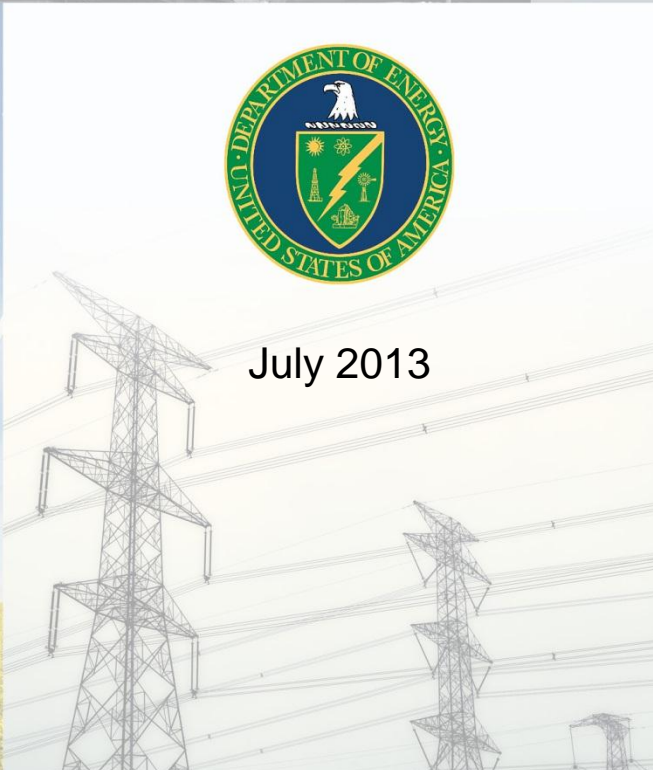


# Year-in-Review: 2012

## Energy Infrastructure Events and Expansions

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



July 2013

## For Further Information

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# 1. Introduction

The 2012 Year-in-Review (YIR) provides a summary of significant energy disruptions and infrastructure changes that occurred in the United States in 2012. The report also summarizes international events that directly or indirectly impacted the United States.

## 1.1 Background and Organization

The 2012 YIR is based primarily on information reported in the [Energy Assurance Daily](#) (EAD) between January 1, 2012 and December 31, 2012.<sup>1</sup> The 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 DOE/OE's [Emergency Situation Reports](#).

Stories reported in the EAD are grouped by the level of impact on energy infrastructure, either as Major Developments or as Energy Sector Stories, which are subdivided into Electricity, Petroleum, Natural Gas, and Other energy types. International News is reported in its own category, irrespective of the level of impact (see Appendix A. Criteria for EAD Story Selection criteria).

Major Development stories describe events that disrupt energy service to a large segment of the population and/or damage critical assets in the energy sector. These events frequently show up in newspaper headlines and in televised news reports. The EAD and DOE/OE Emergency Situation Reports focus on the event's impact to the energy sector. For example, Hurricane Sandy in October 2012 caused numerous deaths and severe damage to property in the Northeast, but the EAD and DOE/OE Emergency Situation Reports focused on the impacts to energy infrastructure and supply.

Most events covered in the EAD are not classified as Major Developments; rather, they fall into the Energy Sector Stories category. Energy Sector Stories are based on significant events, but the level of disruption or damage is less widespread than that caused by events classified as Major Developments.

## 1.2 Data Sources and Limitations

The EAD is derived from publicly available information and does not include classified, confidential, or information accessible only through subscription services. As a result, the EAD—and by extension, the 2012 YIR—should not be viewed as an exhaustive summary of all significant energy events. Information published in DOE/OE Emergency Situation Reports is similarly limited to data available in the public domain or confirmed from company websites, DOE communications, and/or Federal, State, and local government agencies.

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<sup>1</sup> Unless noted otherwise, the source of all information in this report is the EAD ([www.oe.netl.doe.gov/ead.aspx](http://www.oe.netl.doe.gov/ead.aspx)).

Events reported in the EAD may also be reported from Federal and State regulatory agencies. Hence, some of the information presented may be skewed towards one region or sector. For example, California and Texas State agencies tend to release more energy information into the public domain than other States. This abundance of information can distort the balance of stories published, with more coverage appearing for California and Texas. Similarly, the U.S. Nuclear Regulatory Commission (NRC) provides an abundance of public information on nuclear power plants, including daily records on the operational status of all nuclear power plants in the United States. There is no equivalent reporting mechanism for coal, natural gas, or any other class of utility-scale power generation. As a result, the EAD often includes a relatively high number of stories about nuclear power plants, as compared to coal and other plant types, even though coal accounts for significantly more electricity production in the United States.<sup>2</sup>

Due to the limited scope of data sources used to support the EAD and DOE/OE Emergency Situation Reports, readers are cautioned not to use data in the 2012 YIR to support detailed analyses. This report compares events and infrastructure changes that occurred in 2011 and 2012 to highlight a few selected trends, but these comparisons are based only on stories captured by the EAD and should not be viewed as thorough analysis. Readers are advised to view the 2012 YIR as a snapshot of newsworthy events and broad trends that shaped the U.S. energy sector in 2012.

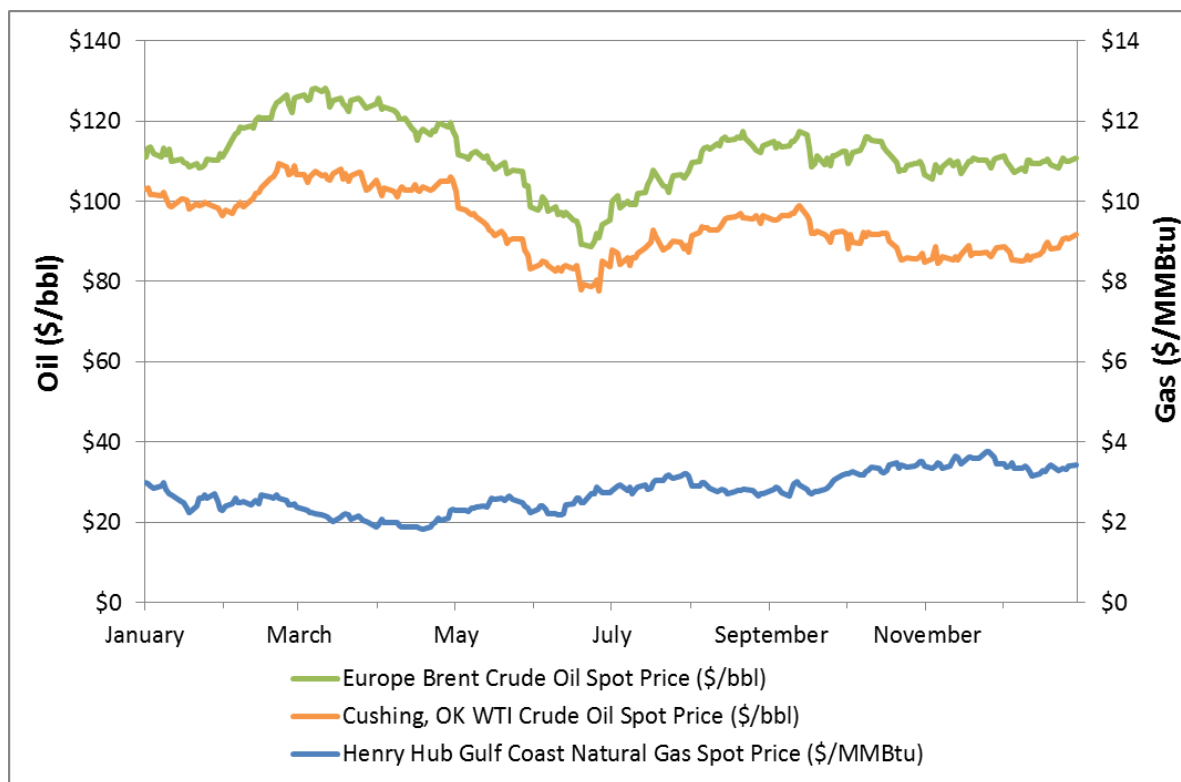
### **1.3 Financial and Economic Context**

The EAD reports spot U.S. energy prices for crude oil (West Texas Intermediate, or WTI) and natural gas (Henry Hub). Figure 1 presents a time series of these prices in 2012, as well as the European North Sea Brent benchmark crude oil price. Brent crude is a blended crude stream produced in the North Sea region which serves as a reference or "marker" for pricing a number of crude streams in the Atlantic market. West Texas Intermediate (WTI) is a crude stream produced in Texas and southern Oklahoma which serves as a marker for pricing North American crude streams and which is traded in the domestic spot market at Cushing, Oklahoma.

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<sup>2</sup> According to the U.S. Energy Information Administration (EIA), coal-fired power plants account for 42 percent of U.S. electric generation, and nuclear power plants account for 20 percent of electric generation. EIA Electric Power Annual <http://www.eia.gov/electricity/annual/>

**Figure 1. U.S. Oil and Gas Spot Prices, 2012**



Source: EIA

In 2012, WTI crude prices peaked at the end of February at \$109.39 per barrel (bbl) and Brent prices peaked in mid-March at \$128.14/bbl. From March to June, crude prices fell more than 20 percent to hit 2012 lows in late June. Prices climbed in July, and by August, WTI and Brent prices had reached levels just below those in the beginning of the year. Prices did not vary significantly over the remainder of the year; averaging \$90/bbl and \$110/bbl for WTI and Brent, respectively.

Historically, WTI has traded at a slight premium to Brent. In 2011, however, the market price for Brent was as high as \$28/bbl more than WTI. Brent’s premium to WTI continued in 2012, averaging \$18/bbl. The departure from historical price trends in 2011 and 2012 is attributed to a surplus of crude oil inventories in Cushing, Oklahoma—the delivery point for WTI contracts—due to rapidly growing crude production from the Williston Basin and Bakken formation in North Dakota, other U.S. oil fields, and Western Canada, and a lack of pipeline infrastructure from Cushing to Gulf Coast refining centers. Numerous petroleum transportation projects to address these inventory constraints were announced or underway in 2012 (See Section 3.3.2 of this Report).

Natural gas prices averaged \$2.75 per million British thermal units (MMBtu) in 2012—a 31 percent drop in prices from the 2011 average, and the lowest annual average since 1999. In April, natural gas prices reached their lowest point at \$1.82/MMBtu. Gas prices rose over the summer as production began to level off and demand from the power sector increased to meet



air-conditioning loads during a hotter-than-average summer. Prices continued to rise through the autumn and winter months, averaging \$3.40/MMBtu in the last quarter of 2012, prices. High domestic production, especially from the Marcellus and Eagle Ford Shale formations, mild weather conditions, and record storage inventory levels all contributed to the historically low gas prices in 2012.

## 2. Energy Disruptions

This section provides a summary of major incidents and disruptions reported in the EAD in 2012.

### 2.1 Major Events

Major Event stories in the EAD describe events that disrupt energy service to a large segment of the population and/or damage critical assets in the energy sector. Twenty-three unique energy events met the criteria for major disruptions, down from 37 events in 2011 (see Appendix B. Major Events 2012 for details about each Major Development in 2012). Figure 2 maps a timeline of these events. Eighteen of the 23 major disruptions were caused by severe weather or other natural disasters. Equipment failures caused the remaining five disruptions.

**Figure 2. 2012 Timeline for Major Developments**

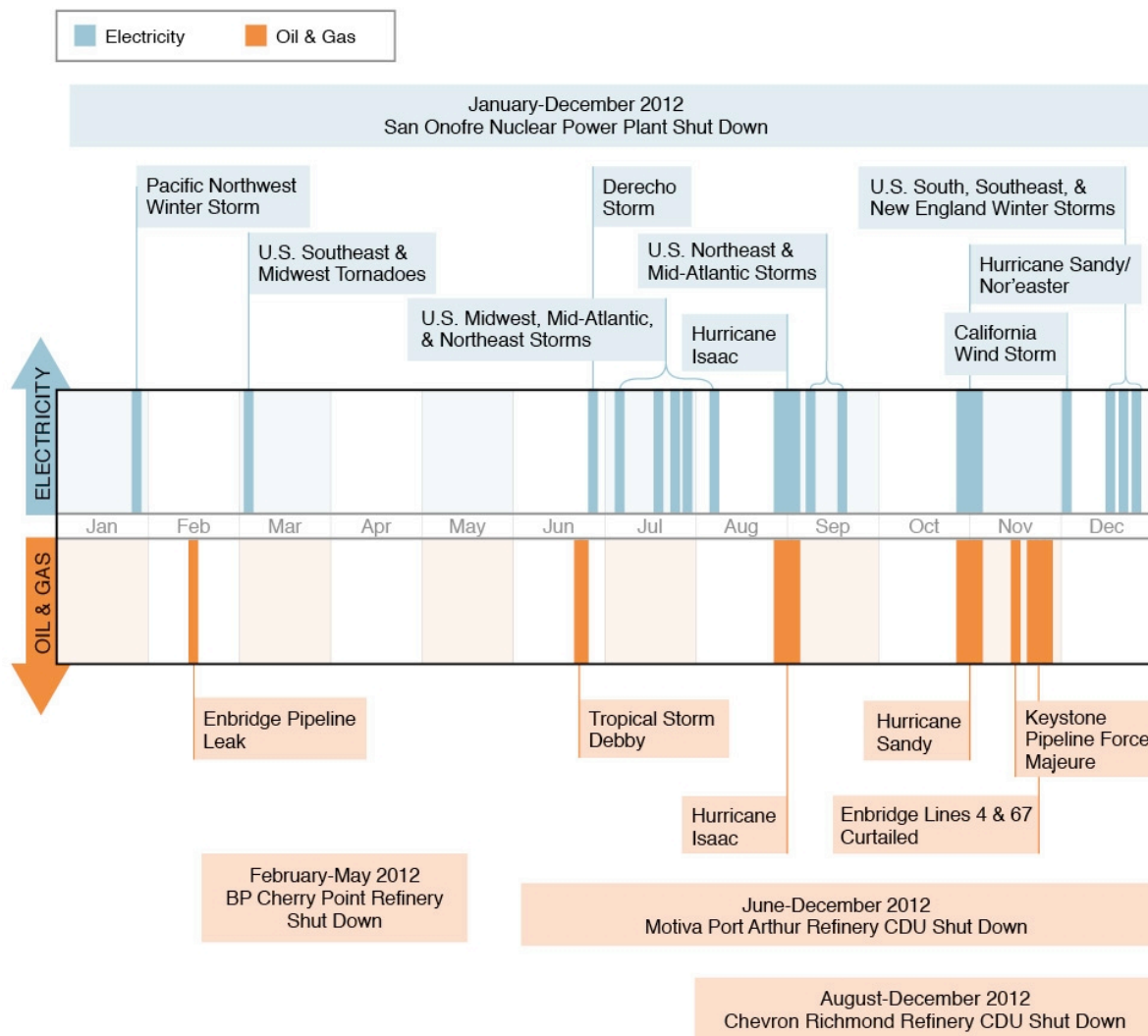


Table 1 summarizes electricity, natural gas, and petroleum sector outages/shut downs for select Major Events in 2012. The events in Table 1 are sorted chronologically. Three Major Events affected multiple energy sectors in 2012: Tropical Storm Debby, Hurricane Isaac, and Hurricane Sandy. More detailed impacts on these events can be found by sector in the next section of this report (2.2 Disruption Analysis).

**Table 1. Outages/Shut Downs Reported for Select Major Events in 2012**

Event	Dates	Outages/Shut Downs		
		Electricity	Natural Gas	Petroleum
<b>San Onofre Nuclear Power Plant Shutdown</b>	1/31/12- Ongoing	<ul style="list-style-type: none"> <li>• Generation: 2,150 MW</li> </ul>		
<b>Port Arthur Refinery CDU Fire &amp; Corrosion</b>	6/10/12 - 4/21/13			<ul style="list-style-type: none"> <li>• Refining: 325,000 b/d</li> </ul>
<b>Tropical Storm Debby</b>	6/24/12 – 6/26/12	<ul style="list-style-type: none"> <li>• Customers: 0.15 million</li> </ul>	<ul style="list-style-type: none"> <li>• Gas Production: 1.56 Bcf/d</li> </ul>	<ul style="list-style-type: none"> <li>• Crude Production: 0.6 MMb/d</li> </ul>
<b>Derecho</b>	6/29/12 – 7/6/12	<ul style="list-style-type: none"> <li>• Customers: 4.20 million</li> </ul>		
<b>Hurricane Isaac</b>	8/27/12 – 9/7/12	<ul style="list-style-type: none"> <li>• Customers: 1.13 million</li> </ul>	<ul style="list-style-type: none"> <li>• Gas Production: 3.26 Bcf/d</li> </ul>	<ul style="list-style-type: none"> <li>• Crude Production: 1.31 MMb/d</li> <li>• Refining: 936,500 b/d</li> <li>• Terminals: 7+</li> <li>• Pipelines: Capline, Houma-Houston</li> </ul>
<b>Richmond, CA Refinery Fire</b>	8/6/12 – 4/26/13			<ul style="list-style-type: none"> <li>• Refining: Reduced Rates</li> </ul>
<b>Hurricane Sandy/Nov. 2011 Nor'easter</b>	10/28/12 – 12/3/12	<ul style="list-style-type: none"> <li>• Customers: 8.51 million</li> <li>• Generation: 3,038 MW</li> </ul>	<ul style="list-style-type: none"> <li>• Gas Utilities: 32,000 New Jersey Natural Gas customers lost service</li> </ul>	<ul style="list-style-type: none"> <li>• Refining: 308,000 b/d</li> <li>• Terminals: 57+</li> <li>• Pipelines: Colonial, Buckeye, Plantation</li> </ul>

Notes: MW = megawatt  
 Bcf/d = billion cubic feet per day  
 MMb/d = million barrels per day  
 b/d = barrels per day

## 2.2 Disruption Analysis

Energy disruptions that occurred in 2012 are grouped into four energy sectors: electricity, natural gas, petroleum, and biofuels. A fifth cross-cutting category, cyber security, is discussed following the four energy sectors.

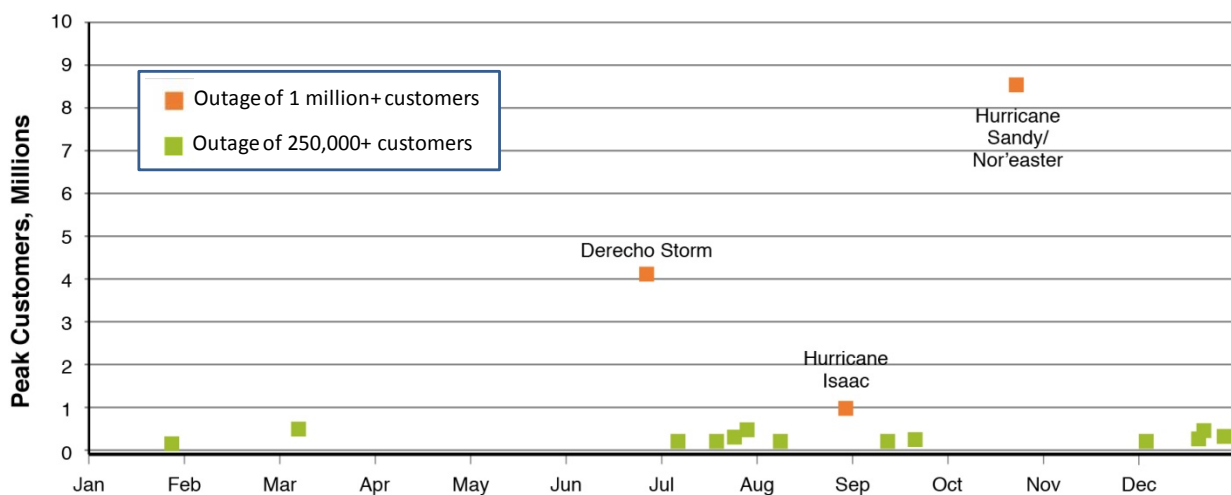
## 2.3 Electricity Disruptions

Electricity disruptions are discussed from two perspectives: customer outages and power plant outages.

### 2.3.1 Customer Outages

Sixteen major disruptions affected 250,000 or more electric customers during 2012, down from 30 major disruptions in 2011. All 16 of these disruptions were weather-related (see Figure 2 for a timeline of major disruptions in 2012, and Appendix B. Major Events 2012 for details about each event). Three events affected more than 1 million customers. These are marked in orange in Figure 3.

**Figure 3. Major U.S. Electric Customer Outage Events, 2012**



The three events that impacted more than 1 million customers were:

- **The Derecho Storm**, was a massive storm system that took just 10 hours to travel 600 miles across the Ohio Valley and Mid-Atlantic regions on June 29. The storm knocked out power to a peak of 4.22 million customers in 11 States and the District of Columbia, knocking trees into power lines with wind gusts up to 80–100 miles per hour (mph). Restoration efforts took upwards of 10 days in several affected areas.
- **Hurricane Isaac**, which cut power to 1.13 million customers across the U.S. Gulf Coast and was the slowest-moving of the three major storms. The storm made two landfalls along the Gulf Coast: the first on August 28 in Plaquemines Parish, Louisiana, and the second on August 29 west of Port Fourchon, Louisiana. The storm brought storm surges of up to 10–11 feet.

- **Hurricane Sandy and the November 2012 Nor'easter**, which cut power to 8.66 million customers from North Carolina to Maine and as far west as Illinois and Wisconsin in late October and early November. Sandy made landfall near Atlantic City, New Jersey on October 29 as a post-tropical cyclone, and brought maximum sustained winds of 80 mph and large storm surge along the coasts of New Jersey, New York, and Connecticut. The storm's impact was felt across 24 States, although not all States had measurable energy impacts. DOE/OE Emergency Situation Reports, recorded power outages to 8.51 million customers across 20 States and the District of Columbia. On November 7, a Nor'easter brought wind, snow, rain, and storm surge to parts of the Northeast still recovering from Sandy, cutting power to an additional 150,000 customers.

Excluding the three aforementioned major outage events, the 13 other major outage events in 2012 averaged nearly 400,000 outages per incident. 2012 data indicate that there were more outage events in the summer than in the winter, with winter storms averaging approximately 435,000 outages per incident and summer storms averaging 365,000 outages. States in the Northeast and Midwest were the hardest hit by these storms. Of the 13 other major outage events in 2012, six of them impacted Connecticut and New Jersey; while five impacted Indiana, Michigan, Illinois, New York, Pennsylvania, and Virginia.

In addition to major outages events, the EAD reports smaller outage events affecting 10,000 or more customers. Including both major events and smaller events, a total of 126 outage events were recorded in the EAD in 2012 that met this reporting threshold (See Figure 4). More than 70 percent of these were weather-related, up slightly from 2011, when 65 percent of outage events were weather-related.

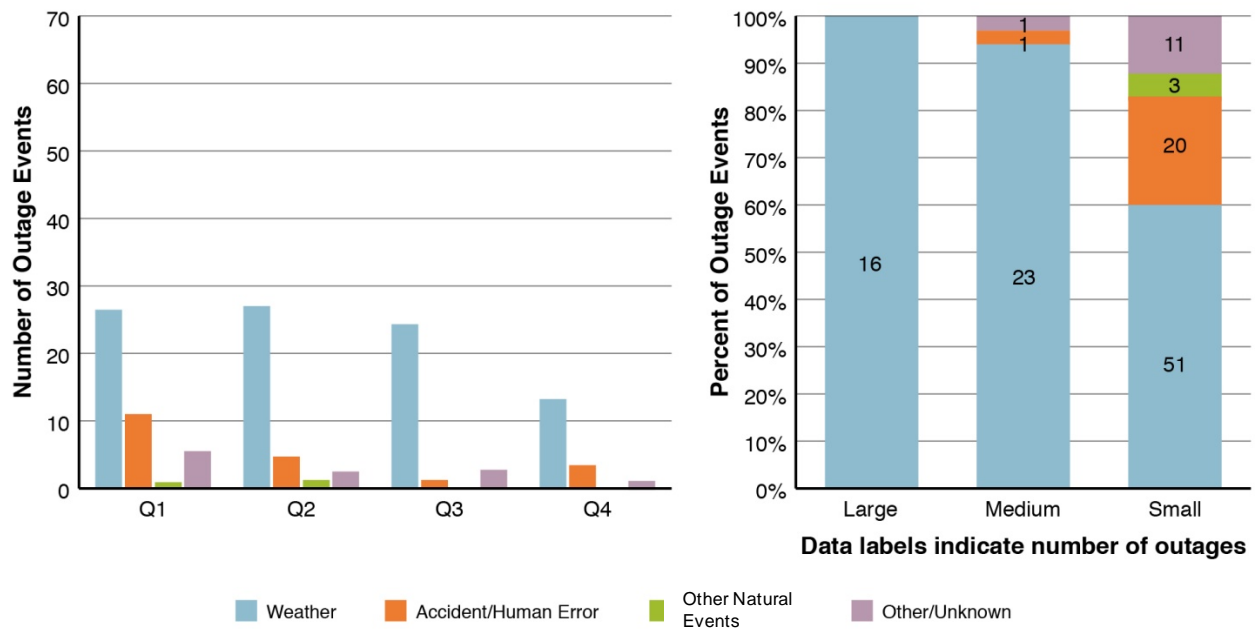
The graph on the right in Figure 4 breaks down the number of large, medium, and small disruptions by event cause.<sup>3</sup> All 16 of the large disruptions were weather-related, whereas 60 percent of the smaller events were caused by weather. Other causes for smaller events include accidents/human error and other natural events, such as squirrels or other small animals accidentally shorting or causing damage to electrical equipment at substations.

Fewer outage events in 2012 were caused by accidents or human error than in 2011. In 2011, 64 events were caused by accidents or human error; in 2012, only 21 outage events by accidents or human error.

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<sup>3</sup> Large events are those affecting 250,000 customers or more; medium, those affecting 50,000–249,999 customers; and small, those affecting 49,999 customers or less.

**Figure 4. U.S. Electric Customer Outage Events by Cause and Magnitude, 2012<sup>4</sup>**



### 2.3.2 Power Plant Outages

Data on power plant outages are less comprehensive than data on customer outages. While significant customer outages are almost always widely reported by utilities and the media, power plant outages do not often receive the same level of attention, with one exception. The NRC closely tracks and reports the scheduled and unscheduled outages of all nuclear power plants. For information regarding non-nuclear power plant outages, the EAD relies on publicly available industry newsletters, company announcements, and regulatory entities (e.g., the California Independent System Operator (CAISO), and the Texas Commission on Environmental Quality (TCEQ)). As a result, the EAD’s coverage of non-nuclear power plant outages varies substantially between States and regions, and between the companies that own these assets.

In 2012, the EAD reported 287 domestic power plant outages caused by unplanned (or forced) causes or by causes that were not reported. Figure 5 presents these outages by season. Outage data for coal- and natural gas-fired plants represent only power plants located in California and Texas, which are reported by CAISO and TCEQ, respectively. Other States don’t have comparable reporting mechanisms.

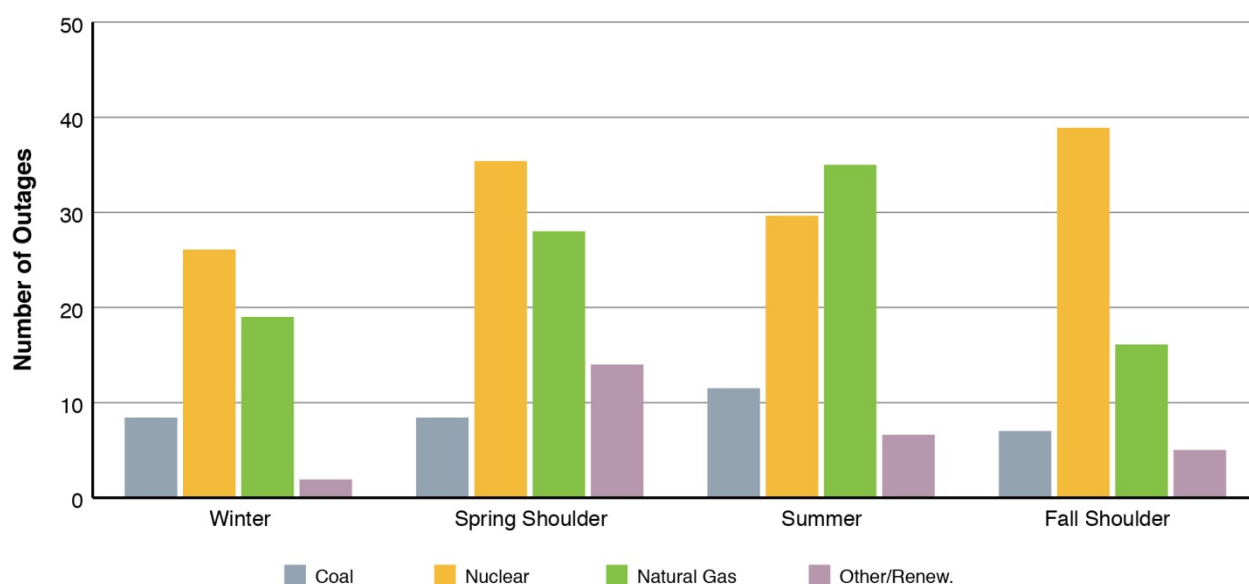
The most significant power plant outage reported in 2012 was the shutdown of Southern California Edison’s 2,150 MW San Onofre Nuclear Generating Station, which began in January

<sup>4</sup> Large = x ≥ 250,000 customers; Medium = 50,000–249,999 customers; Small = x ≤ 49,999 customers

and continued through the rest of the year. The plant shut due to premature tube degradation on steam generators at both of the plants units (see Section 3.1.5 for details on this outage).

Outages for coal-fired and nuclear units were relatively flat across the seasons, because these plants are typical base load suppliers. That is, they operate all year and provide power at a constant operating rate at all times of the year to meet the minimum demands of customers. Natural gas-fired power plants, on the other hand, ramp up during the summer months when demand peaks, which is likely why unplanned outages at these plants was highest in the summer. In 2012, however, extremely low gas prices allowed many natural gas plants, particularly combined cycles, to serve as base load units throughout the year.

**Figure 5. Unplanned Power Plant Outages, 2012**



## 2.4 Natural Gas Disruptions

In 2012, major storms caused the biggest impacts to natural gas assets, including production platforms, fields and wells, processing plants, and pipelines. Other incidents and outages were caused by equipment failures, power failures, or smaller weather-related events.

### 2.4.1 Production, Gathering Pipelines, and Processing Plants

Several events had significant impacts on upstream natural gas assets in 2012, including wells and platforms, flow lines and gathering lines, and processing plants.

- Tropical Storm Debby:** In June, Tropical Storm Debby passed through the Gulf of Mexico before making landfall on the west coast of Florida, shutting in production at several offshore oil and gas platforms. Companies affected included ExxonMobil, BP, ConocoPhillips, Anadarko, BHP Billiton, and Shell. In total, Tropical Storm Debby shut-in 1.56 Bcf/d of natural gas production, which was 34.8 percent of all production in the Gulf.

- **Hurricane Isaac:** Hurricane Isaac had a larger impact on natural gas production in the Gulf of Mexico than Tropical Storm Debby. This was because Debby turned eastward after entering the Gulf, sparing platforms in the Western Gulf. Isaac, by contrast, moved westward and at a much slower pace. At its peak, Isaac shut-in 3.26 Bcf/d, or 72 percent, of total gas production in the Gulf. Gas processing plants were also impacted by the storm, with 22 being shutdown by the storm. The processing plants were shutdown due to potential or actual impacts from the storm or due to the loss of offshore supply. The loss of platforms in the Gulf forced pipelines transporting gas to shore to shut-in or reduce flows, curbing supply to some onshore gas processing plants.
- **Colorado Wildfires:** Encana and Black Hills Exploration took more than a 135 natural gas wells offline in early July due to a series of wildfires in western Colorado. Encana reported it lost about 99 MMcf (total) of natural gas production during the wildfires, representing a fraction of the Piceance Basin's 2.0 Bcf/d output. Black Hills Exploration's 98 wells in the region remained shut until the Bureau of Land Management and local authorities deemed the area safe.
- **Lathrop Compressor Station Fire:** Williams Partners L.P. reported on March 29 its 365 MMcf/d Lathrop compressor station in Susquehanna County, Pennsylvania experienced a flash fire causing the station to shut down for a day. The next day the Lathrop compressor station was operating at 55 percent of its pre-fire volumes rerouting 200MMcf/d of gas to other compressor stations in the area. The Lathrop station pressurizes and dehydrates natural gas from Marcellus Shale wells in the county for transport through interstate pipelines, including the Tennessee Gas and Transco pipelines.
- **Pinon Compressor Station Fire:** BP reported an explosion at its 30 MMcf/d Pinon natural gas compressor station in Colorado on June 25. The explosion, which took place as a crew was performing pipeline maintenance at the site, killed one person and wounded two others. The Pinon station gathers natural gas from BP's operations in Colorado's San Juan Basin.
- **West Texas Gas Pipeline Explosion:** An explosion hit a 16-inch West Texas Gas pipeline near Goldsmith, Texas on December 5, shutting DCP Midstream's nearby 160 MMcf/d Goldsmith gas processing plant, which feeds the pipeline. The resulting fire was extinguished the same day. The DCP Goldsmith plant was back online within 48 hours.

#### 2.4.2 Transmission, Distribution, and Service Pipelines

Several events had significant effects on the downstream natural gas sector, including transmission, distribution, and service pipelines.

- **Hurricane Sandy:** New Jersey Natural Gas (NJNG) shut down part of its natural gas infrastructure serving coastal New Jersey counties and the barrier islands. As part of the shutdown, NJNG vented gas from its distribution pipelines, allowing water to infiltrate the pipes. The damage caused by the water was severe enough that some portions of the distribution system needed to be completely rebuilt. The shut-downs affected approximately 32,000 of NJNG's customers, a quarter of whom remained without service for the remainder of the year.



- **Columbia Gas Pipeline Explosion:** An underground, high-pressure pipeline explosion on November 23 injured more than 20 people and damaged 42 buildings in Springfield, Massachusetts. The incident was caused when a utility worker accidentally punctured the line while using a metal tool to locate the source of a leak. A flood of gas then built up in a building, and a spark triggered the blast.
- **Columbia Gulf Pipeline Fire:** A Columbia Gulf Transmission pipeline (line 200) exploded and erupted into flames in Estill County, Kentucky in early January. Line 200 carries natural gas from Louisiana to Kentucky, where the gas enters a Columbia Gas Transmission line for distribution to Eastern and Mid-Atlantic states. Columbia Gulf rerouted gas flow into other company transmission lines to avoid disrupting deliveries.
- **Florida Gas Pipeline Rupture:** A 30-inch natural gas pipeline operated by Florida Gas Transmission Co. ruptured in Pride, Louisiana on February 13. Florida Gas operates a 5,000-mile pipeline system delivering up to 2.3 Bcf/d of gas from Texas to Florida. The gas was rerouted to another pipeline in the area.
- **Mark West Energy Partners Pipeline Explosion:** A 12-inch natural gas transmission line ruptured and exploded on April 4, igniting a fire that was quickly extinguished by local emergency responders. The explosion took place south of Carthage, Texas, near the Gary Compressor Station. Operators capped the pipeline and immediately shut the compressor station. No structural damage to the compressor station equipment was reported.
- **Natural Gas Pipeline Company Pipeline Fire:** Natural Gas Pipeline Company of America (NGPL) declared force majeure beginning June 6 on its Oklahoma Extension #1 pipeline after a fire ignited on the line in Gray County, Texas, resulting in a reduction in throughput capacity through two segments in NGPL's Amarillo System and impacting upstream supply. Kinder Morgan Energy Partners, L.P., which operates and owns a 20 percent interest in NGPL, reported the fire that closed the line was extinguished several hours later, and the company diverted gas to other lines.
- **Louisiana Sinkhole Shuts Pipelines, Impacts Storage Cavern:** On August 3, Chevron subsidiary Bridgeline Holdings declared force majeure through the rest of the year on its NS1 gas storage cavern in Louisiana as a precautionary measure after discovering a sinkhole nearby. Bridgeline asked customers to cut all nominations of gas into the storage cavern, and it reduced its storage inventory to 40 percent of each of its customer's contracted amounts. Additionally, Crosstex Energy and Enterprise Product Partners shut their pipelines after discovering the sinkhole had caused significant damage but no leaks. Crosstex later decided to relocate a portion of its pipeline that was affected by the sinkhole.

## 2.5 Petroleum Disruptions

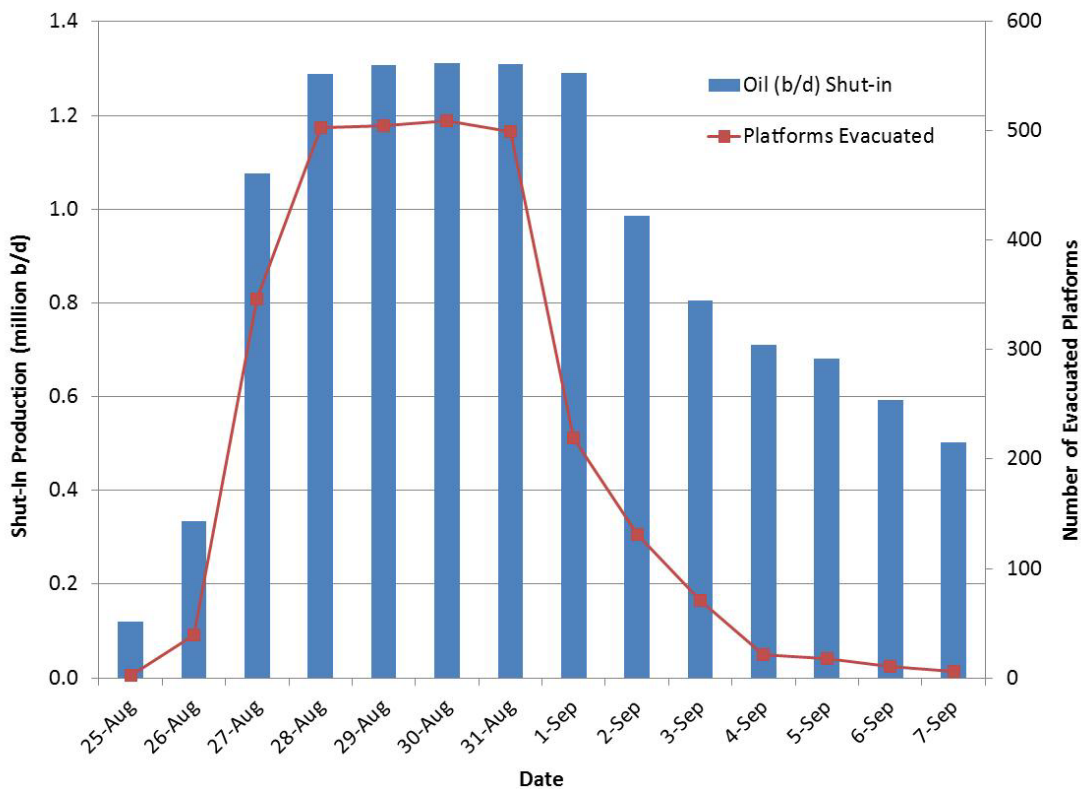
In 2012 several events significantly disrupted infrastructure across the petroleum supply chain, including assets related to production, refining, and transportation. Some of these events were severe enough to prompt State governments to issue exemptions to hours-of-service regulations, which restrict the amount of time commercial drivers are allowed to operate, as officials worked to maintain an adequate supply of fuel in affected areas.

### 2.5.1 Production

Hurricane Isaac had the most significant impact on crude oil production in 2012. Isaac, which strengthened to a category 1 hurricane as it moved through the Gulf of Mexico, shut-in nearly all Gulf oil production as personnel were evacuated and operations suspended at offshore platforms in advance of the storm. The storm caused operators to evacuate personnel from 509 of the 586 platforms and shut-in 1,310,801 b/d of production, equal to 95 percent of the total crude production in the Gulf. Figure 6 tracks the evacuations and shut-ins from August 25 to September 7, as reported by the U.S. Bureau of Safety and Environmental Enforcement.

Peak production shut-ins continued for 5 days after the storm made landfall, as producers inspected infrastructure, conducted clean-up operations, and returned personnel to offshore platforms. Isaac ultimately did not cause severe damage to offshore infrastructure, and by September 7, operators had restored more than 60 percent of all the production shut-in by the storm.

**Figure 6. U.S. Gulf of Mexico Platforms Evacuated and Crude Oil Production Shut-in due to Hurricane Isaac**



Source: Department of Interior, Bureau of Safety and Environmental Enforcement (BSEE)

### 2.5.2 Refineries

In 2012, weather events and major fires caused the majority of notable disruptions at refineries.

- **Hurricane Isaac:** Of the 11 refineries in the path of Isaac along the Louisiana and Mississippi Gulf Coasts, 5 shut down and 6 reduced crude runs. The refineries that shut down accounted for 936,500 b/d of refining capacity, or roughly 11 percent of total refining capacity in the Gulf Coast region (Petroleum Administration for Defense District (PADD) 3). As a result of supply disruptions caused by Isaac, Marathon Petroleum requested, and the DOE granted, a loan of 1 million barrels of crude oil from the Strategic Petroleum Reserve at the Bayou Choctaw site in Louisiana. While most refineries affected by Isaac had returned to normal operations within 1 to 2 weeks of the storm's passage, restoration at several refineries took significantly longer. Due to equipment damage, operations remained at reduced rates at Chevron's 330,000 b/d Pascagoula, Mississippi refinery until September 28, a month after Isaac made landfall.
- **Hurricane Sandy:** Hess's 70,000 b/d Port Reading<sup>5</sup> and Phillips 66's Bayway 238,000 b/d Linden refineries in New Jersey shut down as a precaution prior to Hurricane Sandy's landfall, and three other refineries in New Jersey, Pennsylvania, and Delaware reduced runs. During Sandy, Phillips 66 lost power and sustained flooding in low-lying areas of its Linden refinery, and Hess lost power at its Port Reading refinery after a substation feeding the facility sustained damaged during the storm. Following Sandy, neither refinery could restart until storm damage had been repaired and power supply was restored. Refining activity in the Northeast region (PADD 1) remained below pre-storm levels until November 27 when the Linden refinery returned to full operation.
- **Cherry Point, Washington CDU Fire:** BP's 225,000 b/d Cherry Point refinery in Washington was shut after a fire broke out in the Crude Distillation Unit (CDU) on February 17 when a corroded pipe ruptured, discharging crude. BP initially planned on bypassing the CDU to bring the refinery back up at a reduced rate, but the damage was too extensive and the plant remained out till May 7.
- **Port Arthur, Texas CDU Fire and Corrosion Damage:** Motiva Enterprises halted the start-up of a newly commissioned 325,000 b/d CDU at its 600,000 b/d Port Arthur in Texas refinery on June 10 after two unsuccessful start up attempts. Motiva commissioned the unit on May 31 after a 5-year expansion project that more than doubled the refinery's crude processing capacity and improved the refinery's capability to refine heavier crudes. The start-up was initially aborted after a minor fire occurred on the new CDU. Although damage from the fire proved negligible, an investigation into the incident later revealed extensive corrosion damage to the CDU vessel and piping had occurred when caustic fluid seeped into the unit after it was idled following the fire. Continued attempts to restart the unit had vaporized the caustic, causing accelerated corrosion. The damaged CDU remained shut for the remainder of the year. Operators planned to again attempt to start up the unit in early 2013. The refinery's original 275,000 b/d CDU continued normal operations throughout the year.
- **Richmond, California CDU Fire:** On August 6, a major fire caused by a rupture in a corroded piece of pipe shut the CDU at Chevron's 245,271 b/d Richmond refinery in

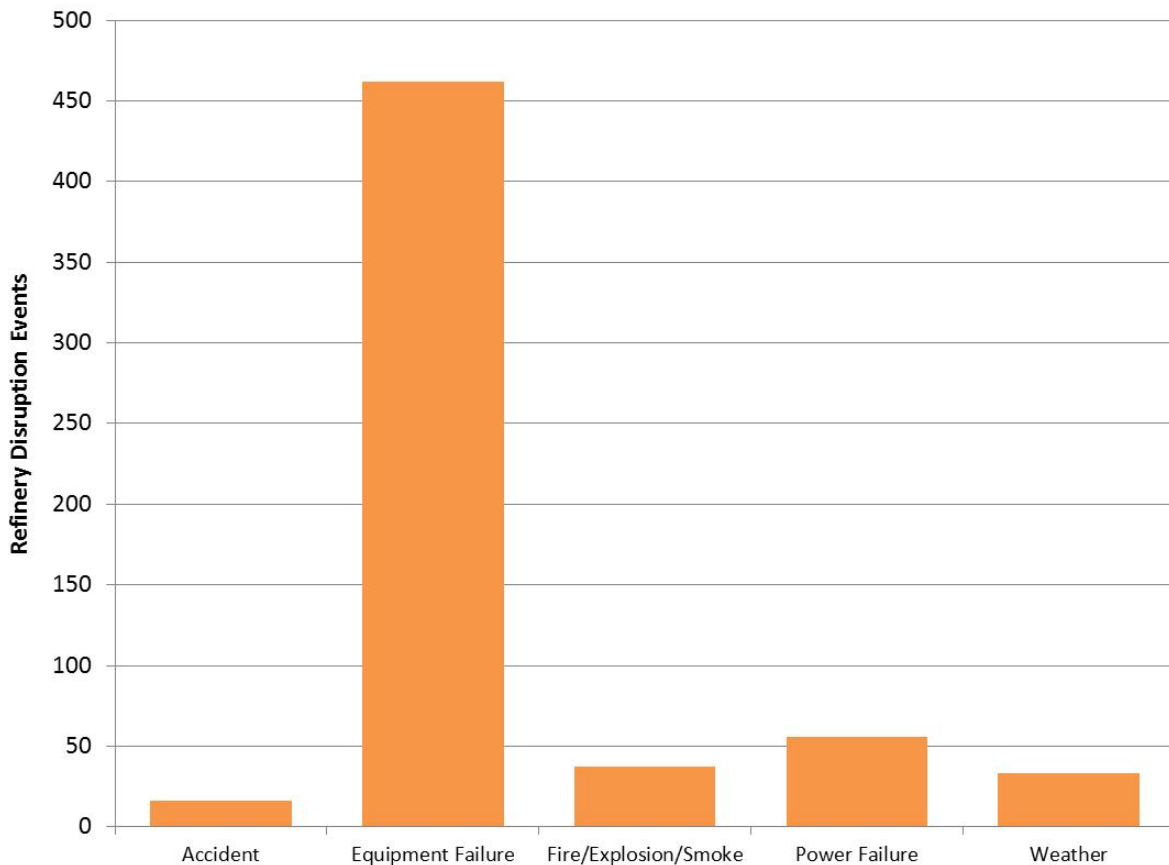
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<sup>5</sup> The Hess Port Reading, NJ facility does not process crude, but processes gas oils to produce petroleum products.

California. Investigators found that the metallurgy of the pipe made it susceptible to thinning by sulfur at high temperatures. The refinery continued operating, bypassing the shut CDU, at unspecified reduced rates after the incident. Repairs to the damaged unit were set to be completed in the first part of 2013. The shutdown of the Richmond CDU, combined with other West Coast refinery disruptions, led to a shortage of fuel and a spike in fuel prices in California. As a result, Governor Brown approved a waiver on October 7 as per the request of the California Independent Oil Marketers Association to allow station operators to sell winter blend gasoline prior to the November 1 deadline.

Figure 7 presents refinery disruption events reported in the EAD in 2012 by cause.<sup>6</sup> Equipment failures caused most disruptions, as was the case in 2011. Following equipment failures, power failures were the second greatest cause of disruptions. These events highlight the interdependency between the petroleum and electric power sectors.

**Figure 7. U.S. Refinery Disruption Events by Cause, 2012**



<sup>6</sup> The “cause” is determined by the initial action. For instance, if a transfer line leak leads to a fire, this would be classified as an “equipment failure” due to the initial cause, the line leak.

### 2.5.3 Transportation and Storage

Crude oil and petroleum products are largely transported by marine vessels and pipelines. These assets deliver the vast majority of the world's crude oil supply, including that of the United States. The number of pipeline outage events is larger because there are thousands of miles of pipelines across the country, and they rely heavily on other assets within the petroleum industry to function properly. Marine and pipeline shipping outages in 2012 stemmed from a variety of problems including severe weather, equipment malfunctions, and accidents. The following incidents were some of the most significant of 2012.

- **Hurricane Isaac:** The hurricane forced several ports and terminals across the U.S. Gulf Coast to close temporarily, including the Louisiana Offshore Oil Port (LOOP), the largest crude import terminal in the United States and the country's only port capable of offloading deep draft tankers; NuStar Energy's St. James and Mobile terminals; Shell's Convent, Kenner, and Collins terminals; and Stolt-Nielsen's Stolthaven terminal. The storm also caused Shell to shut its Capline Pipeline, which receives crude from the LOOP, and its Houma-to-Houston pipeline.
- **Hurricane Sandy:** Power outages and flooding at pipeline facilities and petroleum product terminals along the East Coast—particularly in the New York Harbor area—forced pipelines supplying the Northeast to shut segments or operate at reduced capacity in the wake of Hurricane Sandy. At least 57 terminals along the East Coast were partially or completely closed by the storm, and product flows remained severely disrupted more than 9 days after the storm made landfall on October 29. The outages along the East Coast impacted operations at two major petroleum product pipeline systems. Colonial Pipeline, the largest product pipeline in the United States, shut sections of its mainline in Virginia, Maryland, and New Jersey in response to power outages at receiving terminals in northern New Jersey. The Colonial pipeline originates in the Gulf Coast and delivers products to markets across the Southeastern and Northeastern U.S., terminating in Linden, New Jersey. Buckeye Pipeline shut its system serving New York City, Long Island, and Upstate New York when its source hub in Linden, New Jersey lost power. In addition, Kinder Morgan shut segments of its Plantation Pipeline, which carries products from the Gulf Coast to Southeastern markets, terminating in Washington D.C. Finally, the hurricane shut ports in the Northeast from Hampton Roads, Virginia, to Boston, Massachusetts. Although most ports resumed operation within 1 to 3 days after closing, shipping in parts of New York Harbor remained closed or restricted for more than a week due to an oil spill from a terminal in Sewaren, New Jersey. More details can be found in the report "Comparing the Impacts of Northeast Hurricanes on U.S. Energy Infrastructure".
- **ExxonMobil North Line Crude Spill in Louisiana:** ExxonMobil's 160,000 b/d North Line Pipeline running from St. James, Louisiana to Anchorage, Louisiana was shut down on April 28 when a 17 foot-long rupture was discovered in the pipeline. The rupture which leaked 1,800 barrels of crude oil. The pipeline supplies Louisiana grades to several key delivery points including the Mid-Valley Pipeline, Alon's Krotz Spring, Louisiana refinery, Calumet's Shreveport, Louisiana refinery, Delek's El Dorado,

Arkansas refinery, and ExxonMobil's Baton Rouge, Louisiana refinery. The pipeline was repaired and resumed operation by October 19<sup>7</sup>.

- **Car Accident at Enbridge Line 14/64 Pump Station:** On March 2, a car collision at a pumping station in New Lenox, Illinois caused a leak and fire that forced Enbridge to shut down Line 14 and Line 64 (a combined 318,000 b/d of capacity) of its Lakehead Pipeline System, which carries Western Canadian crude oil to refineries in the Chicago area. In addition, Line 6A, which carries 670,000 b/d, was temporarily shut down as a precaution but restarted hours after the collision. The shutdown caused supply to back-up in Canada forcing Enbridge to slow the flow on Line 2B and Line 3<sup>8</sup>. Line 14 and Line 64 were back online by March 9.
- **Buckeye West Shore Pipeline Leak:** Buckeye shut its West Shore Pipeline on July 17 due to a leak that released 1,000 barrels of gasoline. The shutdown caused a shortage of fuel in Northern Wisconsin and the Upper Peninsula of Michigan, which prompted Governor Snyder to declare an energy emergency. Petroleum product suppliers were forced to truck supplies from alternate terminals in Milwaukee and Madison, Wisconsin. This prompted the waiving of State and Federal hours-of-service regulations for commercial drivers to help alleviate the fuel shortage. The pipeline was returned to service on July 21.
- **Chevron KLM Crude Pipeline Contamination in California:** Chevron shut its Kettleman-Los Medanos (KLM) pipeline, which carries crude from fields in Kern County to refineries in Northern California, after an elevated level of potentially corrosive organic chloride was detected in the pipeline. The line was shut from September 19 to early December while Chevron decontaminated and repaired the line. The KLM pipeline shutdown, along with a number of refinery outages on the West Coast, contributed to a regional price spike for gasoline in California.

#### 2.5.4 Hours-of-Service Exemptions

Hours-of-service (HOS) regulations (49 CFR Part 395) restrict the amount of time drivers are allowed to operate commercial vehicles and mandate time-off requirements between shifts to ensure on-road safety. During emergency situations, State governments will often issue exemptions to these regulations, to maintain the supply of critical fuels such as heating oil, propane, gasoline, and diesel fuel. The EAD tracks HOS exemptions to identify events that have triggered States to enact emergency management measures. Table 2 summarizes the HOS exemptions issued in 2012, a majority of which were issued from late October until late November as a result of Hurricane Sandy. The hurricane triggered HOS exemptions in 14 States in the Eastern United States.

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<sup>7</sup> "UPDATE 2-Exxon fixing crude line after oil sheen in Louisiana." *Reuters*. October 19, 2012. [http://www.reuters.com/article/2012/10/19/exxon-louisiana-sheen-idUSL1E8LJCO020121019?feedType=RSS&feedName=rbssEnergyNews&utm\\_source=feedburner&utm\\_medium=feed&utm\\_campaign=Feed%3A+reuters%2FUSenergyNews+%28News+%2F+US+%2F+Energy%29&utm\\_content=Google+Reader](http://www.reuters.com/article/2012/10/19/exxon-louisiana-sheen-idUSL1E8LJCO020121019?feedType=RSS&feedName=rbssEnergyNews&utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+reuters%2FUSenergyNews+%28News+%2F+US+%2F+Energy%29&utm_content=Google+Reader).

<sup>8</sup> Jones, J. "Enbridge shuts part of key U.S. oil pipeline after fire." *WSAU*. March 3, 2012. <http://wsau.com/news/articles/2012/mar/04/enbridge-shuts-part-of-key-us-oil-pipeline-after-fire/>.

**Table 2. Hours-of-Service Exemptions, 2012**

State	Start Date	End Date	Days
Connecticut	10/28/2012	11/27/2012	31
District of Columbia	10/28/2012	11/27/2012	31
Delaware	10/28/2012	11/27/2012	31
Maine	10/28/2012	11/27/2012	31
Maryland	10/28/2012	11/27/2012	31
Massachusetts	10/28/2012	11/27/2012	31
Michigan	7/24/2012	8/7/2012	14
New Hampshire	10/28/2012	11/27/2012	31
New Jersey	10/28/2012	11/27/2012	31
New York	10/28/2012	11/27/2012	31
Ohio	6/30/2012	7/8/2012	9
Pennsylvania <sup>1</sup>	10/28/2012	11/27/2012	31
Rhode Island	10/28/2012	11/27/2012	31
Vermont	10/28/2012	11/27/2012	31
Virginia	6/30/2012	7/30/2012	31
	10/28/2012	11/27/2012	31
West Virginia	7/2/2012	7/9/2012	8
	10/28/2012	11/27/2012	31

Notes: 1) Pennsylvania issued multiple waivers within the listed time period.

Sources: The National Propane Gas Association ([www.npga.org](http://www.npga.org)) and State waiver information.

## 2.6 Biofuel Disruptions

There were few disruptions reported at biofuel refineries in 2012.

- In July, three railcars, each carrying 30,000 gallons of ethanol, derailed and exploded when a train derailed near Columbus, Ohio.
- During Hurricane Sandy, a biodiesel storage tank ruptured at Motiva's Sewaren, New Jersey terminal, leaking 10,000 gallons of biodiesel.

Impacts to the biofuels industry from the 2012 drought are covered in the Infrastructure Changes section later in this report.

## 2.7 Cyber Security

While only a handful of cyber security breaches were publically reported in 2012, the threat remained a serious concern to governmental agencies and the energy industry. The EAD reported three cyber security events in 2012:

- In March, the U.S. Department of Homeland Security's (DHS) Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) identified an active series of cyber intrusions targeting natural gas pipeline companies. Various sources provided

information to ICS-CERT describing targeted attempts and intrusions into multiple natural gas pipeline sector organizations.

- In June, ICS-CERT released a report summarizing cyber incidents, onsite deployments, and associated findings from 2009 through 2011. U.S. critical infrastructure companies saw the number of reported cyber security incidents between 2009 and 2011 increase from 9 to 198, according to the report.
- In September, Telvent Canada (now Schneider Electric), a software and services company that monitors the energy sector, was hit by a cyber attack on its operations in the United States, Canada, and Spain. A Chinese hacking group was blamed for the attack. Telvent said hackers had installed malicious software and stolen project files.

The Federal Government in 2012 announced a handful of initiatives to enhance cyber security:

- **In January**, the Electricity Subsector Cybersecurity Capability Maturity Model (ES-C2M2) was developed as part of a White House initiative led by the Department of Energy in partnership with the Department of Homeland Security (DHS) and involved close collaboration with industry, other Federal agencies, and other stakeholders. The model, which was finalized in May 2012, allows electric utilities and grid operators to assess their cybersecurity capabilities and prioritize their actions and investments to improve cybersecurity. This combines elements from existing cybersecurity efforts into a common tool that can be used consistently across the industry. The model is also accompanied by an assessment tool, the Cybersecurity Self Evaluation Survey Tool, which helps electric utilities and grid operators identify opportunities to further develop their own cybersecurity capabilities by posing a series of questions that focus on areas including situational awareness and threat and vulnerability management.
- **In September**, The U.S. Federal Energy Regulatory Commission (FERC) created the Office of Energy Infrastructure Security to address cyber-related issues as they pertain to facilities over which FERC has jurisdiction. This will include identifying, communicating, and developing solutions to cyber attacks and physical threats, such as EMPs.

Researchers in 2012 published several studies designed to gain a better understanding of cyber security risks in the energy sector.

- **In February**, a survey by Bloomberg showed that companies would have to invest in cyber security more than seven times as much as they have in the past to adequately protect their smart grid systems. The survey cited 21 companies that spend an average of \$45.8 million per year on cyber security and prevent an estimated 69 percent of known cyber attacks against their networks. If these companies were to increase their spending to an average of \$69.3 million per year, they could prevent an estimated 88 percent of cyber attacks; an increase of spending to \$344.6 million per year could prevent an estimated 95 percent of these attacks.
- **In February**, the Federation of American Scientists and Washington and Lee University released a joint study on the future of nuclear power plants in the United States, which includes an analysis of the plausible threats that nuclear plants may face and must



defend against. The study recommends new reactor designs, site locations, and operating procedures that could help these plants withstand not only accidents, but also intentional attacks in physical and cyber forms.

- **In September**, a report published by researchers at Rice University examines how energy companies' web-based networks are exposed to an increasing threat of cyber attacks that could impact the continuity of their operations, including their capacity to deliver products and services.

### 3. Infrastructure Changes

The previous section provided a summary of significant disruptions in the energy sector during 2012. This section focuses on changes to energy infrastructure.

Disruptions and infrastructure changes can be viewed differently. With disruptions, the cause is frequently severe weather or equipment failure, leading to energy problems measured in hours or days. Following a disruption, the goal is to repair damaged assets as quickly as possible and return the infrastructure to the condition preceding the event.

Infrastructure changes are typically driven by underlying economic conditions or regulatory requirements. When business conditions driven by economic or regulatory factors lead to an infrastructure change—such as shutting down a refinery or installing a wind farm—the change is long-lasting, often times signaling a fundamental shift in the energy infrastructure.

#### 3.1 Electricity

U.S. electric infrastructure underwent many changes in 2012, as operators planned to retire power plants—often citing environmental regulations—and announced new generation capacity and transmission expansions.

##### 3.1.1 Environmental Regulations

On August 21, the U.S. Court of Appeals for the D.C. Circuit vacated the U.S. Environmental Protection Agency's (EPA) Cross-State Air Pollution Rule (CSAPR), which sought to regulate sulfur dioxide and nitrogen oxides emissions from coal-fired power plants regionally across 28 States. CSAPR, which was first proposed in July 2011, was intended to replace the 2005 Clean Air Interstate Rule (CAIR). The court ruled that in requiring compliance with CSAPR, EPA was exceeding its powers under the Clean Air Act. Under the decision, the court ordered EPA to continue its regulation under CAIR. Despite the ruling, however, most utilities citing CSAPR in their decision to retire aging coal-fired power plants are still planning to do so, citing EPA's other major rule, the Mercury and Air Toxics Standards (MATS). EPA proposed MATS in March 2011 to establish mercury emissions limits, which would require power plant operators to invest in emissions control technologies to comply with the limits or retire.

##### 3.1.2 Coal-fired Plant Retirements

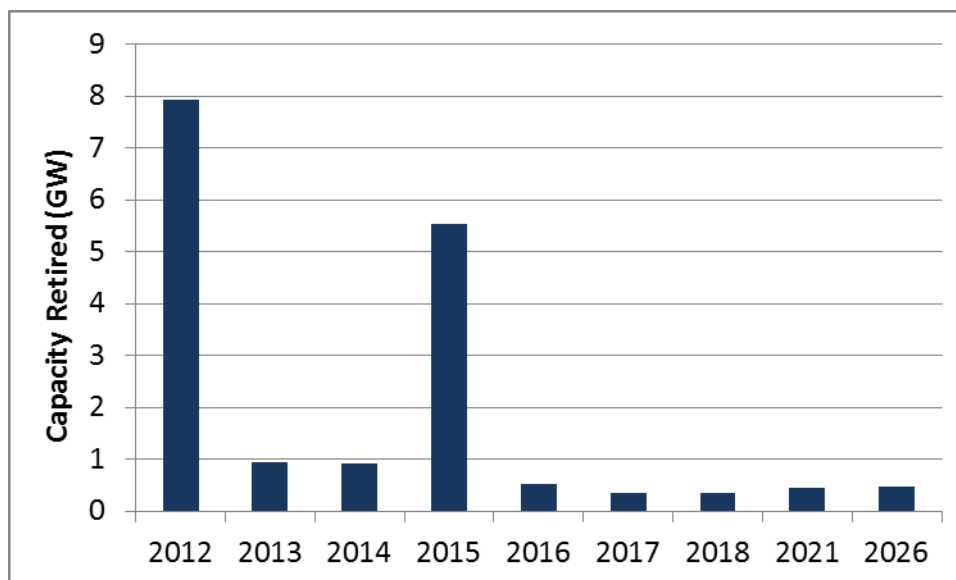
The EAD reported 49 coal-fired power plants totaling 17.4 gigawatts (GW) of generating capacity either retired or were the subject of retirement announcements in 2012.<sup>9</sup> These include several power plants whose retirement was announced prior to 2012. The plants that were the subject of retirement announcements in 2012 are planned for retirement by 2026. Figure 8 shows the retirement capacity by online year. 41 of the 49 plants reported on in 2012 are located in the Midwest, Southeast, and Mid-Atlantic regions, and most (again, 41 of 49) of these

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<sup>9</sup> According to data drawn from Form EIA-860, 16.8 GW represents about 5 percent of total coal-fired generation in the United States, which is 317 GW. <http://www.eia.gov/electricity/data/eia860/>

retirements were associated with EPA's environmental regulations, including 17 that explicitly cite EPA's MATS rule.

**Figure 8. Capacity Retired or Announced to be Retired**



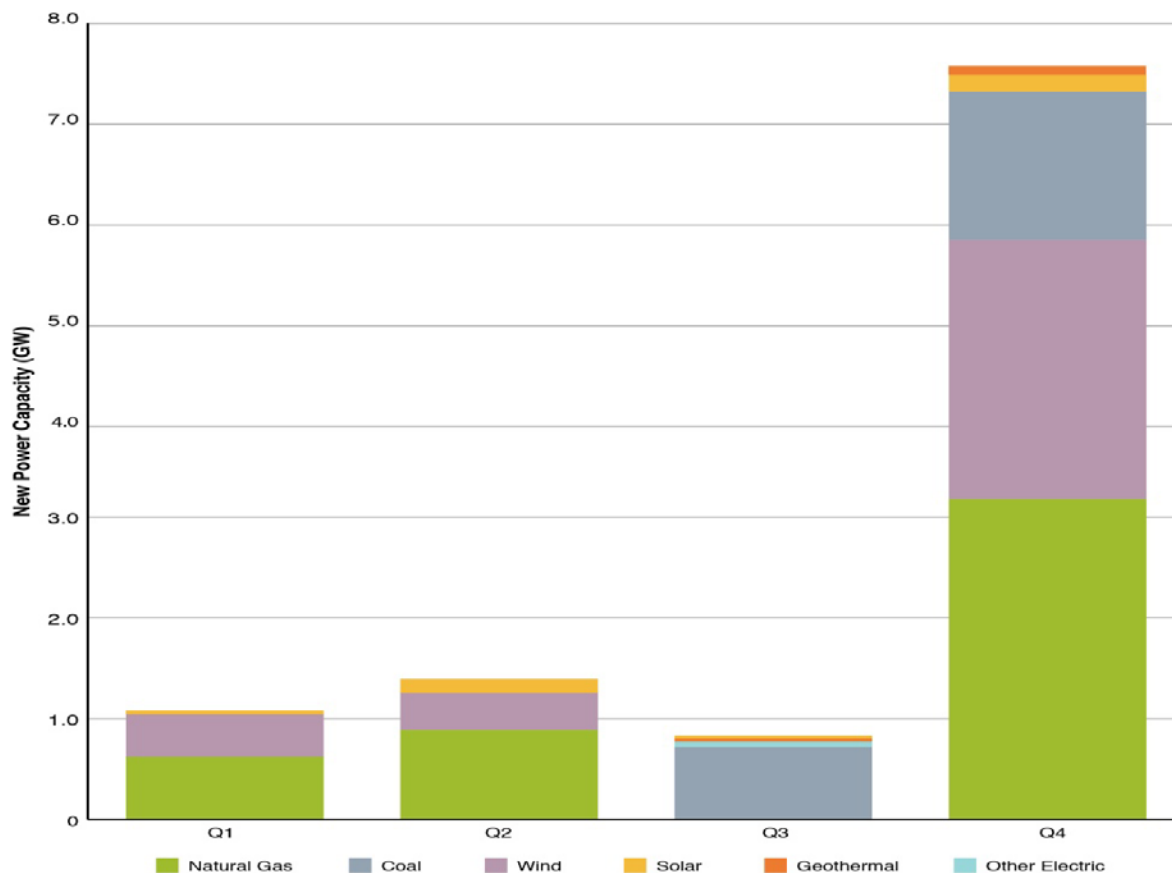
In addition to EPA's environmental regulations, historically low natural gas prices made natural gas-fired generation more competitive with coal. These factors further accelerated the retirement of coal-fired power plants. Natural gas prices in 2012 averaged about 30 percent lower than 2011 levels, which were already nearly 10 percent lower than the 2010 average.<sup>10</sup> Most of the retirements that took place or were announced in 2012 were associated with announced replacement capacities, primarily in the form of proposed natural gas-fired generation.

### 3.1.3 New Generating Capacity

In 2012, 10.9 GW of new generating capacity came online, with 70 percent (7.5 GW) coming online in the fourth quarter. Figure 9 illustrates this new capacity, breaking it down by quarter and by fuel source. The U.S. Southeast claimed the most new capacity (6 GW), followed by the Midwest (2 GW).

<sup>10</sup> U.S. Natural Gas Electric Power Price. Energy Information Administration. <http://www.eia.gov/dnav/ng/hist/n3045us3a.htm>

**Figure 9. New Power Plant Capacity in the United States, 2012**



### 3.1.3.1 *New Coal- and Natural Gas-fired Plants*

Six natural gas-fired power plants totaling 4.5 GW came online in 2012, including:

- American Electric Power’s 580 MW Dresden combined-cycle unit in Ohio, which came online in February;
- Georgia Power’s two new 840 MW McDonough-Atkinson combined-cycle units in Georgia, which came online in April and October;
- Southern Power (a subsidiary of Southern Company) 720 MW Plant Cleveland combustion turbine in North Carolina, which came online in December; and
- Duke Energy’s 620 MW Dan River combined-cycle unit and 920 MW H.F. Lee combined-cycle unit, which are both in North Carolina and came online in December.

Three new coal-fired power plants were placed into service in 2012, including:

- Dominion Power’s Virginia City Hybrid Energy Center in Virginia, which burns mostly coal but also some biomass, came online in July;
- Southwestern Electric Power Company’s 600 MW John W. Turk, Jr. power plant in Arkansas, which came online in December; and
- Duke Energy’s 825 MW Cliffside Unit 6 in North Carolina.

The shift towards natural gas in new power plant construction continued in 2012, spurred by the low cost of natural gas and regulatory uncertainty surrounding emissions from coal-fired power plants. Operators in 2012 announced 28 new projects to build fossil-fired power plants in the United States, totaling 17 GW. Of these, 26 were for natural gas-fired power plants.<sup>11</sup> Several other projects proposing fuel-source conversions from coal to natural gas or biomass were also announced in 2012.

### **3.1.3.2 Renewable Capacity Additions**

The renewable sector, particularly wind-powered capacity, saw a flurry of activity in 2012. The Federal Renewable Electricity Production Tax Credit (PTC) was set to expire by the end of 2012, and there was great uncertainty about the PTC's fate beyond 2012.<sup>12</sup> Companies worked to get their projects online before the credit expired at the end of the year, which resulted in more than 2.8 GW of new wind-powered capacity, or 77 percent of the total for the year, coming online in the fourth quarter (see Figure 9). Wind-powered capacity additions in 2012 (3.6 GW) amounted to 87 percent of all renewable capacity additions, and 34 percent of total capacity additions in 2012.

The PTC was extended on January 2, 2013 as a provision of the American Taxpayer Relief Act of 2012. Now, projects that begin construction before January 1, 2014 are eligible for the Federal tax credit. The extension is expected to similarly prompt a number of new wind-power projects in 2013.

Figure 10 shows the total number of new and proposed renewable energy projects that either came online or were announced in 2012. Note that Figure 10 shows new power plant additions by the number of projects per State, whereas Figure 9 shows new power plant additions by capacity. Next to wind-power projects, solar-power projects were the most prevalent and were mainly concentrated in the West. Very few biomass and geothermal projects were proposed or came online in 2012.

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<sup>11</sup> These do not include announced power plant projects that did not include a proposed capacity.

<sup>12</sup> The PTC provides a cents per kilowatt-hour-of-generation tax credit for qualifying renewable resources.

**Figure 10. Number of New and Proposed Renewable Energy Projects, 2012**

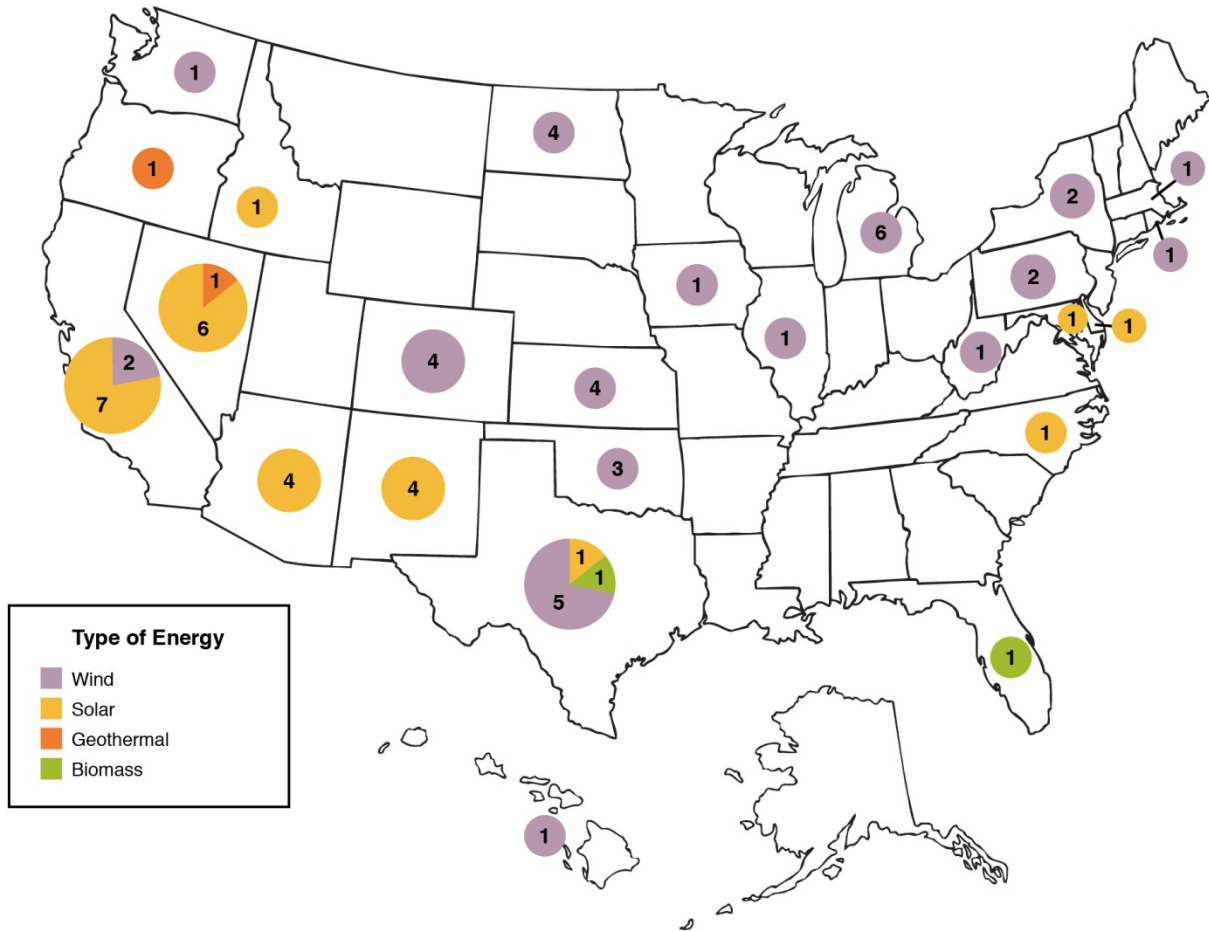


Table 3 below shows the amount of new and announced capacity by the type of renewable energy. As mentioned above, wind development is the most dominant, at 8,035 MW of new and proposed capacity. Solar power plants come in second with 2,600 MW of capacity.

**Table 3. New and Proposed Renewable Energy Capacity**

Renewable Type	Capacity (MW)
Biomass	106
Geothermal	53
Solar	2,600
Wind	8,035
<b>Total</b>	<b>10,794</b>

### **3.1.4 Nuclear Power Plants**

This section discusses some of the major changes to the nuclear power industry in 2012.

#### ***3.1.4.1 San Onofre Nuclear Generating Station Outage***

Southern California Edison (SCE) shut both units at its San Onofre Nuclear Generating Station (SONGS) in California in January after operators discovered premature tube wear in the steam generators of both units. Operators shut the 1,070 MW Unit 2 on January 9 and the 1,080 MW Unit 3 on January 31, and both remained offline for the rest of the year. The loss of the plant forced the California ISO (CAISO) to order the restart of mothballed generation facilities and take other measures to avoid rolling blackouts during the peak demand summer months. Table 4 describes the sequence of events in 2012.

**Table 4. A Timeline of the San Onofre Nuclear Generating Station Shutdown, 2012**

<b>Date</b>	<b>Unit Impacted</b>	<b>Event Description</b>
<b>1/9/2012</b>	Unit 2	Unit 2 is shut for planned maintenance and refueling. Operators also plan hardware and system upgrades while this maintenance is taking place.
<b>1/31/2012</b>	Unit 3	Unit 3 is shut after operators discover a steam generator leak, which is later deemed to be minor. Unit 2 is unaffected by this leak.
<b>2/1– 2/2/2012</b>	Units 2 & 3	Operators determine the tube degradation issues are in the steam generators of both units. The NRC begins inspections of Unit 2; SCE and its manufacturers begin inspections of Unit 3.
<b>3/16/2012</b>	Unit 3	The NRC launches additional inspections after a series of failed pressure tests conducted by SCE on Unit 3.
<b>3/22/2012</b>	N/A	SCE and CAISO begin developing contingency plans to address reliability issues should San Onofre continue to be offline through the summer and beyond. Plans include conservation efforts, restarting retired units, and accelerating transmission improvements.
<b>3/27/2012</b>	Units 2 & 3	The NRC issues a Confirmatory Action Letter that documents actions SCE must complete to address the degradation issues prior to restarting the units.
<b>4/13/2012</b>	Unit 2	SCE finds more unusual wear on Unit 2 steam generator tubes. The wear is similar to that on Unit 3's tubes but not as severe.
<b>5/11/2012</b>	N/A	AES Corp. restarts its mothballed 225 MW Huntington Beach natural gas-fired Unit 3 and 215 MW natural gas-fired Unit 4 to help make up for the loss of generation from San Onofre.
<b>6/18/2012</b>	Units 2 & 3	San Diego Gas & Electric's (SDG&E) Sunrise Powerlink transmission line comes online. SCE and SDG&E hope that Sunrise will mitigate power needs from the San Onofre outage by allowing more imports from the Imperial Valley.  The NRC blames the manufacturer of the tubes in the steam generators, Mitsubishi, for failing to properly test the materials before installing them.
<b>7/19/2012</b>	Units 2 & 3	The NRC identifies 10 specific actions SCE must complete to address the degradation issues prior to restarting the units.
<b>10/29/2012</b>	Units 2 & 3	The California Public Utilities Commission opens a formal investigation to determine whether ratepayers should bear the costs related to the extended shutdown and to assess the cost-effectiveness of repairing or replacing the San Onofre units.
<b>Year-end 2012</b>	Units 2 & 3	As of December 31, 2012, SCE had no specified restart date for either unit at San Onofre.

### **3.1.4.2 Nuclear Infrastructure and Uprates**

No significant new nuclear infrastructure changes were proposed in 2012. The only project completed in 2012 was the expansion of Florida Power & Light's (FPL) Point Beach plant, whose capacity was increased from 1,030 MW to 1,200 MW, a 17 percent uprate. Eight other plant uprates or capacity additions were proposed in 2012, as shown in Table 5. These do not include uprates proposed in any other year.



**Table 5. Nuclear Upgrades and Capacity Additions Proposed in 2012**

Power Plant	Unit	Capacity Proposed (MW)	Company	Location
Callaway	N/A	225	Ameren	Missouri
Grand Gulf	Unit 1	200	Entergy	Mississippi
St. Lucie	Unit 2	149	FPL	Florida
Cooper	N/A	146	Nebraska Public Power District	Nebraska
St. Lucie	Unit 1	129	FPL	Florida
Turkey Point	Unit 4	123	FPL	Florida
Turkey Point	Unit 3	123	FPL	Florida
Shearon Harris	N/A	30	Progress	North Carolina

Several major projects to build new nuclear power plants underwent schedule delays or cancellations in 2012. They are discussed below, sorted by size:

- Progress Energy’s Levy Project:** Progress Energy delayed the in-service date of its proposed 2,200 MW Levy nuclear plant in Florida, which would build two new 1,100 MW units. The first unit was expected to be online by the beginning of 2021, with the second unit coming online 18 months later. The first unit is now slated to begin service by 2024, with the second unit again coming online 18 months later. The company cited low customer demand, an economic downturn, uncertainty surrounding carbon regulation, and low natural gas prices as reasons for the setback.
- Southern Company’s Vogtle Project:** Southern Company announced in May that its project to build two new 1,100 MW nuclear reactors at its Vogtle plant in Georgia was delayed by 7 months, citing \$400 million in unanticipated costs due to design changes and other delays. The first unit had been scheduled to come online in April 2016, with the second unit coming online a year later. Under the new schedule, the first unit would begin service in November 2016, and the second, a year later. In November, however, Southern said the revised schedule it had announced in May was too optimistic, without specifying why, and that the first unit could be delayed a few months beyond its expected November 2016 start date.
- Tennessee Valley Authority (TVA) Watts Bar Project:** In early February, TVA announced its project to build the new 1,180 MW Watts Bar nuclear Unit 2 in Tennessee was delayed even further than had previously been announced, and that it was further over budget. Operators had planned to bring the plant online by the end of 2012 but later revised the expected start up to December 2015. The company cited new regulatory changes it was expecting as in response to the Fukushima Dai’ichi nuclear plant disaster in Japan in 2011, as well as poor previous construction schedules and budget estimates, and insufficient progress reviews. The Watts Bar delay may also delay the completion of TVA’s planned 1,260 MW Bellefonte nuclear Unit 1. TVA had said that completion work on Bellefonte would not begin until initial fuel loading at Watts Bar Unit 2 was complete.
- Exelon’s Victoria Project:** Exelon in August announced it had abandoned its plans to build a nuclear power plant in Victoria County, Texas, citing low natural gas prices and poor economic conditions.

### 3.1.4.3 Nuclear Retirements

The operators of two nuclear power plants in 2012 faced decisions on whether to retire certain units.

- **Duke's Crystal River Plant:** Crystal River has been shut since September 2009, when workers replacing the steam generators discovered a large gap in the concrete containment dome. Duke has estimated that the repair work could take several years and cost up to \$3.5 million, and the utility announced in October it was delaying its decision whether to retire or repair the plant.
- **Dominion's Kewaunee Plant:** Dominion Resources announced in October that it plans to retire its 566 MW Kewaunee nuclear plant in Wisconsin in the second quarter of 2013. The utility had announced in April 2011 that it was hoping to sell the plant due to poor economics.

Entergy's 563 MW Vermont Yankee nuclear power plant also faced problems in 2012, when challengers continued their attempt to revoke a 20-year operating license extension Entergy had received from the NRC in March 2011. Vermont argued State law could require Entergy to shut the plant when its first Federal operating license expired on March 21, 2012. In January a U.S. District Court ruled that Federal laws governing nuclear power plants, particularly with regard to safety, preempt State laws. Vermont appealed that ruling to a Second Circuit Court of Appeals in New York, arguing the State could shut the plant through the Vermont Public Service Board, which is considering Entergy's application for a new certificate of public good, by preventing Entergy from storing any spent fuel beyond March 21. Pending a decision on that appeal, the District Court blocked the State from shutting the plant over the spent fuel issue because it found a shutdown would cause "irreparable harm" to Entergy and the plant's workers.

In June, the U.S. Court of Appeals for the District of Columbia dismissed a lawsuit filed against the NRC to challenge its renewal of the operating license for the Vermont Yankee plant. The Vermont Department of Public Service and the New England Coalition, a nuclear-safety watchdog group, sued the NRC in May 2011, claiming the license renewal was unlawful because Entergy didn't furnish a valid water quality certification as required under the Clean Water Act. The court ruled that the petitioners should have raised objections directly to the NRC during the proceedings that led up to the plant's relicensing last year.

Another nuclear regulatory story the EAD tracked in 2012 began in February, when the NRC proposed three rules to address safety issues raised by the March 2011 Fukushima Dai'ichi nuclear power plant disaster in Japan. The rules, which could be implemented by the end of 2016, would require operators to better prepare for extreme events, better secure the pools used to store spent nuclear fuel, and address containment vent structures at certain plants.

In March, the NRC issued a statement authorizing its staff to issue orders that would apply to every U.S. commercial nuclear power plant. The first of three orders requires plants to better protect safety equipment, the second requires plants to install enhanced equipment for monitoring water levels, and the third requires plants with boiling-water reactors and Mark I or Mark II containment structures to improve their venting systems, which help prevent or mitigate

core damage in the event of a serious accident. Plants have until December 31, 2016 to fulfill these requirements.

### 3.1.5 Transmission Expansion and Smart Grid Implementation

The EAD reported eight new transmission projects, as shown in Table 6, which came into service in 2012. These projects involved more than 320 miles of transmission lines, with voltage levels varying from 115 to 500 kilovolts (kV). The biggest of these was San Diego Gas and Electric’s (SDG&E) Sunrise Powerlink, a 500-kV transmission line linking San Diego to the Imperial Valley in California, which was placed into service in June.

The Sunrise Powerlink consists of more than 110 miles of overhead 500-kV and 230-kV transmission towers and conductors, 6.2 miles of underground 230-kV cable, and a 40-acre, 500-kV transmission substation. Capable of bringing initially up to 800 MW of additional imported power into San Diego, the Sunrise Powerlink will eventually carry 1,000 MW of solar and wind power from projects in Imperial County. The project has also been expected to help with reliability issues stemming from the SONGS outage.

**Table 6. Transmission Line Projects Entering Service in 2012**

<b>Transmission Line Name</b>	<b>In-Service Date</b>	<b>Miles</b>	<b>State</b>
<b>ABB Bayonne-New York City</b>	1/2012	6.5	New Jersey/New York
<b>Sunrise Powerlink</b>	6/2012	116	California
<b>Hugo-Valliant</b>	7/2012	18	Oklahoma
<b>Dallam-Channing-Potter</b>	10/2012	75	Texas
<b>Dallam-Sherman</b>	10/2012	Not Specified	Texas
<b>Hitchland-Moore</b>	10/2012	62	Texas
<b>Limon</b>	10/2012	45	Colorado
<b>KETA (Spearville-Axtell)</b>	12/2012	Not Specified	Kansas

The EAD also reported more than 30 proposals for new transmission projects spanning more than 3,000 miles across the United States. These projects include small interconnections, lines connecting new renewable generation, and large-scale regional projects like the New York Energy Highway program. In addition to these projects, numerous companies have begun to overhaul their aging and vulnerable transmission infrastructure, some proposing billions of dollars in upgrades to their networks to improve reliability and safety.

### 3.2 Natural Gas Projects

The production of natural gas from shale resources in the United States continued to grow in 2012, with new proposals to build production, processing, and pipeline infrastructure to develop the resource and bring it to market.

According to the EIA, U.S. natural gas production increased to more than 66 Bcf/d in 2012, up 25 percent from 52.8 Bcf/d in 2007.<sup>13</sup> Between 2011 and 2012 alone, U.S. gas production increased by 5 percent. The boom in U.S. shale gas production has been complemented by infrastructure projects to process and deliver the resource. Record high natural gas storage levels in 2012, coupled with supply continuing to outpace demand growth, kept natural gas prices depressed in 2012, and buttressed the economic case for liquefied natural gas (LNG) exports from the United States. In August, DOE for the first time approved a company, Sabine Pass Liquefaction, LLC, to export LNG to any country with which the United States does not have a Free Trade Agreement (FTA). Other companies have applied for permits to do the same.

### 3.2.1 Natural Gas Processing Plants

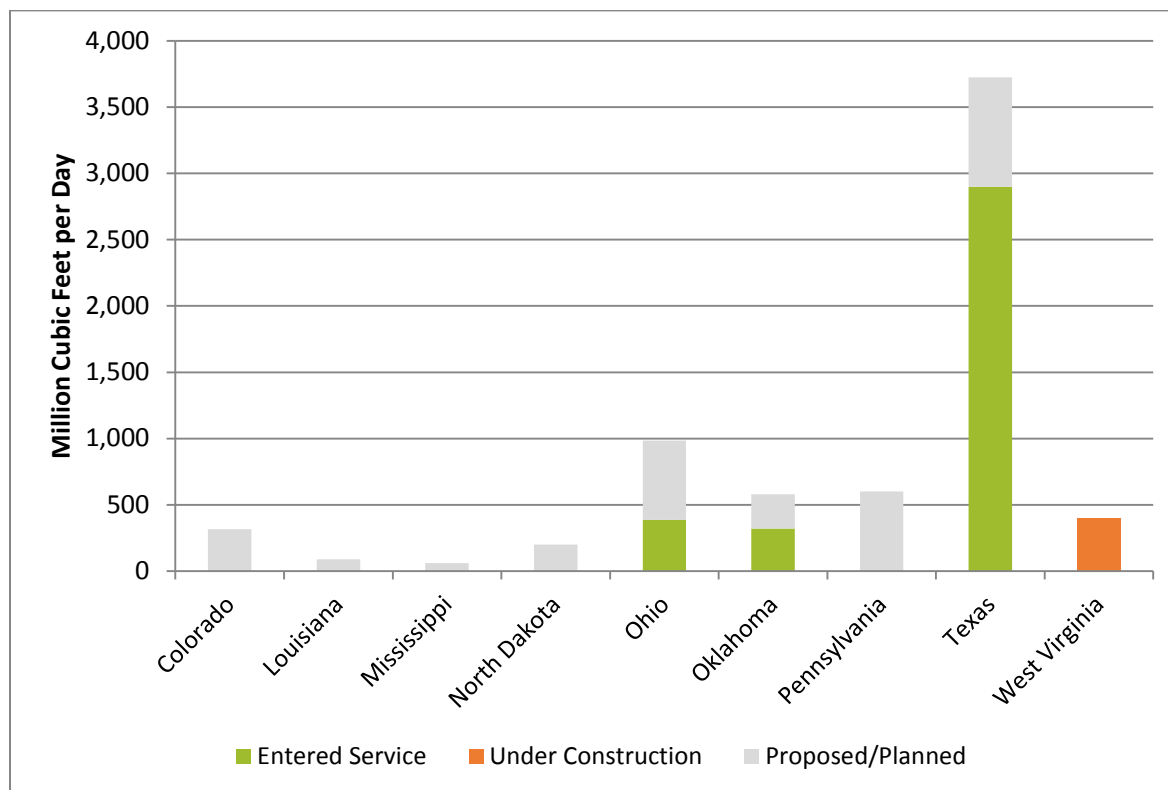
In 2012, the EAD reported 39 projects to construct new natural gas processing plants or to expand processing capacity at existing plants, primarily to serve growing shale gas production in the United States. Figure 11 shows the capacity of these projects by State and project status. As indicated, for 2012, the EAD reported total “proposed/planned,” “under construction”, and “entered service” plants of 6.9 Bcf/d in shale plays across the United States, including 3.7 Bcf/d in Texas, 1.0 Bcf/d in Ohio, and 600 million cubic feet per day (MMcf/d) in Pennsylvania.<sup>14</sup>

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<sup>13</sup> U.S. Dry Natural Gas Production, Energy Information Administration, [http://www.eia.gov/dnav/ng/ng\\_prod\\_sum\\_dc\\_u\\_NUS\\_a.htm](http://www.eia.gov/dnav/ng/ng_prod_sum_dc_u_NUS_a.htm) (Released February 28, 2013).

<sup>14</sup> A resource play is an area in which hydrocarbon accumulations or prospects of a given type occur.

**Figure 11. Capacity of New Natural Gas Processing Plant Projects by State**



The EAD reported 13 plants which “entered service” in 2012. This included five new plants and eight expansion projects that entered service or were expected to enter service in 2012. These projects totaled 3.6 Bcf/d: 2.9 Bcf/d in Texas, 385 million cubic feet per day (MMcf/d) in Ohio and 320 MMcf/d in Oklahoma. Additionally, the EAD also reported a new gas processing plant with a planned expansion was under construction in West Virginia with a total capacity of 400 MMcf/d. Further, if all the proposed projects reported in 2012 come online, their combined capacity would represent an increase of almost 4.5 percent over total U.S. natural gas processing capacity, which stood at 64.7 Bcf/d for 2012.<sup>15</sup>

### 3.2.2 Natural Gas Pipelines

The EAD reported several pipeline projects that entered service in 2012 and collectively added over 1.5 Bcf/d of natural gas transportation capacity, including:

- DTE Bluestone Pipeline:** Placed into service in January, this 275 MMcf/d pipeline connects the local gas production of Southwestern Energy to the Tennessee Gas Pipeline in Lenox Township, Pennsylvania. The pipeline will also connect with the Millennium Pipeline in Sanford, New York.

<sup>15</sup> “Natural Gas Annual Respondent Query System (EIA-757 Data)”, Energy Information Administration, [http://www.eia.gov/cfapps/ngqs/ngqs.cfm?f\\_report=RP9](http://www.eia.gov/cfapps/ngqs/ngqs.cfm?f_report=RP9) (Released October 2012). This was the most recent data available at the time this report was written.

- **Wayne County Pipeline:** Placed into service in June, Piedmont's 38-mile pipeline provides natural gas delivery service to Progress Energy's H.F. Lee Energy Complex in Wayne County, North Carolina from the Transcontinental Pipeline at Clayton, North Carolina.<sup>16</sup>
- **Appalachian Gateway Project:** Placed into service in September, this 484 MMcf/d pipeline transports Marcellus Shale gas produced in West Virginia and southwest Pennsylvania to storage fields and pipelines in Pennsylvania.
- **PVR Partners Wyoming Pipeline:** Placed into service in October, this 750 MMcf/d pipeline extends from northern Pennsylvania southward to a new interconnection with Transco's interstate pipeline system in Luzerne.
- **Yoakum Pipeline:** Placed into service in April, Enterprise Products Partners' 65-mile pipeline connects its Yoakum gas processing plant in Texas to its Wilson storage facility.

### 3.2.3 LNG Export Terminals

The shale gas production boom and resulting relatively low natural gas prices in the United States have created an incentive to export U.S. natural gas. As of December 31, 2012, the EAD reported 12 proposed LNG export projects in the contiguous United States (see Table 7). Seven of these projects involve the installation of liquefaction trains and LNG carrier loading facilities at existing LNG import terminals, which have been running at reduced rates due to ample domestic supplies. The other five projects are greenfield projects<sup>17</sup> that have been proposed at sites that were initially slated for the construction of LNG import terminals but were never constructed.

Table 7 summarizes these 12 proposed export projects, including information on the proposed site, export capacity, and target in-service date.<sup>18</sup>

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<sup>16</sup> Pipeline Project Serving Progress Energy's H.F. Lee Energy Complex, Piedmont Natural Gas, <http://www.piedmontng.com/about/pipelineprojects/wayne.aspx>.

<sup>17</sup> A greenfield site is an area of agricultural or forest land, or some other undeveloped site, earmarked for commercial development or industrial projects.

<sup>18</sup> Some of the data given for proposed export capacity in Table 6 has been converted from other units of measure (e.g., million tonnes per annum) to Bcf/d using BP's conversion factors resource (<http://www.bp.com/conversionfactors.jsp>).

**Table 7. Proposed LNG Export Projects in the United States, 2012**

Terminal	Site	Proposed Export Capacity (Bcf/d)	Target In-Service Date
Sabine Pass (LA)	Existing Import Terminal	2.6	2015
Lake Charles (LA)	Existing Import Terminal	2.0	2015
Cove Point (MD)	Existing Import Terminal	1.0	2016
Cameron (LA)	Existing Import Terminal	1.7	2017
Warrenton (OR)	Greenfield	1.3	2017
Brownsville (TX)	Greenfield	2.8	2018
Corpus Christi (TX)	Greenfield	1.8	---
Elba Island (GA)	Existing Import Terminal	0.5	---
Port Lavaca (TX)	Greenfield	1.3	2017
Pascagoula (MS)	Existing Import Terminal	1.5	---
Golden Pass (TX)	Existing Import Terminal	2.1	---
Robbinston (ME)	Greenfield	---	---

### 3.3 Petroleum Projects

In 2012 major petroleum infrastructure changes were driven by the production boom from Canadian oil sands and shale formations in the Bakken and Eagle Ford regions in North Dakota and Texas, respectively. The rapid production growth in these regions has outpaced takeaway infrastructure growth, resulting in price discounts for Mid-Continent crudes. Petroleum logistics are changing to take advantage of these lower prices, including the construction of new pipelines and rail infrastructure to increase takeaway capacity. See Appendix C. Petroleum Infrastructure Projects for a complete listing of petroleum infrastructure projects, including those highlighted in this section.

#### 3.3.1 Refineries

The EAD reported several refinery sales, new refinery projects, and refinery expansions in 2012.

##### 3.3.1.1 Refinery Sales

Two U.S. East Coast refineries in the Philadelphia area that were threatening closure in late 2011 due to poor economics were sold in 2012, including Phillips 66's 185,000 b/d Trainer refinery and Sunoco's 335,000 b/d Philadelphia refinery.

Before their closures, these two refineries represented approximately one-third of the operable refining capacity in the East Coast (PADD 1). Refining margins at these refineries had struggled in large part because they are configured to process expensive sweet crudes. They are not equipped with the capacity or metallurgy to process heavier and cheaper crude types or

upgrade less valuable residual products into more desirable petroleum products. The refinery owners had planned to shutter these assets if they could not find buyers.<sup>19</sup>

The threat of these closures prompted a U.S. congressional subcommittee to pursue a review of the region's energy security and potential impacts of the closures on prices and supply logistics. The closures did not ultimately come to pass:

- On April 30, 2012, Monroe Energy, LLC, a subsidiary of Delta Air Lines, Inc., agreed to purchase the Phillips Trainer refinery and announced plans to reconfigure the plant to maximize its jet fuel production. The company claimed that the acquisition would allow them to meet approximately 80 percent of their fuel needs and save them \$300 million in fuel costs.
- On July 2, 2012, Carlyle Group L.P. and Sunoco formed Philadelphia Energy Solutions to operate Sunoco's Philadelphia refinery. Carlyle Group has majority interest and maintains day-to-day operations, while Sunoco retained a non-operating, minority interest.

### ***3.3.1.2 Refinery Expansion Projects***

Several companies proposed or completed expansion projects at existing U.S. refineries in 2012. One notable expansion was at Motiva Enterprises' Port Arthur, Texas refinery. The 5-year project, formally completed on May 31, expanded the refinery capacity by 325,000 b/d to reach a total of 600,000 b/d, making it the largest refinery in the United States. The expansion project also enabled the refinery to process a wider range of crude types. The start up of the unit failed, however, due to a fire and the discovery of extensive corrosion damage caused (See the Refinery subsection of the Petroleum Disruptions section of this report for more details).

Table 8 offers a summary of this and other completed and proposed expansion projects.

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<sup>19</sup> "Petroleum & Other Liquids—Refinery Capacity Reports," Energy Information Administration, <http://www.eia.gov/petroleum/refinerycapacity/> (Data as of June 2011).



**Table 8. Completed and Proposed Expansion Projects**

Company	Refinery	Description	Incremental Capacity (b/d)	Completion Date
<b>Sinclair Wyoming Refining Corp.</b>	Sinclair, WY	Crude processing expansion; expanded hydrocracker rate, and added a coker unit	24,000 (to 80,000)	January 25, 2012
<b>Motiva Enterprises</b>	Port Arthur, TX	New crude unit and additional downstream processing units	325,000 (to 600,000)	May 31, 2012
<b>Consumers' Co-operative Refineries Ltd.</b>	Regina, Saskatchewan	Crude processing expansion; added fluid catalytic cracking unit	45,000 (to 145,000)	October 24, 2012
<b>Marathon Petroleum Co.</b>	Detroit, MI	Crude processing expansion; increased heavy crude refining capacity	14,000 (to 120,000) <sup>1</sup>	November 7, 2012
<b>Western Refining</b>	El Paso, TX	Crude processing expansion	25,000 (to 147,000)	Planned for 2014
<b>Husky Energy</b>	Lima, OH	Installing new kerosene hydrotreater to increase jet fuel production	20,000 <sup>2</sup>	Planned Q2 2013
<b>BP</b>	Whiting, IN	New crude distillation unit, new coker unit, new gas oil hydrotreating and sulfur recovery unit; increased heavy crude refining capacity	260,000 <sup>3</sup>	Planned Q2 2013
<b>HollyFrontier</b>	Wood Cross, UT	Crude processing expansion	15,000 (to 45,000)	Planned Q4 2014

Notes: 1) Heavy crude processing capability increased from 20,000 b/d to 100,000 b/d.

2) Hydrotreater expansion only

3) Incremental increases in heavy crude processing capability

### 3.3.1.3 Proposed New Refineries

A new refinery has not been constructed in either the United States or Canada since 1986. However, with Canadian oil sands and Bakken shale oil production growing, two companies proposed plans for new refineries in 2012.

- **MDU Resources and Calumet Refining** in February announced they had signed a letter of intent to explore the feasibility of jointly building and operating a new 20,000 b/d diesel refinery in southwestern North Dakota. The facility would process Bakken crude and market the diesel within the Bakken region. At the time of this announcement, site selection, permitting, crude oil feed procurement, marketing, and engineering studies were already underway.
- **Kitimat Clean Ltd.** in August announced it was submitting an Environmental Assessment Application to build an oil refinery in Kitimat, British Columbia that would

process oil sands crude transported via Enbridge's Northern Gateway pipeline.<sup>20</sup> The refinery would have a processing capacity of 550,000 b/d and produce 240,000 b/d of diesel, 100,000 b/d of gasoline, and 50,000 b/d of aviation fuel. The refinery would take advantage of the shipping terminals in the region to market products to consumers around the Pacific Rim. Upon necessary approvals, construction could begin in 2014.

### 3.3.2 Transportation

Petroleum is most efficiently transported via intra- and inter-state pipelines. These assets are extremely important to the reliable supply of crude oil and petroleum production in the United States. In 2012, the majority of crude-transportation projects reported in the EAD involved assets in Western Canada and the Bakken region in North Dakota, where increased production has spurred the development of new pipeline projects and rail terminals.

#### 3.3.2.1 Pipeline Projects

- **TransCanada's Keystone XL Pipeline:** The Keystone XL pipeline project expands on TransCanada's currently operating Keystone Pipeline System. Phases III and IV of this expansion project will connect Cushing, Oklahoma with Nederland and Houston, Texas, and Hardisty, Alberta with Steele City, Nebraska, respectively. The pipeline is expected to carry 830,000 b/d of crude from Alberta to supply refineries on the Gulf Coast. Phase III is under construction and is expected to come online by mid-to-late 2013, and Phase IV is currently pending U.S. government approval. On January 18, the U.S. Department of State denied a Presidential Permit for the Keystone XL project citing insufficient time to assess the environmental impact of the pipeline, whose proposed route traversed several environmentally sensitive areas, including the Ogallala Aquifer in Nebraska. On May 4 TransCanada re-applied for the permit, proposing an alternate route through Nebraska. A decision on this new application is expected in mid-2013.
- **Enbridge's Northern Gateway Pipeline:** Enbridge has proposed the Northern Gateway Pipeline project to transport 525,000 b/d of crude produced from oil sands in Alberta to an export terminal in Kitimat, British Columbia, and 193,000 b/d of condensate in the opposite direction. The National Energy Board is conducting an environmental review of the project and is scheduled to produce a draft by the middle of 2013 and a final decision later that year.
- **Enbridge's Lakehead System:** The Lakehead System is part of Enbridge's mainline network connecting the Upper Midwest and Eastern Canada with refinery markets on the U.S. Gulf Coast. Enbridge in 2012 announced major expansion projects planned on several lines to accommodate increased production of crude from the Bakken Shale and Western Canada. Notably, Enbridge is expanding its Alberta Clipper Pipeline from 450,000 b/d to 570,000 b/d, Southern Access Pipeline from 400,000 b/d to 560,000 b/d, Spearhead North Pipeline from 135,000 b/d to 235,000 b/d, and Line 6B from 240,000 b/d to 500,000 b/d. The projects are set to be completed between 2013 and 2014.

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<sup>20</sup> Kitimat Clean Ltd., Presentation to the British Columbia Chamber of Commerce, March 6, 2013. <http://kitimatclean.ca/vancouver-chamber-of-commerce-march-6-2013/>

### 3.3.2.2 Pipeline Reversals

- **Enterprise's Seaway Pipeline:** Enterprise in 2011 announced it was reversing the Seaway pipeline to move crude from the Cushing, Oklahoma to the Gulf Coast in response to excess inventory in Cushing as a result of increased production from the Bakken Shale and Western Canada. The first shipment of crude was made on May 19, 2012. The pipeline has a capacity of 150,000 b/d but was expected to ramp up to 400,000 b/d in the first quarter of 2013 after a new pumping station in Cushing is brought online. Enterprise has plans to increase the capacity to 850,000 b/d by 2014.
- **Shell's Ho-Ho Pipeline:** Shell's Houston-to-Houma (Ho-Ho) pipeline reversal project received positive interest during its open season in 2012. As a result, Shell proceeded with the project, which will supply the U.S. Gulf Coast with 300,000 b/d of Eagle Ford production and is set to come online in 2013. The pipeline will carry crude from Houma, LA and serve the major Gulf Coast refineries in the Nederland, TX and Houston, TX area.

### 3.3.2.3 Pipeline Conversions

- **Magellan Midstream's Longhorn Pipeline:** Magellan announced it will convert its Longhorn fuel products pipeline, which runs from Houston to El-Paso, to crude oil service running in the opposite direction to address increased production from the Eagle Ford Shale. The initial phase of the project, which will transport 135,000 b/d, was slated for completion in the first quarter of 2013. An expansion, which will bring the total capacity of the pipeline to 235,000 b/d, is slated for completion by the second or third quarter of 2013.
- **Kinder Morgan's El Paso Natural Gas Pipeline Conversion:** Kinder Morgan in October announced it was considering converting parts of its underutilized El Paso Natural Gas Pipeline System to transport up to 400,000 b/d of light Permian Basin crude from West Texas to Southern California. The project is intended to address the oversupply of light crude to Gulf Coast refineries and the limited pipeline capacity available to move crude westward to California, where refineries are largely reliant on foreign crude.<sup>21</sup>

### 3.3.2.4 Rail Projects

- **Rangeland Energy's Crude Oil Loading Terminal (COLT):** Rangeland's COLT in Williams County, North Dakota filled its first unit train on June 5. The facility supports producers in the Bakken Shale and Three Forks Shale with outbound service by unit train to receiving terminals throughout North America, including the Gulf Coast. The facility has the capacity to load 120,000 b/d and can transport an additional 75,000 b/d of crude using a bidirectional pipeline that connects to Rangeland's Dry Fork Terminal. This

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<sup>21</sup> Kristen, H. "Kinder Morgan may convert California natgas line to crude-CEO," Reuters, October 18, 2012 <http://www.reuters.com/article/2012/10/18/kindermorgan-pipeline-conversion-idUSL1E8LI9KE20121018>; and "UPDATE 2—Kinder Morgan to start work on Texas-California oil pipeline," Reuters, January 16, 2013 <http://www.reuters.com/article/2013/01/16/kindermorgan-pipeline-conversion-idUSL1E9CGI1520130116>.

connection provides an alternate route through existing pipeline networks operated by Tesoro and Enbridge, and several planned pipeline projects. The terminal is serviced by BNSF Railway Company and has the capacity to store 720,000 barrels of crude.

- **Musket Corporation's Crude-by-Rail Facility:** Musket in June completed an expansion project at its Dore, North Dakota crude-by-rail facility that increased its loading capacity from 10,000 b/d to 60,000 b/d. The terminal will be supplied via trucks and a connection to the Banner Pipeline and will provide outbound service to companies throughout the U.S.

In addition to the completed projects, several companies announced planned and proposed projects aimed at improving rail infrastructure to move crude out of the Mid-Continent:

- The U.S. Development Group announced that their planned Van Hook, North Dakota facility will be able to handle crude and related products with an initial capacity of 35,000 b/d.
- Enbridge's Berthold rail crude oil-export terminal received approval from North Dakota regulators for expansions. The expansion includes construction of a double loop unit train facility, crude oil tankage, and other terminal facilities capable of handling 120,000 b/d by Q1 2013.
- Gibson Energy announced that it signed a letter of intent with a major unit train operator to move crude from its Hardisty Terminal in Alberta along the North Main Line to markets across North America.
- Canadian National Railway and Tundra Energy Marketing signed a memorandum of understanding to build a 30,000 b/d COLT by the second quarter of 2013. The partners are building the COLT in Cromer, Manitoba to accommodate Bakken producers.
- Arc Terminals and Canadian National Railway are building a rail tank-car unloading terminal in Mobile, Alabama with a maximum capacity of 75,000 b/d. The terminal, expected to enter service in Q2 2013, is set to handle Canadian and Bakken crude transported via rail to Gulf Coast refineries.

#### **3.3.2.5 Terminals**

- **Plains All American's Yorktown Terminal:** In December 2011, Plains All American purchased the shuttered Yorktown refinery and terminal complex. Plains All American plans to disassemble the refinery and sell its salvageable parts, and enhance the terminal complex to enable rail and marine deliveries. Construction has begun on the rail unloading infrastructure, which will be able to handle 130,000 b/d, or approximately two unit-train unloading operations per day. The Yorktown site has an existing 6 million barrels of storage. The project is slated for completion in the first half of 2013.
- **Enterprise's Crude Houston (ECHO) Storage Terminal:** Enterprise opened the first 750,000 barrels of crude oil tankage at its terminal in November. The company plans to add another 900,000 barrels of storage to the facility by first quarter of 2014. The terminal will receive crude from a pipeline that serves the Eagle Ford region and the reversed Seaway pipeline, which connects the terminal to Cushing, Oklahoma.

Enterprise has mentioned plans to expand the terminal to ultimately store as much as 6 million barrels of crude.

- **TransCanada's Keystone Hardisty Crude Oil Terminal:** TransCanada plans to build a crude oil storage facility at the origin point of its Keystone Pipeline in Hardisty, Alberta. TransCanada had originally proposed a 2 million-barrel storage facility, but after a successful open season the company announced in May that it would change its proposal to plan for a 2.6 million-barrel facility. The terminal will be connected to the Keystone XL pipeline, which will serve producers in Western Canada. Pending regulatory approvals, the facility is slated for completion by late 2014.<sup>22</sup>

## 3.4 Biofuels

The biofuels industry continued to announce plans for new production plants and related infrastructure in 2012, albeit far less often than it did in 2011. A number of existing plants closed or were idled during the year, while others were brought back online. Most of the new projects announced in 2012 have proposed building cellulosic and waste sugar ethanol plants, marking a clear trend away from new corn ethanol plants. Moreover, several distribution infrastructure changes announced in 2012 may further improve economic ethanol and biodiesel penetration.

### 3.4.1 New Biofuel Plants

The EAD reported plans for 15 new biofuel production facilities in 2012. Of these, 12 are to be located in the United States and 3, in Canada. These plants are to produce advanced ethanol, corn ethanol, and non-specific biofuel, while none are slated to produce biodiesel.

#### 3.4.1.1 Advanced Ethanol

A total of 11 advanced ethanol plants with a combined capacity of 222.1 million gallons per year (MMgal/year) were announced in 2012, making advanced ethanol the most popular type of biofuel plant proposed during the year. Cellulosic ethanol is the most common of the advanced ethanol technologies. Cellulosic ethanol is produced by processing a wide variety of waste biomass like plant fiber, including stalks, grain straw, switchgrass, and municipal waste into ethanol. Six planned cellulosic plants were announced in 2012, with a combined capacity of 117.1 MMgal/year. The feedstocks for these plants include energy grasses (56 MMgal/year), corn residue (51.1 MMgal/year) and municipal solid waste (10 MMgal/year).

Four other advanced ethanol plants proposed in 2012 will use energy beets and waste sugar to produce a total of 30 MMgal/year. The energy beet industry is growing in North Dakota, where the Green Vision Group of Fargo announced their intention to construct at least 12 energy beet ethanol plants across the State in the coming years, without specifying further. Finally, one hybrid ethanol plant announced in North Dakota will have a capacity of 75 MMgal/year.

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<sup>22</sup> TransCanada Corp., "Keystone Hardisty Terminal," <http://www.transcanada.com/5967.html>.

### **3.4.1.2 Corn Ethanol**

One corn ethanol plant was announced in 2012. FarmTech Energy Corporation announced plans to build a 55 MMgal/year plant at the Port of Oshawa in Ottawa. The plant, which had previously been announced and scrapped due to financial reasons, was brought back to life when the Oshawa Port Authority approved it in July. Operators hope to bring the project online by 2014.

### **3.4.1.3 Biofuels**

The EAD announced three non-specific biofuels plants. ZeaChem Boardman Biorefinery announced a project to build a 25 MMgal/year advanced biofuel plant in Oregon, where it will use woody biomass as feedstock. CORE BioFuel Inc. proposed a 17.7 MMgal/year wood-to-gasoline plant in Ontario, and Fulcrum Bioenergy proposed a 10 MMgal/year waste-to-biofuels plant in Nevada.

Figure 12 maps the 15 biofuel plants proposed in 2012. The majority of these plants were proposed in the U.S. Midwest.

**Figure 12. Proposed Biofuel Plants, 2012**



### 3.4.2 Plants in Transition

In addition to the 15 biofuel plants proposed in 2012, a number of other changes took place within the industry during the year. A variety of existing plants were decommissioned or idled due to poor margins stemming from a combination of high corn prices and low ethanol prices. Several plants that were idled or closed prior to or during 2012 were reopened. Moreover, some previously announced plans to build proposed corn or cellulosic ethanol plants were scrapped during 2012. Table 9 presents the status of biofuel plants in transition.

In addition to the plants listed in Table 9, Gevo’s new 18 MMgal/year biobased isobutanol plant in Minnesota—the first commercial biobased isobutanol production plant in the United States – switched back to ethanol production at the end of September. The plant, which had produced 18 MMgal/year of isobutanol from corn starch, switched back to ethanol production to allow the company to optimize its technology to enhance production rates. Gevo has been the subject of

a patent lawsuit with Butamax Advanced Biofuels, which claims Gevo misappropriated patent rights on the processing technology.

**Table 9. List of Biofuel Plants in Transition, 2012**

<b>Company</b>	<b>Location</b>	<b>Product</b>	<b>Capacity (MMgal/year)</b>	<b>Announced</b>	<b>Status</b>	<b>Notes</b>
<b>ADM</b>	Walhalla, ND	Corn Ethanol	30	2/9/2012	Decommissioned	Poor margins, geography, plant scale
<b>Aventine</b>	Nebraska	Unspecified Ethanol	113	5/16/2012	Started Up	Start-up after resolving financial and other issues
<b>Valero</b>	Albion, NE	Corn Ethanol	110	6/20/2012	Idled	Poor margins
<b>Valero</b>	Linden, IN	Corn Ethanol	110	6/27/2012	Idled	Poor margins
<b>JH Kelly</b>	Clatskanie, OR	Corn Ethanol	108	7/3/2012	Delayed	Poor margins
<b>Powers Energy</b>	Lake County, IN	Advanced Ethanol	175	7/12/2012	Delayed	Lack of funding
<b>FarmTech Energy Corp.</b>	Ottawa, CN	Unspecified Ethanol	55	7/12/2012	Delayed	Lack of funding
<b>W2 Energy</b>	Ontario, CN	Biodiesel	0.65	8/7/2012	Started Up	Completed fabrication and installation
<b>Agri-Energy, LLC</b>	Garnett, KS	Corn Ethanol	42	8/9/2012	Idled	Poor margins
<b>Pennsylvania Grain Processing</b>	Clearfield, PA	Unspecified Ethanol	110	8/9/2012	Restarted	Restart after purchase
<b>INEOS Bio</b>	Vero Beach, FL	Cellulosic Ethanol	8	8/13/2012	Started Up	Received notice of registration from EPA
<b>Central MN Ethanol Co-op</b>	Little Falls, MN	Corn Ethanol	15	8/14/2012	Idled	Poor margins
<b>Purified Renewable Energy</b>	Buffalo Lake, MN	Corn Ethanol	25	9/6/2012	Restarted	Restart after purchase
<b>Valero</b>	Albion, NE	Corn Ethanol	110	9/20/2012	Restarted	Restart amid improved economics
<b>Valero</b>	Linden, IN	Corn Ethanol	110	9/20/2012	Restarted	Restart amid improved economics
<b>BioFuel Energy Corp.</b>	Fairmount, MN	Corn Ethanol	115	9/25/2012	Idled	Poor margins
<b>Abengoa</b>	Madison, IL	Unspecified Ethanol	88	10/1/2012	Idled	Indefinite, maintenance, poor margins
<b>Bunge North America, Inc.</b>	Vicksburg, MS	Corn Ethanol	54	10/16/2012	Idled	Indefinite, poor margins
<b>Southwest Georgia Ethanol</b>	Camilla, GA	Corn Ethanol	100	10/26/2012	Idled	Indefinite, poor margins



<b>logen Corp. and Royal Dutch Shell</b>	Manitoba, CN	Cellulosic Ethanol	N/A	10/26/2012	Scrapped	Poor economics
<b>Valero</b>	Albion, NE	Corn Ethanol	110	11/1/2012	Idled	Poor margins
<b>Valero</b>	Linden, IN	Corn Ethanol	110	11/1/2012	Idled	Poor margins
<b>Coskata</b>	Boligee, AL	Cellulosic Ethanol	55	11/1/2012	Scrapped	Site infrastructure did not support plan

### 3.4.3 Distribution Infrastructure

The EAD reported a number of new projects aimed at transporting and distributing ethanol and biodiesel in 2012.

- Kinder Morgan's Linden Ethanol Pipeline:** Kinder Morgan Energy Partners announced in April the completion and start-up of a 16-inch ethanol pipeline connection between its Linden, New Jersey unit-train facility and its New York Harbor terminal in Carteret, New Jersey. The Linden terminal has handled as much as 36,000 barrels of ethanol a day with 550,000 barrels of storage through Citgo Petroleum's Tremley Point terminal. The pipeline will initially move only domestic grade, fully denatured product, but Kinder Morgan plans to offer the capability to handle ethanol specifications suitable for export in the near future as the market dictates. The project complements a previously announced 1 million-barrel expansion project at the 8 million-barrel Carteret storage terminal, and gives Kinder Morgan's Linden customers access to four existing Carteret barge docks, two ship docks, and a full unit-train receiving system. Of the 1 million barrels of additional storage capacity, 195,000 barrels are to be dedicated to ethanol storage.
- Magellan's Des Moines Terminal:** In September, Magellan Midstream Partners, LP opened a new biodiesel storage and blending facility at its Des Moines, Iowa terminal that will store and blend 5,000 barrels of biodiesel into distillate blends including B2, B5, B10, and B20.<sup>23</sup>
- Motiva's Sewaren Terminal:** In March, Motiva announced plans to convert storage tanks at its terminal in Sewaren, New Jersey to hold ultra-low sulfur diesel (ULSD) and biodiesel. Motiva said the conversion project would address increased demand for these products in the Northeast, where States are beginning to require consumers to switch from higher-sulfur heating oil to ULSD to reduce pollution. Motiva completed the conversion to ULSD by the end of the second quarter of 2012 and the conversion to biodiesel by the third quarter of 2012.
- Green Plains' Birmingham Rail Terminal:** Green Plains Renewable Energy, Inc. announced in December that BlendStar, LLC, its wholly-owned subsidiary, completed construction and began operations at its 96-car unit train terminal in Birmingham, Alabama. The new terminal is served by the BNSF Railway and has an ethanol

<sup>23</sup> The number affixed to the biodiesel blend identifies the percentage of biodiesel blended into the fuel. For instance, B2 is comprised of 2 percent biodiesel and 98 percent petroleum diesel (or other distillate).

throughput capacity of 7.1 million barrels per year. BlendStar expected the terminal to be at full capacity in January 2013. The Birmingham terminal currently has 160,000 barrels of storage and a four-lane covered truck rack, both with expansion capabilities.

- **REG's Clovis Terminal:** In June, Renewable Energy Group (REG) announced plans to establish a biodiesel wholesale terminal at its 15 MMgal/year biodiesel plant currently under construction near Clovis, New Mexico. The company is converting the site's liquid storage and truck load-out into a wholesale terminal for REG-9000 branded biodiesel sales via truck and rail. Completion is expected during the first quarter of 2013.
- **Eco-Energy/NuStar's Ethanol Unit Train and Storage Facility:** Eco-Energy Holdings, Inc. announced in July a partnership with NuStar Terminals Operations Partnership L.P. to jointly develop an ethanol unit train and storage facility to serve the Northern Virginia and Washington, DC markets. The two companies plan to develop an ethanol unloading, storage, and outbound truck loading solution at NuStar's Dumfries, Virginia facility. The terminal will have approximately 155,000 barrels of ethanol storage capacity and will be capable of distributing over 400,000 barrels per month. The facility will be equipped to receive up to 96 rail car unit trains via CSX Transportation with 24/36 hour turnaround time. Operations at the Dumfries, Virginia site are expected to commence in the third quarter of 2013.
- **Englewood Enterprises' Transfer Facility and Pipeline:** In January, Englewood Enterprises received approval to build an ethanol transfer facility and proposed fuel pipeline in Tennessee. Ethanol will be delivered to the facility via 14 railway tank cars. The proposed pipeline will then transfer the ethanol to four nearby petroleum distribution facilities. No startup date for the project was announced.<sup>24</sup>

#### 3.4.4 Policy Changes

In April, the U.S. EPA approved the first applications for the registration of ethanol for use in making gasoline that contains up to 15 percent ethanol (E15). The law had previously limited the amount of blended ethanol to 10 percent by volume for use in gasoline-fueled vehicles. Registering ethanol to make E15 was necessary before it could be introduced into the marketplace. Before it can be sold, manufacturers must first take additional measures to help ensure retail stations and other gasoline distributors understand and implement labeling rules and other E15-related requirements. Automobile industry groups and others have warned consumers will likely be confused about whether they can use E15 to fuel their vehicles, presenting the potential for vehicle damage as a result of the misuse of E15. These groups have urged regulators and the industry to stop the sale of E15 until motorists are better protected.

In September, the U.S. EPA established the volume of bio-diesel products required to be included in diesel fuel markets in 2013 at 1.28 billion gallons under the Energy Independence and Security Act of 2007 (EISA). The EISA established the second phase of the Renewable Fuel Standards program. EISA specified a 1 billion-gallon minimum volume requirement for the biomass-based diesel category for 2012 and beyond, and it also called on the EPA to increase

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<sup>24</sup> "Ethanol Transfer Facility At Bonny Oaks Gets Planning Commission OK." January 09, 2012. <http://www.chattanooga.com/2012/1/9/216921/Ethanol-Transfer-Facility-At-Bonny-Oaks.aspx>

the volume requirements after consideration of environmental, market, and energy-related factors.

Government funding for new biofuel projects continued in 2012. In early April, DOE announced it would make up to \$15 million available for research on biomass-based supplements for traditional fuels. In July, the White House, in conjunction with the Department of Agriculture, the U.S. Navy, and DOE, announced that \$30 million in Federal funding would be made available to match private investments in commercial-scale advanced drop-in biofuels, new innovations in biofuels technologies, and strategies for increasing U.S. production of biofuels. DOE also announced a total of \$32 million in new investments for earlier-stage research that will continue to drive technological breakthroughs and additional cost reductions in the industry.

## 4. International Events

While the EAD focuses on domestic and North American issues, it also reports significant international events that impact or have the potential to impact energy markets in the United States. This section highlights international incidents that disrupted energy markets in 2012, and summarizes the status of global infrastructure changes that were announced, under construction, or placed into service during 2012.

### 4.1 Incidents and Disruptions

Energy disruptions were felt around the world in 2012. The impact of the 2011 Japanese earthquake and tsunami that damaged the Fukushima Dai'ichi nuclear power plant continued in 2012, with nuclear plants throughout Japan closing and tightening regulations. In the Middle East, Iran threatened to close the Strait of Hormuz, a major water route for global crude oil transport, due to international sanctions regarding the country's nuclear program.

These threats prompted a variety of responses from nations around the world, including proposals for new infrastructure to circumvent the waterway. The continuing civil war in Syria involved a number of attacks targeting petroleum and natural gas operations. Crude production in Iraq continued to climb, with output in March exceeding 3 MMb/d for the first time since 1979. Output reached 3.4 MMb/d in October, around the time reports began estimating that Iraqi production could reach 9–10 MMb/d by 2020. Other major energy disruptions in 2012 are discussed below.

#### 4.1.1 Africa

- Sudan and South Sudan engaged in disputes throughout the year, which resulted in production impacts to Sudan's 115,000 b/d of oil output, and completely halted South Sudan's 350,000 b/d oil output starting on January 29.
- A 2-day protest in Libya on July 6-8 shut-in 300,000 b/d of oil production; a week-long protest and pipeline leak in December hindered production at four oil fields in the country that account for 320,000 b/d of production; and a 4-day protest (December 22-27) forced the 60,000–70,000 b/d Al-Zuweitina oil port to shut down.
- Nigeria suffered severe flooding that reduced oil production by as much as 500,000 b/d in September and October. Nigeria produces around 2.6 MMb/d, but the deluged oil fields in the Niger River delta cut rates to 2.1 MMb/d.
- Crude theft in Nigeria occurred on Shell's operations throughout the year. Shell estimated it was losing 43,000 b/d to thieves illegally tapping into company pipelines.
- A fire that began on January 16 at Chevron's Funiwa well offshore Nigeria burned out on March 2. The fire had followed an explosion at the Funiwa Deep 1A natural gas exploration well. On June 18, relief drilling was completed, and the well was sealed and abandoned.

#### 4.1.2 Asia

- India suffered two massive blackouts in late July, after multiple states simultaneously purchased power beyond their scheduled allowance. On July 29 a failure on the country's northern grid cut power to 360 million people, roughly 30 percent of the India's population of 1.24 billion. Customers were restored by late on July 30. On July 31 three regional power grids in northern and eastern India failed, cutting off power to approximately 620 million people from New Delhi to Kolkata.
- South Korea shut two 1,000 MW nuclear reactors at the Yonggwang nuclear plant for nearly 2 months to replace parts provided with forged certificates. Korea Hydro & Nuclear Power Co., Ltd., which operates the plant, alleged that 8 firms forged 60 false certificates to cover 7,682 items between 2003 and 2012.

#### 4.1.3 Europe

- Between June 9 and July 13, extensive labor strikes in Norway shut-in approximately 240,000 b/d of oil production and 11.9 million cubic meters per day (420 MMcf/d) of natural gas production.
- From March 26-May 16, Total shut down its Elgin platform in the North Sea, which was leaking 200,000 cubic meters per day (7 MMcf/d) of natural gas. Before the shutdown, Elgin's output was 9 million cubic meters of gas per day (318 MMcf/d) and about 60,000 b/d of light crude oil.

#### 4.1.4 Latin America

- A substation fire in northeastern Brazil cut power to 53 million people on October 25.
- An explosion at Venezuela's 645,000 b/d Amuay refinery on August 25 killed 48 people and resulted in a fire that burned for 4 days. State-owned Petroleos de Venezuela SA operated the refinery at reduced rates throughout the remainder of 2012.
- In Mexico, an explosion at a natural gas processing plant operated by the state-owned oil company Petroleos Mexicanos near Reynosa on the U.S. border killed 30 people and injured at least 46 others on September 18. The explosion shut-in 800 MMcf/d of natural gas production from the Burgos gas fields for several weeks.

#### 4.1.5 Middle East

- Yemen's 110,000 b/d light crude oil pipeline was attacked on September 5 and September 9. The pipeline was restarted and then attacked again on November 11 and November 21. The pipeline transports oil from the Safir oil fields to the Ras Isa export terminal on the Red Sea.
- During the second half of 2012 Iraq's 450,000 b/d Kirkuk-Ceyhan crude oil pipeline suffered a variety of setbacks due to sabotage and technical issues. The pipeline ships crude oil from northern Iraqi oil fields to the Turkish port of Ceyhan on the Mediterranean.
- It was widely held that Iran's production and export rate of crude oil suffered throughout 2012 due to international sanctions against the country. Although Iran disputed the

effectiveness of the sanctions, others believed Iranian export rates fell 20–30 percent, while oil production rates collapsed to 20-year lows. \

- An explosion hit a pipeline system delivering natural gas from Egypt to Israel and Jordan north of the Sinai Peninsula in Egypt on February 5. Before the pipeline was restarted a subsequent attack took place on April 9. On July 22, the pipeline was bombed again, which constituted the 15th attack on the pipeline since the uprising against President Hosni Mubarek began in 2011.
- Pirates captured an LNG tanker off the coast of Oman in June. The LNG Aries, a 126,750 cubic meter tanker, is managed by Japan's Mitsui O.S.K. Lines.
- On October 8 and again on October 19, explosions hit a natural gas pipeline that transports gas from Iran to Turkey, disrupting flows to Azerbaijan. To offset the loss in supply, operators requested an additional 18 million cubic meters per day (636 MMcf/d) be shipped on a separate pipeline.
- On eight separate occasions in 2012, militants in Yemen bombed a 38-inch natural gas pipeline that transports natural gas from Maarib to an LNG export facility at Balhaf on the Arabian Sea.

## 4.2 Infrastructure Projects

Major international infrastructure events reported in the EAD in 2012 mostly focused on the petroleum sector, primarily in the Middle East and Latin America. International stories about assets in Mexico and Canada include more incidents involving natural gas pipelines and processing plants, as well as LNG export projects. International stories about the electricity sector mostly involve the deployment of renewable generation and transmission projects in Canada.

### 4.2.1 Electricity

International stories reported in the EAD for electricity infrastructure largely surround North American projects. However, large international events that have major implications on safety and policy are tracked by the EAD like to the Fukushima Dai'ichi disaster in 2011 and the resulting actions in 2012.

#### 4.2.1.1 Japan

The Fukushima Dai'ichi nuclear power plant incident spawned a variety of investigations into the causes of the disaster, inspections and shutdowns of other nuclear plants, modifications and updates to help protect against future incidents, and a plan issued on September 14 for Japan to phase out nuclear power generation by 2040. The last nuclear reactor was shut May 5 for inspection. On June 16 the first nuclear reactors approved for restart were two Kansai Electric Power Co. reactors in Ohi town.

#### 4.2.1.2 Mexico

Sempra Energy and Terra-Gen Power, LLC developed wind generation projects in the United States and Mexico in 2012, including the Energia Sierra Juarez project in Baja California,

approved on March 22, which will sell 156 MW of wind generated power to San Diego Gas & Electric.

#### 4.2.1.3 Canada

In Canada, a variety of nuclear and natural gas power generation plans were announced in 2012.

- On May 2, Canada's natural resources minister approved Ontario Power Generation's (OPG) expansion plans at its Darlington nuclear power station near Toronto, a project that would add four new reactors producing a combined 4,800 MW of electricity. The project is still pending other governmental approvals.
- On October 26, TransAlta Corporation and MidAmerican Energy Holdings Company announced they were partnering to build an 800 MW natural gas-fired unit at TransAlta's 1,566-MW Sundance coal-fired plant in Alberta.
- TransCanada finalized plans to develop and operate a 900 MW natural gas-fired power plant at OPG's Lennox Generating Station near Napanee, Ontario on December 17.

Canada also saw a flurry of renewable projects proposed or completed in 2012, totaling over 300 MW in power generation.

- Q.CELLS North America finalized construction on May 30 of its 69 MW solar project in Ontario.
- OPG on September 12 announced it had begun converting its 211 MW coal-fired power plant in Atikokan, Ontario to operate instead on wood pellets made primarily from unused and underutilized species, non-marketable wood, and forest and sawmill residue.
- NextEra Energy Canada announced an affiliate had placed into service its 22.9 MW Conestogo Wind Energy Centre in Wellington County, Ontario on December 21.

A variety of transmission projects were underway in Alberta in 2012.

- Two north-south, 500-kV electricity transmission lines were approved on February 23 to carry power from coal-fired plants near Edmonton to Alberta's southern region.
- On May 8, the Alberta Utilities Commission (AUC) approved projects consisting of over 300 kilometers of transmission lines, six new substations and the alteration of three substations, five new 240-kV lines, six new 144-kV lines, and the alteration of 144-kV and 72-kV lines. The projects were proposed in response to expected increases in regional demand, and to help ensure 105 MW would be available for two TransCanada pump stations needed for its proposed Keystone XL oil pipeline.
- In Ontario on September 24, NextEra Energy Canada, Enbridge, and Borealis Infrastructure announced they had filed for regulatory approval to develop a new east-west 230-kV transmission tie that will span 400 kilometers.
- The AUC also approved ATCO Electric's plans to build a 500-kV direct-current transmission line from northeast of Edmonton to southeast Alberta on November 15.

## 4.2.2 Petroleum

The petroleum industry underwent a few notable changes in 2012. In March, Saudi Arabia's oil production surpassed that of Russia, making it the world's leading oil producer for the first time in 6 years. Meanwhile, the International Energy Agency predicted that the United States will become the world's leading oil producer by 2017 and a net exporter of natural gas by 2020.

### 4.2.2.1 Middle East

- Iraq placed two floating single-point mooring (SPM) platforms into service offshore Basra in 2012. Each SPM has an exporting capacity of 900,000 b/d, bringing the total export capacity from Southern Iraq to 3.5 MMb/d. The first loaded tanker sailed in March for delivery in North America and the second began operations on April 20.
- Iran announced plans to build a new oil terminal outside the Strait of Hormuz at Bandar Jask on the Gulf of Oman on May 21. The proposed export facility will have 20 million barrels of storage capacity and will connect to a proposed 1 MMb/d crude oil pipeline extending from Neka on the Caspian Sea.
- On June 21, the United Arab Emirates placed into service a pipeline designed to bypass the Strait of Hormuz, prompted by threats from Iran. The 360-kilometer (km), 48-inch Habshan-Fujairah Pipeline can transport 1.4 MMb/d of crude oil from the Habshan oil fields to the port of Fujairah on the Gulf of Oman. The project also involved offshore loading facilities and an 8 million-barrel storage terminal at Fujairah designed to process 1.5 MMb/d of crude oil throughput.
- Total, Petrochina, and Petronas on June 27 began production at Iraq's Halfaya oil field. Production rates reached 100,000 b/d on July 18 at the 16 billion-barrel oil field, and slated to increase to 600,000 b/d by 2016.
- Saudi Arabia reopened the 1.6 MMb/d Iraqi Pipeline in Saudi Arabia (IPSA), an old crude oil pipeline built by Iraq to bypass Persian Gulf shipping lanes on June 28. The IPSA will allow the Saudi government greater capacity to export more crude from Red Sea terminals if it's needed to bypass the Strait of Hormuz, a move that was also prompted in part by threats from Iran.
- Abu Dhabi opened a 400-km, 1.8 MMb/d pipeline on July 16 that connects onshore oil fields with a port on the Gulf of Oman.
- Iraq approved plans on September 19 to install pipelines in the Zubair oil field as part of an effort to increase production there from 270,000 b/d to 1.2 MMb/d by 2017. The pipelines will transport crude from oil wells to production facilities, and to carry oil exports from Zubair to a crude storage depot.
- On October 10, Oman announced it was considering building a 200 million-barrel crude oil storage facility outside the Strait of Hormuz on the Arabian Sea coast.
- On December 24, Iraq and Jordan announced plans to build a 1 MMb/d crude oil pipeline across Jordan to the Red Sea port of Aqaba.



#### 4.2.2.2 Russia/Asia

- Chevron announced on February 15 plans to move forward with a 250,000–300,000 b/d expansion at the Tengiz oil field in Kazakhstan.
- Nevskaya Pipeline Company opened an export terminal at the Baltic port of Ust-Luga in Russia on September 27. The export terminal has an annual capacity of 30 million tons (550,000 b/d), roughly 15 percent of Russia's annual oil exports.
- On December 25, Transneft commissioned the second phase of its 600,000 b/d East Siberia-Pacific Ocean pipeline, which delivers crude oil to the port of Kozmino in Russia. Crude oil is shipped from the port to markets in the United States, among other destinations.

#### 4.2.2.3 Latin America

- BP launched operations on February 3 to transport 100,000 b/d of crude oil westward on the Trans-Panama pipeline for export from the port of Charco Azul to U.S. West Coast refineries.
- Enbridge on March 13 announced it was conducting feasibility studies for a 200,000–400,000 b/d pipeline to transport crude oil produced in Colombia's Llanos Basin to the Pacific Coast. The company proposed five routes, each of which would stretch 800 kilometers through the Andes to ports Tumaco or Buenaventura.
- Valero Energy Corp. announced the imminent shutdown of the 235,000 b/d Aruba refinery on March 19, citing low margins. The refinery had exported petroleum products to the United States, among other places.
- In May, a Venezuelan official announced that a proposed Colombian-Venezuelan Pipeline was under consideration to transport 500,000 b/d of crude from the Orinoco Oil Belt and areas in Colombia to the Pacific Coast.

#### 4.2.2.4 Canada

- The Canada-Newfoundland and Labrador Offshore Petroleum Board approved ExxonMobil's plans to develop the Hebron oil field offshore Newfoundland on May 31. The 707 million-barrel field is expected to produce 150,000–180,000 b/d of heavy crude oil.

#### 4.2.2.5 Other Markets

- On January 23, Petroplus began shuttering its 220,000 b/d Coryton refinery in southeast England, citing poor margins.
- Total and Nexen announced the start of production from their 180,000 b/d Usan floating production platform offshore Nigeria on February 24. The project also includes 2 million barrels of storage.
- Buckeye Partners announced on May 4 plans to expand its Bahamas Oil Refining Company terminal in the Bahamas by adding 1.2 million barrels of storage by the third quarter 2013. The expansion is in addition to the 3.5 million-barrel Phase I expansion announced last year.

### 4.2.3 Natural Gas

The vast majority of international natural gas infrastructure projects reported in the EAD pertain to Canada and Mexico. Marine transport of natural gas is much more difficult and expensive than marine transport of crude oil, thus natural gas infrastructure outside North America is less relevant to U.S. supply.

#### 4.2.3.1 Mexico

- An LNG import terminal on Mexico's Pacific Coast at Manzanillo began operations on March 27.
- On October 22, Semptra International was awarded contracts for the construction of a 310-mile, 770 MMcf/d pipeline and a 200-mile, 510 MMcf/d pipeline that will interconnect to the U.S. interstate pipeline system in Arizona with Mexico's Northwestern states of Sonora and Sinaloa. TransCanada was awarded a contract to construct a 530-km, 670 MMcf/d pipeline from El Encino, Chihuahua to Topolobampo, Sinaloa on November 1.

#### 4.2.3.2 Canada

In Canada, a variety of pipeline and processing plant projects were announced or underway in 2012.

- KBR, Inc. announced on May 3 it was constructing a 200 MMcf/d natural gas processing plant in British Columbia.
- Spectra Energy opened the initial phase of its 200 MMcf/d Dawson Processing Plant in Bessborough, British Columbia on July 13, while the second phase is slated for completion in early 2013.
- TransCanada and Shell Canada partnered on June 5 to develop a 1.7 Bcf/d natural gas pipeline to transport gas from the Montney Shale to the LNG Canada export facility near Kitimat, British Columbia.
- Spectra Energy announced a 50-50 joint venture with BG Group to develop a 4.2 Bcf/d natural gas transportation system that would extend from northeast British Columbia to BG Group's proposed LNG export facility in Prince Rupert, British Columbia on September 10.
- Enbridge announced on October 22 the indefinite deferral of its previously proposed 800 MMcf/d Cabin Gas Plant project in British Columbia.

The boom in North American shale gas production fueled interest in exporting natural gas to global markets. The EAD reported four Canadian LNG export projects in 2012.

- BC LNG's received an approved license on February 2 to export 1.8 million tonnes per annum (mpta), equivalent to 229 MMcf/d, of LNG from its site in Kitimat, which is expected to come online in 2013–2014.
- Shell, Korea Gas Corporation, Mitsubishi Corporation, and PetroChina Company Ltd. announced plans on May 15 to develop a gas liquefaction plant near Kitimat, British Columbia to store and export 12 mpta of LNG, equivalent to 1.5 Bcf/d.

- PETRONAS Carigali Canada Ltd. and Progress Energy Resources Corp. announced they were developing engineering plans for an LNG export facility on Lelu Island in British Columbia on December 4. The project will include two liquefaction plants with an initial capacity of about 7.6 mpta (967 MMcf/d).
- On December 24, Apache Corporation announced its agreement with Chevron Canada, Ltd. to develop an LNG plant in Kitimat, British Columbia. The plans call for two liquefaction trains, each with an expected capacity of about 750 MMcf/d.

#### **4.2.3.3 Other Markets**

Aside from infrastructure in North America, another project of interest is the Ras Laffan Gas-to-Liquids (GTL) facility in Qatar, which is co-owned by Qatar Petroleum and Royal Dutch Shell. The facility ramped up to full-scale operations in June, reaching a capacity to convert 1.6 Bcf/d of natural gas into 140,000 b/d of GTL products (gasoil, kerosene, base oils naphtha, and normal paraffins) and 120,000 b/d of natural gas liquids and ethane.

## Appendix A. Criteria for EAD Story Selection

Asset or Sector Activity	Type of Event or Disruption	Criteria by Story Category <sup>1</sup>	
		Major Development	EAD Story
End-Use	Power Outage/ Restoration	≥ 250,000 customers	25,000–249,999 customers
Power Plant	Shut Down/ Restart/ New Capacity	Depends on impact; typically > 2,000 MW	100–1,999 MW
Transmission Line	Shut Down/ Restart/ New Capacity	Depends on impact; typically > 500-kV	115–500-kV
Substation	Break-in Damage/ Shutdown	---	Copper theft or severe impact
Refinery	Shut Down, Restart, Flaring, New Capacity	≥ 200,000 b/d	< 200,000 b/d
Production or Transportation <sup>2</sup>	Shut Down, Restart, Flaring, New Capacity	U.S./Canada: ≥ 200,000 b/d Foreign: Depends on impact <sup>3</sup>	U.S./Canada: 10,000–199,999 b/d Foreign: ≥ 25,000 b/d <sup>3</sup>
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 <sup>2</sup>	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. Major Events 2012

Date	Incident/ Weather Type	Incident	Impact
1/9/2012 – 12/31/12	Equipment Failure	San Onofre Nuclear Generating Station shutdown	Tube degradation issues at SCE's 2,150 MW San Onofre nuclear plant in California kept both units shut from January through the end of the year. Unit 2 was shut on January 9, and Unit 3 was shut on January 31. The unexpected shutdown forced SCE to develop contingency plans to meet demand during the summer.
1/20/12	Winter Storm	Outages Pacific Northwest	Peak outages at 278,755 customers, in Oregon and Washington.
2/16/2012 – 2/17/2012	Fuel Spill/Leak	Enbridge shuts Line 1 and Line 5 pipelines	Enbridge shut two pipelines after a leak was discovered in Michigan: its 237,000 b/d Line 1, which runs from Edmonton, Alberta to Superior, Wisconsin, and its 500,000 b/d Line 5, which runs from Superior to Sarnia, Ontario.
2/17/2012 – 5/29/2012	Fire	BP shuts Cherry Point refinery	BP shut its 225,000 b/d Cherry Point refinery in Washington after a fire shut the CDU. The refinery remained offline for several months, affecting wholesale gasoline prices in the short-term.
3/5/2012	Tornado	Outages U.S. Southeast and Midwest	Peak outages at 501,609 customers, from Alabama to Michigan.
6/9/2012 – 12/31/2012	Equipment Failure	Motiva Enterprises shuts CDU at its Port Arthur refinery	Motiva Enterprises shut a newly commissioned 325,000 b/d CDU at its Port Arthur, Texas refinery after operators discovered severe corrosion due to a caustic leak in the vessel. The unit remained offline for the rest of 2012.
6/25/2012 – 6/28/2012	Tropical Storm Debby	Oil and gas curtailments Gulf of Mexico	Tropical Storm Debby shut-in over 600,000 b/d of oil production and 1.56 Bcf/day of gas production in the Gulf of Mexico.
6/29/2012	Derecho Storm	Outages Ohio Valley, Mid-Atlantic	Peak outages of 4.23 million customers, across the Ohio Valley and Mid-Atlantic regions.
7/5/2012	Wind Storm	Outages Michigan	Peak outages at 383,300 customers, in Michigan.
7/19/2012	Thunderstorm	Outages U.S. Midwest and Northeast	Peak outages at 401,586 customers, across the U.S. Midwest and Northeast.
7/24/2012	Thunderstorm	Outages U.S. Midwest	Peak outages at 312,000 customers, in Illinois and Wisconsin.

Date	Incident/ Weather Type	Incident	Impact
7/27/2012	Wind Storm	Outages U.S. Midwest, Mid-Atlantic, and Northeast	Peak outages at 528,908 customers, from the U.S. Midwest to the Northeast.
8/6/2012	Other Storm	Outages U.S. Midwest	Peak outages at 321,000 customers, in Illinois, Indiana, and Michigan.
8/28/2012 – 9/4/2012	Hurricane Isaac	Outages, oil and gas curtailments Gulf of Mexico	<p>Peak outages: 1.05 million across the U.S. Gulf Coast.</p> <p>Power plant outages: Entergy shut its 1,075 MW Waterford nuclear Unit 3 in Louisiana by August 28 as a precaution in advance of the storm. The facility did not sustain damage during the storm and was restarted by September 3.</p> <p>Petroleum curtailment: 1,310,801 b/d of oil production shut-in.</p> <p>Gas curtailment: 3.2 Bcf/day shut-in.</p> <p>Processing Plants: 20 shut</p>
9/10/2012	Thunderstorm	Outages U.S. Northeast and Mid-Atlantic	Peak outages at 301,509 customers, across multiple states in the U.S. Northeast and Mid-Atlantic regions.
9/19/2012	Other Storm	Outages U.S. Northeast and Mid-Atlantic	Peak outages at 314,815 customers, across multiple states in the U.S. Northeast and Mid-Atlantic regions.
10/29/2012 – 11/7/2012	Hurricane Sandy/ Nor'easter	Outages, pipelines, terminals, U.S. Northeast	<p>Peak outages: 8.66 million across the U.S. Northeast.</p> <p>Petroleum: Colonial Pipeline's products Line 3 (NC to NJ) shut; Buckeye Pipeline's products pipeline in NY and NJ shut; at least 57 terminals along the East Coast were partially or completely closed by the storm.</p>

<b>Date</b>	<b>Incident/ Weather Type</b>	<b>Incident</b>	<b>Impact</b>
11/14/2012 – 11/15/2012	Power Failure/Ice	Keystone pipeline curtailment, force majeure	Power supply restrictions forced TransCanada to reduce rates at its 591,000 b/d Keystone pipeline. Force majeure was declared for some shipments on the pipeline. The pipeline travels from Alberta to Illinois and from Nebraska to Oklahoma.
11/16/2012 – 11/30/2012	Equipment Failure	Enbridge curtails Line 4 and Line 67	Enbridge reduced flows on its 796,000 b/d Line 4 and 450,000 b/d Line 67 by 18 percent during the second half of November due to unplanned maintenance. Both lines travel from Alberta to Wisconsin, though starting at different points in Alberta.
12/3/2012	Wind Storm	Outages California	Peak outages at 337,547 customers, in California.
12/20/2012	Winter Storm	Outages U.S. South and Southeast	Peak outages at 469,568 customers, across the U.S. South and Southeast.
12/21/2012	Winter Storm	Outages U.S. South to New England	Peak outages at 537,799 customers, from the U.S. South to New England.
12/26/2012	Winter Storm	Outages U.S. South to New England	Peak outages at 456,397 customers, from the U.S. South to New England.

## Appendix C. Petroleum Infrastructure Projects

### Crude Oil Pipeline Projects

Project	Project Type	Company	Origin	Destination	Capacity (Thousand b/d)	Operational Date
Sand Hills Pipeline (NGL)	New Construction	DCP Midstream	West Texas	Gulf Coast	Initial: 200 Final: 350	Initial: In operation Final: Q2 2013
Paline Pipeline	Reversal	Delek	Longview, TX	Nederland, TX	36	In operation
Crude Oil Pipeline	New Construction	Enbridge	Tioga, ND	Watford, ND	60	Q4 2013
Sanish Crude Oil Pipeline	Expansion	Enbridge	Johnson's Corner, ND	Beaver Lodge, ND	67	2013
Flanagan South Crude Oil Pipeline	Expansion	Enbridge	Flanagan, IL	Cushing, OK	Initial: 585 Final: 800	Q2/Q3 2014
Alberta Clipper Pipeline (Line 67)	Expansion	Enbridge	Neche, ND	Superior, WI	570	Q2/Q3 2014
Southern Access Pipeline (Line 61)	Expansion	Enbridge	Superior, WI	Pontiac, IL	560	Q2/Q3 2014
Spearhead North Pipeline (Line 62)	Expansion	Enbridge	Flanagan, IL	Griffith, ID	235	2013/2014
Line 6B	Replacement, Expansion	Enbridge	Griffith, ID	Marysville, MI	500	Q4 2013
Edmonton-to-Hardisty Crude Oil Mainline	Expansion	Enbridge	Edmonton, Alberta	Hardisty, Alberta	800	Q2/Q3 2015
Northern Gateway Pipeline	New Construction	Enbridge	Bruderheim, Alberta	Kitimat, British Columbia	Crude: 525 Condensate: 193	Pending approval
West Texas Gateway NGL Pipeline	New Construction	Energy Transfer Partners, Regency Energy Partners	Winkler County, TX	Jackson County, TX	209	In operation
Front Range NGL Pipeline	New Construction	Enterprise, Anadarko, DCP Midstream	Weld County, CO	Skellytown, TX	Initial: 150 Final: 230	Q4 2013
Seaway Crude Pipeline	Reversal	Enterprise, Enbridge	Cushing, OK	Freeport, TX	Initial: 150 Final: 400 Expansion: 850	Initial: In operation Full: Q1 2013



Project	Project Type	Company	Origin	Destination	Capacity (Thousand b/d)	Operational Date
ECHO Terminal to Port Arthur/Beaumont Crude Oil Pipeline	New Construction	Enterprise, Enbridge	Harris County, TX	Beaumont/Port Arthur, TX	400	2014
Texas Express Pipeline (NGL)	New Construction	Enterprise, Enbridge, Anadarko	Skellytown, TX	Mont Belvieu, TX	232	Q2 2013
SEKCO Crude Oil Gathering Pipeline	New Construction	Enterprise, Genesis Energy	Lucius, Keathley Canyon	South Marsh Island, Gulf of Mexico	115	Mid-2012
Pecos Crossing Crude Oil Pipeline	New Pipeline	Hoover Energy Partners	Ward and Reeves County, TX	Pecos, TX	120	In operation
Trans Mountain Crude Oil Pipeline	Expansion	Kinder Morgan	Edmonton, Alberta	Vancouver, British Columbia	550	2017
KMCC Crude Oil Pipeline	New Construction, Conversion	Kinder Morgan	Eagle Ford, TX	Houston, TX	300	In operation
El Paso Natural Gas Pipeline	Conversion	Kinder Morgan	Permian Basin	Southern California	400	Uncertain
Longhorn Crude Oil Pipeline	Reversal, Conversion	Magellan Midstream	Crane, TX	Houston, TX	Initial: 135 Final: 235	Initial: Q1 2013 Full: Q2/Q3 2013
BridgeTex Crude Oil Pipeline	New Construction, Conversion	Magellan Midstream, Occidental Petroleum	Colorado City, TX	Texas City, TX	278	Q2/Q3 2014
Bakken NGL Pipeline	New Construction	ONEOK Partners, Overland Pass	Williston Basin, CO	Northern Colorado	Initial: 60 Expansion: 110	Initial: Q1 2013 Expansion: Q3 2014
Great Salt Plains Crude Oil Pipeline	New Construction	Parnon Gathering	Cherokee, OK	Cushing, OK	Initial: 20 Final: 35	In operation
Eagle Ford Crude Oil Pipeline Project	New Construction	Plain All American, Enterprise	Gardendale, AL	Corpus Christi, TX	350	Q4 2012/Q1 2013
Mississippian Lime Crude Oil Pipeline	New Construction	Plains All American	Alva, OK	Cushing, OK	175	Q2 2013
Basin Pipeline Crude Oil System	Expansion	Plains All American	Colorado City, TX	Cushing, OK	450	In operation
High Prairie Pipeline	New Construction	Saddle Butte	Alexander, ND	Clearbrook, MN	150	Q3/Q4 2013
White Cliffs Crude Oil Pipeline	Expansion	Semgroup Corp.	Platteville, CO	Cushing, OK	150	Q1/Q2 2014

Project	Project Type	Company	Origin	Destination	Capacity (Thousand b/d)	Operational Date
Glass Mountain Crude Oil Pipeline	New Construction	SemGroup Corp., Gavilion Midstream Energy, Chesapeake Energy	Alva, ND Arnett, ND	Cushing, OK	Initial: 140 Final: 180	Q3 2013
Ho-Ho Crude Oil Project	Reversal	Shell	Houma, LA	St. James, LA	300	Q1 2013
Permian Express Project	Reversal	Sunoco	Wichita Falls, TX	Nederland, TX	Phase 1: 90 Phase 2: 150	Phase 1: Q1 2013 Phase 2: Q3/Q4 2013
West Texas-Longview Crude Pipeline	New Construction	Sunoco Pipeline	Permian Basin, TX	Longview, TX	30	Q1 2013
West Texas-Houston Crude Pipeline	New Construction	Sunoco Pipeline	Permian Basin, TX	Houston, TX	40	In operation
West Texas-Nederland Crude Oil Pipeline	New Construction	Sunoco, West Texas Gulf Pipe Line Co., Mobil Pipeline Co.	West Texas	Nederland, TX	40	Q1 2013
Keystone XL Phase III	New Construction	TransCanada	Cushing, OK	Nederland, TX	830	Q2/Q3 2013
Keystone XL Phase IV	New Construction	TransCanada	Hardisty, Alberta	Steele City, NB	830	Pending approval
Grand Rapids Crude and Diluent Pipeline System	New Construction	TransCanada, Phoenix Energy	Fort McMurray, Alberta	Edmonton/Heartland region, Alberta	900 crude 330 diluent	2017

### Petroleum Products Pipeline Projects

Project	Project Type	Company	Origin	Destination	Capacity (Thousand b/d)	Operational Date
New Jersey to Pennsylvania Pipeline	Expansion	Buckeye	Linden, NJ	Macungie, PA	45	Q1 2013
Main Distillate Line	Expansion	Colonial Pipeline	Houston, TX	Greensboro, NC	75	In operation
Line 3	Expansion	Colonial Pipeline	Greensboro, NC	Linden, NJ	950	2014
Parkway Pipeline	New Construction	Kinder Morgan, Valero	Norco, LA	Collins, MS	Initial: 110 Full: 200	Q3 2013

Project	Project Type	Company	Origin	Destination	Capacity (Thousand b/d)	Operational Date
Cochin Pipeline	Reversal	Kinder Morgan	Windsor, Ontario	Fort Saskatchewan, Alberta	75	Q2 2014
Allegheny Access Pipeline	New Construction	Sunoco	Midwest	Eastern, OH Western PA	Initial: 85 Final: 110	Q1/Q2 2014

## Terminal Projects

Project	Company	Type of Project	Location	Storage Capacity (MMbbl)	Operational Date
ECHO Terminal	Enterprise	New Construction	Harris County, TX	Initial: 0.75 Final: 1.65	Initial: In operation Final: Q1 2014
St. Croix Refinery and Crude Terminal	Hovensa	Conversion to Terminal	St. Croix, US Virgin Islands	32	Uncertain
Trans Mountain Crude Pipeline Terminal	Kinder Morgan	Expansion	Edmonton, Alberta	Phase 1: 8.2 Phase 2: 9.4	Phase 1: Q1/Q2 2013 Phase 2: Q4 2014
Texas City Crude and Product Terminal	NuStar Energy	Expansion	Texas City, TX	2.8	In operation
Houston Crude Terminal	Oiltanking Partners	Expansion	Houston, TX	15.3	Q4 2013
St. James Bulk Liquids Storage Terminal	PetroPlex	New Construction	St. James, LA	10	2014
Yorktown Refinery and Crude/NGL Terminal	Plains All American	Conversion to Terminal	Yorktown, VA	6	Q1/Q2 2013
Eagle Point Products Storage Terminal	Sunoco	Expansion	Westville, NJ	5	In operation
Keystone Hardisty Crude Terminal	TransCanada	New Construction	Hardisty, Alberta	2.6	Q4 2014

## Rail Projects

Project	Company	Location	Loading/Unloading Capacity (Thousand b/d)	Operational Date
Crude Oil Loading Terminal	Arc Terminals	Mobile, AL	75	Q2 2013
Crude Oil Loading Terminal	Canadian National Railway, Tundra Energy Marketing Ltd.	Cromer, Manitoba	30	Q2 2013
Crude Oil Loading Terminal	Canadian Pacific	Lloydminster, Saskatchewan	Unspecified	In operation
Berthold Rail Crude Oil Export Terminal Expansion	Enbridge	Berthold, ND	120	Q1 2013
Crude Oil Unloading Terminal	Genesis Energy	Walnut Hill, FL	75	In operation
Hardisty Terminal Crude-to-Rail	Gibson Energy	Hardisty, Alberta	Unspecified	Unspecified
Crude Oil Loading Terminal	Mercuria Energy	Hutchinson County, TX	Unspecified	Unspecified
Crude Oil Loading Terminal	Musket Corporation	Windsor, CO	16	N/A
Dore Crude-by-Rail Terminal	Musket Corporation	Dore, ND	60	In operation
Pecos Valley Producer	Pecos Valley Producer Services	Pecos, TX	Unspecified	In operation
Yorktown Crude/NGL Terminal	Plains All American	Yorktown, VA	130	Q3 2013
Tampa Crude Oil Loading Terminal	Plains All American	Tampa, CO	68	Q3 2013
Crude Oil Loading Terminal Expansion	Rangeland Energy	Williams County, ND	120	In operation
Van Hook Crude Oil Loading Terminal	U.S. Development Group	Van Hook, ND	35	In operation
St. James Crude Oil Loading Terminal Expansion	U.S. Development Group	St. James, LA	130	In operation

## Appendix D. Abbreviations

AUC	Alberta Utilities Commission
b/d	Barrels per day
bbl	Barrel
Bcf	Billion cubic feet
Btu	British thermal units
CAISO	California Independent System Operator
CDU	Crude Distillation Unit
CPUC	California Public Utilities Commission
CAIR	Clean Air Interstate Rule
COLT	Crude Oil Loading Terminal
CSAPR	Cross-State Air Pollution Rule
DHS	Department of Homeland Security
DOE	Department of Energy
E15	15 percent ethanol-blended gasoline
EAD	Energy Assurance Daily
EISA	Energy Independence and Security Act
EMP	Electromagnetic pulse
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
FPL	Florida Power & Light
FTA	Free Trade Agreement
GTL	Gas-to-liquids
GW	Gigawatt
Ho-Ho	Houston-to-Houma
HOS	Hours-of-service

ICS-CERT	Industrial Control Systems Cyber Emergency Response Team
ISER	Infrastructure Security and Energy Restoration
KLM	Kettleman-Los Medanos
km	Kilometer
kV	Kilovolts
LNG	Liquefied natural gas
LOOP	Louisiana Offshore Oil Port
MATS	Mercury and Air Toxics Standards
MMBtu	Million British thermal units
MMcf	Million cubic feet
MMgal/year	Million gallons per year
mph	Miles per hour
mtpa	Million tonnes per annum
MW	Megawatts
NGPL	Natural Gas Pipeline Company of America
NJNG	New Jersey Natural Gas
NRC	Nuclear Regulatory Commission
OE	Office of Electricity Delivery and Energy Reliability
OEIS	Office of Energy Infrastructure Security
OPG	Ontario Power Group
PADD	Petroleum Administration for Defense District
PG&E	Public Gas & Electric
PTC	Production Tax Credit
REG	Renewable Energy Group
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric

SPM	Single-point mooring
TCEQ	Texas Commission on Environmental Quality
TVA	Tennessee Valley Authority
ULSD	Ultra-low sulfur diesel
WTI	West Texas Intermediate
YIR	Year-in-Review