OILCHANGE INTERNATIONAL

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Crude-By-Rail Data Focus:

U.S. East Coast: a Key Destination for North American Crude-By-Rail

Photo credit: Associated Press – Matt Rourke

Key Findings

A review of data on the transportation of crude oil by rail in North America finds the U.S. east coast to be a prime destination for the continent's oil trains.

- An average of 450,000 bpd of crude was delivered by rail to the east coast region in 2014.
- Around 50% of all crude-by-rail is unloaded in the wider east coast region (PADD 1).
- Around 50% of the crude oil input to six east coast refineries is supplied by rail.
- Over 80% of the crude oil delivered by rail to the region comes from North Dakota (Bakken crude).
- Canada is the next biggest source of crude-by-rail for the region at around 12%.
- Five key terminals account for 73% of the unloading capacity and around 65% of the throughput of the region's crude-by-rail terminals.

This briefing provides additional information on crude-by-rail to the east coast. For further information on crude-by-rail see www.priceofoil/rail

Crude-By-Rail Background

Shipping crude oil by rail has become a major new activity for the North American oil industry, as the geography of the continent's oil production has shifted. Shipments have averaged around 1 million barrels per day (bpd) since the beginning of 2014, rising some 5,400 percent from the 20,000 bpd shipped in early 2010.[1]

The movement of crude oil in the U.S. in particular used to primarily be about transporting it from coastal areas to the interior – whether it was domestic offshore production or crude oil imported from overseas. This was primarily done by pipeline.

The biggest shifts have come from the recent rapid growth of oil production in North Dakota and the slow but steady rise of tar sands production in Alberta, Canada. North Dakota was a state with relatively minor oil production that has seen a rapid rise in production since 2005, from 100,000 bpd to 1.1 million bpd in 2014.[2] North Dakota's landlocked location and its lack of proximate pipelines and refineries triggered the crude-by-rail boom.

The first unit train of over 100 cars of crude oil loaded anywhere in North America was loaded by EOG Resources in Stanley, North Dakota in December 2009. This has been credited as the beginning of the crude-by-rail boom.

In Alberta, the emergence of crude-by-rail has followed a different path to North Dakota. A Canadian province that has long been dominated by oil; pipelines and refineries are common. But for Alberta's tar sands production to grow, new markets beyond the Canadian west and U.S. Midwest need to be reached. Major new proposed pipelines such as Keystone XL to the U.S. Gulf Coast and Northern Gateway to the Canadian west coast, among others, have become mired in controversy as citizen's movements on both sides of the border have protested the intensified impact of tar sands production, its threat to the climate, and the threat of pipeline and tanker spills new infrastructure would bring. The rise of crude-by-rail in Alberta has been slower and more modest than in North Dakota as the costs and logistics of moving tar sands crude by rail heavily impact the profitability of this high cost, high carbon oil source.[3]

About the Data

We use two sources of data for analyzing crude-by-rail flows into, out of, and around the United States. For figures on total flows we use the U.S. Energy Information Administration (EIA) crude-by-rail data that was first released in March 2015 and is updated monthly with a two month time lag.[4] The data starts in January 2010, and the latest data presented in this update is for April 2015.

We also use a Genscape subscription data service that provides weekly data for a selection of crude-by-rail terminals.[5] This is more up to date but is not as complete as the EIA data as it only covers a selection of key terminals.

It should also be noted that the figures for barrels of crude loaded or unloaded from both sources are estimates. They are generally derived from data on tank car movements and formulas are used to estimate the average contents of a tank car. The EIA and Genscape

use different formulas and therefore their numbers can be difficult to compare. All numbers should be regarded as highly informed estimates and not precise figures.

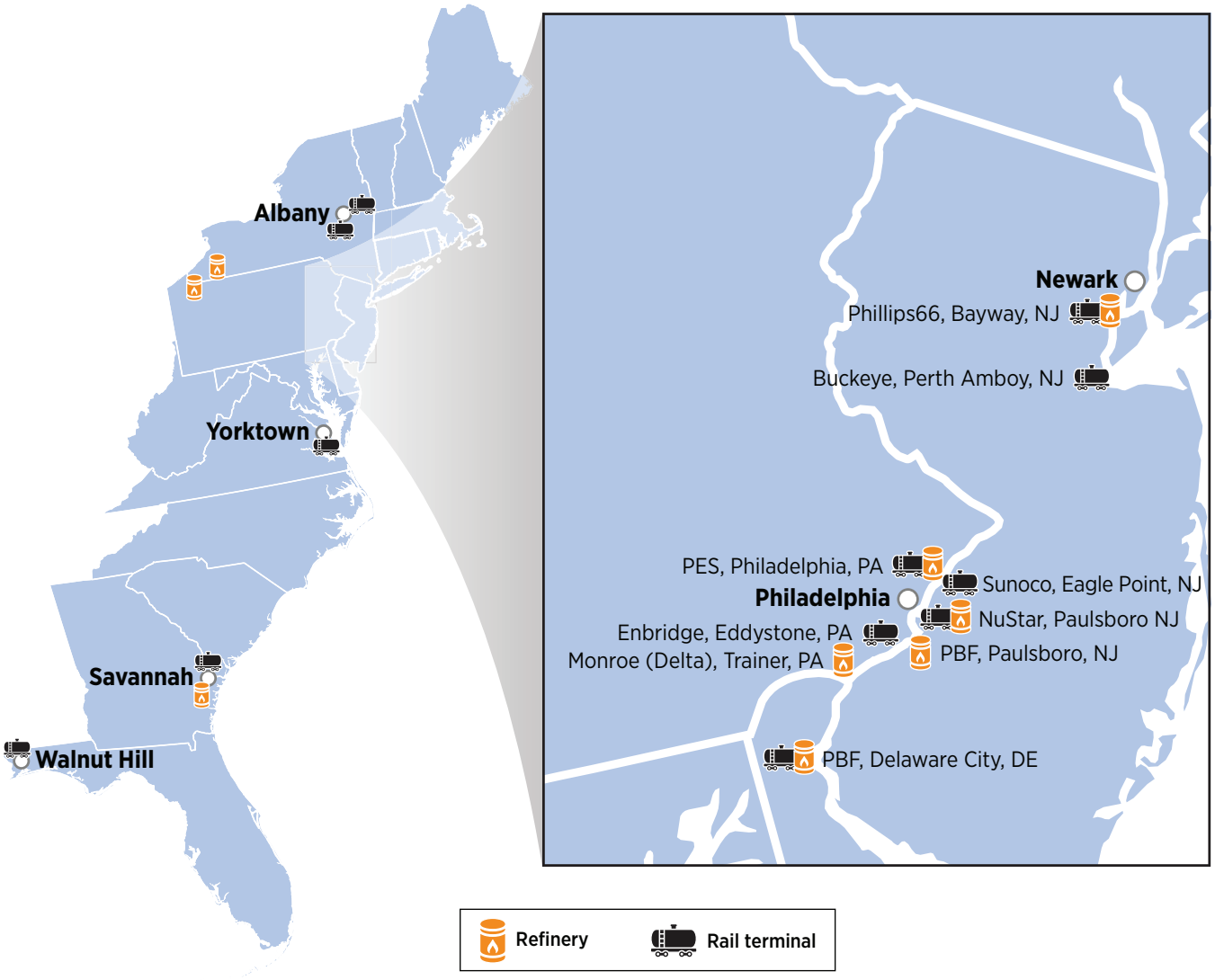
The U.S. East Coast is the Prime Destination for North America's Crude Shipped by Rail

The U.S. East Coast has become the primary regional recipient of crude oil delivered by rail from both North Dakota and Canada and is the destination of around 50 percent of all crude-by-rail traffic by crude oil volume, yet it represents less than 7 percent of U.S. refining capacity.

There are nine refineries operating in what the EIA designates as PADD 1, with a combined capacity of a little less than 1.3 million barrels per day (bpd).[6] Six of these are close to the coast around Philadelphia and New Jersey, including one in Delaware City.[7] The other three are further inland in western Pennsylvania and West Virginia. According to the Oil Change International crude-by-rail terminals map[8], most of the PADD 1 rail terminals are focused on serving the six coastal refineries (see Figure 1).[1] Some crude delivered by rail to the region may be exported to Canada but there is no concrete data on this and we believe that the vast majority is currently delivered to the six coastal PADD 1 refineries in the Philadelphia, New Jersey and Delaware area.

1 There is a rail terminal connected to an asphalt refinery in Savannah, Georgia and one in Florida that do not serve the Philadelphia-New Jersey area refineries. We believe the throughput at these two terminals to be relatively small, perhaps less than 30,000 bpd.

Figure 1. East Coast (PADD 1) Refineries and Crude Oil Rail Terminals



Source: Oil Change International

How Much Crude Oil Does the East Coast Receive by Rail?

The amount of crude delivered to the east coast by rail has grown sharply since 2012. Figure 2 shows EIA data with 'Total Crude-by-Rail' including U.S. crude exported to Canada by rail and Canadian crude imported from Canada by rail. No data is currently available on Canadian rail shipments that stay within Canada.

East coast receipts were negligible through 2011. However, by the end of 2012, as new unloading facilities were completed, receipts reached over 100,000 bpd. By December 2014, receipts peaked at over 533,000 bpd. The average for 2014 is just over 450,000 bpd. In 2015 there has been a slight decline as lower oil prices and tighter oil price spreads[2] have reduced the overall flow of crude-by-rail, especially from Canada.

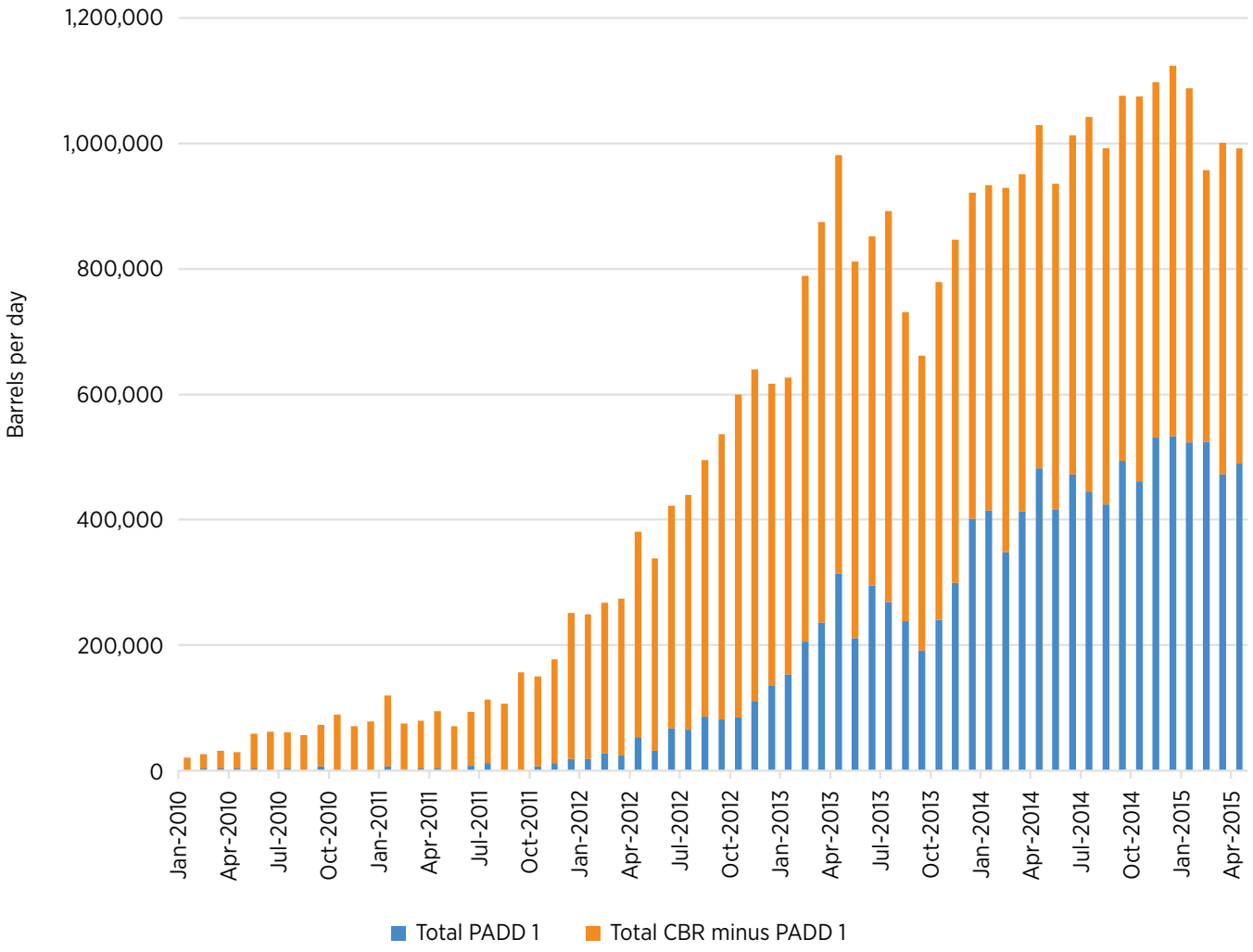
The east coast consistently received over 40% of all crude oil shipped by rail from December 2013 onwards, with the exception of February 2014 when the proportion dropped to 37%. In February 2015, the proportion hit an all-time high of 55%.

What Percentage of East Coast Refinery Input is Supplied by Rail?

The six east coast refineries averaged around 1 million bpd of crude oil input in 2014. About 45 percent of it

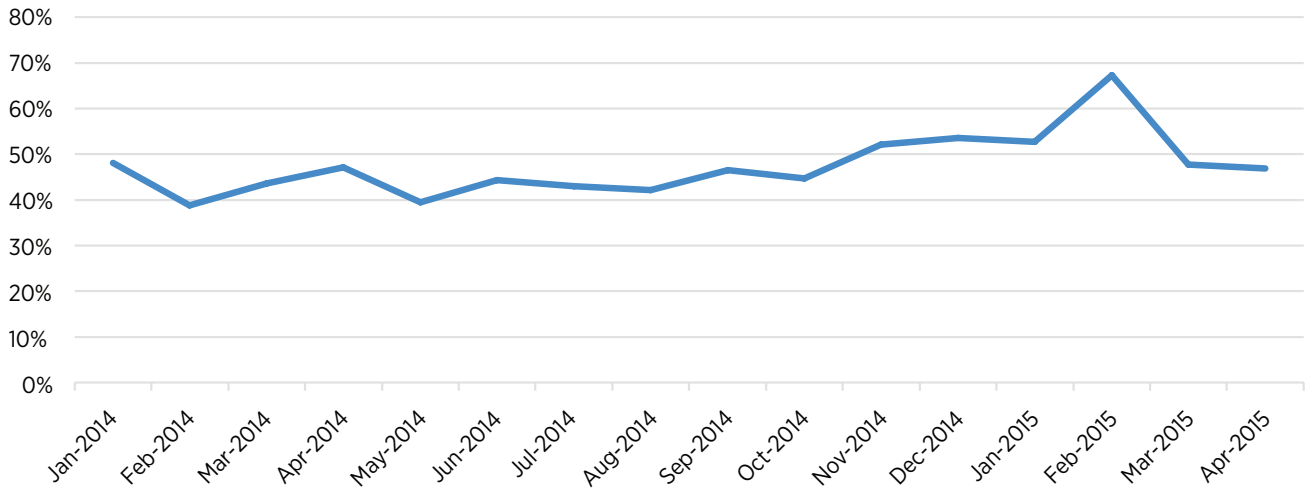
2 The difference in prices at the source (generally North Dakota and Alberta) and at the destination.

Figure 2: East Coast (PADD 1) Receipts Compared with Total Crude-by-Rail



Source: Oil Change International with EIA data

Figure 3: East Coast Crude-by-Rail as Percentage of Total Refinery Input



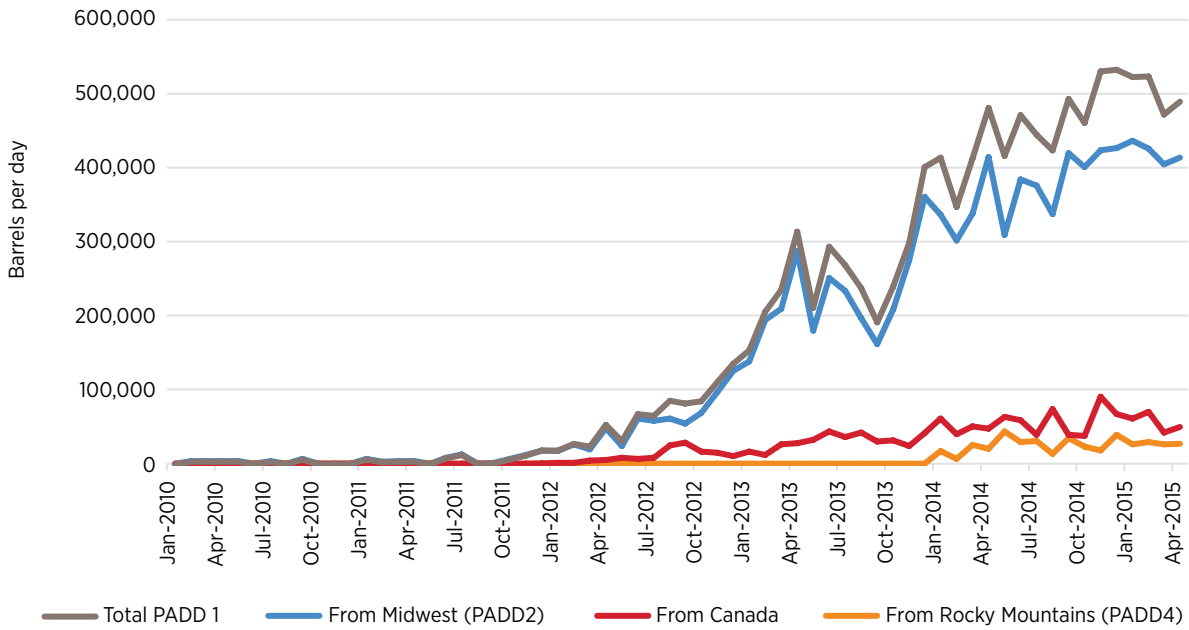
Source: Oil Change International with EIA data

was supplied by rail. In February 2015, the proportion of crude oil inputs to east coast refineries delivered by rail shot up to 67 percent. However, this was more a result of a temporary decline in crude oil runs, probably due to refinery maintenance, than to a jump in rail receipts. From November 2014 through to January 2015, the proportion of refinery input delivered by rail held steady at between 52 and 54 percent. (See Figure 3.)

Where Does East Coast Crude-by-Rail Come From?

The vast majority of crude oil arriving on the east coast by rail comes from North Dakota (PADD 2 in the EIA data) with Canada the second biggest source. A small amount comes from Rocky Mountain states, (PADD 4) probably Montana and Colorado. No crude oil arrives by rail from the Gulf Coast or west coast regions, nor does any crude come from within the east coast region. (See Figure 4.)

Figure 4: Crude-by-Rail Shipments to U.S. East Coast (PADD1) by Source Region



Source: Oil Change International with EIA data

Table 1: Crude-by-Rail Unloading Terminals in the East Coast Region (PADD 1)

Operator / Terminal	Railroad	City	State	Crude Oil	Facility	Unload Capacity BPD
PBF Refining	Norfolk Southern	Delaware City	Delaware	Tar Sands and Light Oil	Refinery	210,000
Philadelphia Energy Solutions (PES)	CSX / Norfolk Southern	Philadelphia	Pennsylvania	Light Oil	Refinery	210,000
Global Energy Partners	CSX / CP	Albany	New York	Light Oil	Rail to barge	160,000
Eddystone Rail Terminal (Enbridge/Canopy)	CSX / Norfolk Southern	Philadelphia	Pennsylvania	Light Oil	Rail to barge	160,000
Plains All American	CSX	Yorktown	Virginia	Light Oil	Rail to barge	160,000
Buckeye Partners	CSX	Albany	New York	Light Oil and Ethanol	Rail to barge	135,000
Phillips 66	CSX / Norfolk Southern	Linden	New Jersey	Light Oil	Refinery	75,000
Buckeye Partners	CSX / Norfolk Southern	Perth Amboy	New Jersey	Tar Sands and Light Oil	Rail to barge	70,000
Sunoco Eagle Point	Norfolk Southern	Westville	New Jersey	Light Oil	Rail to barge	40,000
NuStar (Axeon)	CSX	Paulsboro	New Jersey	Tar Sands	Asphalt Refinery	12,000
TOTAL CAPACITY (main east coast region)						1,232,000
Other PADD 1 terminals						
Genesis Energy	**BNSF**	**Walnut Hill**	**Florida**	**Light Oil**	**Rail to Pipe**	**75,000**
NuStar	**CP**	**Savannah**	**Georgia**	**Tar Sands**	**Asphalt Refinery**	**12,000**
Total (All PADD 1)						**1,319,000**

Total receipts of crude into the PADD 1 regions averaged over 450,000 bpd in 2014. Around 370,000 bpd was Bakken crude from North Dakota (PADD 2) but Bakken receipts reached a high of almost 430,000 bpd in January 2015. North Dakota is consistently the source of over 80 percent of crude-by-rail into the east coast.

Canada is the next most important source but only contributes around 12 percent of the total. Receipts from Canada averaged around 55,000 bpd in 2014 but reached a peak of over 90,000 bpd in November of that year. They have since declined to below 50,000 bpd.

The data does not differentiate between different types of crude oil. We can probably safely assume that the bulk of the Canadian crude oil received by rail on the east coast is heavy crude likely derived from Alberta's tar sands, although some of it may also be synthetic crude also derived from tar sands sources. We know that the PBF refineries at Delaware City and Paulsboro, NJ as well as the NuStar (Axeon) asphalt refinery in Paulsboro, NJ are capable of handling heavy crude and have the rail unloading facilities. We also know that the Phillips66 refinery in Bayway, NJ receives synthetic crude by rail.

Receipts from the Rocky Mountain region only began in January 2014 and averaged 25,000 bpd for the year.

East Coast Rail Terminals

There are ten operating crude oil unloading rail terminals in the main east coast region between Yorktown, Virginia and Albany, New York. There are two other terminals in the EIA's PADD 1 region; one in Florida and one in Georgia. It is unclear from available data if the Georgia terminal operates regularly. The Florida terminal sends crude on by pipe to refineries in Alabama and Mississippi (PADD 3). While this terminal has a capacity of 75,000 bpd, company statements suggest that it has rarely operated above 30,000 bpd.[9] These flows however should be considered part of the EIA data for PADD 1 discussed above.

There are two types of rail terminal. Terminals located at refineries and terminals that transfer the crude to barges for onward delivery to refineries. Most of the terminals are the latter. One exception is the PBF Delaware City refinery terminal that does both. It unloads crude for use onsite and loads some onto barges for delivery upriver to PBF's Paulsboro, NJ refinery.

We do not know exactly where all the crude goes from the terminals that transfer for onward delivery. We do know that the Eddystone Terminal delivers crude by barge to the Trainer refinery owned by Delta Airlines (Monroe Trainer) and that that refinery has also received crude by barge that was delivered by rail to Yorktown, Virginia.

The two terminals in Albany, New York transfer crude to barges that travel down the Hudson River. Reports that Buckeye Partners barge crude from Albany to the Irving refinery in St John, New Brunswick, Canada are unsubstantiated by data. We suspect most of the crude unloaded in Albany finds its way to the Philadelphia area refineries. It is confirmed that the Irving refinery receives Bakken crude directly from North Dakota by rail. Finally, plans announced by Buckeye to export Canadian heavy crude (tar sands) from its recently opened rail terminal in Perth Amboy, New Jersey appear yet to be fulfilled.[10] There has been no data on such exports and this may be due to the fall in oil prices making the trade unviable.

East Coast Terminals Data

Genscape monitors five of the east coast rail terminals. These have a combined unload capacity of 900,000 bpd representing 73 percent of the capacity in the main east coast region (see Table 1).

Two of the terminals – PES Philadelphia and PBF Delaware City – are refineries. PES is the biggest refinery on the east coast (335,000 bpd). As mentioned above, the PBF terminal serves both PBF's Delaware City and Paulsboro, NJ refineries. PBF also has the capacity to heat tank cars to unload tar sands bitumen at the maximum rate of 80,000 bpd. Its refineries have the only cokers on the east coast, equipment that is required for converting tar sands bitumen into light petroleum products.

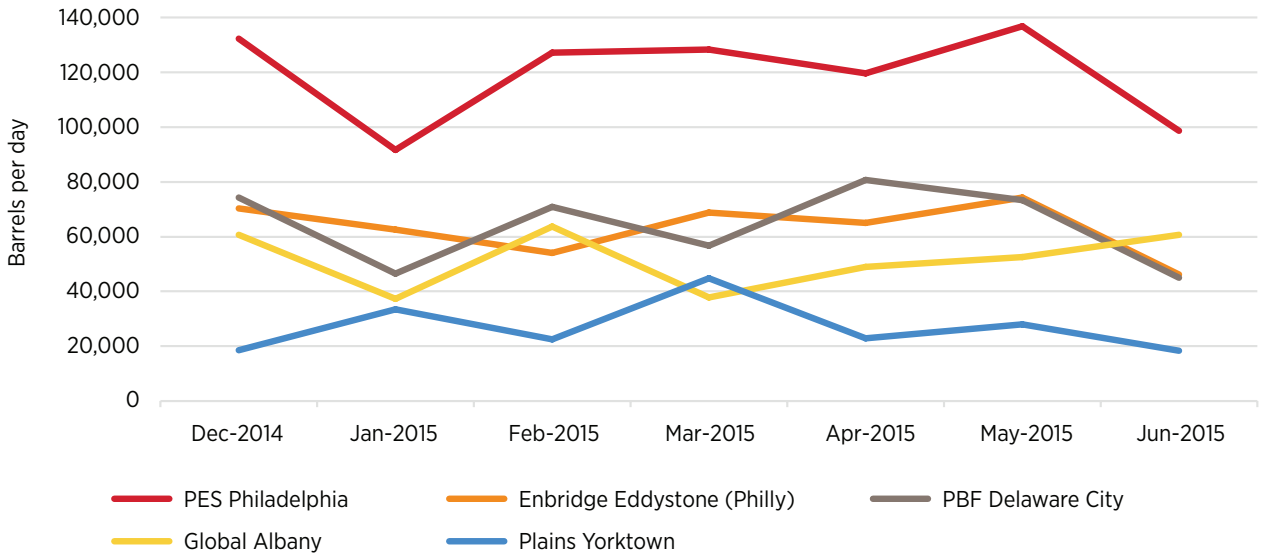
The other terminals all load crude onto barges for delivery to east coast refineries. The Eddystone terminal is in the heart of the Philadelphia industrial area. Barges loaded on the Delaware River have only a very short distance to go to deliver to local refineries. The Global terminal in Albany, NY and the Plains terminal in Yorktown, VA load barges that travel a greater distance to serve the east coast refineries.

Figure 5 shows the average monthly unloading at the five terminals since December 2014. This is as far back as available data goes for all five terminals. It is clear that the PES terminal handles the most crude oil on the east coast. However this terminal, along with the others, has been operating far below capacity for the entire period (see Table 1 for capacities).

When comparing with the EIA data, which only runs to April, these terminals handled around 65 percent of all the crude oil railed into the PADD 1 region. The Genscape data also shows a clear decline in receipts in June at all terminals except Global Albany. This is in line with reports of declining crude-by-rail traffic nationally as oil prices and narrowing prices differentials have dented the economics of the trade.

Nonetheless, the east coast region remains one of the most important destinations for crude-by-rail from North Dakota, Canada and elsewhere. If and when oil prices improve it seems likely that traffic volumes into this densely populated region will grow.

Figure 5: Average Monthly Unloading at Five Key East Coast Terminals



Source: Oil Change International with data from Genscape

This paper was researched and written by Lorne Stockman.

Oil Change International (OCI) exposes the true costs of fossil fuels and identifies and overcomes barriers to the coming transition towards clean energy. Oil Change International works to achieve its mission by producing strategic research and hard-hitting, campaign-relevant investigations; engaging in domestic and international policy and media spaces; and providing leadership in and support for resistance to the political influence of the fossil fuel industry, particularly in the United States.

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