2010	Goodstein, D.	Vice Provost, Cal Tech (U.S.) <sup>5</sup>
Around 2010	Campbell, C.J.	Oil geologist (ret., Ireland) <sup>6</sup>
After 2010	World Energy Council	World Non-Government Org. <sup>7</sup>
2012	Pang Xiongqi	Petroleum Executive (China) <sup>8</sup>
2010-2020	Laherrere, J.	Oil geologist (ret., France) <sup>9</sup>
2016	EIA nominal case	DOE analysis/ information (U.S.) <sup>10</sup>
After 2020	CERA	Energy consultants (U.S.) <sup>11</sup>
2025 or later	Shell	Major oil company (U.K.) <sup>12</sup>

# The Hirsch Report

*"...the peaking of world oil production presents the US and the world with an unprecedented risk management problem. As peaking is approached, liquid fuel prices and price volatility will increase dramatically, and without timely mitigation, the economic, social and political costs will be unprecedented. Viable mitigation options exist on both the supply and demand sides, but to have substantial impact, they must be initiated **more than a decade** in advance of peaking" (emphasis added)*

(Hirsch 2005).