

OPEC at 50: Oil Market Modeling and Projections

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Overview

- Provide a quick retrospective of the world oil market for the past 50 years, reviewing the main aggregates: world oil demand, Non-OPEC supply, OPEC output and export levels, and crude oil price – disaggregating Non-OPEC into the OECD, the FSU, and the Rest of the World. We analyze how well OPEC did in achieving its own interests.
- Summarize and compare long-term projections to 2030, from Exxon-Mobil, BP, DOE, IEA, and OPEC: slowly growing demand, even slower growth in Non-OPEC supply, and a growing need for OPEC exports. We argue that projections of Non-OECD demand are too low, especially for the OPEC countries, and that higher prices (and/or slower income growth) will be needed in order to constrain demand growth to equal the slower growth of Non-OPEC supply and OPEC exports.

1. Retrospective: 1960-2010

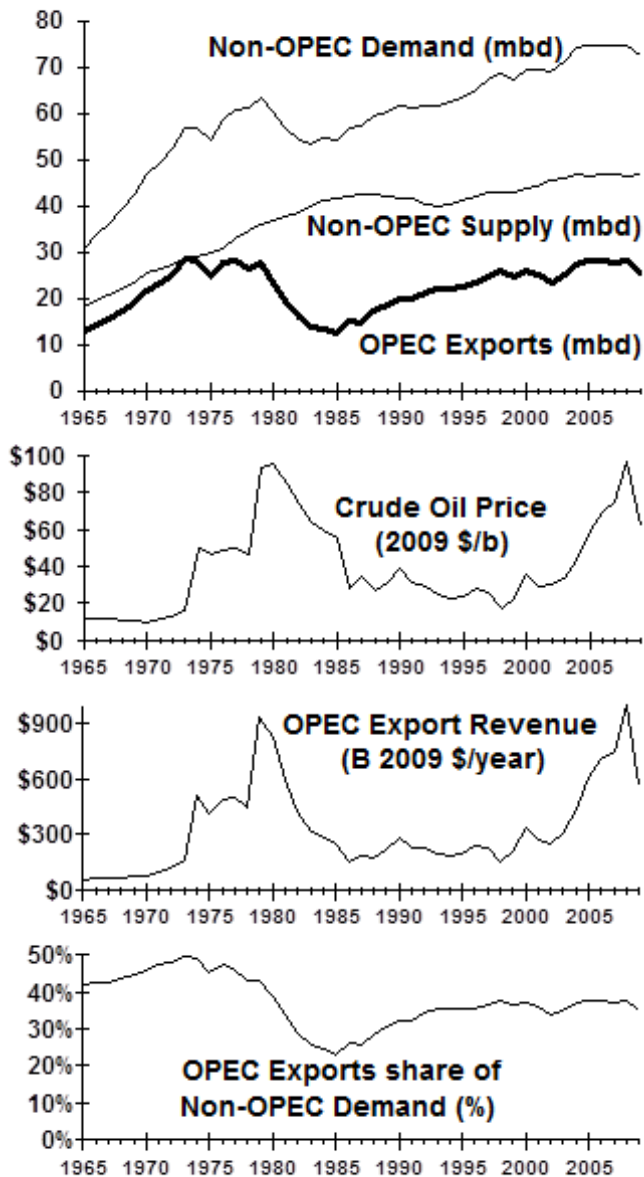
OPEC and Non-OPEC, 1965-2009

OPEC and Non-OPEC

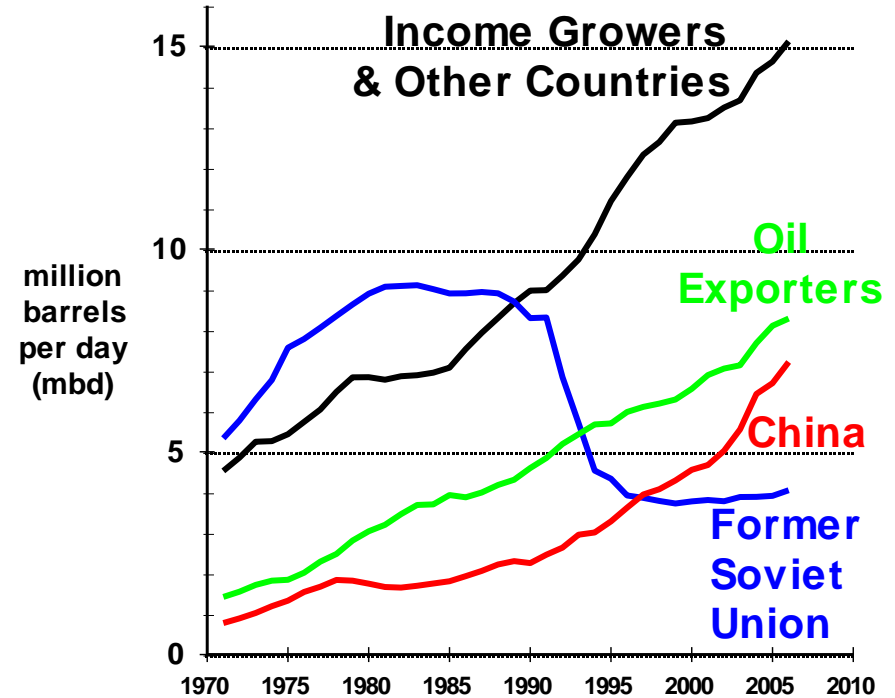
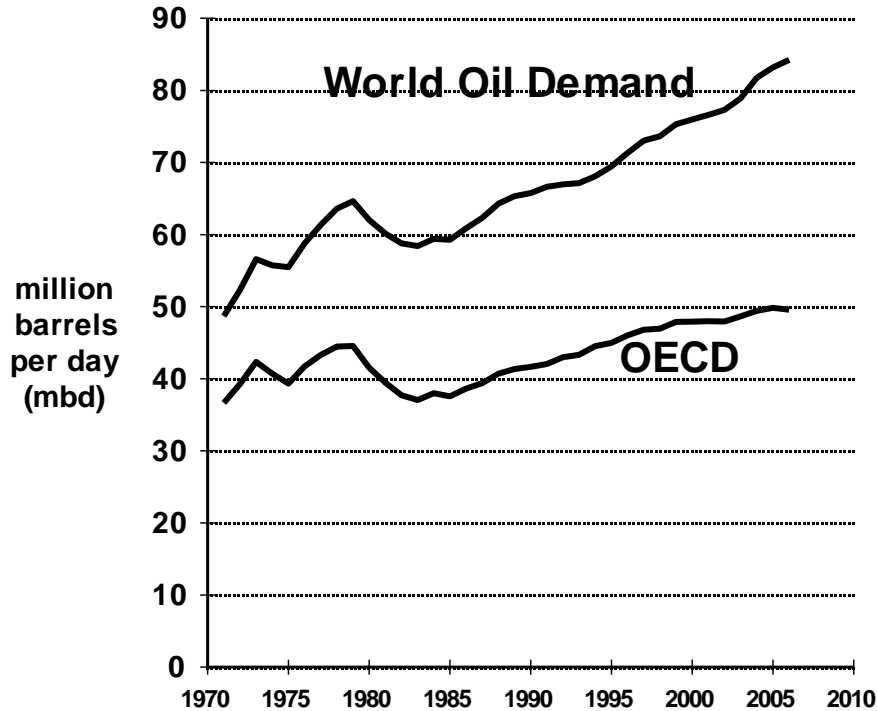
Ignore OPEC's own oil consumption, which grew rapidly, from 1 mbd in 1965 to 8 mbd in 2009.

Quick summary:

- 1960-80: spectacular success
- 1981-85: kept price too high for too long, leading to disastrous loss of market share
- 1986-2004: two decades for OPEC to recover
- 2004-2011: big price increases needed to slow demand growth to equal slowly growing Non-OPEC & OPEC supply

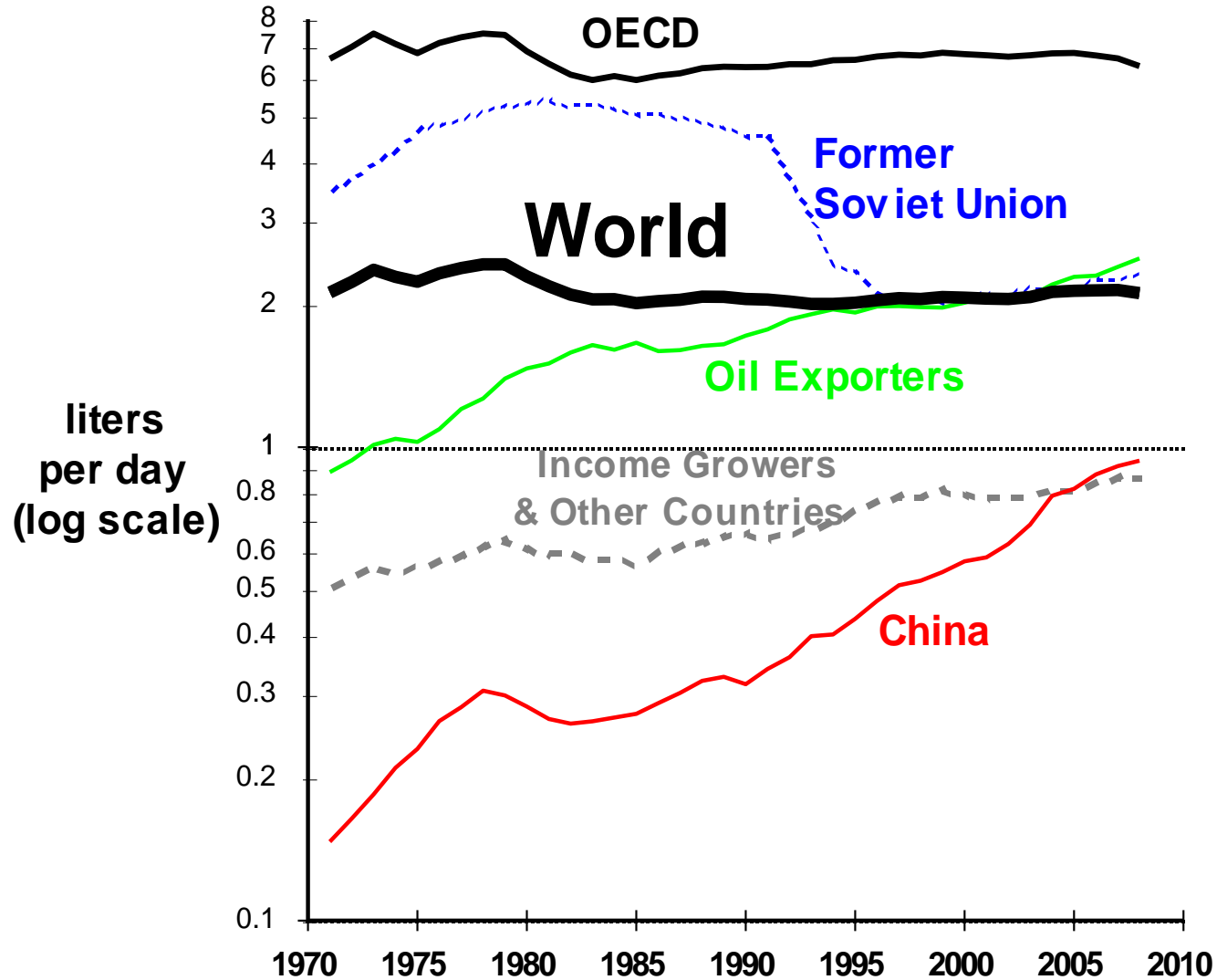


World Oil Demand since 1971 in million barrels per day



The OECD and FSU consumed 86% of world oil in 1971, compared with only 61% today. Most of the demand reductions since 1973-74 were due to fuel-switching away from fuel oil (in electricity generation and space heating), especially in the OECD. In addition, the economic collapse of the Former Soviet Union (FSU) reduced their oil consumption substantially. Neither of these can be repeated.

World oil demand, per-capita (liters/day)



Two oil-price quintuplings: much smaller price-responsiveness of oil demand in 1998-2008 than in 1973-84

Dargay & Gately, "World oil demand's shift toward faster growing and less price-responsive products and regions", *Energy Policy*, 2010.

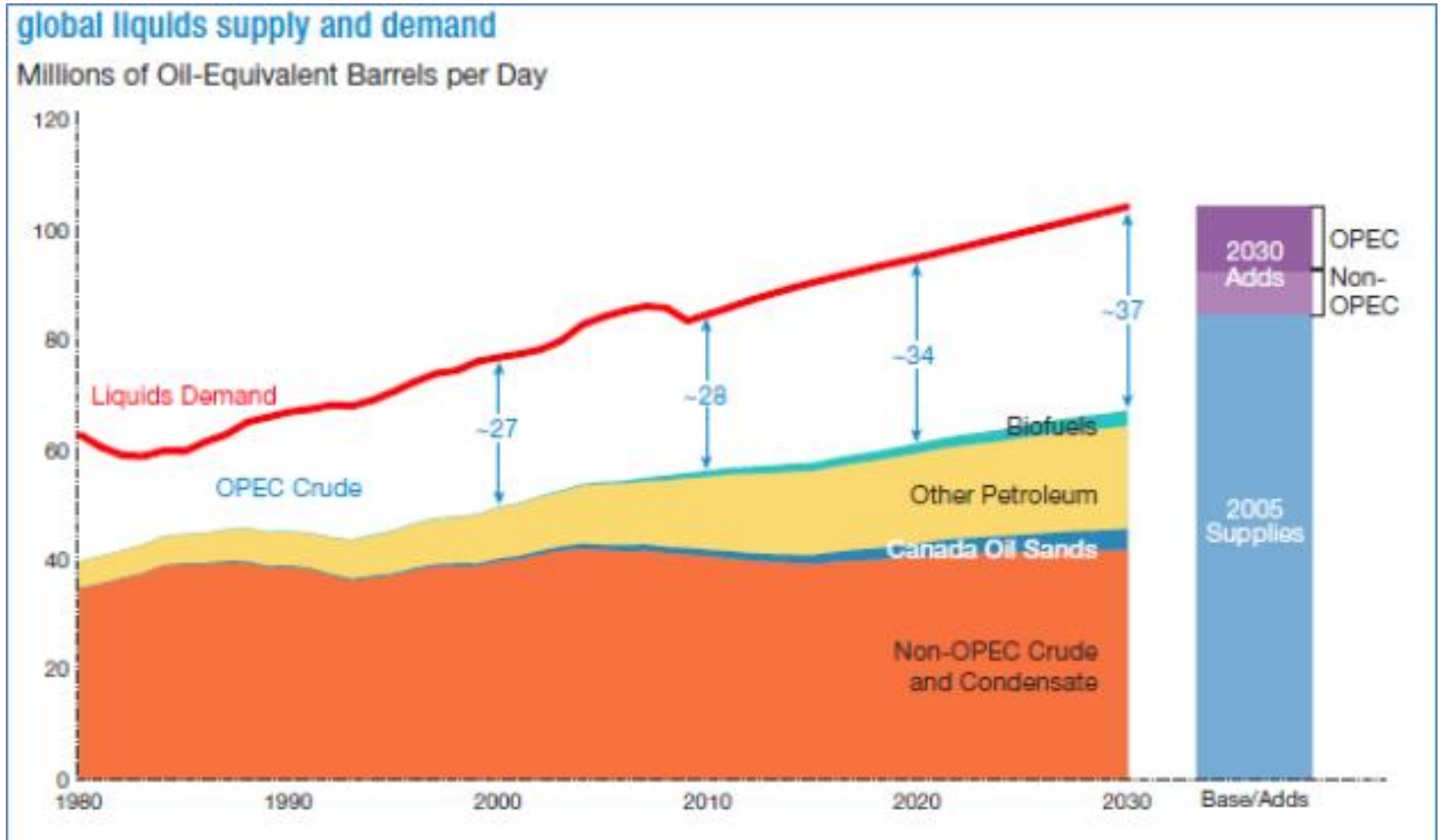
	1973	1984	% change 1973-1984	1998	2008	% change 1998-2008
Crude Oil Price (2007 \$/b)	\$16.01	\$96.62 (1980)	504%	\$17.32	\$97.26	461%
OECD						
Real Income per capita (Th.\$)	\$14.3	\$17.0	20%	\$22.7	\$27.3	20%
Total Oil per capita (liters/day)	7.27	5.98	-19%	6.66	6.33	-3%
Fuel Oil per capita (liters/day) (a)	3.28	1.89	-42%	1.52	1.06	-30%
<i>Fuel Oil share of Total OECD Oil</i>	45%	32%		23%	17%	
Transport Oil per capita	2.60	2.71	4%	3.45	3.71	8%
<i>product share of Total Oil, OECD</i>	36%	45%		52%	59%	
<i>OECD share of Total World Oil</i>	73%	63%		63%	56%	
<i>OECD Fuel Oil share of Total World Oil</i>	33%	20%		14%	9%	
Non-OECD						
Real Income per capita (Th.\$)	\$2.3	\$2.9	27%	\$3.5	\$5.8	66%
Total Oil per capita (liters/day)	0.78	0.94	20%	0.92	1.14	23%
Residual Oil per capita (liters/day) *	0.27	0.30	12%	0.21	0.18	-17%
<i>Residual Oil share of Total Non-OECD Oil</i>	32%	31%		23%	16%	
<i>Non-OECD share of Total World Oil</i>	27%	37%		37%	44%	
<i>Non-OECD Residual Oil share of Total World Oil</i>	9%	12%		8%	7%	
World						
Real Income per capita (Th.\$)	\$5.1	\$5.9	16%	\$7.2	\$9.8	35%
Total Oil per capita (liters/day)	2.37	2.05	-13%	2.05	2.11	3%
Residual Oil per capita (liters/day) (b)	0.66	0.45	-32%	0.31	0.23	-24%
<i>Residual Oil share of Total World Oil</i>	28%	22%		15%	11%	

2. Long-term projections to 2030

Latest projections of prices and quantities published by the major institutions:

Exxon-Mobil, BP, DOE, IEA, and OPEC

Exxon-Mobil(2009) Long-term Projections of Global Liquids Supply



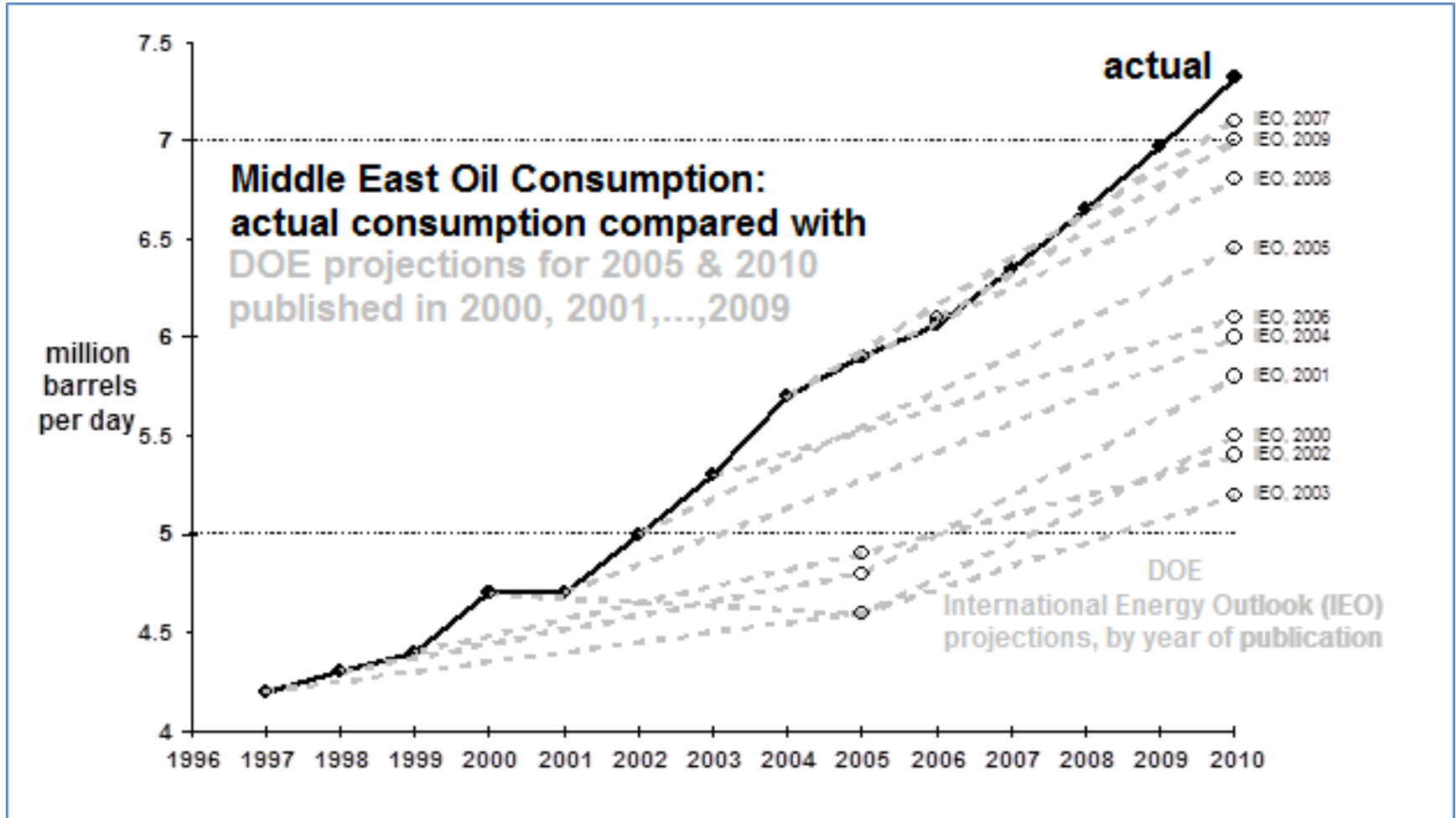
Differences & Similarities in Projections:

1. Demand projections are very similar for all.
2. IEA projects lower Non-OPEC supply than others, especially DOE. Hence the demand for OPEC exports is highest for IEA and lowest for DOE.
3. OPEC projects lower prices than others.

	History		Projections for year 2030				
	1973	2008	BP Outlook (2010)	Exxon-Mobil Outlook (2009)	OPEC Outlook (2010)	IEA (2010) Current Policies Scenario ("Ref.Case")	DOE Reference Case (2010)
Demand (mbd): World	56.0	85.2	103	104	106	104	104
OPEC	1.6	7.4	11	11	11	11	11
Non-OPEC	54.4	77.8	89	90	95	93	93
Production (mbd): World	58.5	82.0	103	104	106	104	104
OPEC	29.9	35.6	49	47	48	54	44
Non-OPEC	28.5	46.4	54	57	58	50	60
OPEC Exports (mbd)	28.3	28.2	38	36	37	41	33
as % of Non-OPEC Demand	0.5	0.4	43%	40%	39%	44%	36%
Price (2009\$/b)	15.9	96.9	?	?	\$71	\$130	\$124

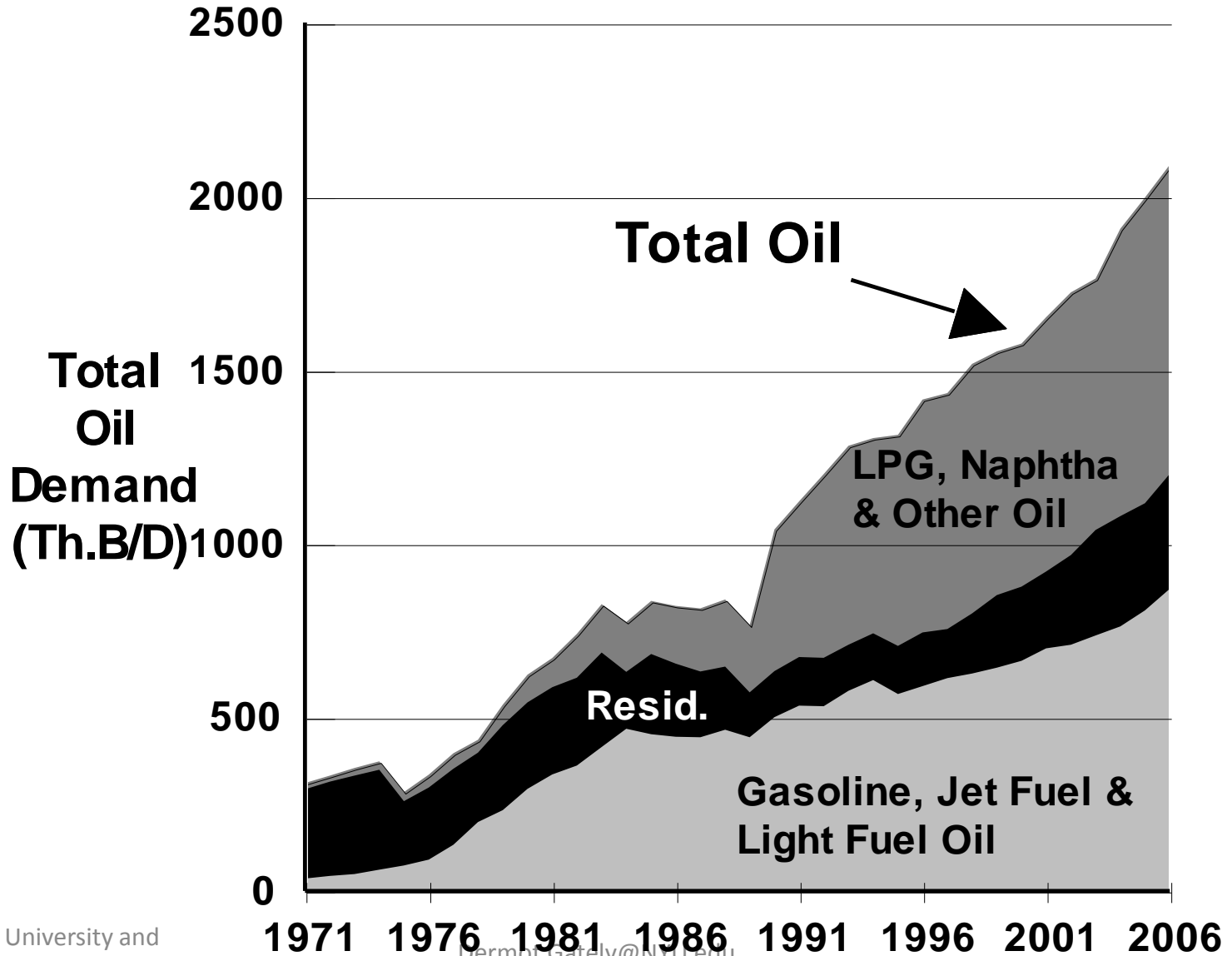
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DOE has consistently under-predicted Middle East oil consumption



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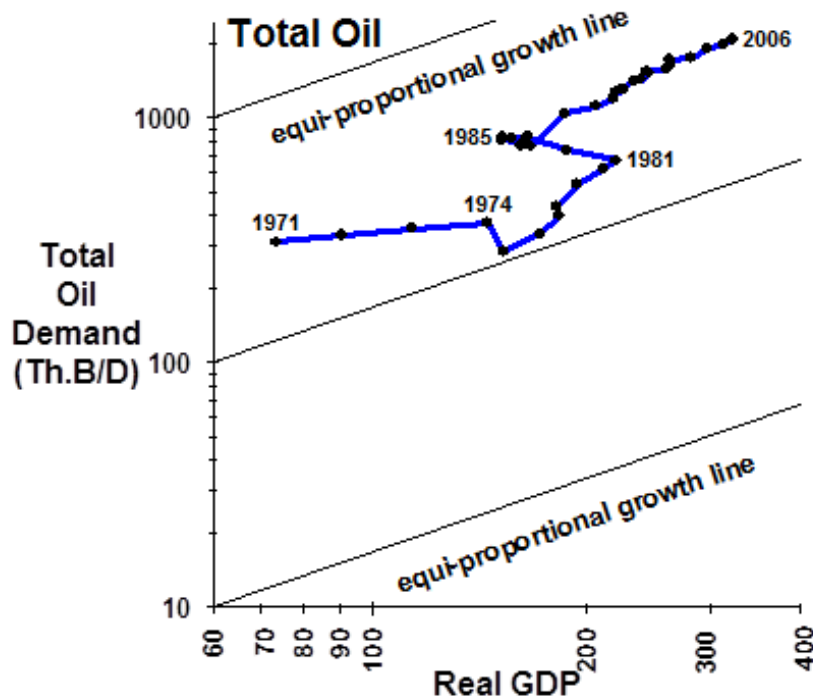
Saudi Arabia's Domestic Oil Demand



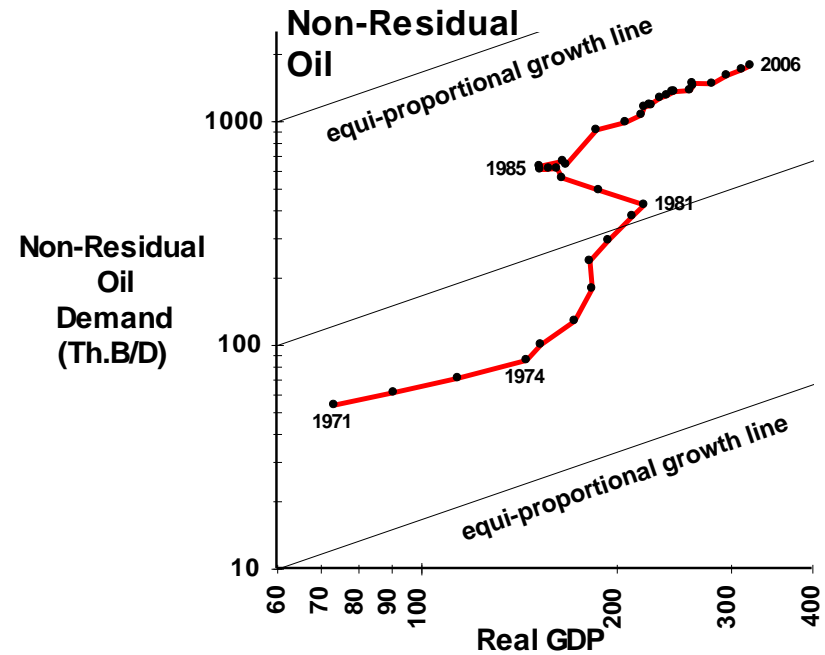
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Saudi Arabia's Domestic Oil Demand

Total Oil demand is growing faster than income.

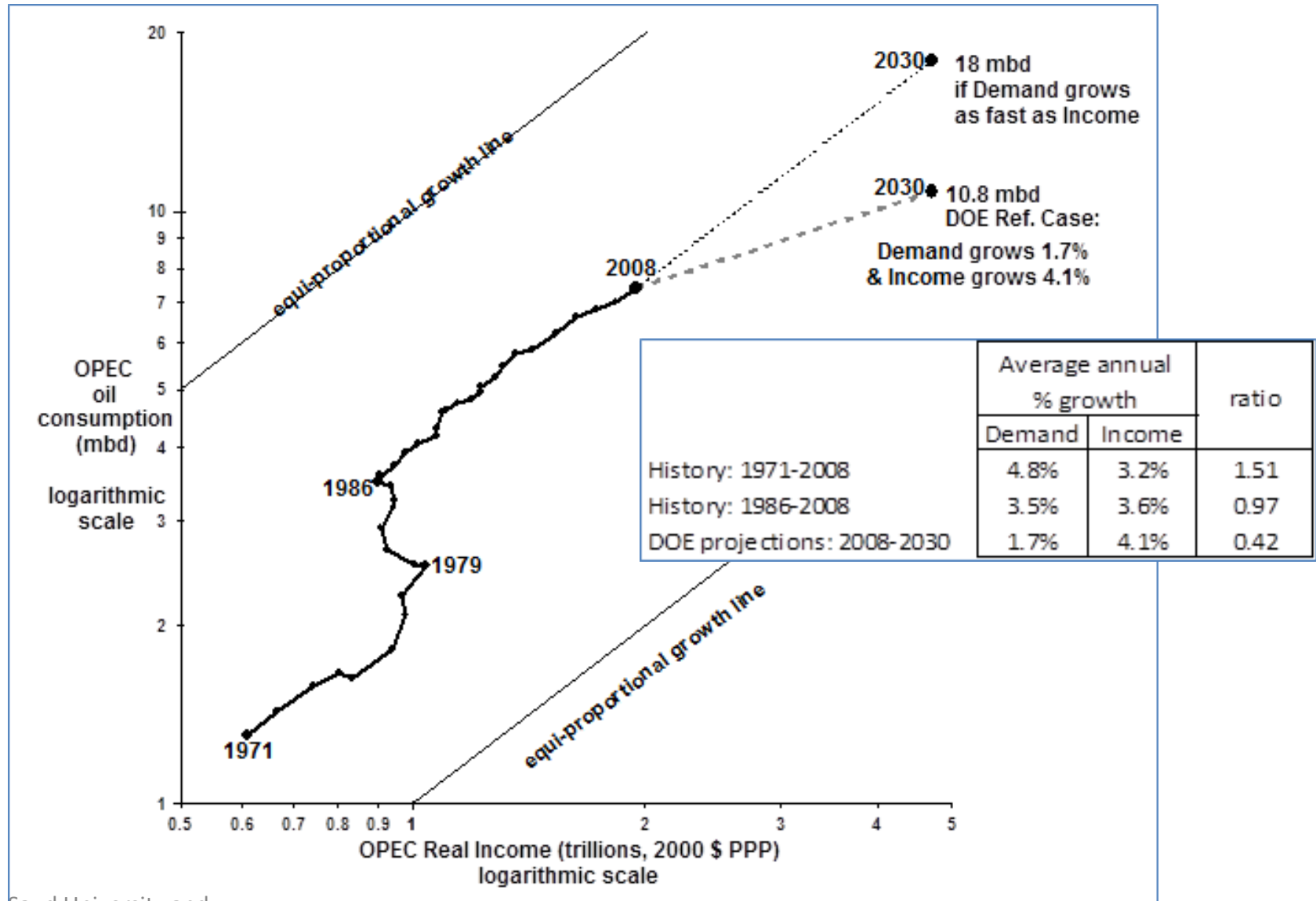


Non-Residual Oil demand is growing twice as fast as income.



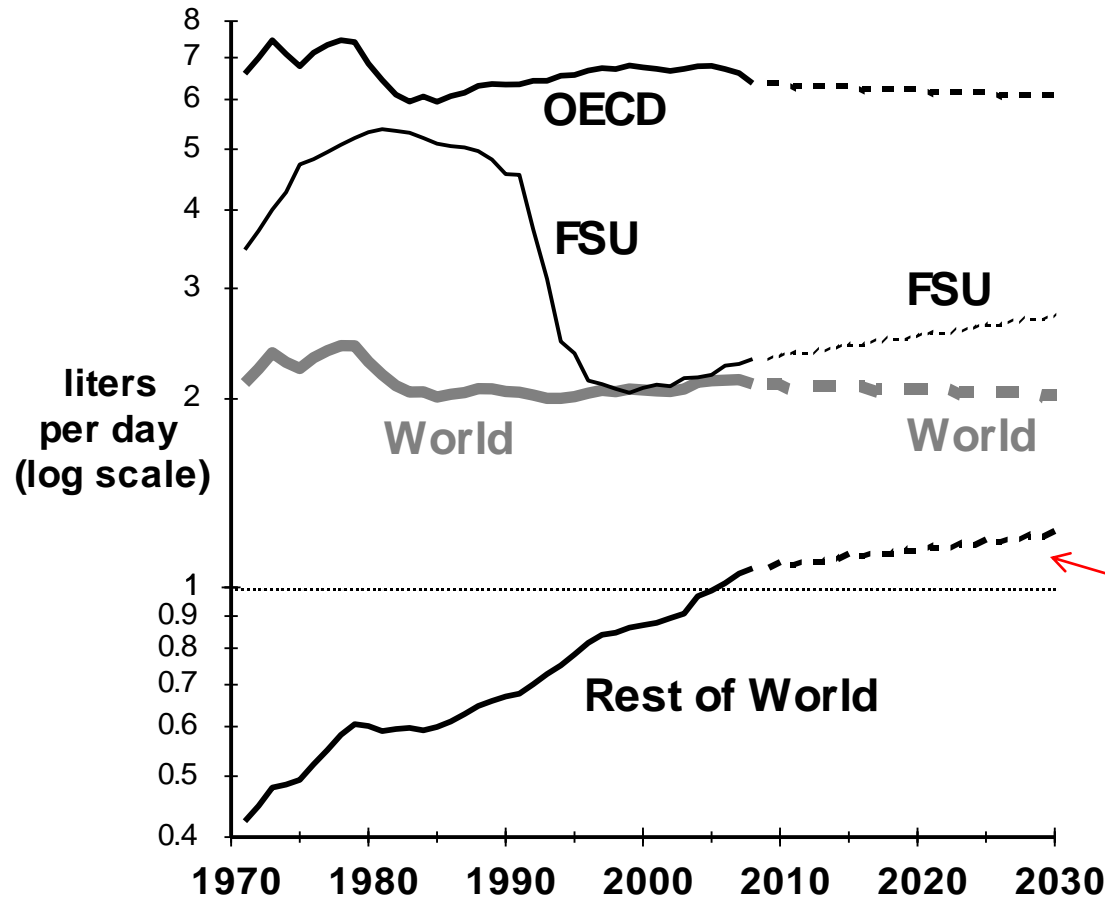
2a. Why these long-term projections of demand (& thus of price) may be too low:

DOE projects OPEC oil consumption to grow to 10.8 mbd in 2030, less than half as fast as income – much more slowly than in the past



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Projections of per-capita oil liquids demand to 2030
using DOE Ref. Case assumptions for crude oil prices & income growth:
DOE projections (**104 mbd** in 2030)



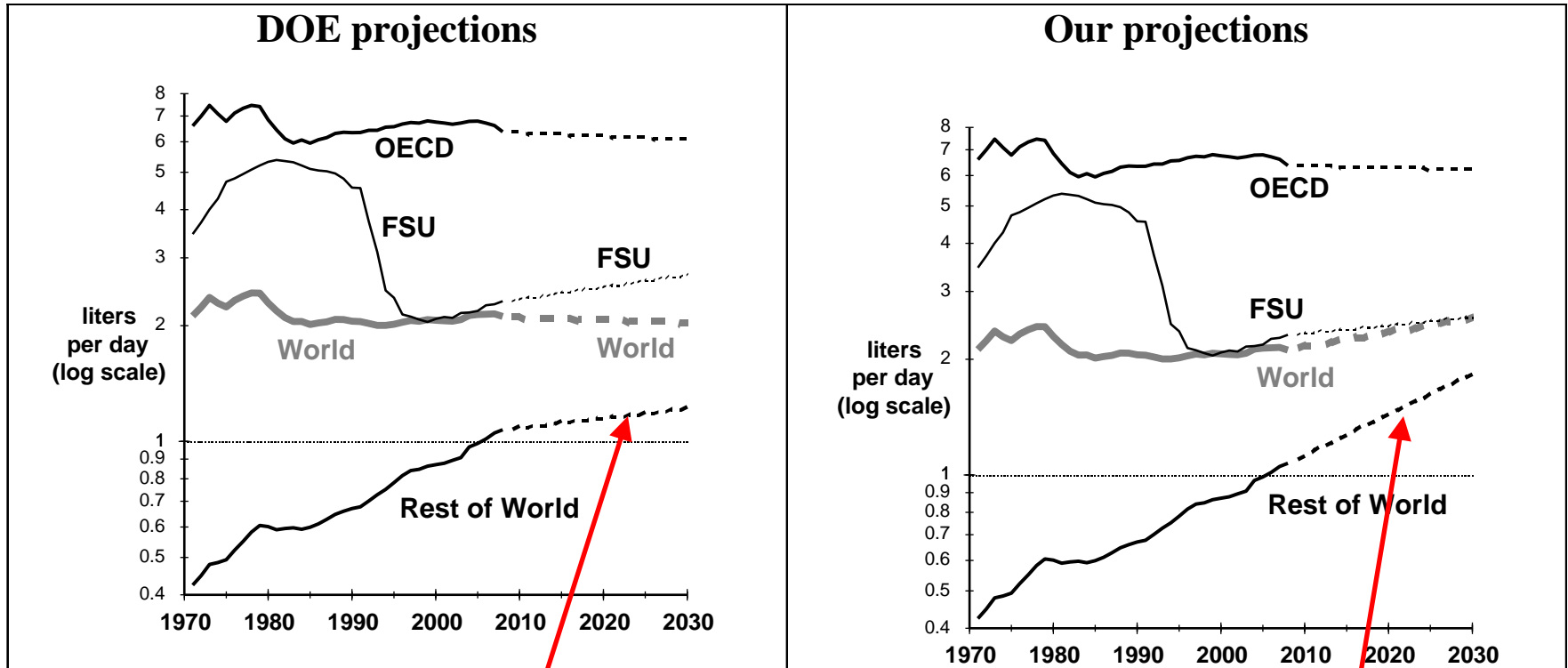
DOE: Next time it's different.
Annual % growth in per-capita demand:
2.54% historically,
but only 0.56% in future
(despite faster income growth)

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DOE projections (**104 mbd** in 2030) and Dargay-Gately projections (**134 mbd**)



DOE: Next time it's different.
Annual % growth in per-capita demand:
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Dargay-Gately: Next time will be like
last time: 2.5% annual growth.

Dargay & Gately, "World oil demand's shift toward
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2b. How well have consensus long-term projections done in the past – say projections to 2020 from 2001 – how well did they do?

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US Dept. of Energy, *International Energy Outlook 2001*

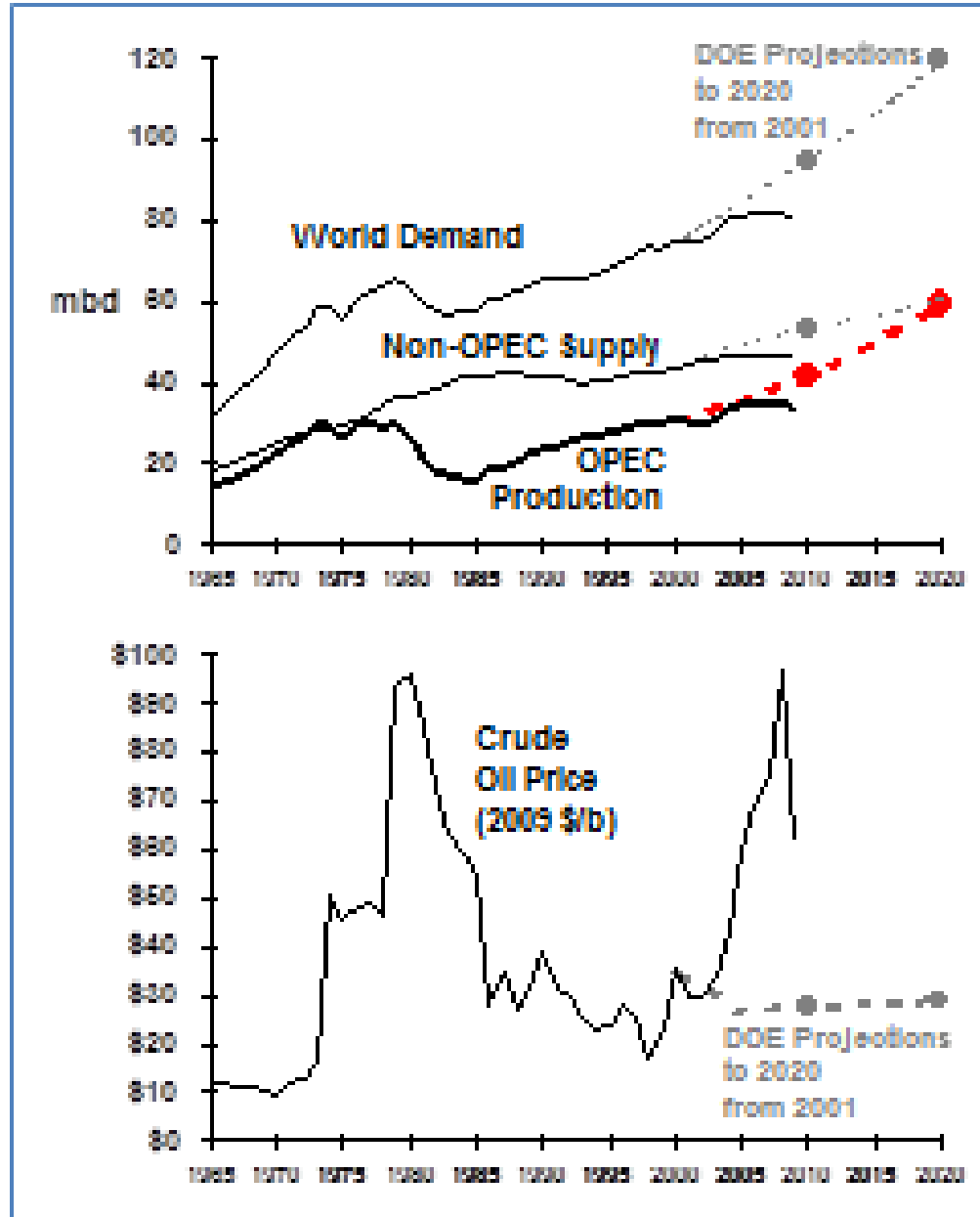
Table 14. Comparison of World Oil Price Projections, 2005-2020 (1999 Dollars per Barrel)

Forecast	2005	2010	2015	2020
<i>IEO2001</i>				
Reference Case	20.83	21.37	21.89	22.41
High Price Case	26.04	26.66	28.23	28.42
Low Price Case	15.10	15.10	15.10	15.10
S&P (October 2000)	19.47	18.65	19.87	21.16
IEA (November 2000)	19.83	19.83	—	27.04
PEL (February 2000)	15.63	13.77	11.75	—
PIRA (October 2000)	22.56	23.58	—	—
WEFA (February 2000)	18.39	18.48	19.42	20.41
GRI (January 2000)	18.17	18.17	18.17	—
NRCan (April 1997)	21.24	21.24	21.24	21.24
DBAB (January 2001)	17.08	16.98	17.34	17.68

Table 15. Comparison of World Oil Production Forecasts

Forecast	Percent of World Total			Million Barrels per Day			
	OPEC	EE/FSU	Rest of World	OPEC	EE/FSU	Rest of World	Total
2020							
<i>IEO2001</i>	50	13	38	59.3	15.1	44.9	119.3
S&P ^a	46	6	44	54.1	7.6	51.3	116.6
IEA ^b	54	11	29	61.8	12.3	33.8	114.7
DBAB	48	13	36	56.0	15.3	42.5	116.5

Projections to 2020 from 2001: how did they do?



**Projections to 2020 from 2001:
DOE Reference Case**

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Wimbledon, 1981

http://www.youtube.com/watch?v=ekQ_Ja02gTY

Gately, “How Plausible is the Consensus Projection of Oil below \$25 and Gulf Output Doubling by 2020?”, *Energy Journal*, 2001.

What was wrong with the long-term projections from 2001 – in which OPEC would double its output to 60 mbd by 2020?

These institutions did NO analysis of whether the projected doubling of OPEC output levels made sense for OPEC.

- **What incentive did OPEC have to expand its output as rapidly as projected? It was NEGATIVE!**
- **Might OPEC be better off if instead it did not expand its output so rapidly and just let price increase? Yes, definitely.**

See articles by Gately in Energy Journal:

(2001): “How Plausible is the Consensus Projection of Oil below \$25 and Gulf Output Doubling by 2020?”

(2004): “OPEC’s Incentives for Faster Output Growth”

(2007): “What oil export levels should we expect from OPEC”

Conclusions about OPEC exports

- We should not rely upon OPEC's export-share of non-OPEC demand increasing, or even remaining constant.
- We might not even be able to count upon OPEC being able to maintain its *level* of oil exports.
- OPEC's own oil consumption is likely to grow much faster than is projected by DOE and IEA, perhaps as fast as OPEC income. Now at 8 mbd (nearly 25% of OPEC output), it could grow to 18 mbd by 2030 if it grows as fast as OPEC income, as it has since 1987. That would be 40% to 50% of OPEC production by 2030, greatly constraining OPEC's ability to increase oil exports.

Conclusions about OPEC exports

- We could see a future in which OPEC investment in capacity expansion is too slow and the world's need for OPEC oil goes unmet.
- Sharply higher prices that overshoot a long-term equilibrium path could be the short-term result, together with lower economic welfare worldwide.
- We could witness low-cost oil reserves in OPEC remaining underutilized while high-cost substitutes are over-utilized elsewhere – in economically wasteful cycles.

Thank you