

Unconventional Oil: Filling in the Gap or Flooding the Market?

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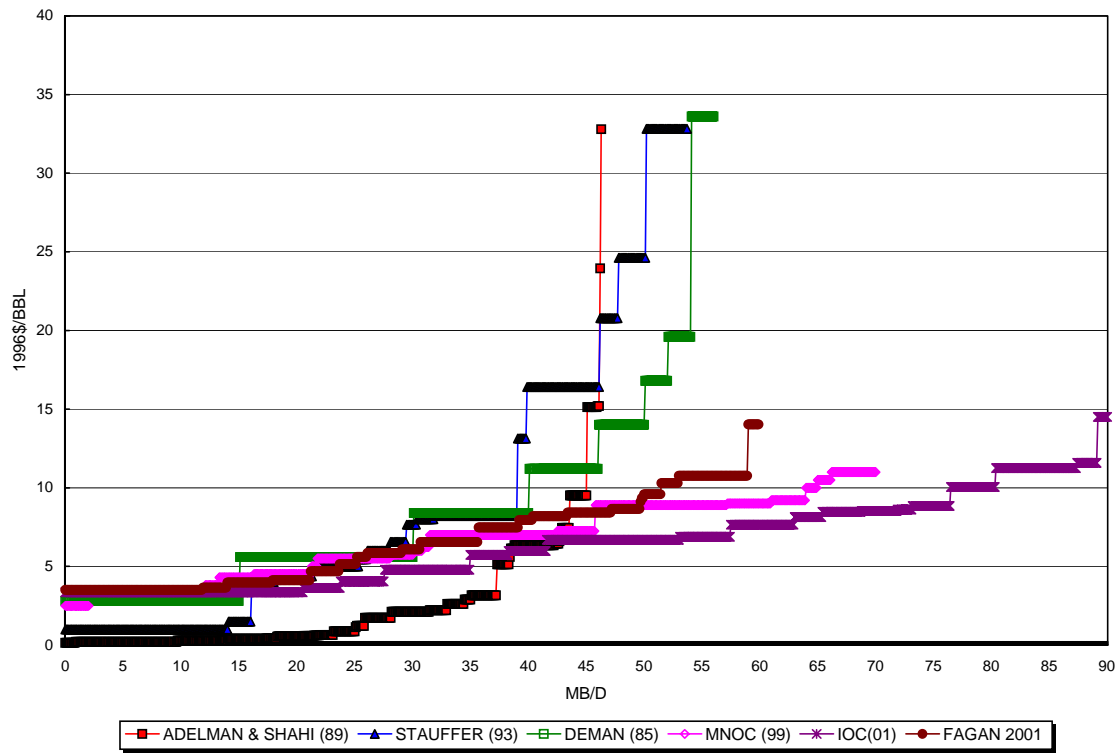
URBAN LEGENDS (OIL DIVISION)

- CONVENTIONAL OIL NEAR A PEAK
 - DISCOVERIES ARE INADEQUATE
- TAR SANDS TOO DIRTY TO BE PRODUCED
- EROEI ON ETHANOL IS NEGATIVE
- SHALE OIL ALWAYS MORE EXPENSIVE THAN CONVENTIONAL OIL
- EASY OIL IS GONE, COSTS ARE RISING
- OIL MARKET ANALYSTS ARE YOUNG AND HANDSOME

PERTINENT ISSUES

- VOLUMES ARE HUGE
- COSTS MODERATE—COMPARED TO PRICES, NOT CONVENTIONAL OIL
 - VERY CAPITAL INTENSIVE
 - FUEL INTENSIVE
- RECOVERY RATES LOW
- CONTAMINANTS/EMISSIONS SIGNIFICANT
- WHAT RATE OF CHANGE POSSIBLE?

CONVENTIONAL OIL SUPPLY CURVES



HURDLES

- NIMBY/GHG AND OTHER ENVIRONMENTAL PROBLEMS
 - BUSH CAN OPEN IRAQ, BUT CAN HE OPEN COLORADO?
- RELATIVELY HIGH COSTS
 - ARE HIGH PRICES PERMANENT?
- WILL GOVERNMENTS ACCEPT LOW RETURNS IF PRICES DROP?

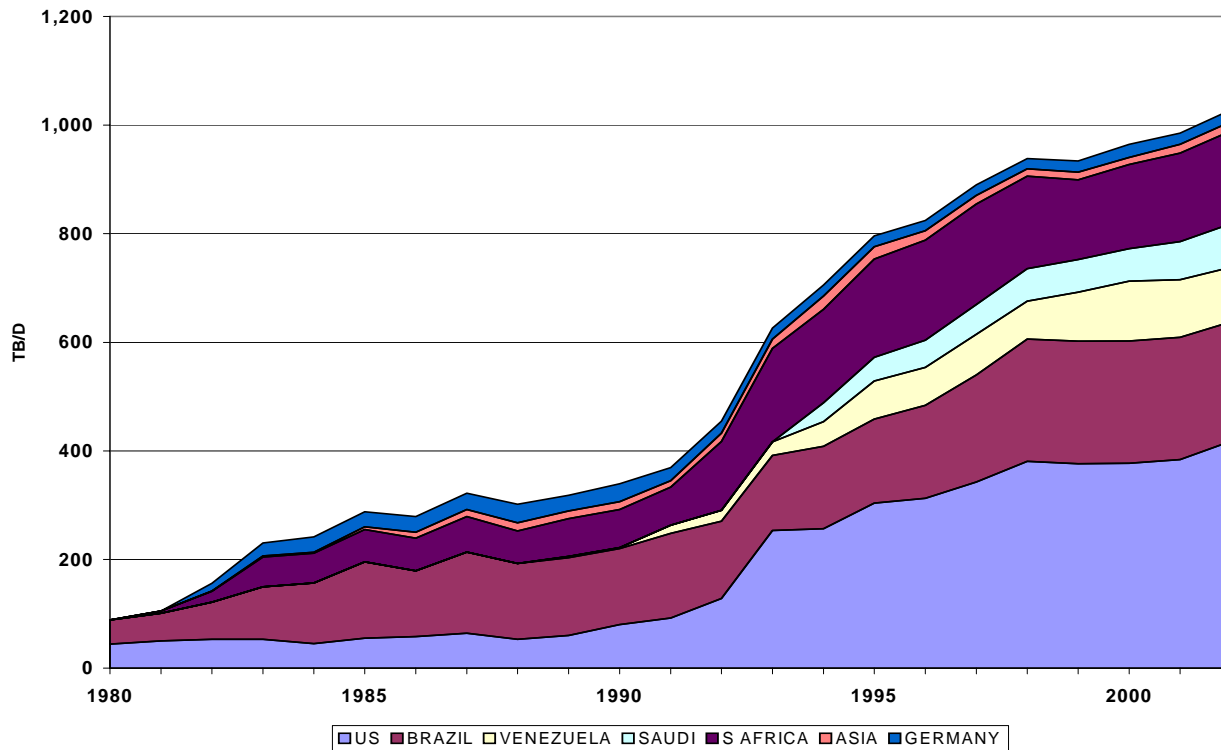
ADVANTAGES

- NO EXPLORATION RISK, MODERATE POLITICAL RISK
- INCREMENTAL VOLUMES MEANS LOWER PRICE RISK
- CONTINUING TECHNOLOGICAL IMPROVEMENTS
 - NON-VIABLE RESOURCES MOVE INTO VIABLE CATEGORY
 - LESS PRICE RISK AS COSTS DROP

MAIN SOURCES

- CANADIAN TAR SANDS
- VENEZUELAN HEAVY OIL
 - ORIMULSION
- ETHANOL, MTBE, ETC.
- GTL
- US SHALE OIL

“OTHER” LIQUIDS (ETHANOL, MTBE, ORIMULSION, ETC.)

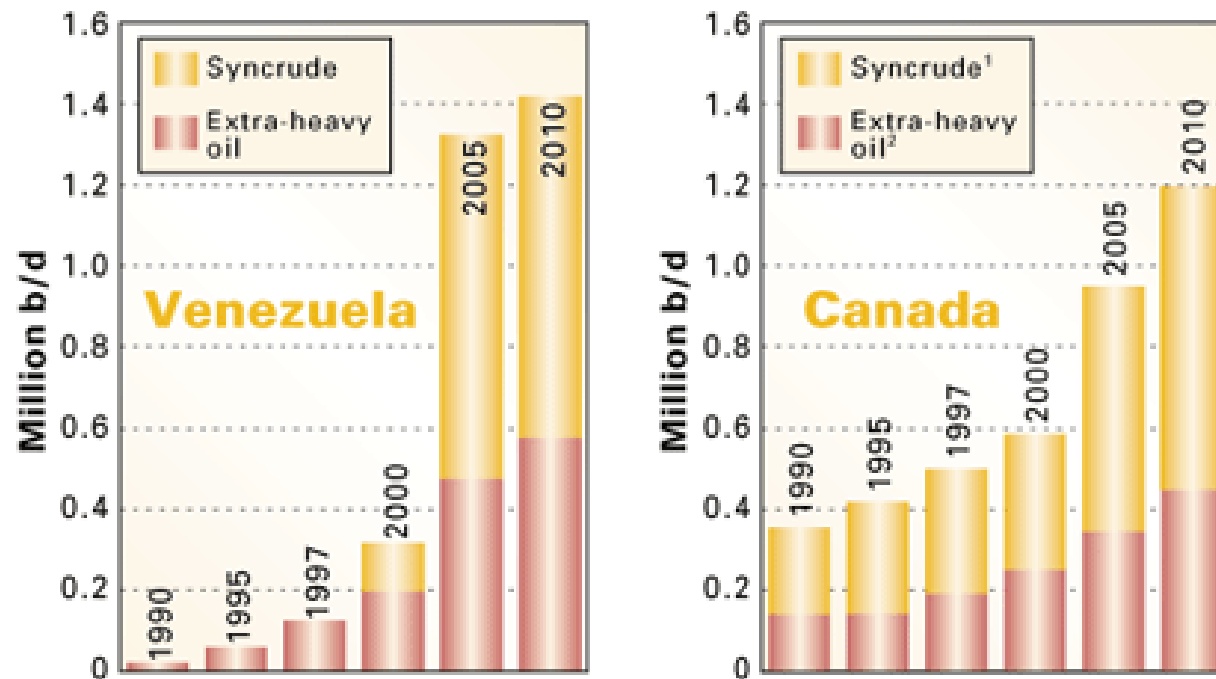


HEAVY OIL/TAR SANDS

- RESOURCES 5 TRILLION, 10-15% RECOVERABLE
- PRODUCTION BOOMING
- COSTS ARE APPROXIMATELY \$8-12/BBL, \$15-18 IF ADJUSTED FOR QUALITY
 - EXCHANGE RATE SENSITIVE
- CANADA/VENEZUELA MAIN ARENAS
- HIGH FUEL USE

EXTRA-HEAVY OIL, SYNCRUDE PRODUCTION

Fig. 2



¹ Surface mined. ² Bitumen. Source: Statoil ASA

SHALE OIL

- ENORMOUS RESOURCE, MUCH IN US
 - 3 TO 10 TRILLION BARRELS
- COSTS REMAIN HIGH, RESEARCH ONGOING
- WHAT COST MODEL?
 - “CRUDE OIL +\$5/BBL” (i.e., Manana)
 - OR TAR SANDS DECLINE?

GAS-TO-LIQUIDS

- LARGE POTENTIAL RESOURCE
 - STRANDED GAS OF >1 TRILLION BBLs
 - ULTIMATE GAS MUCH MORE
- TECHNOLOGY 'PROVEN' BUT EVOLVING
- 500 TB/D IN 5 YEARS
- CAPITAL COSTS ARE DROPPING:
\$50K/BBL TO \$25K/BBL (c. \$10/BBL)
- SENSITIVE TO OIL PRICES, TAXES

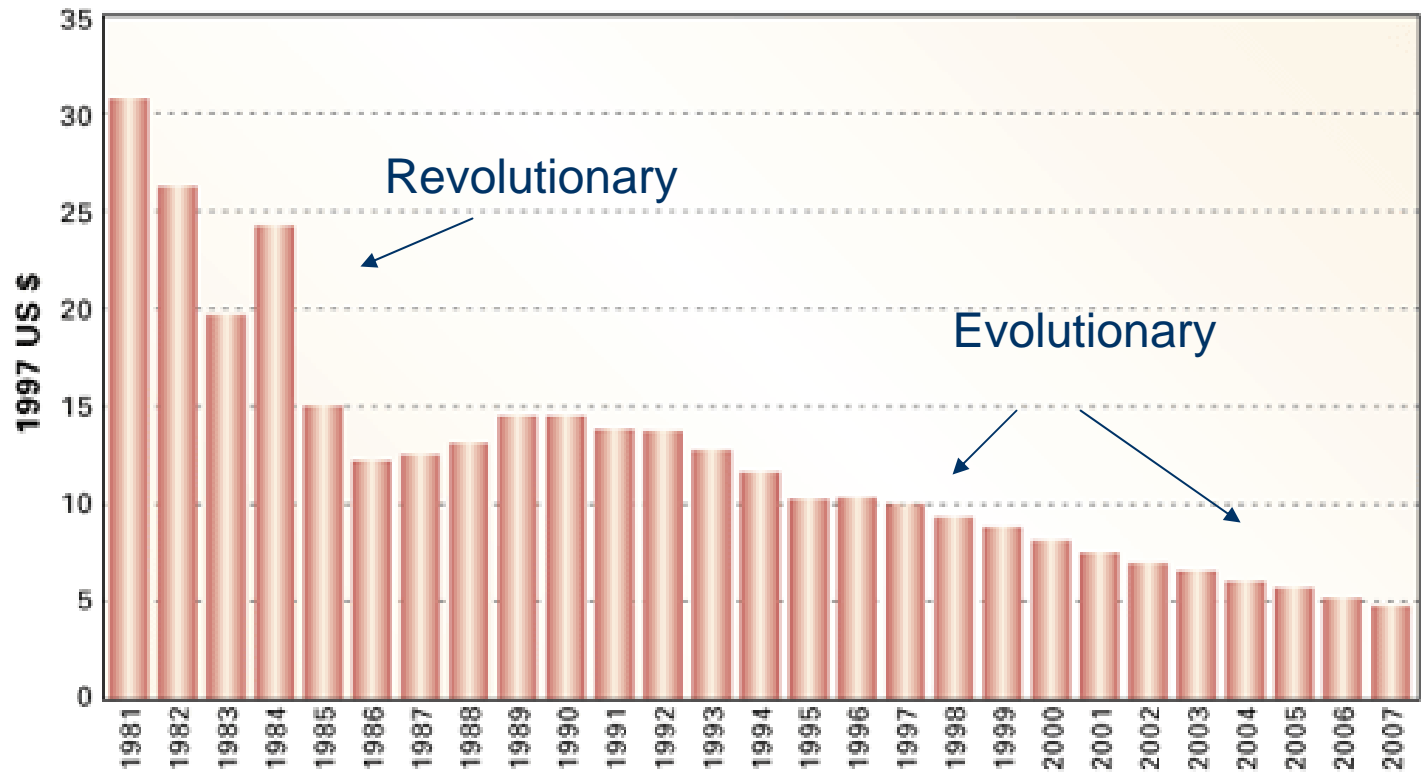
INVESTMENT APPROACH

- HIGH-COST MEGA-PROJECT
 - HOPE PRICES STAY UP
 - TAR SANDS/SHALE OIL 1970S
- GO FOR SWEET SPOTS
 - CBM, ORINOCO, TAR SANDS
- DRIVE COSTS DOWN
- NEW TECHNOLOGIES
 - SAGD

SAMPLE COST TRENDS

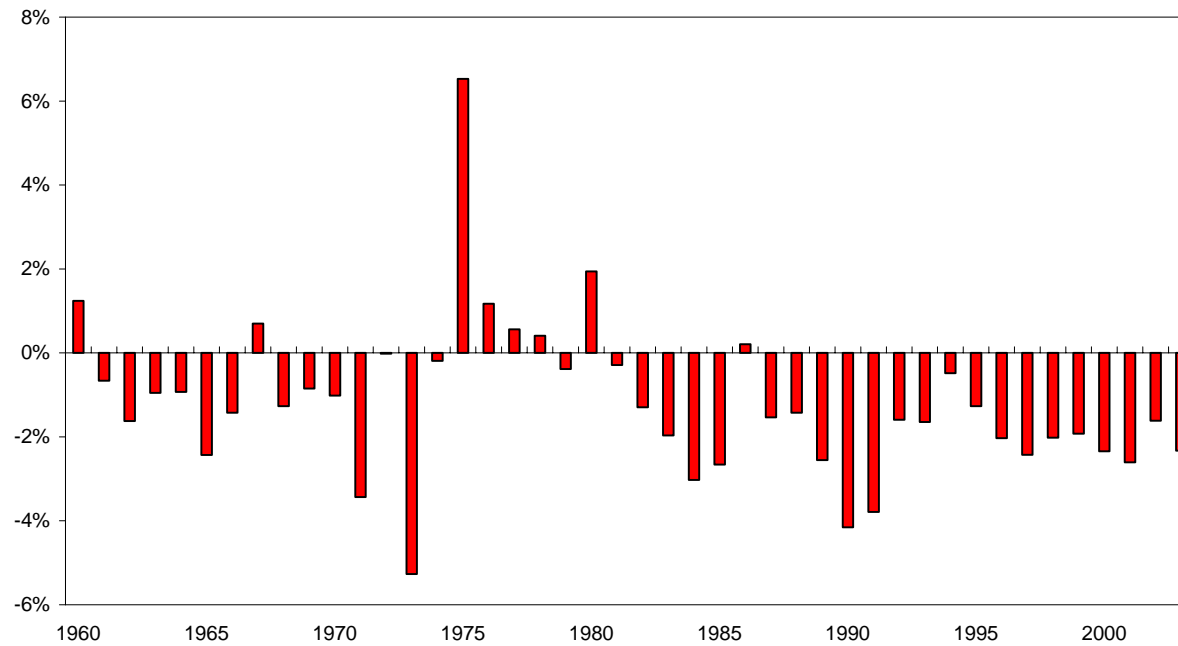
HOW CANADIAN OIL SANDS COSTS ARE DECLINING

Fig. 7

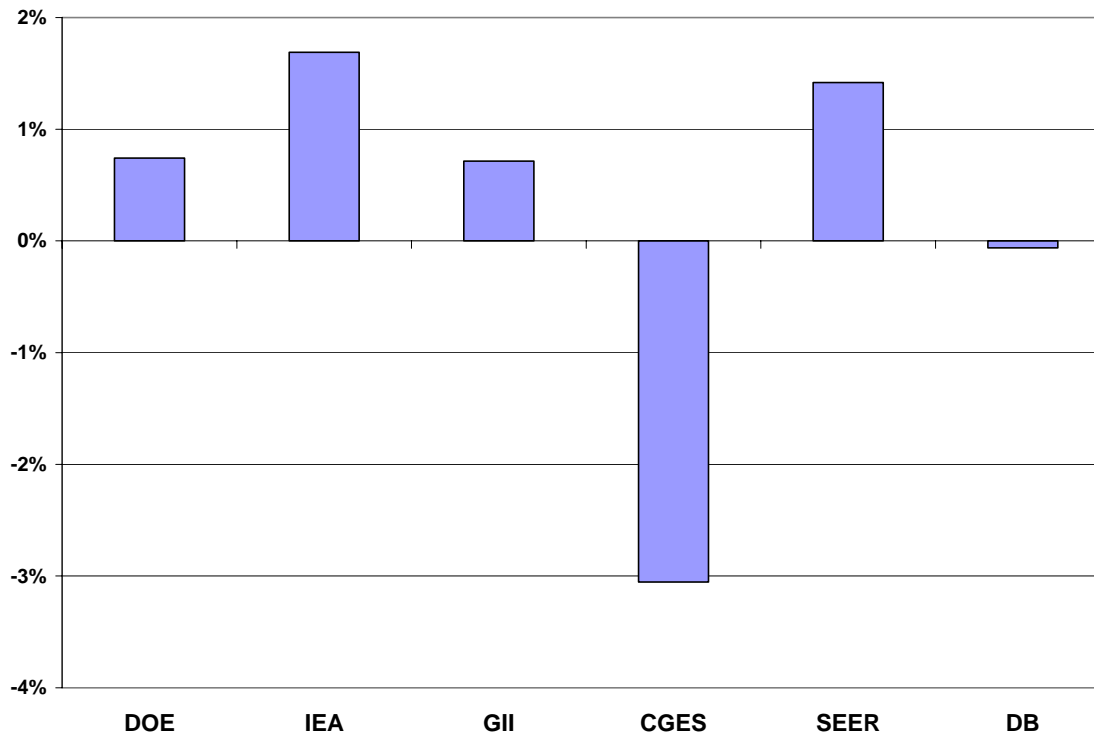


Source: Syncrude Ltd.

EQUIPMENT COST TRENDS



EXPECTED OIL PRICE TREND (ANNUAL REAL CHANGE 2010-2025)



DOE IEO 2004, expect increase next year.

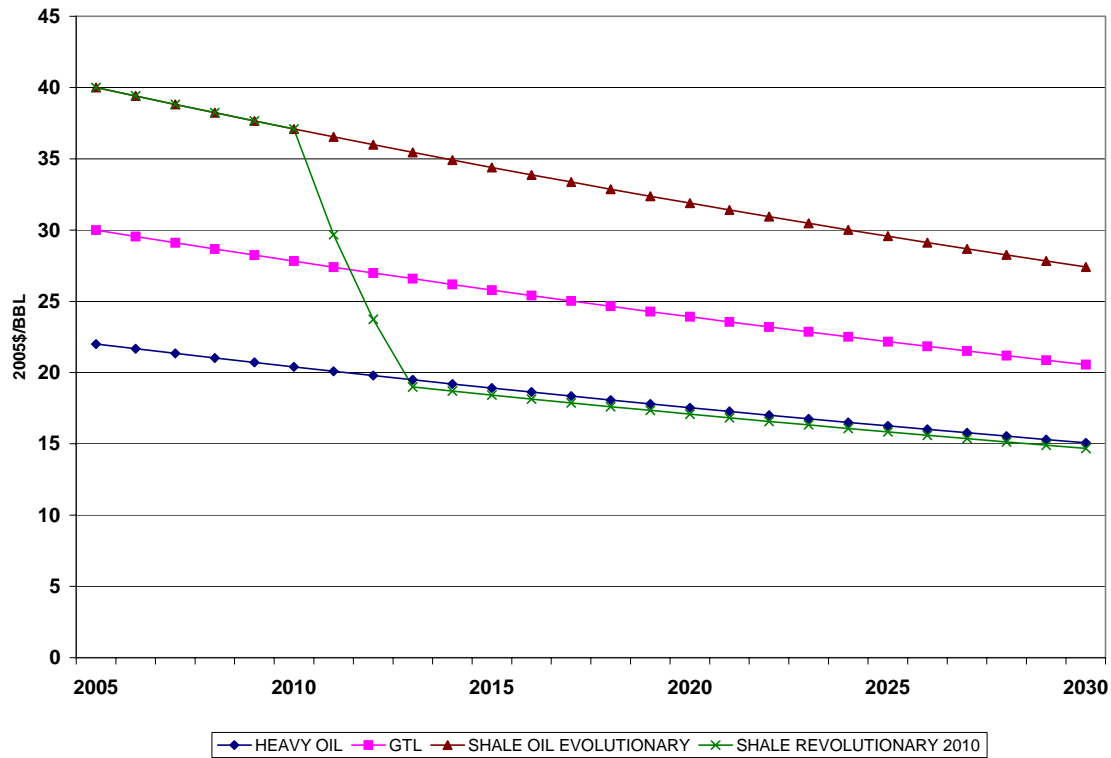
LESSONS

- SHORT-TERM PROBLEMS ARE LONG-TERM OPPORTUNITIES
 - ENGINEERS ARE SMART
 - HIGH PRICES MOTIVATE THEM
- RESOURCES ARE CONTINUOUS
 - CONVENTIONAL OIL
 - UNCONVENTIONAL OIL
 - QUALITY, DENSITY, EASE OF EXTRACTION





POTENTIAL COST TRENDS



FUTURE TRENDS

- WILL HIGH PRICES SEE HEAVY INVESTMENT, THEN COST-CUTTING AS IN TAR SANDS IN 1970S?
- WILL LOWER PRICES CAUSE ABANDONMENT OF GTL AS IN 1980S?
- HOW WOULD GOVERNMENTS RESPOND TO LOWER PRICES?
 - PUSH VOLUMES OR REACH INDIFFERENCE TO INCOME?

EXPECTATIONS

- HEAVY OIL/TAR SANDS TO ADD 200-350 TB/D PER YEAR
- GTL TO ADD 75-150 TB/D/YR
- “OTHER” TO ADD 50-100 TB/D/YR
- SHALE OIL NOT BY 2010
- PRICE PRIMARY FACTOR DETERMINING LEVEL
 - TECHNOLOGY, POLICY SECONDARY

THEREFORE...

- MAINLY GAP FILL, BECAUSE OF 'INERTIA'
 - CAN'T ADD CAPACITY FAST ENOUGH TO SWAMP MARKET UNLESS DEMAND WEAK
- PRIMARY UNCERTAINTY TO 2010 IS PRICE
 - FOLLOWED BY GTL
- SHALE OIL COULD BECOME IMPORTANT BY 2015
- HIGH INVESTMENT NOW IS THE SEED FOR LOWER COSTS, HIGHER VOLUMES IN NEXT DECADE
 - HIGH PRICES FOR 2 MORE YEARS COULD BE BIG TROUBLE FOR OPEC LATER