

GLOBAL OIL SUPPLY OUTLOOK

IEEJ TOKYO JULY 2013

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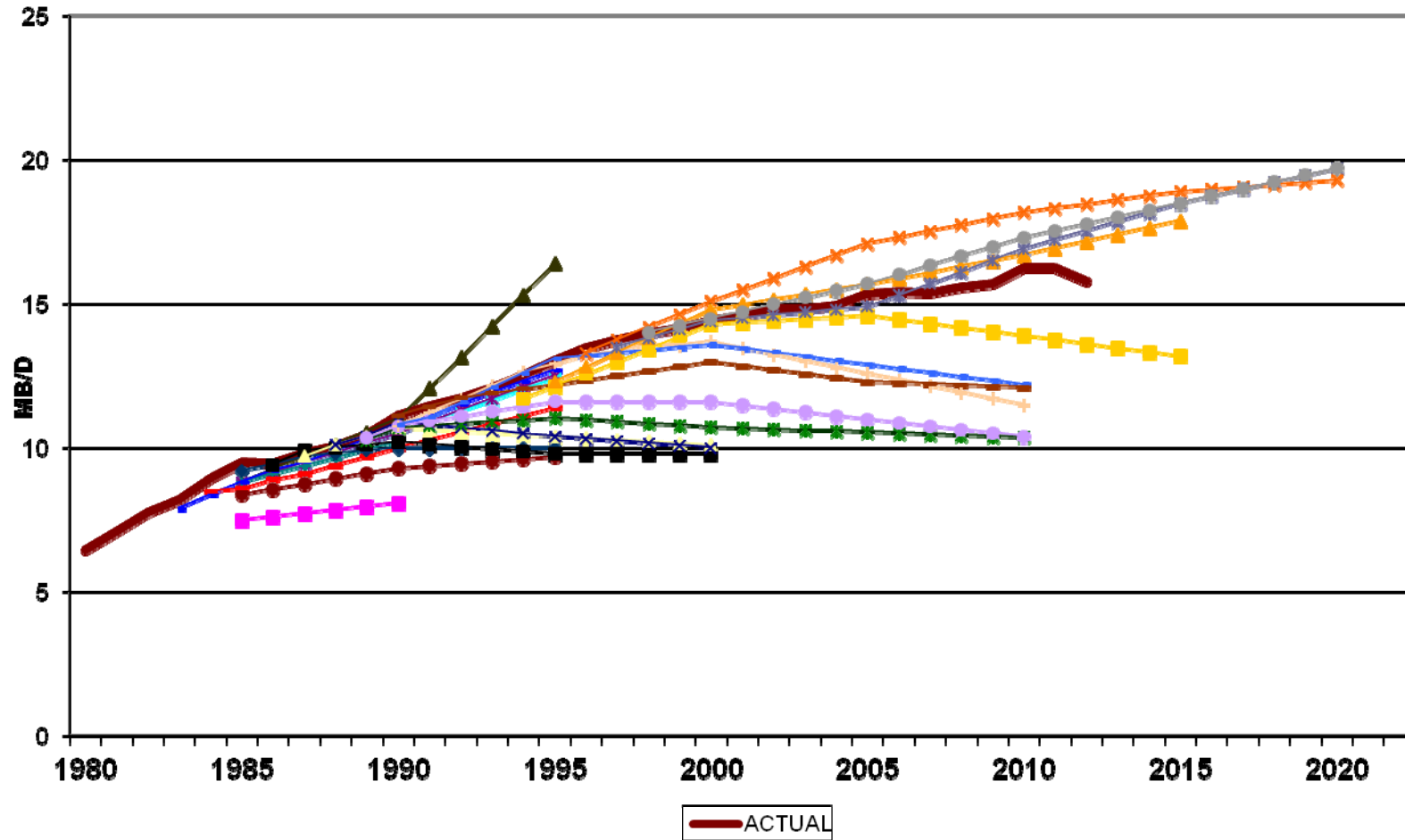
ISSUES

- SUPPLY SEEMS TO HAVE SLOWED
 - BUT PEAK OIL IS PSEUDOSCIENCE
- 'EASY' OIL IS GONE
- 'CHEAP' OIL IS GONE
 - \$100 IS NEW FLOOR, DUE TO HIGH COSTS
 - RESOURCE NATIONALISM HUGE OBSTACLE

LESSONS FROM PAST FORECASTING

- MANY BAD MODELS USED
 - HUBBERT, CREAMING CURVES
- PESSIMISTIC AFTER 1979
 - EVERYONE BUT MIDDLE EAST AT A PEAK
 - PEAK KEEPS MOVING OUT
- OPTIMISM APPEARS LATE 1990S
 - JUST AS PRICES COLLAPSE
- MAJOR CHANGES/TURNING POINTS NOT EXPECTED

US DOE FORECASTS LDC SUPPLY (1980-2000)

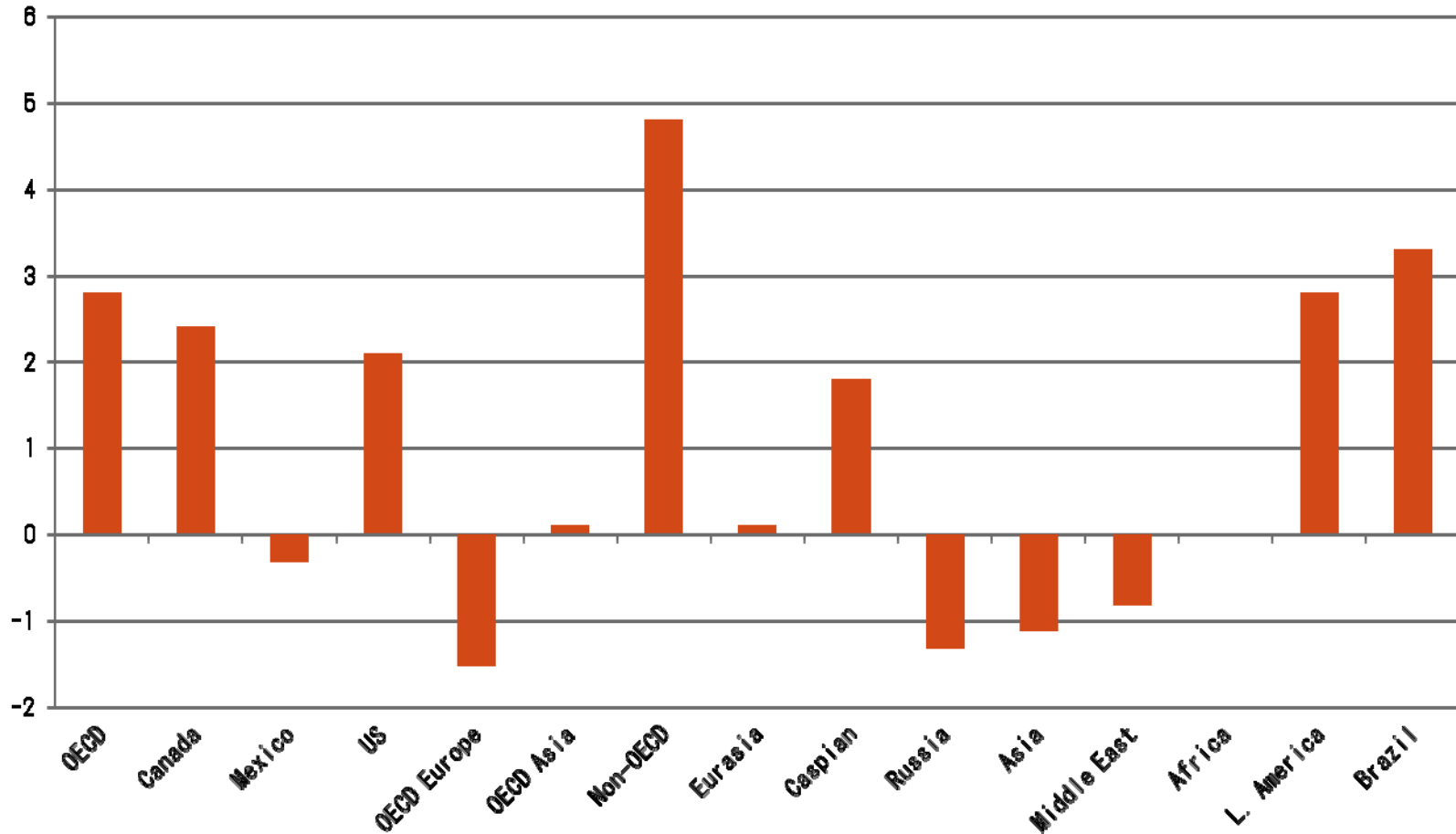


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EARLY FORECASTS TOO LOW, LATER TOO HIGH.

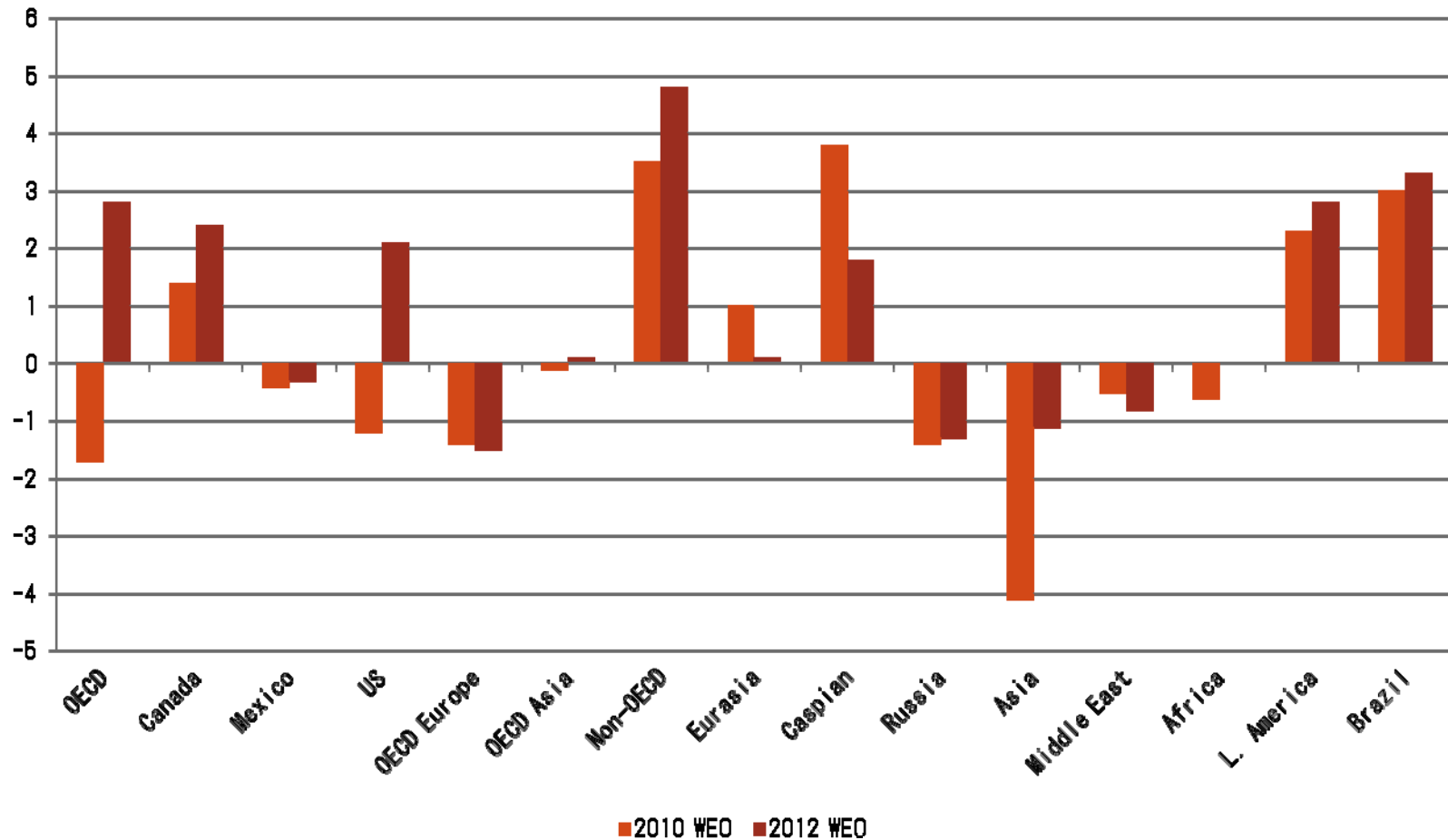
IEA FORECAST OIL SUPPLY CHANGE

2011-2030 IN MB/D



SHOWS PROJECTED CHANGE IN NON-OPEC OIL SUPPLY FROM 2011-2030.

...AND COMPARISON WITH 2010 WEO

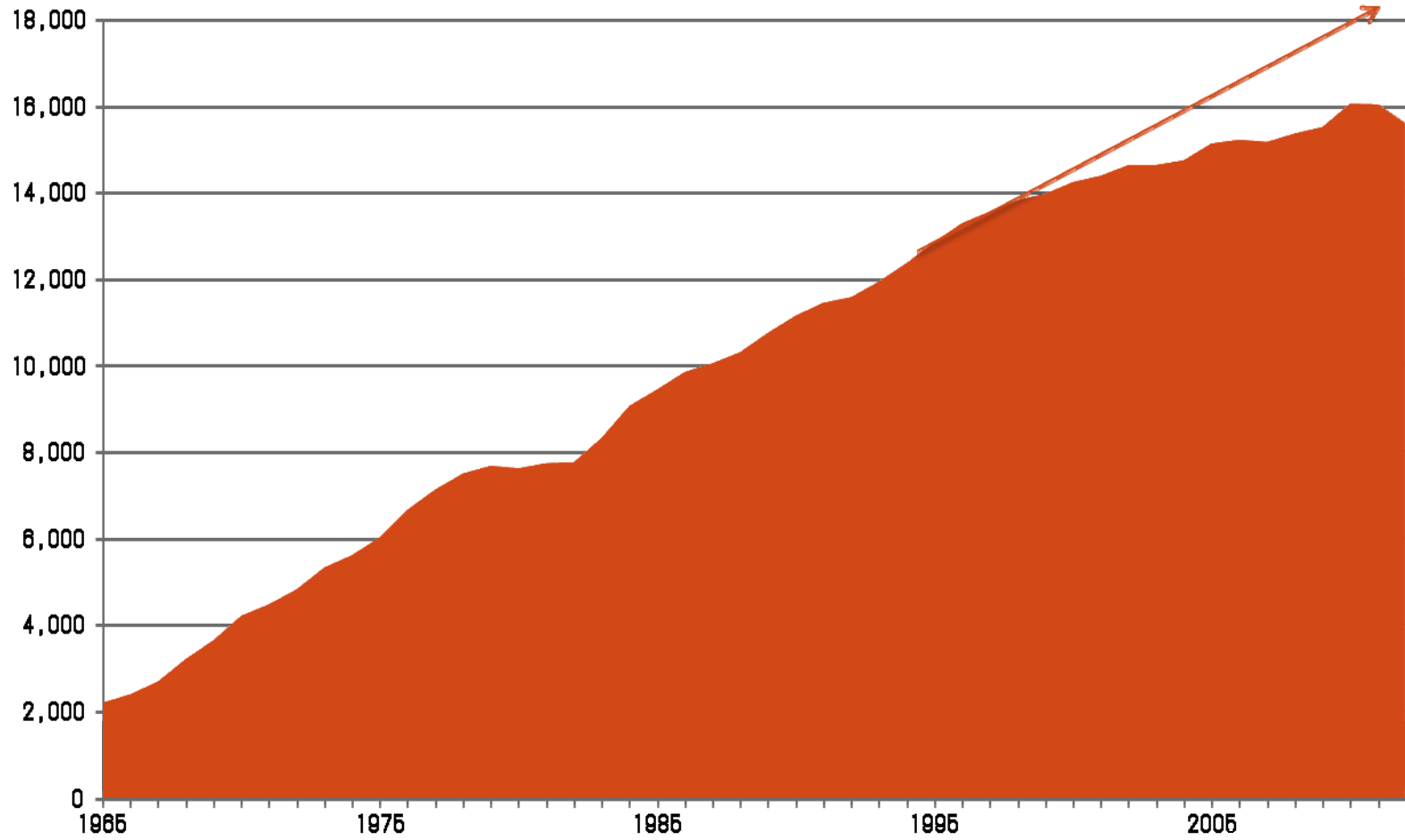


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SHOWS PROJECTED CHANGE IN NON-OPEC OIL SUPPLY FROM 2011-2030.

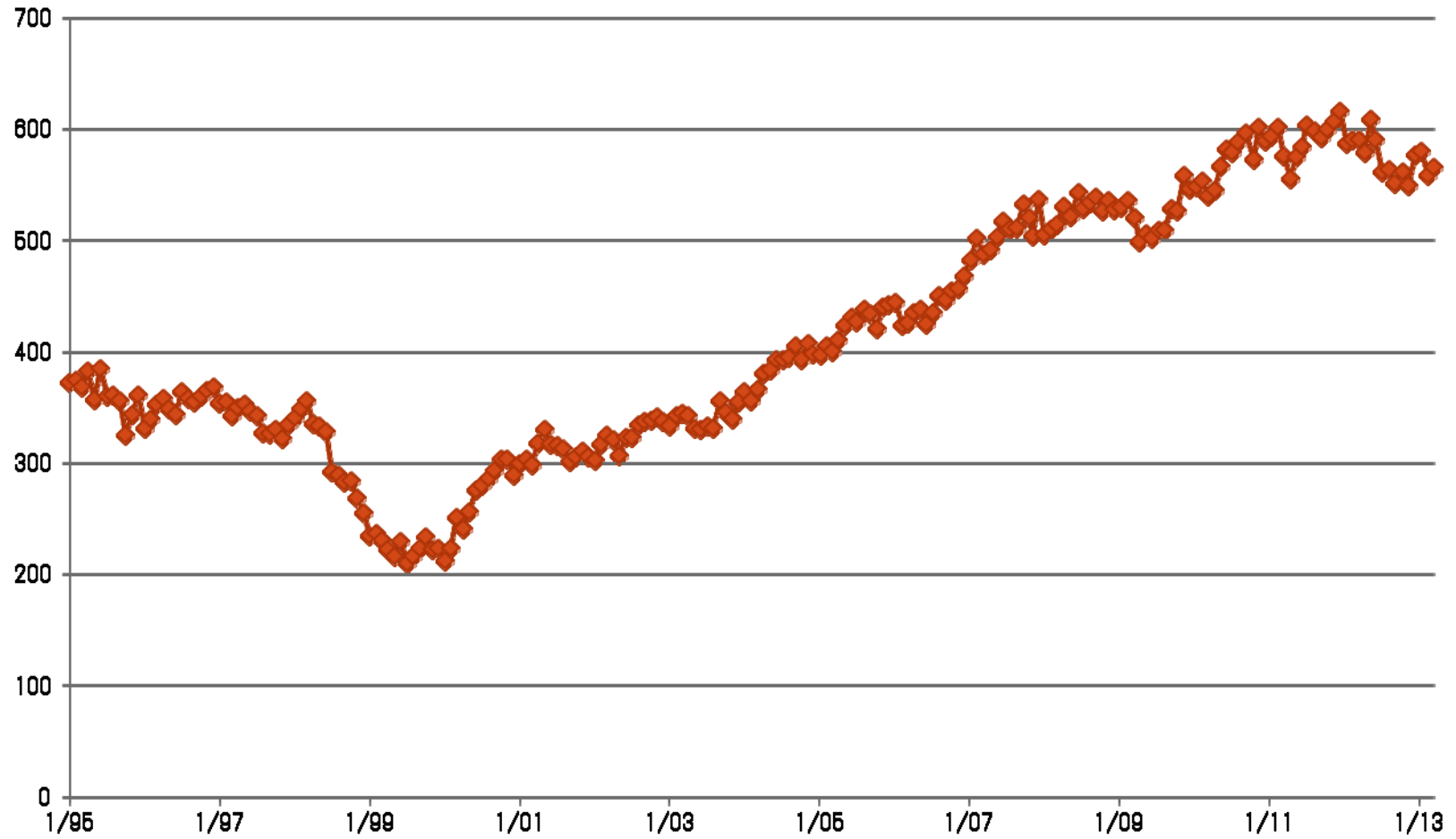
SUPPLY WEAKNESS

NON-OPEC LDCS

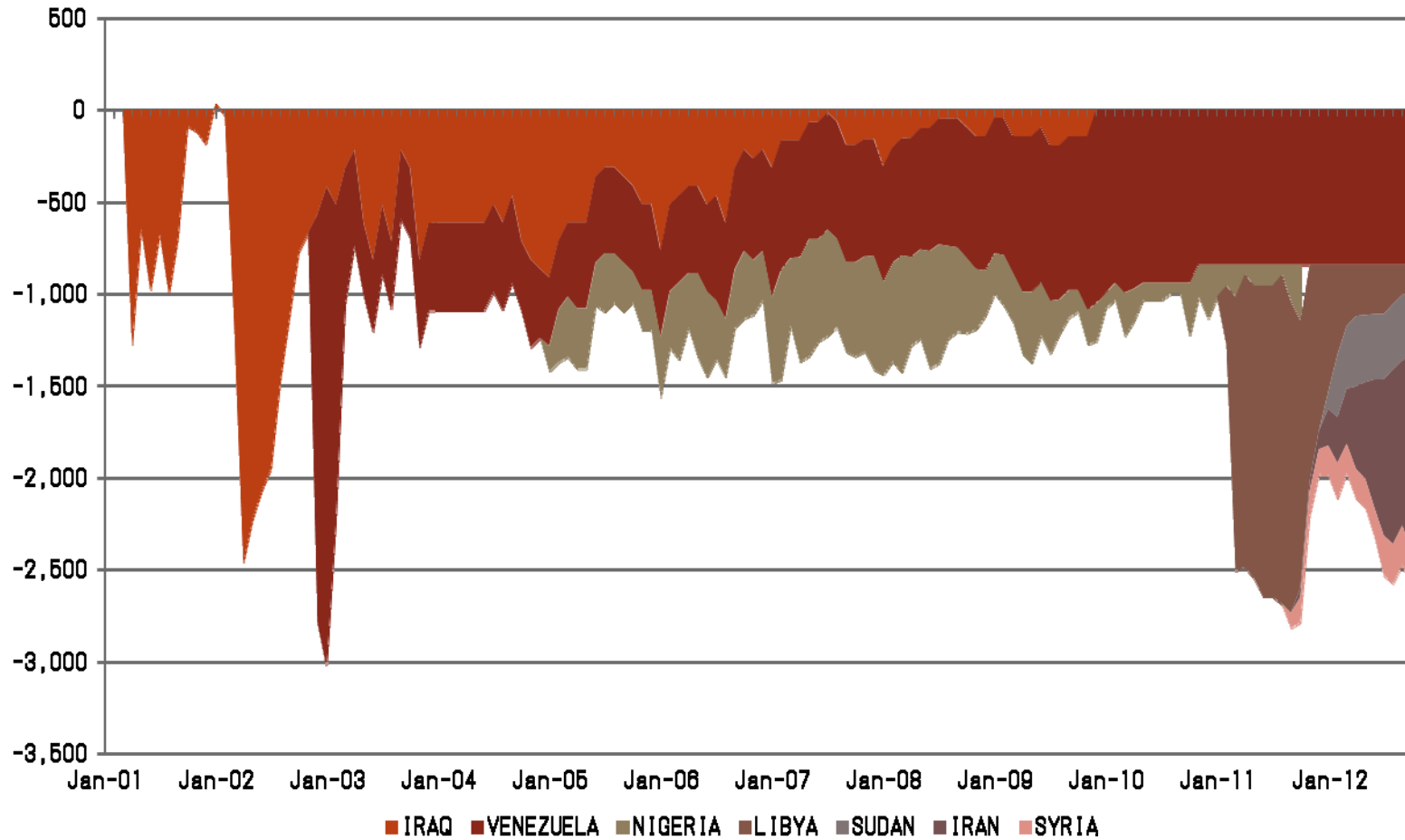


OIL RIG COUNT

NON-OPEC, NON-OECD, NON-FSU



WHY ARE PRICES HIGH? DISRUPTED OIL SUPPLY



POLITICS MASSIVELY IMPORTANT

- MEXICO: BUDGET PROCESS LEADS TO DELAYS
- RUSSIA: GOVERNMENT CREATES UNCERTAINTY, DELAYS
- ARGENTINA, COLOMBIA, INDIA, ETC.
 - GOVERNMENT POLICIES FLUCTUATE
- US, CANADA: PIPELINES, OFFSHORE DRILLING, GHG POLICY UNCERTAINTY

OPEC'S CONTRIBUTION

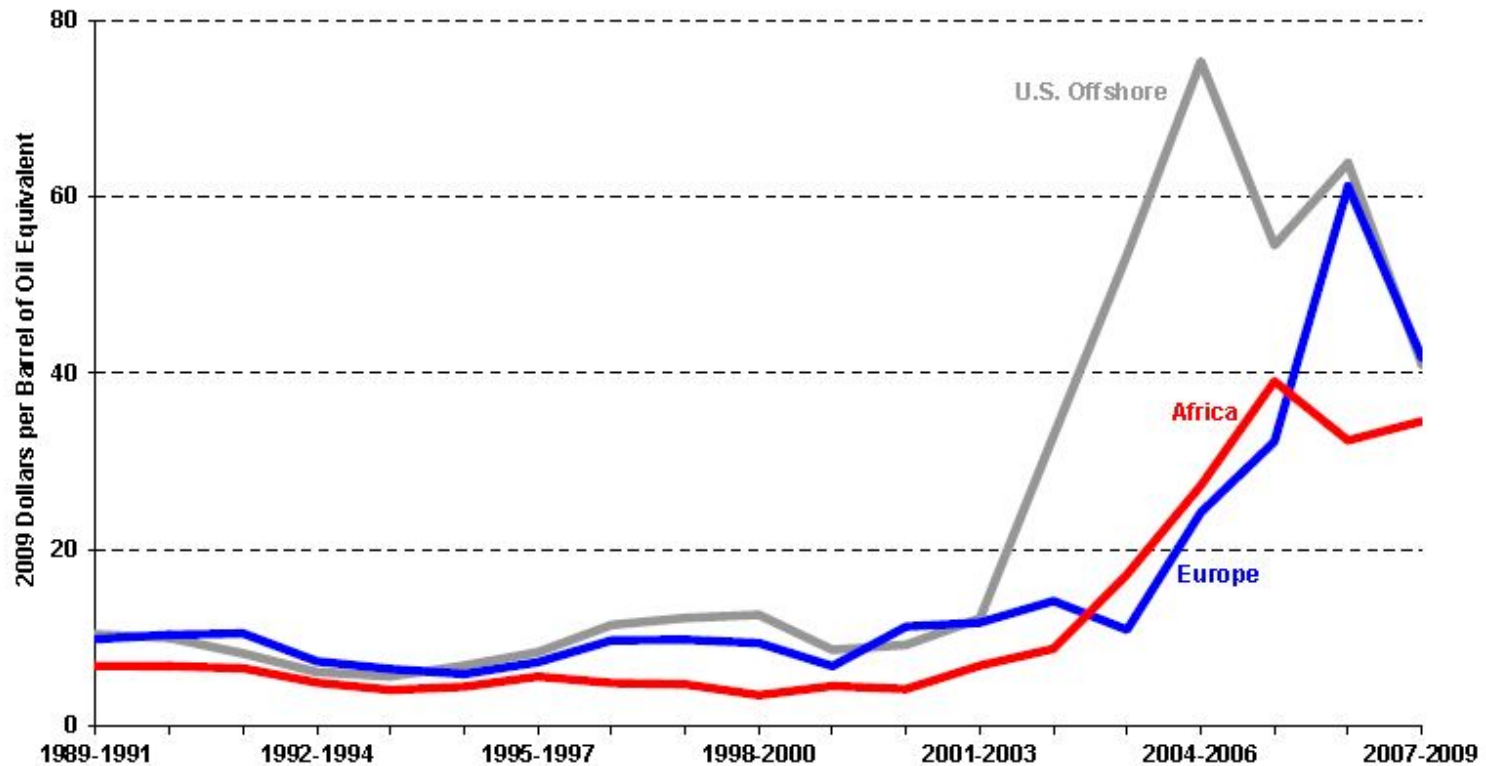
- IRAQ MODERATE GROWTH
- IRAN/VENEZUELA/NIGERIA COULD RETURN WITH POLITICAL REFORM (DATE UNCERTAIN)
- ANGOLA/UAE SOME GROWTH
- POTENTIAL FOR POLITICAL DIFFICULTIES STILL SIGNIFICANT
- WILL SAUDI MAKE ROOM FOR IRAQ?

THE COST ISSUE

- DEFINITELY HIGHER, BUT WHY?
- ESTIMATES OFTEN IMPRECISE, INCORRECT
 - INCLUDING TAXES OVERSTATES COSTS
 - HIGHEST COST NOT NECESSARILY REPRESENTATIVE
- COST INFLATION: THREE FACTORS
 - DEPLETION (EASY OIL IS GONE)
 - GENERAL INFLATION: 1970S
 - CYCLICAL INFLATION: 1970S, LATE 1990S, NOW?

FINDING COSTS

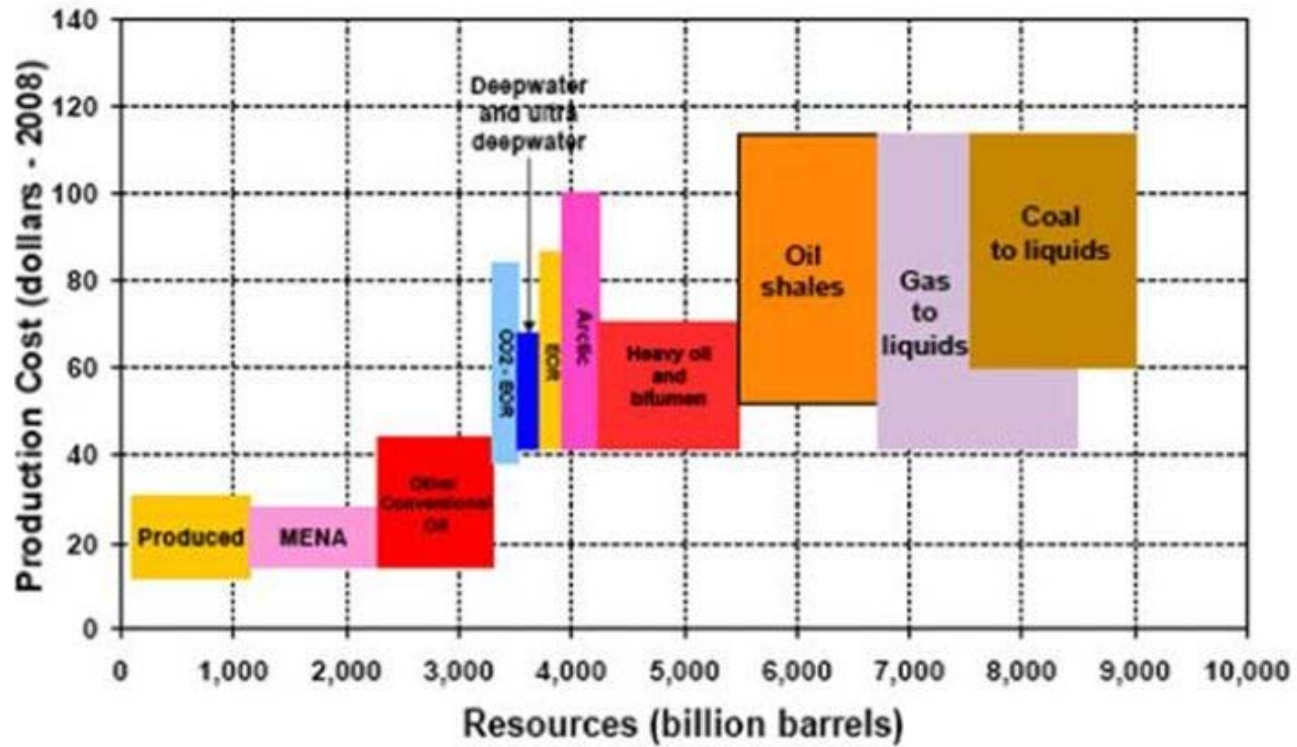
Figure 16. Finding Costs for FRS Companies for Selected Regions, 1989-1991 to 2007-2009



Notes: Costs are the quotient of costs and reserve additions for each 3-year period. BOE = Barrels of oil equivalent.
Source: U.S. Energy Information Administration, Form EIA-28 (Financial Reporting System).

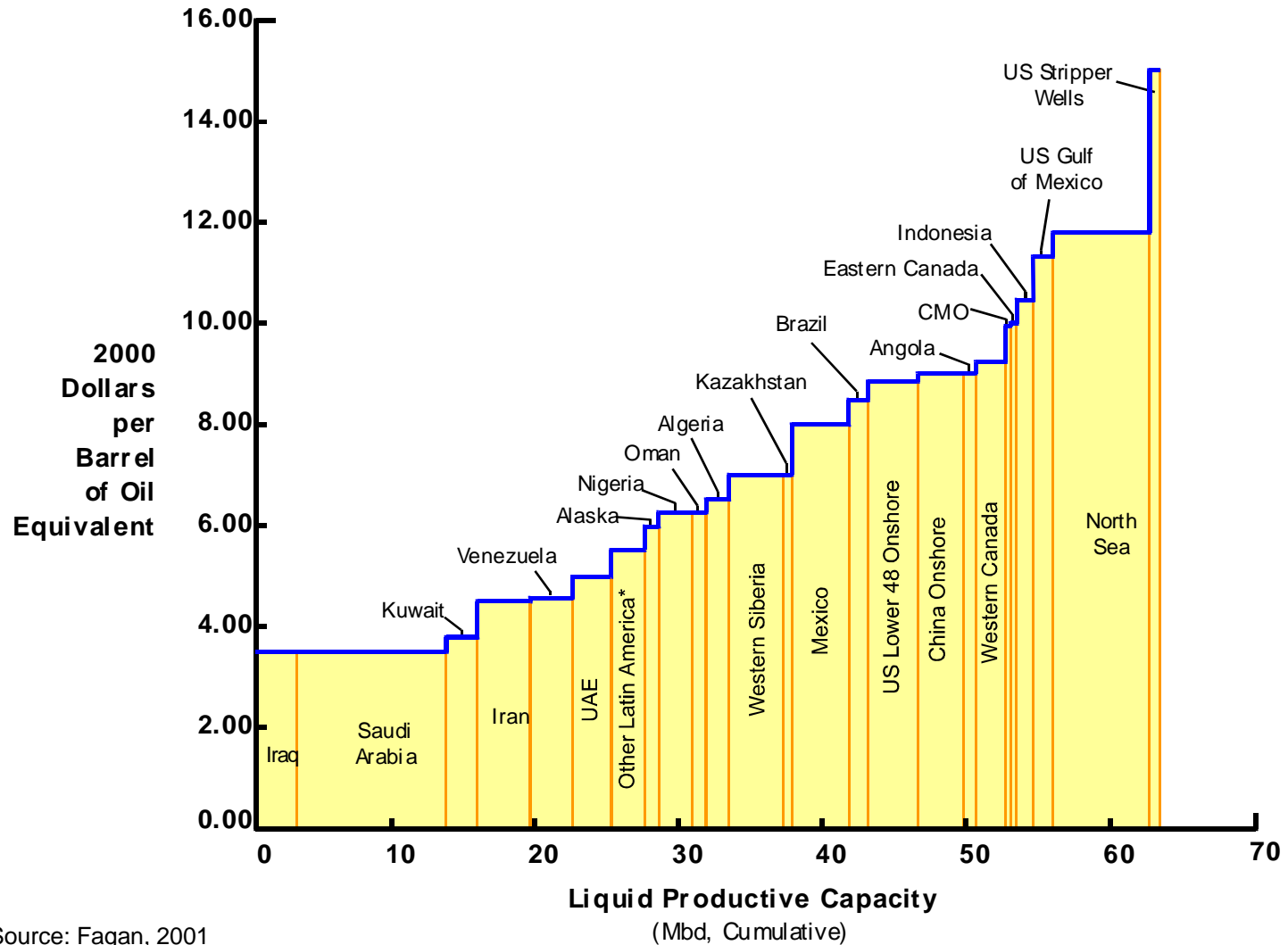
UPSTREAM COSTS

Costs of Production by Resource

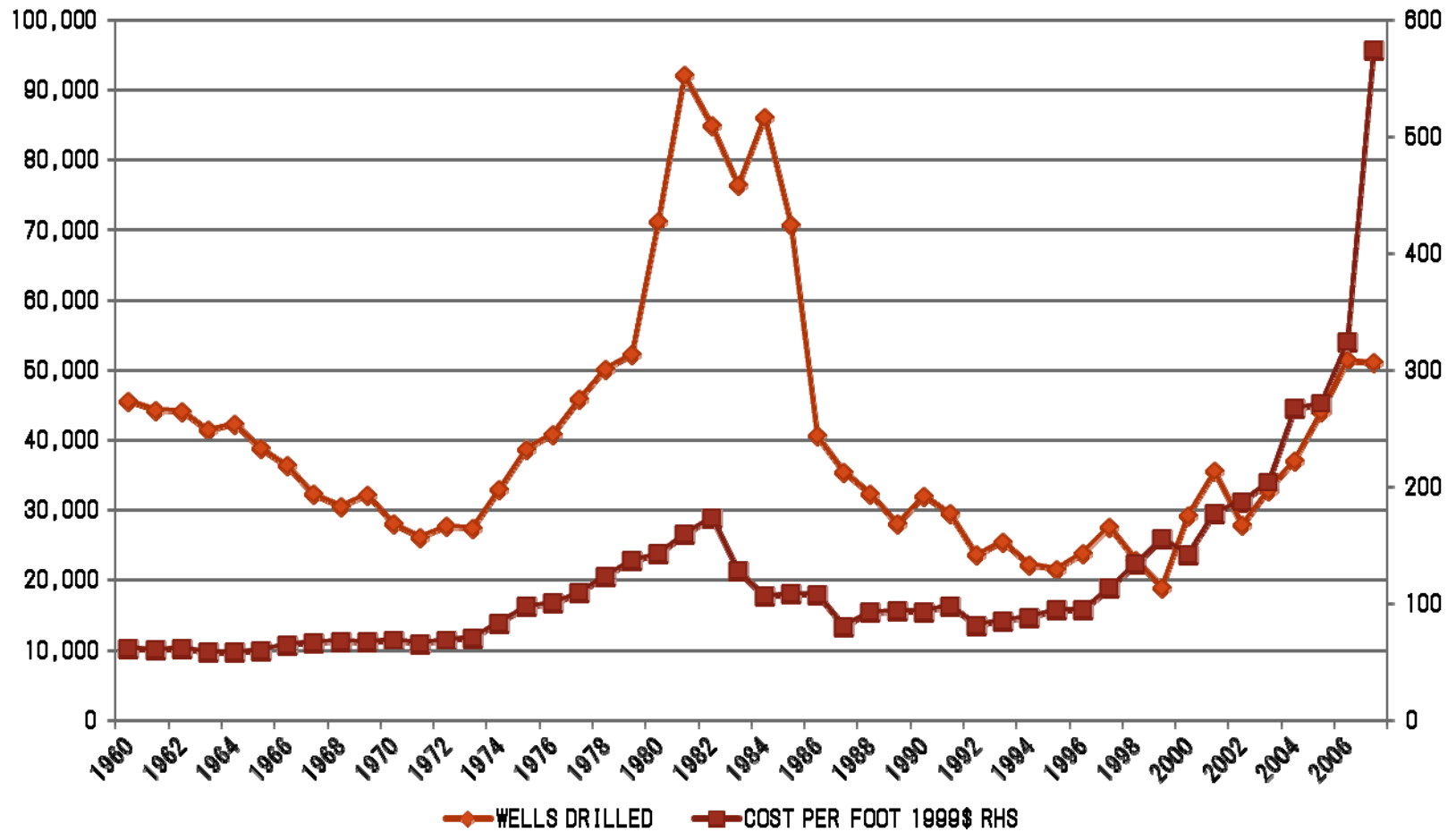


Source: Meeting the World's demands for Liquid Fuels, EIA

Global Oil Supply Costs



US WELLS AND COSTS



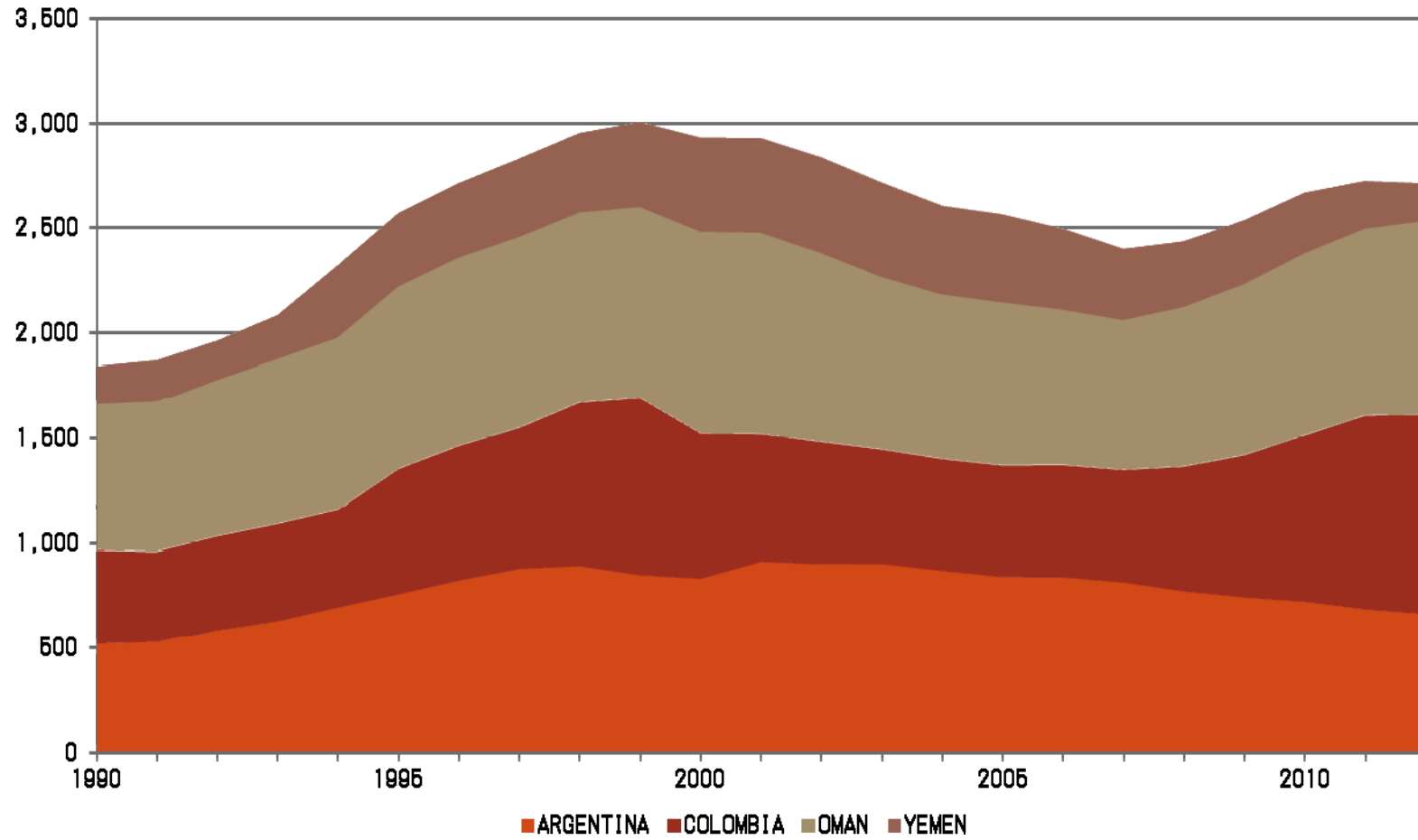
DO COSTS DRIVE PRICES?

- IN THEORY, ONLY OVER THE LONG-TERM
- MARGINAL COSTS VERY LOW IN SHORT-TERM
- PRICES DEFINITELY DRIVE COSTS
- 1998 PRICE DROP
 - DRILLING CUTBACK
 - NON-OPEC WEAKNESS
 - HIGHER PRICES
- BUT THIS IS MORE LIKE 1986
 - PRICES AT ELEVATED LEVELS
 - COSTS LIKELY TO DROP

FUTURE SUPPLIES

- RETURN OF OLD WINE
 - IRAQ
 - IRAN, VENEZUELA SOMEDAY?
- NEW WINE IN OLD BOTTLES
 - ENHANCED RECOVERY
 - SMALL PRODUCERS
- NEW WINE IN NEW BOTTLES
 - BRAZIL, EAST AFRICA
- NEW WINE FROM BOXES
 - SHALE OIL

SMALL PLAYERS



BRAZIL

- PRE-SALT HAS 60-100 BBOE POTENTIAL
 - GREATER THAN NORTH SEA
- TUPI ALONE IS 6-8 BLN BBLS.
- SERIOUS TECHNICAL CHALLENGES
 - FIRST DEVELOPMENT PROBABLY LATE, OVER BUDGET
 - THEN IT GETS EASIER, CHEAPER

OTHER DEEPWATER

- US, MEXICO, WEST AFRICA
 - NOT AS GOOD AS BRAZIL PRE-SALT
 - FIELDS ABOUT 1 BLN BBLS EACH
 - ULTIMATE 1-2 MB/D
- INDONESIA, CENTRAL AMERICA, OTHER AREAS
 - EARLY DAYS YET
 - COULD CONTRIBUTE AFTE 2020
 - PROBABLY MODEST AMOUNTS

HEAVY OIL TO BOOM?

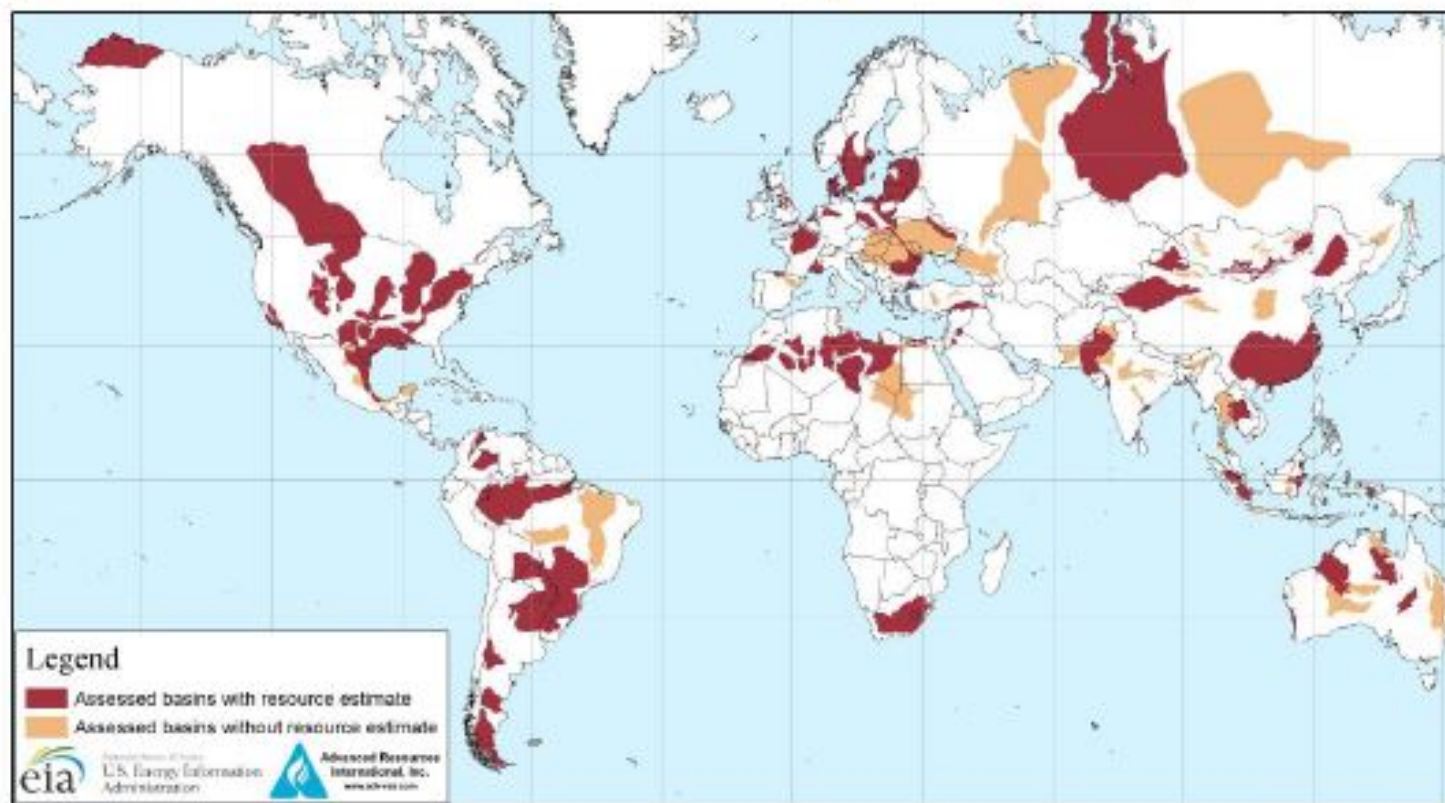
- OIL SANDS SHOULD SLOW
 - OVERLOADED INFRASTRUCTURE
 - RISING OPPOSITION (NATIVE, NIMBY)
- ECONOMICS IMPROVED
 - QUALITY DIFFERENTIAL NOT AS IMPORTANT AT \$100
 - NEW METHODS LIKE THAI
- MANY NEGLECTED DEPOSITS
 - COLOMBIA, BRAZIL, KUWAIT, RUSSIA

SHALE LIQUIDS

- HUGE RESOURCE
- STILL LARGELY UNIDENTIFIED/ESTIMATED
- VERY LOW RECOVERY RATE BUT RISING
 - 1% FIVE YEARS AGO, NOW 4-6% (BAKKEN)
- DELIVERY COMPLEX
 - MEDIUM COST
 - WELL PRODUCTIVITY LOWER THAN MIDDLE EAST, DEEPWATER: 1 TB/D
 - QUICK DROP: 50% IN FIRST YEAR

Latest shale evaluation

Figure 1. Map of basins with assessed shale oil and shale gas formations, as of May 2013



Source: United States basins from U.S. Energy Information Administration and United States Geological Survey; other basins from ARI based on data from various published studies.

OOPS, WE DID IT AGAIN

NEW ARI/DOE REPORT

	2011	2013
Number of Countries	32	41
Basins	48	95
Formations	69	137
TRR, incl US		
Shale Gas (Tcf)	6622	7299
Shale oil (bln bbls)	32	345

LATEST ESTIMATES BY REGION

BILLION BARRELS

	Shale oil	Conventional	
	TRR	Proved	Unproved
Europe	12.9	11.7	14.6
FSU	77.2	119	114.5
N. America	80	208	306
Asia/Pacific	61	41	64
S. Asia	12.9	6	8
MENA	42.9	867	463
SS Africa	0.1	63	141
L. America	59.7	326	258
	346.7	1641.7	1369.1

TRR IS TECHNICALLY RECOVERABLE RESERVES.
ABOUT 3% RECOVERY FACTOR

IS US UNIQUE?

- PRIVATE OWNERSHIP OF MINERALS
 - INFRASTRUCTURE
 - MANY INDEPENDENT COMPANIES
 - HUGE SERVICE INDUSTRY
-
- BUT: SOVIET UNION HAD NONE OF THOSE, STILL WAS LARGEST OIL PRODUCER IN THE WORLD
 - NONE ARE INSURMOUNTABLE

SCENARIO FOR SHALE

- US BOOMING: AT LEAST 500 TB/D INCREASE EACH YEAR
- CANADA LESS SUPPLY BUT STARTING NOW
- COLOMBIA, ARGENTINA IN 2-3 YEARS
- RUSSIA, BRAZIL, MAYBE CHINA AND AUSTRALIA AFTER 5-6 YEARS
- LATER: NORTH AFRICA, CASPIAN, ETC.
- FRANCE???
- BY 2018, SHOULD BE AT LEAST 1 MB/D OF NEW SUPPLY EACH YEAR

NEW MODEL OF SUPPLY FORECASTING FOR SMALL PRODUCERS

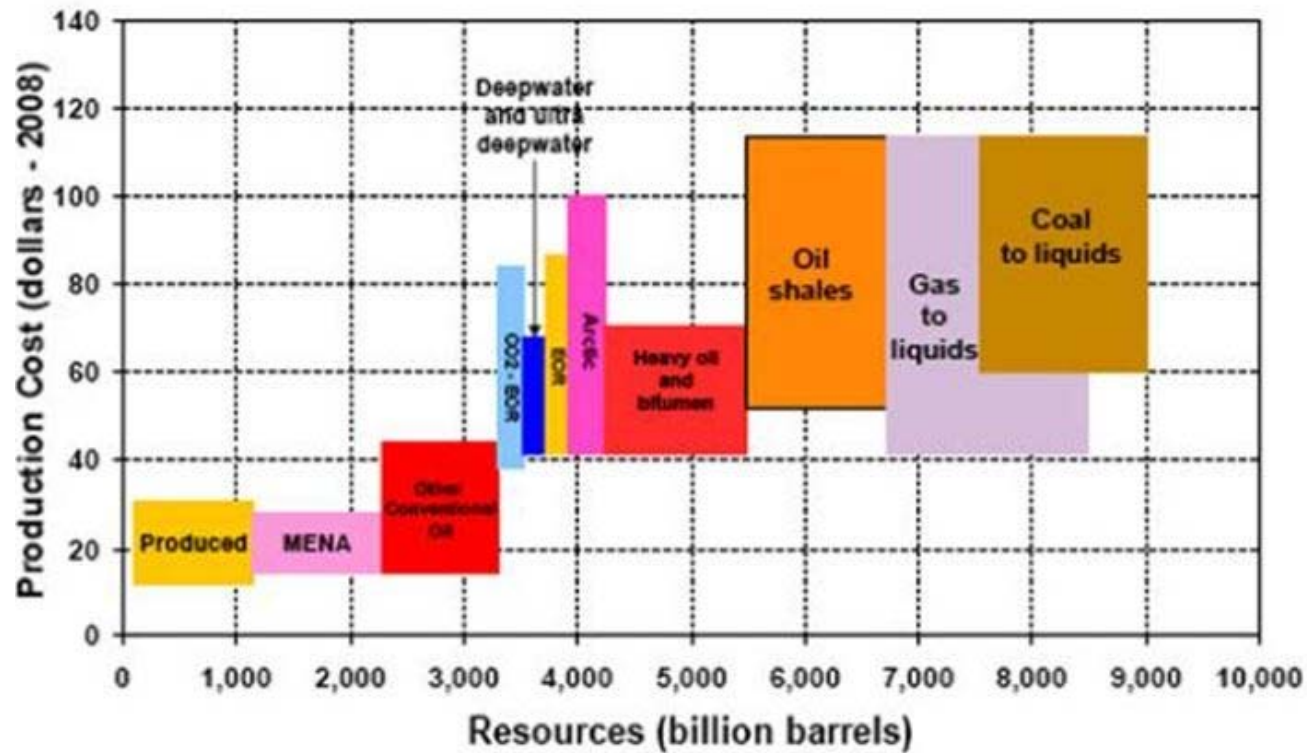
- GOVERNMENT ATTRACTS INVESTMENT
- SUPPLY RISES
- GOVERNMENT BECOMES COMPLACENT
- INVESTMENT TAPERS OFF
- SUPPLY PLATEAUS OR DECLINES
- GOVERNMENT ATTRACTS NEW INVESTMENT
- MEXICO AS CASE STUDY

MISINTERPRETATION OF SUPPLY CURVES

- NOT TIME FUNCTION
- SHOULD BE DYNAMIC
- DIFFERENT REGIONS/TYPES OF OIL WITH DIFFERENT DRIVERS
 - DEPLETION
 - INFRASTRUCTURE
 - TECHNOLOGY

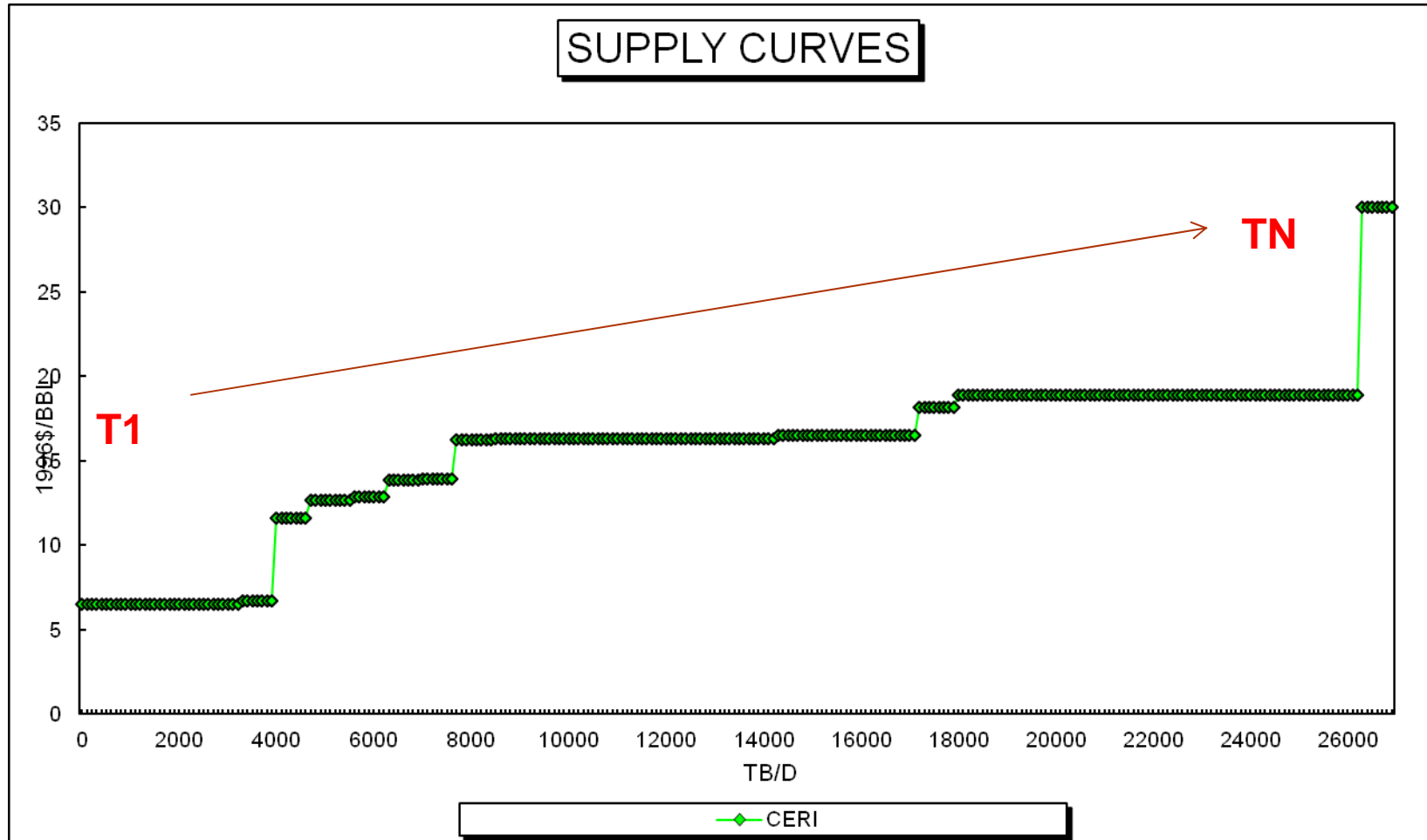
SUPPLY CURVE: STANDARD

Costs of Production by Resource



Source: Meeting the World's demands for Liquid Fuels, EIA

WRONG INTERPRETATION



SUGGESTED MODEL

- ONLY PRIVATE SECTOR
- PRICE DRIVES REVENUE
 - NON-LINEAR
- REVENUE DRIVES INVESTMENT
 - NON-LINEAR TO LEFT
- INVESTMENT DRIVES ACTIVITY
 - NON-LINEAR TO LEFT
- REGIONAL RESULTS