## 17.906 The Geopolitics and Geoeconomics of Global Energy, Spring 2007 Prof. Flynt Leverett

## Lecture 3: Global Energy Balance

## Downstream sector

- Production
- Stuff that comes out of the well head
  - Natural gas
  - o Water
  - o Crude oil
  - Contaminates
- Step 1 of production is separation
  - Wet Crude Handling Facility (WCHF)
    - Older fashion
      - Did not care about natural gas
        - Just burned it off
  - Gas Oil Separation Plant (GOSP)
    - Current method
    - Get crude oil after initial separation
    - Then sent to a refinery
      - Want to separate the different chains from one another
        - Use heat to do fractional distillation and separate the hydrocarbon chains
      - Naphtha
        - Basic building block of gasoline
    - How do you measure the relative weights of oil (Heavy oil)
      - API gravity
        - American Petroleum Institute
        - For oil
          - (141.5/specific gravity of crude oil) –
            131.5
          - Specific gravity of crude oil is around 5.0
          - The higher the API gravity, lower the actual specific gravity of the oil
          - o Industry norms
          - o 15°-39° for heavy crude
            - nasty
            - toxic
            - tar-looking
            - high cost of refining
          - o 40°-60° for intermediate
            - honey in color
          - 60° + for light oil
            - looks and feels kind of like baby oil
            - refining costs are very low
          - This matters because of the cost of refining the oil
          - Light
        - For water
          - $\circ$  (141.5/1) 131.5 = 10°

- Specific gravity
  - Different calculation
- Different markets have certain benchmark crude oils
  - WTI
    - West Texas Intermediate
    - For US markets
  - Brent Intermediate
    - · Came from the North Sea
  - Oil contracts get written in terms of the price of a benchmark crude
    - Price + or a quality differential depending on whether you stuff is worse or better than the benchmark
- o Where does the natural gas go?
  - Gas plant
    - Same sort of refining process
    - End product is methane
    - Beginning product will have lots of other gas in it
    - Natural gas liquids or condensates
      - Propane and butane
      - If you cool down enough, you can liquefy ethane
      - CO2
      - Sulfur compounds
        - Sweet and sour gasses
          - Sweet has no sulfur compounds
          - Sour has lots of sulfur
- What can you do with natural gas once it's purified?
  - Local production (heating and stuff)
  - Use it in oil recovery
  - o Pipe it or condense it to Liquid Natural Gas (LNG) to ship it around the world
    - Having the ability to ship creates a true global market
      - Already available for oil
      - Emerging for natural gas
    - Could also use as feed stock for purification
    - Gas to liquids (GTL)
      - Turning gas into lubricants and gas
  - Regional markets for gas
    - Europe
    - Asia
    - North America / Western Hemisphere
    - Some signs of arbitraging across those markets, but nowhere near like the oil market

## **Politics**

- US is the only place in the world where if you own land, you also own the subsurface rights, as well
- British law
  - Land was given to vassals
  - Subsurface rights still to the states
  - o 6 feet under
    - term comes from this notion
    - anything below 6 feet still belongs to the sovereign

- What is a concession?
  - Define a territory, and the investor has full access to the subsurface resources in that defined territory
  - o The production is the property of the investor
  - Ways sovereign is going to get a piece of the action
    - Signing bonus
    - Royalties
    - Taxes
  - Sovereign will still not have a lot of say
  - Overtime sovereigns had lots of dissatisfaction
    - Responses to dissatisfaction
      - Nationalization
        - Aramco became Saudi Aramco, for example
      - Expropriation
        - Compensate the investor
      - 50-50
      - Form a cartel
  - o OPEC
    - Want to re-establish control
      - Have a say over investment and pricing decisions
    - Want money, too
  - For deep water drilling in international waters there are all sorts of treaties and rules governing terms of use
  - o If you have just nationalized, what do you do if you're not going to give concessions?
    - Do it yourself
      - Saudi Arabia and Saudi Aramco
        - Since the 1970s there has been no foreign investment into upstream oil sector (Saudi Aramco)
        - Most capable national oil company in the world (Saudi Aramco)
        - Finance virtually everything on their own, too
        - Put a lot of money into the latest technology
          - The most supercomputers in the world, second to the NSA
        - Service contracts
    - Production Sharing Agreement (PSA)
      - Like a concession
        - Agreement between the sovereign and an investor dealing with a specified territory for a specified amount of time
      - Different than a concession
        - In PSA the sovereign will have more to say in what the investor will be doing with regards to investment of resources and monies
        - Government shares production with investor
          - Take total volume of production and spit it up based on specified amount agreed upon in contract
            - Initial compensatory product

- The amount of product that the investor needs to break even
- Everything past compensatory product is what gets spilt up
- Why this is good for the sovereign
  - Keep ownership rights
  - Higher say in goings on
- · Who is the biggest oil company in the world?
  - By booked reserves
    - Saudi Aramco
    - Top ten are all nationalized oil companies
  - By publicly traded booked reserves
    - ExxonMobile
  - o "Competitive fringe" is being phased out
    - Private companies are going to have a harder and harder time fighting against the nationalized oil companies
    - Demand is only going up, especially with Asian economies on the rise, which gives the nationalized companies and OPEC a huge advantage and leverage
    - We don't have the same sort of plays that we once did
  - Peakists
    - Since it is a finite resource, there is a peak point of production at some point where, once hit everything subsequent to it will fall into decline
      - US oil production peaked in the 1970s
      - There must be a global peak for production
        - There are some people that argue that we are almost there
      - Not everyone peaks at the same time
        - UK peaked in the late 1990s
        - Norway is near peak
        - Mexico has peaked
        - Some people think Saudi Arabia is going to peak soon