When Will World Oil Production Peak?

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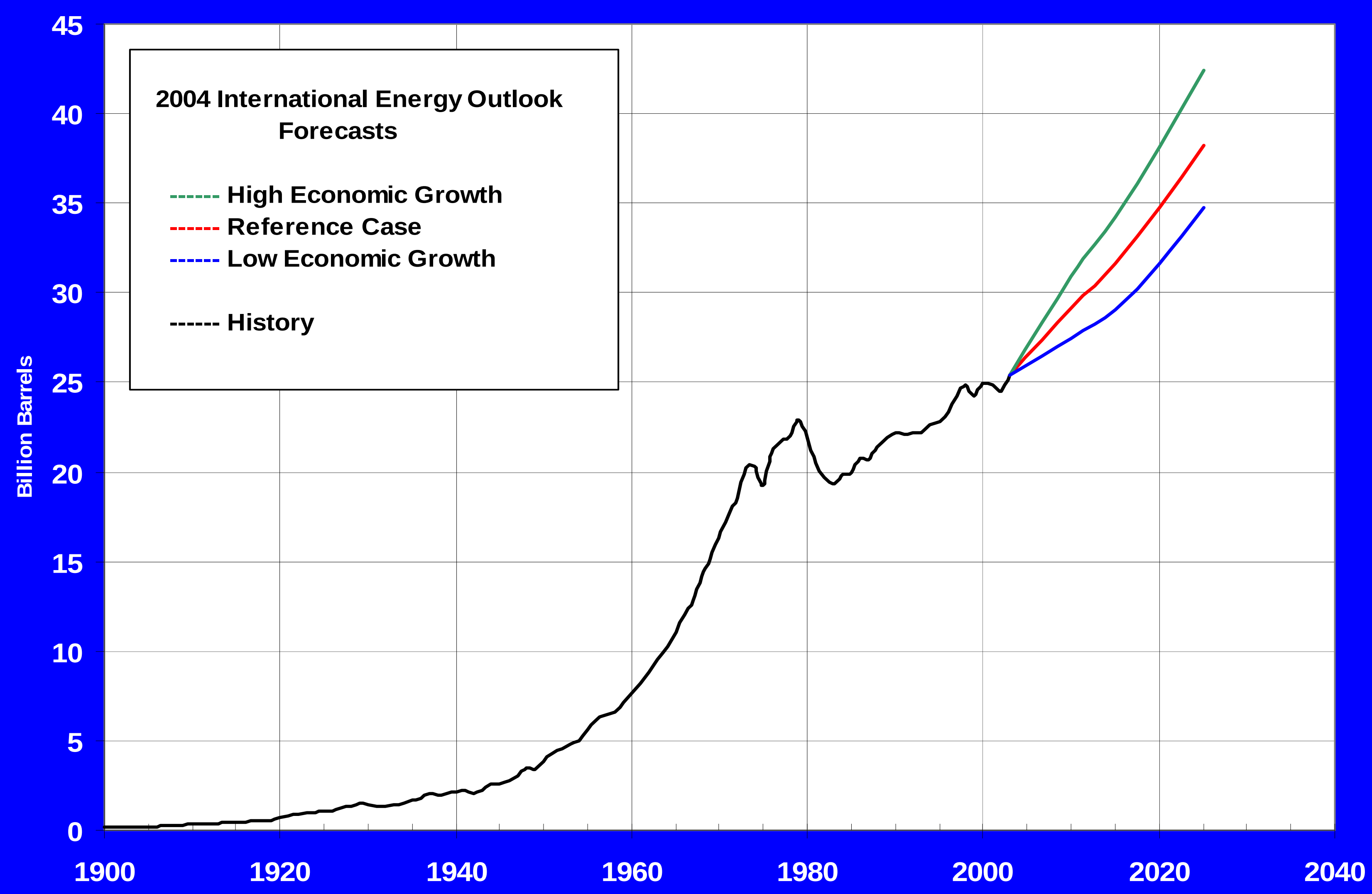
EIA's Short Answer Is:

Not Soon … But Within the Present Century.

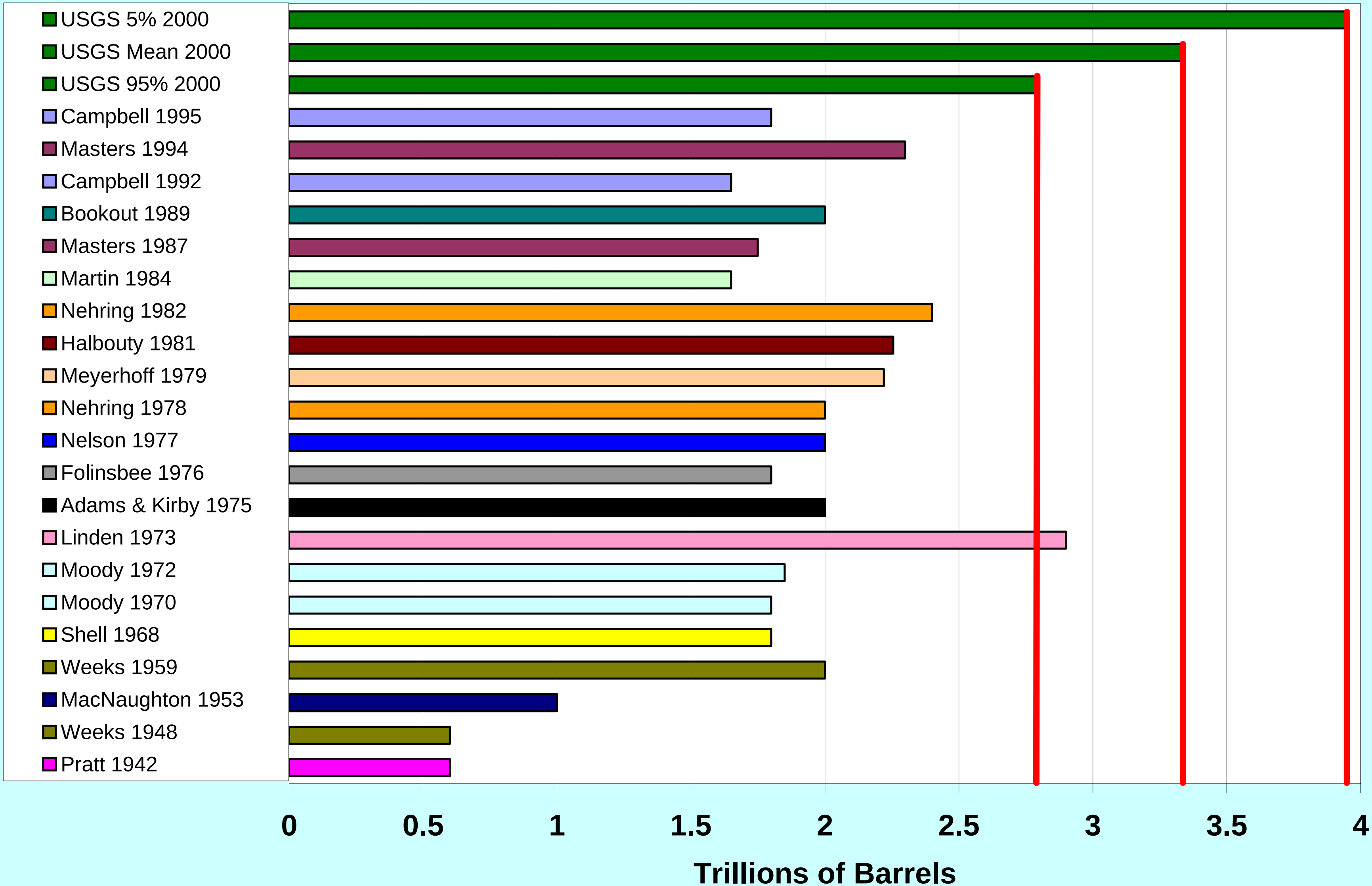
36 Estimates of the Time of Peak World Oil Production (There Are More)

Published	By	Peak Year/Range	Published	By	Peak Year/Range
1972	ESSO	About 2000	1999	Parker	2040
1972	UN	By 2000	2000	Bartlett	2004 or 2019
1974	Hubbert	1991-2000	2000	Duncan	2006
1976	UKDOE	About 2000	2000	EIA	2021-2167; 2037 most likely
1977	Hubbert	1996	2000	IEA (WEO)	Beyond 2020
1977	Ehrlich, et al.	2000	2001	Deffeyes	2003-2008
1979	Shell	Plateau by 2004	2001	Goodstein	2007
1981	World Bank	Plateau around 2000	2002	Smith	2010-2016
1985	Bookout	2020	2002	Campbell	2010
1989	Campbell	1989	2002	Cavallo	2025-2028
1994	Ivanhoe	OPEC Plateau 2000-2050	2003	Greene, et al.	2020-2050
1995	Petroconsultants	2005	2003	Laherrère	2010-2020
1997	Ivanhoe	2010	2003	Lynch	No visible peak
1997	Edwards	2020	2003	Shell	After 2025
1998	IEA (WEO)	2014	2003	Simmons	2007-2009
1998	Campbell/Laherrère	2004	2004	Bakhitari	2006-2007
1999	Campbell	2010	2004	CERA	After 2020
1999	Odell	2060	2004	PFC Energy	2015-2020

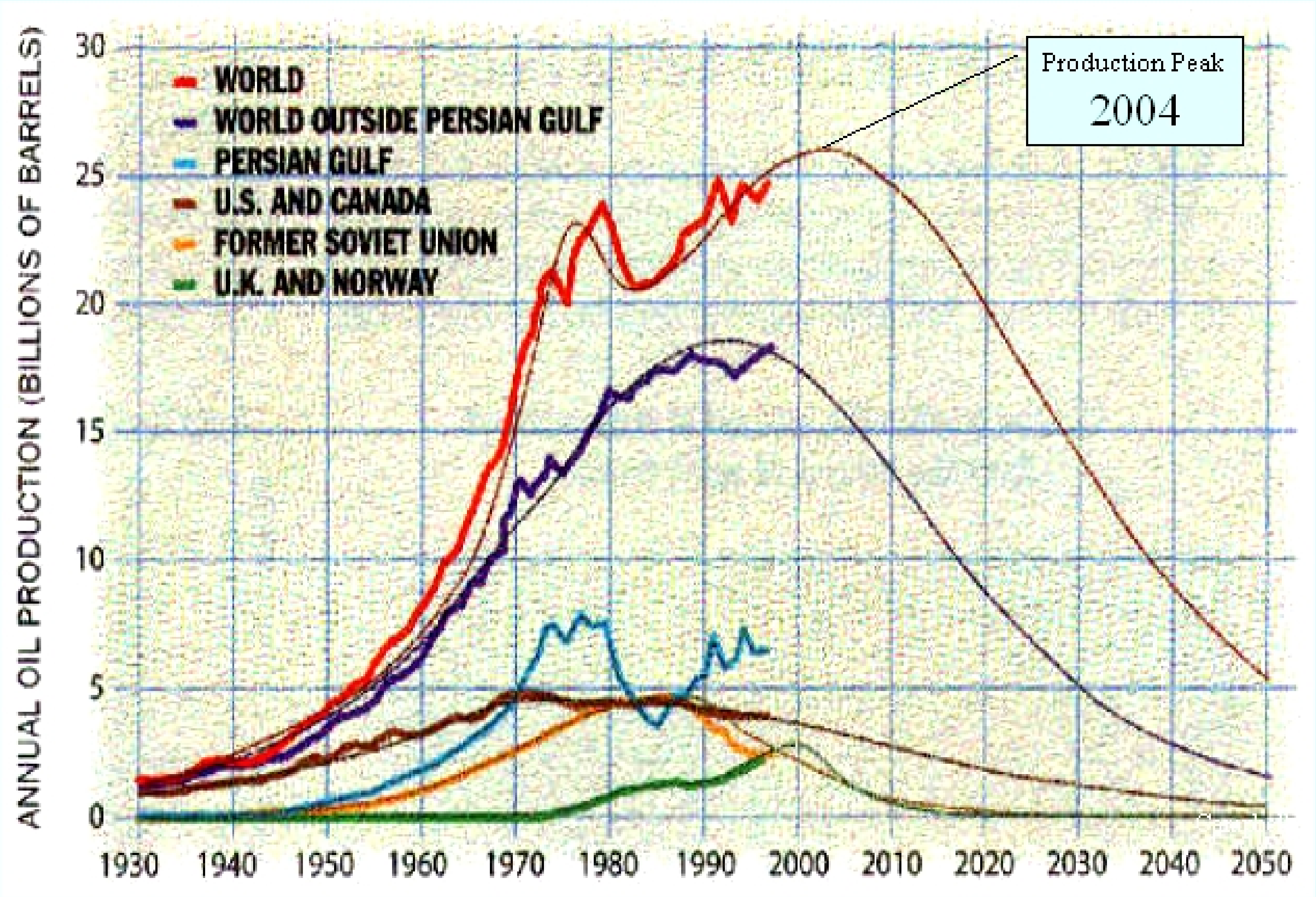
World Oil Production 1900-2003 and EIA's Forecasts to 2025



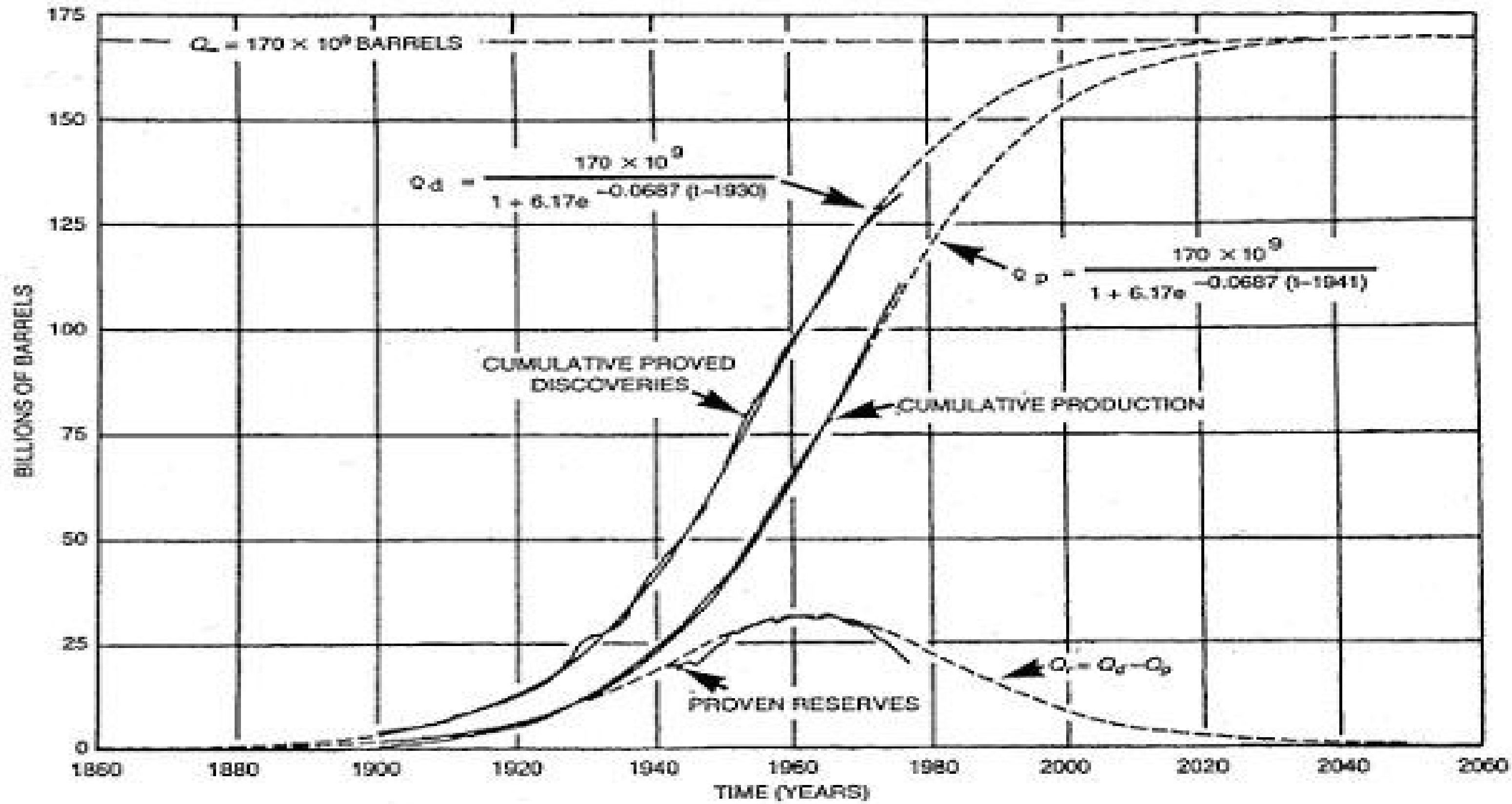
Published Estimates of World Ultimate Recovery



Campbell-Laherrère World Oil Production Estimates, 1930-2050



M. King Hubbert's 1956 Prediction of Peak U.S. Oil Production



Q_d cumulative discovery

Q_p cumulative production lags 11 years

$Q_r = Q_d - Q_p$ proved reserves

EIA's Long-Term World Oil Supply Modeling Scenarios for Conventional Crude Oils

(>10º API Gravity Or <10,000 cP Viscosity)

Three Pre-Peak Production Growth Rates:

1, 2, and 3 percent per year

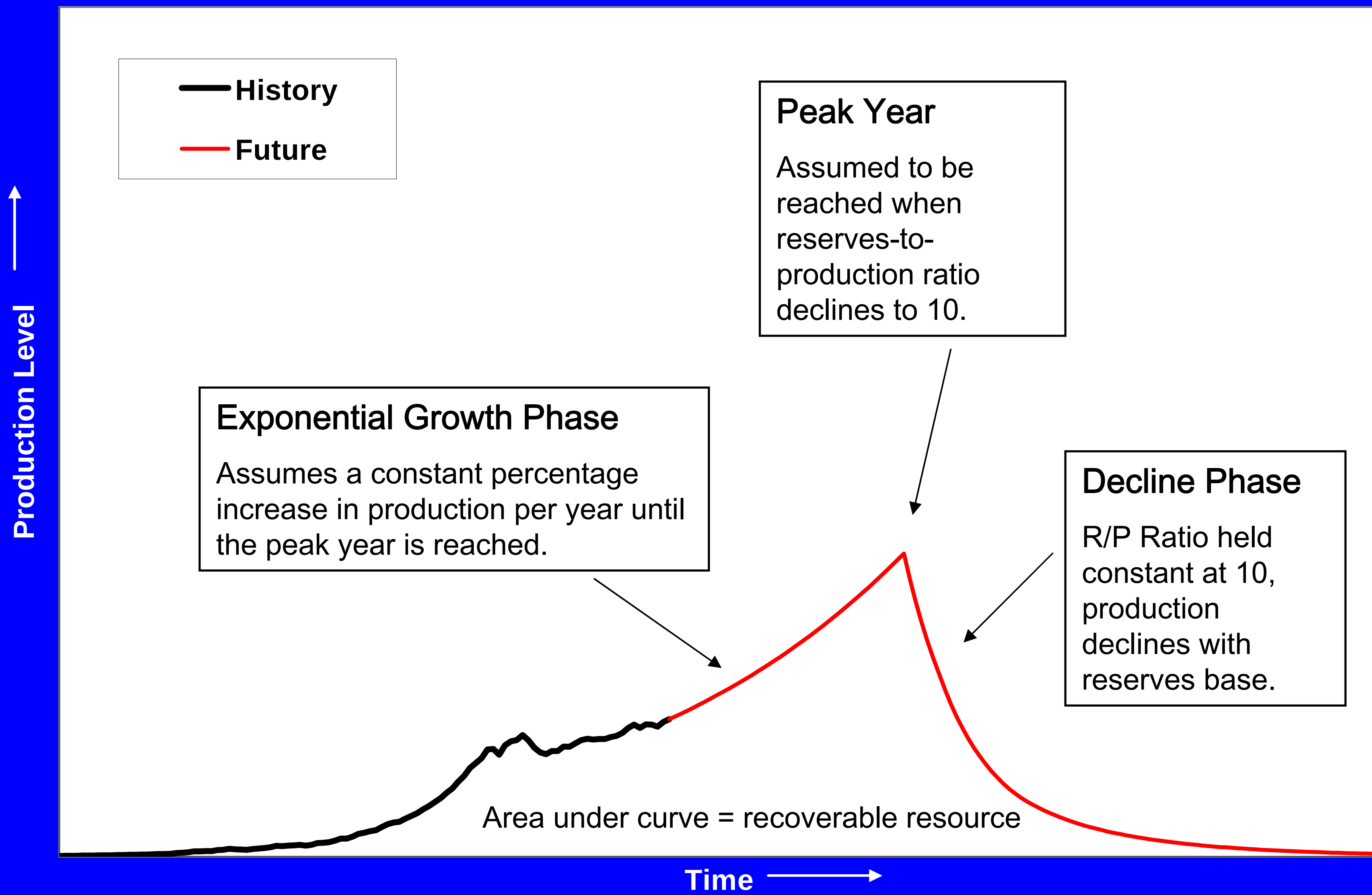
Combined with Three USGS / MMS / EIA-Sourced Technically Recoverable Resource Base Levels:

2.793 trillion barrels (95% chance of that much or more)
3.338 trillion barrels (expected value; statistical mean)
3.947 trillion barrels (5% chance of that much or more)

To Yield Nine Model Projections Spanning the Plausible Range of Outcomes.

The central scenario combines the 2-percent growth rate and the expected value resource base estimate.

EIA's Model For Conventional Oil Resources
(>10º API and <10,000 cP Viscosity)



Comparative Advantages of the EIA Model

Explicitly and quantitatively considers both supply and demand.

Relies on the USGS WPA2000 resource estimates. They reflect the most modern, thorough, and detailed study of world petroleum resources ever made.

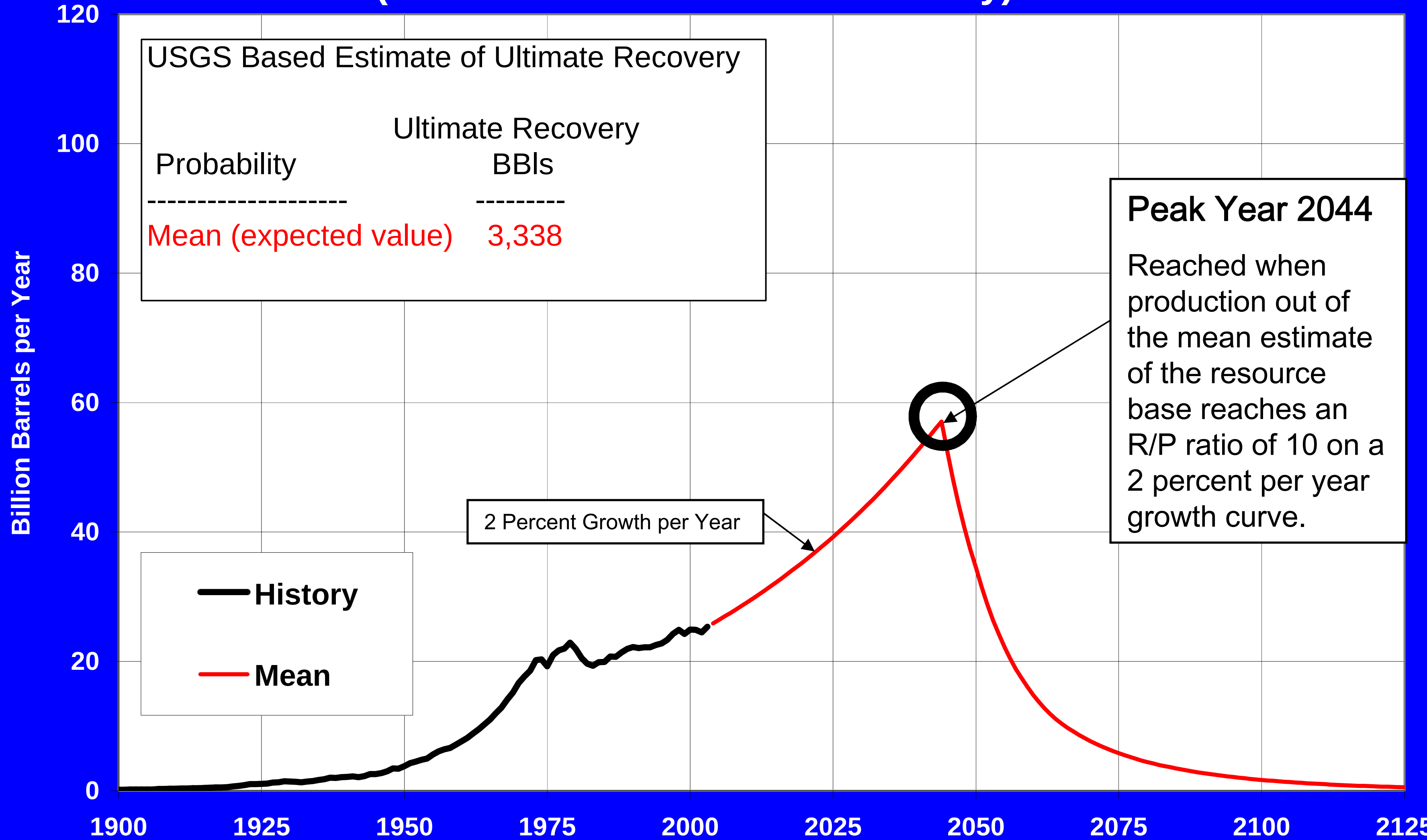
Assumes (as does the USGS) that proved ultimate recovery grows over time outside the borders of the United States, albeit not in every field.

Does not assume symmetry of the growth and decline phases of the world production path. There is no science-based reason why these phases should be symmetrical for a closed world-wide system.

Explicitly recognizes the primary uncertainties and their plausible bounds.

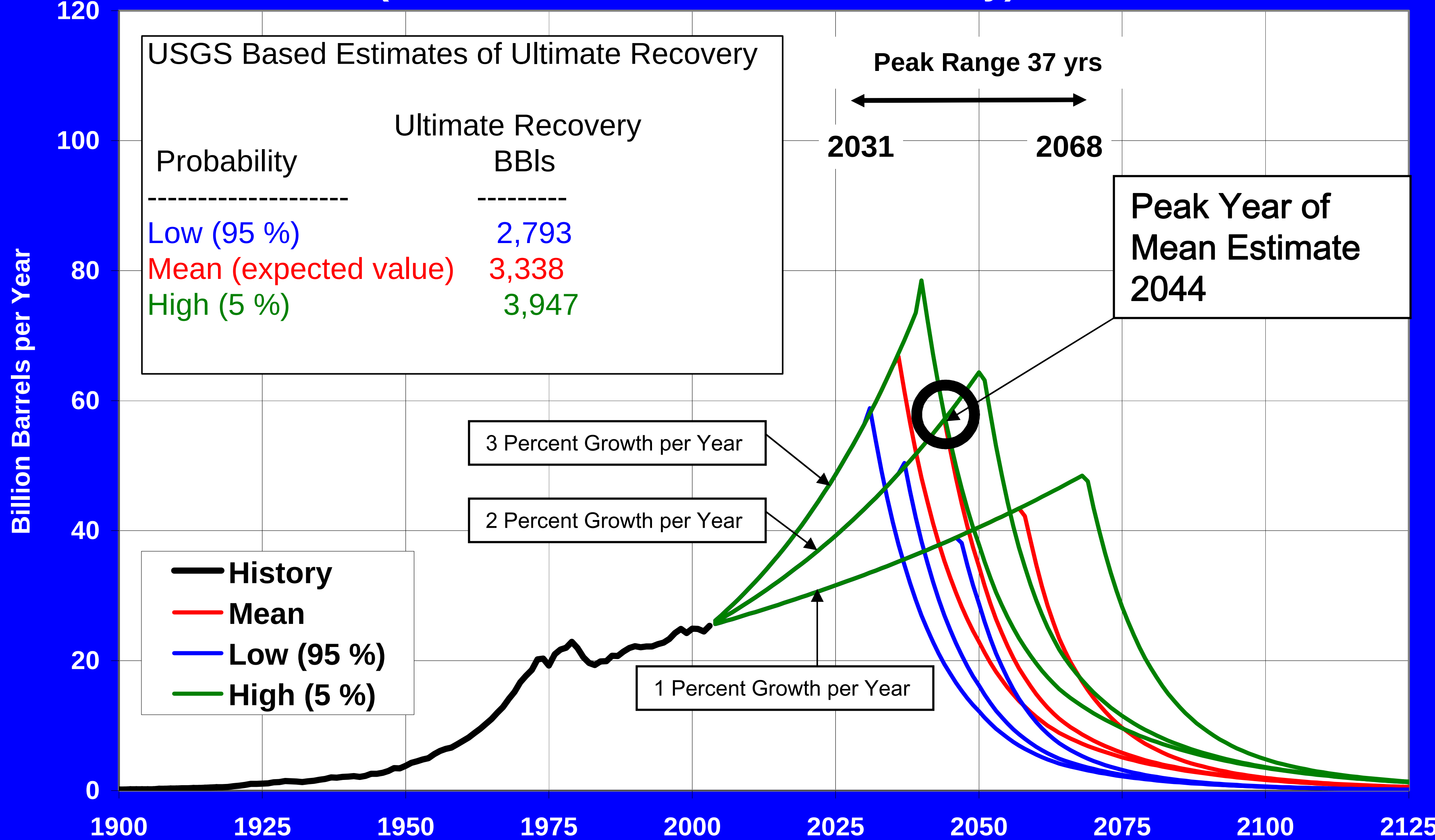
Conventional Oil Resources, Central Scenario

(>10º API and <10000 cP Viscosity)



Conventional Oil Resources, All Nine Scenarios

(>10º API and <10000 cP Viscosity)



Summary Table For Conventional Oil Resources

(>10º API and <10000 cP Viscosity)

Resource Base	Ultimate Recovery BBbls	Annual Demand Growth, %	Peak Year	Peak Rate, MMBbls/yr	Peak Rate, MMBbls/day
Low (95%)	2,793	1.0	2046	38,932	107
	2,793	2.0	2037	50,389	138
	2,793	3.0	2031	58,841	161
Mean	3,338	1.0	2057	43,424	119
(expected	3,338	2.0	2044	57,069	156
value)	3,338	3.0	2036	66,795	183
High (5%)	3,947	1.0	2068	48,446	133
	3,947	2.0	2050	64,355	176
	3,947	3.0	2040	78,475	215

The World's Primary Additional "Oil" Resources

Canadian Bitumen (Alberta; "tar sands")

≈80 percent of the world's in-place bitumen (< 10º API)

Venezuelan Extra-Heavy Oil (Orinoco Belt)

≈90 percent of the world's in-place extra-heavy oil (> 10000 cP)

For both:

- There's no finding risk (or cost).
- Commercial production is happening (and accelerating).
- The achievable recovery factors and the production costs are mostly technology-driven.

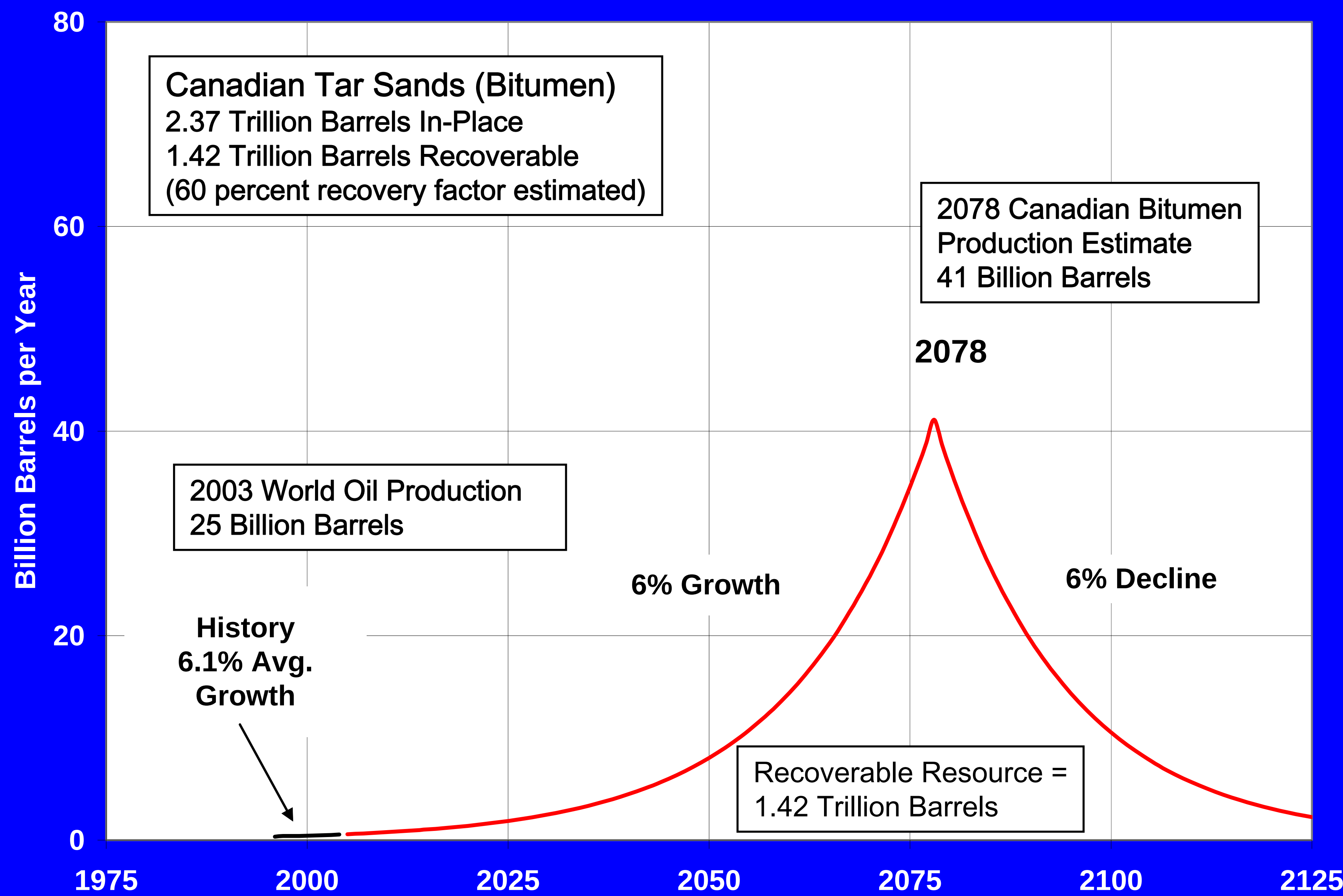
Oil Shales

A huge in-place kerogen resource … but the technology to economically produce large quantities of synthetic oil from them does not exist and is not likely to in the next few decades.

Canadian Bitumen

Estimated In-Place Resource	2.372 trillion barrels
API Gravity	7.5-9.0 degrees
Viscosity	Up to 1,000,000 centipoise
Host Formation Characteristics	Porosity 31 to 35 percent Permeability 2.5 to 5.0 Darcies
Resource Drawbacks	High metallics content
Extraction/Processing Drawbacks	High energy requirements (and associated CO_2 emissions); large volumes of light hydrocarbon diluent and freshwater are required.

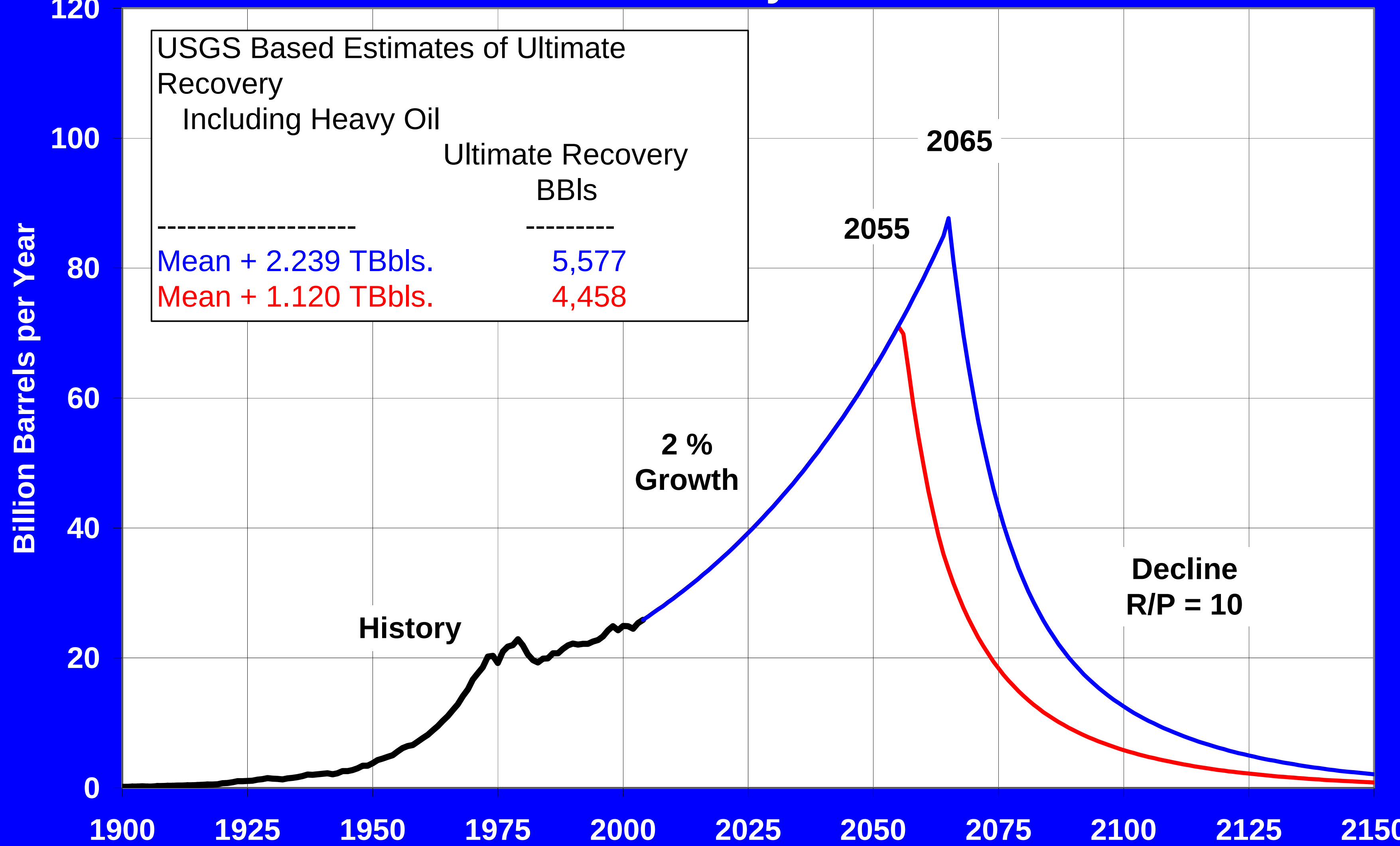
Canadian Bitumen : A Potential Path from Resource Base to Production



Venezuelan Extra-Heavy Oil

Estimated In-Place Resource	1.36 trillion barrels
API Gravity	8-10 degrees
Viscosity	10,000+ centipoise
Host Formation Characteristics	Porosity 30 to 36 percent Permeability 1 to 17 Darcies
Resource Drawbacks	2.0-3.5 percent sulfur content High metallics content
Extraction/Processing Drawbacks	Requires large volumes of light hydrocarbon diluent and/or fresh water (for Orimulsion).

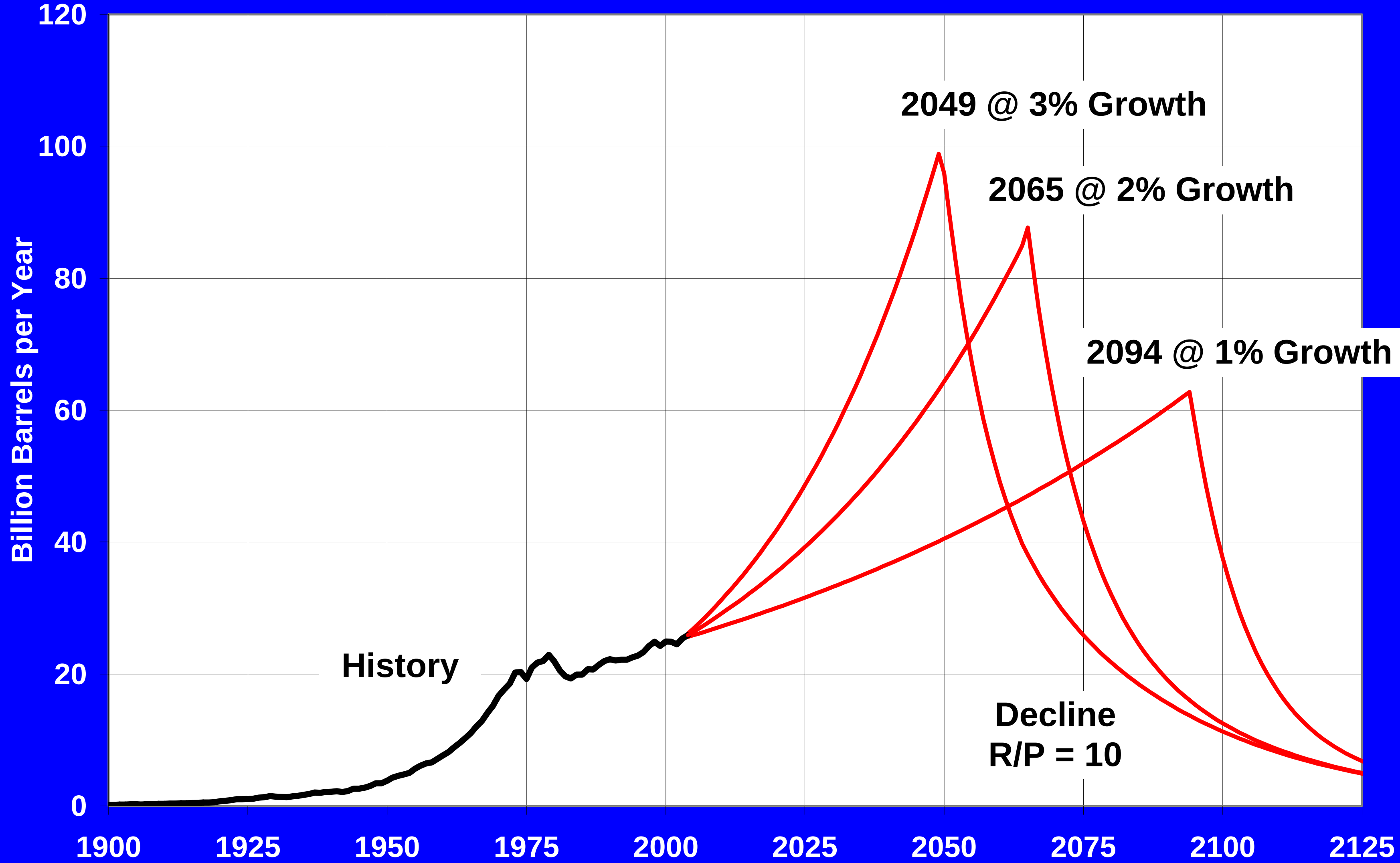
EIA Model Results Including Canadian Bitumen And Orinoco Extra-Heavy Oil Resources



Summary of EIA Model Results Including Canadian Bitumen And Orinoco Extra-Heavy Oil Resources

Resource Base	Ultimate Recovery BBbls	Annual Demand Growth, %	Peak Year	Peak Rate, MMBbls/yr	Peak Rate, MMBbls/day
Mean + 1.120 TBbls	4,458	1.0	2077	52,985	145
(30% recovery)	4,458	2.0	2055	71,053	195
	4,458	3.0	2043	82,768	227
Mean + 2.239 TBbls	5,577	1.0	2094	62,750	172
(60% recovery)	5,577	2.0	2065	87,677	240
	5,577	3.0	2049	98,829	271

The Other Half of the Economic Equation: Demand Reduction



Conclusions, Interpretations, and Implications

A peak in world oil production is decades away … not years away.

Geopolitical factors may cause plateaus or even declines for considerable periods of time.

Oil production growth rates of 1 to 3 percent per year will not soon be constrained by the size of the technically recoverable resource base, particularly when extra-heavy oil and bitumen resources are included.

Primarily its the size of the technically recoverable resource base that determines the peak year. Reasonable long term world oil supply models use the best available resource base estimates and include all economically producible petroleum resources.

However, complacency about both supply and demand side energy research, development, and analysis is risky given the involved scientific and technical challenges and the long lead times needed for significant market penetration of new energy technologies.