Potential Transportation Fuel Supply and Price Impacts of HF Ban

Proposed Rule 1410

Working Group Meeting #6

Toyota Meeting Hall, Torrance, CA

September 20, 2017

Gordon Schremp

Energy Assessments Division

California Energy Commission

Gordon.schremp@energy.ca.gov

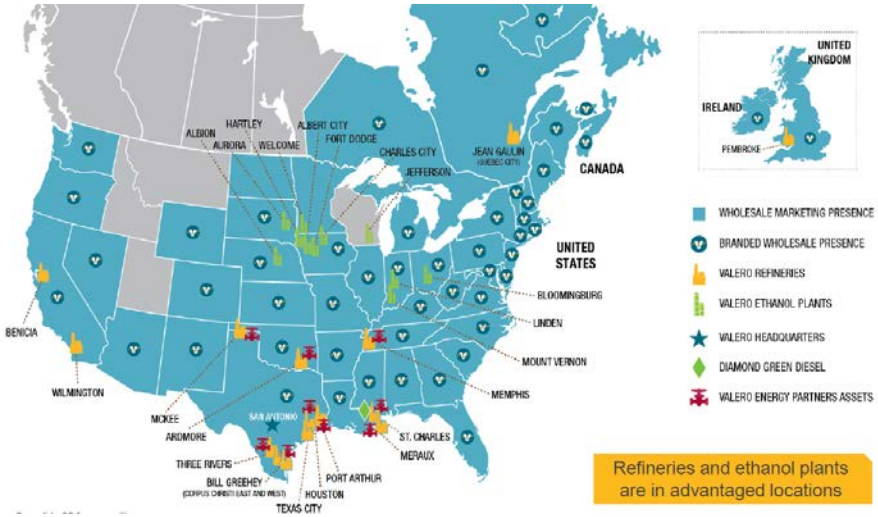
Presentation Topics

- Refinery assets – portion of larger portfolio
- Capital for refining projects
- Investment decision guidance & approved projects
- Likelihood of alkylation replacement
- Implications for regional supply, fuel prices, competition, and contingency planning

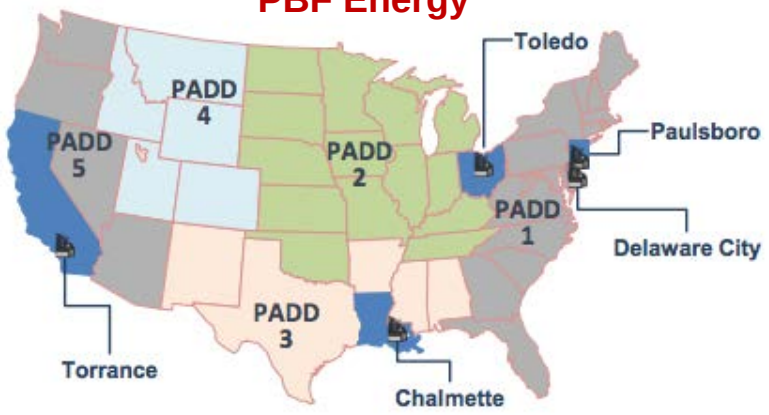
Refinery Assets

Refineries & Locations

Valero Energy

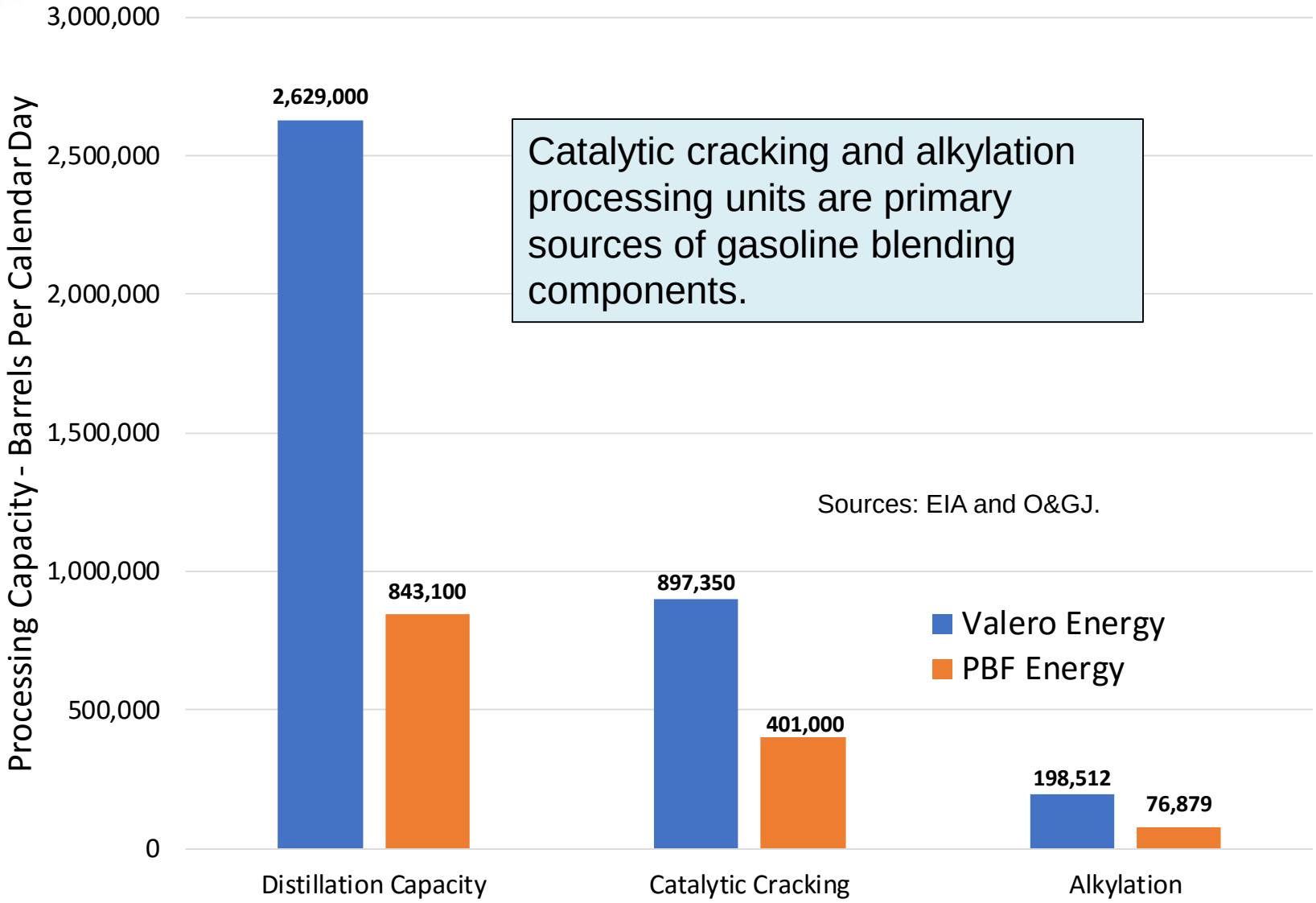


PBF Energy

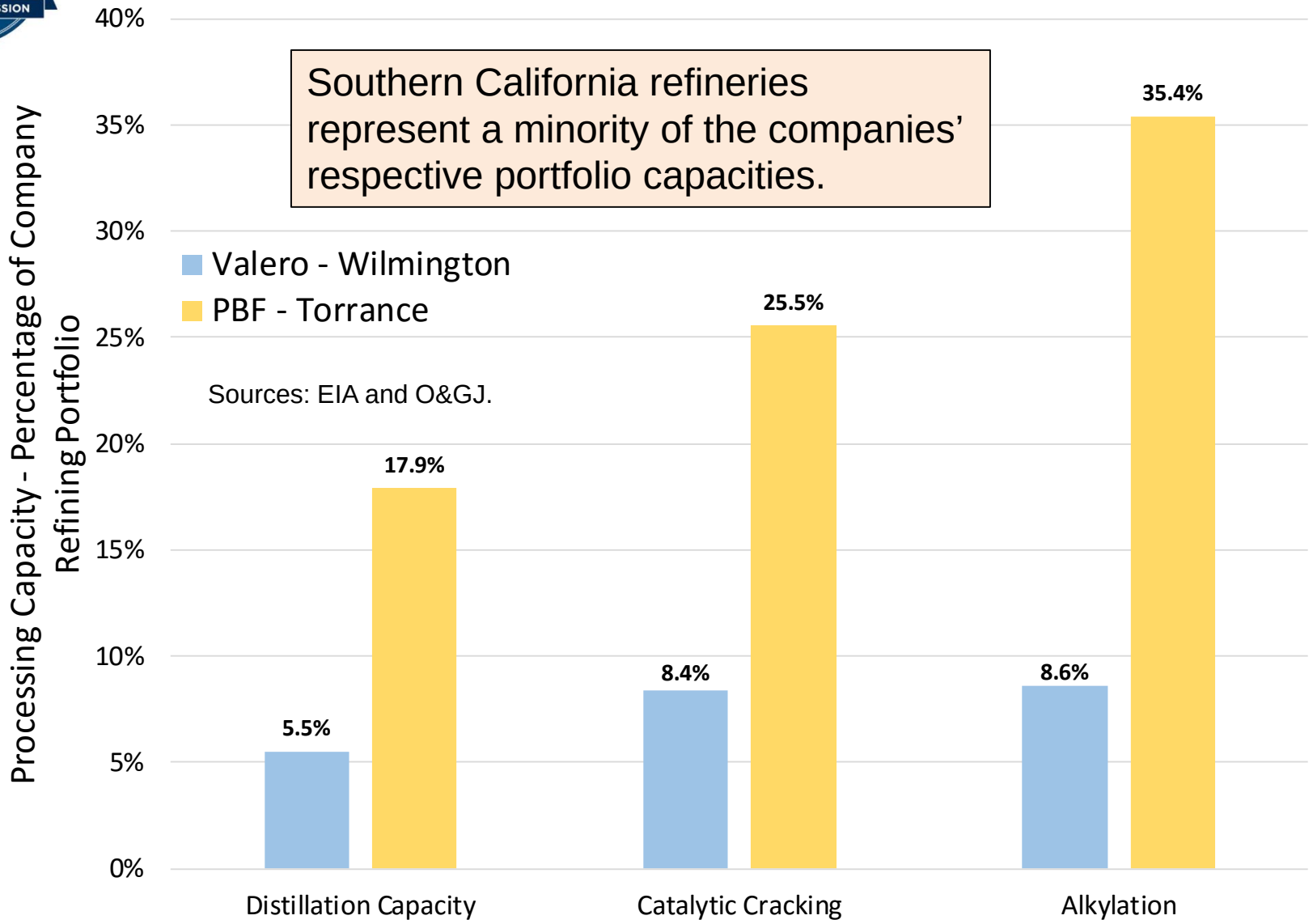


- Valero and PBF combined domestic refining assets represent 16.5 percent of U.S. crude oil processing capacity as of January 1, 2017
  - 18.7 percent catalytic cracking
  - 18.5 percent alkylation
- Valero Energy operates 15 refineries in the U.S., Canada and United Kingdom
  - 2.63 million barrels per day crude processing capacity according to Energy Information Administration (EIA) and Oil & Gas Journal (O&GJ)
- PBF Energy operates 5 refineries in the United States
  - 0.84 million barrels per day crude processing capacity according to EIA

Refining Capacity – Selected Processes



Southern California Portion of Portfolio



Capital for Refining Projects

Capital Expenditures – Petroleum Industry

WHERE FUNDS WILL GO FOR US PROJECTS

Table 1

	2017 million $	2017-16 change,%	2016 million $	2016-15 change,%	2015 million $
Exploration-production					
Drilling-exploration	102,000	37.8	74,000	-39.5	122,220
Production	19,380	37.8	14,060	-39.5	23,222
OCS lease bonus	200	12.4	178	-68.3	561
Subtotal	**121,580**	**37.8**	**88,238**	**-39.6**	**146,003**
Other					
Refining and Marketing	13,200	0.8	13,100	-3.1	13,520
Petrochemicals	8,100	5.2	7,700	14.6	6,720
Crude and products pipelines	2,327	-89.5	22,130	190.3	7,624
Natural gas pipelines	7,685	18.7	6,475	94.0	3,338
Other transportation	3,600	2.9	3,500	10.7	3,163
Miscellaneous	3,000	25.0	2,400	-37.5	3,840
Subtotal	**37,911**	**-31.5**	**55,305**	**44.8**	**38,206**
Total	**159,491**	**11.1**	**143,543**	**-22.1**	**184,209**

Source: Oil & Gas Journal.

- Majority of capital expenditures for U.S. projects go to upstream activities
  - 79.3 percent in 2015, 61.5 percent in 2016 & 76.2 percent for 2017
- Only a small portion usually goes towards refining and marketing projects
  - 7.3 percent in 2015, 9.1 percent in 2016 & 8.3 percent for 2017

Investment Decisions & Approved Projects

Capital Approval for Projects

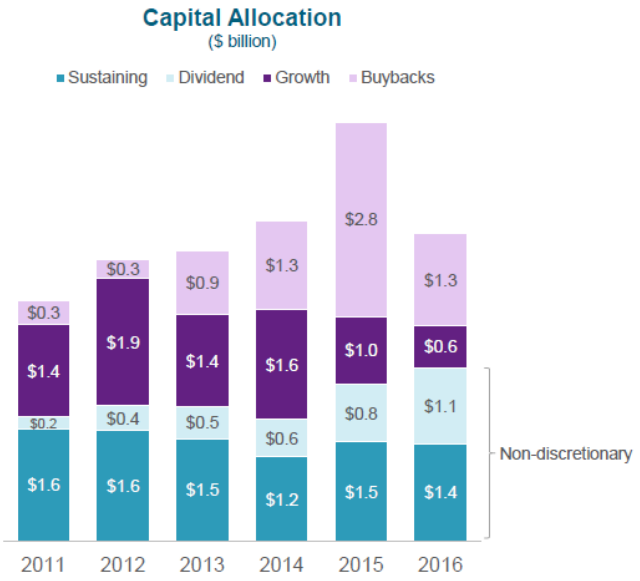
- Refining companies have specific guidance for capital expenditures
  - Non-discretionary (Maintenance & dividends)
  - Discretionary (Projects, acquisitions & stock buy-backs)
  - Limits of total capital expenditures (CAPEX)

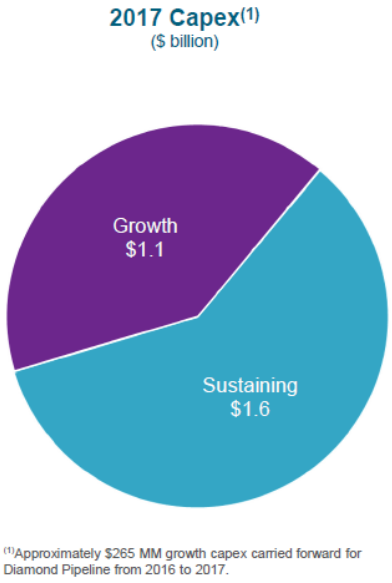
Valero Energy

Discretionary

Growth Capex

- 25% IRR hurdle rate for refining projects
- Lower hurdle rate for steady cash flow midstream projects





Source: Valero Investor Relations Presentation – September 2017.

Recent Valero Discretionary Projects & IRRs

- Meraux refinery hydrocracker conversion
  - $260 million, 25 percent unlevered IRR at 2014 prices
  - Operational December 2014
- McKee refinery diesel recovery improvement and crude unit expansion
  - $160 million, 45 percent unlevered IRR at 2014 prices
  - Completed in 2015
- Corpus Christi and Houston refinery light topping expansion projects to handle greater quantities of lighter crude oils – 160 KBD additional processing capacity
  - $750 million, 50 percent unlevered IRR at 2014 prices
  - Corpus Christi work completed in 2015

Likelihood of Alkylation Replacement

Alkylation Replacement Costs

- If an HF ban were compelled it is unlikely either or both companies would elect to make such changes to their facilities
  - Alkylation process unit projects are extremely expensive
    - A recent project approved for the Valero Houston refinery is estimated to cost $300 million for an alkylation unit with a capacity of 13,000 barrel per calendar day
    - Capacity of the alkylation units at Valero Wilmington and PBF Torrance are 22,000 and 24,200 barrels per day capacity, respectively
    - These alkylation unit capacities are each nearly twice the capacity, meaning the potential costs for such projects at the two California refineries could, at a minimum, easily approach or exceed $500 million *per facility* – excludes spent acid regeneration
    - Burns & McDonnell estimated $600 million for Torrance facility, additional $300 for spent acid regeneration capacity
  - These estimated costs for such a replacement project could be near or exceeding the value of the refinery when one considers that ExxonMobil sold the entire Torrance refinery to PBF Energy for $537.5 million

Capital & Business Logic

- You own a mid-size car with financing payments for another three years
  - Would a bank loan you money to replace your *working* transmission that amounted to a sum greater than the value of your vehicle? – Probably not
- You own a 3 bedroom home with 20 years remaining on your mortgage
  - Would a mortgage company loan you money to replace your *working* HVAC system that amounted to a sum greater than the assessed value of your home? – Probably not
- You own a complex refinery in Southern California
  - Would a board of directors agree to commit discretionary capital to replace your *working* alkylation process unit that amounted to a sum greater than the resale value of your entire refinery and had a negative IRR? – Probably not

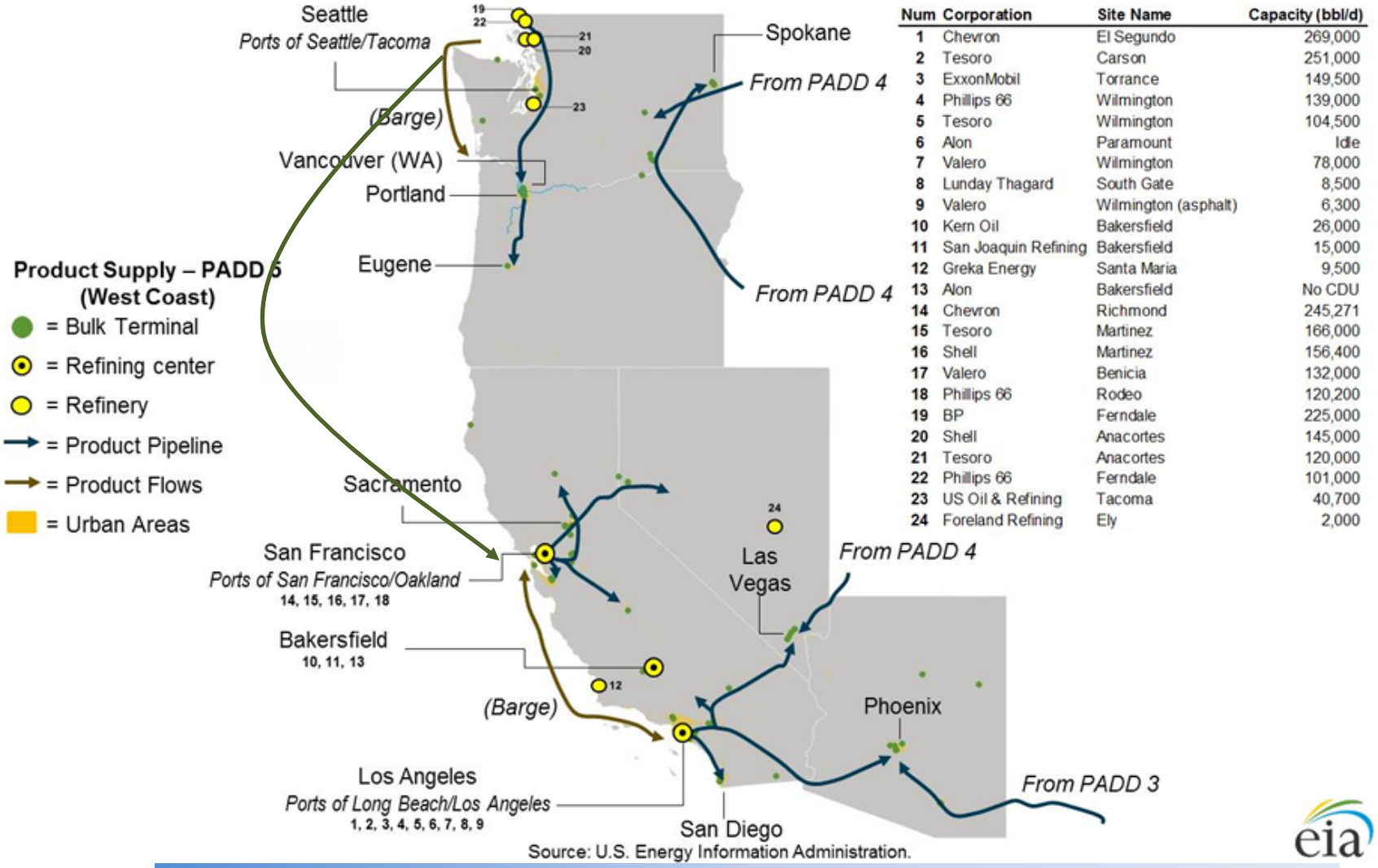
Likelihood of Alkylation Replacement

- It goes against sound business principles that the Valero and PBF board of directors would agree to spend an amount of capital on two refinery assets that would be greater than the valuation of the facilities and would incur a negative IRR
- Conclusion – if the HF ban is approved, the two Southern California refineries would likely cease operations some time prior to the effective deadline
- Therefore the particulars regarding the amount of time necessary to obtain all permits, complete engineering, demolish the existing alkylation units, and construct the new process units would be less relevant

Refinery Closure Implications – Regional Supply

Western States More Isolated than Rest of U.S.

West Coast petroleum product supply map



Num	Corporation	Site Name	Capacity (bbl/d)
1	Chevron	El Segundo	269,000
2	Tesoro	Carson	251,000
3	ExxonMobil	Torrance	149,500
4	Phillips 66	Wilmington	139,000
5	Tesoro	Wilmington	104,500
6	Alon	Paramount	Idle
7	Valero	Wilmington	78,000
8	Lunday Thagard	South Gate	8,500
9	Valero	Wilmington (asphalt)	6,300
10	Kern Oil	Bakersfield	26,000
11	San Joaquin Refining	Bakersfield	15,000
12	Greka Energy	Santa Maria	9,500
13	Alon	Bakersfield	No CDU
14	Chevron	Richmond	245,271
15	Tesoro	Martinez	166,000
16	Shell	Martinez	156,400
17	Valero	Benicia	132,000
18	Phillips 66	Rodeo	120,200
19	BP	Ferndale	225,000
20	Shell	Anacortes	145,000
21	Tesoro	Anacortes	120,000
22	Phillips 66	Ferndale	101,000
23	US Oil & Refining	Tacoma	40,700
24	Foreland Refining	Ely	2,000

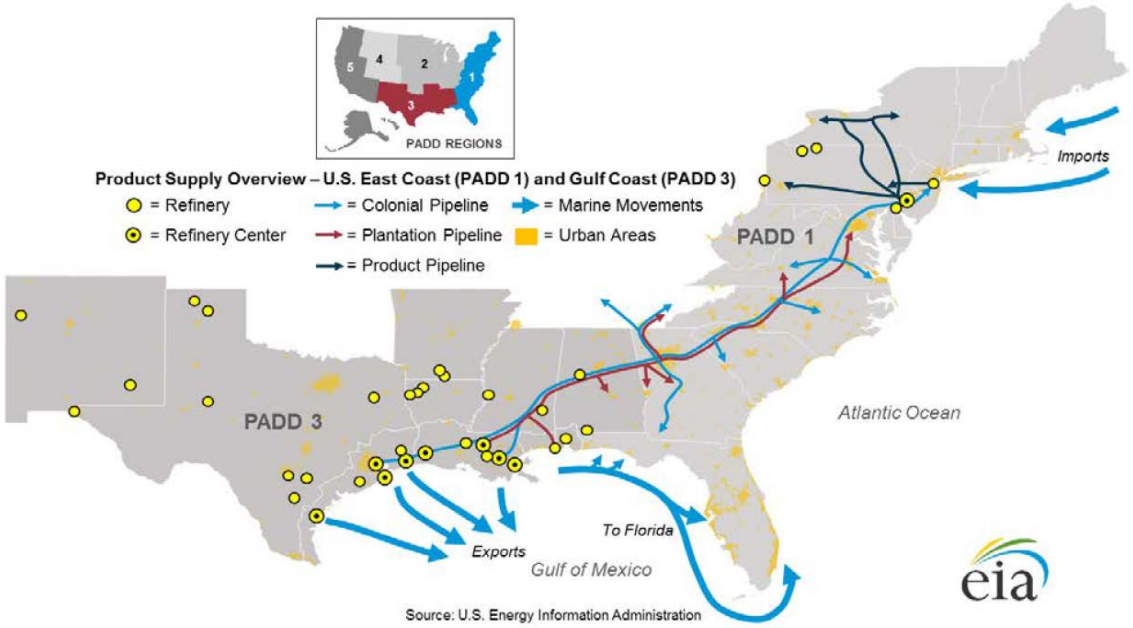
Source: U.S. Energy Information Administration.

California Fuels Market - Isolated

- California's market is nearly self-sufficient, so supplies of gasoline and diesel fuel from outside of California are not routinely needed to balance out supply with demand
  - Imports of gasoline and blending components account for only 3 to 6 percent of supply
- The California market is geographically isolated from other locations in the United States that produce refined products
- Pipelines connect California refining centers to distribution terminals in Nevada and Arizona, but these pipelines only operate in one direction – sending gasoline and other transportation fuels to these neighboring states
- California market is isolated by time and distance from alternative sources of re-supply during unplanned refinery outages

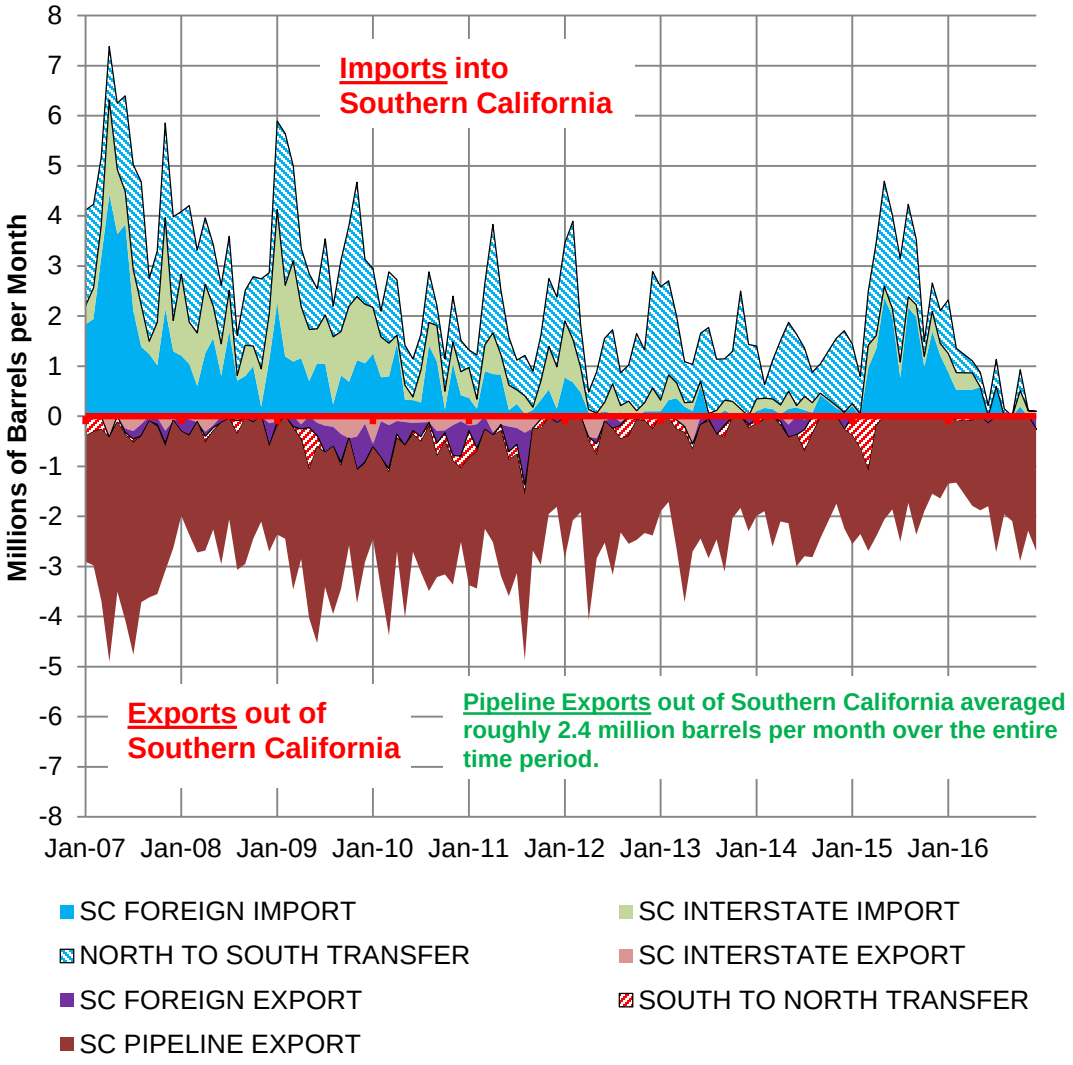
Balance of Other Regions Varies

- U.S. Gulf Coast (PADD 3) large net ***exporting*** region
  - During 2014, region consumed an average of 2.5 million barrels per day (b/d) of transportation fuels yet produced 7.5 million b/d
- U.S. East Coast (PADD 1) large net ***importing*** region
  - During 2014, region consumed an average of 4.9 million b/d of transportation fuels but only produced 1.0 million b/d, representing 20 percent of the region's supply



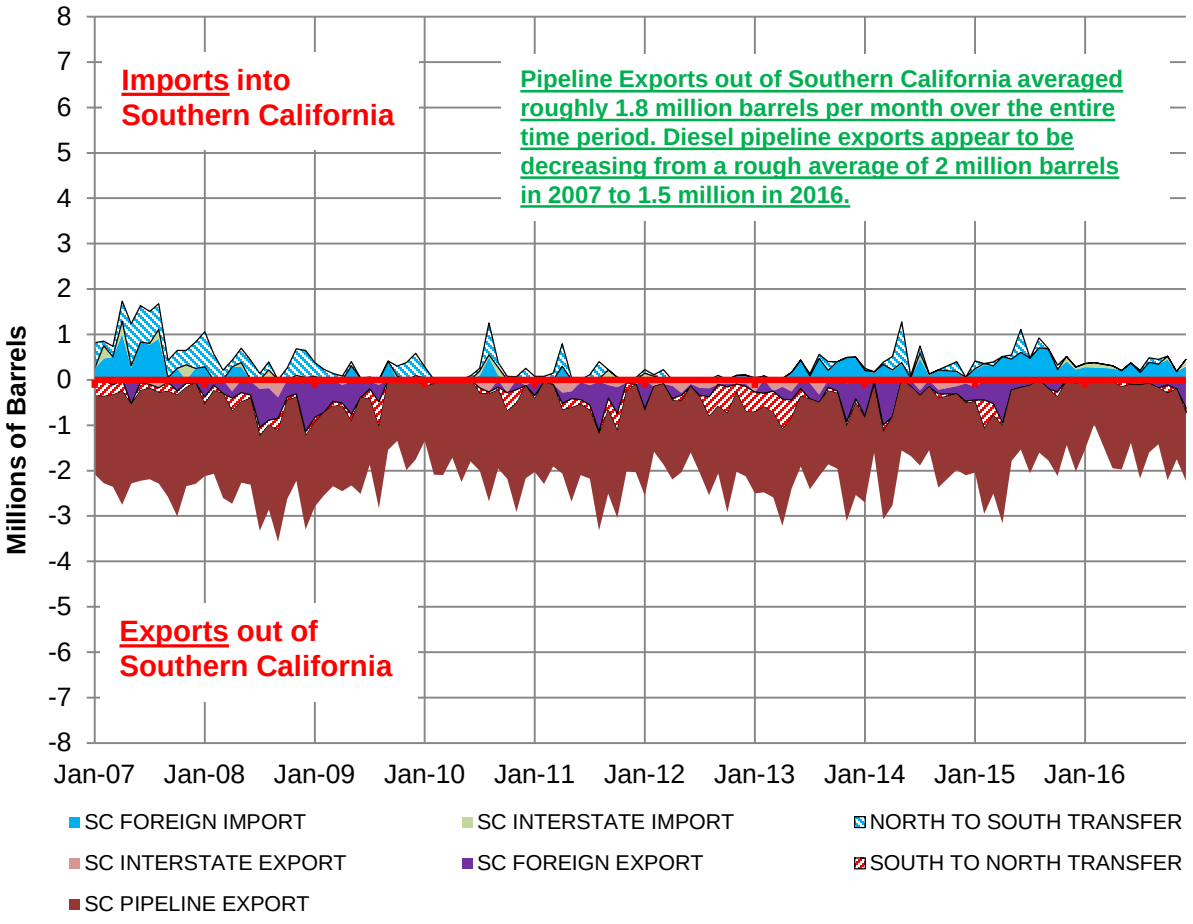
Gasolines Flows – Southern California

- Net importer via marine
- Usually close to balance
- Foreign imports when needed & economic
- Domestic imports rare
- Imports from N. Calif. normal portion of their supply – volumes fluctuate based on refinery outages
- Pipeline exports to NV & AZ
  - 5 times N. Calif. volumes
- Foreign exports minimal
- Domestic exports eliminated
- Exports to N. Calif. rare – volumes fluctuate based on refinery outages



Source: California Energy Commission

Diesel Flows – Southern California



Source: California Energy Commission

- Large net exporter
- Foreign imports when needed & economic
- Domestic imports rare
- Imports from N. Calif. Related to refinery outages
- Pipeline exports to NV & AZ
  - 3 times N. Calif. volumes
- Foreign exports declined
- Domestic exports eliminated
- Exports to N. Calif. rare – volumes fluctuate based on refinery outages

Loss of Refining Capacity Impacts Markets – Historical Example

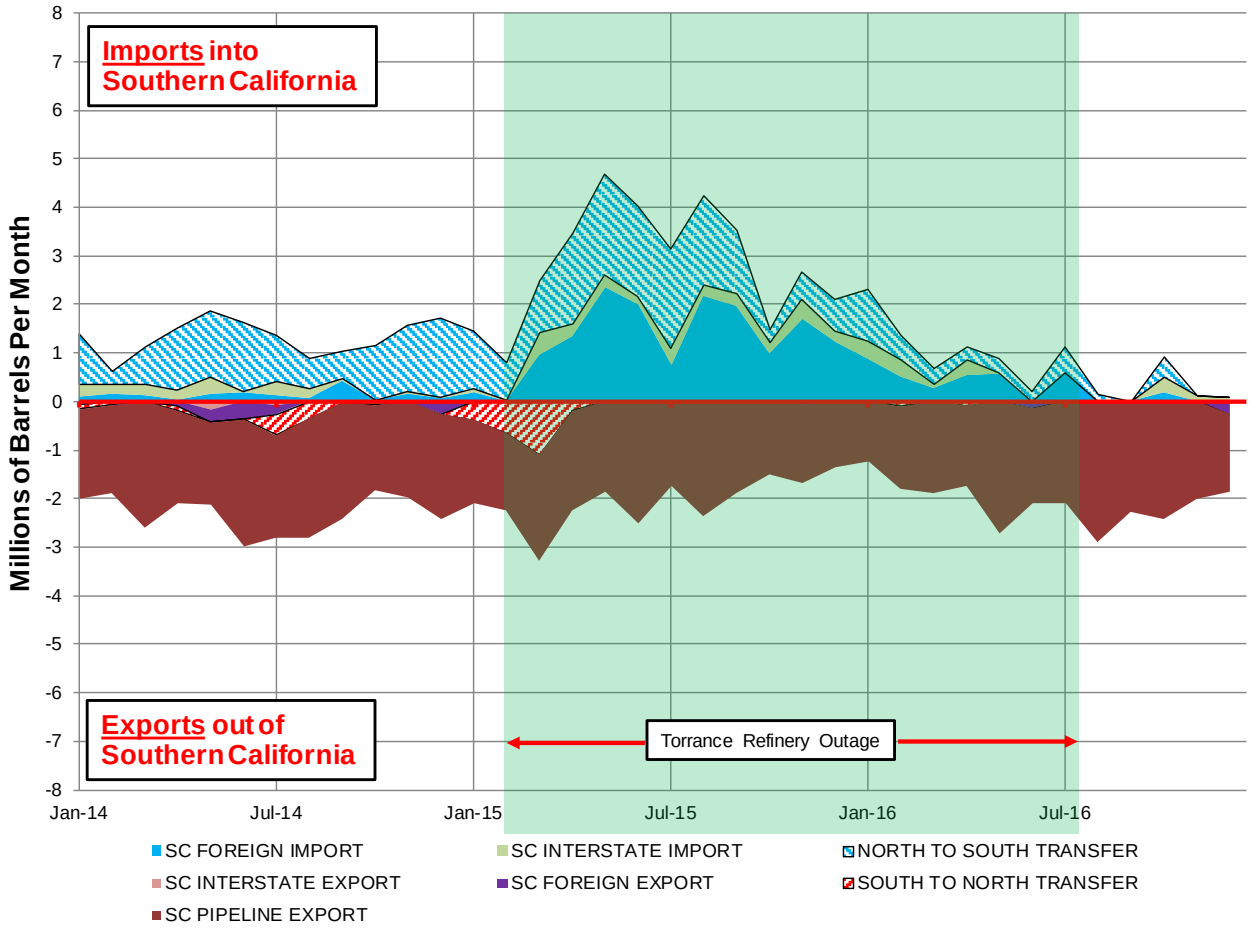
- The Torrance ESP explosion and subsequent inability of ExxonMobil to operate their primary gasoline-producing process equipment for 17 months necessitated a rebalancing of the transportation fuels market for West Coast
  - Decreased local supply had to be replaced by combination of increased imports from outside the region and decreased shipments to Nevada and Arizona

		2014		2015		Change
Demand (MBPD)						
	Domestic	1543		1575		32
	Export	55		42		(13)
	Total	1598		1617		19
Supply (MBPD)						
	Production	1410		1345		(65)
	From PADD 3	130		145		15
	From PADD 4	42		50		8
	Inventory	(4)		15		19
	Imports	21		62		41
	Total	1598		1617		19

Source: Energy Information Administration.

Shortfall	
Demand	32
Production	65
Total	97
Makeup	
Imports	41
Inventory	19
PADD 3	15
Exports	13
PADD 4	8
Total	97

Gasoline Market – ESP Explosion



- 2015 vs. 2014 Changes March thru December

Marine imports jump

- Foreign imports increased by 14.1 million barrels or 46.1 KBD
- Washington imports increased by 1.4 million barrels or 4.5 KBD
- N. Cal. transfers increased by 2.5 million barrels or 8.3 KBD

Pipeline exports decline

- Arizona exports declined by 1.2 million barrels or 4.1 KBD
- Las Vegas exports droped by 1.4 million barrels or 4.4 KBD

Source: California Energy Commission

Regional Supply Impacts – Valero & PBF Refinery Closures

Stillwater Associates performed a detailed assessment

Stillwater Associates LLC

1. Loss of 225 KBD of G+D production represents about 25% of regional demand
2. Finished gasoline production will be 153 KBD lower and require foreign imports
3. Jet fuel production will be 26 KBD lower and require foreign imports
4. Diesel production will be 46 KBD lower and require some foreign imports
5. Estimate 140 KBD of domestic crude production will need to find a new home

Thousand Barrels /Day	Base	Refinery Shutdown	Net Change
Refinery Input			
Crude - Domestic	140	0	(140)
Crude - Foreign	60	0	(60)
Imported FCC Feed	32	0	(32)
Imported Alkylate	1	0	(1)
LPG/Other	17	0	(17)
Total Input	**250**	**0**	**(250)**
Refinery Production			
Alky Feed	0	0	0
Gasoline	153	0	(153)
Jet Fuel	26	0	(26)
Diesel	46	0	(46)
LPG/Other	12	0	(12)
Total Liquid Products	**237**	**0**	**(237)**
Memo: Total G+J+D	**225**	**0**	**(225)**

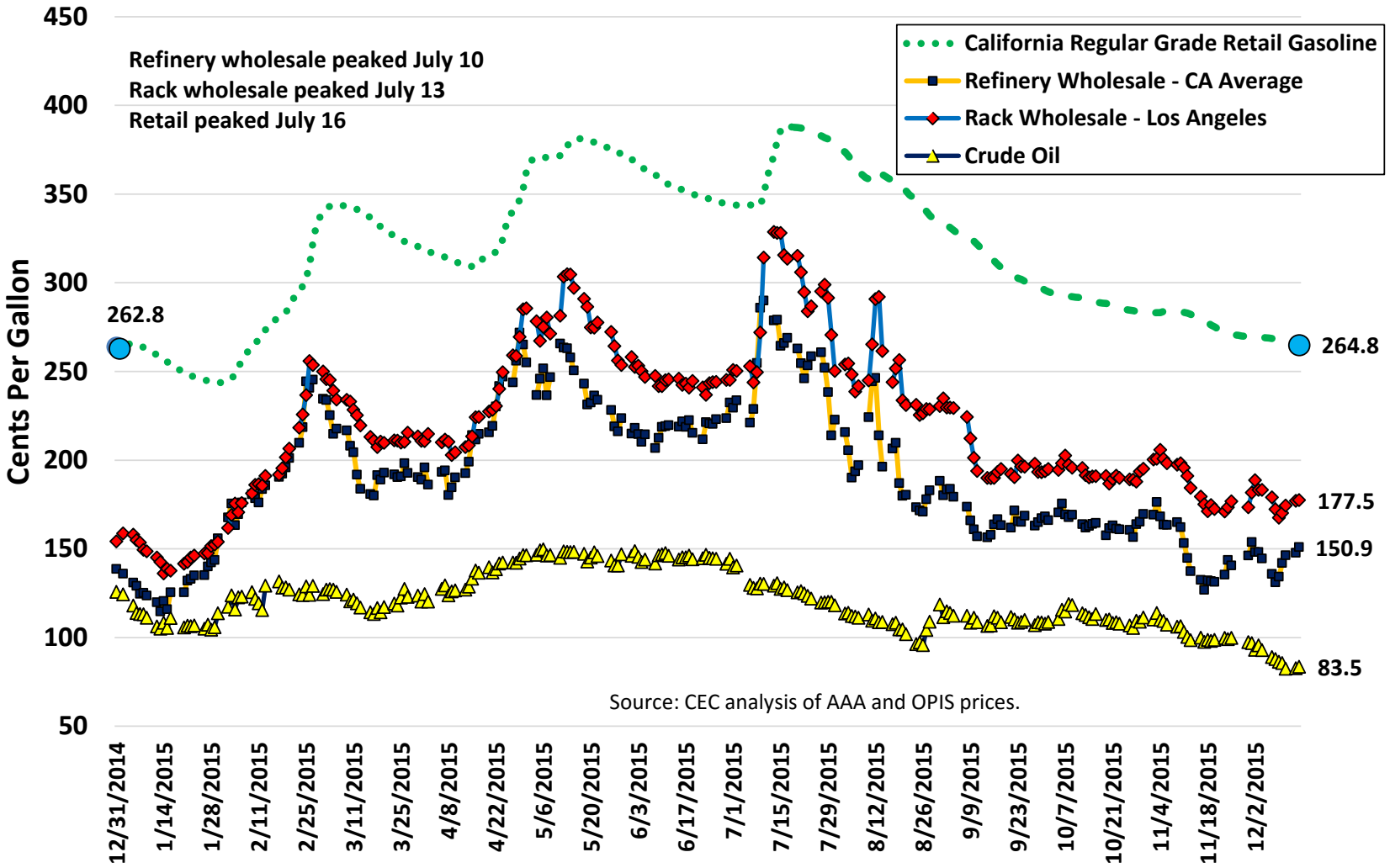
Source: Stillwater analysis

Impact of an HF Ban on Southern California Transportation Fuels Supply, June 23, 2017

Supply impacts of two refineries being closed down expected to be greater in magnitude, of longer duration, and higher in costs to motorists and truckers than those resulting from the temporary loss of gasoline production capability at Torrance refinery following the ESP explosion on 2/18/15

Refinery Closure Implications – Fuel Prices

California Gasoline Price Changes
Retail, Rack and Refinery Wholesale



Source: CEC analysis of AAA and OPIS prices.

HF Ban – Fuel Price Implications

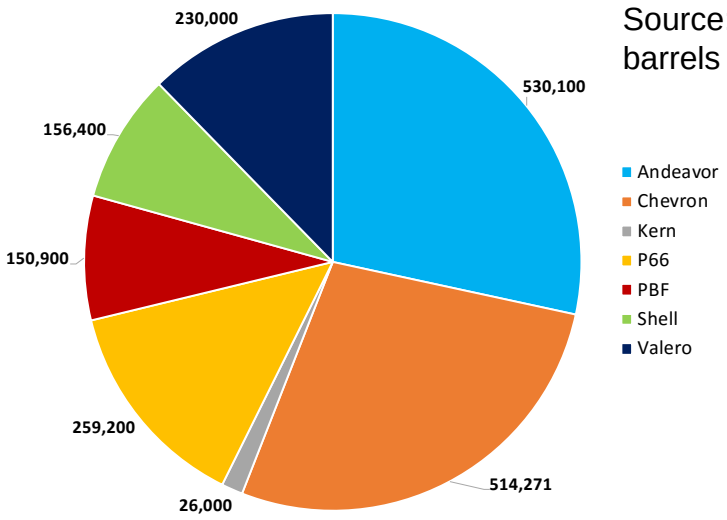
- Permanent loss of process units primarily creating gasoline blending components (catalytic cracking & alkylation) would be 60.4 percent greater than the temporary loss associated with the Torrance outage
  - 207.9 KBD versus 129.6 KBD
- Incremental impacts on gasoline costs for consumers and businesses could be as bad or worse than those of experienced for the duration that the Torrance ESP was out of operation
  - Gasoline prices averaged 26 cents per gallon greater than normal for 17 months
  - Equates to incremental costs of $5.6 billion for motorists & businesses
- Closure of two refineries would also increase prices for diesel and jet fuel

Refinery Closure Implications – Competition

Crude Oil Processing Capacity - Statewide

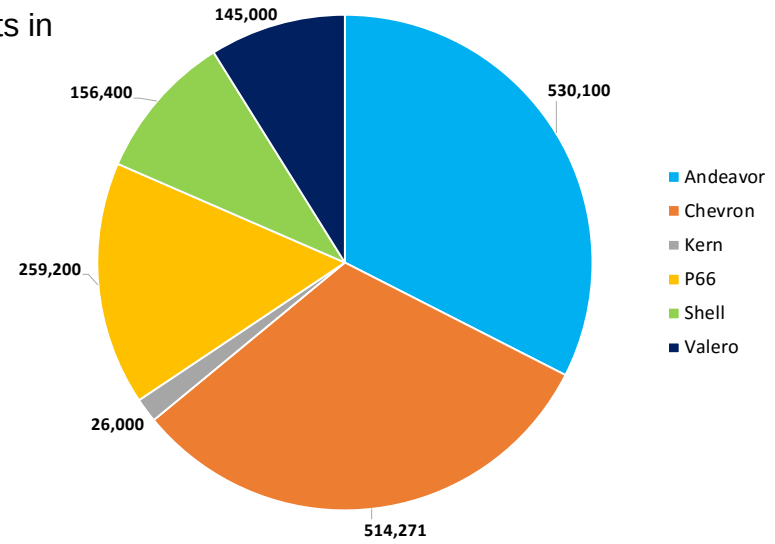
- California crude oil processing capacity would be more concentrated by refinery ownership post closure of Valero Wilmington and PBF Torrance

Current



Source: EIA. Units in barrels per day.

Post Closures

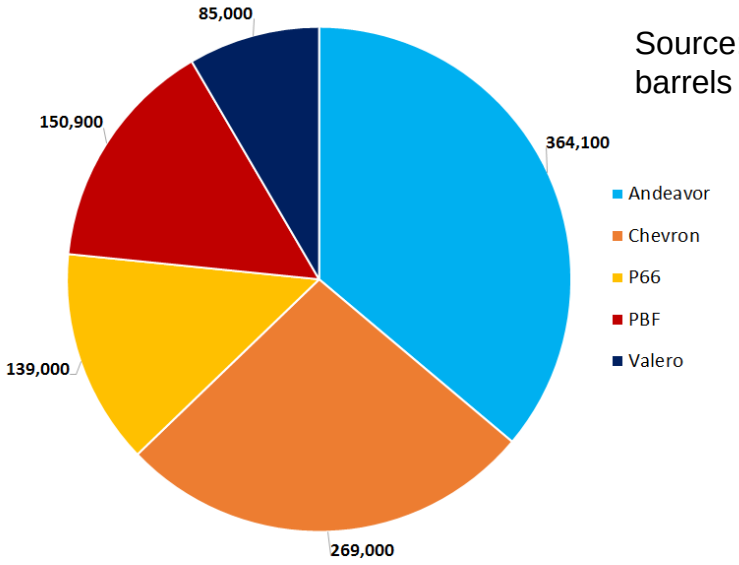


Portion operated by Andeavor, Chevron & P66 would rise from 69.8 to 79.9 percent of total.

Crude Oil Processing Capacity – S. Calif.

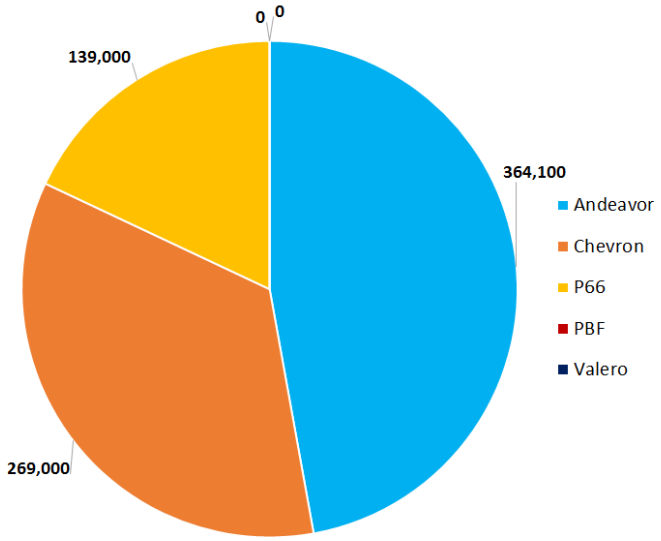
- Southern California crude oil processing capacity would be more concentrated by refinery ownership post closure of Valero Wilmington and PBF Torrance

Current



Source: EIA. Units in barrels per day.

Post Closures

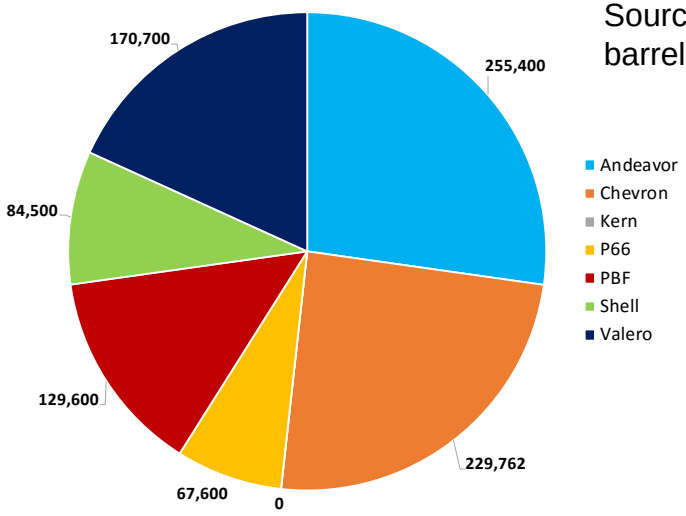


Portion operated by Andeavor & Chevron would rise from 62.8 to 82.0 percent of total.

Gasoline-Related Process Capacity - Statewide

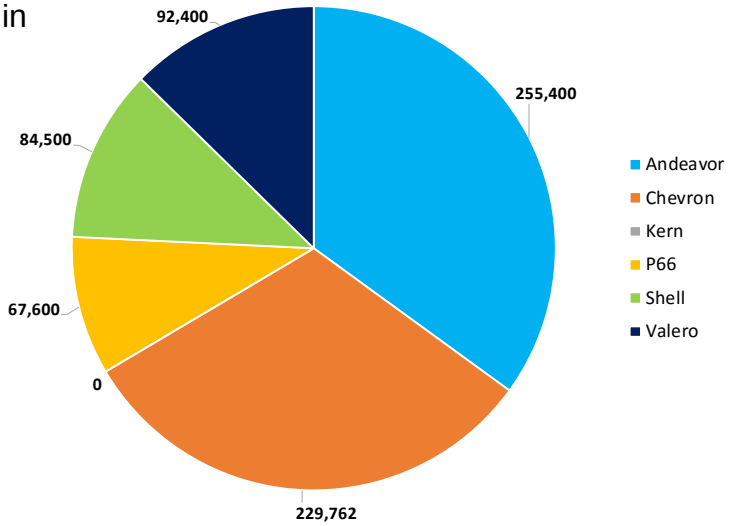
- California catalytic cracking & alkylation processing capacity would also be more concentrated by refinery ownership post closure of Valero Wilmington and PBF Torrance

Current



Source: EIA. Units in barrels per day.

Post Closures

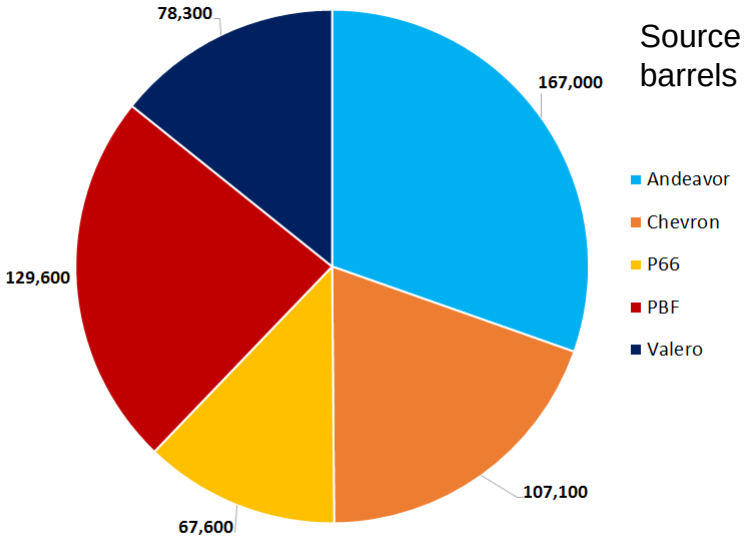


Portion operated by Andeavor, Chevron & P66 would rise from 59.0 to 75.8 percent of total.

Gasoline-Related Process Capacity – S. Calif.

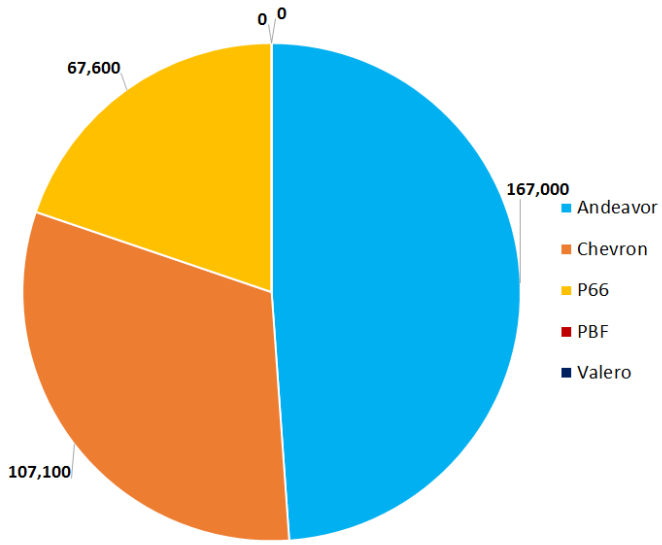
- Southern California catalytic cracking & alkylation processing capacity would also be more concentrated by refinery ownership post closure of Valero Wilmington and PBF Torrance

Current



Source: EIA. Units in barrels per day.

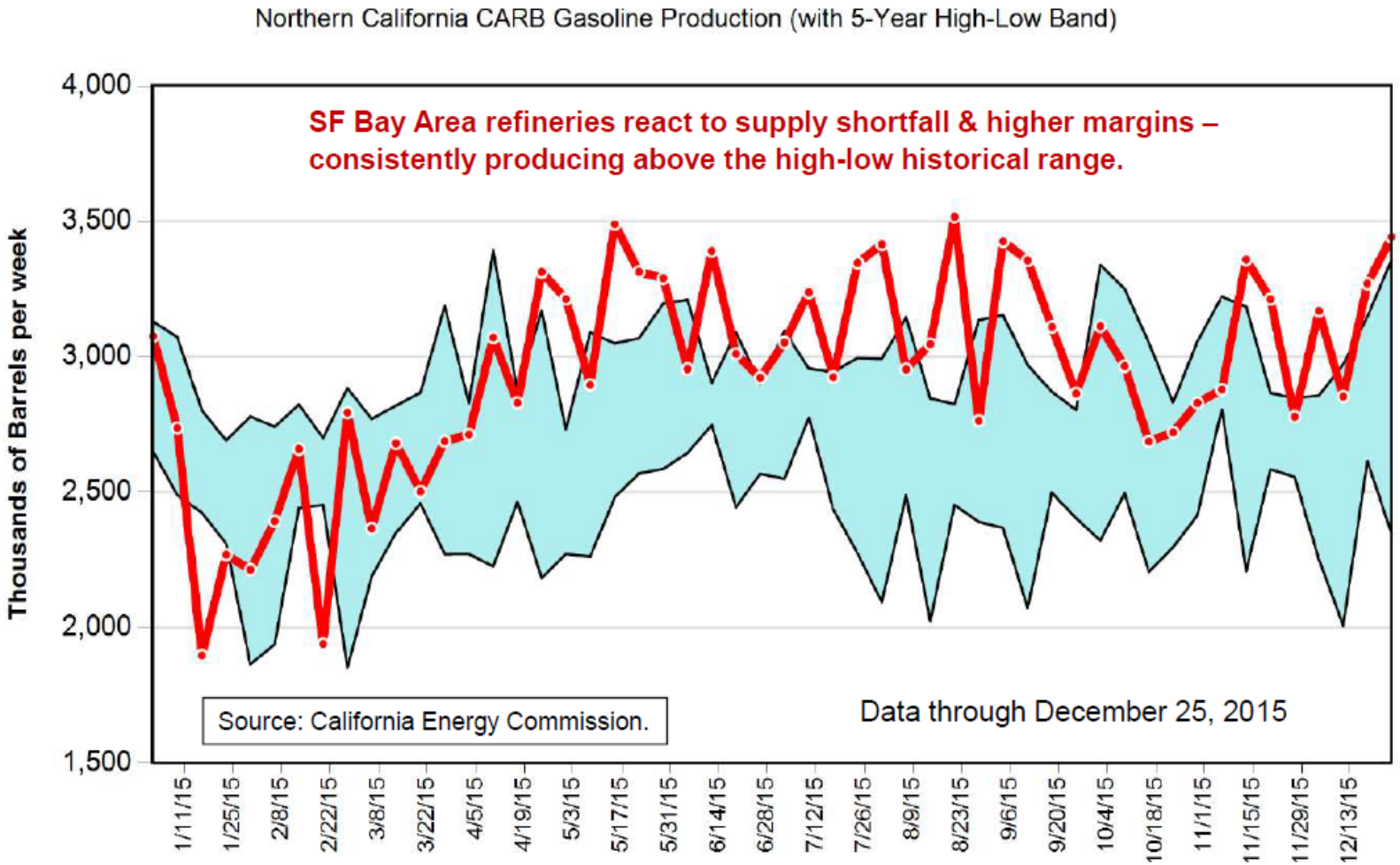
Post Closures



Portion operated by Andeavor & Chevron would rise from 49.9 to 80.2 percent of total.

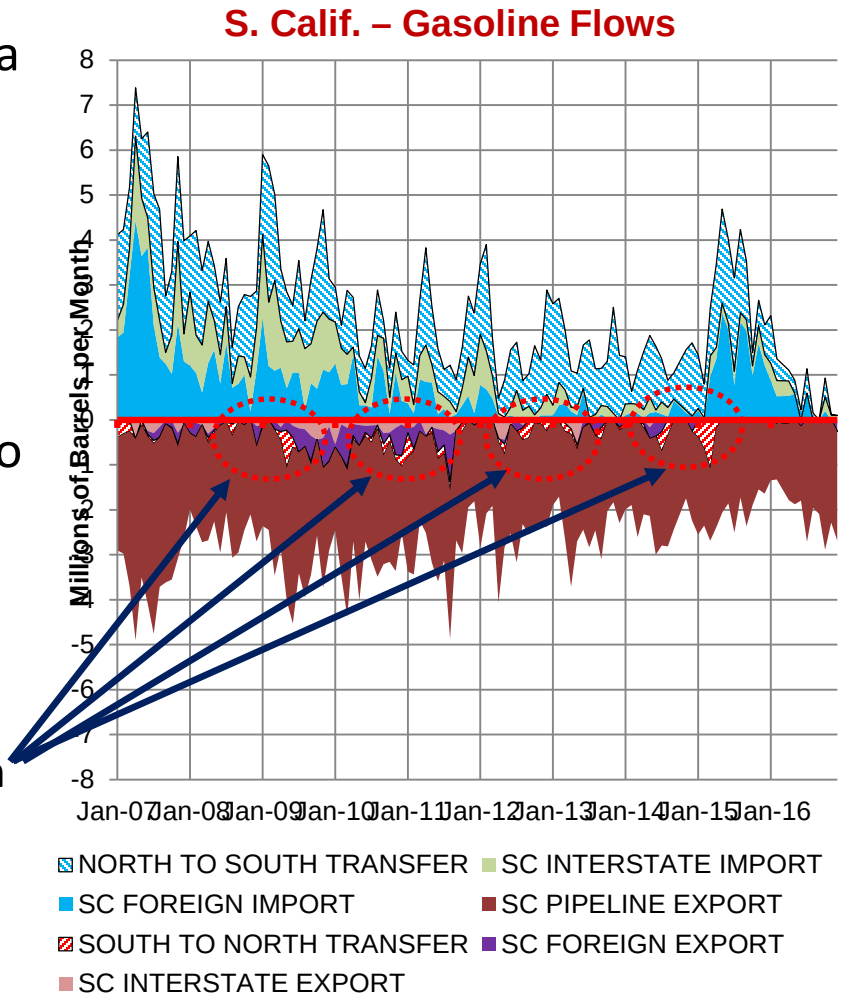
Refinery Closure Implications – Contingency Planning

Refiners – Surge Production Capability



Loss of Excess Refining Capacity

- Closure of two Southern California refineries will decrease statewide refining surge capacity
- Ability of remaining Southern California refineries to ramp up refinery output will be greatly diminished as region transitions to a significant net importer of gasoline and other refined petroleum products
  - Will decrease ability to send supplies to Northern California in response to:
    - Significant unplanned refinery outages
    - Catastrophic earthquake in the greater San Francisco Bay Area



Additional Q & A

Del Amo oil field in southern Torrance, circa 1938 – Daily Breeze.

Circa 2014 - LA-Curbed & Google Earth.