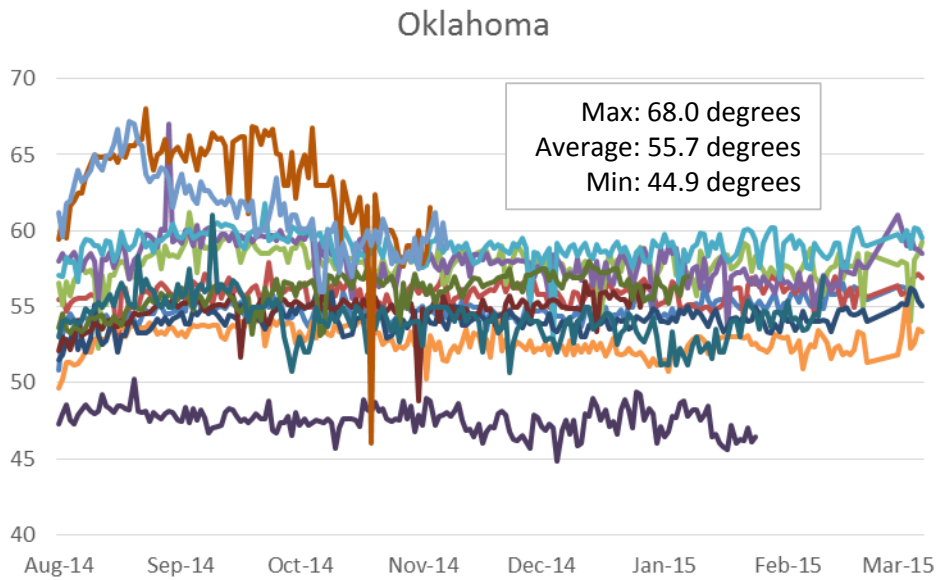
Challenges Facing Growth in Light Tight Oil (LTO) Production

Unconventional Plays & API Gravity[1]

Production streams from unconventional plays tend to be lighter than those from conventional fields as very tight rock prevents larger hydrocarbon molecules from escaping. Production "slates" in unconventional fields vary widely depending upon when the wells were drilled and where with respect to the oil and gas "windows". Initial production from liquids rich wells with gas drives will often yield liquids first and lighter molecules later as the gas drive engine depletes. Wells drilled in marginal, tighter rock will yield lighter APIs in any case.

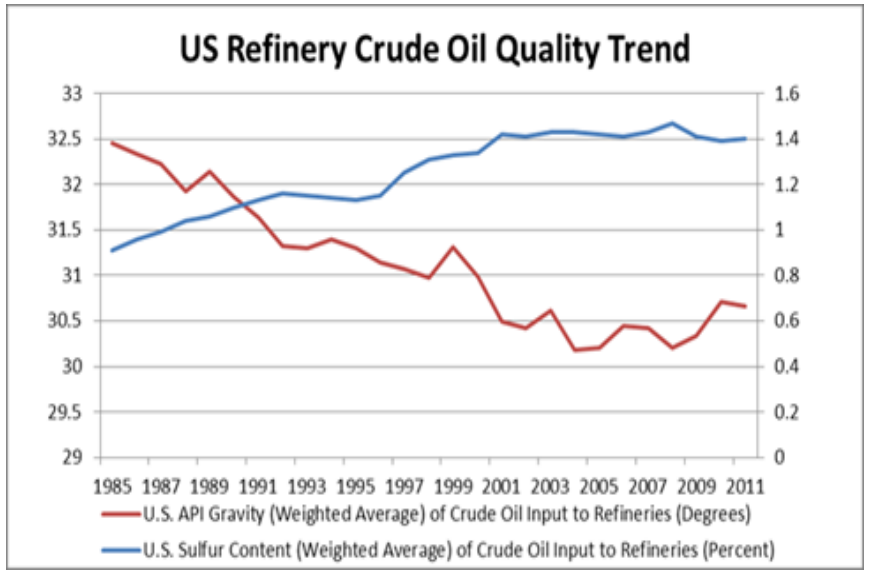
The Issue

The increase in production of lighter crude oil and natural gas liquids presents challenges to the entire oil and gas value chain. The majority of current refining capacity is configured to utilize heavier crudes (see 'US Refinery Crude Oil Quality Trend' below), and refining lighter crude oils is suboptimal for some facilities. Midstream companies have been struggling to build out sufficient infrastructure in the locations where this new production is occurring, such as fractionation, stabilizers, and pipeline storage. The upstream sector is challenged to find markets for this new production and achieve values for LTO and NGLs that provide sufficient returns for drilling and development.



Case Study

The chart (left) is a sample from a CEE case study on central Oklahoma. It shows daily API gravity data from 13 different wells drilled in Stephens County (about 150 miles southwest of Cushing, the main trading point for crude oil). Light oil producers, like those in Oklahoma, are blending their crude with heavy Canadian oil sands for pipeline shipment while they seek export approvals in order to better manage the problem of light oil supply gluts.



[1] API gravity is a measure, in degrees, of how heavy or light the petroleum product is when compared to water- the specific gravity of petroleum relative to water. Oil with an API number less than 10 (which is the degrees API of water) has a high specific gravity, i.e., it is heavier than water and will sink. Oil with a high degree API is lighter than water. Lighter crude oils are valued more in the market as they will refine more easily into "light ends" like gasoline, diesel, kerosene, naphtha, and so on.

CEE CENTER FOR ENERGY ECONOMICS
Bureau of Economic Geology, Jackson School of Geosciences
The University of Texas at Austin

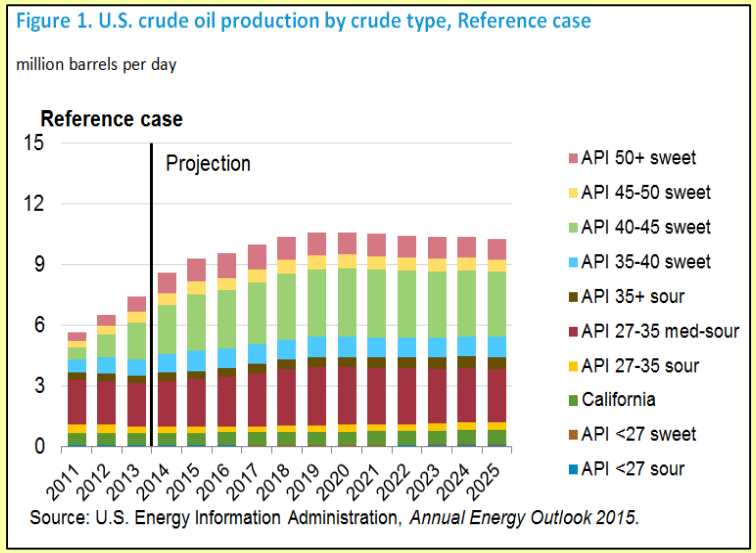
Copyright © 2015 by Bureau of Economic Geology's Center for Energy Economics, UT Austin

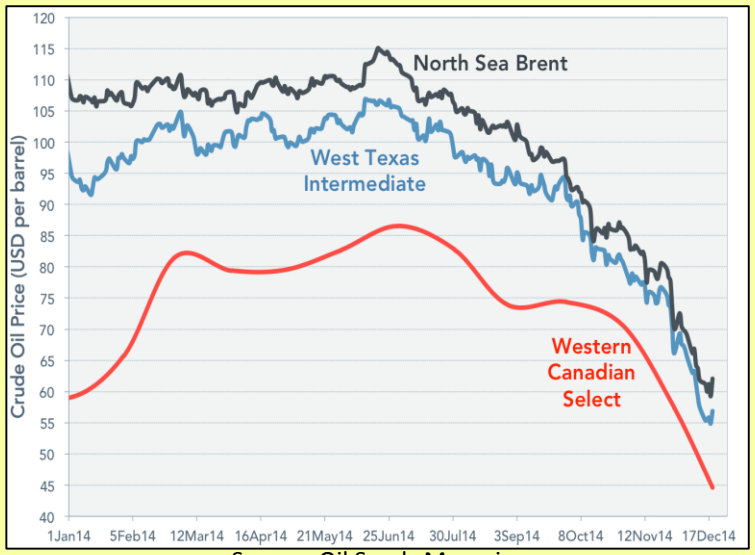
LTO: Upstream, Midstream, and Downstream Implications

Light/Heavy Imbalance – Problems and Some Options

- Historically, light grades have traded at a premium to heavier grades. Now, the mismatch between upstream oversupply of LTO production and downstream demand of heavier barrels by refiners has pushed light grades prices into deep discounts relative to the standard domestic grade, West Texas Intermediate (WTI). In some locations LTO is less than half the value of WTI quality crude.
- Gravity penalties for an API above 45 degrees reaching up to $1-2/bbl have crept into the current economics, starting to cause tension between upstream and midstream companies.
- Importing Western Canadian Select (WCS) to serve as blend stock could be a solution vis-a-vis the KXL portion of the Keystone Pipeline system. Currently, major oil pipeline developers are competing to carry WCS and Bakken production eastbound for export (see Bakken Oil Transport, September 2014). Using WCS would provide value added opportunities for the domestic market, reduce imports of oil from outside of North America (Canada is the largest oil exporter to the US), and enable more efficient use of US refining capacity.
- Exporting LTO would enable producers to access international markets and pricing and also boost US trade balances.

According to the EIA, "Roughly 90% of the nearly 3.0 million barrel per day (b/d) growth in production from 2011 to 2014 consisted of light, sweet grades…" (left) which have historically traded at a premium to the heavier grades (right).





Source: Oil Sands Magazine

Who Absorbs the Cost? (Value Chain Economics)

- Upstream: Producers are facing pressure on profit margins from lower oil prices overall, lower values for LTO, and higher marketing and transport costs.
- Midstream: Costs to build new or debottleneck existing infrastructure for transportation or blending must be undertaken profitably. Railway transporters are facing increased costs from new regulations governing light oil transport safety. Midstream costs are transferred upstream and downstream.
- Downstream: Some existing refiners (such as Flint Hills, Marathon Petroleum, Valero, Delek, and Holly Frontier) have investment plans ranging from $70-$400MM in the shale plays, opting to modify their plants to process LTO more economically. *Source: Turner Mason & Company, Jan 2015*
- End users absorb costs in gasoline and other fuels but benefit from competitive LTO production and lower prices.

Copyright © 2015 by Bureau of Economic Geology's Center for Energy Economics, UT Austin