


SPECIAL REPORT

ALL OILED UP



A wide-angle photograph of a Union Pacific train of empty tank cars climbing a steep, dry hillside. The train is a long line of dark-colored tank cars, with a red locomotive at the front. The terrain is arid and hilly, with sparse green vegetation and patches of white rock. In the background, more hills and mountains are visible under a clear blue sky. The train is moving up the hill, following the curve of the grade.

A Union Pacific train of empty tank cars climbs Cuesta Grade at Chorro, Calif., north of San Luis Obispo, on Aug. 1, 2008, headed for reloading at the San Ardo oil field. Matt C. Batrynrodriguez

**HOW RAILROADS GOT
BACK IN THE OIL BUSINESS,
AND WHY THEY AREN'T
GOING AWAY – EVER**

BY FRED W. FRAILEY



Canadian Pacific GP40 No. 4601 leads an oil train loaded at New Town, N.D., east through Makoti, N.D., on Sept. 26, 2011. Jeff Robertson

James Cairns is jazzed, as well he should be. The Canadian National Railway marketing executive is standing at a podium in Calgary, Alberta, facing 200 movers and shakers of the Canadian oil business. Three years ago they wouldn't return his phone calls. Now these same people hang on his every word. He starts with a 102-second video that graphically delivers (over a fast, loud rhythm) CN's transportation advantage, that it goes from the heart of the Alberta oil fields to the Atlantic, Pacific, and Gulf coasts and most places in-between. Then Cairns leans into his presentation. The CN network, he says, "looks a lot like the pipeline network today *and* where it wants to go tomorrow." At its core, his message the next 30 minutes is this: I can help you make a lot more money. The audience eats it up.

Half a century after being elbowed by pipelines out of transporting crude oil, railroads are back at it. In the first three quarters of 2013, they hauled 11 percent of the oil coming out of the ground in the U.S. That's compared to almost nothing three years earlier. The demand for crude by rail today far exceeds the supply. The reason the rail share isn't already 15 or 20 percent may well be that the specialized tank cars and unit train transload terminals that will drive down the cost of moving oil don't exist; there's a two-year backlog of orders for new tank cars. "A savings of \$1 a barrel returns \$450 million a year back to our business," remarks Joe Gallagher of refiner Phillips 66, reflecting that industry's focus. "We're on the hunt for that dollar."

Oil is a jump ball, and this time railroads won't be elbowed aside. Partly it's because

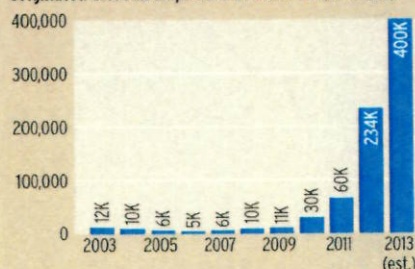
they are not the overregulated, undercapitalized, and unimaginative creatures of yore (offering transportation service but not adept at either selling or delivering it). But it's also because the oil business has changed, too — it's been turned on its head. "The U.S. oil infrastructure is a puzzle someone just threw on the floor, and it's being completely redrawn," says Jay Harbison, senior vice president of EDF Trading. New drilling methods opened up oceans of oil until recently thought untouchable. Now the centers of growing oil production are new locales the pipelines barely reach, places like North Dakota (the Bakken shale deposit), Alberta (oil sands), and South Texas (Eagle Ford shale). "The past is almost irrelevant today," says Stephen Bradley, vice president of oil marketing for Continental Resources.

The fly in the ointment: the disastrous safety record involving Bakken shale oil on railroads. Three explosive derailments in less than six months, all involving oil from North Dakota, expose a problem railroads don't know how to solve (or even its cause). After all, crude oil isn't normally thought of as explosive. Yet 47 people are dead as a result, and public mistrust of railroads as safe custodians of this substance is on the rise.

When Norfolk Southern CEO Wick Moorman says, "Everybody is trying in every way they can to land crude oil and get it to refiners," he could as easily be speaking for the producers and pipelines as he is for the railroads.

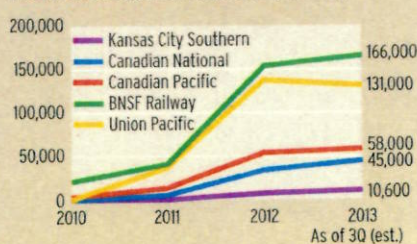
OIL BY RAIL'S RAPID RISE

Originated U.S. rail shipments of crude oil (carloads)



Source: Association of American Railroads

Class I railroad crude oil shipments (carloads)



Source: Railroad annual reports and investor presentations

LAND OF OPPORTUNITY

Oil by rail the first time around peaked in 1943, with 162 million barrels carried. A decade later, the number had tumbled to 28 million barrels and a decade after that, to just 5 million. Why? Pipelines had begun connecting the established oil fields either to refineries or to storage hubs, primarily Cushing, Okla. Once built, pipelines are an extremely efficient way to move oil and hard to under-price. For railroads to have a second chance, something had to change.

Finally, it did. In the U.S., the change agent was George Mitchell, who died last summer at age 94. The founder of Mitchell Energy & Development, he discovered, through years of frustrating trial and error, how to marry two existing technologies, hydraulic fracturing and horizontal drilling, and open up hitherto-impregnable deposits of oil and natural gas, trapped in huge formations of shale rock. Fracking involves injecting water, super-hard sand, and chemicals into the shale under high pressure. The injection opens cracks in the rocks, which the sand particles hold open, allowing the oil and gas to escape. Then horizontal drilling allows the seam of shale to be worked its entire length rather than in a single cross-section.

Fracking first began to uncover huge reservoirs of natural gas in the Marcellus and Utica shale formations in Ohio, Pennsylvania, and West Virginia. Then the exploration company Continental Resources began a hugely successful campaign of fracking for oil in western North Dakota's Bakken shale formation, and the race was on. Trouble was, how to get the oil to refineries?

Meanwhile in Canada, a quite different set of events unfolded to upend the status quo. For several decades, oil producers had sought economical ways to extract oil from Alberta's aptly named tar sands. The oil is so heavy you can't drill and pump it out. You either must mine the sand and then extract the oil or heat the substance below the surface and boil it out. By 2010, the technologies to extract the oil by both of these methods had matured, and then began the search to bring the product, called bitumen, to market. Hint: Raw bitumen won't flow through a pipeline.

So in both North Dakota and Canada, the pipelines weren't ready, and railroads jumped in. But looking five or 10 years down the road, to what effect?

ECONOMIC REALITIES

The efficiency of moving oil by pipelines is unquestioned. So is that of barges. Low-cost inland waterways once dominated the export grain business, with railroads a distant second. Today their market shares are reversed. What happened is that, deregulated and shorn of layers of costs, railroads of-



An empty coal train passes Sully Springs, N.D., on the former Northern Pacific main line. By mid-2013, BNSF was loading eight unit trains a day of North Dakota oil. Travis Dewitz

TANK CAR MATH

For light sweet crude (such as Bakken)		
Gross weight on rails	Gallons per car	Barrels per car
263,000 pounds	30,000 gallons	675 barrels
286,000 pounds	31,800 gallons	720 barrels
For heavy Canadian oil sands crude (coiled and insulated)		
Gross weight on rails	Gallons per car	Barrels per car
286,000 pounds	28,800 gallons	600 barrels
263,000 pounds	25,500 gallons	550 barrels
Bottom line: A typical unit oil train has between 80 and 120 cars, which means each train carries approximately 50,000-75,000 barrels, or about 3 million gallons, of oil.		

ferred grain shippers attractive unit-train rates to *anywhere* that the boat people, who only went *somewhere*, couldn't match. Try moving a river.

That's one advantage of oil by rail — the ability to go wherever the price is right. Valero Energy, the largest independent oil refiner, is investing close to \$1 billion in 5,325 new tank cars (its fleet will total more than 10,000 cars) and unit-train terminals — a huge commitment. Valero's strategy is to load its tank cars wherever it can find low-priced oil, meaning North Dakota and Alberta for the moment, where prices are heavily discounted, and deliver it to those of its 16 refineries that now use the highest-priced oil. Owning its own rolling stock, Valero can move its fleet wherever it wishes, driving hard bargains with producers and railroads alike. Perhaps that's why energy economist Philip K. Verleger Jr. calls tank cars "options on wheels."

Rail has other advantages over pipe, too. You can lease tank cars and launch a unit train in weeks; it takes years to plan and subscribe and permit a pipeline and years more to build it. Leasing tank cars requires no capital, and the oil they carry pays for the lease; pipelines cost billions. Railroads require only short-term commitments; pipe-

lines demand 10- to 20-year take-or-pay contracts. You can negotiate rates with railroads; pipelines post fixed tariffs. If conditions change — if better opportunities present themselves — you can move your unit trains elsewhere; with pipelines, you're stuck.

These are all attractive reasons to consider railroads. Still, in a head-to-head matchup between Point A and Point B, with no complicating factors, pipelines will win. New pipelines are being built, and old ones reversed, to move more oil out of North Dakota and Alberta. Does that mean railroads will soon lose their foothold? Not at all.

But some big changes will occur. For instance, in late 2013 roughly 65 percent of the oil that BNSF Railway moved from North Dakota was destined for Texas and Louisiana (or to barges on the Mississippi River that would float downstream to those two states). Within a year or two, that huge flow (about 390,000 barrels a day, or bpd) will probably diminish to a relative trickle. One reason will be new pipeline capacity. Equally telling, Gulf Coast refineries have a limited appetite for light sweet crude oil, and North Dakota is being squeezed out of the Gulf refineries by similar oil from the burgeoning Eagle Ford shale formation in South Texas, which is close by and cheaper to transport.



A Union Pacific freight passes LyondellBassell's Houston refinery, which processes heavy crude oil. Gulf Coast refineries are the top destination for unit oil trains. Steve Schmollinger

John Miller, BNSF's former vice president for industrial products sales (now handling agricultural products), is not at all bothered by this. "In the next few years," he says, "you'll see a natural change in the flow" on his railroad, away from the Gulf Coast and toward the Atlantic and Pacific coasts. Refiners in the eastern and western states aren't reached by pipelines from the U.S. interior and may never be. They depend on oil bought at the world benchmark price (called the Brent benchmark) and brought to their refineries by ship. As U.S.-produced oil began trading at a sharp discount to the Brent price, refineries on the East Coast were put at such a price disadvantage that some announced plans to close. Those closures abruptly ended when oil-by-rail deliveries from North Dakota and Alberta became realities in late 2011.

Altogether, the East Coast refineries, many concentrated along the Delaware River near Philadelphia, have a refining capacity of 1.3 million barrels per day and are receptive to the light sweet crude found in North Dakota. The West Coast refineries can process 2.4 million barrels per day, and they are also more sweet than sour (sweet versus sour is determined by the sulfur content of the oil). Combined, that's almost 4 million barrels per day that is biased toward Bakken oil and rail delivery. By the time you read this, daily oil production in North Dakota and neighboring eastern Montana and southern Saskatchewan will be at 1 million barrels a day, on its way to perhaps 2 million barrels within another five years.

So just do the math. East and west coast refineries are capable of buying twice as much U.S. oil as the Bakken shale is likely to ever produce. Today, BNSF claims a 65 percent market share of oil leaving North Dakota. "We see a pathway to handle as much as 1.3 million barrels a day," says BNSF's

Miller, which translates to a market share of Bakken oil delivery as much as (sit down before you read this) 75 percent. Moreover, the Bakken shale is looking more and more like a long-term play. Miller is thinking 50 years. Beneath the Bakken rock is another oil-soaked formation called Three Forks, which has hardly been explored. And below the Three Forks lies a possible third bench.

Pipelines are largely irrelevant to BNSF and its North Dakota neighbor, Canadian Pacific. If they can persuade refiners on the Atlantic and Pacific coasts to buy Bakken oil (not hard to do, because it's cheaper than imported oil), the only way to get it there is by train. "All the exploration guys are finding ways to lower costs," Miller says. "So are we. We want to drive our costs down. We want to create a system for the long term. It has all the characteristics to be that way." North Dakota state officials predict the rail share of oil leaving that state could be as high as 90 percent in 2014, owing to demand from east and west coast refineries.

HEAD-TO-HEAD

It's a completely different story in Alberta. If BNSF Railway is the big winner in the U.S., Canadian National Railway stands to be its equal north of the international border. The largest natural landing spots for the oil sands output is the U.S. Gulf Coast. It is the epicenter of American oil refining (9 million barrels per day of capacity), and the refineries in Texas and Louisiana are geared toward processing heavy sour crude, which is what Alberta produces.

So Alberta to the Gulf of Mexico is the real rail-pipe battleground. On the face of it, pipes are a slam dunk. But a couple of recent analyses show rail with a noticeable cost advantage over pipeline.

That advantage arises from the fact that to get bitumen to flow through a pipeline,



Great Western Railway serves this oil terminal at Windsor, Colo., which in November 2013 was building a two-track platform (left) to load unit trains. Chip Sherman

you have to dilute it with distillate, so that the flow is 72 percent bitumen and 28 percent diluent, making the pipeline barely 70 percent efficient. Diluted bitumen goes by the nickname dilbit. Plus, you have to buy the diluent and ship it (maybe by rail!) to the pipeline source. And of course, when it gets to the other end of the pipeline, the refinery gets an ocean of diluent and must dispose of it. "Diluent is the box that bitumen comes in and nobody wants," says engineer Scott Smith of Cenovus Energy. "It just adds transportation costs."

Using ordinary tank cars, you also need dilbit. But if you load the oil into an insulated tank car outfitted with steam-heat coils (reportedly, this describes the bulk of the 60,000 tank cars to be built through 2015), you can fill it with "railbit" — that is, 83 percent bitumen and only 17 percent diluent. At the destination, steam heat is applied to warm the railbit to a flowable temperature. Plus, these same insulated tank cars can also haul raw bitumen, which must be steam-heated to 200 degrees Fahrenheit to flow.

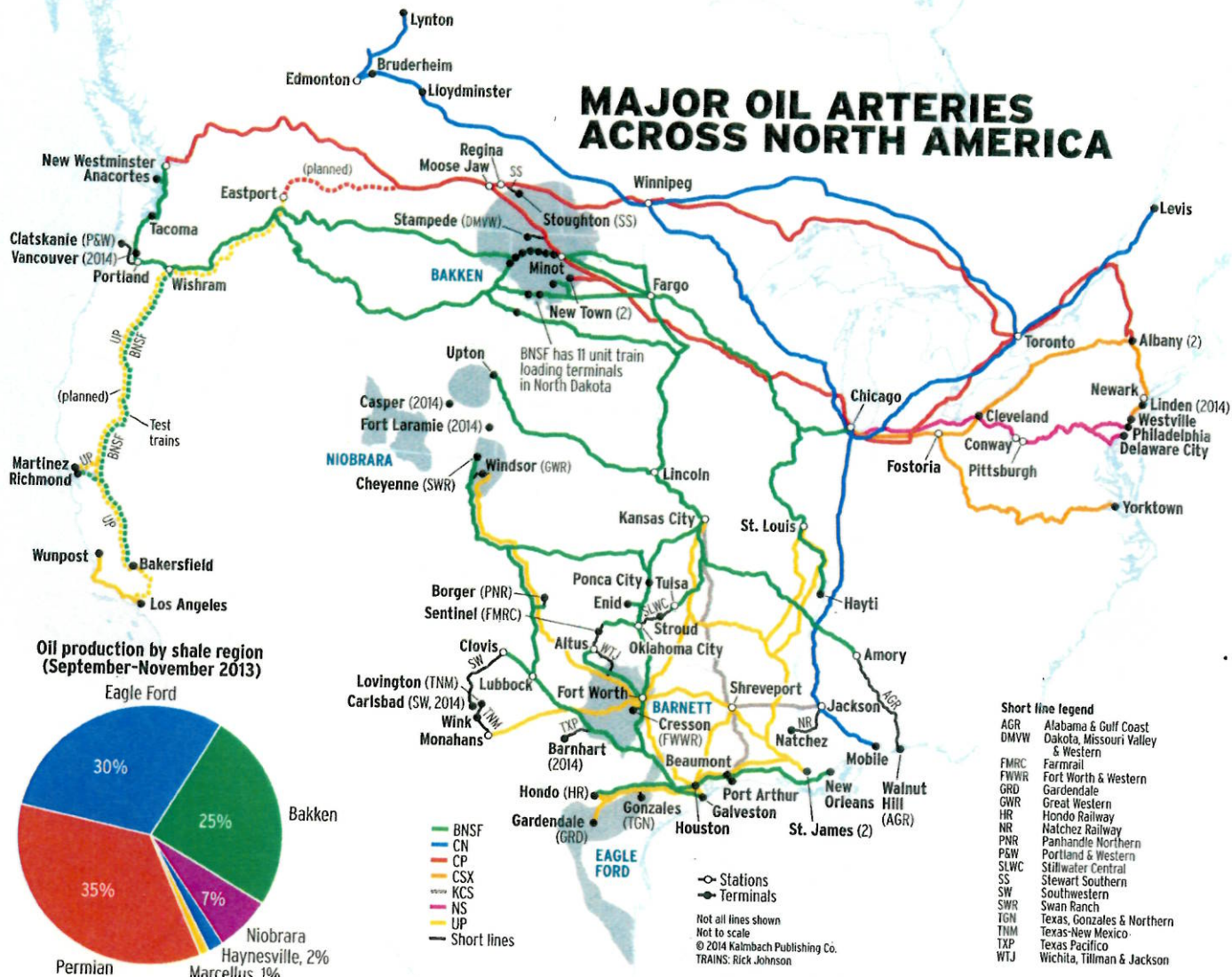
RBN Energy, an information and consulting company, published a rail-versus-



Netback price of one barrel of oil moving from Alberta to the Gulf Coast	
Raw bitumen in heating-coil tank cars via unit train:	\$65
Raw bitumen in heating-coil tank cars via manifest train:	\$62
Railbit (83% bitumen) in heating-coil tank cars via unit train:	\$52.60
Railbit in heating-coil tank cars via manifest train:	\$48.99
Dilbit (72% bitumen) via pipeline:	\$45.71
Dilbit in ordinary tank cars via unit train:	\$39.45
Dilbit in ordinary tank cars via manifest train:	\$35.28

Source: RBN Energy

MAJOR OIL ARTERIES ACROSS NORTH AMERICA



Source: Energy Information Administration and RBN Energy

pipe cost comparison between the shipping hub of Hardisty in northern Alberta and the Gulf Coast. RBN's Sandy Fielden presumed a price upon delivery at the Gulf of \$88 per barrel. The table at left shows what Fielden calculated would be an oil producer's netback price, or ultimate profit (factoring in all revenues from the oil minus all production and transportation costs), after delivering a barrel's worth of bitumen.

Jarrett Zielinski, chief executive of Torq Transloading, reached a similar conclusion, calculating that from Alberta to the Gulf Coast, unit trains of railbit have a cost advantage of more than \$3 per barrel over pipeline per delivered barrel of bitumen; manifest trains and pipeline are a draw.

Still, the problems are vexing. Raw bitumen is immediately diluted to dilbit or railbit in the oil fields, then sent to the rail loading terminals. As yet, nobody has built facilities at the unit train terminals for extracting the diluent to load just the raw bi-



Barges play a big role in moving crude oil in the East and Gulf coasts, receiving it at transloads, some rail-served, and delivering it to refineries with marine access. Michael S. Murray



tumen. So for the moment, putting raw bitumen onto unit trains is a dream and nothing more. Any raw bitumen currently loaded occurs in small batches and goes onto manifest trains.

In addition, going into 2014, unit train facilities to handle railbit in Canada and the Gulf Coast are only starting to appear. On the Canadian side, according to RBN Energy, nine unit train-sized terminals are being built in northern Alberta and western Saskatchewan, and at least a couple will be able to load the pipeline-competitive railbit crude. Canadian National's first unit train from Alberta, destined to PBF Energy's Delaware City, Del., refinery, operated in September but was assembled from several loading locations.

This slow pace owes a lot to misplaced faith in pipelines. By now, TransCanada's Keystone XL should have been transporting 730,000 barrels per day of oil from Alberta and picking up 100,000 of North Dakota crude as it passed through that state. But the XL is mired in politics and still years from completion, if it is ever approved. So frustrated is TransCanada's chief executive that he is talking to railroads (probably Canadian Pacific and Union Pacific) about hauling bitumen from Alberta to TransCanada's existing pipeline terminal in Steele City, Neb., on Union Pacific's Kansas City-North Platte, Neb., artery.

Kinder Morgan proposed expanding its 751-mile Trans Mountain pipeline between Alberta and Vancouver, B.C., from 300,000 to 890,000 bpd, but is being effectively blocked by a host of First Nations (Indian) tribes that don't want their lands disturbed. Trans Mountain is the only existing pipeline to the Pacific Ocean. Enbridge wants to build a 525,000 bpd pipeline from Edmonton to near Prince Rupert, B.C., but that is also opposed by the First Nations. Meanwhile, oil sands production hit 2 million barrels per day in 2013, on its way to doubling within 10 years, adding to the desperation of Canadian producers.

As a result, Canada's oil industry is about three years behind the North Dakota producers in embracing railroads. "Not until six months ago did producers start agreeing rail is cheaper," says Cairns, CN's vice president of oil products marketing. "They'd done take-or-pay agreements with pipelines and refused to admit they weren't right. If we all go pipeline, we have a predictable netback. Now producers are competing based on their choice of transportation. It's very different today."

RAILROAD BY RAILROAD

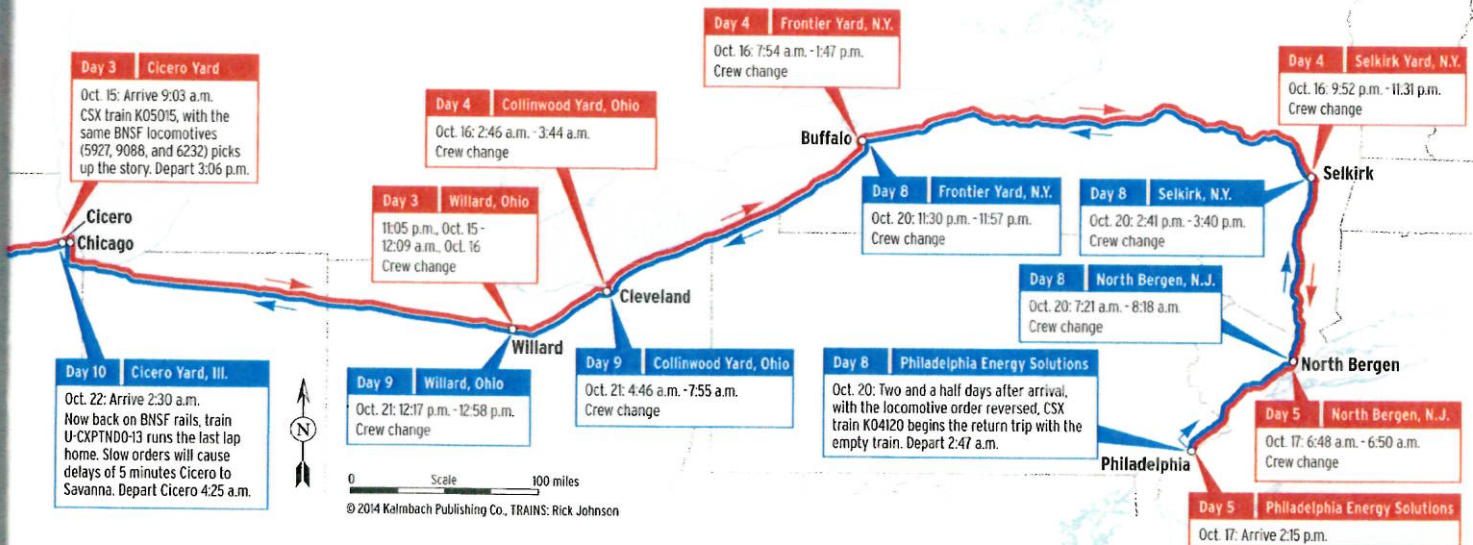
Cutting through the heart of the Bakken shale oil fields, BNSF Railway is the undisputed king of oil by rail in 2014. Heading west from the crew-change town of Minot, N.D., you encounter six oil-loading loops in the 133 miles to Trenton. Then just inside North Dakota from Montana on a branch line connecting the former Great Northern and Northern Pacific main lines is a seventh oil terminal in Dore. In the south of North Dakota are two more unit train terminals along the former NP route, one on the branch line



FOLLOW A CRUDE OIL TRAIN

At 12:15 a.m. on Oct. 13, 2013, a BNSF Railway crew reported for duty in Minot, N.D. The engineer and conductor were taken by van to a Savage Cos. oil-loading loop track in Trenton, N.D., 133 miles west, where they inspected the power and tested the brakes of a unit oil train. At 2:47 that Sunday morning, train U-TNDCXPO-13 departed eastward, with 103 loads of crude oil and a buffer car, weighing 14,631 tons and measuring 6,457 feet long, led by two General Electric ES44AC locomotives and an Electro-Motive SD70ACe. Destination: Philadelphia. Follow its 12-day journey there and back. — Fred W. Frailey

On Aug. 17, 2012, a BNSF Railway crude oil train rolls west across the causeway at Stink Lake west of Medina, N.D., on the former Northern Pacific Jamestown Subdivision. TRAINS: Tom Danneman





NS oil trains began serving PBF's Delaware City, Del., refinery in 2012. The facility can unload both light and heavy crude oil. Michael S. Murray

to Beulah, and an eleventh on the former Milwaukee Road main line.

Altogether these loading sites are capable of moving more oil than North Dakota produces. In late 2013 BNSF was loading about 600,000 barrels per day, Miller says, which at 70,000 barrels per unit train comes to between eight and nine trains a day. In round terms, 65 percent of that oil was headed to the Gulf Coast, 20 percent to the East Coast, and 15 percent to the West Coast.

The most popular of the 17 destinations this autumn was St. James, La., on the Mississippi River between New Orleans and

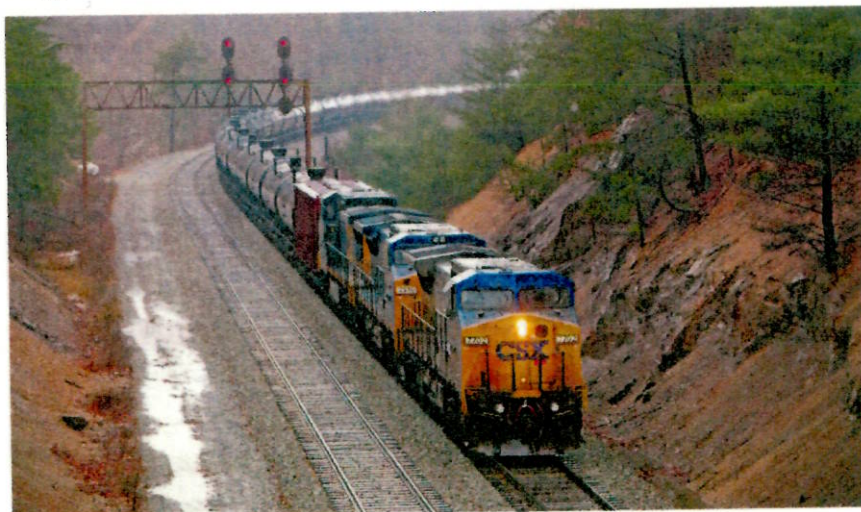
Baton Rouge, to two oil-distribution centers; these trains interchanged with Union Pacific in either Kansas City or St. Louis. Other ports of call getting between one and two trains a day included PBF Energy in Delaware City, Del., Tesoro's refinery on Puget Sound in Anacortes, Wash., and a terminal on the Mississippi River in Hayti, Mo., run by Marquis Terminals (the oil is barged to Gulf refineries). Once or twice a week a train heads to Amory, Miss., where BNSF gives it to Genesee & Wyoming subsidiary Alabama & Gulf Coast Railway for the run to a pipeline transfer station in Wal-

nut Hill, Fla., and ultimately to a Shell Chemical refinery in Saraland, Ala.

The interesting thing is that trains to any destination don't seem to originate at any single North Dakota loading site. In other words, the logistics companies that run these places appear to be competing to get the business from producers. Trains for Hayti, for instance, were observed late in 2013 being loaded in Berthold, Eland, Epping, Fryburg, Tioga, and Trenton.

This traffic and the dozens of cars of sand, pipe, and chemicals consumed each time a well is drilled obviously strains the railroad's capacity. By mid-2014, BNSF will double-track the Glasgow Subdivision from Minot to Ross, N.D., 61 miles, and in 2015 complete another 86 miles, to Snowden, Mont. In addition, staging tracks for unit trains were added in 2013 in both Minot and Glasgow, Mont. The Devils Lake Sub between Minot and Grand Forks, N.D., was on death watch in 2010, as its namesake body of water threatened to swallow the tracks. Then government money to raise the track (Amtrak's *Empire Builder* uses this route) and the appearance of the oil business changed everything; it is now getting rail, tie, and signal improvements. BNSF is routing some oil trains this way rather than over the more direct but crowded KO Subdivision between Minot and Fargo, N.D.

How BNSF serves California refineries remains to be seen. It can run oil trains directly to Oakland, Bakersfield, and the Long Beach area, but parts of that route



CSX's inaugural unit oil train destined to a new rail-marine transloading terminal at Yorktown, Va., passes White Sulphur Springs, W.Va., on Dec. 6, 2013. Chase Gunnoe



(such as the Oregon Trunk Subdivision) aren't built for speed and other parts (Keddie to Stockton, Calif.) use Union Pacific trackage rights. One development to watch is the joint venture at the Port of Vancouver, Wash., between refiner Tesoro and Savage Cos. When completed in 2014, it will be able to unload almost two unit trains a day (if expanded, four trains) and transfer the oil to barges or ships for delivery down the Pacific coast.

BNSF has also begun unit trains of oil fracked from Niobrara shale north of Denver. In late 2013 one such train originated about every four days on Watco's Swan



A northbound Canadian National train rolls through Hammond, La., on June 14, 2013. Look for CN to transition more oil traffic from manifest to unit trains in 2014. James Terrebonne

Ranch Railroad in Cheyenne, Wyo., destined for New Orleans. Swan Ranch is a transload and bulk handling site. And this October Great Western Railway of Colorado, an OmniTRAX line, began delivering trains to BNSF in Fort Collins. The initial destination was Stroud, Okla., near Cushing, on Watco's Stillwater Central Railroad.

Canadian National had the foresight in 2006 and 2007 to buy four short lines in western Alberta that pass through the oil sands region and subsequently invested another quarter of a billion dollars improving its acquisitions. It is the only railroad connecting Alberta to the U.S. Gulf Coast. "If you have a single-line haul you'll receive better service, which translates to lower costs," Cairns says. "Two hands in the cookie jar tends to be more pricey." (Unit trains to the Pacific Ocean ports of Vancouver and Prince Rupert would seem to

be a no-brainer, but Cairns says no credible plans are afoot by shippers.)

An early CN convert to rail was Southern Pacific Resource, which inked a long-term agreement with the railroad in 2012 to put railbit oil on CN manifest trains from Lynton, Alta., to Natchez, Miss., 85 miles above Baton Rouge on the Mississippi, there to be transloaded onto barges for delivery to refineries downriver. Southern Pacific Resource envisions volume of more than 12,000 cars a year (barge is a popular way to get oil from railroads to refineries, because most refiners in that region have offloading abilities from water). Up to this point, CN has carried oil almost exclusively as cuts of tank cars in its scheduled trains. This will change rapidly in 2014, Cairns reports.

One drop spot on the Gulf Coast to watch is the ambitious Arc Terminals development in Mobile, Ala. It presently takes up to 50 cars a day of raw bitumen, heats and unloads it, then sends it to storage tanks or to heated barges, for delivery to refineries. Starting in 2014 it will handle unit trains of raw bitumen, presuming there is somewhere to heat and load the bitumen in Alberta. "We are a big believer in CN direct service," says Darrell Brock, head of business development for Arc. "There's no way to get to the Gulf cheaper or quicker."

Of course, all this begs an answer: What will CN do if Alberta-Gulf Coast really succeeds? Can you imagine a dozen unit oil trains a day heading down the hallowed Main Line of Mid-America from Chicago to Louisiana? CN spent \$70 million in 2013 above its original intent to add capacity between Edmonton and Winnipeg, including yard track extensions in Winnipeg and Saskatoon, Sask., extended sidings, and sections of double track. The U.S. portion of CN's Oil Highway



The entire seven-unit roster of the Stewart Southern Railway teams up to deliver an 80-car unit oil train to Canadian Pacific at Regina, Sask., on Feb. 11, 2013. David Onodera



Union Pacific's 78-car oil train rolls north through Casmalia, Calif., on Feb. 23, 2013. The train is headed back to Wunpost, Calif., for reloading. *John Roskoski*

BEFORE NORTH DAKOTA, CALIFORNIA SHOWED THE WAY

For motorists stopped at a grade crossing, watching a parade of black oil cars slowly going by is an exercise in patience (while their waiting automobiles burn fuel that will have to be replenished — perhaps even by the train delaying them).

Yet such sights are not new. Crude oil trains have been around for more than a century. And perhaps the most famous example in the latter half of the 20th century was Southern Pacific's "Oil Cans." Oil from California's San Joaquin valley was loaded into tank cars at Saco, a half-dozen miles north of Bakersfield, then moved by unit train south through the Tehachapi mountains and Los Angeles to a Shell Oil refinery in Wilmington, Calif. The train grew out of Shell's need to supply its LA-area refinery with large volumes of heavy crude, using a less expensive method than the tanker ships from Alaska it had been relying on. The oil train ran from 1983 to late 1997, when a pipeline replaced the rail operation.

On May 30, 1998, a new version of the Oil Cans began operating, on a new routing that uses Union Pacific's scenic, ex-SP Coast Line. Symbolized OWPDO, the train originates at Wunpost, in the San Ardo oil field, about 30 miles north of Paso Robles, Calif., headed for a Valero oil refinery in Wilmington. This move also had been previously made by ship, until the marine terminal serving the oil field shut down.

Three General Electric high-horsepower locomotives on the head end (DPUs are rare) typically power the train, which consists of 78 tank cars, in six strings of 13 semi-permanently connected groups. The train can hold 1.8 million gallons of oil. The 300-mile trip takes about 12 hours, including a stop at Dolores Yard in Los Angeles, where a yard crew will get on to take the train to Wilmington.

The loaded train runs about every third day, on a schedule that sends it south in the middle of the night, when the line is free of passenger trains. Likewise, the empty northbound (symbolized ODOWP) is also a night crawler, except on weekend runs when it can be found working its way back home in daylight. — *Bob Miller, a freelance writer from California*

hasn't gotten such loving care.

Canadian Pacific dispatches one to two unit trains a day from three loading terminals in North Dakota. One is in New Town, at the end of a 111-mile branch line, and a second one is nearby at Van Hook. The third is at Stampede, on the Dakota, Missouri Valley & Western Railroad. CP crews move the trains between Stampede and a junction of the two railroads at Flaxton,

N.D., just below the Canadian border. In late 2013 about three-fourths of the oil trains ran to a Global Partners rail-barge terminal in Albany, N.Y., on all-CP routings, the Stampede trains via Canada and the New Town and Van Hook trains via Chicago, Windsor, Ont., and Montreal. The remaining CP trains were billed to the Philadelphia Energy Solutions refinery in South Philadelphia, using CSX via Selkirk,

N.Y., and northern New Jersey.

CP also dispatches a Bakken shale unit train, received from short line Stewart Southern at Regina, Sask., every other day or so. Most go to Global in Albany, but a new destination is Port Westward in Clatskanie, Ore., near Portland, via BNSF from Vancouver, B.C. (CP would not talk to TRAINS for this article.)

CSX Transportation and Norfolk Southern play similar roles, competing from Chicago for primacy at the Delaware River refineries. Both BNSF and CP hand oil trains to CSX for Philadelphia Energy Solutions, a refiner that CSX serves exclusively. CSX also gets from BNSF trains for Cleveland (where they are transloaded onto boats for Irving Oil's refinery in Saint John, N.B.) and Albany (to a Buckeye Partners distribution hub). In December 2013, CSX began delivering oil to a Plains All American Pipeline distribution hub in Yorktown, Va.

Norfolk Southern exclusively serves the PBF Delaware City refinery, which has installed a second loop track. Unit trains, received from BNSF in Chicago, run four or five days a week. A second, less frequent BNSF-fed unit train serves a Sunoco Logistics distribution center in Westville, N.J., near Camden, on Conrail Shared Assets. NS puts less-than-unit train loads from CN and CP onto manifest trains to Conway Yard near Pittsburgh, where they are consolidated into unit trains for Delaware City. (This is the only refinery in the region with a coker, enabling it to handle oil sands crude).

Up for grabs are three East Coast oil customers, two near Philadelphia, that haven't tipped their hands toward a rail provider. One is the Trainer, Pa., refinery, bought by a Delta Air Lines subsidiary to produce jet fuel. Nearby, Eddystone Rail Co. is developing a distribution hub on land that once was part of the Baldwin Locomotive Works complex. The third is the Phillips 66 Bayway refinery in Linden, N.J., whose rail hub will open in mid-2014. All three will be served by Conrail.

For both CSX and NS the crude oil is a welcome offset to the decline in coal loadings in the eastern U.S. "But I wouldn't say it makes up for it," says NS's Moorman. "It is healthy revenue, and we want as much as we can get."

Kansas City Southern is a potential artery for large volumes of oil from Alberta, particularly through its connection in Kansas City with Canadian Pacific. So far, the oil has come in cuts of cars rather than unit trains, the gateways being Jackson, Miss., for Canadian National and KC for CP. KCS will share primacy with BNSF and UP in a new Port of Beaumont rail terminal in southeast Texas that can drain 120 tank cars at a time



and will soon be ready to heat coil cars of raw bitumen. But KCS is also developing (with an unnamed third party) an exclusive terminal in Port Arthur, Texas, that will permit barge delivery along the Gulf Coast or export of Canadian oil (by law, U.S. oil cannot be exported). Says Darin Selby, the railroad's energy marketer: "Our goal is more." Who wouldn't approve of that?

Union Pacific has a problem. Two-thirds of its oil volume comes from the trains it gets from BNSF Railway for St. James, La. But that traffic could disappear. It's cheaper for Gulf refiners to obtain close-in light sweet crude from Texas. On Union Pacific's agenda: Partner with Canadian Pacific to move Canadian oil to California or Washington via their connection in Eastport, Idaho; find shippers in the Niobrara shale formation in Colorado and Wyoming; and carry oil from the Permian Basin in West Texas to California refineries. Will these come to pass? "We're in the very early innings of this story," Rob Knight, chief financial officer, told an investment conference in 2013.

AWAKEN, LAZARUS!

Finally, don't forget the regional railroads and short lines, including the *really* short lines, starting with W. B. Johnston Grain in Shattuck, Okla., astride the BNSF Transcon. On average, two or three cars a day of crude oil are loaded there by producers who lack pipeline access, the switching being done by a modified Electro-Motive alumnus named Pistol Pete.

Fracking brought moribund railroads in Texas to life. Texas Pacific Transportation, the southern U.S. end of Arthur Stilwell's fabled Kansas City, Mexico & Orient, was a 1,000-car-a-year operation limited to 5 mph on many of its 376 miles from San Angelo Junction to Presidio on the Mexican border, until fracking began in southwest Texas. It expected 30,000 carloads in 2013, thanks to crude oil going out and drilling supplies heading in. The 19-mile Pecos Valley Southern Railway in west Texas mainly served its owner's sand and gravel pit until Watco leased the property in 2012 and began signing up oil producers as new customers.

Led by the New York Central heritage unit, NS oil empty Z5R rolls through Wilmerding, Pa., on Nov. 1, 2013. Robert Shook

The Utah Railway (a G&W property) loads about 20 cars a week of "waxy" crude that looks and feels like shoe polish, in Wildcat, Utah, near Martin. The oil is found in the Uinta Basin of western Colorado and eastern Utah and must be heated to flow. At least one unit train of waxy oil was observed in late 2013 crossing UP, CSX, and Pan Am Railways, en route to Canada.

Or consider the fortunes of two Iowa Pacific Holdings affiliates, the Texas-New Mexico and West Texas & Lubbock railroads. The 104-mile TNM, connecting with UP in Monahans, Texas, benefits from oil producers who aren't convenient to pipelines. And the WT&L has among its customers the Swiss trading company Mercuria, which found a market among refiners for pure light sweet crude that hasn't been contaminated in pipelines, and is shipping trainloads of the stuff to its storage tanks on the Houston Ship Channel. See, yet *another* reason crude oil is going by rail. **I**