Heavy Crude Oil: A Global Analysis and Outlook to 2030

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Excerpt
Table II.15: North American Heavy Crude Disposition  
(Thousand barrels per day)

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<th>Production</th>
<th>2009</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
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Source: Hart Energy Consulting

United States

Nearly all of the crude oil produced in the United States is refined locally or within the PADD area where it is produced. U.S. refining capacity has been slowly increasing through expansions, even though no new refineries have been built for several decades. Much of the recent expansion in U.S. refining capacity has been associated with increasing the capability to process heavy crude.

Expansions are continuing at existing refineries, many of which are designed to further increase capacity to refine heavy oils. The major heavy crude refining areas are California, which refines the heavy oil produced in the state as well as imports from Mexico and South America, the Texas Gulf Coast, which refines heavy crude from Mexico, Venezuela and other countries, and the northern Midwest, which refines most of the bitumen and conventional heavy oil exported from Canada. A brief summary of each PADD region and the expansions that have been announced or are in the construction phase are summarized below.

PADD I:

PADD I is located along the East Coast of the United States with refineries in Delaware, New Jersey, Pennsylvania and West Virginia. There are 13 refineries with a total capacity of 1.7 million b/d. Three of these refineries process 0.04 million b/d Canadian heavy oil. Total heavy oil processed in 2006, including imports from other regions was 0.26 million b/d. No heavy oil capacity expansions have been announced.

PADD II:

PADD II, located in the U.S. Midwest, is the largest market for western Canadian crude oil and has a refining capacity of almost 3.6 million b/d. Northern PADD II has 12 refineries in Illinois, Indiana, Minnesota, North Dakota, Ohio (Toledo) and Wisconsin that run about 0.56 million b/d of heavy
Total refining capacity in northern PADD II is 2.1 million b/d. The nine refineries in southern PADD II, located in Kansas, Oklahoma and Tennessee, have a total refining capacity of 1.0 million b/d but process only 0.06 million b/d of heavy crude. Eastern PADD II is located east of Chicago and Patoka, but excludes Toledo, Ohio. It has a refining capacity of 0.5 million b/d and processes 0.02 million b/d of heavy oil.

The largest heavy oil capacity expansions are planned for the PADD II region to accommodate higher heavy oil and synthetic crude volumes from Canada. The following expansions are in various stages of completion:

- The WRB Refining (ConocoPhillips/Encana joint venture) Wood River, Ill. refinery expansion that increased heavy oil capacity by 100,000 b/d was completed in 2007.

- Marathon Detroit, Mich. refinery, a US$1.9 billion project, will increase the refinery’s heavy oil processing capacity, including Canadian bitumen blends, by about 80,000 b/d, and will increase its total crude oil refining capacity by about 15%, from 100,000 b/d to 115,000 b/d. This project was approved by Marathon’s board in late 2007.

- BP is seeking permits to expand the Whiting, Ind. refinery to increase heavy oil processing from 90,000 b/d to 350,000 b/d. This project has been stalled because of concerns over water discharge. The expansion is scheduled to be complete by 2011.

- BP Refinery, Toledo Ohio, with a crude distillation capacity of 155,000 b/d of which 60,000 b/d capacity is currently heavy oil, will be expanded to process approximately 170,000 b/d of heavy oil and bitumen by 2015. The expected investment is around US$2.5 billion.

- Frontier’s El Dorado, Kan. refinery will undergo a small expansion to increase heavy oil capacity by 5,000 b/d.

- Marathon’s Catlettsburg, Ky. refinery is under a conceptual study to add 150,000 b/d heavy oil capacity.

- Marathon is conducting a study to expand the Robinson, Ill. refinery by 180,000 b/d heavy oil capacity.

- Husky purchased Valero’s Lima, Ohio refinery and is currently reviewing options for reconfiguring and expanding the refinery to process heavy crude oil and bitumen.

PADD III:
PADD III, which includes Alabama, Arkansas, Louisiana, Mississippi, New Mexico and Texas, has 56 refineries with total capacity of 7.99 million b/d, of which a significant portion is heavy crude oil processing capability. In 2006, PADD III refineries imported over 5.6 million b/d of crude oil, 2.15 million b/d of which was heavy crude oil. In recent years, PADD III refineries have added six new cokers and other facilities to allow refineries in order to run heavier, sour grades of crude oil. New heavy oil capacity expansions that have been recently completed or are planned are: the WRB Borger refinery expansion by 25,000 b/d heavy oil capacity, completed in 2007; the Navajo Refining Artesia, N.M. refinery expansion to 40,000 b/d in 2008; and the Motiva refinery joint venture between Shell and Saudi Aramco, which will expand its capacity by 325,000 b/d. The expansion will process heavy and medium heavy sour crude oils.

PADD IV:
PADD IV which includes Colorado, Montana, Utah, Wyoming and Idaho is the smallest of the districts, with a total capacity of 0.66 million b/d. They run crude produced locally and from Canada of which 0.10 million b/d is heavy oil.
PADD V:
PADD V includes California, with 21 refineries, the state of Washington, with 5 refineries, and Alaska with 6 refineries. Alaska only refines crude produced in state. Alaska North Slope (ANS) crude is also shipped to California and Washington. In 2006 California received 16% of its crude supply from Alaska. Washington refineries process mainly medium sour crude oil and have historically sourced most of their feedstocks from Alaska (currently 70%). They also refine small amounts of heavy oil from Canada.

Overall, PADD V refineries process 0.66 million b/d of heavy oil: 0.45 million b/d domestic and 0.21 million b/d imported.

One expansion is planned, the ConocoPhillips Ferndale, Washington expansion, which will add 25,000 b/d heavy processing capacity.

Canada
Canadian heavy oil production, including heavy synthetic crude was 1.3 million b/d in 2009. This far exceeds the processing capability of refineries in Western Canada and therefore a large portion of the production (0.9 million b/d) is exported to the U.S. Western Canadian refiners process about 70% of the heavy crude volume remaining in Canada and Ontario processes the remainder. Figure II.9 illustrates the volume of heavy oil processed in refineries in the U.S. and Canada.

The traditional markets (i.e. western Canada, Ontario, upper PADD II, PADD IV and the state of Washington) will continue to process western Canadian crude oil. With the expansions noted previously, particularly those in PADD II, the heavy crude processing capability will be greatly enhanced. There is potential for expansions into new markets such as Québec, eastern PADD I, southern and eastern PADD II, PADD III, California and the Far East. The latter will be accommodated by pipeline expansion projects currently underway or under consideration.

In Western Canada, Petro-Canada has recently completed a conversion project that will allow processing 100% oil sands feed. Consumer’s Co-Operative refinery plans to expand Canadian processing as well. Additional refinery conversions are anticipated that will increase domestic refining capabilities.
Pipelines
Pipeline capacity from Canada to the United States is adequate for current production, but new pipelines will be necessary to move the increased volumes. The map in Figure II.10 depicts the major crude oil pipelines between and within the US and Canada. Capacities and locations are shown in Table II.16.

Figure II.10: Crude Oil Pipelines in North America

Source: Hart Energy Consulting
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For any additional information including questions on price and ordering, please contact Zach Muroff, Business Development Director, Hart Energy Consulting, +1.713.260.6429 or zmuroff@hartenergy.com