# Trends in Sources of Crude Oil
# 2014 IEPR Workshop

## California Petroleum Overview & Background

Berkeley City College, Berkeley, CA

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# Energy Commission – Data Collection

- Data collection related to petroleum and transportation fuels activities stem from authority under the Petroleum Industry Information Reporting Act or PIIRA
- Confidentiality provisions of regulations linchpin of ability to routinely obtain business sensitive information, as well as ad hoc requests for confidential information
  - Unplanned refinery outages, pipeline closures, etc.
- Encompass several reporting entities
  - Refiners, importers, exporters, terminal operators, pipeline companies, and retail stations
- Annual, monthly, and weekly data collection

# Rail-Related Data Collection

- Energy Commission data collection has recently expanded to include shipments into California via rail tank cars
- Two sources of information reported monthly
  - Union Pacific and Burlington Northern Santa Fe
  - Refiners
- Railroad data
  - Originating point (state or province)
  - In some cases a specific loading terminal is identified
  - Commodity code (crude oil, ethanol, biodiesel, propane, butane, and other petroleum products)
  - Volume of commodity per rail tank car
  - Delivery point within California

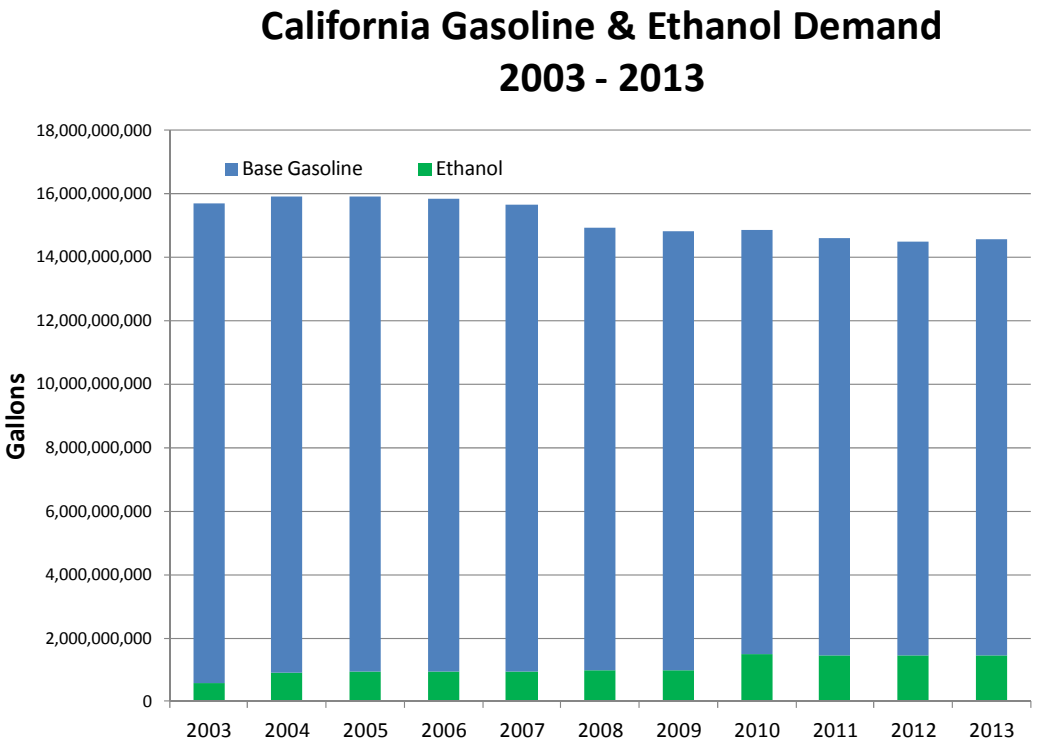
# Rail-Related Data Collection

- Rail-related data does not include:
  - In-state routing of rail tank cars
  - Type of crude oil transported
    - Canadian heavy
    - Light crude oil from shale formation like Bakken
    - Light synthetic crude oil from Canadian upgraders
  - Density of crude oil or weight of each rail tank car cargo
  - Title holder of the commodity
- There is no rail-related data provided to CEC prior to train shipments into California
  - DOT Emergency Order from May 7, 2014 is related to single train shipments containing at least 1,000,000 gallons of Bakken crude
    - Provided to the State Emergency Response Commissions Contact, OES

# Transportation Fuel Infrastructure Overview

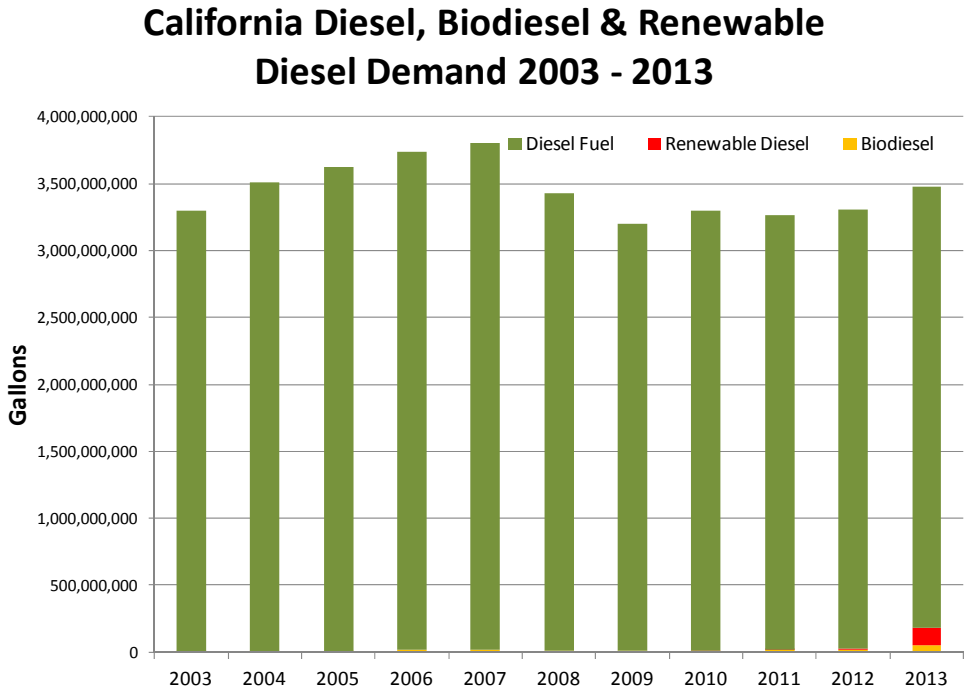
# California On-road Transportation Fuels

- 14.54 billion gallons of gasoline consumed in 2013
- Base gasoline demand down 13.4 percent between 2003 and 2013
  - Ethanol use increasing due to Renewable Fuel Standard
  - Ethanol use up to 1.46 billion gallons during 2013
  - 148 percent increase since 2003
  - Ethanol accounted for 10 percent of total gasoline gallon during 2013



# California On-road Transportation Fuels

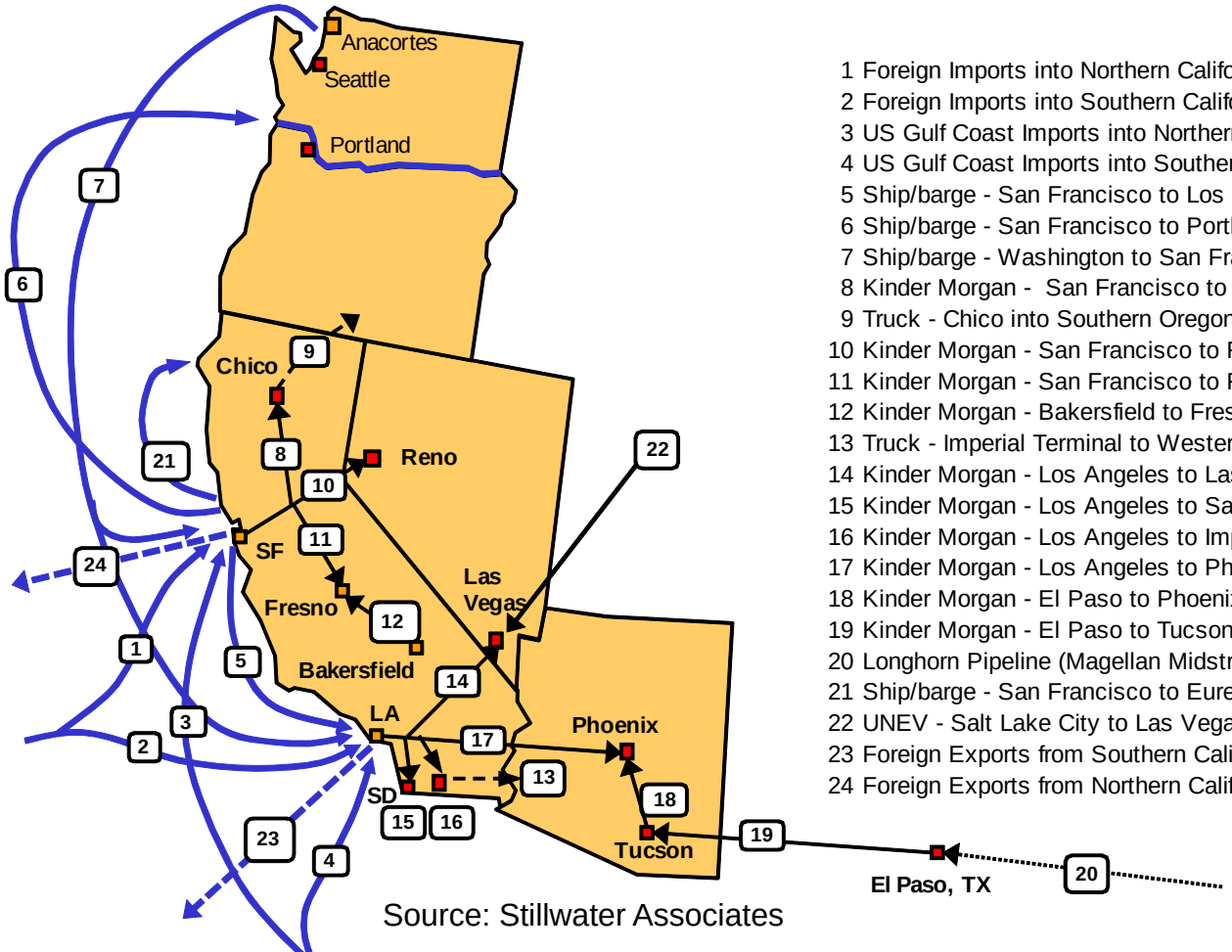
- 3.48 billion gallons diesel consumed during 2013
- Base diesel fuel demand unchanged between 2003 and 2013
  - Biodiesel use increasing due to Renewable Fuel Standard and the Low Carbon Fuel Standard
    - 49 MM gallons during 2013
  - Renewable diesel fuel use up to 136 MM gallons during 2013 due to LCFS
  - Combined renewable component accounted for 5.3 percent of total diesel gallon



# Fuel Infrastructure – Key Elements

- The California transportation fuel "infrastructure" consists of several interconnected assets operated by a combination of refiner and third-party companies
  - Refineries
  - Pipelines
  - Marine terminals
  - Storage tanks
  - Rail
- Crude oil and petroleum product infrastructure assets are separate and distinct from one another – not interchangeable
- Unlike with the electricity distribution system, Northern California is not directly connected to Southern California

# Western States – Fuel Flows




1 Foreign Imports into Northern California
2 Foreign Imports into Southern California
3 US Gulf Coast Imports into Northern California
4 US Gulf Coast Imports into Southern California
5 Ship/barge - San Francisco to Los Angeles
6 Ship/barge - San Francisco to Portland
7 Ship/barge - Washington to San Francisco and Los Angeles
8 Kinder Morgan - San Francisco to Chico
9 Truck - Chico into Southern Oregon
10 Kinder Morgan - San Francisco to Reno
11 Kinder Morgan - San Francisco to Fresno
12 Kinder Morgan - Bakersfield to Fresno
13 Truck - Imperial Terminal to Western Arizona
14 Kinder Morgan - Los Angeles to Las Vegas
15 Kinder Morgan - Los Angeles to San Diego
16 Kinder Morgan - Los Angeles to Imperial
17 Kinder Morgan - Los Angeles to Phoenix
18 Kinder Morgan - El Paso to Phoenix
19 Kinder Morgan - El Paso to Tucson
20 Longhorn Pipeline (Magellan Midstream Partners, L.P.)
21 Ship/barge - San Francisco to Eureka
22 UNEV - Salt Lake City to Las Vegas
23 Foreign Exports from Southern California
24 Foreign Exports from Northern California

Source: Stillwater Associates

# Key Elements - Refineries

- 3 primary refinery locations
- 13 refineries produce transportation fuels that meet California standards
- 8 smaller refineries produce asphalt and other petroleum products
- California refineries provide majority of transportation fuel to neighboring states
- Process over 1.6 million barrels per day of crude oil

# Key Elements - Refineries

- Refineries are a primary hub of logistical activity
  - Raw materials imported & finished products shipped
- Crude oil receipts during 2013 received by
  - Marine vessels (foreign) - 866.1 TBD
  - Marine vessels (Alaska) – 201.7 TBD
  - Marine vessels (other domestic) – 4.4 TBD
  - California source via pipelines – 627.0 TBD
  - Rail/truck – 3.5 TBD
- Process units operate continuously at or near maximum capacity, except during periods of planned maintenance or unplanned outages

# Key Elements – Refineries (cont)

- Output from the refineries is usually placed in intermediate tanks prior to blending the finished products
- The majority of gasoline, diesel and jet fuel is shipped from the refinery by pipeline to over 60 distribution terminals
- Tanker trucks then transport fuel to retail & non-retail stations
- Several truck trips during 2013
  - Gasoline – 39.84 MM gal/day
    - 4,980 tanker deliveries/day
  - Diesel fuel – 9.53 MM gal/day
    - 1,191 tanker deliveries/day

# Key Elements – Pipelines

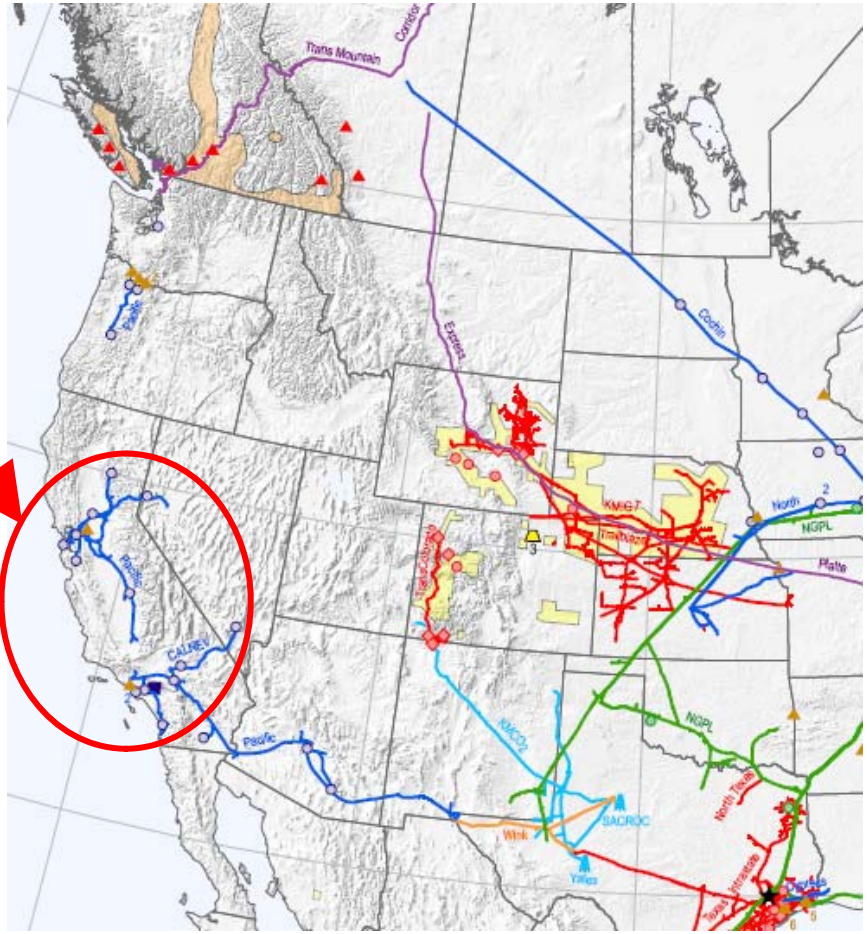
- Pipelines are used throughout the distribution infrastructure to interconnect key elements
- Intra-state pipelines are used to convey petroleum products within California's borders
- Interstate pipelines are used to export transportation fuels to Arizona and Nevada
  - NV – Over 90% of supply
  - AZ – Over 50% of supply
- As is the case with refineries, pipeline systems normally operate on a continuous basis
- Pipelines can only operate if transportation fuels are available to push liquid through the system

# Key Elements - Pipelines (cont)

- The pipeline infrastructure in California is controlled by a combination of common carrier and private companies
- Kinder Morgan is the sole common carrier of petroleum product pipelines in the State and transports the majority of transportation fuels through its system every day
- Other private companies, such as Chevron, ExxonMobil, Shell, and Tesoro operate some proprietary systems or segments that handle the balance of transportation fuels

# Key Elements - Pipelines (cont)

- Kinder Morgan's Northern California system is not connected to its Southern California system.
- Fuel re-supply by pipeline from Southern California not possible
- Tanker trucks quickest, viable option to bring in additional fuel



# Key Elements – Marine Facilities

- Marine facilities are located in sheltered harbors with adequate draught to accommodate typical sizes of petroleum product tankers and crude oil vessels
- Wharves usually have adjacent storage tanks that are used to temporarily hold petroleum products prior to transfer to a subsequent location
- Most refiners operate a proprietary dock
- Third party storage provides access to majors and independents
  - Kinder Morgan
  - Pacific Atlantic
  - NuStar
  - Petro-Diamond

# Rail Logistics - Ethanol

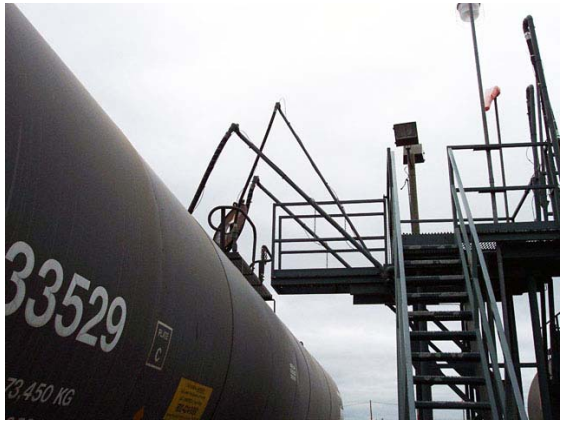
- State receives ethanol via rail unit trains at two locations
  - Lomita Rail Terminal in Carson
  - West Colton Rail Terminal
- Ethanol is then trucked to gasoline distribution terminals
  - – 4.0 MM gal/day during 2013 or 500 tanker truck deliveries/day

# Rail Logistics - Ethanol

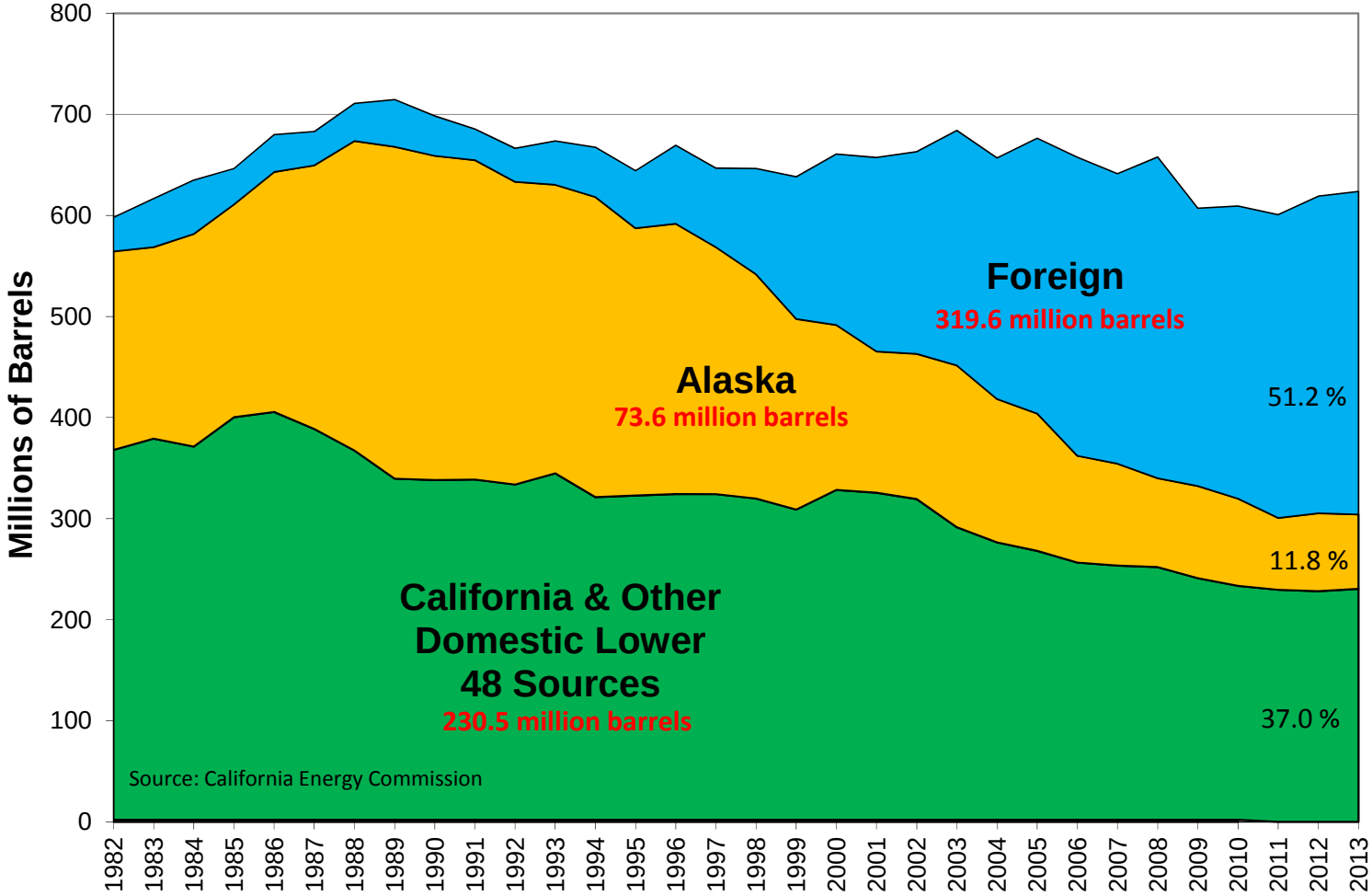
- Northern California has no facilities to receive unit trains of ethanol following the conversion of the KinderMorgan Richmond rail yard from ethanol to crude service during September of 2013
- Current federal and state regulations require 10% ethanol in gasoline

# Rail Logistics – Other Uses

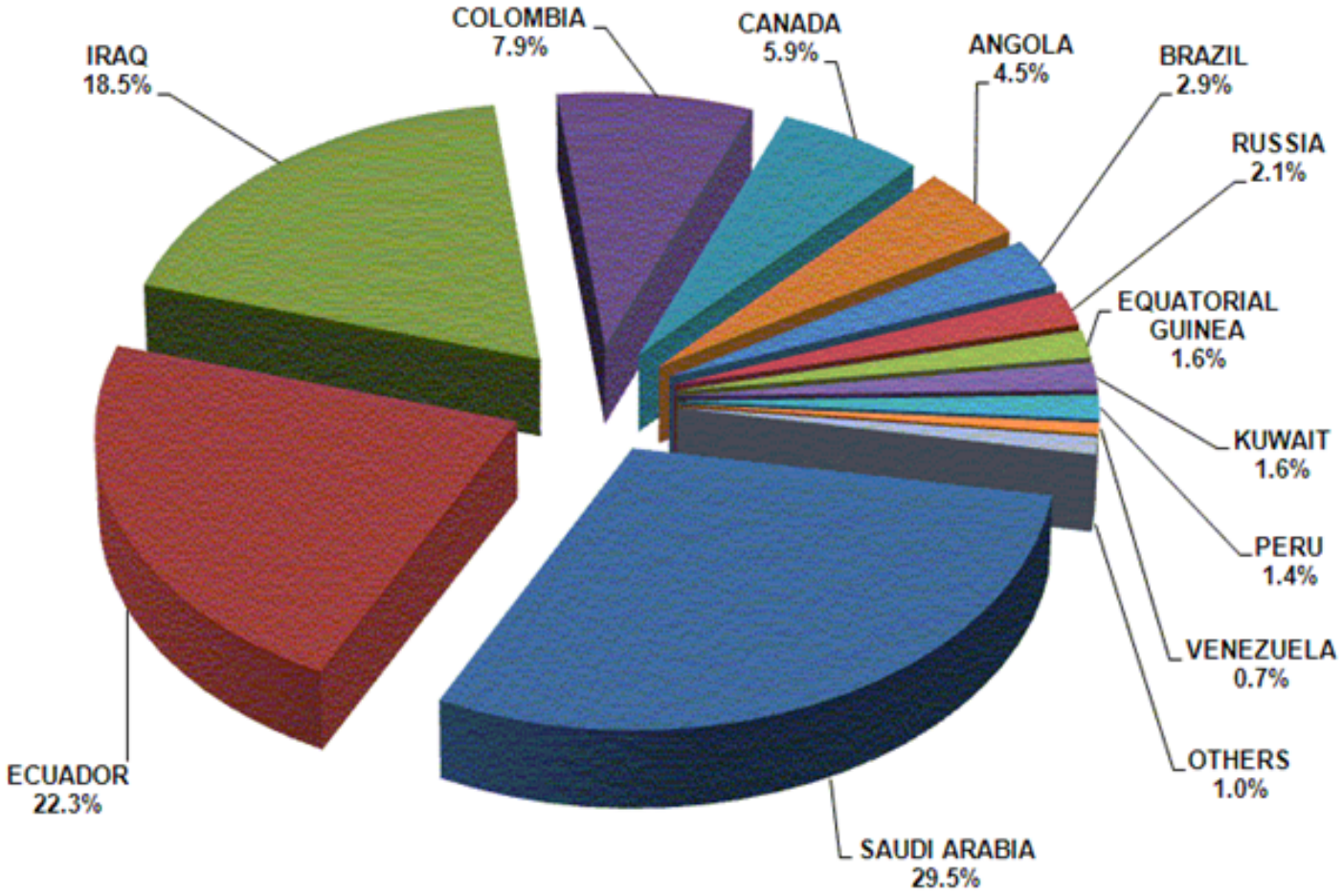
- Refiners use rail cars to routinely ship propane and seasonally send out and receive butane
- Rail cars are also used to deliver refinery feedstock such as gas oils and sulfuric acid for alkylation units
- More recently, California refiners have started using rail cars to import crude oil from Canada and domestic sources outside the state due to changing trends of increasing oil production and discounted prices




# California Refineries – Crude Oil Sources

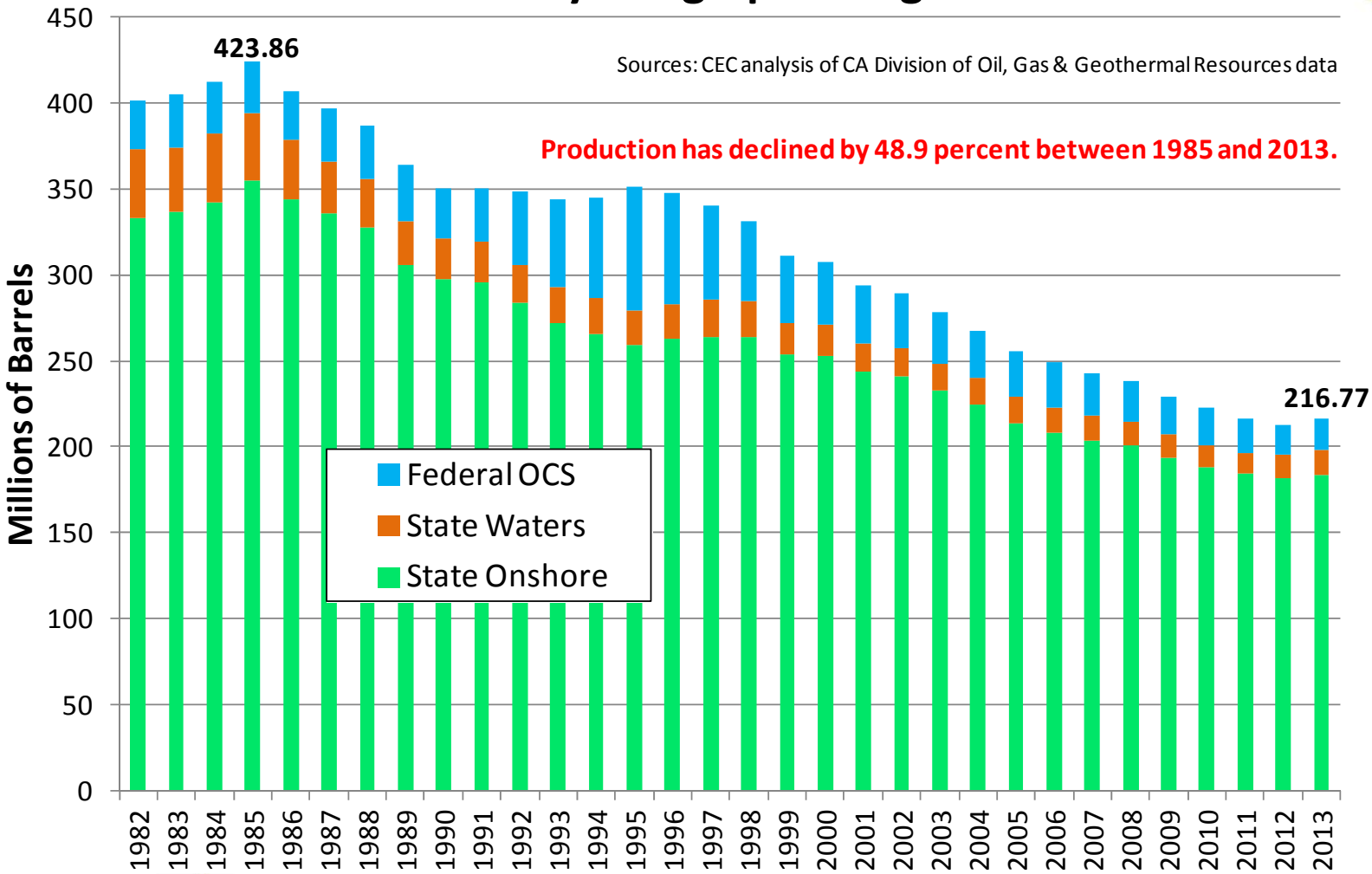


# Foreign Sources of Crude Oil Imports to California 2013



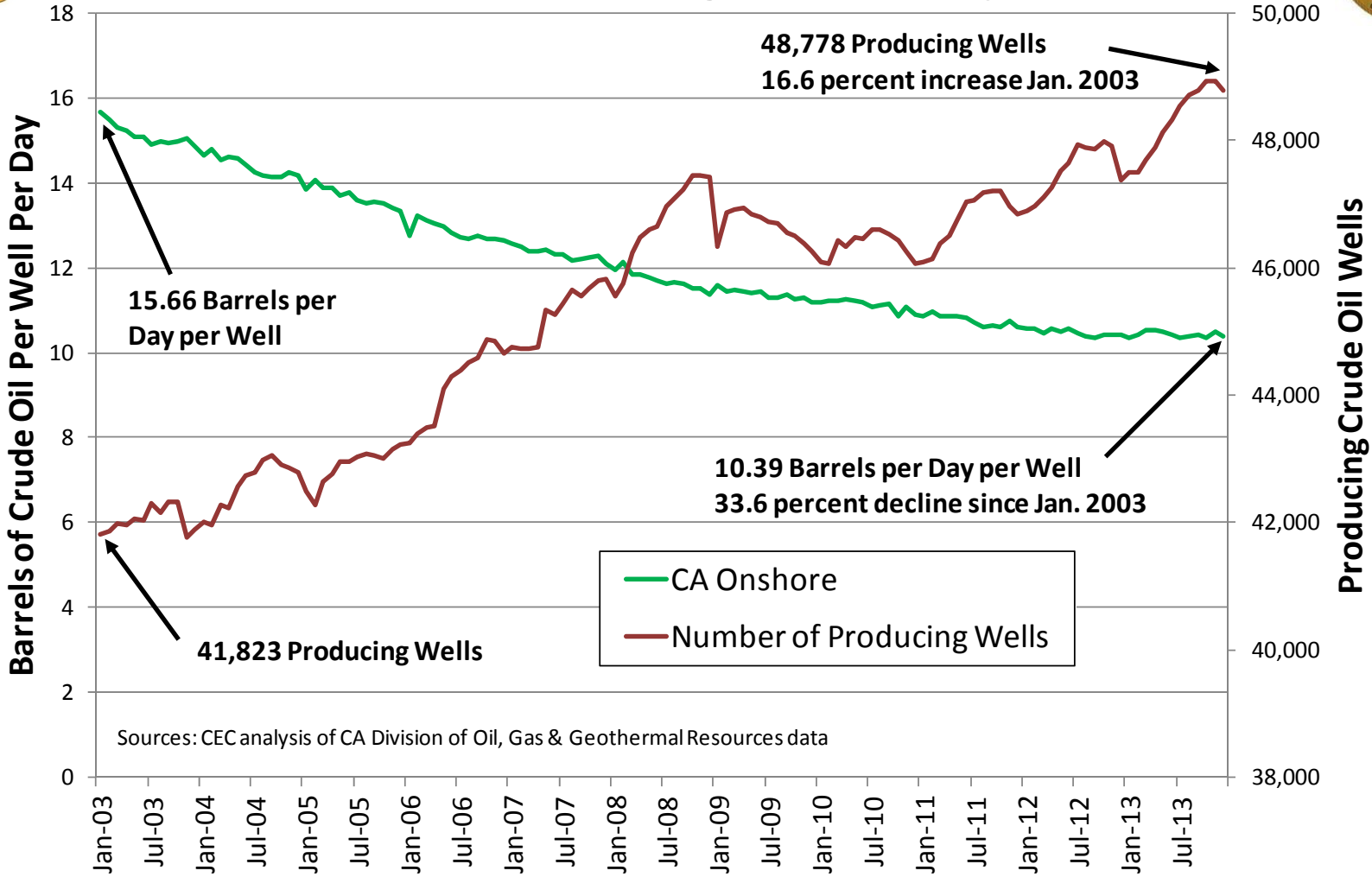

Source: Energy Information Administration (EIA), Company-Level Imports.

# California Crude Oil Production Source By Geographic Region



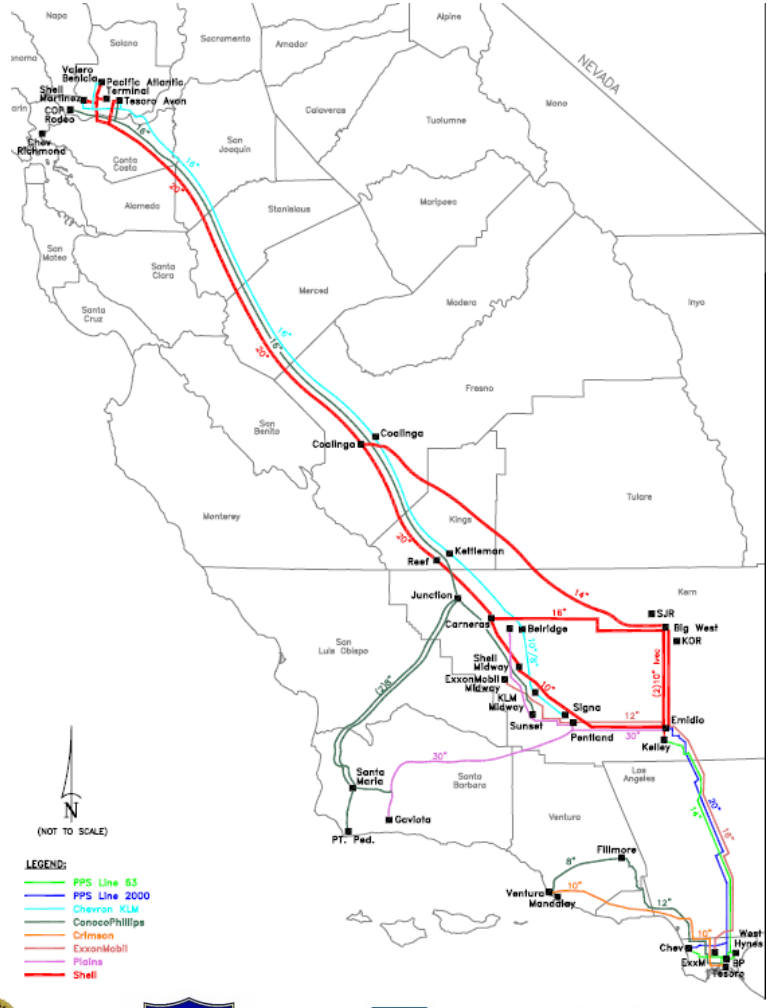
# California Crude Oil Production

## Onshore - Producing Wells & Output

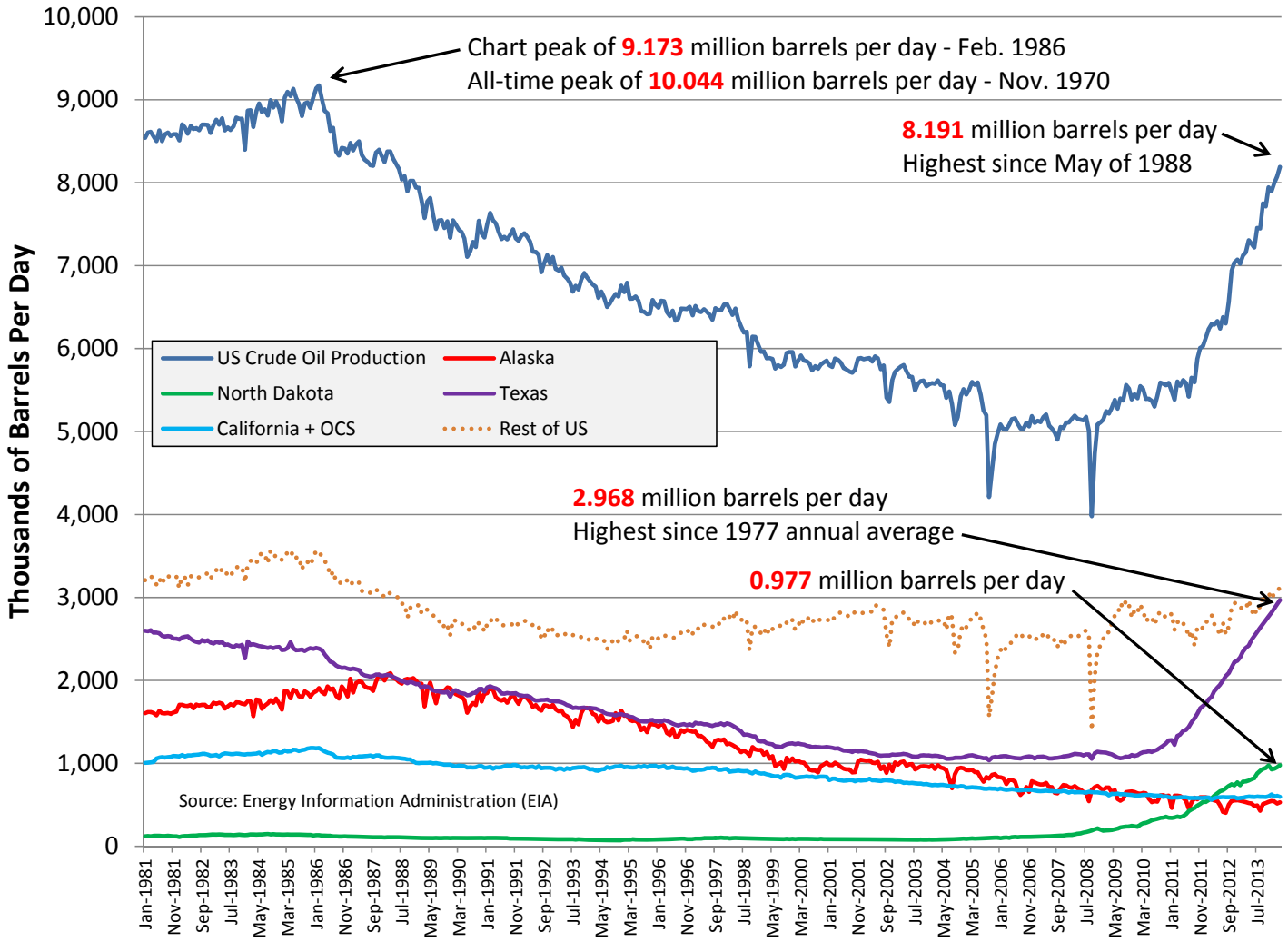


# Crude Oil Sources – Bay Area Refineries

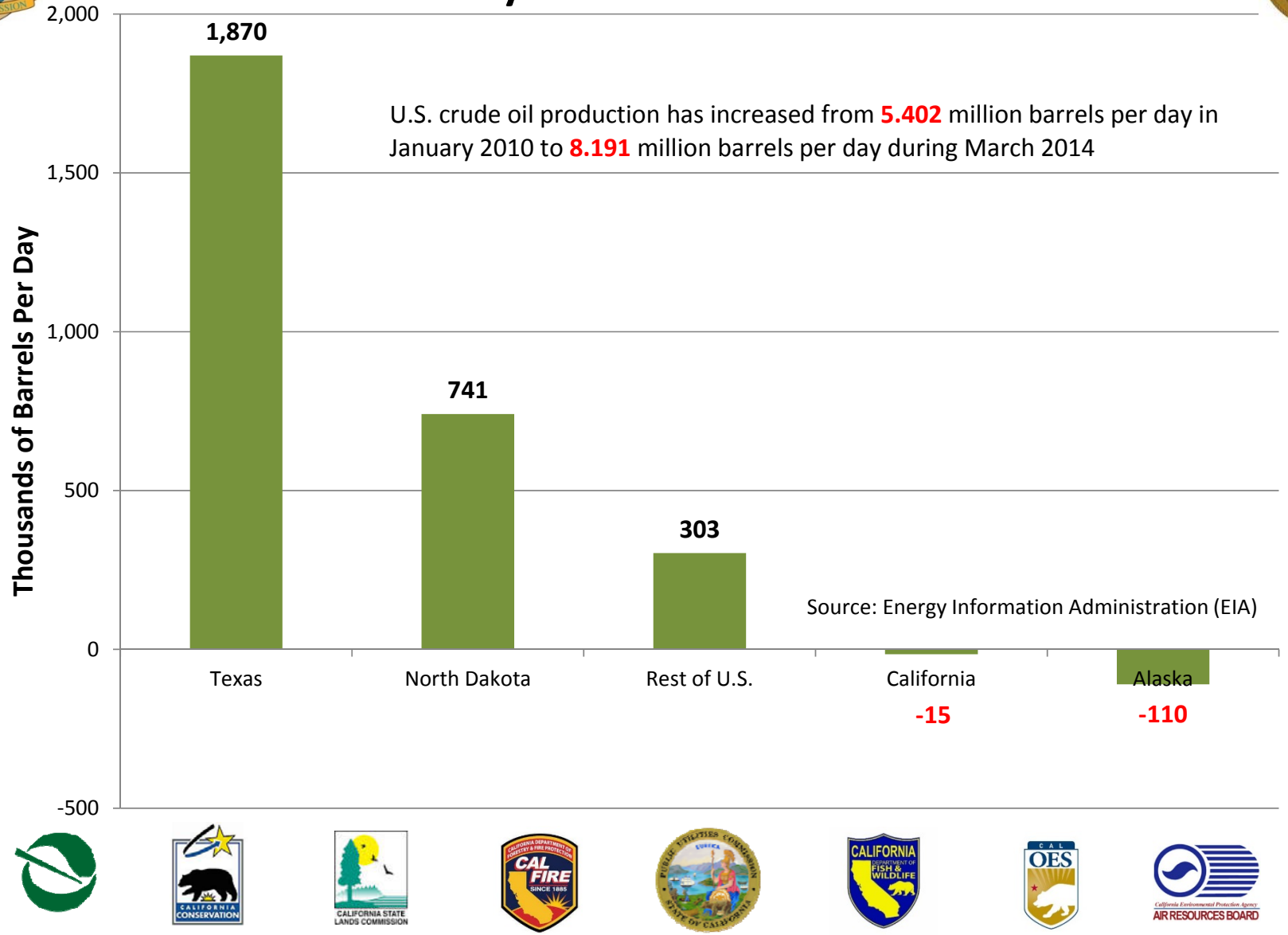
- Northern California refineries processed 642.2 thousand barrels per day of crude oil during 2012
  - 316.0 TBD foreign marine imports
  - 247.8 TBD pipeline shipments
  - 77.8 TBD ANS marine imports
  - 0.6 TBD rail imports
- Bay Area refineries processed 39.5 percent of total crude oil
- Increased crude-by-rail likely to back out marine receipts of similar quality
- Rail capability increases flexibility to enhance supply options & reduces risk of crude oil receipt curtailment



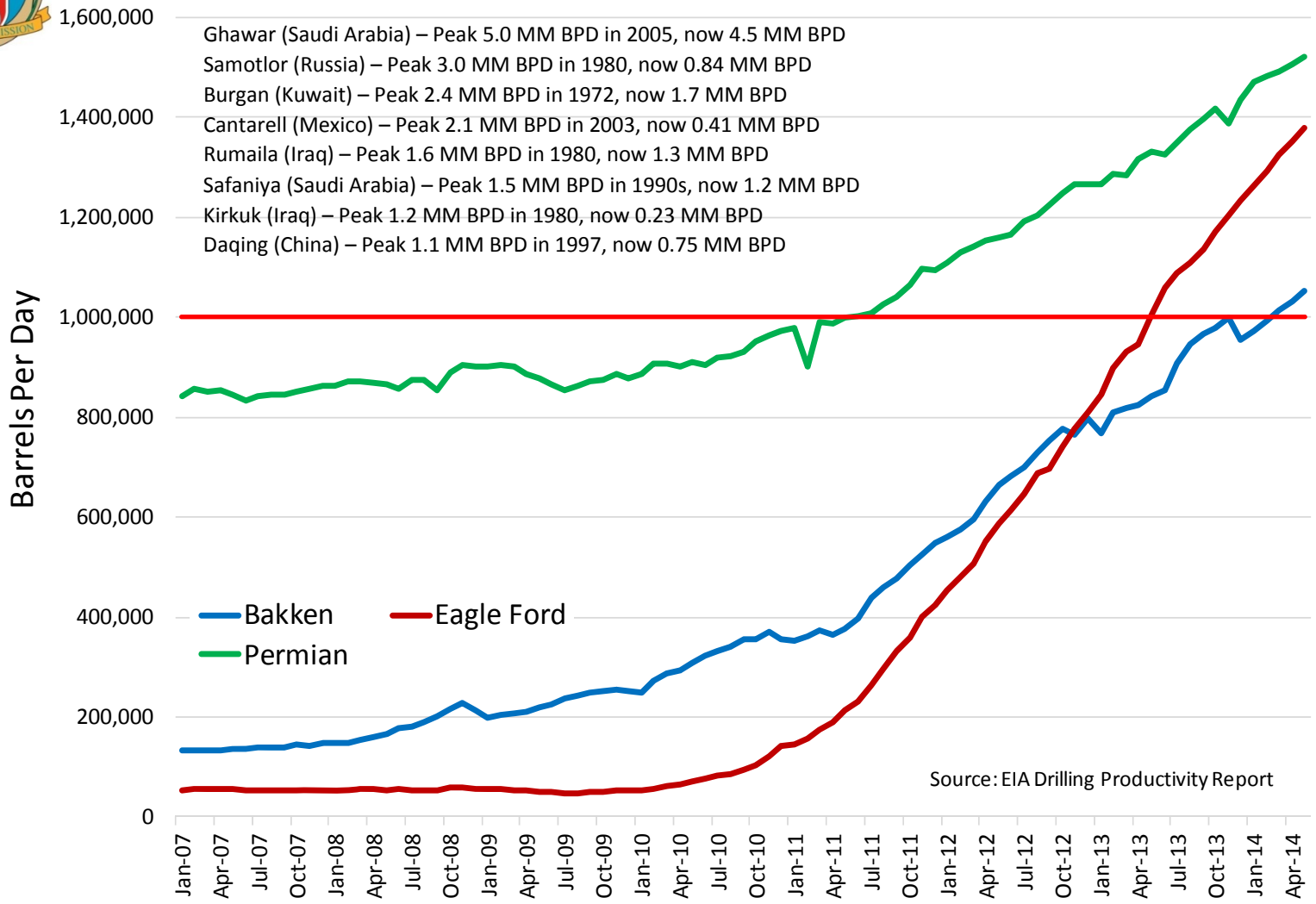
# U.S. Crude Oil Production Rebounding



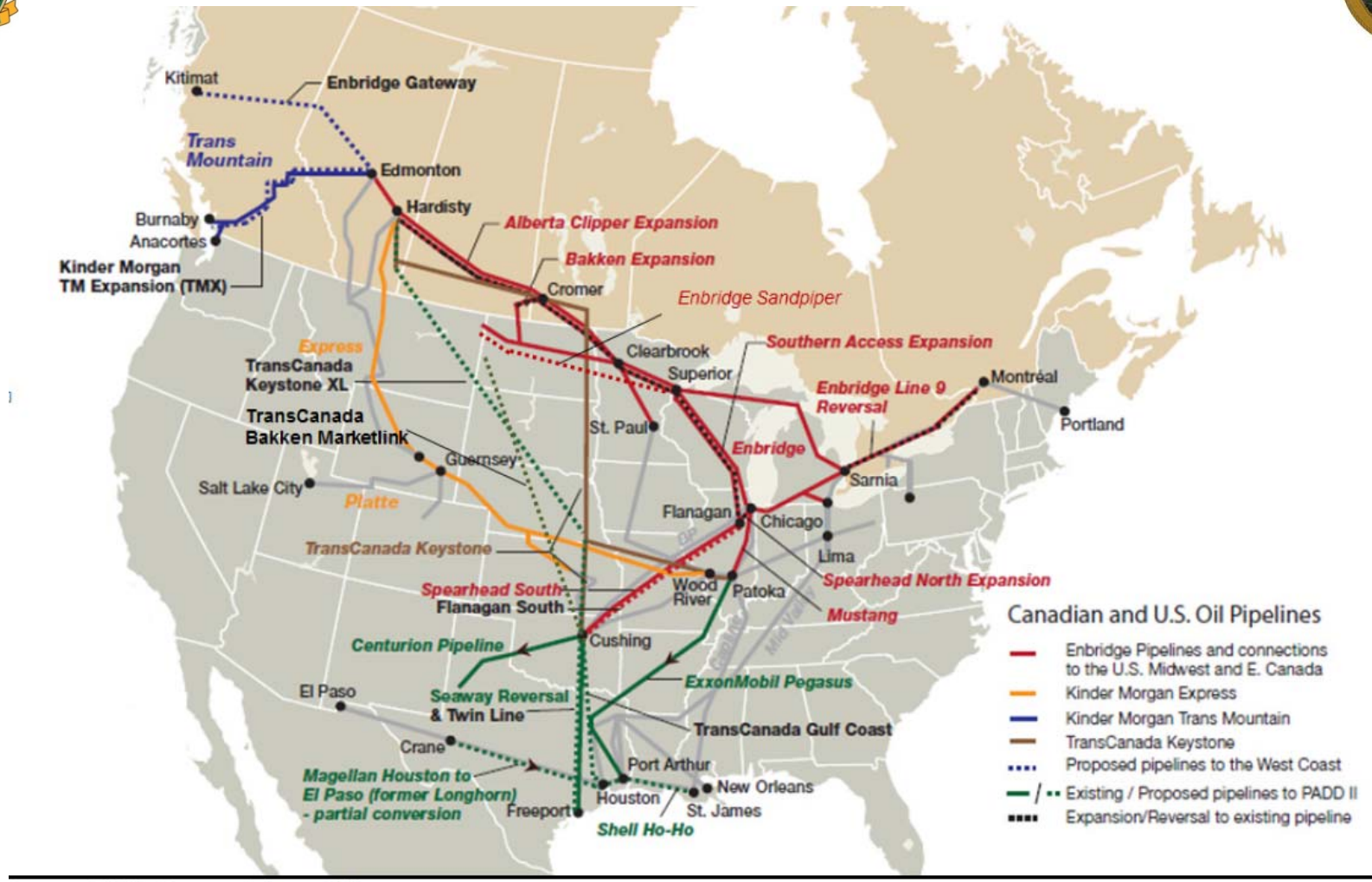
# Change in Crude Oil Production
# January 2010 vs. March 2014



# U.S. Tight Crude Oil Production Surging



# Crude Oil Pipeline Projects

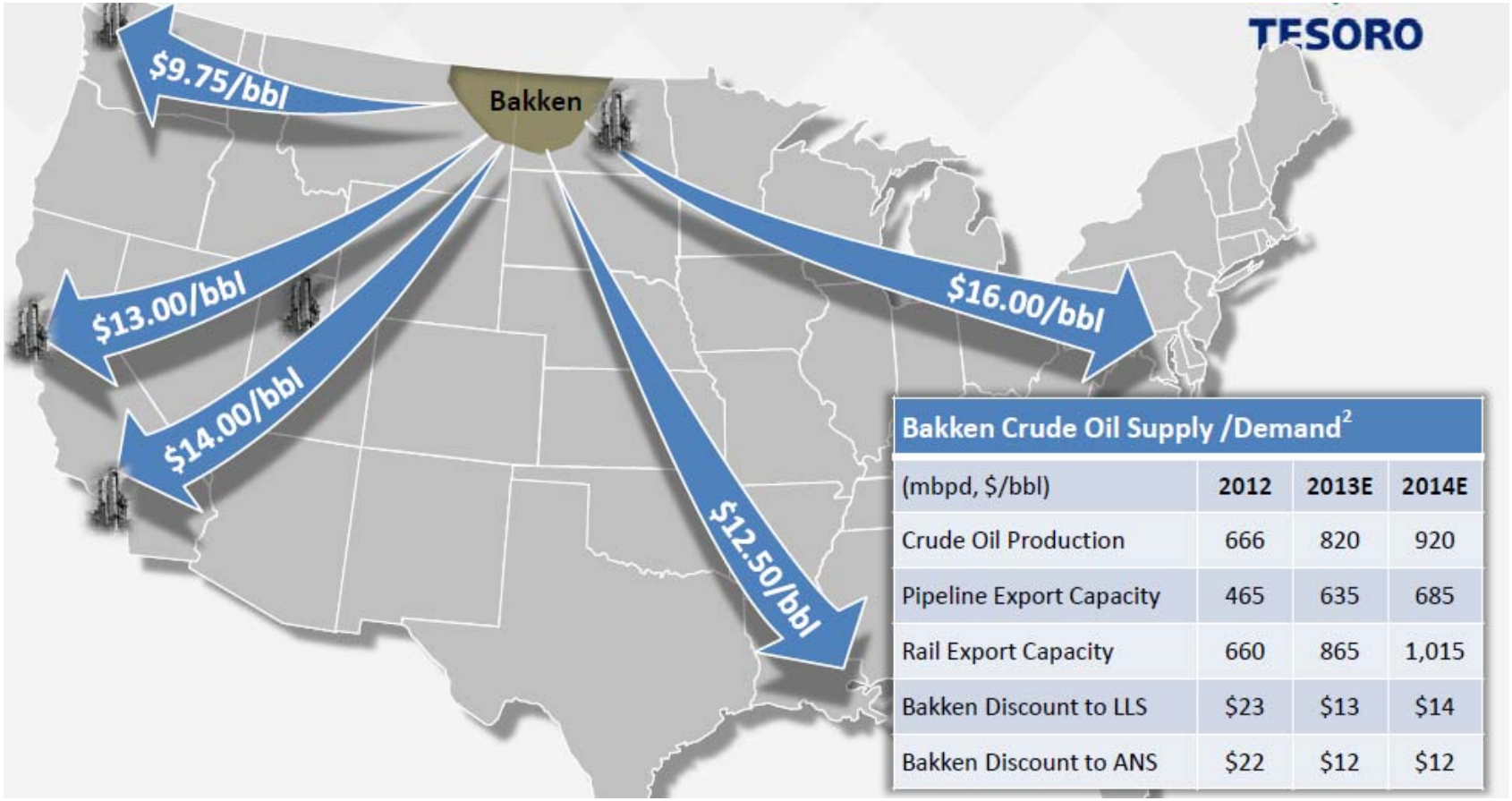



Source: CAPP, Raymond James Ltd.

# Crude Oil – Export Restrictions

- Domestically-produced crude oil exports to foreign destinations are allowed under specific "license exceptions" identified under federal statute. Those primary exceptions include:
  - Alaska crude oil shipped on the Trans-Alaska Pipeline System (TAPS) and exported via a Jones Act vessel directly from Valdez Harbor
  - California heavy crude oil production with API gravity of 20.0 degrees or lower, limit of no more than 25,000 barrels per day
    - First export license for California heavy crude oil was granted on December 9, 1991 – no heavy crude oil exports for several years
  - Exports of domestic crude oil to Canada for processing by Canadian refineries
  - Exports in connection with refining or exchange of Strategic Petroleum Reserve crude oil
- Companies can also apply to the federal Bureau of Industry and Security (BIS) for an export license that basically requires Presidential approval

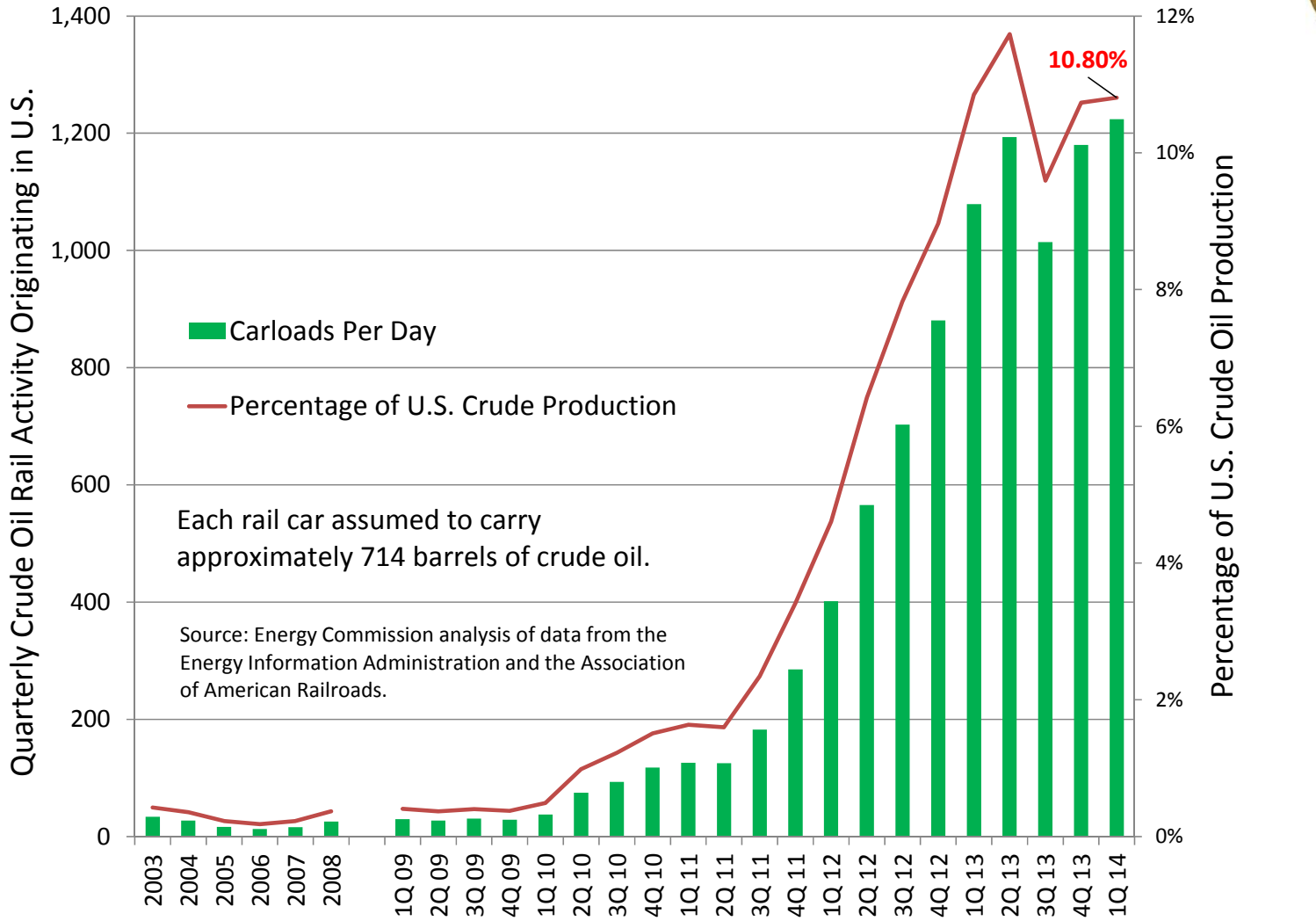
# Crude Oil Discounts Enable Rail Shipment




| Bakken Crude Oil Supply /Demand[2] | | | |
|---|---|---|---|
| (mbpd, $/bbl) | 2012 | 2013E | 2014E |
| Crude Oil Production | 666 | 820 | 920 |
| Pipeline Export Capacity | 465 | 635 | 685 |
| Rail Export Capacity | 660 | 865 | 1,015 |
| Bakken Discount to LLS | $23 | $13 | $14 |
| Bakken Discount to ANS | $22 | $12 | $12 |

Source: Barclays CEO Energy-Power Conference, Tesoro, September 2013

# U.S. Crude-by-Rail Movements



# CBR Loading Terminals

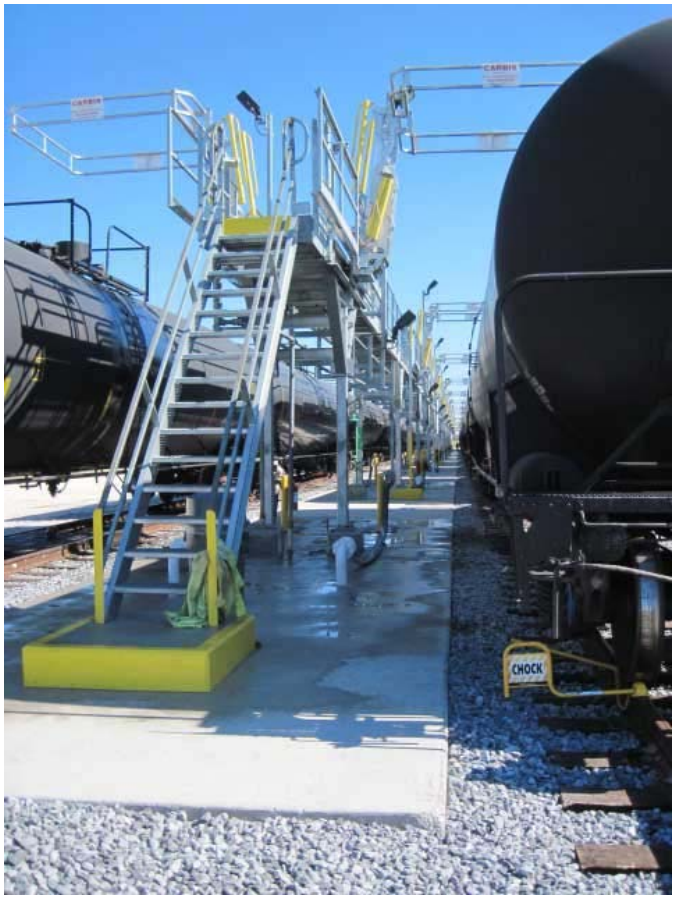
- CBR loading facilities designed to load manifest or unit trains
- Can be located at receiving hub that has
  - Connections to crude oil pipelines
  - Transload directly from tanker truck
  - Trucks can offload to truck rack
- Tanker trucks can be shuttling between producing wells and back to transload facility
- Covered facilities allow operations to safely continue during winter weather

Source: Inergy, COLT Hub – Epping, North Dakota

Source: Bulk Transporter, Atlas Oil – Odessa, Texas

# CBR Unloading Terminals

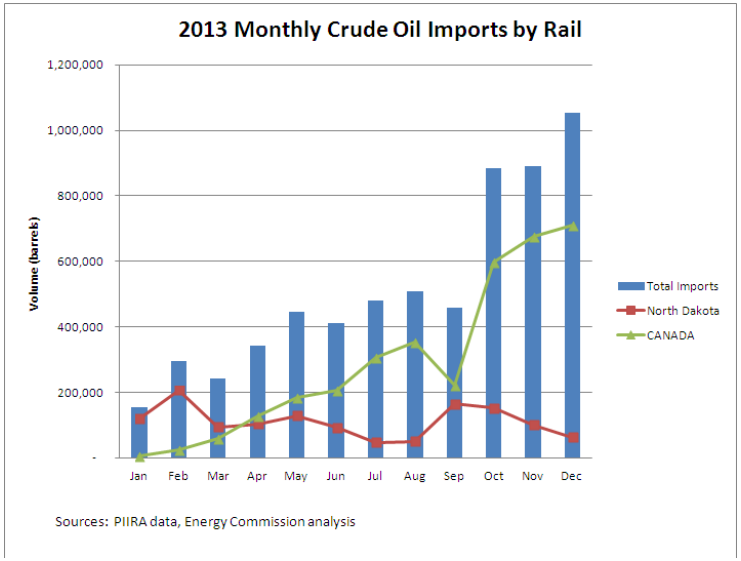
- CBR unloading facilities designed to receive manifest or unit train
- Can be located at refinery or receiving hub that has
  - Pipeline connections to refineries
  - Marine loading capability
- Can offload crude oil to piping connected to storage tanks
- Can also trainload crude oil to tanker trucks
- Crude oil in storage tanks used to feed pipeline infrastructure connected to refineries




Source: JFSCO Engineering – St. James, LA Terminal

# California Crude-by-Rail Imports

- 2012 CBR imports – 1.1 MM Bbls
- 2013 CBR imports – 6.3 MM Bbls
  - Average of 17,251 barrels/day
  - Approximately 9,600 rail tank cars
  - Average of 660 barrels/rail tank car

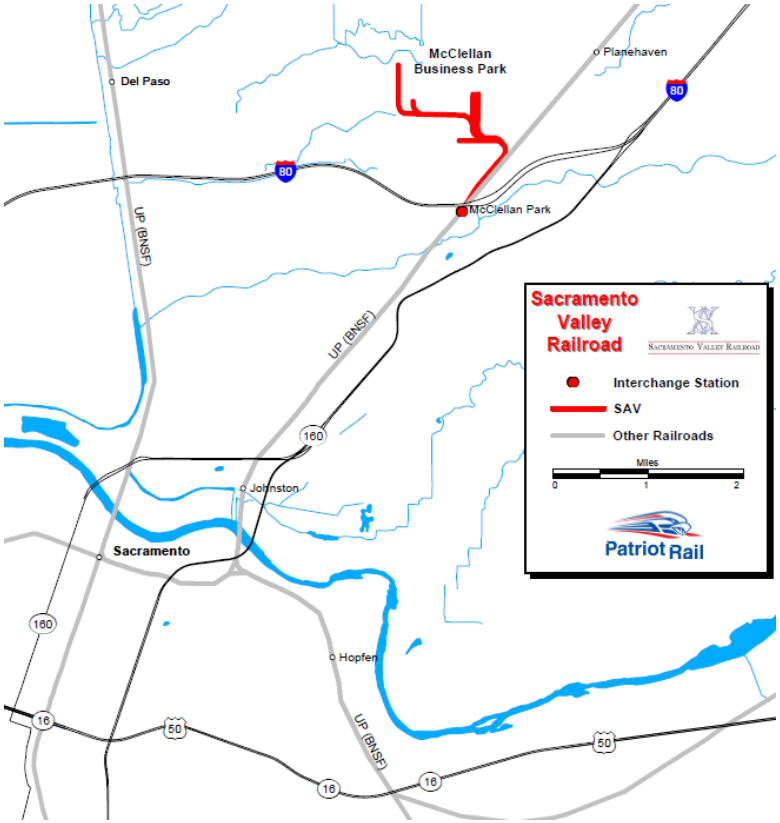



| 2013 Crude-By-Rail Imports | | |
|---|---|---|
| California Energy Commission Country or State of Origin for Railcars | 2013 Total Barrels | 2013 Percentage |
| ***California Totals*** | | |
| Canada | 3,472,050 | 55.14% |
| Colorado | 500,707 | 7.95% |
| New Mexico | 411,725 | 6.54% |
| North Dakota | 1,348,681 | 21.42% |
| Utah | 59,004 | 0.94% |
| Wyoming | 441,398 | 7.01% |
| Other States | 63,207 | 1.00% |
| Subtotals | 6,296,772 | 100.00% |
| ***Northern California*** | | |
| Canada | | |
| Colorado | 157,836 | 12.53% |
| New Mexico | | |
| North Dakota | 1,075,861 | 85.41% |
| Utah | | |
| Wyoming | | |
| Other States | 25,952 | 2.06% |
| Subtotals | 1,259,649 | 100.00% |
| ***Bakersfield & Southern California*** | | |
| Canada | 3,472,050 | 68.93% |
| Colorado | 342,870 | 6.81% |
| New Mexico | 411,725 | 8.17% |
| North Dakota | 272,820 | 5.42% |
| Utah | 59,004 | 1.17% |
| Wyoming | 441,398 | 8.76% |
| Other States | 37,255 | 0.74% |
| Subtotals | 5,037,122 | 100.00% |

*Other States* include Illinois, Nebraska, Oklahoma, Texas and Washington.

# Northern California – CBR Activity

- Two locations currently receiving CBR deliveries
  - Kinder Morgan – Richmond Rail Facility
  - SAV Patriot – McClellan
- Combined deliveries during 2013 amounted to 1.26 million barrels or 3,451 barrels per day
  - Two facilities are permitted to receive a maximum of 21,354 barrels per day of crude oil via rail tank car
  - Crude oil transferred to trucks
- Kinder Morgan facility can receive crude oil unit trains




Source: Patriot Rail

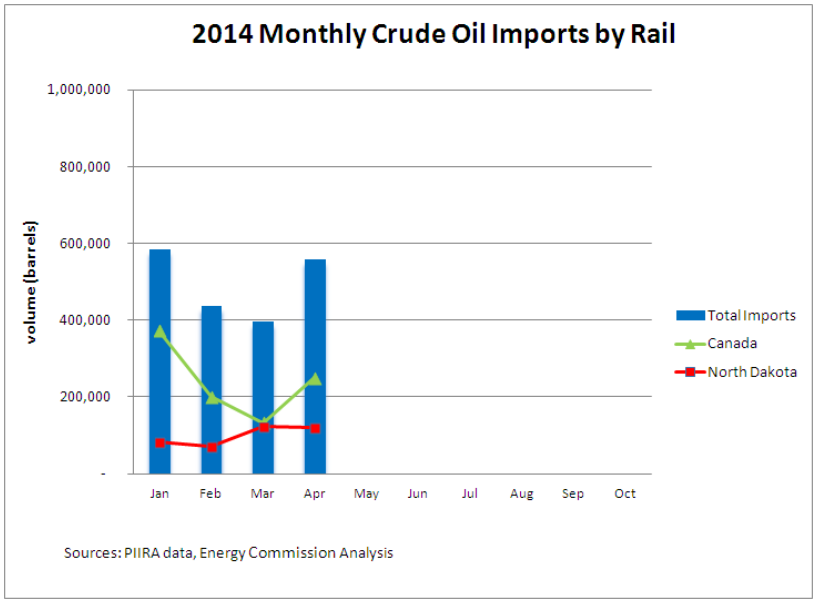
# Southern California – CBR Activity

- Four locations currently receiving CBR deliveries
  - Bakersfield, Carson, Long Beach and Vernon
- Combined deliveries during 2013 amounted to 5.04 million barrels or 13,800 barrels per day
  - Maximum permit off-loading capability being determined
- Manifest rail cars of crude oil being delivered but no full unit trains to these locations


Source: Google Map image of Kern facility.

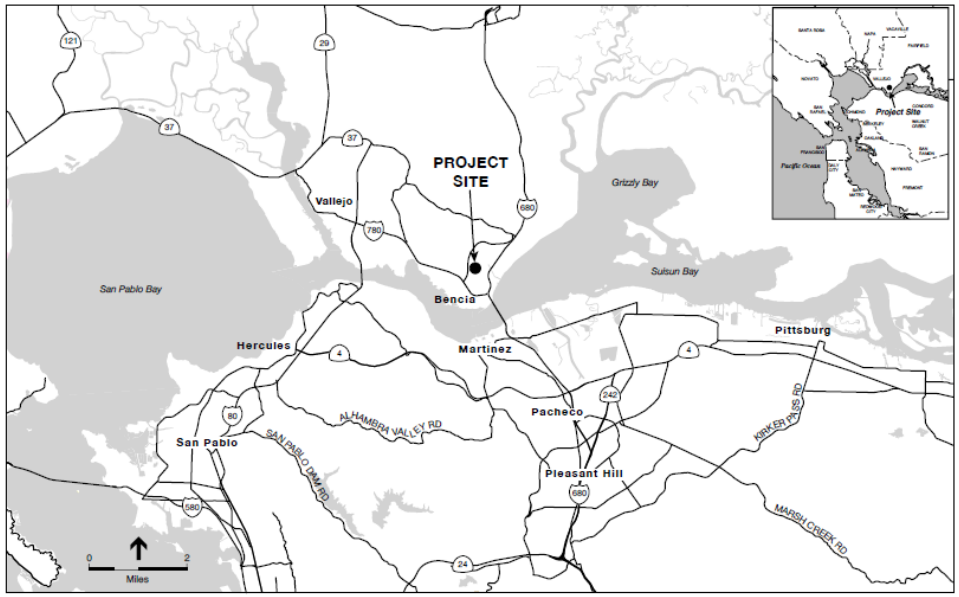
# California CBR Imports Expected to Grow

- 2014 CBR imports, first 4 months
  - 1.971 MM barrels
  - Average of 16,431 barrels/day
  - 90.5 percent higher than same period in 2013
- Five CBR projects seeking permits
  - 2 Northern California
  - 2 Bakersfield area
  - 1 San Luis Obispo County
- Could grow up to 23 percent by 2016, assuming:
  - Permits issued, customers signed up, financing approved, constructed & operated at capacity




# Crude-by-Rail Projects – Northern California

- Valero – Benicia Crude Oil By Rail Project - Planned
  - Benicia refinery
  - Up to 70,000 BPD
  - Construction will take 6 months
  - Could be operational by 2015
  - Draft EIR released June 17, 2014
  - Lead agency – City of Benicia
  - http://www.ci.benicia.ca.us/index.asp?Type=B_BASIC&SEC={FDE9A332-542E-44C1-BBD0-A94C288675FD}




SOURCE: ESA

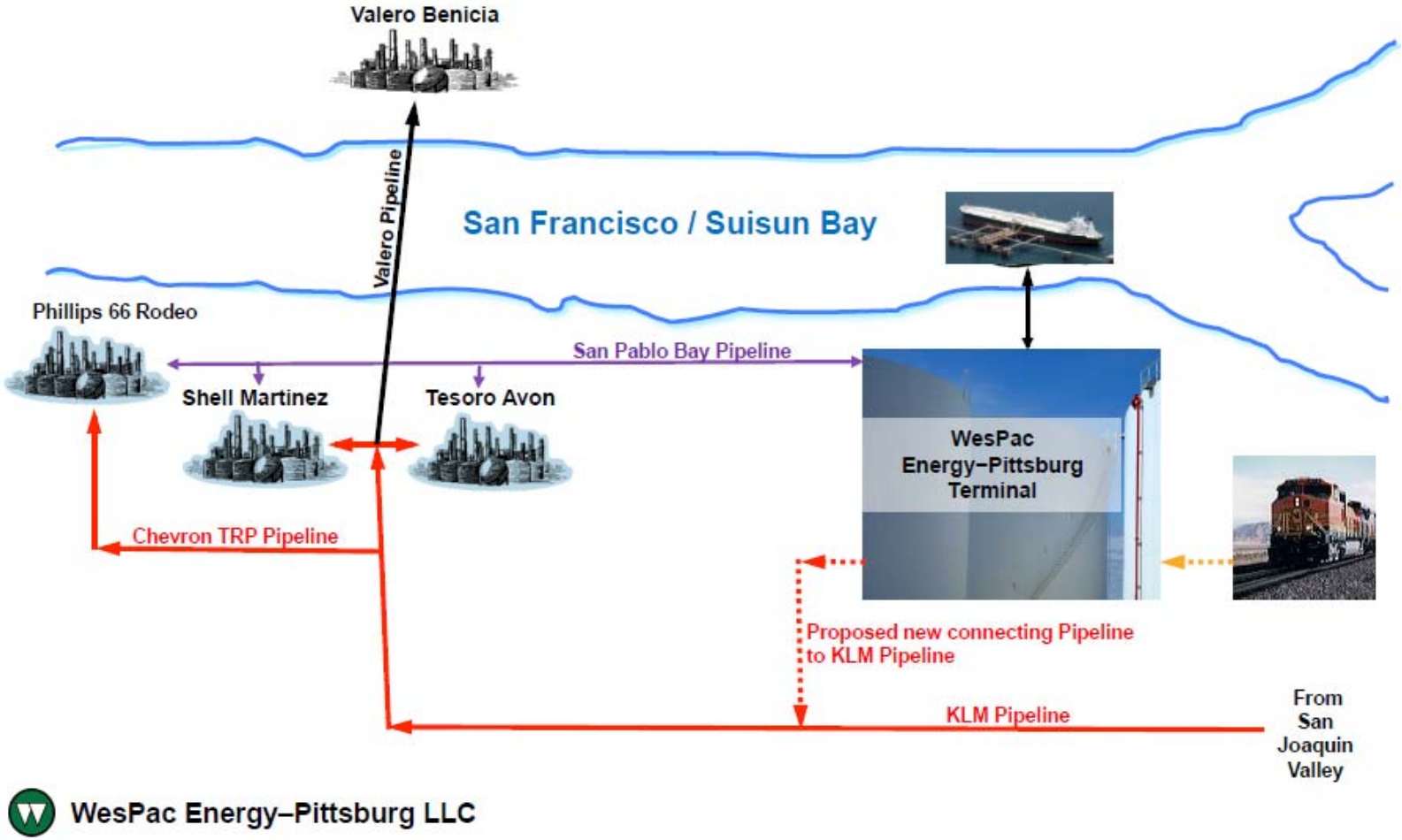
Benicia Valero CBR . 202115.01
Figure 3-1
Project Location

# Crude-by-Rail Projects – Northern California

**WesPac Energy Project – Pittsburg - Planned**

- Rail receipt average capability of 50,000 barrels per day (BPD)
- Includes marine terminal for receipt and loading – average of 192,000 BPD
- Combined average receipt capability of 242,000 BPD
- Connection to KLM pipeline – access to Valero, Shell, Tesoro & Phillips 66 refineries
- Connection to idle San Pablo Bay Pipeline – access to Shell, Tesoro & Phillips 66 refineries
- Construction of the first phase for the rail facility and associated storage tanks could be completed within 12 to 15 months of receiving all permits
- Could be operational by 2016
- A recirculated draft environmental impact report (RDEIR) will be developed and a new comment period set for those applicable sections
- There is currently no scheduled release date for the RDEIR
- Lead agency – City of Pittsburg
- http://www.ci.pittsburg.ca.us/index.aspx?page=700

# WesPac Project – Refinery Connections



# Crude-by-Rail Projects – Bakersfield

**Alon Crude Flexibility Project - Planned**

- Alon – Bakersfield Refinery
- 2 unit trains per day
- 150,000 BPD offloading capacity
- Will be able to receive heavy crude oil
- Oil tankage connected to main crude oil trunk lines – transfer to other refineries
- Draft EIR comments due by July 7
- Final EIR could be scheduled for hearing on September 9
- Construction will take 9 months, could be complete by 2015
- Lead agency - Kern County Planning and Community Development Department

**Plains All American – Bakersfield Crude Terminal – Under Construction**

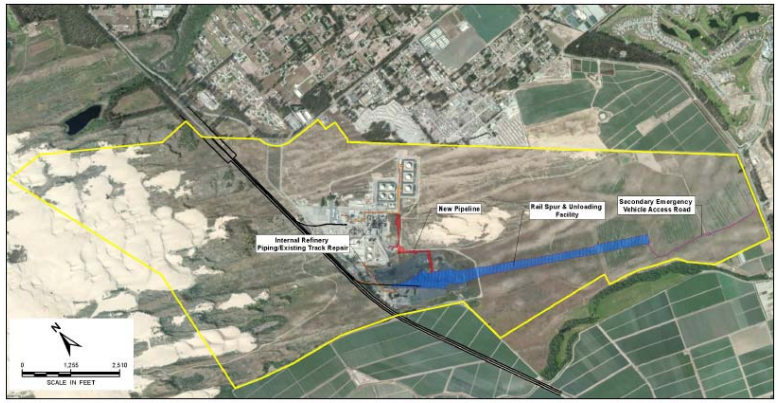
- Up to 65,000 BPD
- Connection to additional crude oil line via new six-mile pipeline
- Draft EIR will be developed for that pipeline later this year
- Could be operational by late 2014


Source: KernGoldenEmpire.com

# Crude-by-Rail Projects – San Luis Obispo

**Phillips 66 – Santa Maria Refinery – Planned**

- Up to 41,000 BPD
- Planning Commission meeting on revised EIR scheduled for late 2014
- Construction 9 to 12 months to complete
- Lead agency – County of San Luis Obispo
- http://www.slocounty.ca.gov/planning/environmental/EnvironmentalNotices/railproject.htm




Source: Phillips 66 Draft EIR – November 2013

**Valero – Wilmington Refinery – Canceled**

- Up to 60,000 BPD
- Withdrew permit application

# Crude-by-Rail Projects – Not Included

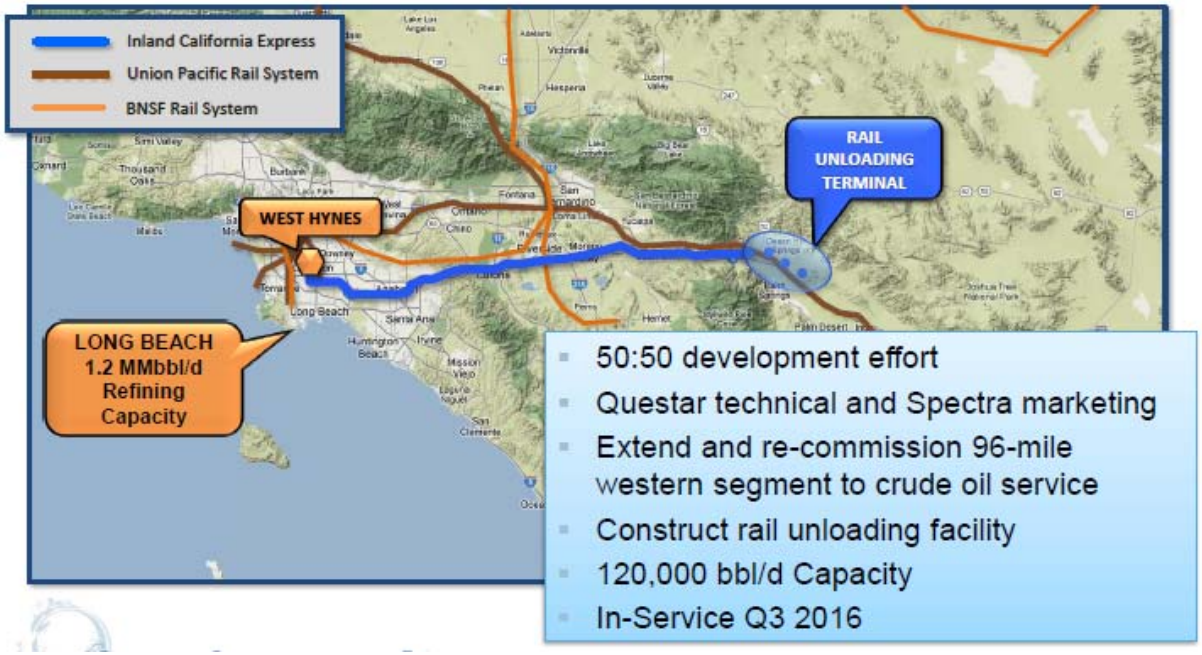
**Two Projects not included in CBR projection by Energy Commission**

**Targa – Port of Stockton – Planned**

- Up to 65,000 BPD
- Receive rail, load barges

**Questar Project - Planned**

- East of Desert Hot Springs
- Nearly 2 unit trains per day
- 120,000 BPD offloading capacity
- Connection to Los Angeles basin crude oil pipeline network
- Company is still performing an engineering analysis




Source: Questar Pipeline customer meeting, March 2014

# CBR Projects – Pacific Northwest

**Tesoro – Anacortes Refinery – Operational**

- Up to 50,000 BPD
- Operational September 2012

**BP – Cherry Point Refinery – Operational**

- Up to 70,000 BPD
- Operational December 2013

**Global Partners – Clatskanie, OR – Operational**

- Up to 28,600 BPD

Source: Skagit Valley Herald

**Phillips 66 – Ferndale Refinery – Operational**

- Up to 20,000 BPD, mixed freight cars
- Permits received for expansion to 40,000 BPD in 2014 – ready by late 2014

**U.S. Oil and Refining – Tacoma Refinery – Operational**

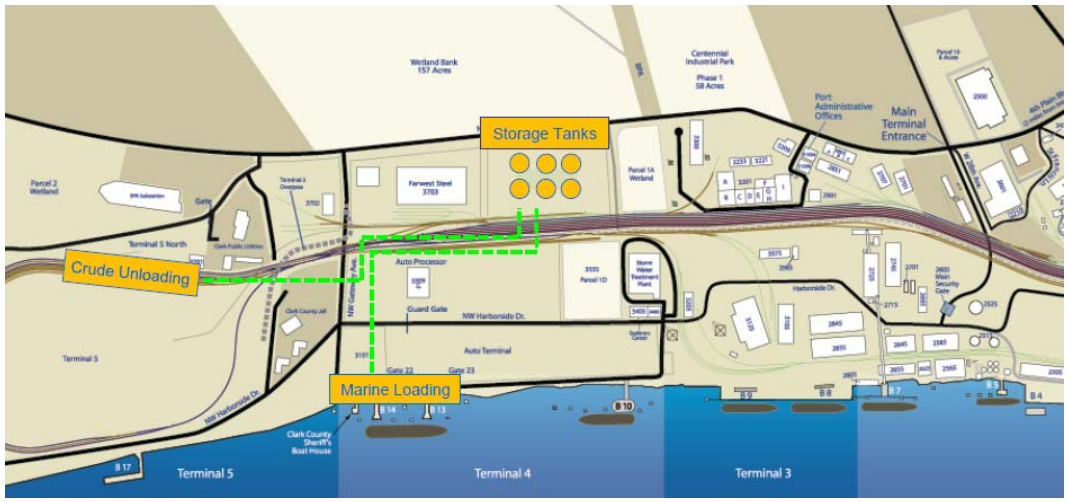
- Up to 6,900 BPD

**Combined CBR off-loading capacity up to 195,500 by end of 2014**

# CBR Projects – Pacific Northwest

**Tesoro – Savages, Port of Vancouver Project – Planned**

- Rail receipts of unit trains & loading of marine vessels
- Initial capacity up to 120,000 BPD
- Tesoro will have off-take rights to 60,000 BPD
- Expansion capability of up to 280,000 BPD
- Lead agency - Energy Facility Site Evaluation Council
- Possible initial start-up during 2015
- http://www.efsec.wa.gov/Tesoro-Savage.shtml



# CBR Projects – Pacific Northwest

**Shell – Anacortes Refinery Project – Planned**

- Rail receipts of unit trains
- Capacity up to 61,000 BPD
- Seeking a Mitigated Determination of Nonsignificance permit
- Lead agency – Skagit County Planning & Development Services
- Possible initial start-up during 2015
- http://www.skagitcounty.net/Departments/PlanningAndPermit/shellpermit.htm

# Refiner Adjustments to Lighter Oil

- Refiners do not have to undertake any modifications to their processing equipment to handle CBR oil
  - CBR could be utilized by California refineries without construction of new processing equipment, just displacement of marine imports of crude oil
- Although no refinery equipment replacement or modifications would normally be necessary to handle Bakken crude oil, refiners may have to make some adjustments to their operating procedures
  - Higher paraffinic content can result in waxy coating of storage tanks
  - Greater development of sludges and solids can occur when combining Bakken with non-Bakken quality crude oils
  - Treatment of Bakken crude to reduce hydrogen sulphide levels require operational changes to avoid potential increase in corrosion

# U.S. Refinery Projects – Light Crude & Condensate

| Company | Location | Capacity (TBD) | Cost | Investment Type |
|---|---|---|---|---|
| Alon | Big Spring | 5 | Unknown | Refinery expansion |
| American Energy Holdings | Devils Lake, ND | 20 | $250 million | New refinery |
| Castleton Commodities Intl | Corpus Christi, TX | 100 | Unknown | Condensate splitter |
| Dakota Oil Processing | Trenton, ND | 20 | $200 million | New refinery |
| HollyFrontier | Woods Cross, UT | 14 | $300 million | Refinery expansion |
| Husky | Lima, OH | 40 | $300 million | Increase heavy crude capacity |
| Kinder Morgan | Galena Park, TX | 100 | $360 million | Condensate splitter |
| Magellan Partners | Corpus Christi, TX | Unknown | Unknown | Condensate splitter |
| Marathon | Canton, OH | 25 | $250 million for the Canton, OH and Catlettsburg, KY facilities | Condensate splitter |
| Marathon | Catlettsburg, KY | 35 | | Condensate splitter |
| Marathon | Robinson, IL | 60 | $160 million | Increase light crude capacity |
| Martin Midstream | Corpus Christi, TX | 50-100 | Unknown | Condensate splitter |
| MDU/CLMT Dakota Prairie | Dickinson, ND | 20 | $300 million | New refinery |
| NCRA | McPherson, KS | 15 | $327 million | Refinery expansion |
| Tesoro | Salt Lake City, UT | 4 | Unknown | Refinery expansion |
| Three Affiliated Tribes | Dickinson, ND | 20 | $450 million | New refinery |
| Trafigura | Corpus Christi, TX | 50 | Unknown | Condensate splitter |
| Valero | Corpus Christi, TX | 70 | $350 million | Crude topping unit |
| Valero | Houston, TX | 90 | $400 million | Crude topping unit |
| Valero | Port Arthur, TX | 15 | Unknown | Increase light crude capacity |
| Valero | McKee, TX | 25 | Unknown | Refinery expansion |
| Western | El Paso, TX | 25 | Unknown | Refinery expansion |

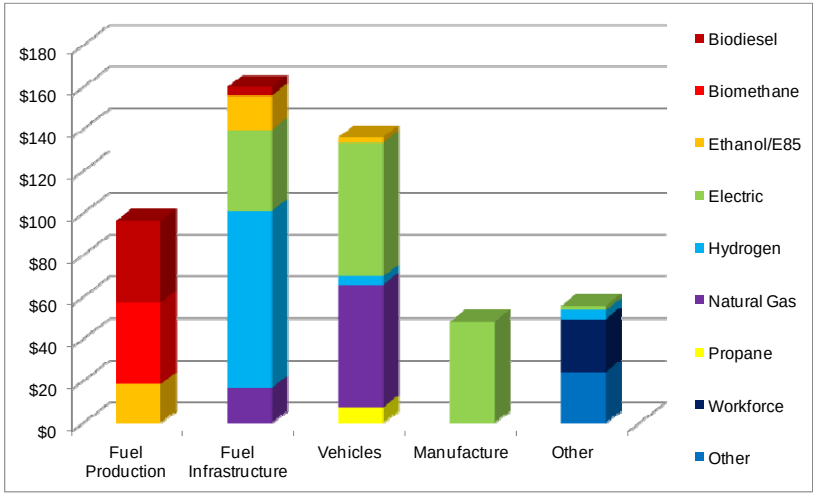
*Source: Compiled from various public sources by ICF International*

Note: Due to limitations in other process units, total crude input capacity will not necessarily increase by the same amounts as the project capacities shown in this exhibit. The capacity for projects with announced capacities totals between 803,000 to 853,000 barrels per day.

# Alternative and Renewable Fuel and Vehicle Technology Program

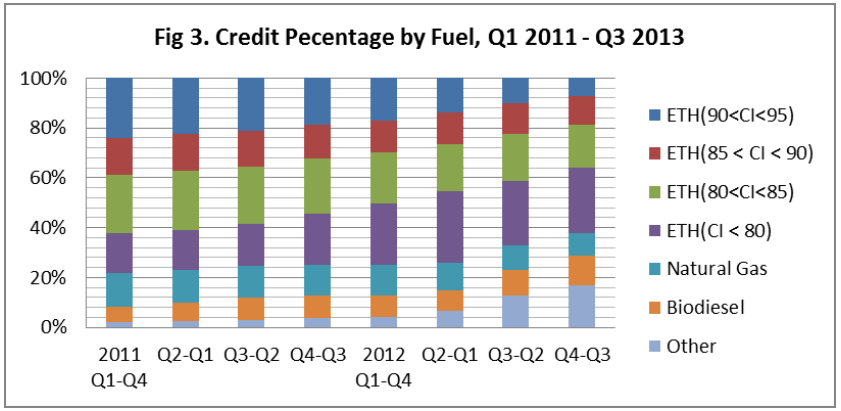
- Purpose of the program:
  - To transform California's transportation market into a diverse collection of alternative fuels and technologies and reduce California's dependence on petroleum.
  - "…develop and deploy innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies" (Health and Safety Code Section 44272(a))
- 2014 Benefits Report
  - Taking comments on approach

| Investment Areas | Funding Amount (millions) | Percent of Total (%) | Number of Awards |
|---|---|---|---|
| Biofuels | $119.5 | 24 | 45 |
| Electric Drive | $152.7 | 31 | 120 |
| Natural Gas/Propane | $82.3 | 16 | 55 |
| Hydrogen | $92.6 | 19 | 26 |
| Workforce Development | $25.2 | 5 | 30 |
| Market and Program Development | $24.1 | 5 | 36 |
| **Total** | **$496.4** | **100** | **312** |



# Low Carbon Fuel Standard

- California Air Resources Board program adopted in 2009 that is designed to reduce the per-gallon carbon intensity of gasoline and diesel fuel by 10 percent by 2020
- Obligated parties can comply by:
  - Blending lower carbon-intensity fuels such as sugarcane ethanol, biodiesel from corn oil, and renewable diesel fuel
  - Purchasing excess credits generated by other participants
- Standards unchanged for 2013/14
- Revised LCFS will be brought to Board later in 2014
  - Cost containment provisions
  - Adjustments to indirect land use changes calculated carbon-intensity
  - Electricity provisions



# LCFS – Crude Oil Provisions

| Source | Crude Oil Name | 2012-13 Quantity Barrels | Carbon Intesnity (gCO2/MJ) |
|---|---|---|---|
| US - California | Elk Hills | 26,070,461 | 5.36 |
| US - California | Wilmington | 27,123,801 | 6.36 |
| Columbia | Castilla | 24,792,862 | 6.45 |
| Columbia | Vasconia | 22,736,813 | 6.63 |
| Saudi Arabia | Arab Light | 102,036,845 | 6.75 |
| Saudi Arabia | Arab Extra Light | 37,146,086 | 6.86 |
| Ecuador | Napo | 44,274,270 | 7.45 |
| Ecuador | Oriente | 79,695,073 | 9.34 |
| US - California | Kern River | 51,925,635 | 9.55 |
| 2013 | Average | | **11.36** |
| Saudi Arabia | Arab Medium | 24,343,374 | 11.39 |
| US - California | Lost Hills | 21,508,937 | 11.40 |
| Iraq | Basra Light | 111,315,276 | 12.08 |
| US - Alaska | ANS | 147,992,805 | 12.81 |
| US - California | Belridge, South | 47,146,523 | 14.49 |
| US - California | Cymric | 28,143,746 | 19.91 |
| US - California | Midway-Sunset | 58,083,465 | 21.18 |
| Subtotals | | 854,335,972 | |
| Other Types of Crude Oil | | | |
| US - North Dakota | Bakken | 3,822,020 | *11.39** |
| US - Utah | Covenant | 1,339,076 | *11.39** |
| US - Colorado | Niobrara | 987,807 | *11.39** |
| Canada | Cold Lake | 11,312,831 | 18.74 |
| Canada | Albian Heavy Synthetic | 7,666,165 | 21.02 |
| Canada | Suncor Synthetic (all grades) | 7,824,657 | 24.49 |

* Baseline default value.

- CARB collects data on types of crude oil used by California refiners
- A volume-weighted average is calculated to determine if there has been a change relative to 2010
- If average increases in a significant manner, the incremental carbon deficit would have to be offset by obligated parties
  - 2013 average of 11.36 gCO2/MJ unchanged from 2012 and below the baseline of 11.39 gCO2/MJ
  - Top 16 sources accounted for 72.2 percent of the crude oil volumes