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

EARLY FORECASTS TOO LOW, LATER TOO HIGH.
SHOWS PROJECTED CHANGE IN NON-OPEC OIL SUPPLY FROM 2011-2030.
...AND COMPARISON WITH 2010 WEO

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, 1969-1991 to 2007-2009

Notes: Costs are the quotient of costs and reserve additions for each 3-year period. BOE = Barrels of oil equivalent.
UPSTREAM COSTS

Source: Meeting the World’s demands for Liquid Fuels, EIA
Global Oil Supply Costs

Source: Fagan, 2001
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
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 AFTER 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 NEGLLECTED 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**

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<td><strong>Number of Countries</strong></td>
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<td>137</td>
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<td><strong>TRR, incl US</strong></td>
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<td><strong>Shale oil (bln bbls)</strong></td>
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LATEST ESTIMATES BY REGION
BILLION BARRELS

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<th>Shale oil TRR</th>
<th>Conventional Proved</th>
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<td>S. Asia</td>
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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

SUPPLY CURVES
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