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Potential Refinery Reliability Issue with Reduced Natural Gas Availability from Aliso Canyon

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1. Stillwater is a transportation energy consulting firm, headquartered in Irvine
   a. The firm operates at the intersection of engineering and logistics, markets and regulations for the downstream oil industry
   b. Practice areas include energy policy, technology development, mergers & acquisitions and litigation support
   c. Several Associates have in depth experience in several of the California refineries
2. Dave Hackett
   a. Founded Stillwater in 1998 after a career with Mobil Oil
   b. Serves on the CEC's Petroleum Market Advisory Committee
3. Comments are general and not refinery specific

Agenda

1. Product flows on the West Coast
2. Gasoline supply & demand in Southern California
3. Refineries and natural gas
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5. Conclusions

West Coast refining centers are connect by marine vessel

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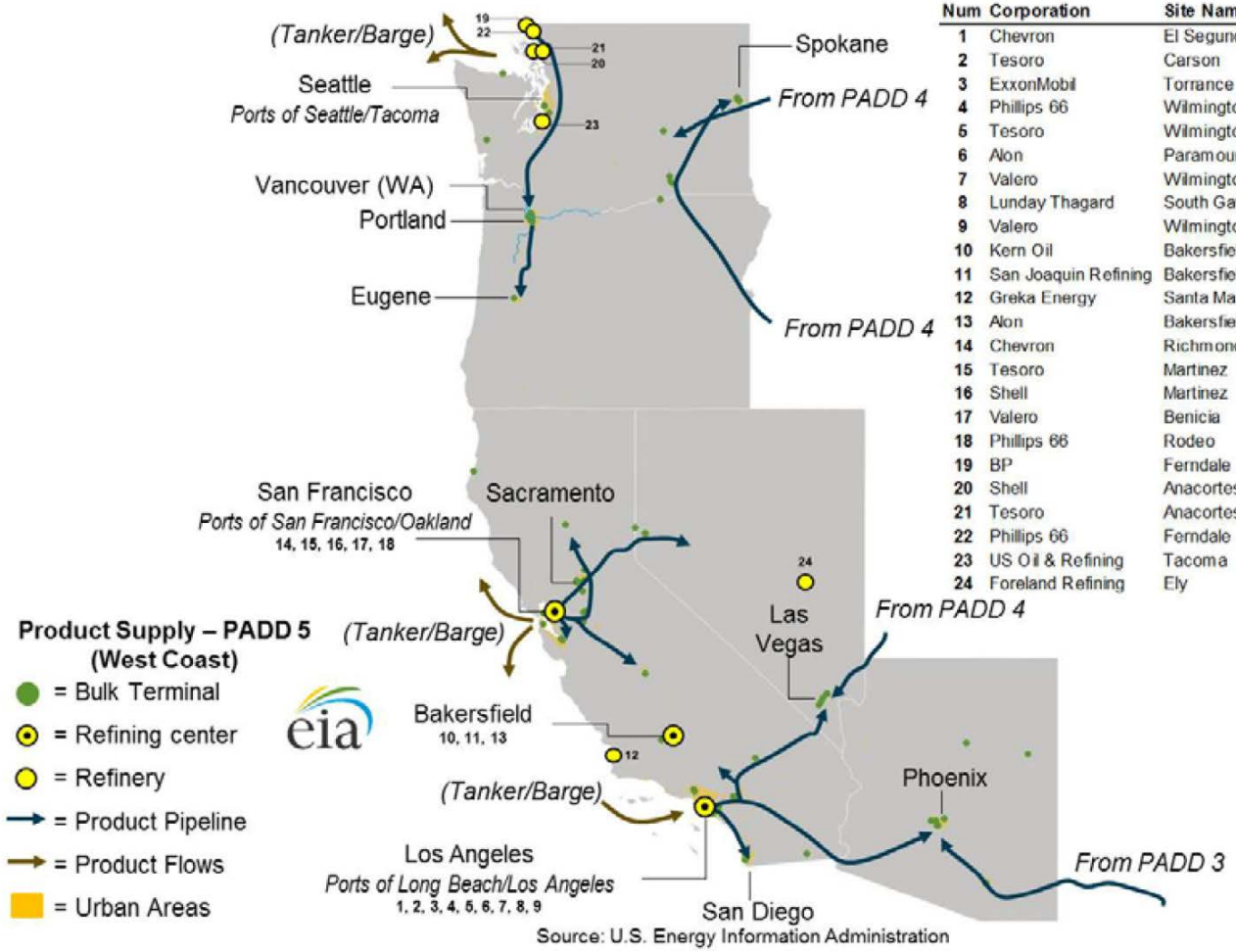
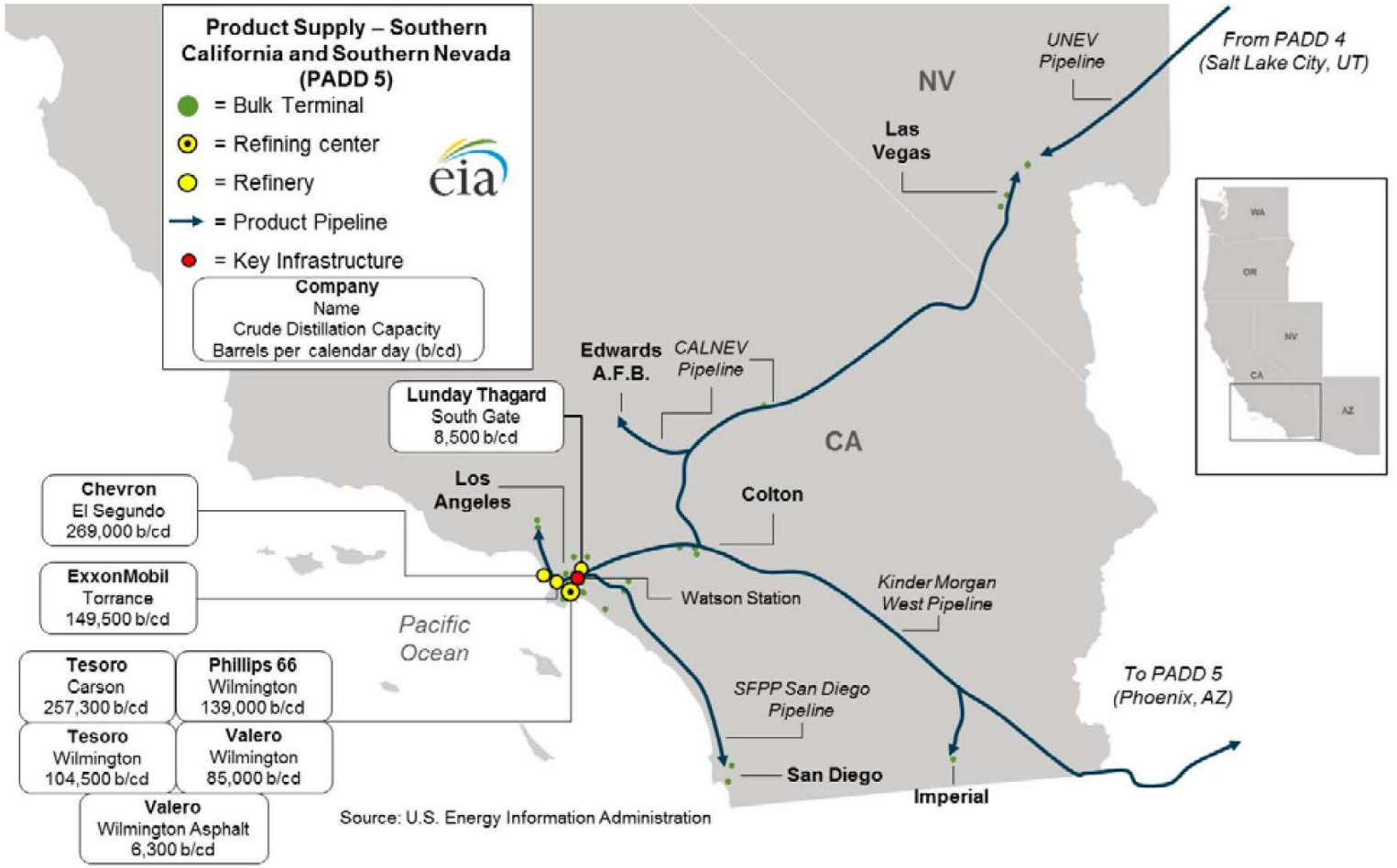


Num	Corporation	Site Name	Capacity (b/cd)
1	Chevron	El Segundo	269,000
2	Tesoro	Carson	251,000
3	ExxonMobil	Torrance	149,500
4	Phillips 66	Wilmington	139,000
5	Tesoro	Wilmington	104,500
6	Alon	Paramount	Idle
7	Valero	Wilmington	78,000
8	Lunday Thagard	South Gate	8,500
9	Valero	Wilmington (asphalt)	6,300
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

There are no interconnecting pipelines between the refining centers

Products flow from LA to Las Vegas, Phoenix and San Diego



LA supplies most of Las Vegas gasoline demand and some of Phoenix

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Southern California Fuels Market

1. Remote and isolated from other sources of gasoline, jet fuel and diesel
   a. If production of gasoline, jet fuel and diesel are curtailed because of reductions of natural gas, these products must be supplied from elsewhere
   b. When Southern California is short of fuels, prices rise and exceed levels that attract fuel supplies from remote areas of the US and world
      1. Unique specifications limit alternative sources of product
      2. Southern California has limited port facilities to import products
      3. We have seen this recently when the ExxonMobil refinery in Torrance experienced an explosion in February 2015 that resulted in greatly curtailed operations until the past month the FCCU was restarted
      4. During this period, gasoline prices rose and remained much higher than the rest of the US
      5. Recently, the retail price premium in Southern California has come back to its historical levels coincident with the ExxonMobil FCCU startup
2. This is a historic pattern we have seen over and over when there are unexpected refinery outages

Gasoline demand in SoCal is normally higher than local production

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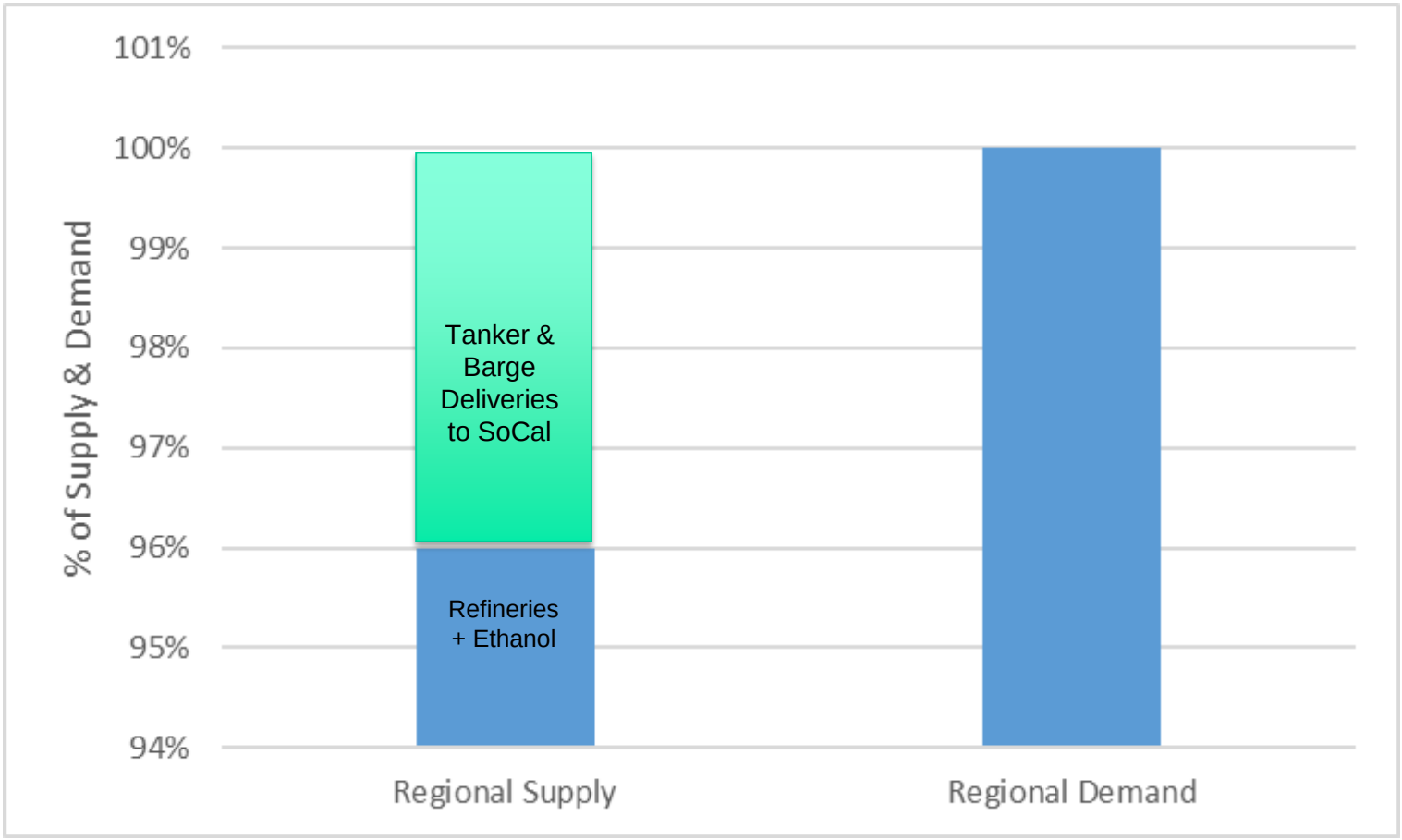
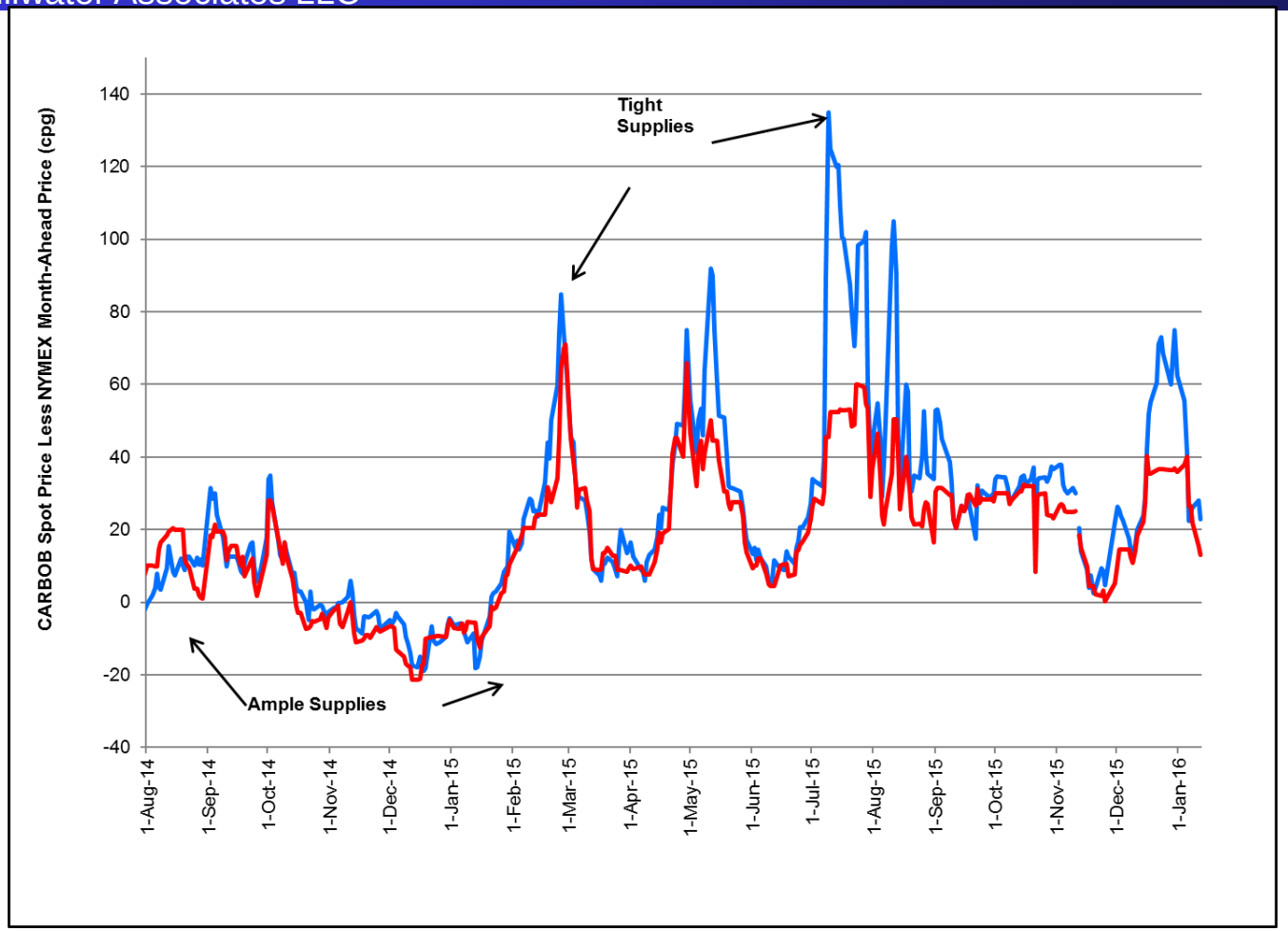


Source: EIA

The tanker & barge deliveries from SF Bay, Washington and Canadian refineries are typical when LA refineries run normally

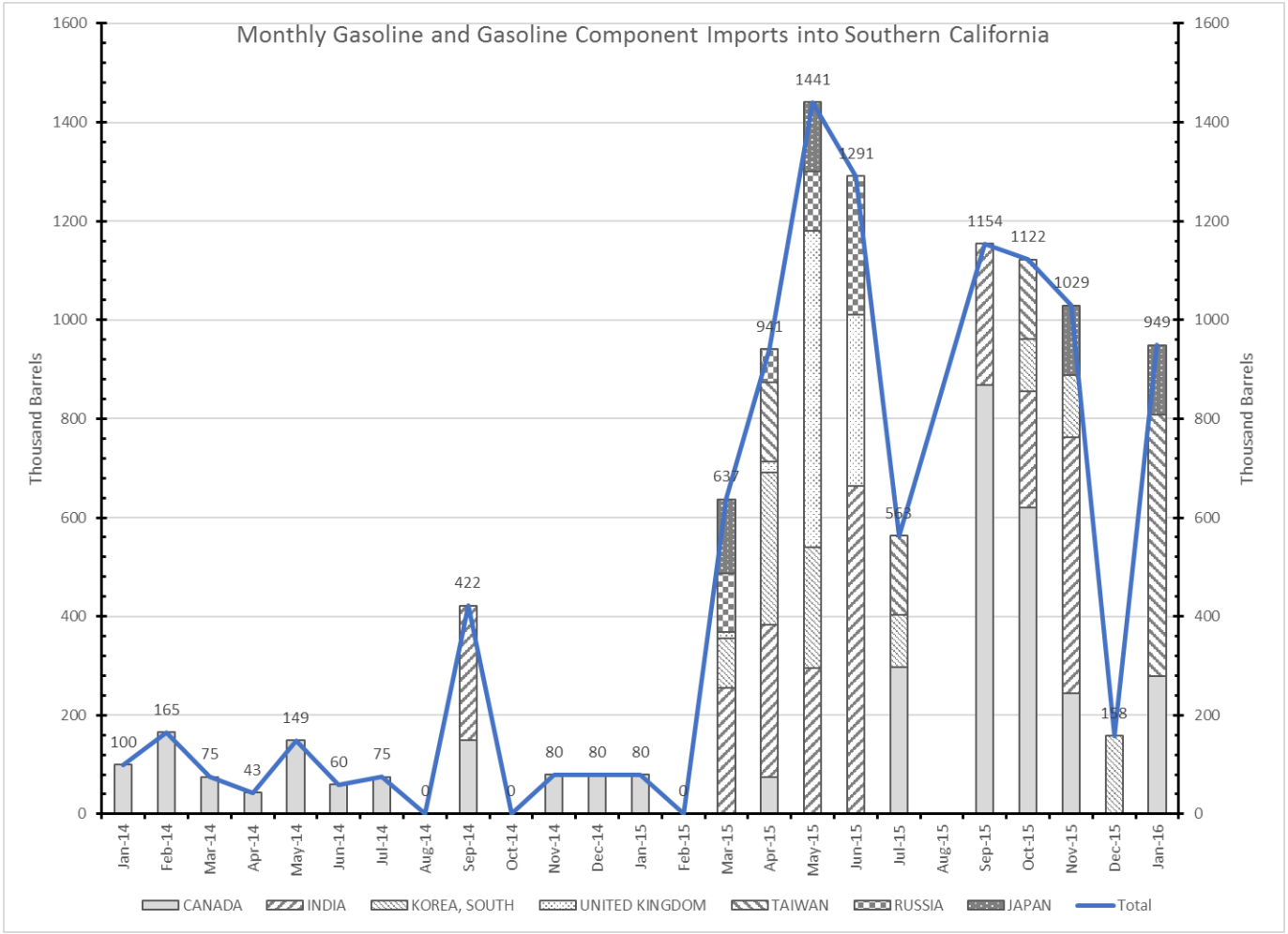
Unplanned refinery outages cause price spikes



Source: CEC

LA gasoline prices are more volatile than SF Bay gasoline prices

Long duration supply shortfalls are made up from imports from around the world



Local prices reflect the cost to deliver from long distance

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Refineries depend on natural gas for:

1. Fuel to supplement the gas that is produced as a byproduct of refining
   a. Local refineries produce methane and ethane produced from crude oil refining for fuel
   b. They may also burn propane and butane for fuel, but these have alternative uses
2. Feedstock to manufacture hydrogen
   a. Hydrogen is used to lower sulfur and aromatic levels
   b. Critical in the refining process for production of the clean fuels
3. Fuel for cogeneration plants
   a. Highly efficient production of power and steam
   b. Provides power for the refinery
   c. Excess is provided to the local grid

History: Refineries and Natural Gas Curtailment

1. Years ago, refineries were counted on to curtail natural gas consumption when necessary
   a. Typically in winter
   b. Refineries switched to using low sulfur fuel oil in place of natural gas
2. The capability for refineries to replace natural gas as a fuel has been eliminated
   a. Air district rules for low sulfur fuel are prohibitive
   b. Facilities to burn fuel oil are no longer there
   c. All recently installed facilities are limited to using natural gas
   d. Greatly increased dependence on hydrogen to produce clean fuels
   e. Installation of cogeneration units in the refineries

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Good quality electricity is vital to fuel production and distribution

1. Refineries are large consumers of electricity
    a. Major use is electricity to power pumps and compressors which need to operate continuously
    b. Other electricity use are equipment to support safe operations
    c. Electricity is used to operate and monitor emissions control devices (i.e.: ESP at Torrance)
    d. Several refineries have cogeneration and supply their own electricity needs
2. Reliable and continuous electricity supply is required
    a. Voltage dips will cause equipment to “trip”
    b. Equipment “trips” lead to emissions events, safety risks and potential production losses
3. The fuel logistics system requires electricity to deliver fuel
    a. Network of pipelines from refineries to product terminals
    b. Product terminals
    c. Retail sites

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Curtailment of natural gas and/or electricity:

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1. This may result in reduced refining operations and lower product supply
2. Unplanned reductions of refining operations have lead to higher gasoline prices in the past
3. Refinery curtailment will essentially trade a natural gas/power supply issue to a broader transportation fuels supply issue
4. Reduction of natural gas to refineries may reduce cogeneration of power, reducing efficient in-basin supply
5. The Commission should not consider the refining industry to be a fly-wheel to control natural gas or electricity demand without in-depth consultation with each refinery to determine reduction capability and impacts
6. Perhaps the SCAQMD could provide waivers to allow refineries to substitute other fuels in order to maintain transportation fuel production levels

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- … experience runs deep

Questions and Comments

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