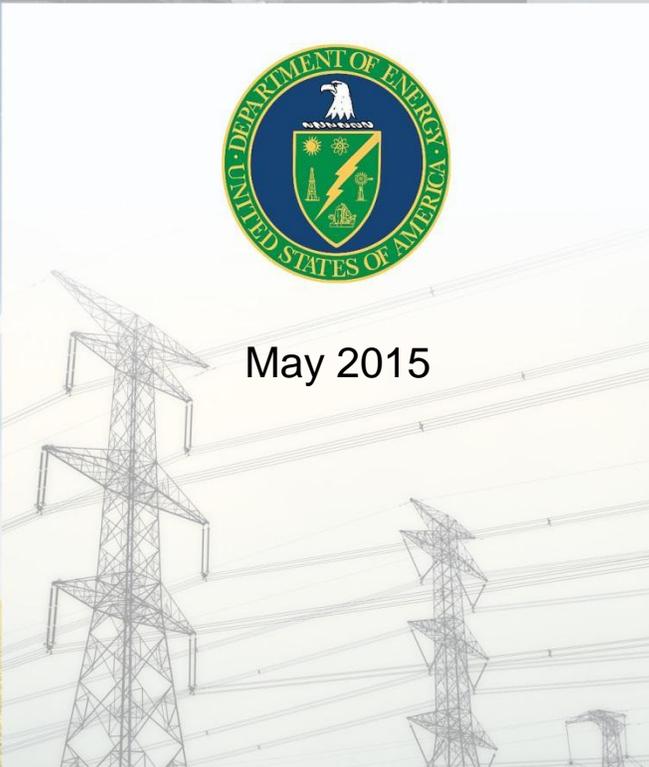




Infrastructure Security and Energy Restoration
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy



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For Further Information

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Contents

1.	Introduction	1
1.1	Background and Organization.....	1
1.2	Data Sources and Limitations	1
1.3	Financial and Economic Context.....	2
2.	Major Events	4
2.1	Electricity	4
2.2	Natural Gas.....	5
2.3	Petroleum	6
3.	Energy Disruptions	8
3.1	Electricity Disruptions.....	8
3.1.1	Customer Outages	8
3.1.2	Power Plant Outages.....	13
3.1.3	Physical Attacks and Sabotage	13
3.2	Natural Gas Disruptions	14
3.2.1	Upstream.....	14
3.2.2	Midstream and Downstream.....	15
3.3	Petroleum Disruptions.....	16
3.3.1	Production	16
3.3.2	Refineries	17
3.3.3	Transportation and Storage	18
3.3.4	Hours-of-Service Exemptions	20
3.4	Biofuel Disruptions	22
3.5	Cybersecurity.....	23
4.	Infrastructure Changes	25
4.1	Electricity	25
4.1.1	Environmental Regulations Impacting Infrastructure Developments	25
4.1.2	Coal Retirements.....	26
4.1.3	Capacity Additions.....	27
4.1.4	Nuclear Power Plants	28
4.1.5	Transmission Expansion.....	29
4.2	Natural Gas Projects.....	30
4.2.1	Natural Gas Processing Plants	30
4.2.2	Natural Gas Pipelines	30
4.2.3	Liquefied Natural Gas Export Terminals	31

4.3	Petroleum Projects.....	32
4.3.1	Crude Oil Production and Transportation Projects	33
4.3.2	Refining and Petroleum Product Transportation	39
4.4	Biofuels.....	42
4.4.1	New Biofuel Plants	42
4.4.2	Plants in Transition	43
4.4.3	Policy Changes.....	44
5.	International Events.....	46
5.1	International Incidents and Disruptions	46
5.1.1	Africa	46
5.1.2	Middle East.....	47
5.1.3	Americas	48
5.1.4	Europe.....	48
5.2	International Infrastructure Projects	48
5.2.1	Africa	48
5.2.2	Middle East.....	49
5.2.3	Americas	49
	Appendix A. Criteria for EAD Selection	50
	Appendix B. List of Biofuel Plants in Transition, 2014.....	51

Figures

Figure 1.	U.S. Oil and Gas Spot Prices, 2013.....	3
Figure 2.	2014 Map of Major Events	4
Figure 3.	Large-Scale U.S. Electric Customer Outage Events, 2014.....	8
Figure 4.	Number of Large-Scale Outage Events by U.S. State, 2014	11
Figure 5.	Small- and Medium-Scale U.S. Electric Customer Outage Events, 2014	12
Figure 6.	U.S. Electric Customer Outage Events by Cause and Magnitude, 2014	13
Figure 7.	U.S. Refinery Disruptions by Cause, 2014	18
Figure 8.	Retired Coal-fired Generation Capacity, 2014.....	27
Figure 9.	In-Service Generation Capacity, 2014.....	28

Tables

Table 1.	Hours-of-Service Exemptions, 2014.....	21
Table 2.	Proposed Transmission Projects, 2014.....	29
Table 3.	Proposed LNG Export Projects in the United States, 2014.....	32

Abbreviations

b/d	Barrels per day
bbl	Barrel
Bcf	Billion cubic feet
Bcf/d	Billion cubic feet per day
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EAD	Energy Assurance Daily
EPA	U.S. Environmental Protection Agency
FCCU	Fluid catalytic cracking unit
FERC	U.S. Federal Energy Regulatory Commission
FTA	Free Trade Agreement
GW	Gigawatt
HOS	Hours-of-service
ICS-CERT	Industrial Control Systems Cyber Emergency Response Team
ISER	Infrastructure Security and Energy Restoration
kV	Kilovolts
LNG	Liquefied natural gas
MMBtu	Million British thermal units
MMcf/d	Million cubic feet per day
MMgal/year	Million gallons per year
mph	Miles per hour
mtpa	Million tonnes (metric) per annum
MW	Megawatts
MWh	Megawatt-hour
NERC	North American Electric Reliability Corporation

NGL	Natural gas liquid
NRC	U.S. Nuclear Regulatory Commission
NTSB	National Transportation Safety Board
OE	Office of Electricity Delivery and Energy Reliability
PHMSA	Pipeline and Hazardous Materials Safety Administration
RFS	U.S. Renewable Fuel Standard
RIN	Renewable Identification Number
RVO	Renewable volume obligation
TCEQ	Texas Commission on Environmental Quality
WTI	West Texas Intermediate
YIR	Year-in-Review

1. Introduction

The 2014 Year-in-Review (YIR) provides a summary of significant energy disruptions and infrastructure changes that occurred in the United States in 2014. The report also summarizes several international events of significance that impacted global energy markets..

1.1 Background and Organization

The 2014 YIR is based primarily on information reported in [Energy Assurance Daily](#) (EAD) between January 1, 2014 and December 31, 2014.¹ EAD contains summaries of energy sector highlights and is published Monday through Friday by the U.S. Department of Energy (DOE) Office of Electricity Delivery and Energy Reliability (OE), Infrastructure Security and Energy Restoration (ISER) Division. For the summaries of certain major events, information is drawn from emergency situation and emergency spot reports, which are also published by ISER.

Events and developments reported in EAD are grouped by energy sector: Electricity, Petroleum, and Natural Gas. The Other News section includes information related to coal, biofuels, and energy policy. These sections primarily cover events and developments in the United States, but also include relevant events and developments in Canada and Mexico that affect the United States due to the interdependencies among North American energy markets. Events and developments outside of North America that have a significant impact on global energy markets are reported in the International News section. EAD reports events and developments that meet a specific threshold of impact or importance to energy supply (see Appendix A for selection criteria). A special section, Major Developments, reports on events that disrupt energy service to a large segment of the population and/or damage to critical assets in the energy sector. The Major Developments section is only included in EAD when an event meets the criteria for a Major Development.

1.2 Data Sources and Limitations

EAD is derived from publicly available information and does not include classified or confidential data or information accessible only through subscription services. As a result, EAD—and by extension, the 2014 YIR—is not an exhaustive summary of all significant energy events.²

This report compares events and infrastructure changes that occurred in 2013 and 2014 to highlight a few selected trends, but these comparisons are based only on information captured

¹ Unless noted otherwise, the source for all information in this report is EAD, <http://www.oe.netl.doe.gov/ead.aspx>.

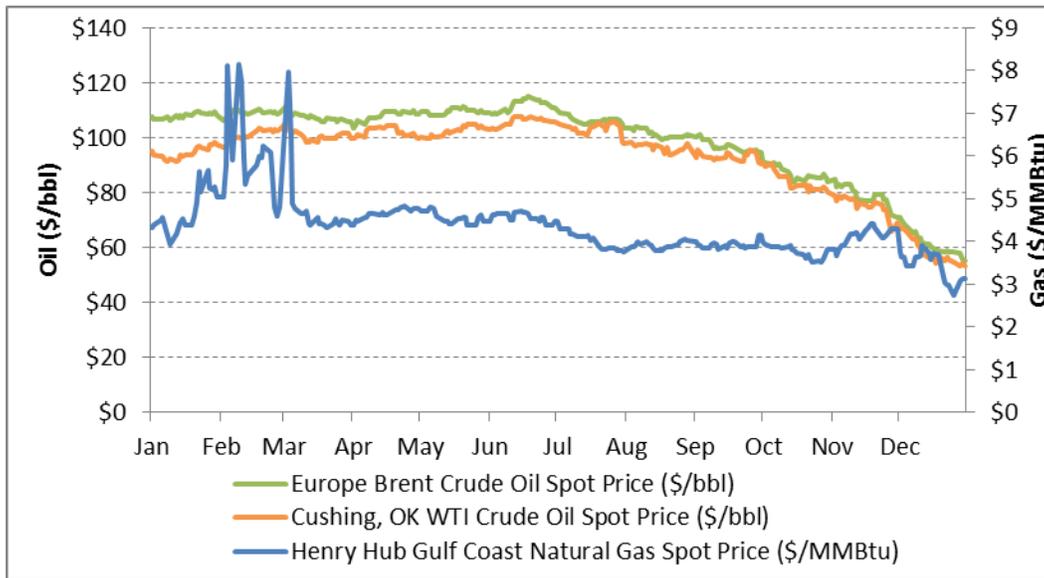
² For example, California and Texas State agencies release more energy information into the public domain than other States thus distorting the balance of information published in favor of those States. Similarly, the U.S. Nuclear Regulatory Commission (NRC) provides an abundance of public information on nuclear power plants. There is no equivalent reporting mechanism for coal, natural gas, or any other class of utility-scale power generation.

by EAD and other ISER reports, and are not a thorough analysis. Readers are advised to view the 2014 YIR as a snapshot of newsworthy events and broad trends that shaped the U.S. energy sector in 2014.

1.3 Financial and Economic Context

EAD reports spot U.S. energy prices for crude oil (West Texas Intermediate [WTI]) and natural gas (Henry Hub). Figure 1 presents a time series of these prices in 2014, as well as the European North Sea Brent benchmark crude oil price. WTI is a crude oil produced in Texas and southern Oklahoma, which serves as a marker for pricing North American crude streams and is traded in the domestic spot market at Cushing, OK. WTI crude is the underlying commodity for the New York Mercantile Exchange's (NYMEX) oil futures contracts. Brent crude is a blended crude stream produced in the North Sea region that serves as a reference, or marker, for pricing a number of crude oils in the Atlantic market. Henry Hub is a natural gas pipeline hub on the Louisiana Gulf Coast and serves as the delivery point for the NYMEX natural gas futures contract.

Figure 1. U.S. Oil and Gas Spot Prices, 2014



Source: U.S. Energy Information Administration

In 2014, both WTI and Brent crude prices peaked in June, reaching highs of \$107.95 per barrel (bbl) and \$115.19/bbl, respectively. Through the first 8 months of the year, crude prices remained relatively steady with WTI averaging \$100.80/bbl and Brent averaging \$107.74/bbl. However, the last 4 months of the year saw a dramatic drop in global oil prices. WTI averaged \$78.15/bbl and Brent averaged \$81.53/bbl from September through December. Both crudes reached lows for the year on December 31, 2014, as WTI prices fell to \$53.45/bbl and Brent fell to \$55.27/bbl. The end of the year marked the lowest prices for WTI and Brent since 2009. The dramatic fall in oil prices during the latter part of 2014 was triggered by both increasing supply and falling demand in the global oil market. From the supply side, U.S. production continued to climb while other major oil producers, including the Organization of the Petroleum Exporting Countries (OPEC), maintained output levels even as oil prices fell. Concurrently, demand weakened in East Asia and European economic concerns perpetuated.

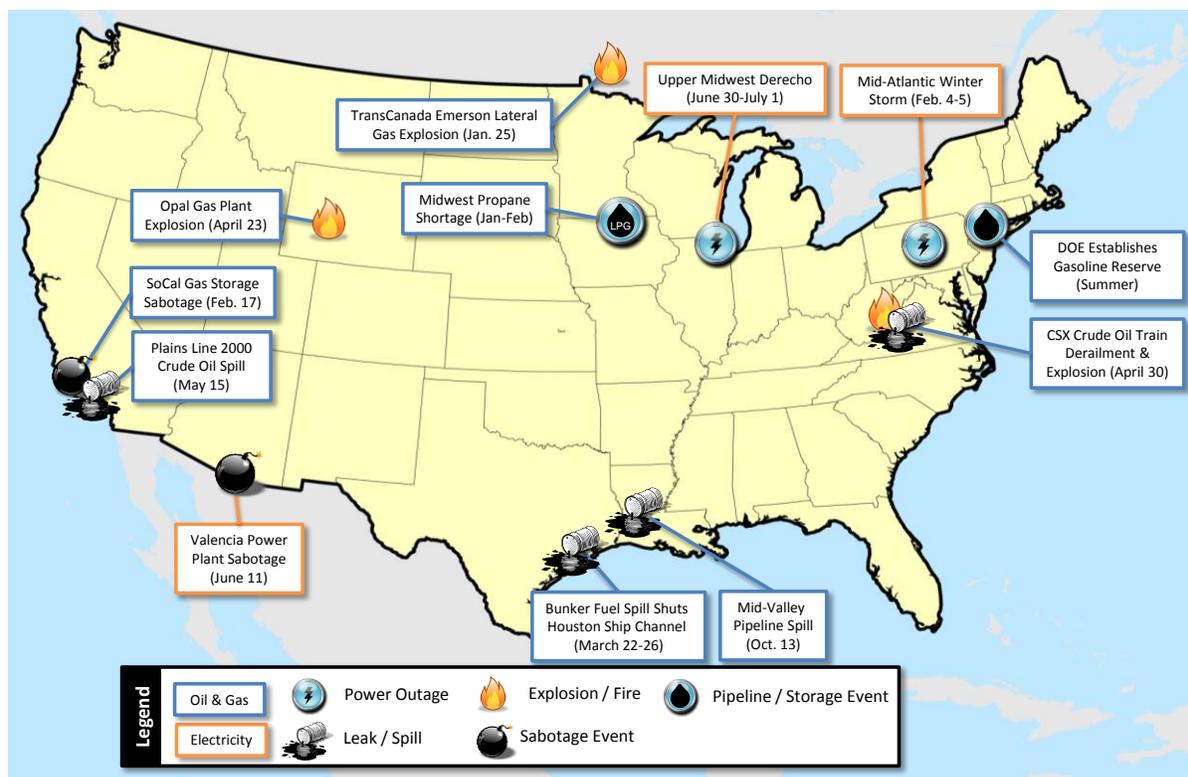
The Henry Hub natural gas price averaged \$4.37 per million British thermal units (MMBtu) in 2014—a 17 percent increase in price from the 2013 average (\$3.73/MMBtu) and a 59 percent increase in price from the 2012 average (\$2.75/MMBtu), as supply and demand continued to equalize amid booming North American production from shale gas resources. Moreover, a significantly colder-than-normal winter in the early months of 2014 led to significant price spikes as several lengthy cold snaps bolstered gas demand and stressed delivery infrastructure. February and March 2014 saw gas prices reach or exceed \$7.75/MMBtu on 4 trading days, peaking at \$8.15/MMBtu, the high for 2014. Meanwhile, the end of the year saw a decline in the gas price, which fell to \$2.74/MMBtu toward the end of December.

2. Major Events

Major Events, or “Major Developments” as referred to in EAD, are typically events that disrupt energy service to a large segment of the population and/or damage critical assets in the energy sector. Major events can also include intentional attempts to sabotage critical infrastructure and major infrastructure changes or policy actions that have a major impact on U.S. energy markets. Twelve unique energy events met the criteria for Major Events in 2014, compared with 11 events in 2013(see Appendix A. Criteria for EAD Selection). Figure 2 maps these events.

Details on the 12 Major Events from 2014 are summarized in the bullet points below. More details on the effects of these events can be found in sections 3 (Energy Disruptions) and 4 (Infrastructure Changes) of this report.

Figure 2. 2014 Map of Major Events



2.1 Electricity

- **Mid-Atlantic Winter Storm (February 4–5):** Severe snow and ice storms in the U.S. Mid-Atlantic in early February knocked out power to approximately 1.1 million customers from Kentucky to New Jersey. In Pennsylvania, the hardest hit State with more than 800,000 outages, tree limbs heavy with ice crashed down on power lines across the eastern and central parts of the State. PECO, the utility serving Philadelphia and southeastern Pennsylvania, said that the storm was the second most damaging in the company’s history. PECO crews worked around the clock to restore power; however,

more than 260,000 of its customers remained without power more than 2 days after the storm had passed.

- **Sabotage at Arizona Power Plant (June 11):** An “incendiary-type device” was found on a large diesel fuel tank at Unisource Energy’s 104-megawatt (MW) Valencia power plant in Nogales, AZ, in mid-June. The device detonated, causing a small leak, but did not cause any serious damage to the fuel tank. The plant remained functional and no services were affected, although the plant and a nearby business were evacuated for precautionary reasons. The Valencia plant site also includes the Valencia substation, which receives power from Tucson via a 138-kilovolt (kV) transmission line, and is the primary source of electrical service for approximately 30,000 customers in Nogales and the surrounding communities. The Federal Bureau of Investigation (FBI), the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF), and the Arizona Department of Public Safety were brought in to investigate, but no arrests were made in connection with the incident.
- **Upper Midwest Derecho (June 30–July 1):** A massive derecho storm brought heavy rain and high winds across the Upper Midwest, knocking out power to more than 1 million customers from Iowa to Indiana and Michigan. Wind gusts reached up to 75 mph in some areas. Commonwealth Edison’s service territory in the Chicago metropolitan area was the hardest hit, with approximately 400,000 customers without power at the height of the storm. Due to the extent of the damage, restoration was a multi-day process, with heavily impacted utilities completing service restoration 4 days after the storm had passed.

2.2 Natural Gas

- **TransCanada’s Canadian Mainline Emerson Lateral Explosion in Manitoba (January 25):** The three pipelines that make up TransCanada’s Emerson lateral, a major pipeline supplying Western Canadian gas to the U.S. Midwest, were shut down after one of the lines exploded and caught fire in Manitoba. The shutdown occurred during one of the coldest periods of the year, when natural gas demand in the Midwest was very high. The two lines that didn’t explode resumed flows in the subsequent days after inspections. Viking Gas Transmission, which receives gas from the Emerson lateral in Minnesota, was forced to interrupt service to some customers when the shutdown occurred, but restored service in a staged manner after the two unaffected lines returned, lifting conservation appeals 2 days after the event.
- **Sabotage at SoCal’s Playa del Rey Gas Storage Facility (February 17):** A suspected sabotage event was reported at Southern California Gas Company’s (SoCal) 2.4-billion cubic foot (Bcf) Playa del Rey underground storage facility in Los Angeles, CA. The event involved a suspect, who was later arrested, damaging an electrical panel, stealing a pickup truck, and hitting a small-diameter valve at the facility, causing an unplanned release of natural gas and a very loud noise. Following the event, SoCal released a statement saying that it was reviewing its security at the facility and adding additional staff and surveillance cameras.

- **Opal Gas Processing Plant Explosion and Fire in Wyoming (April 23):** Williams Partners' 1.5-billion cubic foot per day (Bcf/d) gas processing plant in Lincoln County, WY, was shut down following an explosion and fire in one of the plant's five cryogenic processing trains. All personnel were safely evacuated from the facility. As a result of the shutdown, natural gas gathering from surrounding areas was temporarily suspended and supply of processed gas was disrupted to several major interstate pipelines serving western States. The plant was processing approximately 1 Bcf/d prior to the blast. In the 2 weeks following the incident, Williams brought the four processing trains not involved in the explosion back online, restoring capacity at the plant to 1.1 Bcf/d. The U.S. Chemical Safety Board launched an investigation into Williams Partners' safety practices following the event, which was the third incident for the company in a year, following an explosion at a liquefied natural gas (LNG) storage site in March 2014 and a blast at a chemical plant in Louisiana in June 2013.

2.3 Petroleum

- **Midwest Propane Shortage (Winter 2013–2014):** In January–February 2014, a severe shortage of propane developed in the Midwest due to a number of factors, including low regional stocks entering the winter due to higher-than-normal propane consumption for crop drying during the fall 2013 harvest; high demand amid a record cold winter that brought several extended periods of extremely low temperatures; and unplanned outages to critical supply infrastructure, specifically the Cochin Pipeline, which at the time supplied propane to the Upper Midwest from Canada. The shortage led to supply outages at some terminals, very high propane prices for consumers, and the need to truck in supply from as far away as Texas. The Federal Government took several actions to help ease the shortage: The U.S. Department of Transportation issued a rare regional hours-of-service waiver for 31 States to allow transporters to move propane more freely throughout the most affected regions, and the U.S. Federal Energy Regulatory Commission (FERC) ordered Enterprise Product Partners to prioritize propane shipments on its TE Products Pipeline to accelerate the movement of propane to the Midwest and Northeast.
- **Bunker Fuel Spill Shuts Down Houston Ship Channel (March 22–26):** A 4,000-barrel release of bunker fuel from a barge accident disrupted shipping on the Houston Ship Channel for 4 days in late March. Refineries with a combined processing capacity of 2.1 million barrels per day (b/d) rely on the Houston Ship Channel for waterborne transportation of crude oil into their facilities and products out of their facilities. The U.S. Coast Guard initially reported that the waterway would be closed for a week or longer, but fully reopened the channel after 4 days. On the day that the channel reopened, 51 ships, including 13 oil tankers, were waiting to enter the channel while 36 ships were waiting to leave. Initially, ExxonMobil said that it had cut production at its 560,500-b/d Baytown, TX, refinery and had planned further cuts after 2–3 days because crude oil tankers were unable to supply the plant. The day after the channel reopened, ExxonMobil said that it had received a crude oil cargo and was resuming normal operations. Other refineries in the area did not report impacts publically.

- **CSX Crude Oil Train Derails, Catches Fire in Virginia (April 30):** Thirteen cars of a 105-car CSX Corporation train carrying Bakken crude oil derailed in Lynchburg, VA, with several derailed cars catching fire and 3 cars falling down an embankment into the James River. According to officials, approximately 831 barrels of crude oil spilled into the river. The train was *en route* to Plains All American's crude oil transloading terminal in Yorktown, VA, which receives crude by rail and sends it out by barge to refineries on the East Coast. The cars involved in the accident were classified as DOT-111 tank cars, an older design that had been subject to earlier National Transportation Safety Board safety examinations. CSX resumed operations on the route 3 days after the derailment.
- **U.S. Department of Energy Establishes First Regional Gasoline Reserve to Strengthen Fuel Resiliency (Spring and Summer):** In early May, DOE announced the creation of the first Federal regional refined petroleum product reserve containing gasoline. Based on DOE's lessons learned from the major fuel supply in the aftermath of Superstorm Sandy, DOE said that it would establish a 1 million-barrel reserve at locations near New York Harbor and in New England. Contracts to operate the reserve sites were awarded in late summer, and gasoline was delivered to the sites soon after. The regional reserve has 700,000 barrels of gasoline located in the New York Harbor area, 200,000 barrels positioned in the Boston area, and 100,000 in South Portland, ME. The new reserve complements the Northeast Home Heating Oil Reserve, a 1 million-barrel supply of diesel for the Northeast.
- **Plains' Crude Oil Line 2000 Spills Crude Oil in Los Angeles (May 15):** A valve failure at a pumping station along Plains West Coast's 110,000-b/d Line 2000 caused less than 450 barrels of crude oil to spill over a half-mile area in the West Glendale area of Los Angeles, CA, in mid-May. The spill, which occurred in an industrial area, was knee-high in some areas and affected a handful of nearby business. The pipeline was immediately shut off remotely, but the release continued for about 45 minutes due to residual pressure and gravity on the line. Line 2000 runs from the San Joaquin Valley to a storage terminal in Long Beach that supplies Los Angeles area refineries.
- **Sunoco's Mid-Valley Pipeline Spill in Louisiana (October 13):** A segment of Sunoco Logistics' 280,000-b/d Mid-Valley Pipeline system ruptured in northwest Louisiana in mid-October, spilling approximately 4,500 barrels of crude oil. The Mid-Valley pipeline runs approximately 1,000 miles from Longview, TX, to Samaria, MI, providing crude oil to a number of refineries, primarily in the U.S. Midwest. The pipeline's segment from Longview to Mayersville, MS, was shut down for nearly 2 weeks as a result of the spill. At least one refinery, Husky's 155,000-b/d Lima, OH, refinery, was forced to reduce crude runs as a result of the outage. Husky said that it had reduced runs to 110,000 b/d, or roughly 71 percent of total capacity, during the outage and had warned that even after the pipeline returned to service, "ongoing curtailment" on the line could impact up to 15,000 b/d of throughput into 2015. The Pipeline and Hazardous Materials Safety Administration (PHMSA) ordered Sunoco to operate the line at 80 percent of maximum pressure after restart during investigations into the cause of the leak.

3. Energy Disruptions

This section provides a summary of disruptions reported in EAD in 2014. Energy disruptions that occurred in 2014 are grouped into five categories: electricity, natural gas, petroleum, biofuels, and cybersecurity.

3.1 Electricity Disruptions

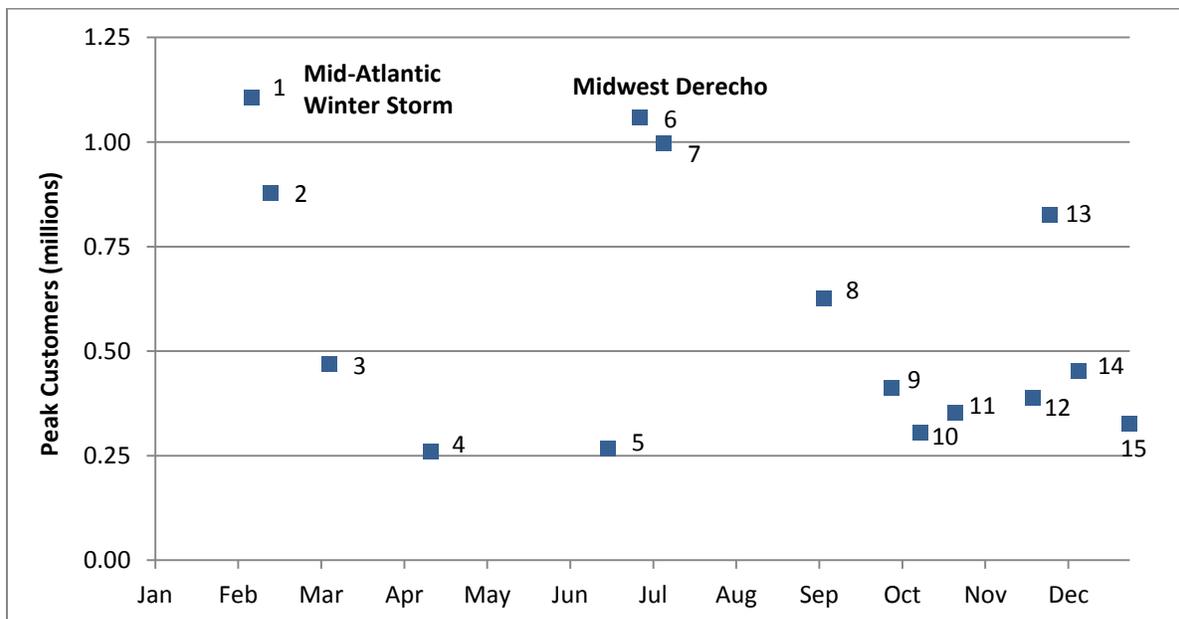
The following three sections discuss disruptions in the electricity sector related to customer power outages, power plant outages, and impacts on other electric industry assets.

3.1.1 Customer Outages

3.1.1.1 Large-Scale Outage Events

Figure 3 shows large-scale electricity outage events that occurred in the United States in 2014. There were 15 outage events that knocked out power to 250,000 or more customers, compared with 12 such events in 2013. All 15 of the large-scale events in 2014 were weather-related, including both winter and summer storms. Included in these events were two storms that affected more than 1 million customers. By comparison, 2013 also had two storms that disrupted power to more than 1 million customers.

Figure 3. Large-Scale U.S. Electric Customer Outage Events, 2014



The 15 events in 2014 that affected more than 250,000 customers were as follows:

1. **Mid-Atlantic Winter Storm (February 4–5):** Severe snow and ice storms in the U.S. Mid-Atlantic in early February knocked out power to approximately 1.1 million customers from Kentucky to New Jersey. In Pennsylvania, the hardest hit State with more than 800,000 outages, tree limbs heavy with ice crashed down on power lines across the

eastern and central parts of the State. PECO, the utility serving Philadelphia and southeastern Pennsylvania, said that the storm was the second most damaging in the company's history. PECO crews worked around the clock to restore power; however, more than 260,000 of its customers remained without power more than 2 days after the storm had passed.

2. **Southeast Winter Storm (February 12–13):** A widespread, multi-day winter storm moved across the U.S. Southeast in mid-February, knocking out power to nearly 880,000 customers from Texas to Virginia. The majority of sustained outages were reported in Georgia, South Carolina, and North Carolina. Five days after the storm had passed, nearly all affected customers had been restored.
3. **North Carolina Ice Storm (March 6–7):** A severe ice storm hit North Carolina in early March, knocking out power to nearly 470,000 customers, including more than 400,000 Duke Energy customers. Outages primarily resulted from ice weighing down trees that then fell onto power lines. Four days after the storm had passed, approximately 9,000 Duke Energy customers remained without power.
4. **Michigan Thunderstorms and High Winds (April 12–14):** Several waves of thunderstorms, bringing heavy rains, lightning, and high winds topping 60 miles per hour (mph), moved across Michigan in mid-April, knocking out power to more than 260,000 customers. Heavy outages were reported in the metropolitan Detroit area by DTE Energy. Restoration was complicated due to the high winds affecting the region after the storms had passed. Nearly all customers were restored within 2 days after the high winds had stopped.
5. **Midwest and Mid-Atlantic Thunderstorms (June 18–19):** A wave of severe thunderstorms stretching from Michigan to Virginia in mid-June knocked out power to nearly 270,000 customers. High winds, lightning strikes on equipment, lightning hitting tree branches, and trees falling on power lines contributed to the outages. Outages were restored within one day to most affected customers; however, Virginia was affected by a second storm, bringing new outages to the State on the evening after the first storm had passed.
6. **Upper Midwest Derecho (June 30–July 1):** A major derecho - a widespread, long-lived, straight-line wind storm that is associated with a land-based, fast-moving group of severe thunderstorms -brought heavy rain and high winds across the Upper Midwest, knocking out power to more than 1 million customers from Iowa to Indiana and Michigan. Wind gusts reached up to 75 mph in some areas. Commonwealth Edison's service territory in the Chicago metropolitan area was the hardest hit, with approximately 400,000 customers without power at the height of the storm. Due to the extent of the damage, restoration was a multi-day process, with heavily impacted utilities completing service restoration 4 days after the storm had passed.
7. **Mid-Atlantic and Northeast Thunderstorms (July 8):** Severe thunderstorms with high winds, lightning, and intense rain moved through the Mid-Atlantic region and into Vermont and Quebec on July 8, knocking out power to approximately 1 million customers. PECO, in southeastern Pennsylvania, was the hardest hit utility, with peak outages of 260,000 customers. Approximately 40,000 customers remained without power in the region after 2 days.

8. **Illinois and Michigan Thunderstorms (September 5):** Strong storms with heavy winds and lightning knocked out power to approximately 630,000 customers in Illinois and Michigan in early September. The greatest number of outages were reported in the metropolitan areas of Detroit and Chicago. DTE Energy, which serves the Detroit area, said that the storm was among the most damaging in the company's 111-year history, with wind gusts of more than 75 mph causing more than 2,000 downed power lines across Southeast Michigan. Full restoration for DTE took 6 days due to a second storm that passed through the area as the utility was still working on restoring power from the first storm.
9. **Texas-Arkansas-Louisiana Storms (October 2–3):** A fast-moving storm with tornado-force winds moved across Texas, Arkansas, and Louisiana in early October, knocking out power to more than 410,000 customers. Hail, heavy rain, and damaging winds of up to 90 mph were reported across northern Texas. Oncor, the hardest hit utility, with more than 300,000 customer outages, said that this was one of the largest storms in the company's history. Oncor's restoration was delayed in some areas due to treacherous roads lined with downed trees and power lines. Three days after the storm had passed, Oncor had restored power to all but 3,000 of its customers.
10. **Texas and Southeast Thunderstorms (October 13):** Thunderstorms with heavy rain and high winds moved across Texas, Arkansas, Louisiana, Mississippi, Alabama, and Georgia in mid-October, knocking out power to more than 300,000 customers. The storms caused damage to trees, which resulted in damage to power poles and lines. Two days after the storm had passed, 10,000 customers remained without power in Louisiana.
11. **Pacific Northwest Wind Storm #1 (October 25):** A strong wind storm impacted western Washington and Oregon in late October, knocking out power to more than 310,000 customers. Wind gusts of up to 60 mph were reported, which downed trees and power lines. Restoration work continued 2 days after the storm had passed, with more than 8,000 customers in the region still without power.
12. **Midwest Wind Storm (November 24–25):** A wind storm in late November moved across the Great Lakes region, knocking out power to nearly 390,000 customers in the U.S. Midwest, particularly in Michigan and Ohio, and an additional 170,000 customers in Ontario and Quebec. Crews in the Midwest and Canada restored power within 2 days.
13. **Northeast Snowstorm (November 26–27):** A major snowstorm knocked out power to more than 820,000 customers from Maine to Virginia in late November. Public Service of New Hampshire (PSNH) was the hardest hit utility, with more than 305,000 customers without power. PSNH had restored power to nearly all of its customers 4 days after the storm had passed. Maine's Governor issued a Declaration of Emergency on November 26 at the request of Central Maine Power, which reported 157,000 customers without power at the height of the storm. The restoration effort in Maine continued for 3 days after the storm.
14. **Pacific Northwest Wind Storm #2 (December 11–12):** In mid-December, high winds with gusts of up to 71 mph knocked out power to more than 450,000 customers in Washington and Oregon, and approximately 70,000 customers in British Columbia.

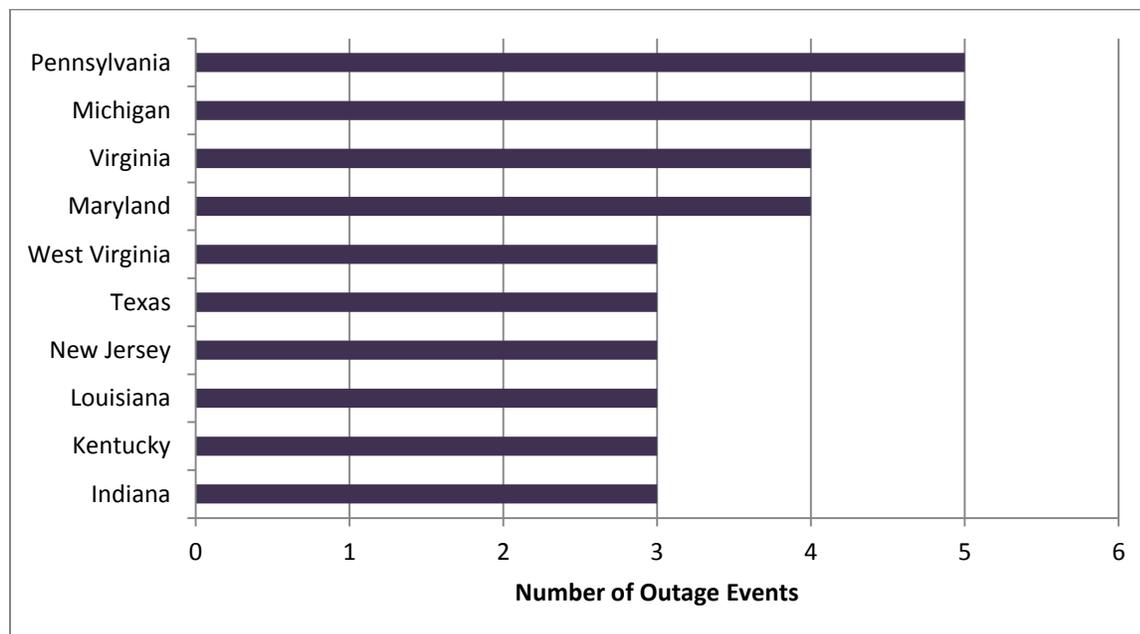
Utilities had restored power to the majority of their customers by the evening after the storm.

- 15. California Wind Storm (December 30–31):** A cold storm system originating in western Canada hit Pacific Gas and Electric's (PG&E) service area in northern California in late December, knocking out power to more than 310,000 customers over the course of the storm. Strong offshore/northeast winds, with gusts of up to 70 mph in the higher terrain, caused trees and other debris to bring down power lines and damage equipment. PG&E restored power quickly, with outages reduced to less than 15,000 by the afternoon after the storm had passed.

From a seasonal perspective, the summer months of June through August only saw three large-scale outage events in the United States in 2014. These summer storms averaged more than 770,000 peak outages per incident. Winter-related storms, which took place in the core winter months, or involved snow or ice in shoulder winter months, were responsible for 6 of the 15 large-scale outage events. These events averaged nearly 820,000 peak outages per incident.

Figure 4 is a histogram of the States that were impacted by the 15 large-scale outage events in 2014. The 15 events were primarily concentrated in the Midwest and on the East Coast. Pennsylvania and Michigan were each affected by five events in 2014. Michigan was also the hardest hit State in 2013, with five events affecting it. New York also had five large-scale power outage events in its State in 2013, but only two such events in 2014.

Figure 4. Number of Large-Scale Outage Events by U.S. State, 2014



3.1.1.2 Small- and Medium-Scale Outage Events

In addition to large-scale outages events, EAD also reports outage events affecting between 10,000 and 250,000 customers. In 2014, there were a total of 119 small- and medium-scale outage events, not including the large-scale events discussed above (see Figure 5). This is a

significant increase from 2013, which experienced a total of 87 such events. An increase in weather and equipment failure events accounts for this large increase. Outage events were concentrated in the summer during peak thunderstorm season.

Figure 5. Small- and Medium-Scale U.S. Electric Customer Outage Events, 2014

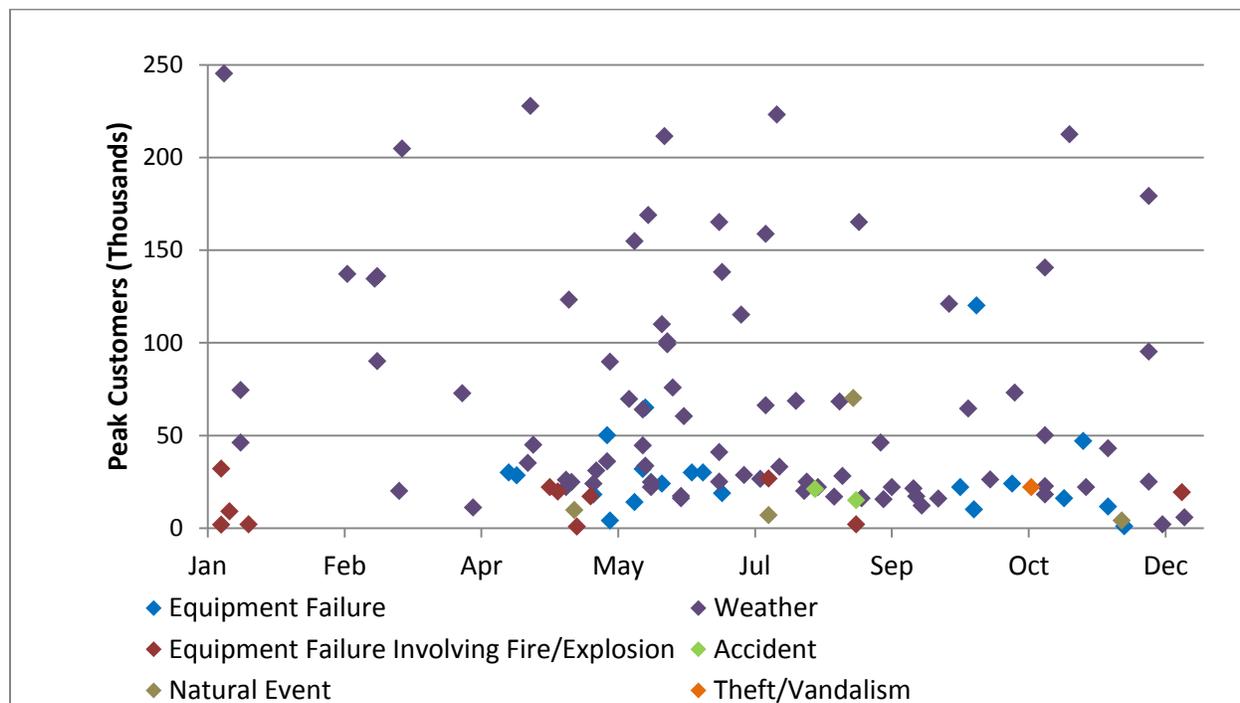
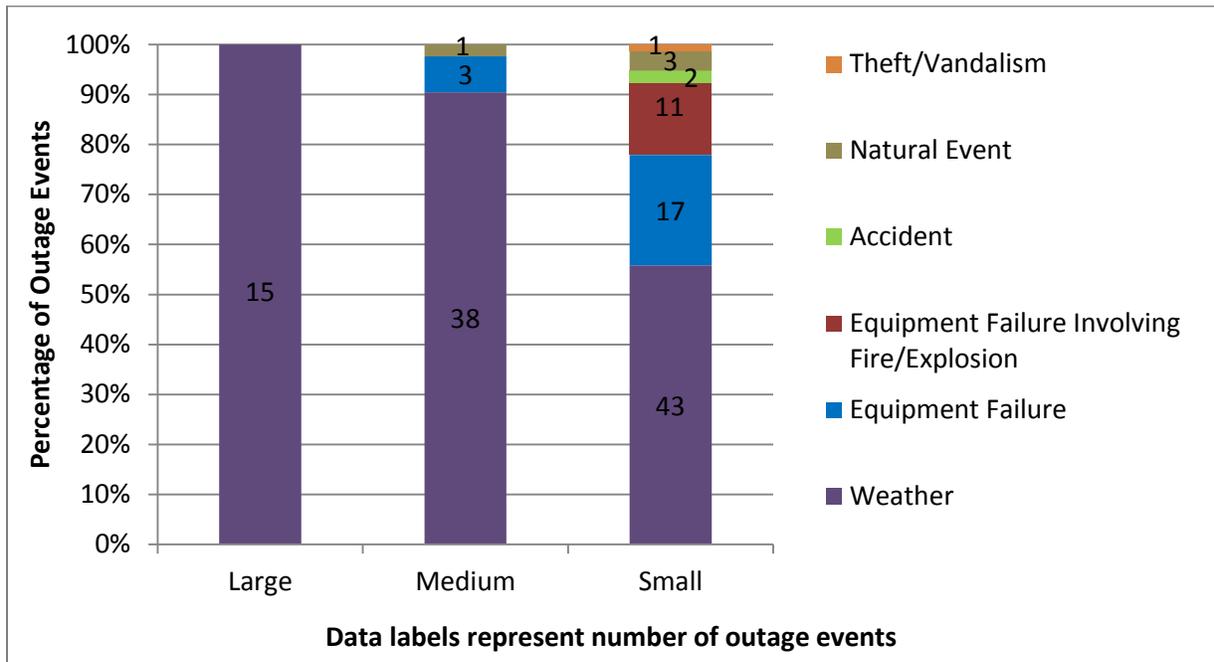


Figure 6 **Error! Reference source not found.** breaks down the number of medium-, and small-scale customer outage events by event cause. While all 15 of the large-scale events were weather related, only 56 percent of the small-scale events were caused by weather. In 2014, equipment failure accounted for 22 percent of all the small-scale outages and 15 percent of the total outages. Equipment failures involving fires and explosions accounted for 14 percent of all small-scale outages and 8 percent of the total outages during the year. Civilian car crashes resulted in two small-scale outages in 2014. They are shown as the two events under accidents. Natural events were relatively minor in 2014. Four natural events, consisting of three wildfires and one earthquake, occurred in 2014. On August 24, a 6.0 magnitude earthquake hit Napa County, CA, and left more than 70,000 Pacific Gas & Electric (PG&E) customers without power. PG&E crews restored power to all customers by morning the next day.

Figure 6. U.S. Electric Customer Outage Events by Cause and Magnitude, 2014



Note: Large: ≥ 250,000 customers; Medium: 50,000–249,999 customers; Small: 10,000–49,999 customers

3.1.2 Power Plant Outages

Unlike customer outages, reporting on power plant outages is less comprehensive because public information on power plant outages is not consistently reported. In 2014, EAD reported 221 outages at U.S. power plants caused by unplanned (or forced) causes or by causes that were not reported. This is a slight decrease from 2013, which had 249 reported power plant outages.

3.1.3 Physical Attacks and Sabotage

One act of sabotage against electrical assets was reported in 2014, but the attack failed to impact electricity generation or transmission. In June, an “incendiary-type device” was found on a large diesel fuel tank at Unisource Energy’s 104-MW Valencia power plant in Nogales, AZ. The device detonated, causing a small leak, but did not cause any serious damage to the fuel tank. The plant remained functional and no services were affected, although the plant and a nearby business were evacuated for precautionary reasons. The Valencia plant site also includes the Valencia substation, which receives power from Tucson via a 138-kV transmission line, and is the primary source of electrical service for approximately 30,000 customers in Nogales and the surrounding communities. The Federal Bureau of Investigation (FBI), the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), and the Arizona Department of Public Safety were brought in to investigate, but no arrests were made in connection with the incident.

While no other acts of sabotage were identified in the press in 2014, there were several developments related to the April 2013 attack on Pacific Gas & Electric’s (PG&E) 500-kV

Metcalf transmission substation in San Jose, CA, which knocked out 17 giant transformers transmitting power to Silicon Valley. The FBI has stated that there was no indication of terrorism. In April, PG&E announced a \$250,000 reward for information leading to the arrest and conviction of the perpetrator(s). In addition, PG&E said that it was investing approximately \$100 million in security upgrades over the next several years on substation security across its service territory. Upgrades include enhanced intruder detection systems, buffer zones through additional fencing, vegetation management, security guards providing 24/7 coverage, improved lighting and cameras, and better coordination with law enforcement.

Other significant developments related to the physical security of electric infrastructure in 2014 are listed below:

- **Dominion Virginia Power Announces Plan to Invest in Substation Security (February):** Dominion announced plans to spend as much as half a billion dollars over the next 5 to 10 years to protect critical transmission substations against physical security threats. The stations at highest risk would be a priority for Dominion. Dominion's security improvements included plans to build anti-climb fences or barrier walls—in some cases, as tall as 20 feet—around substations, to establish dual perimeters around facilities with “no-man zones” between them, to protect critical equipment, and to install key-card access systems for substation yards. The company also said that it was developing plans to construct a new, “hardened” system operations center.
- **NERC Files Physical Security Standard With FERC (May):** The National Energy Regulatory Corporation (NERC) filed the proposed CIP-014-1 – Physical Security Reliability Standard with FERC on May 23. The filing highlighted the culmination of collaboration between NERC and stakeholders to develop and file a standard to address physical security threats and vulnerabilities to the bulk power system, as ordered by FERC. The proposed CIP-014-1 standard enhances NERC's foundational physical security efforts and helps ensure that owners and operators of the bulk power system take the necessary steps to protect the bulk electric system from physical attacks. Specifically, the proposed standard requires transmission owners and operators to identify and protect critical transmission stations and substations, and their associated primary control centers that, if rendered inoperable or damaged as a result of a physical attack, could result in widespread instability, uncontrolled separation, or cascading within an interconnection.

3.2 Natural Gas Disruptions

In 2014, EAD reported numerous disruptions to natural gas assets, including both upstream and downstream assets. Most of these outages were caused by equipment failures or power failures, or were weather related.

3.2.1 Upstream

Four events had notable impacts on upstream natural gas assets in 2014, including wells and platforms, flow lines and gathering lines, and processing plants. These disruptions, which were primarily caused by natural events and equipment failure, are listed below.

- **Marcellus Shale Well Freeze-Offs (January):** A dip in early 2014 natural gas production was attributed to persistent cold in the Midwest and Northeast, causing well freeze-offs, particularly in the Marcellus Shale play in Pennsylvania, Ohio, and West Virginia. According to Bentek Energy, U.S. natural gas production in the lower 48 States in January 2014 fell by an average 0.8 Bcf/d, or 1.1 percent, from the previous month.
- **Chevron Appalachia's Lanco Well Explosions in Pennsylvania (February 11–15):** On February 11, a fire and explosion was reported at Chevron Appalachia's Lanco 7H well pad in Dunkard Township, PA. At the time of the explosion, there were 20 workers at the site. One worker was reported injured, while another was killed in the accident. On February 14, adjacent well pad 6H caught fire due to the heat damage it sustained from 7H. Both wells' fires went out on February 15.
- **Opal Gas Processing Plant Explosion and Fire in Wyoming (April 23):** Williams Partners' 1.5-Bcf/d gas processing plant in Lincoln County, WY, was shut down following an explosion and fire in one of the plant's five cryogenic processing trains. All personnel were safely evacuated from the facility. As a result of the shutdown, natural gas gathering from surrounding areas was temporarily suspended and supply of processed gas was disrupted to several major interstate pipelines serving western States. The plant was processing approximately 1 Bcf/d prior to the blast. In the 2 weeks following the incident, Williams brought the four processing trains not involved in the explosion back online, restoring capacity at the plant to 1.1 Bcf/d. The U.S. Chemical Safety Board launched an investigation into Williams Partners' safety practices following the event, which was the third incident for the company in a year, following an explosion at an LNG storage site in March 2014 and a blast at a chemical plant in Louisiana in June 2013.
- **Fracking Accident Causes Anadarko to Suspend Operations in Weld County, Colorado (November 13):** Anadarko suspended its fracking operations in Weld County on November 13 after a fracking accident killed one worker and seriously injured two others. Halliburton was running the fracking operations when a high-pressure water valve ruptured as workers attempted to heat the frozen pipe.

3.2.2 Midstream and Downstream

In 2014, several events had notable effects on the midstream and downstream natural gas sector, including natural gas transmission, distribution, and service pipelines.

- **TransCanada's Canadian Mainline Emerson Lateral Explosion in Manitoba (January 25):** The three pipelines that make up TransCanada's Emerson lateral, a major pipeline supplying Western Canadian gas to the U.S. Midwest, were shut down after one of the lines exploded and caught fire in Manitoba. The shutdown occurred during one of the coldest periods of the year when natural gas demand in the Midwest was very high. One of the two lines that didn't explode resumed flows in the one day after the blast, following inspections. Viking Gas Transmission, which receives gas from the Emerson lateral in Minnesota, was forced to interrupt service to some customers, including Xcel Energy, when the shutdown occurred, but restored service in a staged manner after the two unaffected lines returned, lifting conservation appeals 2 days after the event.

- **ConEd Gas Explosion in New York City (March 12):** A gas explosion occurred in the Harlem neighborhood of New York City, leveling two apartment buildings and killing eight people. In response to the blast, Consolidated Edison cut power and natural gas service to the immediate area to make the area safe for emergency responders. After an investigation, the National Transportation Safety Board (NTSB) identified a gas leak next to one of the buildings that was leveled. After an investigation, NTSB announced that the 8-inch-diameter cast iron and plastic gas main that served the buildings had failed a pressure test at the normal operating pressure.
- **Tornadoes Cause More Than 100 Gas Leaks for CenterPoint Energy in Arkansas (April 28):** Intense tornadoes in Arkansas caused damage to parts of CenterPoint's gas distribution system, primarily in the cities of Mayflower and Vilonia. CenterPoint technicians responded to nearly 100 gas leaks on April 28 and April 29. According to CenterPoint Energy, leaks were primarily caused by uprooted trees and other heavy debris.

3.3 Petroleum Disruptions

In 2014, multiple events significantly disrupted the petroleum supply chain, including assets related to production, transportation, and refining. This section highlights significant disruptions that affected the United States over the course of the year. This section also identifies instances where State governments issued hours-of-service waivers to fuel truck drivers to expedite the movement of fuel during periods of tight supply.

While most of these events took place within the United States, some took place in Canada at assets that affect U.S. petroleum supply. Other international disruptions that affect global energy markets, but do not directly affect supply to the United States, are covered in section 4.1.

3.3.1 Production

In 2014, hurricanes were not a major factor affecting oil production and the industry only suffered minor interruptions to upstream output. However, there were several explosions and other issues that inflicted fatal injuries.

- **BP Prudhoe Bay Oil Spill (April 28):** A well line at BP's Prudhoe Bay oil field ruptured, spraying a 34-acre area with crude oil and natural gas. BP discovered the leak during a routine investigation on April 28. A few hours after discovery, the line was depressurized in order to stop the leak. It was unclear whether the leak was connected to a decline in North Slope oil production. Since the spill occurred, daily North Slope production dropped from about 533,000 b/d to 521,000 b/d, according to State production data.
- **West Texas Wellhead Explosion (April 30):** An explosion at an oil field in Loving County, TX, killed two workers and injured nine others. The workers were changing a wellhead when the buildup of pressure caused the explosion. The area where the explosion occurred is owned by RKI Exploration and Production.
- **Imperial Shuts Down Kearl Oil Sands Mine in Alberta Due to Vibration (November 10–December 2):** Imperial Oil shut down its 110,000-b/d Kearl oil sands

mine in northern Alberta on November 10 for more than 3 weeks after detecting what it called a “vibration issue” in the facility’s ore-crushing unit.³

- **Pablo Energy Oklahoma Oil Rig Explosion (December 19):** An explosion and fire killed two people and critically injured two others at a Pablo Energy oil rig in southeastern Oklahoma. No evacuations were required in the area and there were no initial reports of environmental damage.

3.3.2 Refineries

In 2014, mechanical failure and power failure events caused the majority of the notable disruptions at U.S. oil refineries.

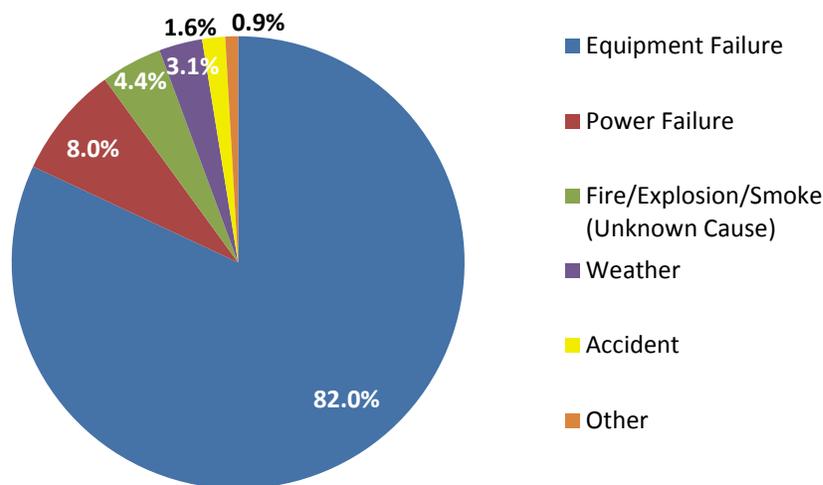
- **Citgo Restarts Lemont, IL, Crude Unit After Fire (February):** On October 23, 2013, Citgo Petroleum shut down the atmospheric and vacuum portions of a crude unit at its 172,045-b/d Lemont, IL, refinery due to a fire. The plant started the atmospheric distillation section on November 11, 2013. Citgo fully reactivated the unit in February 2014.
- **Tornado Shuts Down Crude Unit at Marathon’s Garyville, LA, Refinery (May 28):** Marathon Petroleum shut down one of two crude units at its 522,000-b/d Garyville, LA, refinery after a tornado damaged a cooling water tower and cut electrical power during a storm. Marathon restarted the 256,000-b/d crude unit on June 11 after installing a temporary cooling water system.
- **Fire Shuts Down CVR’s Coffeyville, KS, Refinery (July 29):** CVR Energy shut down its 115,000-b/d Coffeyville, KS, refinery for 4 weeks after suffering damage from a fire on July 29. The fire, which started in an isomerization unit, damaged fiber optics in the refinery’s control system, forcing valve closings on units and preventing crews from operating equipment, according to a person familiar with operations. The refinery restarted normal operations by September.
- **Delayed Rail Deliveries of Crude Force Delta Air Lines to Reduce Throughput at Trainer, PA, Refinery (August–September):** In a letter to the U.S. Surface Transportation Board made public in November, Delta Air Lines said that its energy unit, Monroe Energy, had to reduce throughput at its 185,000-b/d Trainer, PA, refinery in August and September due to a rail delivery shortage of more than 1 million barrels of crude oil to key supply points in the Philadelphia region.
- **Shell Struggles to Restart Fluid Catalytic Cracking Unit (FCCU) at Deer Park, TX, Refinery After August 18 Breakdown:** Royal Dutch Shell struggled to repair and restore the 70,000-b/d FCCU at its 327,000-b/d Deer Park, TX, refinery after a breakdown occurred on August 18. The FCCU’s restart was delayed twice in October, in part, due to delays in receiving the parts needed to complete the work. Shell finally restarted the unit on October 21.

Figure 7 presents all of the 2014 refinery disruptions reported in EAD by cause. There were 549 disruptions reported in 2014. Equipment failures continue to cause the majority of the refinery

³ http://www.imperialoil.ca/Canada-English/about_media_releases_20141202.aspx

disruptions, as has been the case in previous years. Power failures were the second leading cause of disruptions, followed closely by fire, explosions, and smoke. These events highlight the interdependency between the petroleum and electric power sectors.

Figure 7. U.S. Refinery Disruptions by Cause, 2014



Note: There were 549 total refinery disruptions reported in 2014

3.3.3 Transportation and Storage

Crude oil and petroleum products are transported by pipeline, marine vessel, rail, and truck. In 2014, transportation outages mainly resulted from accidents, leaks, and equipment failures. The following incidents were some of the most significant of 2014:

- Sunoco’s Mid-Valley Pipeline Spill in Ohio (March 17):** A 5-inch crack on a segment of Sunoco Logistics’ Mid-Valley Pipeline caused a 480-barrel crude oil spill at a nature preserve in southwest Ohio. The spill affected 1 mile of an intermittent stream, pooling in a wetland; however, oil did not reach the Great Miami River. Crews from the pipeline company arrived a few hours after the leak was discovered and shut down the line. The spill was contained and crews vacuumed oil that had leaked. The 280,000-b/d Mid-Valley pipeline is part of the company’s Midwest system that runs approximately 1,000 miles from Longview, TX, to Samaria, MI, providing crude oil to a number of refineries, primarily in the U.S. Midwest. Sunoco repaired and restarted the affected pipeline on March 23 after receiving approval from PHMSA.
- Bunker Fuel Spill Shuts Down Houston Ship Channel (March 22–26):** A 4,000-barrel release of bunker fuel from a barge accident disrupted shipping on the Houston Ship Channel for 4 days in late March. Refineries with a combined processing capacity of 2.1 million b/d rely on the Houston Ship Channel for waterborne transportation of crude oil into their facilities and of products out of their facilities. The U.S. Coast Guard initially reported that the waterway would be closed for a week or longer, but fully reopened the channel after 4 days. On the day that the channel reopened, 51 ships, including 13 oil tankers, were waiting to enter the channel, while 36 ships were waiting to leave. Initially,

ExxonMobil said that it had cut production at its 560,500-b/d Baytown, TX, refinery and had planned further cuts after 2–3 days because crude oil tankers were unable to supply the plant. The day after the channel reopened, ExxonMobil said that it had received crude oil cargo and was resuming normal operations. Other refineries in the area did not report impacts publically.

- **Colonial Pipeline’s Gasoline and Distillate Line 3 Shut Down for Unplanned Repairs in Virginia (March 25–27):** Colonial Pipeline’s 885,000-b/d Line 3—a major gasoline and distillates pipeline running from Greensboro, NC, to Linden, NJ—was shut down for 3 days while the company worked to repair an anomaly found during investigations.
- **CSX Crude Oil Train Derails, Catches Fire in Virginia (April 30):** Thirteen cars of a 105-car CSX Corporation train carrying Bakken crude oil derailed in Lynchburg, VA, with several derailed cars catching fire and 3 cars falling down an embankment into the James River. According to officials, approximately 831 barrels of crude oil spilled into the river. The train was en route to Plains All American’s crude oil transloading terminal in Yorktown, VA, which receives crude by rail and sends it out by barge to refineries on the East Coast. The cars involved in the accident were classified as DOT-111 tank cars, an older design that had been subject to earlier National Transportation Safety Board safety examinations. CSX resumed operations on the route 3 days after the derailment.
- **Power Outage on Enbridge’s Crude Oil Line 4 in Saskatchewan (May 5–8):** Enbridge’s Line 4, which carries up to 796,000 b/d of heavy crude oil from Edmonton, Alberta, to Clearbrook, MN, went offline for 3 days in early May when strong winds and icy conditions damaged an electric transmission line to a pair of pump stations east of Regina in southern Saskatchewan. Line 4 is part of the Enbridge Mainline system, which carries the bulk of Canadian crude exports to the United States.
- **Pegasus Crude Oil Pipeline Restarts After 2013 Rupture in Arkansas (July 9):** More than a year after ExxonMobil shut down its 96,000-b/d Pegasus pipeline due to a rupture that spilled 210,000 gallons of Canadian Wabasca heavy crude in Mayflower, AR (March 29, 2013), PHMSA approved the restart of the southern section of the pipeline at 80 percent of the operating pressure. ExxonMobil did not restart the 211-mile pipeline section that runs from Corsicana, TX, to Nederland, TX, until July 9.
- **Lightning Strikes Linc Energy’s Crude Oil Tank in Texas (September 17):** A lightning strike hit one of Linc Energy’s crude oil tanks in Baytown, TX, causing an explosion on September 17. The city of Baytown said that two tanks containing approximately 1,400 barrels of crude oil and three tanks containing brine water were destroyed.
- **LOOP Suspends Operations Due to Oil Sheen (August 13–22):** The Louisiana Offshore Oil Port (LOOP), the Nation’s only port capable of offloading deep draft tankers, suspended crude oil offloading at the terminal and operations at its main pipeline on August 13 to investigate a sheen discovered on the LOOP pipeline right-of-way. The suspension did not affect LOOP’s onshore operations at the Clovelly Hub storage site and deliveries of crude oil continued on schedule. LOOP resumed normal offloading operations at its marine terminal on August 22 and expedited the pumping schedule to meet customers’ needs.

- **Sunoco’s Mid-Valley Pipeline Spill in Louisiana (October 13):** Sunoco Logistics experienced a second spill on its Mid-Valley Pipeline system in mid-October when a rupture in northwest Louisiana spilled approximately 4,500 barrels of crude oil. The spill, which was discovered by control room operators, was immediately contained, although some of the oil reached a nearby waterway. The pipeline’s segment from Longview, TX (the origin), to Mayersville, MS, remained shut down for nearly 2 weeks as a result of the spill. At least one refinery, Husky’s 155,000-b/d Lima, OH, refinery was forced to reduce crude runs as a result of the outage. Husky said that it had reduced runs to 110,000 b/d, or roughly 71 percent of total capacity, during the outage and had warned that even after the pipeline returned to service, “ongoing curtailment” on the line could impact up to 15,000 b/d of throughput into 2015. PHMSA ordered Sunoco to operate the line at 80 percent of maximum pressure after restart during investigations into the cause of the leak.
- **Enbridge Line 4 Spill in Saskatchewan (December 17):** Enbridge restarted its 796,000-b/d Line 4 pipeline a day after shutting it down because of a 1,350-barrel oil spill at its Regina, Saskatchewan, terminal. The full cleanup effort proceeded for the subsequent week.
- **Bunker Fuel Spill Shuts Down Houston Ship Channel (March 22–26):** A 4,000-barrel release of bunker fuel from a barge accident disrupted shipping on the Houston Ship Channel for 4 days in late March. Refineries with a combined processing capacity of 2.1 million b/d rely on the Houston Ship Channel for waterborne transportation of crude oil into their facilities and of products out of their facilities. The U.S. Coast Guard initially reported that the waterway would be closed for a week or longer, but fully reopened the channel after 4 days. On the day that the channel reopened, 51 ships, including 13 oil tankers, were waiting to enter the channel, while 36 ships were waiting to leave. Initially, ExxonMobil said that it had cut production at its 560,500-b/d Baytown, TX, refinery and had planned further cuts after 2–3 days because crude oil tankers were unable to supply the plant. The day after the channel reopened, ExxonMobil said that it had received crude oil cargo and was resuming normal operations. Other refineries in the area did not report impacts publicly.

3.3.4 Hours-of-Service Exemptions

Hours-of-service (HOS) regulations (49 CFR Part 395) restrict the amount of time that drivers are allowed to operate commercial vehicles and mandate time-off requirements between shifts to ensure on-road safety. To provide vital supplies and transportation services to a disaster area in the United States, emergency declarations may be issued by the President, Governors of States, or the U.S. Department of Transportation. These declarations trigger the temporary suspension of certain Federal safety regulations, including HOS, for motor carriers and drivers engaged in specific aspects of the emergency relief effort.⁴ In some cases these exemptions are issued in order to maintain the supply of critical fuels, such as propane, heating oil, gasoline, and diesel fuel. EAD tracks HOS exemptions to identify events that have triggered States to enact emergency management measures. Table 1 summarizes the HOS exemptions

⁴ <http://www.fmcsa.dot.gov/emergency>

issued by States in 2014, which were issued to alleviate supply shortages caused by extreme winter weather, infrastructure outages, and other demand factors. The extremely cold weather and high demand for heating fuels during the first months of 2014 forced a number of States to issue HOS waivers. The U.S. Department of Transportation even issued a rare regional order, waiving HOS regulations for 31 States to allow transporters to move propane more freely throughout the most affected regions.

Table 1. Hours-of-Service Exemptions, 2014

State	Start Date	End Date	Days
Alabama	1/23/2014	–	
Arkansas	1/03/2014	1/17/2014	15
Colorado	2/07/2014	3/7/2014	29
Connecticut	1/02/2014	1/9/2014	8
	1/10/2014	1/16/2014	7
	1/23/2014	2/11/2014	20
	2/11/2014	3/01/2014	19
	3/07/2014	3/15/2014	9
Delaware	1/07/2014	1/10/2014	4
	1/10/2014	1/13/2014	4
	1/15/2014	1/18/2014	4
	1/19/2014	1/22/2014	4
Georgia	1/10/2014	1/17/2014	8
Indiana	1/03/2014	1/17/2014	15
	1/17/2014	1/29/2014	13
	1/29/2014	2/28/2014	31
	2/28/2014	3/15/2014	16
Iowa	1/10/2014	1/28/2014	19
	11/20/2014	12/05/2014	16
Kansas	1/09/2014	1/14/2014	6
	1/14/2014	2/13/2014	31
Kentucky	1/08/2014	1/28/2014	21
Louisiana	1/22/2014	2/20/2014	30
Maine	1/19/2014	2/08/2014	21
Maryland	1/10/2014	1/15/2014	6
	1/16/2014	1/21/2014	6
	3/05/2014	3/10/2014	6
	3/16/2014	3/31/2014	16
Massachusetts	1/02/2014	1/07/2014	6
	1/08/2014	1/13/2014	6
Michigan	1/10/2014	2/11/2014	33
	2/11/2014	3/01/2014	19
Minnesota	1/06/2014	2/07/2014	33
	2/07/2014	3/08/2014	30
	10/24/2014	11/23/2014	31
	11/26/2014	12/10/2014	15
Missouri	1/07/2014	1/13/2014	7

State	Start Date	End Date	Days
	1/13/2014	1/19/2014	7
	1/20/2014	1/26/2014	7
	3/04/2014	3/10/2014	7
New Hampshire	1/07/2014	1/21/2014	15
New Jersey	1/08/2014	1/31/2014	24
New York	1/08/2014	1/31/2014	24
	1/15/2014	2/11/2014	28
North Carolina	2/11/2014	3/07/2014	25
	3/07/2014	3/22/2014	16
	4/28/2014	5/28/2014	31
	1/07/2014	2/06/2014	31
North Dakota	10/06/2014	11/05/2014	31
	11/05/2014	12/01/2014	27
	1/06/2014	1/10/2014	5
Ohio	1/10/2014	1/17/2014	8
	1/17/2014	1/28/2014	12
	1/28/2014	2/16/2014	20
Oklahoma	1/06/2014	2/05/2014	31
	1/09/2014	1/26/2014	18
Pennsylvania	1/26/2014	2/03/2014	9
	2/03/2014	3/02/2014	28
Rhode Island	1/03/2014	1/05/2014	3
South Dakota	1/08/2014	2/08/2014	32
	11/13/2014	12/13/2014	31
Tennessee	1/21/2014	2/20/2014	31
Texas	1/22/2014	2/04/2014	14
	2/04/2014	2/17/2014	14
Vermont	1/02/2014	1/13/2014	12
	1/13/2014	1/21/2014	9
Virginia	1/30/2014	2/11/2014	13
	2/11/2014	3/01/2014	19
Wisconsin	1/25/2014	–	
	4/17/2014	4/26/2014	10

Sources: The National Propane Gas Association (<http://www.npga.org>), U.S. Department of Transportation Federal Motor Carrier Safety Administration (<http://www.fmcsa.dot.gov>), and State waiver information.

Note: “Days” count start and end dates as full days.

3.4 Biofuel Disruptions

EAD and the trade press reported several notable disruptions affecting biofuel refineries and the supply chain in 2014. These disruptions included: rail shipment delays, refinery explosions, and natural gas shortages. Some incidents appear to lead to higher fuel prices.

- **Ethanol Train Leak in Arizona (January 3):** Approximately 10,000 to 20,000 gallons of ethanol leaked from a tanker car in Phoenix, AZ, on the Union Pacific railroad yard.

Firefighters and hazardous materials crew members were called, and after 12 hours, the cleanup of the spill had ended.

- **Weather-Related Ethanol Shipment Delays (January):** Ice and snow caused major rail delays and terminal closures for ethanol shipments across the United States. The weather forced some operators to reduce operations, resulting in ethanol price increases across the country.
- **Biofuel Refinery Explosions, Fires (January 22, August 4):** Explosions and fires were reported at JNS Biodiesel, north of New Albany, NY, in January and the Diamond Green Diesel facility in Norco, LA, in August. The facilities produce 8 million gallons per year (MMgal/year) and 140 MMgal/year, respectively, of bio-based diesels and resumed operations later in 2014 after reconstruction.
- **Four Ethanol Plants Curtailed Due to Natural Gas Shortages (January 29):** Andersons, Inc. reported curtailments at four ethanol plants in Iowa, Indiana, Ohio, and Michigan resulting from shortages of natural gas, which is used as an energy source at the plants.
- **Rail Logistical Constraints Led to a Jump in Ethanol Spot Prices (March):** A surge in ethanol spot prices was attributed to logistical constraints in and around ethanol production centers in the Midwest, primarily involving railroads. The prices were as much as \$1 per gallon higher in New York City than Chicago in early March.⁵
- **Dryer Fires at Ethanol Plants in Minnesota, Kansas, Iowa, and Indiana (March 10, June 29, July 17, October 13, respectively):** Green Plains Renewable Energy in Fergus Falls, MN; Arkalon Energy in Liberal, KS; Flint Hills Resources in Arthur, IA; and Valero Renewables in Linden, IN,⁶ suspended ethanol production after fires broke out in dryer systems due to reported mechanical failures.
- **Ethanol Plant Fires in Wisconsin and Ohio (April 1, October 6):** Badger State Ethanol Plant reported a fire at its plant in Monroe, WI, during cleaning and routine maintenance. Valero Energy Corporation reported a fire in the distiller's grain storage area of the facility in Bloomingburg, OH.⁷
- **Flooding Halts Ethanol Rail Shipments in South Dakota (June 27):** Due to flooding near Hudson, SD, rail shipments of ethanol from a POET biorefining plant were halted for several weeks as tracks were being repaired.⁸

3.5 Cybersecurity

EAD reported two notable cybersecurity news items in 2013:

⁵ *The Wall Street Journal*, "Ethanol prices surge as rail problems cut supply," March 16, 2014, <http://www.wsj.com/news/articles/SB10001424052702303546204579439740561525518?mg=reno64-wsj&url=http%3A%2F%2Fonline.wsj.com%2Farticle%2FSB10001424052702303546204579439740561525518.html>.

⁶ WLF1, "Ethanol plant fire in Montgomery County," October 13, 2014, <http://wlf1.com/2014/10/13/ethanol-plant-fire-in-montgomery-county>.

⁷ *Ethanol Producer Magazine*, "Valero: Plant production equipment not damaged in recent fire," October 8, 2014, <http://ethanolproducer.com/articles/11519/valero-plant-production-equipment-not-damaged-in-recent-fire>.

⁸ KTIV, "Railroad service shutdown continues following flood," June 27, 2014, <http://www.ktiv.com/story/25892218/2014/06/27/railroad-service-shutdown-continues-following-flood>.

- **Cybersecurity Summit Raises Key Issues (May):** In May, at the Reuters Cybersecurity Summit in Washington, DC, security experts discussed risks posed by cyber threats to various U.S. industries. Some experts said that the problem stems from programmable logic controllers that are used to control processes in energy plants, water treatment facilities, factories, and other industries. Because these controllers are designed to blindly follow commands, someone would only need to hack into the system and send “malicious” instructions to cause explosions at energy facilities or chemical plants. The U.S. Department of Homeland Security’s Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) told attendees that it responded to reports of 256 cyber incidents in 2013, with more than half in the energy sector. This is double the agency’s 2012 case load. However, there were no incidents that caused a major disruption.
- **MISO Prevents Cybersecurity Breach (July):** The Midcontinent Independent System Operator (MISO) discovered and shut down a cybersecurity breach in early July. MISO had previously revealed the vulnerability on an external third-party server used by MISO’s market monitor Potomac Economics. None of MISO’s or Potomac’s systems were compromised by the third-party server. After discovering the breach, MISO immediately severed the connections between the MISO and Potomac computers. They contacted the appropriate authorities, including FERC, ICS-CERT, and other power grid operators. Potomac moved its Web server to a different third-party provider.

4. Infrastructure Changes

This section focuses on significant changes to energy infrastructure in 2014, including new projects, expansions, closures, and sales. Infrastructure changes are typically driven by a number of factors, including changing production centers, the age and condition of existing infrastructure, underlying economic conditions, and regulatory requirements. As noted in section 1.2, EAD summarizes the day's news on energy disruptions and energy infrastructure using public sources, but it is not a comprehensive survey or database service. Despite this limitation, infrastructure changes reported in EAD highlight important developments and trends in U.S. energy markets.

4.1 Electricity

The following sections discuss changes in the electric industry and are categorized into the following topics: environmental regulations, power plant additions, nuclear power developments, and transmission infrastructure.

4.1.1 Environmental Regulations Impacting Infrastructure Developments

Environmental regulations have the potential to significantly alter the electric infrastructure landscape of the United States. In June, the U.S. Environmental Protection Agency (EPA) proposed the Clean Power Plan to cut carbon pollution from existing power plants. The proposal for the first time seeks to cut carbon pollution from existing power plants, which is the single largest source of carbon pollution in the United States. By 2030, the proposal aims to cut carbon emissions from the power sector by 30 percent nationwide (below 2005 levels). The Clean Power Plan will be implemented through a State-Federal partnership under which States identify a path forward using either current or new electricity production and pollution control policies to meet the goals of the proposed program. The proposal provides guidelines for States to develop plans to meet State-specific goals to reduce carbon pollution and gives them the flexibility to design a program that makes the most sense for their unique situation. States can choose the right mix of generation using diverse fuels, energy efficiency, and demand-side management to meet the goals and their own needs. It allows them to work alone to develop individual plans or to work together with other States to develop multi-State plans. Also included in the proposal is a flexible timeline for States to follow for submitting plans to the agency. Plans would be due in June 2016.

The Clean Power Plan, however, has raised concerns among several electric industry members:

- **NERC Warned of Reliability Concerns Related to EPA's Clean Power Plan:** North America Electric Reliability Corporation (NERC) warned of the increased dependency on gas, wind, and solar generation that could occur if more coal plants retire to comply with the carbon proposal. EPA's proposed Clean Power Plan, depending on implementation, could lead to additional coal-fired generation retirements of approximately 47–68 gigawatts (GW) by 2025, NERC said. There is a little more than 300 GW of coal-fired generation in the United States, which produces approximately 40 percent of the

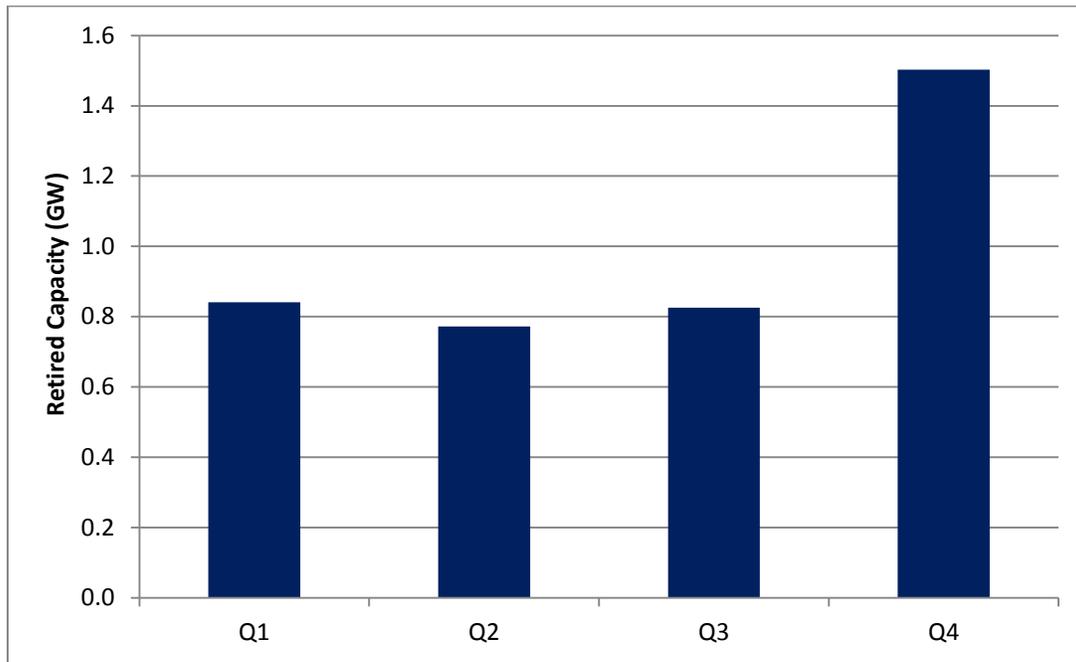
country's power supply. The retirement of more coal plants would further reduce reserve margins and accelerate the Nation's reliance on gas and variable energy resources, such as wind and solar, according to NERC. Gas, meanwhile, has grown to 40 percent of the generation mix, up from 28 percent in 2009, NERC said. NERC recommended that the power and gas industries continue to coordinate to address potential fuel interruptions, especially during extreme weather events like the Arctic weather seen last winter when there was not enough gas available to run power plants in the Northeast due, in part, to pipeline constraints.

- **Southwest Power Pool (SPP) Stated That It Needs More Time to Implement EPA's Carbon Reduction Plan:** SPP released a reliability impact assessment of EPA's proposed plan which indicated that not enough time was allowed to compensate for projected generation unit retirements, nor to build the transmission infrastructure necessary to maintain system reliability. According to the impact assessment, SPP would see 9 GW of existing coal- and gas-fired capacity retired to meet the plan's requirements—6 GW more than SPP members had originally projected. SPP's assessment also concluded that its transmission system could face severe overloads that could lead to cascading outages. Taking into account demand forecasts, planned unit retirements, new generation, and EPA's projected generator retirements, SPP estimated that its reserve margin would be 4.7 percent—a reserve-margin deficiency of about 4,600 MW by 2020.
- **NYISO Concerned That EPA's Clean Power Plan Presents Serious Reliability Implications in New York:** The New York Independent System Operator (NYISO) stressed concerns about the potential implications for electric system reliability and the lack of recognition of the progress that the State has already made in achieving significant reductions in carbon dioxide emissions. NYISO filed comments with EPA on the proposed Clean Power Plan, stating that the majority of the electric capacity within New York City is dual-fuel oil/gas steam-fired electric generating units. If these units are retired, it would cause serious reliability issues in New York City.
- **Nuclear Energy Institute (NEI) Stated That EPA's Clean Power Plan Does Not Help Preserve Existing Nuclear Capacity, Unfairly Penalizes New Nuclear Plants:** NEI said that EPA's treatment of nuclear energy in its proposed carbon reduction regulations is fundamentally flawed and must be reworked. NEI said that the proposed rules do not achieve EPA's objective of incentivizing States to preserve existing nuclear capacity. In addition, the proposed rule creates a significant, inappropriate, and inequitable penalty for Georgia, South Carolina, and Tennessee, where new reactors are being built.

4.1.2 Coal Retirements

Figure 8 shows coal-fired generation that was retired in 2014. A total of 4 GW of coal-fired capacity was retired in 2014. Regionally, the Northeast saw the most retirements with 1.5 GW of coal capacity retired. The Midwest and South each had 1 GW of retirements. In the West, 400 MW of coal generation was retired in 2014.

Figure 8. Retired Coal-fired Generation Capacity, 2014



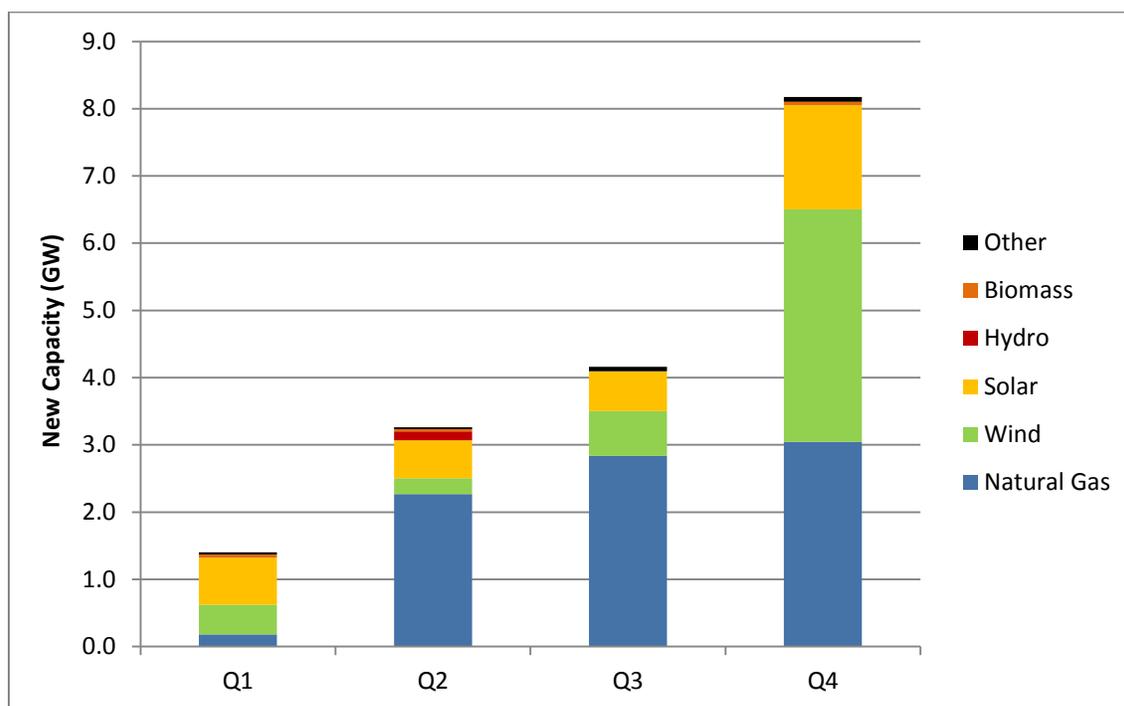
Source: Energy Information Administration

4.1.3 Capacity Additions

Nearly 17 GW of new electric generation capacity came online in 2014, with 8.1 GW coming online in the fourth quarter alone.⁹ Figure 9 below shows the breakdown of new capacity that came online in 2014 by quarter and fuel type. Natural gas, wind, and solar plants were the biggest contributors to new capacity with 8.3 GW, 4.8 GW, and 3.4 GW entering service, respectively. The States that had the most new capacity of any type were Texas (4.1 GW), California (2.7 GW), Virginia (1.5 GW), and Florida (1.2 GW).

⁹ U.S. Energy Information Administration, Form EIA-860, 'Annual Electric Generator Report' and Form EIA-860M, 'Monthly Update to the Annual Electric Generator Report.'

Figure 9. In-Service Generation Capacity, 2014



Source: Energy Information Administration

4.1.4 Nuclear Power Plants

This section discusses some of the major changes to the nuclear power industry in 2014.

4.1.4.1 Nuclear Infrastructure and Upgrades

Below is a list of several major projects in the nuclear power sector that were discussed in 2014. They include proposed new nuclear units, upgrades at existing units, uprates, and license extensions:

- **FirstEnergy Begins \$600 Million Upgrade at Davis-Besse Plant in Ohio:** In February, FirstEnergy began to replace the two original steam generators at the Davis-Besse nuclear plant in Ohio. According to State officials, FirstEnergy’s commitment to the plant is an indication that the company does not plan to shut down Davis-Besse before April 2037.
- **Florida Approves of 2,200-MW Expansion at FPL’s Turkey Point Plant:** In May, Florida Governor Rick Scott and Cabinet members approved Florida Power & Light’s (FPL) plans to add two 1,100-MW units to its Turkey Point Nuclear Station in Florida. The two units are estimated to be in service by 2022 and 2023, respectively.
- **Exelon’s 1,116-MW Peach Bottom Plant in Pennsylvania Gets Approved Uprate:** In August, NRC approved Exelon’s plan to undergo an uprate of 140 MW at its Peach Bottom nuclear plant.
- **Exelon’s 2,264-MW Limerick Station in Pennsylvania Gets License Extension:** In October, NRC renewed the operating license of Exelon’s Limerick Nuclear Generating

Station Units 1 and 2 for an additional 20 years. The new licenses will expire in October 2044 for Unit 1 and June 2049 for Unit 2.

- **Georgia Power’s 2,200-MW Expansion at Vogtle Plant in Georgia Continues Development:** Developers of new nuclear units at the plant reached several milestones on proposed Units 3 and 4, each 1,100 MW. In February, DOE announced that it will award Georgia Power \$6.5 billion in loan guarantees for the two new nuclear units. Unit 3 is expected to be online in 2017 and Unit 4 in 2018.

4.1.4.2 Nuclear Retirements

Two nuclear plants faced major retirement decisions in 2014:

- **SCE Submits San Onofre Decommissioning Plan to the U.S. Nuclear Regulatory Commission (NRC) (September):** Southern California Edison (SCE) submitted a plan to NRC in September stating that the decommissioning of the idled 2,150-MW San Onofre Nuclear Generating Station in San Diego County would cost an estimated \$4.4 billion with work slated to begin in early 2016. The plant was idled in January 2012 due to premature tube degradation in steam generators at both of the plant’s units. In 2013, SCE shelved plans to restart the reactors in favor of retiring the plant.
- **Entergy Retires 510-MW Vermont Yankee Nuclear Plant (December):** On December 29, Entergy permanently closed the plant due to economic reasons. In 2016, the plant will enter a 30-year period during which time its radiation will cool. The plant likely won’t be dismantled until the 2040s or later. Entergy said that decommissioning could cost up to \$1.24 billion.

4.1.5 Transmission Expansion

According to the 2014 NERC Electric Supply & Demand (ES&D), 24,000 miles of transmission lines were proposed as of December 2014, the release date of ES&D. These projects include those that are in “planned” or “under construction” phases. Table 2 below breaks down these proposed projects by NERC Assessment Area. Refer to the footnote for a map of NERC Assessment Areas. Note that some of these transmission lines may originate or terminate in Canada or Mexico, but have sections in the U.S

Table 2. Proposed Transmission Projects, 2014¹⁰

NERC Assessment Area	Miles
ERCOT	767
FRCC	580
MAPP	580
MISO	6,014
New England	398
New York	1,217

¹⁰ NERC ES&D 2014. A map of NERC Assessment Areas can be found at the following link: http://www.nerc.com/AboutNERC/keyplayers/Documents/2015_NERC_Assessment_Areas.png

PJM	2,433
SERC	1,416
SPP	3,177
WECC	7,466
Total	24,049

The online dates of these projects range from 2014-2024. About 21,500 miles are expected to be online between 2014 and 2018. In addition to the 24,000 miles of proposed transmission projects, NERC also categorizes transmission projects that are in the “conceptual” and unspecified phases. “Conceptual” and unspecified projects contribute an additional 6,760 miles of lines.

4.2 Natural Gas Projects

Domestic dry natural gas production increased to more than 70 Bcf/d in 2014, up by more than 5 percent from 2013—the second highest annual growth rate over the past 10 years.¹¹ Production increased in 2014 despite rig counts for gas-directed drilling remaining consistent with previous years, as the practice of drilling multiple wells per pad has increased rig productivity dramatically, allowing more production with fewer rigs. Exports to Mexico continued to grow in 2014 as new pipelines were added to serve the growing power load across the border. While the average natural gas prices in 2014 were higher than the average 2013 prices, they were still low enough to help support an expansion of the LNG export market. Continued production growth, coupled with increasing demand for natural gas in power generation throughout the country, continued to support the need for additional transportation infrastructure and processing capabilities in 2014.

4.2.1 Natural Gas Processing Plants

In 2014, EAD reported on 34 projects that involved either the addition of new gas processing facilities or expansions to existing facilities. These projects were at various stages of development. New capacity was primarily concentrated in areas with active shale plays: Marcellus (West Virginia, Ohio, and Pennsylvania), Bakken (North Dakota and Wyoming), and Eagle Ford (Texas), as well as Louisiana, where much of the Nation’s processing of offshore Gulf of Mexico production takes place.

4.2.2 Natural Gas Pipelines

EAD reported several pipeline projects that entered service in 2014, including projects designed to transport natural gas and natural gas liquids (NGLs). Significant projects included:

- **Enterprise Products Partners’ Rocky Mountain NGL Pipeline Expansion (January 2):** In early January, Enterprise put in service an 85,000-b/d expansion of the Rocky Mountain Segment of its Mid-America Pipeline (MAPL) System. The project,

¹¹ U.S. Energy Information Administration, U.S. Dry Natural Gas Production, http://www.eia.gov/dnav/ng/ng_prod_sum_dc_u_nus_m.htm (released 2/27/2015).

which was designed to accommodate natural gas and NGL production from major basins in Utah, Colorado, and Wyoming, involved looping the existing MAPL system with 290 miles of 16-inch-diameter pipeline, as well as pump station modifications, to transport an additional 85,000 b/d of NGLs. The expansion primarily delivers NGLs to Enterprise's Hobbs fractionator in Gaines County, TX.

- **Consumers Energy Southwest Michigan Natural Gas Pipeline (September 18):** In mid-September, Consumers Energy began service on the 24-mile 1200B natural gas pipeline in southwestern Michigan as part of a \$120 million project. The pipeline completes a 90-mile pipeline corridor aimed to increase reliability and safety for the company's natural gas customers.
- **Kinder Morgan Energy Partners' Sierrita Natural Gas Pipeline (October 31):** The 200-MMcf/d, 60-mile, 36-inch-diameter pipeline provides firm transportation capacity and extends from El Paso Natural Gas's existing south mainlines near Tucson, AZ, to the U.S.-Mexico border near Sasabe, AZ. The Sierrita Pipeline interconnects via a new international border crossing with a new natural gas pipeline in Mexico.
- **Sunoco's Mariner East NGL Pipeline Phase 1 (November):** Sunoco Pipeline L.P.'s Mariner East Phase 1 NGL pipeline went into service during the fourth quarter of 2014, after the Pennsylvania Public Utility Commission validated Mariner East as a public utility. As a public utility, Mariner East is exempt from local zoning. Phase 1 involved re-purposing a former 8-inch-diameter petroleum pipeline to transport NGLs from the Marcellus Shale to a terminal in Marcus Hook, PA. The pipeline has an initial capacity of 70,000 b/d, with the ability to be scaled up as needed.

4.2.3 Liquefied Natural Gas Export Terminals

A combination of factors over the past few years, including an increase in domestic natural gas production and low domestic gas prices, have created a strong economic case for exporting LNG from the United States. FERC receives and approves applications for the siting and construction of onshore and offshore LNG import or export facilities. As of December 31, 2014, there were 19 export terminals proposed to FERC; 5 of these terminals were approved and 14 were pending review.

Table 3 summarizes the 19 export projects that have applied to FERC, including information on the proposed site, export capacity, target in-service date, and the status of FERC approval.

Four of the 19 export terminals applied to FERC in 2014. These include Excelerate Energy's Lavaca Bay, TX, terminal; Trunkline LNG Company's Lake Charles, LA, terminal; Magnolia LNG's Calcasieu River terminal in Louisiana; and Golden Pass Products' terminal in Texas.

Table 3. Proposed LNG Export Projects in the United States, 2014

Terminal	Site	Proposed Export Capacity (Bcf/d)	Target In-Service Date	FERC Project Status
Freeport (TX)	Existing Import Terminal	1.8	2014	Approved
Sabine Pass (LA)	Existing Import Terminal	2.2	2015	Approved
Cove Point (MD)	Existing Import Terminal	1.0	2017	Approved
Cameron (LA)	Existing Import Terminal	1.7	2017	Approved
Corpus Christi (TX)	Existing Import Terminal	2.1	2018	Approved
Lake Charles (LA)	Existing Import Terminal	2.0	2015	Pending
Louisiana LNG (LA)	Greenfield	0.3	2017	Pending
Elba Island (GA)	Existing Import Terminal	0.5	2017	Pending
Gulf LNG (LA)	Existing Import Terminal	1.5	2017	Pending
Oregon LNG (OR)	Greenfield	1.5	2017	Pending
Pangea LNG (TX)	Greenfield	1.0	2018	Pending
Magnolia (LA)	Greenfield	1.1	2018	Pending
Venture Global (LA)	Greenfield	1.3	2018	Pending
Lavaca Bay (TX)	Greenfield	1.4	2018	Pending
Trunkline LNG (LA)	Existing Import Terminal	2.2	2019	Pending
Downeast LNG (MA)	Existing Import Terminal	0.5	2020	Pending
Cambridge Floating LNG (LA)	Greenfield	1.1	–	Pending
Jordan Cove (OR)	Greenfield	1.2	–	Pending
Golden Pass (TX)	Existing Import Terminal	2.0	–	Pending

In addition, projects must apply to the DOE Office of Fossil Energy for approval to export LNG to non-Free Trade Agreement (non-FTA) countries. DOE is currently reviewing all submitted applications and has approved eight (nine, including Freeport LNG's two separate applications) for export to non-FTA countries as of December 31, 2014. Approved and pending export projects to non-FTA countries total 38.1 Bcf/d in exports.

4.3 Petroleum Projects

The continuing transformation of the North American petroleum landscape led to a variety of infrastructure changes in 2014 as transportation and storage infrastructure continues to catch up to growing sources of production, including shale oil formations like the Bakken region in North Dakota and the Eagle Ford region in south Texas, and the Canadian oil sands in Alberta. Continuing a trend from recent years, in 2014, the industry relied increasingly on rail to move

crude oil out of regions where pipeline capacity is lagging production, further utilized marine capacity to that same end, and developed new pipeline systems and reconfigured existing systems to move crude to market.

4.3.1 Crude Oil Production and Transportation Projects

In 2014, the majority of crude oil transportation projects reported in EAD involved increasing the ability to ship supplies by pipeline and rail from the Eagle Ford, Permian, Bakken, and Western Canadian regions to markets across the continent. During the year, crude oil pipeline projects largely fell in two categories: (1) pipelines to move crude oil from Cushing, OK, or West Texas to the U.S. Gulf Coast, and (2) pipelines to move crude oil out of the Bakken shale formation in North Dakota or the Alberta oil sands. In addition to these trends, there were several unique pipeline projects that did not fit into either of these broad categories. New crude oil terminal projects largely fell into two categories as well: (1) rail terminals to load or receive crude oil produced in North Dakota or Alberta, and (2) terminals designed to support new pipeline infrastructure.

4.3.1.1 Crude Oil Pipeline Projects to Cushing, OK, or the Gulf Coast

- **TransCanada's Gulf Coast Pipeline (In Service: January):** In January, TransCanada began shipping crude on the \$2.3 billion southern leg of its Keystone XL project—a 487-mile, 36-inch-diameter pipeline that transports crude oil from Cushing, OK, to Nederland, TX, to serve Texas refineries. The capacity of the line is 700,000 b/d, with the potential to transport up to 830,000 b/d. TransCanada expects to complete a smaller pipeline (Houston Lateral) that will extend from Nederland to refineries near Houston in 2015.
- **BridgeTex Pipeline (In Service: September):** At the end of September, BridgeTex Pipeline, a joint venture between affiliates of Occidental Petroleum and Magellan Midstream, began commercial service on a 400-mile, 300,000-b/d pipeline from the Permian Basin to Magellan's East Houston, TX, terminal. The pipeline project includes a 50-mile pipeline between East Houston and Texas City, TX, and approximately 2.6 million barrels of storage.¹²
- **Enbridge's Flanagan South (In Service: December):** The 590-mile, 36-inch-diameter crude oil pipeline began service on December 1, delivering crude oil from Pontiac, IL, to Cushing, OK. It has an initial design capacity of approximately 600,000 b/d, with an ultimate design capacity of about 880,000 b/d after pumping-power enhancements. The pipeline is designed to transport Bakken and Western Canadian crude oil that arrives in Illinois along other pipeline systems.
- **Seaway Twin (In Service: December):** After purchasing the Seaway pipeline and reversing its flow in 2012, Enbridge and Enterprise Partners "twinned" the pipeline by adding an additional 450,000-b/d line along the same right-of-way from Cushing, OK, to Freeport, TX. The system terminates at the Jones Creek, TX, terminal, but connects directly into Enterprise Products' ECHO terminal in Houston, TX. An additional 750,000-b/d line is being built from ECHO to Port Arthur/Beaumont, TX, to access additional

¹²<http://www.magellanlp.com/uploadedFiles/Investors/Financials/2014/2014%20Annual%20Report%20Full%20022315.pdf>

heavy oil refining capacity. The Seaway Twin shipped its first volumes in December 2014.

- **Energy Transfer's Eastern Gulf Crude Access (Planned: End of 2016):** Energy Transfer Partners announced plans to convert its Trunkline natural gas pipeline to crude service with an estimated capacity of 420,000 b/d by the end of 2016. The line will originate in Patoka, IL, and deliver Bakken crude to St. James, LA, and Nederland, TX.
- **Eagle Ford System Expansion (Planned: Third Quarter 2015):** On November 4, Plains All American and Enterprise Products announced a plan to construct a new condensate gathering system in their Three Rivers, TX, terminal and double the mainline capacity on the Eagle Ford Joint Venture Pipeline from Three Rivers to Corpus Christi, TX. These expansions are expected to be in service in the third quarter of 2015. As part of the expansion, Plains and Enterprise plan to build a new marine terminal on the Corpus Christi ship channel by 2017.
- **Magellan Saddlehorn (Planned: Second Quarter 2016):** In September, Magellan Midstream launched an open season to assess customer interest to transport various grades of Niobrara Shale crude oil from Platteville, CO, to Cushing, OK. The proposed pipeline includes construction of an approximately 600-mile, 20-inch-diameter pipeline capable of transporting up to 400,000 b/d of crude oil. In October, Magellan and Saddle Butte Pipeline entered into an agreement to jointly pursue the project, which is expected online in the second quarter of 2016.
- **Sunoco Logistics Permian Express 2 (Planned: Second Quarter 2015):** The 200,000-b/d Permian Express 2 will ship Permian Basin crude from Garden City, TX, to Corsicana, TX, where it will link to other pipelines for delivery to the U.S. Gulf Coast. The pipeline is expected to start up in the second quarter of 2015.
- **Plains All American Cactus Expansion (Planned: Second Quarter 2015, Fourth Quarter 2015):** The Permian crude oil pipeline spanning from McCamey, TX, to Gardendale, TX, was initially slated to be 200,000 b/d, but further plans called for additional expansion projects to boost the final capacity to 330,000 b/d in response to higher production forecasts. The initial project is scheduled to start in April 2015, while the expansion will be in service in the fourth quarter of 2015. From Gardendale, the pipeline will connect to other lines for delivery to refineries in Three Rivers and Corpus Christi, TX.

4.3.1.2 Crude Oil Pipeline Projects Out of the Bakken Shale Play and the Alberta Oil Sands

- **Enbridge Line 6B Expansion (In Service: May):** Enbridge replaced and expanded its crude oil Line 6B pipeline segment from Griffith, IN, to Sarnia, Ontario, from 240,000 b/d to 500,000 b/d. The pipeline, completed in May 2014, ships western Canadian crude to refineries in Michigan, Ohio, and eastern Canada.
- **Kinder Morgan's Cochin Pipeline Reversal, Conversion (In Service: July):** In July, Kinder Morgan commenced operation on the 1,900-mile, 12-inch-diameter Cochin pipeline to ship up to 95,000 b/d of light condensate from Illinois to Alberta for use as

diluent in oil sands transportation.¹³ The system had previously shipped propane from Alberta to distribution terminals in the U.S. Upper Midwest.

- **TransCanada Energy East (Planned: 2018):** The 2,800-mile Energy East pipeline project consists of reversing and converting from natural gas service an existing TransCanada pipeline to ship 1.1 million b/d of western Canadian crude from Alberta to refineries in eastern Canada. In addition, new sections of the pipeline will be constructed, along with storage assets in Saskatchewan; the Quebec City, Quebec, area; and Saint John, New Brunswick. The project is going through regulatory approval processes and is planned to be in service in 2018.
- **TransCanada Grand Rapids (Planned: 2016):** The 287-mile Grand Rapids Pipeline project will span from Fort McMurray, Alberta, to the Edmonton/Heartland region. The pipeline system is expected to be placed into service in multiple stages, with initial crude oil service in 2016. The system will have the capacity to move up to 900,000 b/d of crude oil and 330,000 b/d of diluent.
- **Kinder Morgan Trans Mountain Twin (Planned):** Kinder Morgan began survey work to expand its Trans Mountain pipeline system from Edmonton, Alberta, to Vancouver, British Columbia, but faced various project delays throughout 2014. The expansion calls for nearly tripling the capacity of the 715-mile line by twinning the existing pipeline where possible and would boost capacity to 890,000 b/d from 300,000 b/d.
- **Enbridge Northern Gateway Twin Pipeline (Planned: 2018):** The 525,000-b/d twin pipeline would ship western Canadian crude 731 miles from Bruderheim, Alberta, to Kitimat, British Columbia, for export. The project also includes a 193,000-b/d pipeline to ship condensate eastward. The project was expected to be online in 2018, but Enbridge announced in September that this timeline was unlikely due to regulatory and permitting uncertainties.
- **Dakota Access (Planned: End of 2016):** In October, Phillips 66 entered into a joint venture with Energy Transfer Partners to develop the previously announced Dakota Access pipeline. The pipeline will have capacity in excess of 450,000 b/d and transport crude oil from the Bakken/Three Forks region in North Dakota to Patoka, IL, where it will connect with Energy Transfer's converted Trunkline pipeline (see the "Crude Oil Pipeline Projects to the Gulf Coast" section). The pipeline is expected to be in service by the end of 2016.
- **Spectra Pipeline Expansion (Planned: 2017):** On October 10, Spectra Energy announced a proposed 400,000-b/d expansion of their oil pipeline network, with service from Guernsey, WY, to Patoka, IL. This announcement was in response to strong market demand to move light, sweet, U.S. domestic crude from multiple supply areas, including the Bakken region, the Denver-Julesburg Basin, and the Powder River Basin, to Patoka, where shippers will be able to access Midwest and Gulf Coast markets. The expansion, which would be in service in 2017, would provide access for shippers to reach markets in the eastern Midwest region and the flexibility to meet light crude refinery demand on the Gulf Coast.

¹³ http://www.kindermorgan.com/business/products_pipelines/cochin.aspx

- **Enbridge Alberta Clipper Expansion (Planned: Late 2015):** The pipeline will be expanded from 450,000 b/d to 800,000 b/d to ship western Canadian crude to the Midwest. The company will connect the expanded Alberta Clipper to its 390,000-b/d Line 3 pipeline just prior to crossing the international border and reconnect Line 3 with the Alberta Clipper south of the border. The expansion is expected to be complete by late 2015.
- **Enbridge Sandpiper Expansion (Planned: 2017):** The pipeline expansion will increase takeaway capacity for Bakken crude from Beaver Lodge Station, ND, 600 miles to the Superior, WS, mainline system terminal. The new 24-inch-diameter lines will twin the existing North Dakota System mainline and add 250,000 b/d of capacity between Tioga and Berthold, ND, and 225,000 b/d of capacity between Berthold and Clearbrook, MN. A new 30-inch-diameter, 375,000-b/d line will be constructed between Clearbrook and Superior. The project was expected to come online by the middle of 2016, but is now expected to come online in 2017.
- **Pembina Pipeline Corporation's Alberta Pipeline Expansion (Planned: 2017):** Pembina Pipeline filed regulatory applications on September 4 for a segment of its Phase III pipeline expansion in Alberta. The new 24-inch-diameter pipeline will span approximately 168 miles and is expected to have an initial capacity of 320,000 b/d and an ultimate capacity of more than 500,000 b/d. As part of the project, Pembina is also considering a 16-inch-diameter pipeline along the same route, pending commercial support. Subject to regulatory approval, Pembina expects the project to be in service by mid-2017.
- **Enbridge Southern Access Extension (Delayed: Late 2015):** Enbridge announced in November that its 300,000-b/d Southern Access Extension pipeline from Flanagan to Patoka, IL, is expected to be in service by late 2015. The extension was previously expected to be in service by mid-2015.
- **Enbridge Line 9 Reversal (Delayed: 2015):** On September 30, Enbridge said that it expected that Line 9, carrying approximately 300,000 b/d of crude oil from Sarnia, Ontario, to Montreal, Quebec, would be in service in early November. The company had reversed the flow of the pipeline in order to take western Canadian crude to refiners in eastern Canada. The reversal startup was delayed due to environmental concerns and had not started up by the end of the year.
- **TransCanada Keystone XL (Planned):** TransCanada's Keystone XL pipeline would have the capacity to ship 830,000 b/d of oil sands crude from western Canada (including 100,000 b/d of Bakken) from Hardisty, Alberta, to Steele City, NE, and ultimately access the U.S. Gulf Coast (see the "Crude Oil Pipeline Projects to the Gulf Coast" section). The pipeline project remains on hold pending the granting of a Presidential permit.

4.3.1.3 Other Crude Oil Pipeline Projects

- **Inter Pipeline Polaris Expansion First Segment (In Service: July):** On July 21, Inter Pipeline announced that a major segment of the Polaris pipeline system expansion was completed and placed into commercial service. The new 180-mile, 30-inch pipeline will deliver as much as 350,000 b/d of diluent from near Edmonton, Alberta, to the Foster Creek and Christina Lake oil sands projects owned by the FCCL Oil Sands Partnership,

a joint venture between Cenovus and ConocoPhillips. The remaining segments of the Polaris expansion, including a diluent connection to FCCL's Narrows Lake oil sands facility, were on schedule and expected to be completed in phases between late 2014 and mid-2017. When complete, the Polaris system will have the capacity to deliver as much as 700,000 b/d of diluent.

- **Kinder Morgan Freedom Pipeline (Proposed):** Kinder Morgan resurrected plans for its Texas-to-California Freedom Pipeline project after the proposal was shelved in mid-2013 when it failed to receive enough interest from shippers. On December 3, the company said that plans now include the construction of an atmospheric topping unit in West Texas to make and ship blends similar to Alaskan North Slope crude. This topping unit would be capable of processing 150,000 b/d and be able to produce two cuts—condensate and gas oils/residual fuels for blending with additional crude. The pipeline would be the first major crude pipeline from Texas into California, giving California access to cheaper inland crudes and cutting dependence on more costly imports. It could take approximately 2 years to bring the pipeline into service.
- **Plains Diamond Pipeline (Planned: End of 2016):** In August, Plains All American announced plans to build the 440-mile, 20-inch-diameter Diamond pipeline to transport 200,000 b/d of crude oil from Cushing, OK, to Valero's 195,000-b/d Memphis, TN, refinery. The project will be completed by the end of 2016.

4.3.1.4 Crude Oil Rail Terminals

- **Plains Bakersfield, CA, Rail Terminal (In Service: November):** In November, Plains All American commenced operations at the 70,000-b/d unloading facility in Bakersfield, CA. The Bakersfield location supplies existing pipelines to Los Angeles and San Francisco.
- **Tesoro Vancouver, WA, Crude Oil Railport (Delayed: Mid-2015):** Tesoro Corporation's planned crude oil rail-to-barge project at the Port of Vancouver in Washington State was delayed on May 1 as the company awaits State requirements for an environmental impact statement. The joint venture project with Savage Services was scheduled to start up late 2014 or early 2015. Construction is now expected to begin during that timeframe, with initial inland U.S. crude volumes running through the railport in mid-2015. Tesoro submitted environmental permit applications for the project in August 2013, seeking approval for a 380,000-b/d facility, but the actual volumes are expected to hover at 300,000 b/d.
- **Enbridge Pontiac, IL, Rail Unloading Terminal (Planned: First Quarter 2016):** Enbridge is considering a 140,000-b/d unit train unloading terminal in Pontiac, IL. The terminal would be able to handle two unit trains per day and could be in service by first quarter 2016. Pontiac is the origin of Enbridge's new 600,000-b/d Flanagan South pipeline to Cushing, OK, and the rail terminal would allow shippers to bypass congestion on pipelines in the Canadian portion of Enbridge's export network.
- **Global Partners' Clatskanie, OR, Rail-to-Barge Terminal Expansion (Planned):** Oregon's Department of Environmental Quality (DEQ) approved an expansion of a crude oil train terminal near Clatskanie to move 1.8 billion gallons of oil annually (approximately 117,500 b/d), enough to receive 50 oil trains per month. DEQ approved

an air pollution permit for the oil train terminal on August 19. The terminal unloads North Dakota oil from trains onto barges, which then head to refineries in Washington State and California.

- **Kinder Morgan Edmonton, Alberta, Rail Terminal Expansion (Planned: First Quarter 2015):** Kinder Morgan and Imperial Oil are expanding the Edmonton, Alberta, rail terminal by 110,000 b/d to increase its capacity at startup in the first quarter of 2015 to more than 210,000 b/d. The terminal will be connected via pipeline to Kinder Morgan's adjacent Edmonton storage terminal and will connect to both Canadian National and Canadian Pacific mainlines.

4.3.1.5 Other Crude Oil Terminals

- **Enterprise Beaumont, TX, Terminal (Reactivated: May):** Enterprise Products reactivated its marine terminal in Beaumont, TX, on May 20. Located on the Neches River, the terminal can load at rates of up to 15,000 barrels per hour. The facility includes a dock that can accommodate Panamax-size vessels with a 40-foot draft and a capacity of up to 400,000 barrels. The terminal has access to more than 12 million barrels of refined products storage and receives products from eight refineries, representing approximately 3.3 million b/d of capacity, as well as the Colonial Pipeline.
- **Oiltanking¹⁴ Beaumont, TX, Expansion (Planned: Third Quarter 2015):** On June 11, Oiltanking announced an expansion project to construct new crude storage, pipelines, and dock infrastructure at its Beaumont, TX, terminal. The multi-phase crude expansion project will add 6.2 million barrels of storage capacity. The company expects to begin delivering initial tanks to customers during the third quarter of 2015, with the balance of the tanks coming online as they are completed through the first half of 2016. Upon completion of the announced crude storage expansions, the Beaumont terminal is expected to have 11.7 million barrels of total capacity.
- **Kinder Morgan Pasadena and Galena Park, TX, Terminal Expansions (Planned):** On October 14, Kinder Morgan announced an expansion project at its Pasadena and Galena Park, TX, terminals to provide additional infrastructure to help meet growing demand for refined product storage and dock services along the Houston Ship Channel. The combined investment will include the construction of 2.1 million barrels of storage between the two terminals. Kinder Morgan will also construct a new ship dock that is capable of handling ocean-going vessels and infrastructure improvements at its Galena Park terminal. The new ship dock and the existing Galena Park ship docks will be capable of loading vessels at rates of up to 15,000 barrels per hour.
- **Gibson Hardisty, Alberta, Terminal Expansion (Planned: Late 2014–Early 2016):** Gibson Energy furthered its expansion plans to increase capacity by 2.3 million barrels at its Hardisty, Alberta, terminal. The new tanks will be constructed on the company's eastern Hardisty lands adjacent to the three 400,000-barrel tanks and the 500,000-barrel tank under construction. Site preparation and civil work for the two new tanks was planned to commence in the third quarter of 2014. Expected in-service dates for the six new tanks span late 2014 to early 2016.

¹⁴ Oiltanking is now owned by Enterprise Products.

- **Petroplex Mississippi River Terminal in Louisiana (Planned):** On May 8, a proposed Petroplex International crude oil tank farm and Mississippi River terminal received a critical waiver from St. James Parish’s newly adopted land use plan. The St. James Parish Council voted to allow the complex to proceed on more than 1,700 acres of agricultural fields and woods near Vacherie, LA. The tank farm could ultimately have 10 million barrels of storage capacity to handle and blend crude, including heavy Canadian and shale oil, as well as gasoline, other petroleum products, vegetable oil, and biodiesel. The terminal will be able to move commodities by ship, rail, highway, or pipeline to refiners, according to permit documents.

4.3.2 Refining and Petroleum Product Transportation

EAD reported on various changes to refinery and petroleum product transportation infrastructure in 2014, including changes to refineries, petroleum product pipelines, and petroleum product terminals. Important changes are summarized in the sections below.

4.3.2.1 Refinery Sales and Closures

In 2014, Flint Hills closed its North Pole, AK, refinery due to poor economics.

- **Flint Hills Ceases Crude Receipts at North Pole, AK, Refinery (May 24):** Flint Hills Resources announced in February that it planned to close its 226,500-b/d North Pole, AK, refinery, citing the high costs of doing business in Alaska and its ongoing obligations from an industrial chemical spill at the refinery. The refinery halted gasoline production on May 1 and ceased crude oil receipts on May 24. The refinery will become an oil shipping and storage terminal.
- **Atlantic Basin’s (ABR) Restart Plans Rejected for St. Croix, U.S. Virgin Islands, Refinery (November 10):** ABR agreed to purchase Hovensa, including the company’s St. Croix, U.S. Virgin Islands, refinery, which was idled in 2012. ABR planned to reconfigure and restart the refinery with the capacity to process 300,000 b/d of crude oil. However, on December 19, the U.S. Virgin Islands Legislature rejected the deal after its counsel warned that ABR might not be able to uphold the contract and the government would have no recourse against ABR if it were to breach the contract.

4.3.2.2 Refinery Expansion Projects

Refinery expansion projects in 2014 were limited; one of the three notable projects was withdrawn after being announced.

- **Phillips 66 Sweeny, TX, Refinery Condensate Splitter (Planned):** Phillips 66 filed a permit application in December with the Texas Commission on Environmental Quality to build a “simplified condensate splitter unit” at the company’s 247,000-b/d Sweeny, TX, refinery.¹⁵ The 75,000-b/d splitter, as well as an Eagle Ford crude and condensate

¹⁵ Light liquid hydrocarbons recovered from lease separators or field facilities at associated and non-associated natural gas wells.

pipeline, and a second 110,000-b/d fractionator at the refinery site are in the engineering design and permitting phase.¹⁶

- **Valero Norco, LA, Refinery Expansion (Planned):** Valero Energy had planned to expand its 205,000-b/d Norco refinery to 290,000 b/d, but scaled the expansion back to 275,000 b/d according to a public notice filed with the Louisiana Department of Environmental Quality (LDEQ) on January 14. No date was given for the start of construction for the expansion, but in an earlier filing with LDEQ, Valero requested the issuance of air permits for the refinery under its revised plans to be issued by February 28, 2014.
- **Motiva Port Arthur, TX, Hydrocracker Expansion (Canceled: December):** In December, Motiva Enterprises withdrew its permit request to expand a hydrocracker and diesel hydrotreater unit at its 600,250-b/d Port Arthur, TX, refinery. The permit application submitted in August said that the project would increase diesel fuel output and push the unit's design capacity to 105,000 b/d from its current 82,000 b/d. The hydrocracker was one of several new process units added to Motiva's Port Arthur refinery as part of a \$10 billion expansion that more than doubled the plant's capacity, making it the largest in the United States.

4.3.2.3 New Refinery Projects

Aside from small, regional refineries, a new refinery has not come online in either the United States or Canada since 1986; however, developments in shale oil in the Eagle Ford and Bakken regions, combined with continued output in Western Canada, are driving proposals and construction of several new large refineries. In addition, the increasing production of condensate, particularly in the Eagle Ford region, has encouraged the development of condensate processing plants.

- **North West Redwater Sturgeon County Bitumen Refinery in Alberta (Planned: September 2017):** The Government of Alberta approved up to CAN\$1 billion in financing for North West Redwater's (NWR) 150,000-b/d bitumen refinery in Sturgeon County, Alberta. In December 2013, NWR and its partners announced a decision to postpone construction of the first phase of the refinery due to rising capital costs. Under the initial plans, Phase 1 of the project called for 50,000 b/d of capacity, while subsequent phases would add an additional 100,000 b/d of capacity. The refinery would also capture 1.2 million tonnes/year of carbon dioxide to be sold for use in enhanced oil recovery. In July, NWR priced bonds to help finance the refinery and stated that approximately 80,000 b/d of capacity would be completed in September 2017.¹⁷
- **Pacific Energy Prince Rupert, British Columbia, Refinery (Planned):** Pacific Energy announced plans on June 10 to build an oil refinery on the northwest coast of British Columbia that could eventually process up to 1 million b/d of oil sands bitumen. The company was looking at three potential building sites in Prince Rupert, British Columbia. The refinery could be producing products such as gasoline and diesel in about 7 years,

¹⁶ http://www.eia.gov/pressroom/presentations/sieminski_02122015.pdf

¹⁷ <https://www.nwrpartnership.com/sites/default/files/pdfs/Press%20Release%20-%20July%2018%202014.pdf>

according to the company's executive chairman. In its initial phase, the refinery will process 200,000 b/d.

4.3.2.4 Petroleum Product Pipelines and Terminals

- **Successful Open Season for Kinder Morgan's Palmetto Pipeline:** Kinder Morgan closed its binding open season for the 167,000-b/d Palmetto Pipeline on October 30 and received committed volumes from shippers sufficient to support the project. The refined product pipeline will ship products such as gasoline and diesel from Louisiana, Mississippi, and South Carolina to points in South Carolina, Georgia, and Florida.

4.3.2.5 Emergency Gasoline Reserves

- **DOE Launches Northeast Gasoline Supply Reserve (June):** As a response to the fuel supply disruptions faced by the Northeast following Superstorm Sandy in 2012, the DOE established the first federal regional refined petroleum product reserve containing gasoline. The reserve holds one million barrels of gasoline to help strengthen regional fuel resiliency in the Northeast. The purpose of the reserve is to provide a buffer large enough to allow companies to compensate for near-term supply disruptions, but not so large as to dissuade the companies from maintaining their own sufficient fuel reserves for emergencies. The regional reserve has 700,000 barrels of gasoline in the New York Harbor area, 200,000 barrels in the Boston area, and 100,000 in South Portland, Maine. Each terminal is required to have backup power at the storage site, and multiple options to move fuel in the event of a disruption, including truck and marine vessel loading facilities. Additionally, several terminals also have pipeline connectivity to move fuel. This new Northeastern gasoline reserve supplements the Northeast Home Heating Oil Reserve, a one million barrel supply of ultra-low sulfur diesel, which was used for the first time by first-responders and to fill emergency generators after Superstorm Sandy.
- **NYSERDA Launches Portable Emergency Generator Program and State Strategic Gasoline Reserve for Declared Emergencies (July):** The New York State Energy Research and Development Authority (NYSERDA) launched two major Fuel NY initiatives—the Portable Emergency Generator Program and the State Strategic Gasoline Reserve. Both initiatives are intended to help alleviate some of the most pressing challenges faced by motorists, first responders and gas station owners after Superstorm Sandy. Under the Portable Emergency Generator Program, approximately 1,000 gas stations in New York City, Long Island, Westchester County, and Rockland County are required to have back-up power capability in the event of an emergency. Stations can apply to rent a portable emergency generator through NYSERDA. The State Strategic Gasoline Reserve was developed to help bridge gaps in the resupply of critical fuel during recovery from disruptions of fuel supplies. The reserve, which contains nearly 3 million gallons of fuel, is located at Northville Industries' terminal in Suffolk County. Fuel from the Strategic Gasoline Reserve may be sold to distributors at market prices to provide it to emergency responders, government customers and retail gasoline outlets during emergencies.

4.4 Biofuels

The U.S. biofuels industry experienced good market conditions in the first part of 2014 despite a challenging policy environment and regulatory uncertainty about the U.S. Renewable Fuel Standard (RFS) renewable volume obligations for 2014. Many ethanol production facilities that were previously idled or shut down were restored and two new cellulosic ethanol facilities were opened. However, most new biofuel production facilities that were announced in 2014 were for biomass-based diesel (i.e., biodiesel and renewable diesel) due to refiners reaching the so called “blend wall” for ethanol use. The blend wall refers to the fact that growth in ethanol use cannot occur without either a growth in gasoline demand, which has been stagnant for several years, or an increase in ethanol blending. Currently, ethanol blends are predominantly at 10% (E-10). Higher blends such as E-15 and E-85 require modified service station infrastructure and flex fuel vehicles and additionally blends higher than 10% may void engine manufacturer’s warranties for existing vehicles.

4.4.1 New Biofuel Plants

In 2014, EAD and the trade press reported the completion of two commercial-scale cellulosic ethanol plants, the restoration of a corn ethanol facility, and the grand opening of a new corn ethanol facility. These projects included:

- **Aventine Renewable Energy, LLC (May):** Aventine officially began production at the 110-MMgal/year corn ethanol facility in May in Aurora West, NE.¹⁸
- **POET-DSM Advanced Biofuels, LLC (September):** POET-DSM hosted a grand opening in September and began production of cellulosic ethanol from corn stover in Emmetsburg, IA. The facility has a production capacity of 20 MMgal/year of ethanol, but is expected to increase capacity by an additional 5 MMgal/year.
- **Abengoa (October):** Abengoa hosted a grand opening in October 2014 to produce cellulosic ethanol from crop residues such as stalks, stems, and leaves in Hugoton, KS. The facility has a production capacity of 25 MMgal/year and generates 21 MW of electricity.
- **Vireol Bio Energy:** Vireol restored the 65-MMgal/year corn ethanol plant in Hopewell, VA, after it was completed but never opened in 2010 by Osage Bio Energy. Investors originally planned to dismantle the plant and ship equipment to England, but reconsidered after production slowed in England.

Seven new biofuel projects were also announced in 2014 with most facilities expected to come online between 2015 and 2017:

- **Appalachian Biofuels LLC:** Appalachian announced plans to build a small biodiesel plant in St. Paul, VA, in 2015.¹⁹

¹⁸ *BusinessWire*, “Aventine announces sugar-based ethanol production in Aurora, Neb.,” May 28, 2014, <http://www.businesswire.com/news/home/20140529005353/en/Aventine-Announces-Sugar-Based-Ethanol-Production-Aurora-Neb.#.U4ehva15xuV>.

¹⁹ TriCities, “Appalachian Biofuels LLC will open in St. Paul; 40 new jobs expected,” October 29, 2014, http://www.tricitie.com/news/article_6f323ee0-5f81-11e4-8a3d-001a4bcf6878.html?mode=story.

- **Tri-State Biodiesel:** Tri-State held a groundbreaking celebration in Bridgeport, CT, to mark the construction of a new 10-MMgal/year biodiesel facility.²⁰
- **United Metro Energy:** United Metro anticipates that the Brooklyn, NY, biodiesel facility will be online in spring 2015 and will produce approximately 50 MMgal/year.²¹
- **Blue Ridge Biofuels:** Blue Ridge announced plans to expand biodiesel production in Asheville, NC, to 3 MMgal/year from 0.5 MMgal/year annually, starting in 2017.²²
- **SG Preston:** SG Preston announced plans to build a 120-MMgal/year renewable diesel facility in Lawrence County, OH, to be completed in 2017. The technology will be licensed from Honeywell UOP.²³
- **Thomas Biodiesel:** Thomas announced plans to build a biodiesel facility in Temple, TX. Construction is expected to be completed in mid-2015.²⁴
- **East Kansas Agri-Energy:** East Kansas Agri-Energy announced plans to integrate renewable diesel production at its ethanol plant in Garrett, KS, from corn distillers' oil produced at the facility. The facility will have the capacity to produce 3 MMgal/year, with the ability to double capacity in the future.²⁵

4.4.2 Plants in Transition

Economic conditions, weather disruptions, and policy changes in 2014 led to some volatility in U.S. biofuels production. Notable issues were related to the loss of the Federal Biodiesel Mixture Excise Tax Credit (although it was reinstated at the end of 2014), a delay in the release of 2014 U.S. Renewable Fuel Standard volumetric requirements, and a decline in oil prices that impacted biofuel margins. Early in 2014, the polar vortex impacted many biofuel production facilities in the Midwest due to natural gas shortages and railroad congestion. Biofuel producers ultimately idled facilities or reduced production. This led to significant price increases along the East Coast by as much as \$1 per gallon in New York Harbor compared to Chicago in early March.²⁶

²⁰ Tri-State Biodiesel, "Mayor Finch holds groundbreaking at Tri-State Biodiesel," October 24, 2014, <http://tristatebiodiesel.com/2014/10/24/mayor-finch-holds-groundbreaking-at-tri-state-biodiesel-creating-25-new-green-jobs-at-eco-technology-park>.

²¹ News12, "United Metro Energy Corporation to open Greenpoint biodiesel plant in spring 2015," October 14, 2014, <http://brooklyn.news12.com/news/united-metro-energy-corporation-to-open-greenpoint-biodiesel-plant-in-spring-2015-1.9499508>.

²² *Mountain Xpress*, "Blue Ridge Biofuels announces expansion in 2015," December 31, 2014, <http://mountainx.com/blogwire/blue-ridge-biofuels-announces-expansion-in-2015>.

²³ *Biodiesel Magazine*, "SG Preston to build 120 MMgy renewable diesel plant in Ohio," August 1, 2014, <http://biodieselmagazine.com/articles/143638/sg-preston-to-build-120-mmgy-renewable-diesel-plant-in-ohio>.

²⁴ *Austin Business Journal*, "Biodiesel manufacturer building \$30 million Temple plant," January 7, 2014, <http://www.bizjournals.com/austin/news/2014/01/07/biodiesel-manufacturer-building-30.html>.

²⁵ *Ethanol Producer Magazine*, "East Kansas Agri-Energy announces renewable diesel project," July 24, 2014, <http://www.ethanolproducer.com/articles/11279/east-kansas-agri-energy-announces-renewable-diesel-project>.

²⁶ *The Wall Street Journal*, "Ethanol prices surge as rail problems cut supply," March 16, 2014, <http://www.wsj.com/news/articles/SB10001424052702303546204579439740561525518?mg=reno64-wsj&url=http%3A%2F%2Fonline.wsj.com%2Farticle%2FSB10001424052702303546204579439740561525518.html>.

Despite challenges in 2014, nine facilities that had been idled or shut down in previous years were restored due to improved economics, technology upgrades or fuel production changes, or government funding assistance. A few examples include:

- **Pinal Energy LLC (March):** The 60-MMgal/year corn ethanol facility in Maricopa, AZ, was restored in March after idling for a year and a half due to improved economics and plant upgrades.²⁷
- **Three Rivers Energy:** The 50-MMgal/year ethanol facility in Coshocton, OH, was restored after being mothballed in 2008 due to a \$9 million U.S. Department of Agriculture (USDA) Rural Energy for America Program loan guarantee, which enabled owners to install the necessary equipment upgrades.²⁸
- **Valero Energy:** The 110-MMgal/year corn ethanol refinery in Mt. Vernon, IN, was restored after a 2-year hiatus after Valero purchased and renovated the facility.²⁹

A full list of biofuel plants in transition can be found in Appendix B. List of Biofuel Plants in Transition,

4.4.3 Policy Changes

In 2014, EAD and the trade press reported a number of Federal policy and regulatory changes by Congress and EPA. EPA delayed several times the final release of the 2013 and 2014 renewable volume obligations (RVOs) for gasoline and diesel refiners and importers under the U.S. Renewable Fuel Standard (RFS). These notices included the proposed 2014 RVO and the final 2013 cellulosic biofuel requirements.

In November 2013, EPA proposed an increase in the 2014 RVO for a total of 18.15 billion gallons compared to 16.55 billion gallons in 2013.³⁰ The 2014 proposal was not finalized in 2014 and will be released in early 2015, along with the 2015 RVO. As a result of the delay, EPA extended the deadline for 2013 RVO compliance until 30 days after the official publication of the 2014 RVO to assist obligated parties in determining the quantity of the 2013 credit rollovers.³¹ As a result of the delays, the American Fuel & Petrochemical Manufacturers filed a notice of intent to sue EPA for failure to issue the 2014 and 2015 RFS rules by the statutory deadline.³²

EPA also revised the 2013 cellulosic biofuel requirements. EPA granted petitioners' requests for reconsideration of the 2013 cellulosic biofuel standard due to substantially lower production

²⁷ *Ethanol Producer Magazine*, "Pinal Energy back online after extended shutdown," March 19, 2014, <http://www.ethanolproducer.com/articles/10863/pinal-energy-back-online-after-extended-shutdown>.

²⁸ USDA, "Resuscitated biorefinery breathes new life into rural Ohio community," August 1, 2014, <http://blogs.usda.gov/2014/08/01/resuscitated-biorefinery-breathes-new-life-into-rural-ohio-community>.

²⁹ *San Antonio Express News*, "Valero restarts ethanol plant," August 28, 2014, <http://www.mysanantonio.com/business/eagle-ford-energy/article/Valero-restarts-ethanol-plant-5718791.php>.

³⁰ Shown in ethanol-equivalent gallons.

³¹ U.S. EPA, "2013 RFS compliance extension," August 8, 2014, <http://www.gpo.gov/fdsys/pkg/FR-2014-08-08/pdf/2014-18568.pdf>.

³² American Fuel & Petrochemical Manufacturers, "AFPM files notice of intent to sue EPA on 2015 RFS," <http://www.afpm.org/news-release.aspx?id=4615>.

volumes than previously estimated. EPA reduced the cellulosic biofuel requirement from 6 million gallons to a little more than 800,000 gallons (or 0.0005 percent of total gasoline and diesel refined and imported in the United States) to reflect actual production in 2013.³³

Other major Federal regulatory announcements in 2014 included:

- **EPA Issues Pathways II Rule:** EPA issued rules for new cellulosic and advanced fuel pathways for compressed and liquefied natural gas and electricity produced from biogas from landfills, municipal wastewater treatment facilities, agricultural digesters, and separated municipal solid waste digesters.³⁴
- **EPA Issues Rule for Voluntary Quality Assurance Program (QAP):** To reduce the potential for Renewable Identification Number (RIN) fraud, EPA finalized a rule to establish a QAP for producers that provides an affirmative defense against liability for the transfer or use of invalidly generated RINs. QAP-verified RINs (also known as Q-RINs) are generated through audits of production facilities conducted by independent third parties.³⁵
- **U.S. DOT Issues Rulemaking Proposal for Ethanol Train Shipments:** DOT released the details of proposed enhanced tank car standards, operational requirements for high-hazard flammable trains (include trains carrying 20 or more tank carloads of flammable liquids, such as ethanol), and comprehensive spill response planning requirements.³⁶

Finally, in December 2014, Congress passed tax credit extensions for the Biodiesel Mixture Excise Tax Credit (also known as the Biodiesel Blenders' Credit). This credit, valued at \$1.00/gallon of pure biodiesel, was retroactively reinstated to January 1, 2014, and was available through the end of the year. Extensions were also approved for a cellulosic ethanol production tax credit and an alternative fueling equipment tax credit.

³³ U.S. EPA, 2013 Cellulosic Standard, April 2014, <http://www.epa.gov/otaq/fuels/renewablefuels/documents/420f14018.pdf>.

³⁴ U.S. EPA, Pathways II, July 2014, <http://www.epa.gov/otaq/fuels/renewablefuels/documents/420f14045.pdf>.

³⁵ U.S. EPA, Quality Assurance Program, June 2014, <http://www.epa.gov/otaq/fuels/renewablefuels/documents/420f14042.pdf>.

³⁶ U.S. DOT, Comprehensive Proposed Rulemaking for the Safe Transportation of Crude Oil, Flammable Materials, July 23, 2014, <http://www.dot.gov/briefing-room/us-dot-announces-comprehensive-proposed-rulemaking-safe-transportation-crude-oil>.

5. International Events

While EAD primarily focuses on domestic and related North American energy issues, it also reports international events with significant implications for global energy markets. This section highlights those international incidents and summarizes the status of major global infrastructure projects that were announced, under construction, or placed into service during 2014. Due to the nature of international reporting and the focus of EAD, this should not be viewed as a complete summary of global events, but rather a summary of those events captured in EAD.

5.1 International Incidents and Disruptions

A number of international events affected global energy markets in 2014, primarily in oil-producing and politically unstable parts of the world. Significant energy events and disruptions from 2014 are listed below. Many of these bullets summarize repeated events, such as attacks on petroleum infrastructure, which continued throughout the year.

5.1.1 Africa

- **Protests and Violence Disrupt Libyan Production and Flow (2014):** Throughout 2014, heightened tension in Libya led to protests and violence at many of the oil fields and export terminals. Nearly every key Libyan asset was affected by the heightened tensions throughout the year. Overall, Libyan oil output dropped to its lowest level at 155,000 b/d in May. As tensions eased toward the end of the third quarter, many ports and oil fields were re-opened after being out of operation for nearly a year. By the end of September, Libyan oil output rose to more than 900,000 b/d. Tensions and violence broke out again, however, and the country's output plummeted to below 400,000 b/d by the end of the year.
- **Fire Destroys Part of Crude Oil Supply at Libyan Oil Port (December 25):** On December 25, a missile fired during fighting at Libya's largest oil port of Es Sider started a fire that destroyed six tanks holding 850,000 barrels of crude oil. The fire burned for nearly a week, destroying approximately 1.8 million barrels of crude oil and causing total damages of \$213 million. The Es Sider terminal, containing two ports, had been out of operation for 2 weeks prior to the missile strike when Tripoli forces tried seizing them from forces allied to Prime Minister Abdullah al-Thinni. The terminal accounted for roughly 300,000 b/d of exports, and Libya's total output was down nearly 45 percent to 380,000 b/d without the terminal. By the end of 2014, the fire had been extinguished, but operations were slow to recover due to the extensive damage.
- **Sinai Natural Gas Pipeline Attacked by Gunmen in Egypt (January–February):** A natural gas pipeline in Sinai, Egypt, was attacked in three separate incidents in January and February by unknown assailants, suspected to be al-Qaeda inspired. The pipeline carries natural gas to an industrial area in the Peninsula. Two of the three attacks were reported to have halted the flow of natural gas temporarily.
- **Nigerian Pipeline Shut Down Due to Theft (January 14):** Italian Company Eni shut down its Tedidaba-Brass export pipeline in Nigeria due to theft. The company reported

losing roughly 17,500 b/d of Brass-grade oil from the theft. It was not reported whether the pipeline had resumed operations.

- **Shell Shuts Down Nembe Creek Trunk Oil Pipeline in Nigeria (February 22):** A leak caused by theft forced Shell to shut down its oil pipeline that carries 95,000–155,000 b/d of Bonny Light crude for export in February. Shell reported in March that it had lost approximately 100,000 b/d from its Nigerian oil and LNG operations due to theft. Pipeline flows resumed on March 10.
- **Shell Shuts Down Forcados Oil Terminal in Nigeria (March–May):** Shell halted crude exports from the Forcados oil terminal in South Nigeria due to a leak in the supply line discovered on March 4. Shortly after the discovery, Shell declared *force majeure* on oil exports from the terminal, stating that the leak was caused by thieves. Shell repaired the leak and lifted the *force majeure* on May 15.
- **Angola LNG Export Project Shut Down (April–Mid-2015):** The Angola LNG export project, led by Chevron, was shut down in April due to a rupture in the flare line. A capsized rig, electrical fires, pipeline leaks, and limited success in processing liquids-rich gas have slowed production over the past year. The major flare line rupture caused a facility-wide shutdown. Production is expected to resume late 2015.

5.1.2 Middle East

- **Kirkuk-Ceyhan Oil Pipeline Bombed by Militants (2014):** The Kirkuk-Ceyhan pipeline in northern Iraq that connects to the Turkish port of Ceyhan was bombed by militants, which forced flows to be suspended. The pipeline was attacked 54 times in 2013, and the attacks have continued into 2014. An attack in September left major damage that is expected to take more than a year to repair before the pipeline can resume operations.
- **Iraq's Baiji Oil Refinery Seized by Islamic State, Damaged by Fighting (June–November):** Iraq's largest oil refinery fell to the Islamic State in June. A series of battles for the refinery took place from June until November, which severely damaged the refinery. Government troops were able to take back control in November, and repairs are expected to take place until mid-2015 before the refinery can restart.
- **Yemen's Marib Oil Pipeline Is the Target of Attacks (2014):** Tribesmen in Yemen attacked the Marib pipeline consistently throughout the year. The attacks targeted the 120,000-b/d pipeline carrying crude from the Masila oil field, the most important field in Yemen, to the country's main export terminal on the Red Sea coast. The tribesmen bombed the pipeline, and were successful in halting flow at least 15 times in 2014. There were eight casualties as a result of the attacks: six soldiers and two tribesmen.
- **Al-Qaeda Knocked Out Yemen's National Power Grid (June 9):** On June 9, al-Qaeda of the Arabian Peninsula (AQAP) attacked major power lines in Marib and knocked out Yemen's entire national power grid. Technicians began repairs to the power lines immediately.
- **Kazakhstan's Kashagan Oil Field Production Halted (2014):** Production of nearly 60,000 b/d from the Kashagan oil field in Kazakhstan was stopped due to a leak discovered in October 2013. After months of pipeline analysis, project developer, Total SA, found numerous issues with pipeline integrity and announced that there would be no

production from the oil field until 2017. Approximately 125 miles of pipeline needs to be replaced, which is expected to cost \$3 billion. Recoverable reserves at Kashagan are estimated to be between 9 billion and 13 billion barrels of oil.

5.1.3 Americas

- **Columbia's Cano Limon-Covenas Attacked and Blocked by Rebels (2014):** The Cano Limon-Covenas oil pipeline in Columbia had been the target of several rebel attacks in 2014. In March, attacks on the pipeline caused Ecopetrol to declare *force majeure*. A deal between Columbia and the rebels was reached and the pipeline restarted on May 25. Shortly thereafter, two attacks were carried out in June, and another was reported in December, causing minor damage and halting flow for a couple of days after each attack. The pipeline carries crude from the Cano Limon-Covenas oil field to the Caribbean coast.
- **Columbia's Bicentenario Pipeline Attacked by Rebels (2014):** The Bicentenario pipeline in Columbia was attacked in January, July, and August by rebels. The attack in January was unsuccessful and the pipeline was not damaged. However, the July and August attacks were successful in stopping flow for a couple of days until repairs were completed. This pipeline transports crude from the Eastern Plains to the Cano Limon-Covenas pipeline.

5.1.4 Europe

- **Russia-Ukraine Tension Leads to Gas Supply Crisis (2014):** Building tension between Russia and Ukraine due to Ukraine's debt and dependence on Russian energy led President Vladimir Putin to briefly cut off gas supplies to Ukraine in June. Russia accused Ukraine of failing to repay debt and prepay for monthly gas shipments. While the cutoff had no major impact on Ukrainian or European energy markets, heightened tensions continued.

5.2 International Infrastructure Projects

Major international infrastructure projects reported in EAD in 2014 focused primarily on the petroleum sector and were located in Africa, the Middle East, and the Americas. Significant infrastructure projects are summarized below.

5.2.1 Africa

- **Eni Begins Production From West Hub Development Project (December 8):** Eni began production of oil from the West Hub Development Project in the Angolan Deep Offshore field. The field is currently producing 45,000 b/d and is expected to increase production to 200,000 b/d by 2017.
- **Sudan to Drill More Than 250 Wells to Increase Oil and Gas Reserves:** Sudan's Oil Minister, Stephen Dhieu Dau, announced that Sudan plans to drill more than 250 wells in 2015. The plan aims to increase the country's energy reserves by 65.4 million barrels of oil and 300 Bcf of natural gas.

5.2.2 Middle East

- **Iraq Constructed New 1 Million-b/d Pipeline (August 21):** The Iraqi Oil Ministry stated that crude oil started pumping from Maysan Province oil fields to Iraqi seaports in Basra through a newly constructed 1 million-b/d pipeline. The pipeline links to export facilities.
- **Jordan, Egypt, and Iraq to Implement Major Pipeline Project:** Jordan, Egypt, and Iraq signed a memorandum of understanding under which crude oil will be supplied from Iraq to Jordan and Egypt. The countries will also perform a joint study regarding the possibility of extending a 1 million-b/d oil pipeline from Iraq to Jordan to Egypt, which is scheduled to be completed in 2018. A deal for exports between Iran and Iraq on this pipeline project was reached on May 5.

5.2.3 Americas

- **TransCanada Extends Tamazunchale Pipeline in Mexico (November 18):** TransCanada Corporation announced that the extension of the Tamazunchale pipeline had been placed into service in November. The new pipeline connects an LNG terminal, natural gas supplies from the east coast of Mexico, and the United States to key power facilities in Tamazunchale. The pipeline is 144 miles long and has a capacity of 630 MMcf/d.
- **Canada Approves LNG Export Facilities:** In March, Canada approved four LNG export facilities: (1) Pacific Northwest (19.68 million tonnes per annum [mtpa]), (2) Prince Rupert LNG (21.6 mtpa), (3) WCC LNG (30 mtpa), and (4) Woodfibre LNG (2.1 mtpa). These four terminals will be located along the British Columbia coast and are aimed to meet increasing demand from Asia. In November, British Columbia approved Spectra's application to construct an 8.4-Bcf/d LNG export terminal. As of February 2015, Canada's National Energy Board had approved 12 LNG export terminals.³⁷

³⁷ <https://www.neb-one.gc.ca/pplctnflng/mjrpp/Ingxprtlcn/index-eng.html>

Appendix A. Criteria for EAD Selection

Asset or Sector Activity	Type of Event or Disruption	Criteria by EAD Category ¹	
		Major Event	Energy Sector Event
End Use	Power Outage/ Restoration	≥ 250,000 customers	10,000–249,999 customers
Power Plant	Shutdown/ Restart/ New Capacity	Depends on impact; typically > 2,000 MW	100–1,999 MW
Transmission Line	Shutdown/ Restart/ New Capacity	Depends on impact; typically > 500 kV	115–500 kV
Substation	Break-in Damage/ Shutdown	–	Copper theft or severe impact
Refinery	Shutdown, Restart, Flaring, New Capacity	≥ 200,000 b/d	< 200,000 b/d
Production or Transportation ²	Shutdown, Restart, Flaring, New Capacity	U.S./Canada: ≥ 200,000 b/d Foreign: Depends on impact ³	U.S./Canada: 10,000–199,999 b/d Foreign: ≥ 25,000 b/d ³
Exploration	Oil Discovery	U.S./Canada: > 10 billion barrels	U.S./Canada: 0.2–10 billion barrels Foreign: ≥ 2 billion barrels
U.S./Canada Gas Production, Processing, or Transportation ²	Shutdown, Restart, New Capacity	Depends on impact; typically > 500 MMcf/d or major explosion	100–500 MMcf/d
Ethanol Plant, Biorefinery	Shutdown, Restart, New Capacity	Depends on impact; typically > 500 MMgal/year	10–500 MMgal/year

Notes:

1. Criteria refer to the number of customers affected, or the impact on energy infrastructure (measured in volume or capacity).
2. Transportation includes pipelines, marine tankers, tanker trucks, import/export terminals, railroads, and other forms of transportation.
3. Foreign producers include only those countries that supply the United States.

Appendix B. List of Biofuel Plants in Transition, 2014

Company	Location	Product	Capacity (MMgal/year)	Announced	Status	Notes
JNS Biodiesel	New Albany, MS	Biodiesel	8	1/22/2014	Suspended operations	Major fire
Western Dubuque Biodiesel	Farley, IA	Biodiesel	30	1/27/2014	Idled	Poor economics
Andersons Inc.	Albion, MI	Corn ethanol	55	1/29/2014	Idled	Natural gas shortage
Andersons Inc.	Clymers, IN	Corn ethanol	110	1/30/2014	Idled	Natural gas shortage
Andersons Inc.	Denison, IA	Corn ethanol	55	1/31/2014	Idled	Natural gas shortage
Andersons Inc.	Greenville, OH	Corn ethanol	110	2/01/2014	Idled	Natural gas shortage
Pacific Ethanol	Madera, CA	Corn ethanol	40	2/25/2014	Restored	Restart amid improved economics
White Energy	Plainview, TX	Corn ethanol	110	3/10/2014	Restored	Restart after 2013 drought
Pinal Energy LLC	Maricopa, AZ	Corn ethanol	60	3/19/2014	Restored	Restart amid improved economics and upgrades
Vireol Bio Energy LLC	Hopewell, VA	Corn ethanol	65	4/01/2014	Restored	Restored under new ownership
Three Rivers Energy	Coshocton, OH	Corn ethanol	50	8/01/2014	Restored	USDA loan guarantee; plant upgrades
Diamond Green Diesel	Norco, LA	Renewable diesel	140	8/04/2014	Suspended operations	Major fire
Valero Energy Corp.	Mt. Vernon, IN	Corn ethanol	110	8/28/2014	Restored	Restored under new ownership and renovations
INEOS Bio	Vera Beach, FL	Cellulosic ethanol	8	9/15/2014	Restored	Technology upgrades
Renewable Energy Group	Geismar, LA	Renewable diesel	75	10/27/2014	Restored	New fuel pathway
Ergon BioFuels	Vicksburg, MS	Corn ethanol	60	11/10/2014	Restored	Technology upgrades