SUPPLEMENTAL TESTIMONY

FROM

U.S. ENERGY INFORMATION ADMINISTRATION (EIA)

U.S. DEPARTMENT OF ENERGY

STATEMENT OF JOHN J. CONTI

EIA ACTING ADMINISTRATOR

FOR THE

COMMITTEE ON ENERGY AND COMMERCE

SUBCOMMITTEE ON ENERGY AND POWER

UNITED STATES HOUSE OF REPRESENTATIVES

NOVEMBER 2, 2017

Chairman Upton, Ranking Member Rush, and members of the committee, thank you for the opportunity to submit this testimony for the Committee record.

The U.S. Energy Information Administration (EIA) is the statistical and analytical agency within the U.S. Department of Energy (DOE). EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. By law, EIA's data, analyses, and forecasts are independent of approval by any other officer or employee of the U.S. Government, so the views expressed herein should not be construed as representing those of the DOE or any other Federal agency.

EIA is often called upon to provide information on energy supplies and markets during periods of severe weather events and other circumstances (such as major outages) that impede delivery of energy services. During an emergency situation with (potential) energy-system damage, EIA's expertise with industry supply chains, markets and infrastructure can provide context and relevance useful for national, regional, and state responses.

The Infrastructure Security and Energy Restoration[1] (ISER) Division of the DOE's Office of Electricity Delivery and Energy Reliability[2] (OE), in particular, relies on EIA experts for their knowledge of the oil and natural gas supply chains, sensitivity to business proprietary and confidential company data, and understanding of regional and local supply markets. An EIA electricity expert is currently deployed to Puerto Rico to assist with technical issues related to the restoration of electricity service there. In addition, EIA has 11 employees who volunteer under ISER on the Federal Emergency Management

[1] http://www.oe.energy.gov/our_organization/iser.htm
[2] https://powerpedia.energy.gov/wiki/Office_of_Electricity_Delivery_and_Energy_Reliability

Administration's (FEMA) Emergency Support Function #12 (Energy), and several have deployed to FEMA's National Readiness Coordination Center and Regional Readiness Coordination Centers.

EIA partners with DOE in emergency energy restoration

EIA has a number of products and reports that track and notify policymakers, industry, and the public of potential, active, and recent energy disruptions. EIA also provides information related to energy emergencies and events such as the hurricanes this year (as well as several other hurricanes going back to Superstorm Sandy in 2012 and before), wildfires, other weather conditions (i.e., floods, or extreme heat or cold), and infrastructure or facility failures (such as the natural gas storage failure at Aliso Canyon in Southern California) (**Exhibit A**).

EIA has an Energy Disruptions page that tracks and reports on significant storms that affect or could affect energy infrastructure. This system includes a real-time feed from the National Oceanic and Atmospheric Administration (NOAA) of severe weather or natural disasters—hurricanes, floods, fires—overlaid on EIA's national energy infrastructure mapping system **(Exhibit B)**. **Exhibit C** (the final update for Hurricane Nate in October 2017) is an example of the kind of information EIA provides to ISER. EIA also provides information for daily updates to the DOE emergency situation reports[3] and coordinates closely with other offices in DOE that work on emergency responses.

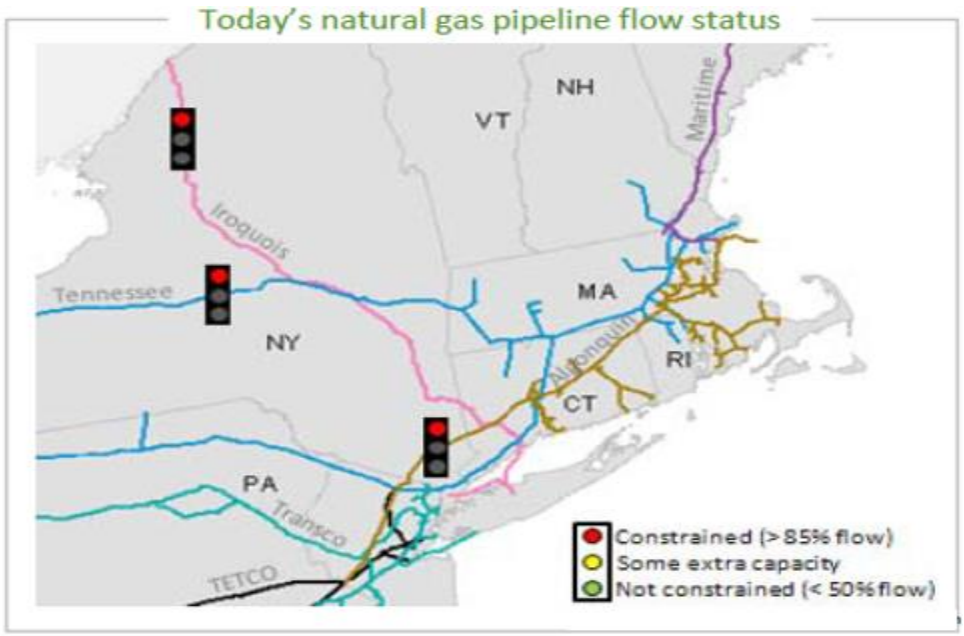
EIA tracks market conditions in times of energy emergencies

Regular reports and features on EIA's website provide indicators of significant changes in market conditions that could indicate stressors on the system. To provide timely information on the energy infrastructure dependencies and market conditions, EIA develops and maintains current information on the energy infrastructure and market workings of the domestic energy systems – electricity, refining,

[3] https://energy.gov/oe/downloads/hurricanes-nate-maria-irma-and-harvey-situation-reports

natural and liquid fuels pipelines, and transportation fuels distribution. For example, during the winter of 2013–14, when natural gas pipeline constraints into New England dramatically affected electricity prices, an EIA daily report on market conditions[4] was posted that allowed the public and policymakers to follow and understand the conditions driving the market.

Figure 1. Northeastern Natural Gas Pipeline Flow Status



Source: U.S. Energy information Administration, Energy Markey Alert, January 9, 2014[4]

Another example is the EIA's Southern California Daily Energy Report[5], which was developed to monitor the effects of the closure of the Aliso Canyon storage facility in Southern California that followed methane leaks. This report is updated daily.

EIA maintains a broad range of regular data series, tools, reports, and analyses that can be used, as needed, to respond to national energy emergencies

[4] https://www.eia.gov/special/alert/east_coast/
[5] https://www.eia.gov/special/disruptions/socal/summer/

EIA's analyses of energy markets require a detailed understanding of the infrastructure and commercial arrangements underpinning energy production, product flows and market transactions -- both wholesale and retail. When disruptions to the energy systems arise, EIA relies on this background knowledge to inform ISER, energy markets, and the public. As described in more detail below, gathering this information includes monitoring the electric grid on a near real-time basis, updating infrastructure and commercial networks in the refined petroleum products sector and tracking weather trends to name a few activities. One timely example is EIA's participation in the National Association of State Energy Officials (NASEO) winter fuels outlook workshop, and the launch of the EIA Winter Fuels page for 2017-18[6] with updates on heating fuels stocks.

EIA's **U.S. Electric System Operating Data**[7] reflect hourly grid operations by balancing authority updated every 60 minutes with a 70-minute delay. The data are transmitted directly from the Regional Transmission Operators (RTOs), Independent System Operators (ISOs), and individual balancing authorities to a single platform available on EIA's website. The EIA-930 survey form[8] on EIA's website provides more detailed information on the data feed. This system allows EIA to see outages in nearly real time. In **Exhibit D**, the hourly electricity data are used in an animated map[9] to show the recovery of the electric grid in Florida after Hurricane Irma.

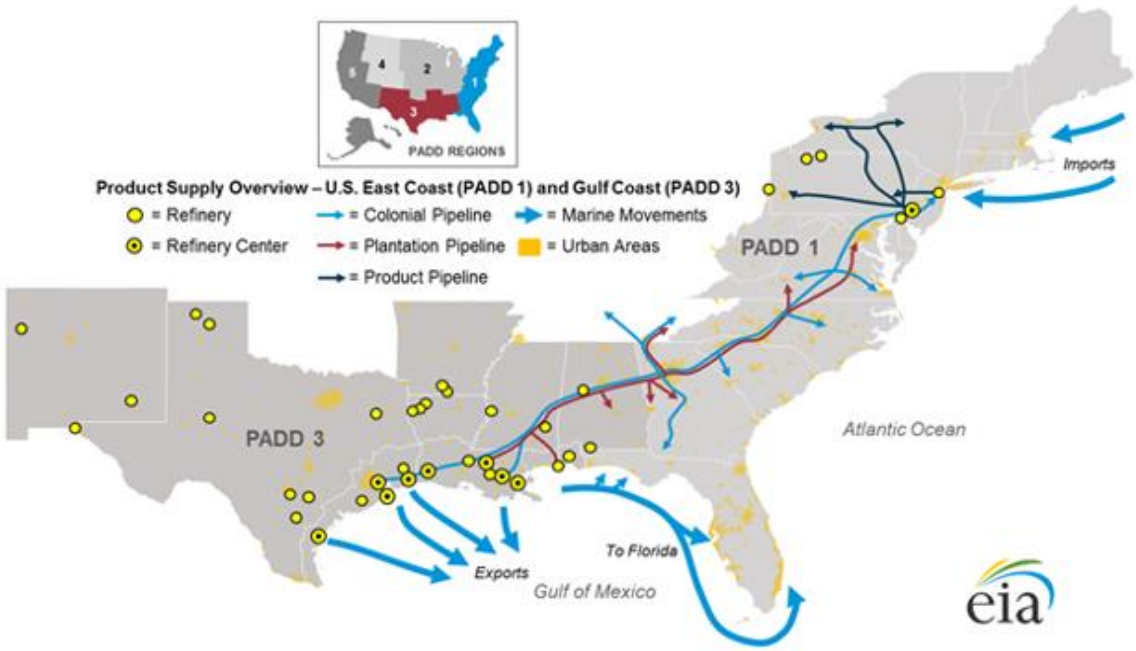
Transportation Fuels Network studies were done in 2016 to update EIA's working information on regional markets, including infrastructure maps, supply/demand balances, refineries, supply and logistics, supply vulnerability, fuel specifications, and the retail market structure for consumption and distribution of transportation fuels by region (Petroleum Administration for Defense Districts (PADDs))

[6] https://www.eia.gov/special/heatingfuels/
[7] https://www.eia.gov/beta/realtime_grid
[8] https://www.eia.gov/survey/#eia-930
[9] https://www.eia.gov/todayinenergy/detail.php?id=32992

of the United States. For these studies, transportation fuels include gasoline, diesel fuel, and jet fuel. Using the information from these studies, EIA can support emergency response activities by identifying the extent of affected parts of the fuel chain to consider alternative routing and/or supply sources.

The Gulf Coast (PADD 3) largely supplies refined petroleum products to the East Coast (PADD1), so that study combines those two independent regions, which are both displayed in **Figure 1**. The East Coast region includes states from Maine to Florida along the U.S. Atlantic Coast. The Gulf Coast region comprises states between New Mexico in the west to Alabama in the east along the Gulf of Mexico. The information in these reports help analysts understand quickly which parts of the infrastructure or supply chain may be affected during an emergency or outage. The regional analysis of the distribution network enables EIA to inform responders how fuels can be procured, produced, and delivered to subregional markets or what alternate facilities or use of alternate transportation means, such as trucks or ships may be available when pipelines are out of service.

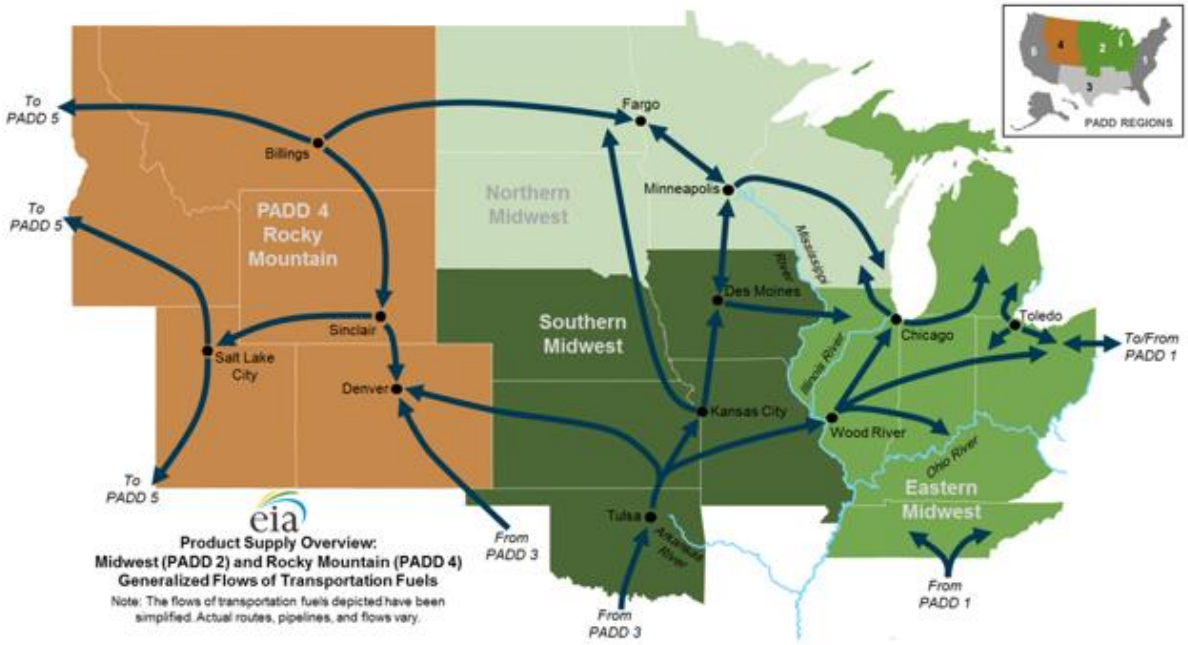
Figure 1. East Coast and Gulf Coast (PADDS 1 and 3) networks



Source: U.S. Energy Information Administration, East Coast and Gulf Coast Transportation Fuels Markets[10]

The Midwest (PADD2) and the Rocky Mountains (PADD4) regions have many bi-directional supply interconnections

Figure 2. Midwest and Rocky Mountains (PADDS 2 and 4)



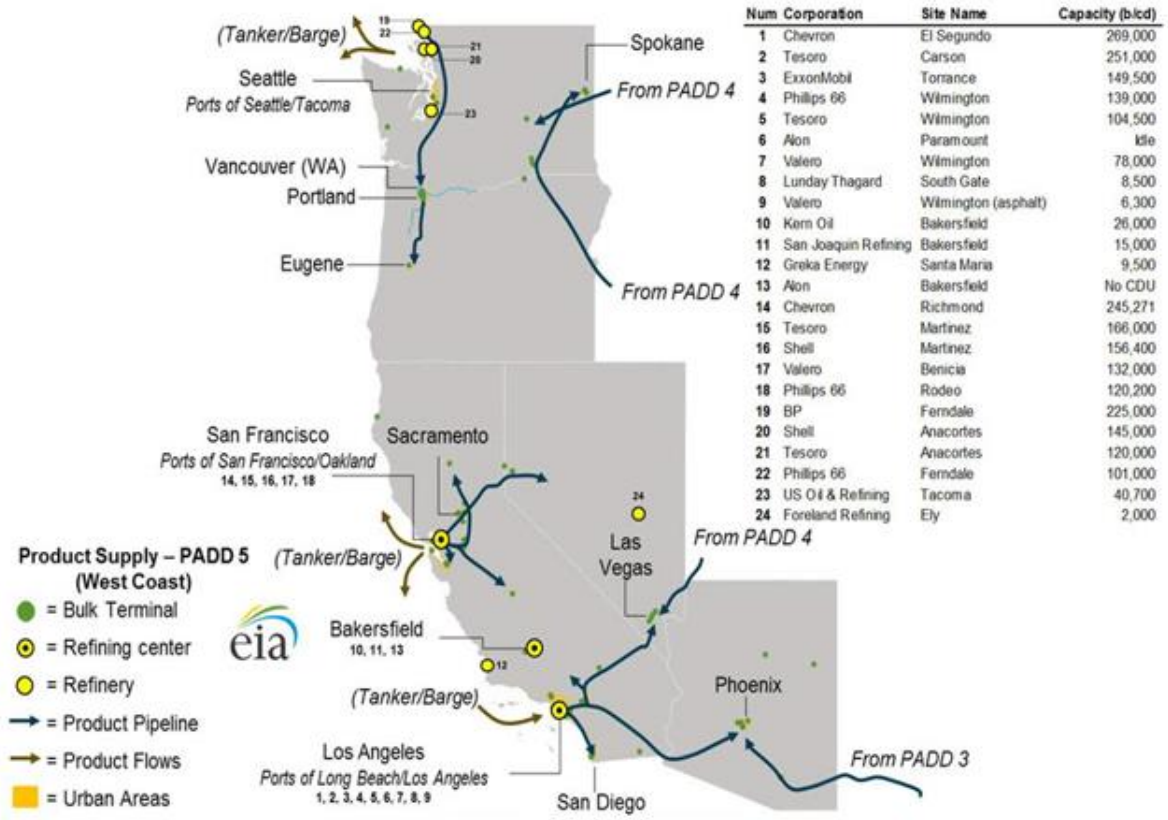
[10] https://www.eia.gov/analysis/transportationfuels/padd1n3/

Source: U.S. Energy Information Administration, Midwest and Rocky Mountain Transportation Fuels Markets[11]

The West Coast (PADD 5) includes Washington, Oregon and California, as well as Alaska and Hawaii. In addition to those refineries located in West Coast states, supplies are also shipped from the Rocky Mountains (PADD 4) and from sources in the Gulf Coast and New Mexico (PADD 3).

[11] https://www.eia.gov/analysis/transportationfuels/padd2n4/

Figure 3. West Coast networks (PADD 5)



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

Source: U.S. Energy Information Administration, West Coast Transportation Fuels Markets[12]

EIA's Winter Heating Fuels report, as part of the October Short Term Energy Outlook (STEO), provides detailed information on outlooks for natural gas, heating oil and propane stocks and prices for October through March. A national map with the real-time NOAA weather feed for the coming week and winter months is also accessible on the webpage. EIA co-funds the states' collection of retail prices for heating fuels. Those prices are updated weekly to provide timely, state specific market information to consumers, state officials, and industry over the course of the winter. A detailed update on propane is also posted weekly.[13]

[12] https://www.eia.gov/analysis/transportationfuels/padd5/
[13] https://www.eia.gov/special/heatingfuels/

EIA provides analysis on disruption-related topics

Analyses in *Today in Energy*, *This Week in Petroleum*, and the *Natural Gas Weekly Update* also provide detailed analysis of disruption events after the fact. The last page of **Exhibit A** includes relevant titles of recent analyses in these publications.

Today in Energy[14] **(TIE)** provides summaries published on EIA's homepage during and after severe disruptions. The price tab on the TIE page features daily updates on wholesale spot prices for crude oil, gasoline, heating oil, low sulfur diesel, and propane and on regional spot prices for electricity and natural gas.

Gasoline and Diesel Fuel Update[15] features weekly reports of on-road retail prices of these two fuels by PADD and selected states and cities.

Weekly Petroleum Status Report[16] **(WPSR)** includes data for crude oil and refined products stocks, refinery inputs, imports and exports, and spot and futures prices.

This Week in Petroleum[17] analyzes a current issue in the sector and provides detailed market information on crude oil and refined products (including gasoline, distillate, and propane). (**Exhibit E)**

Natural Gas Weekly Update[18] provides weekly information on natural gas and liquid natural gas such as wholesale and retail prices, shipments, imports and exports, injections, and supply levels.

Weekly Natural Gas Storage Report[19] **(WNGSR)** tracks U.S. natural gas inventories held in underground storage facilities by region. This report is classified as Principle Economic Indicators by the Department of Commerce.

Thank you for the opportunity to provide this information to the Committee.

[14] https://www.eia.gov/todayinenergy
[15] https://www.eia.gov/petroleum/gasdiesel/
[16] https://www.eia.gov/petroleum/supply/weekly/
[17] https://www.eia.gov/petroleum/weekly/
[18] https://www.eia.gov/naturalgas/weekly/
[19] http://ir.eia.gov/ngs/ngs.html

Exhibit A

EIA's coverage of recent hurricanes

For

The Committee on Energy and Commerce, Subcommittee on Energy and Power

United States House of Representatives

November 2, 2017 | Washington, D.C.

By

John J. Conti, Acting Administrator

EIA is committed to reporting information during emergencies, using multiple sources

- Publications
  - Today in Energy
  - This Week in Petroleum
  - Natural Gas Weekly Update
  - Southern California Daily Energy Report
- Emergency Surveys
  - Special daily version of the Motor Gasoline Price Survey (Form EIA-878) to track vehicle fuel supply conditions in the New York metropolitan area due to Hurricane Sandy
  - Hurricane Natural Gas Processing Plant Survey (Form EIA-757) – Schedule B: Emergency Status Report
- Special Studies
  - Ad hoc reporting to DOE's Infrastructure Security and Energy Restoration group
  - Regional transportation fuel analyses
- Disruption Analysis
  - Cold snaps
  - Heat waves
  - Storms/hurricanes

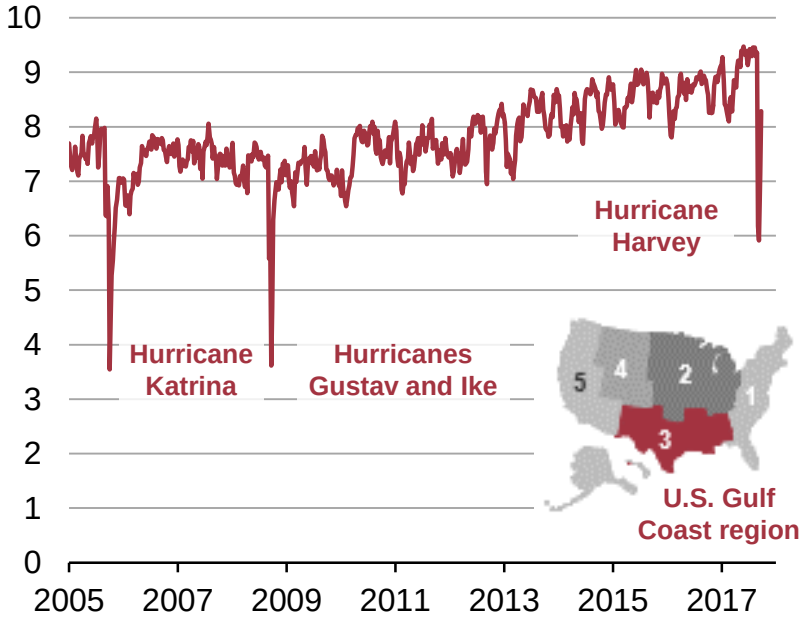
Source: U.S. Energy Information Administration

EIA uses surveys, real time collection, and third party data to deliver energy information

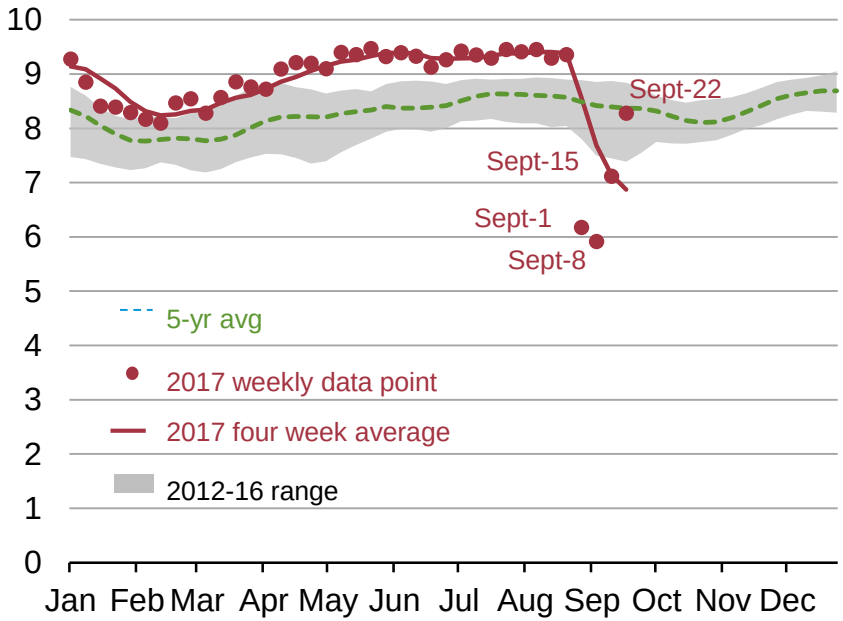
- Traditional data collection: gives us robust historical baselines, but at a maximum frequency of weekly
- Near real-time data collection provided electricity data to Federal emergency responders
- Third parties, including administrative data providers, provided critical data that supplemented EIA data
- EIA chose not to deploy emergency collection options in response to recent storms

Hurricane Harvey caused U.S. Gulf Coast refinery runs to drop

Gulf Coast (PADD 3) gross refinery inputs
million barrels per day



Gulf Coast (PADD 3) gross refinery inputs
million barrels per day

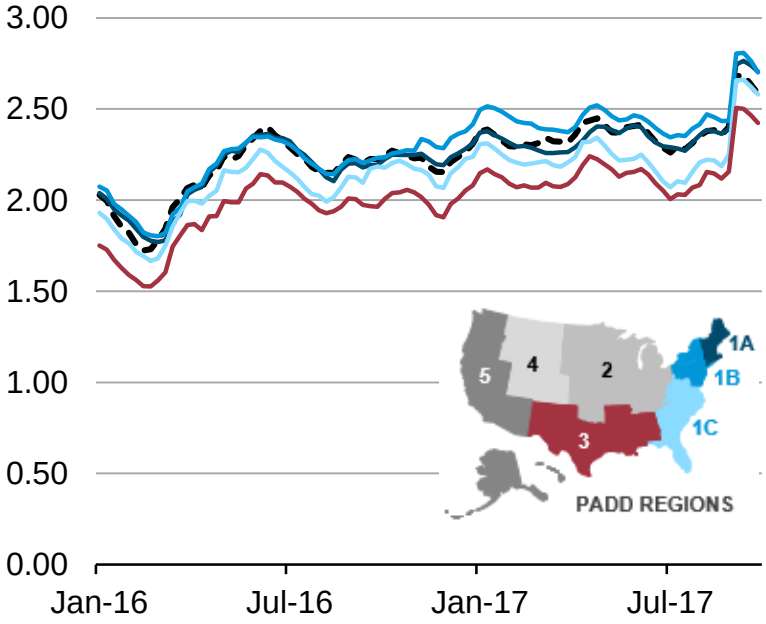


Source: EIA, Weekly Petroleum Status Report

Reduced refinery output contributed to higher gasoline prices and inventory draws, especially in the Southeast

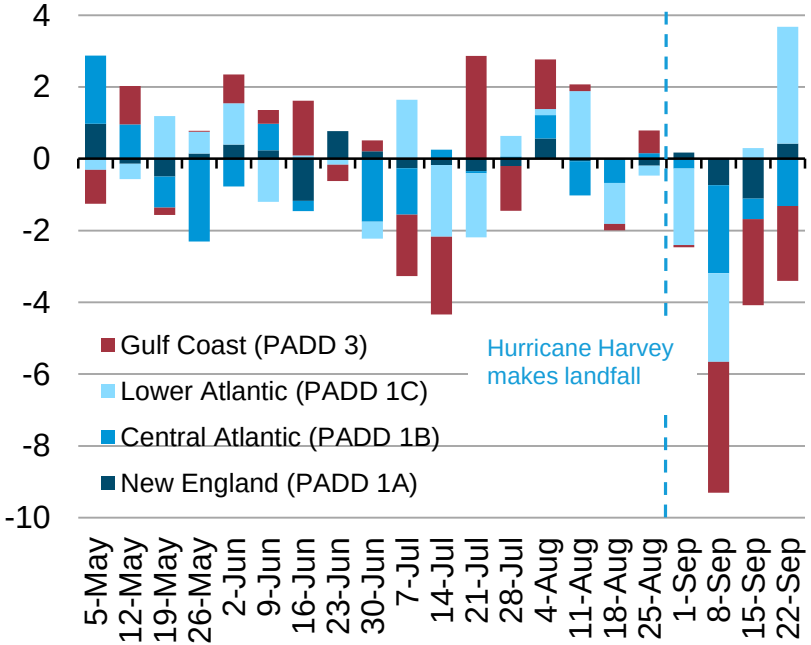
Weekly regular gasoline prices

dollars per gallon



Weekly change in total motor gasoline inventories

million barrels

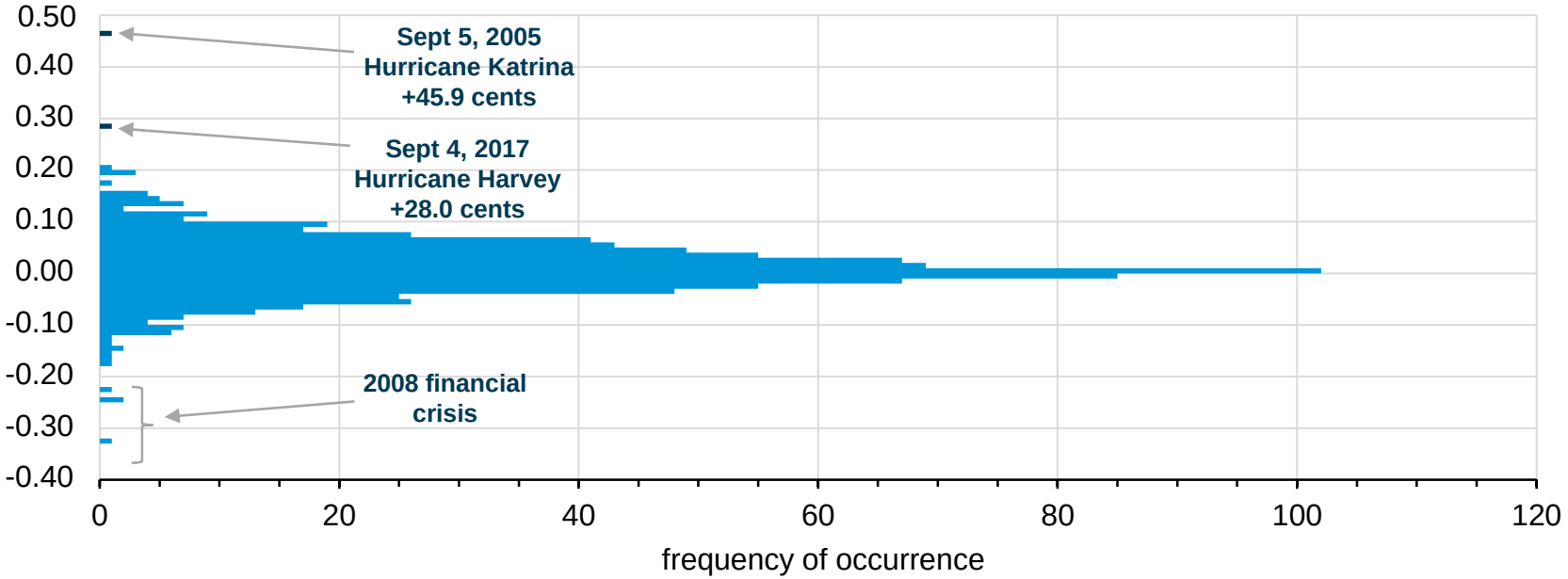


Source: EIA, Gasoline and Diesel Fuel Update and Weekly Petroleum Status Report

Hurricanes can contribute to much higher-than-normal weekly changes in gasoline prices

Weekly changes in U.S. average gasoline prices (Jun 5, 2000 - Sep 4, 2017)

frequency of occurrence (price changes in cents per gallon)



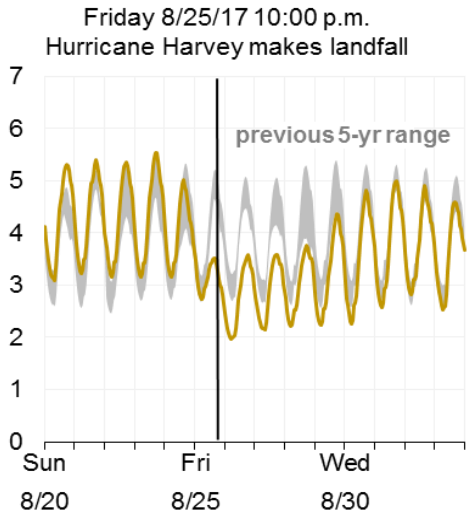
Source: EIA, Gasoline and Diesel Fuel Update

Hurricane Harvey caused significant electric system load losses

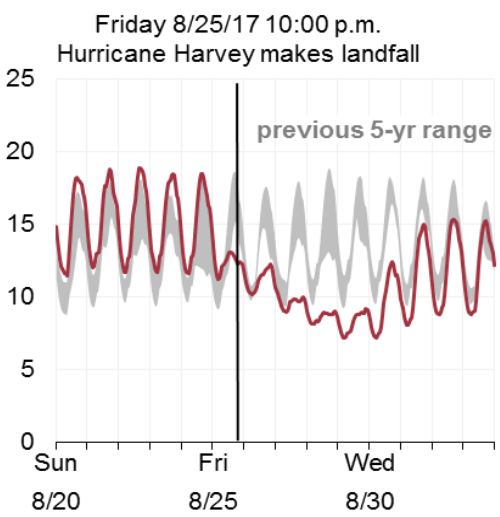
Hourly electricity load in ERCOT southern regions

thousand megawatts (MW)

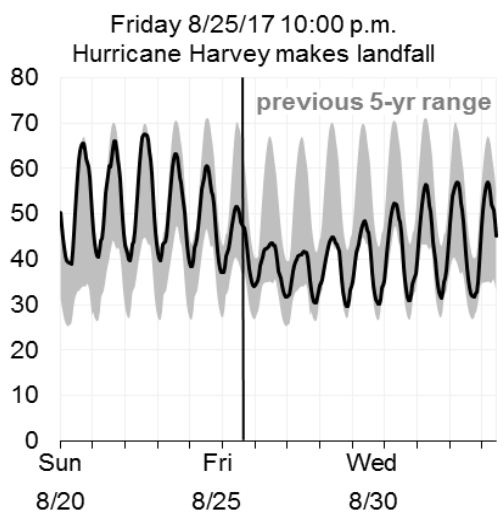
South region



Coastal region



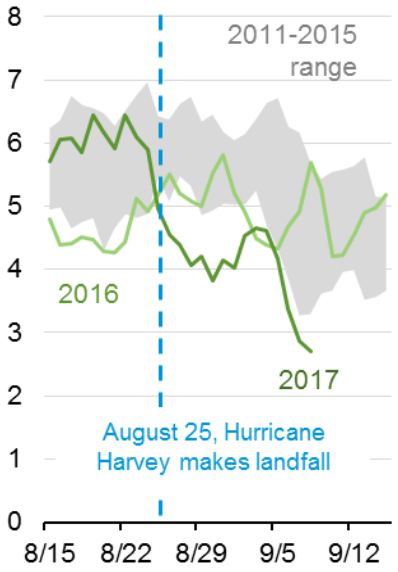
ERCOT total



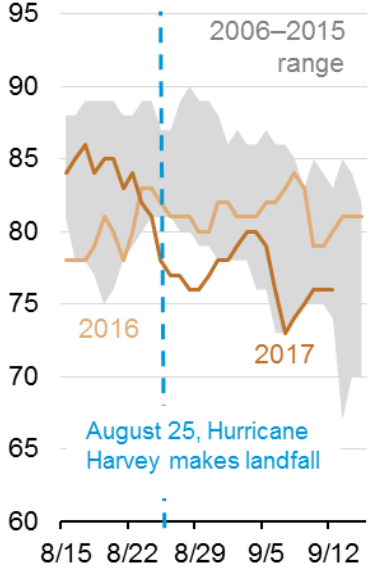
Sources: ERCOT data via Energy Velocity Service and EIA, Today in Energy, September 13, 2017

Hurricane Harvey resulted in lower natural gas demand and little change in spot natural gas prices

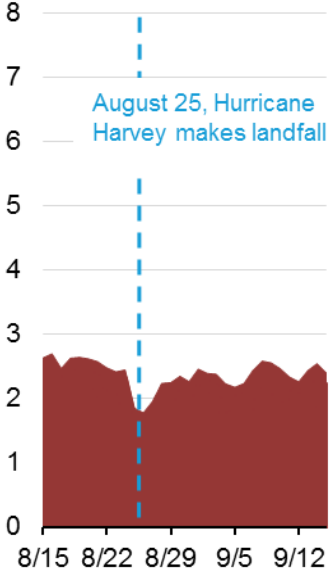
Estimated Texas natural gas use for electricity generation
billion cubic feet per day



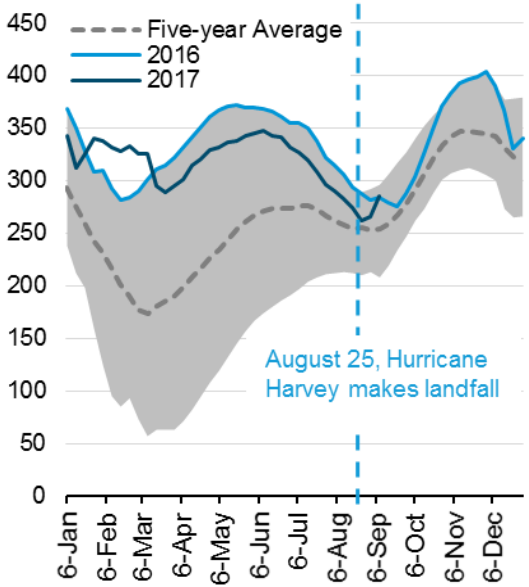
Average Texas temperature
degrees Fahrenheit



Texas pipeline exports to Mexico
billion cubic feet per day



South Central region working gas inventory for salt caverns
billion cubic feet

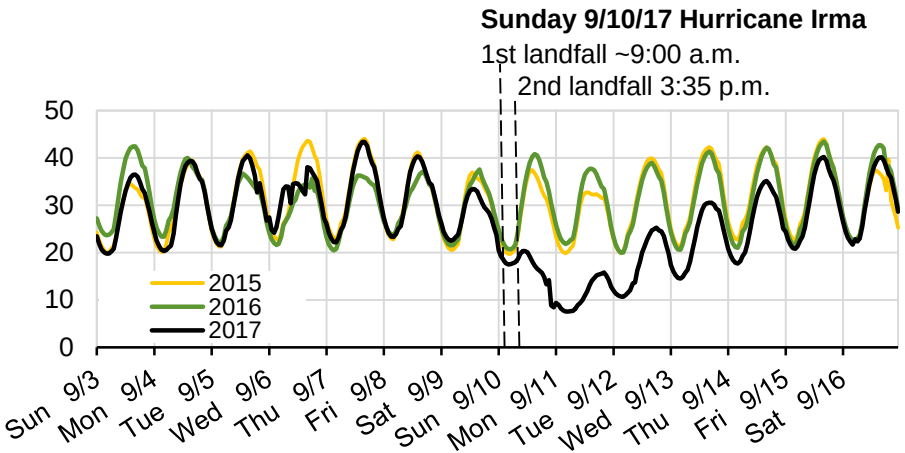


Sources: EIA, Natural Gas Weekly Update, Weekly Natural Gas Storage Report, Natural Gas Intelligence, Genscape

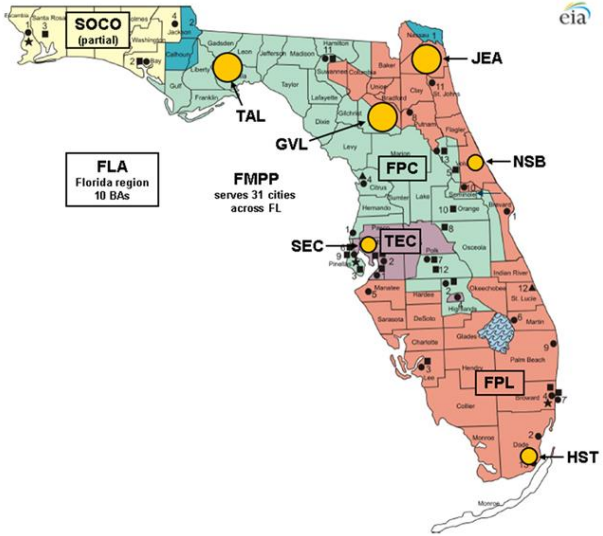
EIA's hourly electricity survey showed much lower electric loads and then steady recovery as Hurricane Irma hit

Florida hourly electricity demand, September 2015-2017

gigawatts



Florida balancing authority map



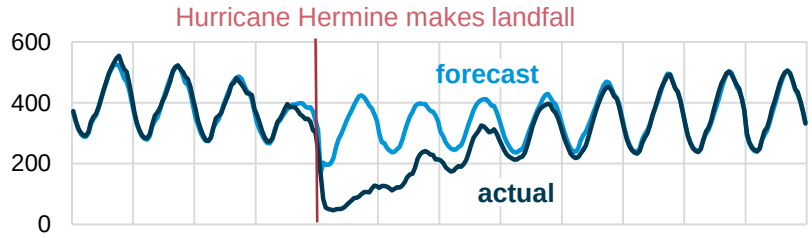
- Aggregate electricity demand for Florida balancing authorities continues to recover day-over-day since the lows seen early on Sept 4. Florida demand exceeded 38,100 MW at 3pm on Sept 8, in-line with pre-hurricane levels the week before Hurricane Irma made landfall. Demand has been exceeding forecast significantly since Tuesday during peak hours.

Note: For graph, previous years are aligned by week number & day of week to 2017 data.

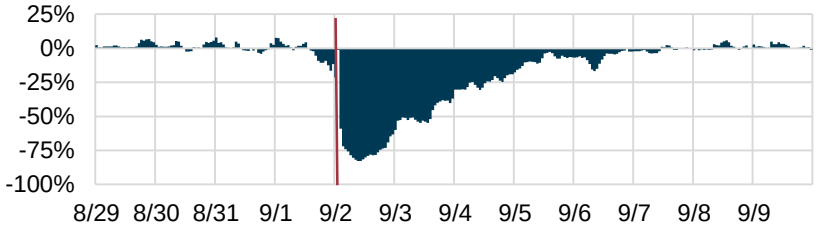
Source: EIA, Hourly and Daily Balancing Authority Operations Report (EIA-930), https://www.eia.gov/beta/realtime_grid and Today in Energy, September 20, 2017

Electricity customers' service restored in Tallahassee after Hurricane Hermine

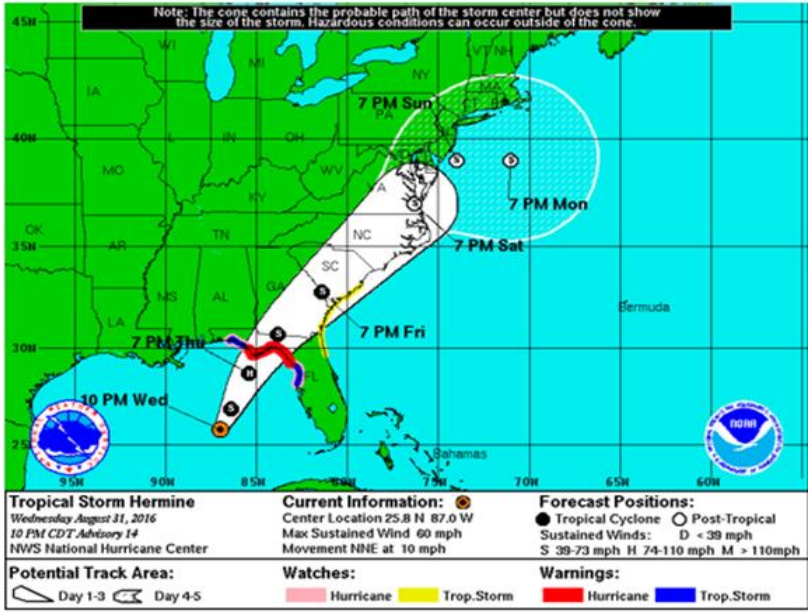
City of Tallahassee electricity balancing authority (Aug 29 - Sep 9, 2016)
hourly actual and forecast load
thousand kilowatthours



Deviation from forecast normal load
percent

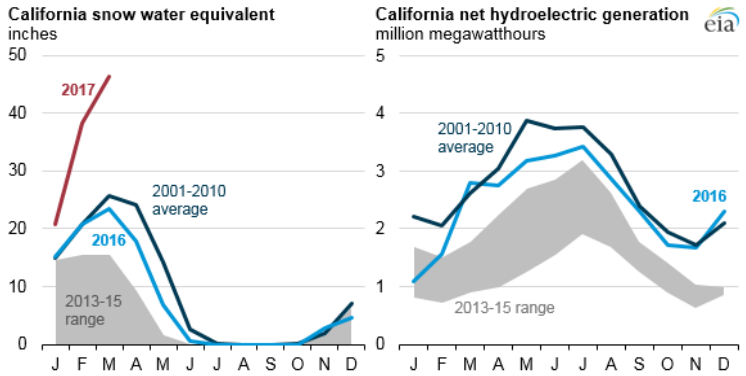


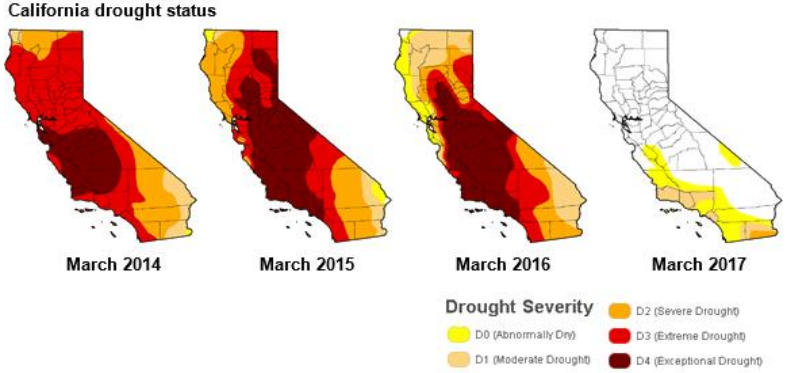
Coastal watches, warnings, and five-day forecast cone for tropical storm Hermine

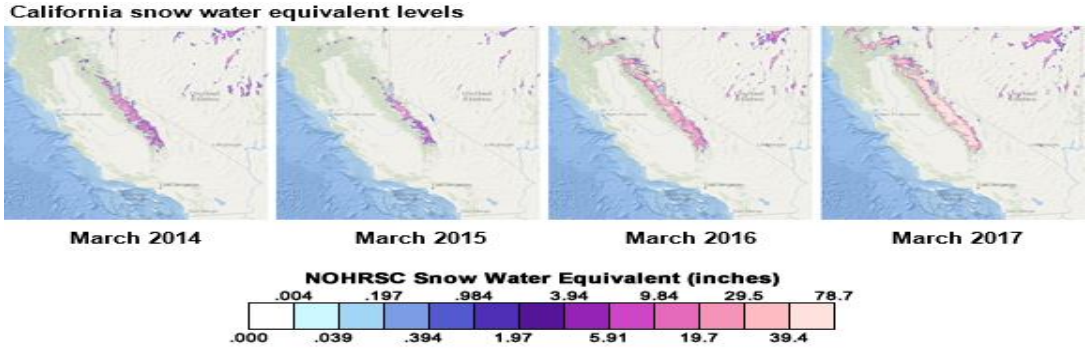


Source: EIA, Hourly and Daily Balancing Authority Operations Report (EIA-930), https://www.eia.gov/beta/realtime_grid and EIA, Today in Energy, September 15, 2016

Above normal precipitation improves California's hydroelectric availability

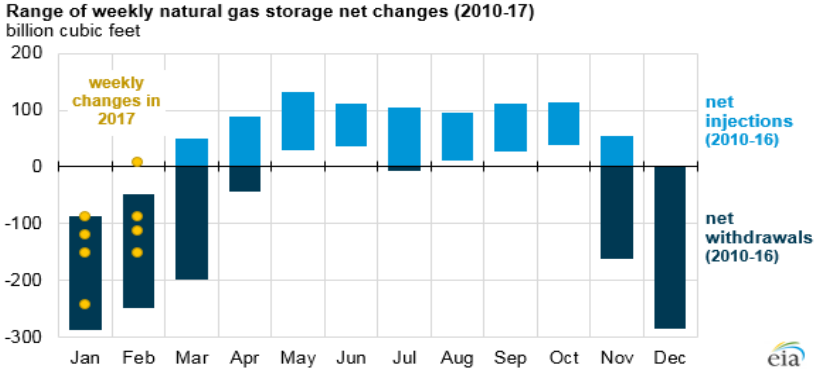


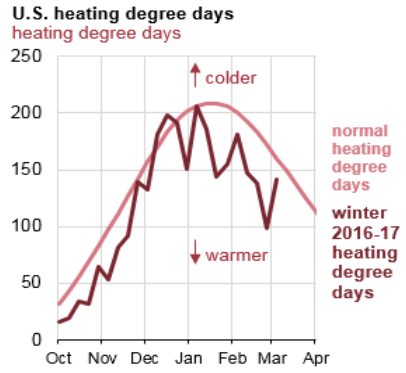


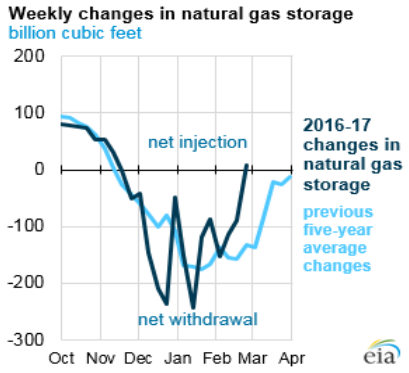


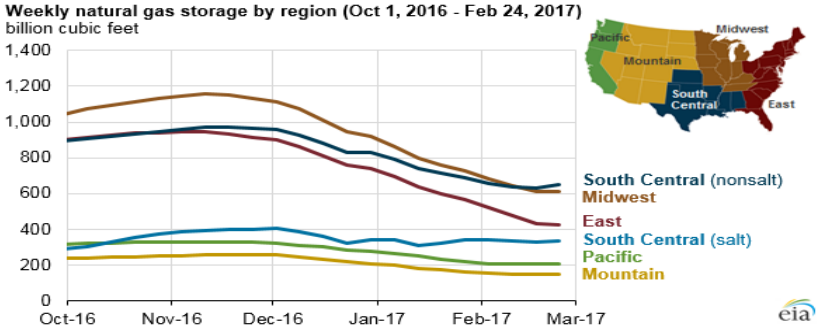
Source: EIA, Today in Energy, March 22, 2017

Warm weather leads to first recorded natural gas storage injection in February





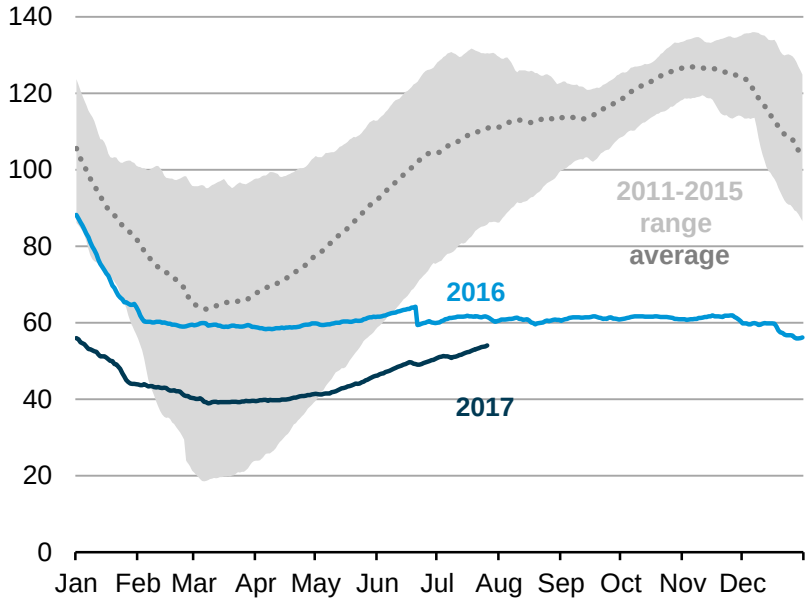




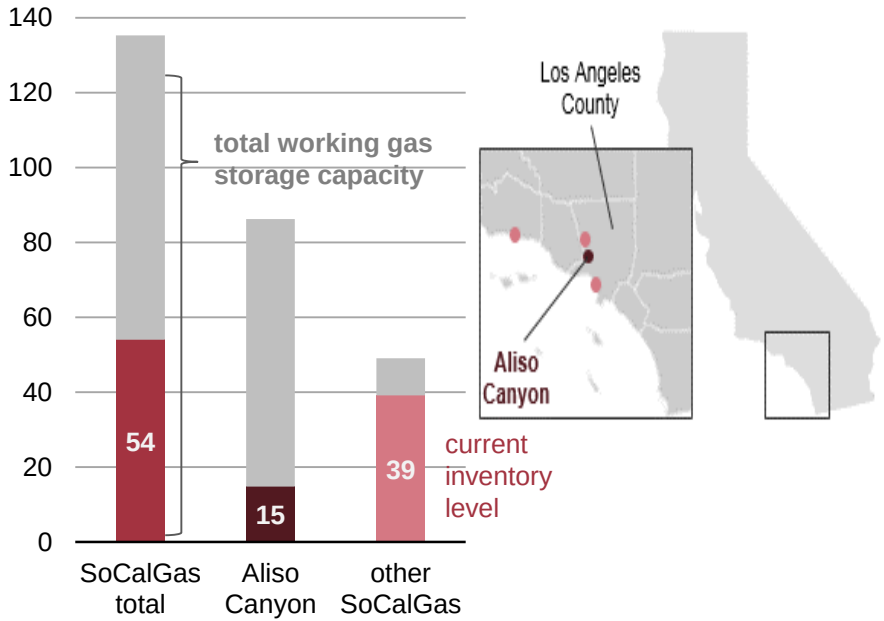
Source: EIA, Today in Energy, March 9, 2017

California's Aliso Canyon natural gas storage facility cleared to resume partial operation

Southern California Gas natural gas storage inventory (2011-2017)
billion cubic feet



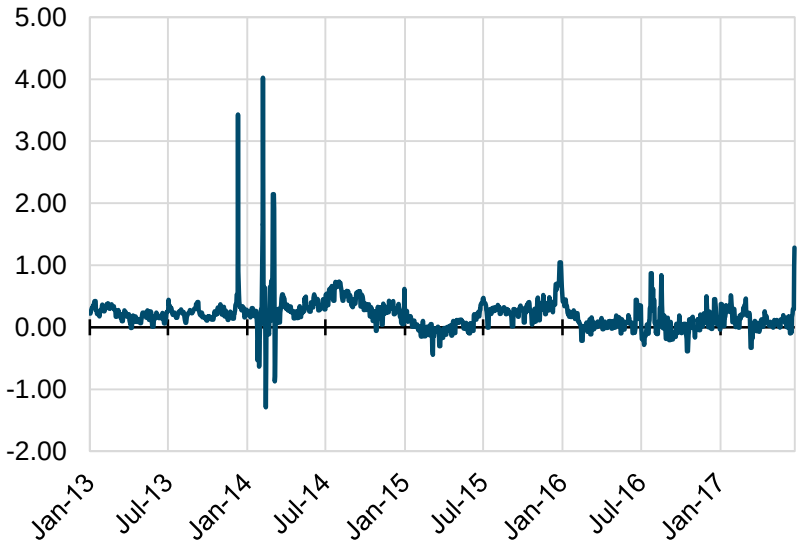
Southern California Gas natural gas storage inventory (as of July 27)
billion cubic feet



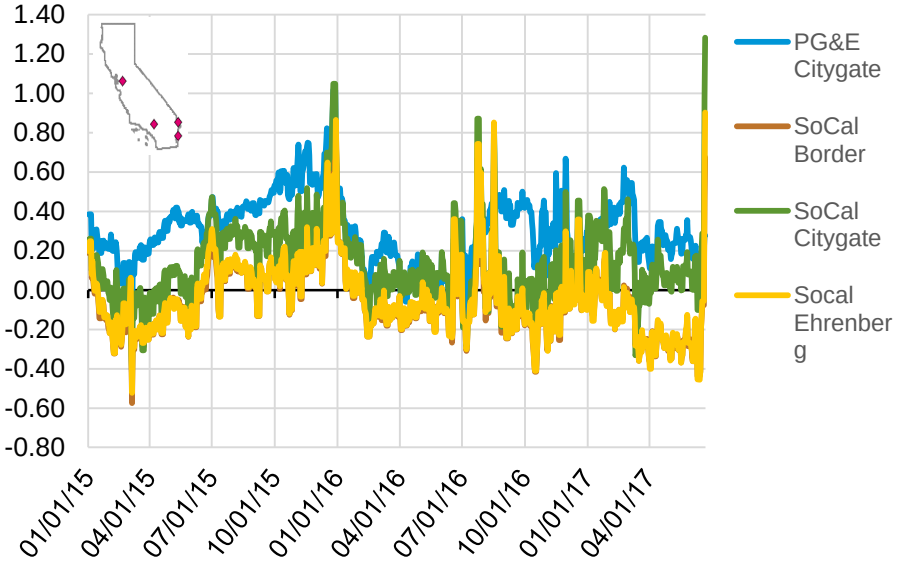
Source: EIA, Today in Energy, July 28, 2017

Warmer-than-normal weather in Southern California in June 2017 led to spot natural gas prices spikes similar to winter conditions

Daily spot natural gas price difference
(SoCalGas Citygate minus Henry Hub)
dollars per million British thermal units

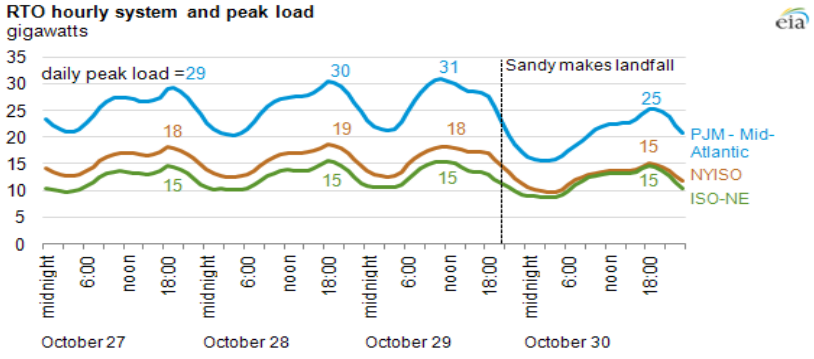


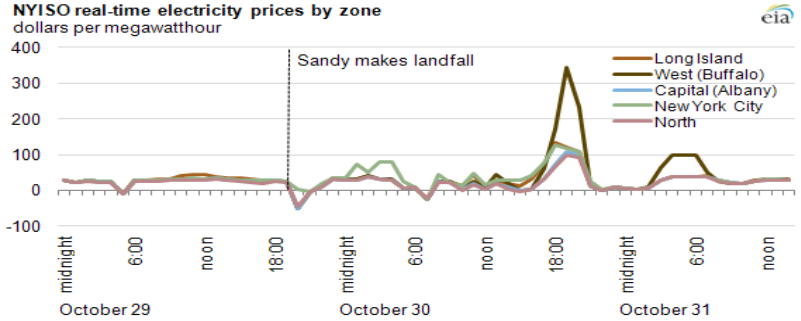
Daily natural spot natural gas price differences between California trading points and the Henry Hub
dollars per million British thermal units

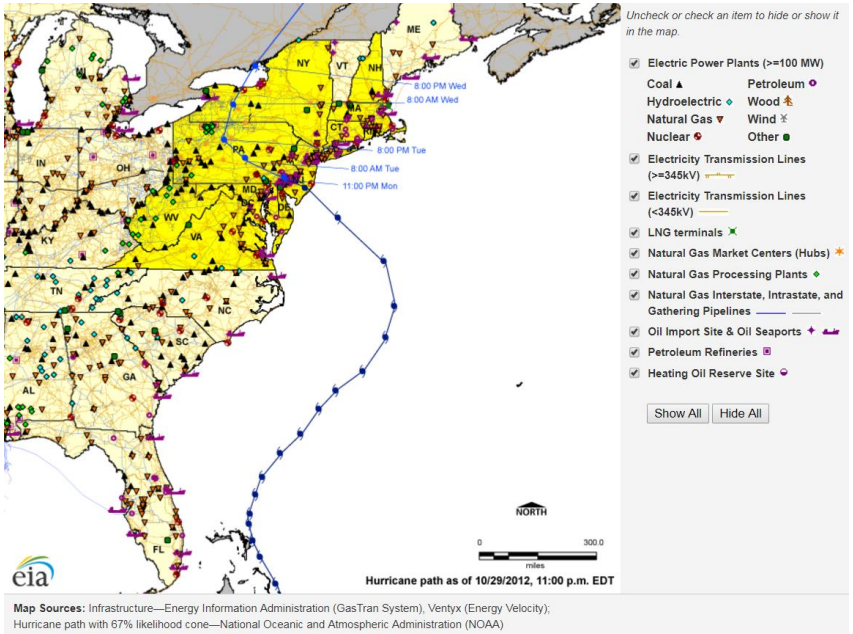


Source: EIA through Ventyx Energy Velocity Suite

Despite customer outages, wholesale electric markets operated during Superstorm Sandy





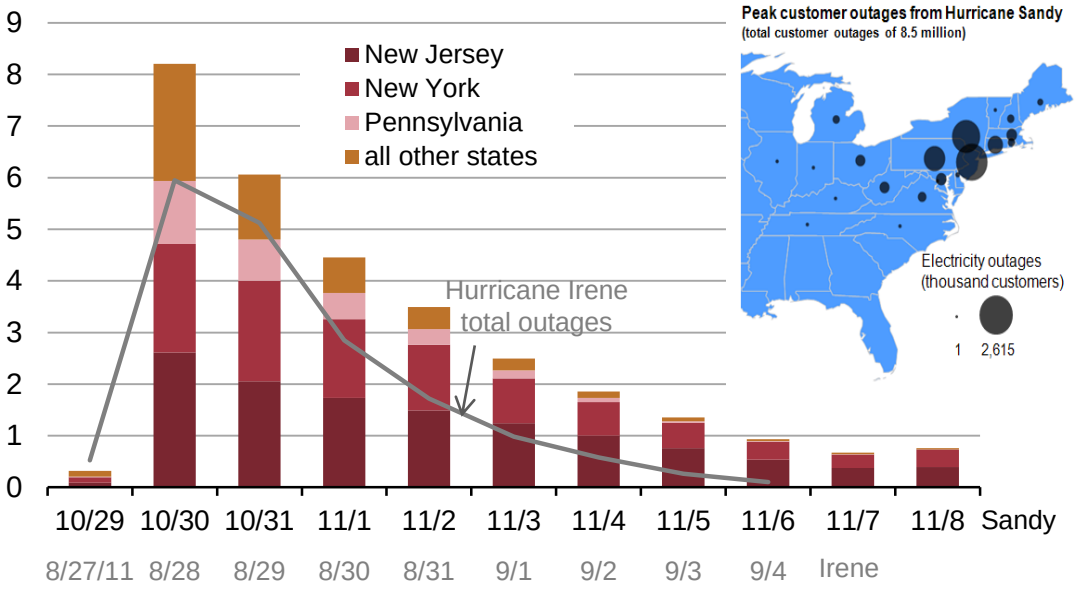


Sources: Data from the PJM, NYISO, and ISO-NE regional transmission organizations and EIA, Today in Energy, November 13, 2012

Electricity restored to many in the Northeast but outages due to Superstorm Sandy persist

Hurricane Sandy power outages

million customers



- About 8.5 million customers (residential, commercial, and industrial) were without power at some point during or after the storm, mostly in parts of the Mid-Atlantic, Northeast, and the Ohio Valley.
- High snowfall slowed the recovery efforts in many Northeastern states.
- Disruptions from Hurricane Sandy exceeded both in magnitude and duration those from Hurricane Irene, which affected millions of Northeastern customers in late August and early September 2011.

Source: U.S. DOE, Office of Electricity Delivery and Reliability and EIA, Today in Energy, November 9, 2012

EIA articles related to Hurricanes Harvey and Irma

Publication date	Title
September 21, 2017	Hurricane Irma briefly disrupts Florida's natural gas consumption for electricity generation (NGWU)
September 20, 2017	Hurricane Irma cut power to nearly two-thirds of Florida's electricity customers (TIE)
September 15, 2017	Hurricanes Harvey and Irma lead to higher gasoline prices in Florida (TIE)
September 14, 2017	Natural gas spot prices at Henry Hub decrease slightly during the days after Hurricane Harvey (NGWU)
September 13, 2017	Hurricane Harvey caused electric system outages and affected wind generation in Texas (TIE)
September 13, 2017	Hurricane Irma prompts high gasoline demand as it disrupts Florida's supply chain (TWIP)
September 11, 2017	Hurricane Harvey caused U.S. Gulf Coast refinery runs to drop, gasoline prices to rise (TIE)
September 8, 2017	Hurricane Irma may cause problems for East Coast energy infrastructure (TIE)
September 8, 2017	Hurricane Harvey disrupts US. Gulf Coast refineries, infrastructure, and supply chains (TWIP)
September 6, 2017	U.S. average retail gasoline prices increase in wake of Hurricane Harvey (TIE)
September 1, 2017	Hurricane Harvey adds uncertainty to gasoline prices for the upcoming Labor Day weekend (TIE)
August 30, 2017	Hurricane Harvey adds considerable uncertainty surrounding gasoline prices for the upcoming Labor Day weekend (TWIP)
August 25, 2017	Hurricane Harvey headed for area with significant oil, natural gas infrastructure (TIE)

*Note: **TIE**= Today in Energy, **TWIP**= This Week in Energy, **NGWU**= Natural Gas Weekly Update*

For more information

U.S. Energy Information Administration home page | www.eia.gov

Short-Term Energy Outlook | www.eia.gov/steo

Energy Disruptions | www.eia.gov/special/disruptions/

This Week in Petroleum | www.eia.gov/petroleum/weekly

Today in Energy | www.eia.gov/todayinenergy

State Energy Profiles | www.eia.gov/state

Southern California Daily Energy Report | www.eia.gov/special/disruptions/socal/summer/#dashboard

Natural Gas Weekly Update | www.eia.gov/naturalgas/weekly

Exhibit B

U.S. Energy Information Administration

Today in Energy

September 8, 2017

Hurricane Irma may cause problems for East Coast energy infrastructure

Source: U.S. Energy Information Administration, *Energy Infrastructure with Real-Time Storm Information*

Hurricane Irma, one of the largest hurricanes ever recorded in the Atlantic, caused significant damage to the northeastern Caribbean and is currently projected to make landfall this weekend. Current model forecasts project that Hurricane Irma will then pass along or just offshore the east coast of Florida, although the actual storm track could change from current projections. To help analysts assess potential energy-related storm effects, EIA maintains an energy disruptions map that displays energy infrastructure and real-time storm information.

Hurricane Irma initially made landfall in the Caribbean as a Category 5 hurricane with sustained wind speeds of more than 185 miles per hour, which made it the second-largest hurricane ever recorded and tied it with the 1935 Florida Keys hurricane as the largest Atlantic hurricane to make landfall. In advance of the storm, states of emergency were declared in the U.S. Virgin Islands, Puerto Rico, and Florida. Thirty counties in Georgia are also under a state of emergency, as are the states of North Carolina and South Carolina.

Significant power outages have already been reported in the U.S. Virgin Islands, with the islands of St. Thomas and St. John reporting that all customers had lost power. The Puerto Rico Electric Power Authority has reported more than one million outages. As Hurricane Irma approaches Florida, high winds, flooding, and storm surge have the potential to affect energy infrastructure such as power plants as well as power transmission and distribution lines. Utilities in the state are preparing for high levels of power outages, and officials in Florida are making plans to shut down two nuclear power plants—Turkey Point and St. Lucie—prior to the arrival of the storm.

The last major hurricane—those rated Category 3 or higher—to make landfall in Florida was Hurricane Wilma in 2005. Hurricane Wilma caused widespread power outages in the state. Florida Power and Light, the largest utility in the state, reported more than three million customer outages. In 2016, Hurricane Matthew, which did not make direct landfall in the state, caused more than one million outages.

EIA’s energy disruptions map displays key layers of energy infrastructure, including oil refineries, power plants, and major electric transmission lines, and real-time storm information from the National Weather Service. The web page also contains links to the U.S. Department of Energy’s Emergency Situation Reports and other websites that provide updates on the effect of severe weather on energy infrastructure. In addition, EIA's U.S. Electric System Operating Data tool provides near real-time information on electricity demand and can show areas where electricity service has been disrupted.

Principal contributors: Michael Mobilia

U.S. Energy Information Administration

Energy Disruptions
Hurricane Nate

Layer information and map data

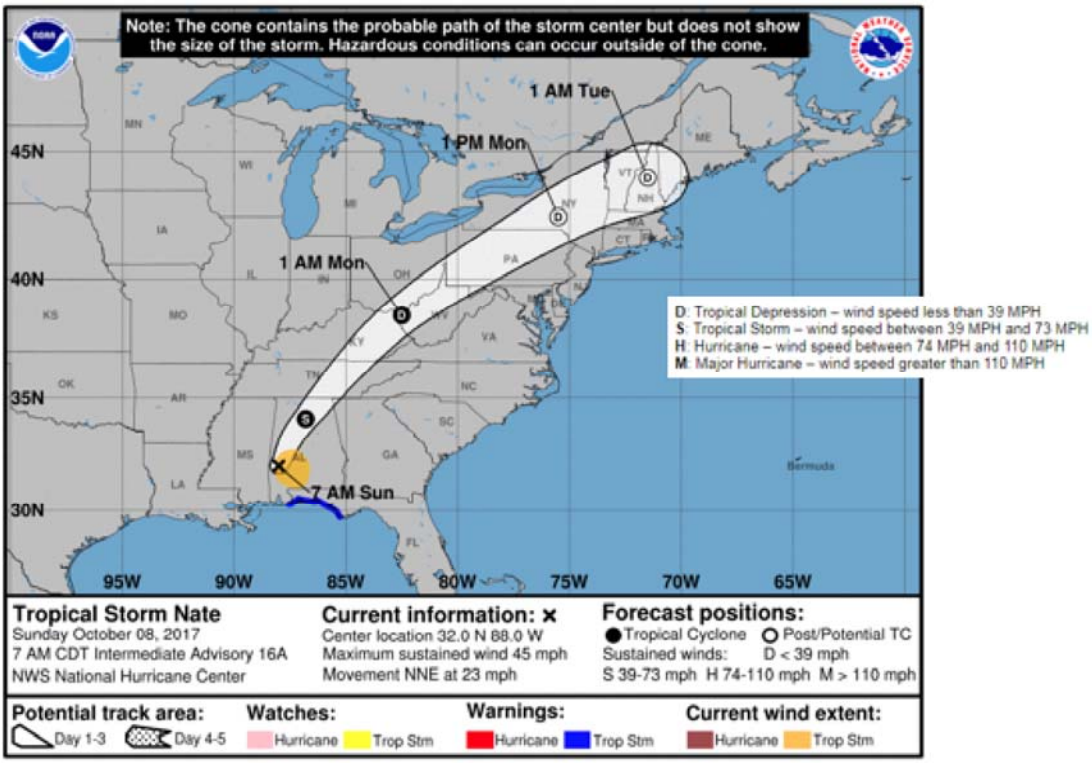
Send map questions, comments and suggestions to: mapping@eia.gov

Note on Hurricane Nate, October 8, 2017, 10:30 am EDT

Background

Hurricane Nate made its initial landfall at 8:00 pm EDT at the mouth of the Mississippi River. The second landfall was at 1:30 am EDT Sunday near Biloxi, MS. The storm made landfall as a Category One hurricane with sustained winds of 85 miles per hour.

Nate weakened as it moved inland and by 4:30 am EDT was downgraded to a tropical storm. As of 8:00 am EDT the National Hurricane Center (NHC) reported that the storm was moving rapidly inland (23 miles per hour) with sustained winds of 45 miles per hour. The NHC anticipates that Nate will rapidly weaken and should “degenerate into a remnant low late Monday.” The projected storm track is shown below.



Power System Impacts

Peak outages associated with Nate totaled about 100,000 customers in Mississippi and Alabama as of 6:00 am EDT:

- Alabama: 56,250 customers
- Mississippi: 46,487 customers

In addition, about 10,000 outages were reported in the Florida panhandle.

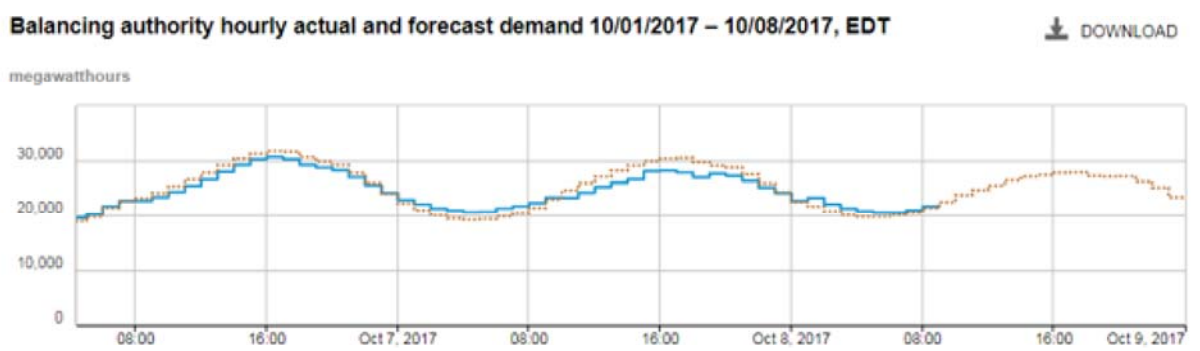
The following table compares total customer counts to outages in Mississippi and Alabama

State	Total customers (thousnds)	Residential customers (thousnds)	Approximate customers without power, Sunday morning (thousnds)
Mississippi	1,557	1,311	56
Alabama	2,621	2,243	46

Source: EIA-861M for July 2017; press reports

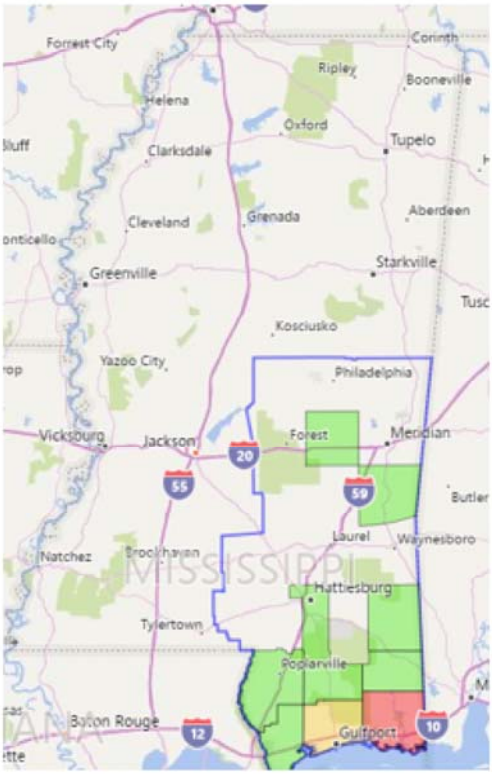
Outages were largely concentrated around Mobile, Alabama, with over 50,000 customers out. Outages took place in areas where the main power provider is Southern Company (Alabama Power, Mississippi Power, and Gulf Coast (Florida) Power.) Southern Company is also the balancing authority for the region. Because of the small number of outages relative to total customers the impact on projected load versus actual, as reported by the EIA-930 hourly data, was minimal.

Balancing authority electricity demand

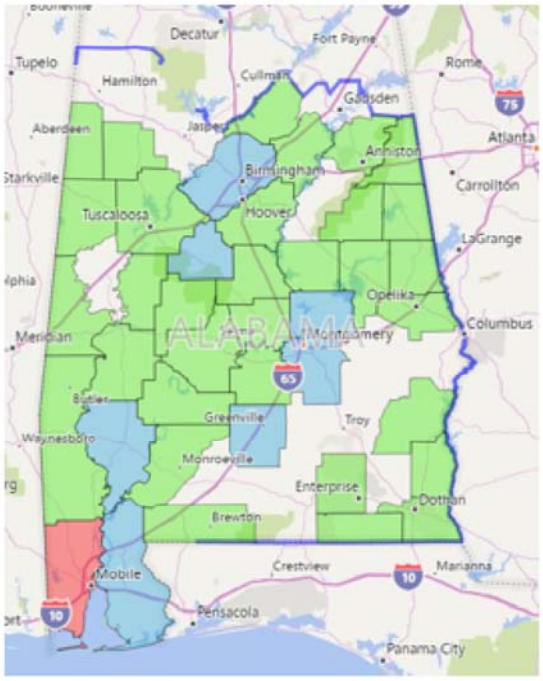


The total projected demand peak for Sunday the 8th, just under 30,000 MWh, appears to be consistent with recent weekend experience.

The following outage maps are from the utility websites as of 10:00 am EDT Sunday morning. The maps illustrate that the main impact of Nate was on the coast and particularly around Mobile, AL, and Gulfport, MS. Outages inland are scattered.



Mississippi



Alabama

Florida Panhandle

- > 5,000 Customers Out
- 1,001-5,000 Customers Out
- 101-1,000 Customers Out
- 1-100 Customers Out
- Service Area Boundary

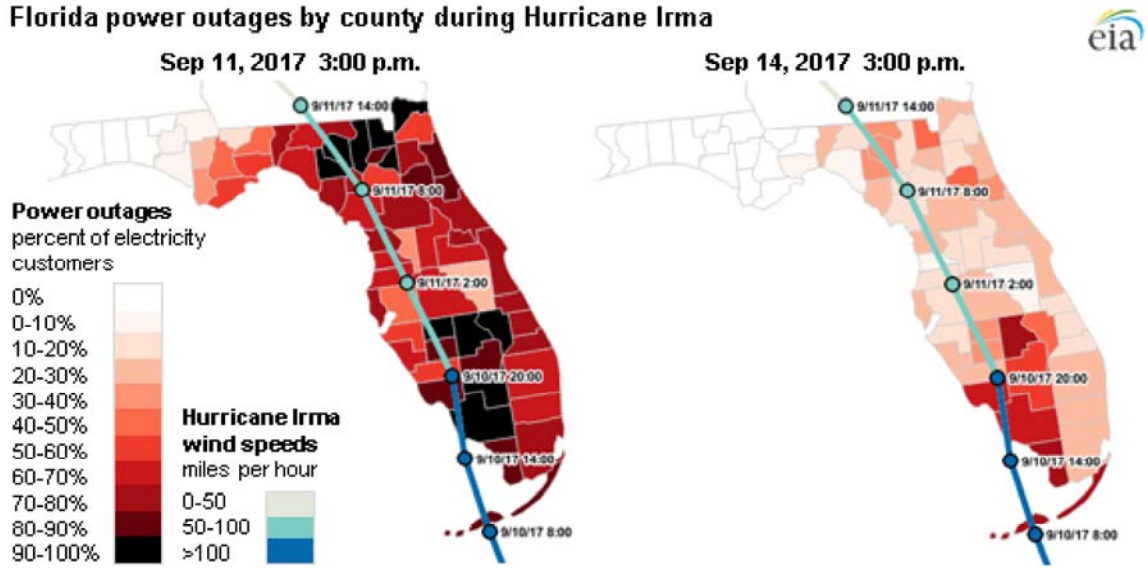
Exhibit D

U.S. Energy Information Administration

Today in Energy

September 20, 2017

Hurricane Irma cut power to nearly two-thirds of Florida's electricity customers (click to open webpage)

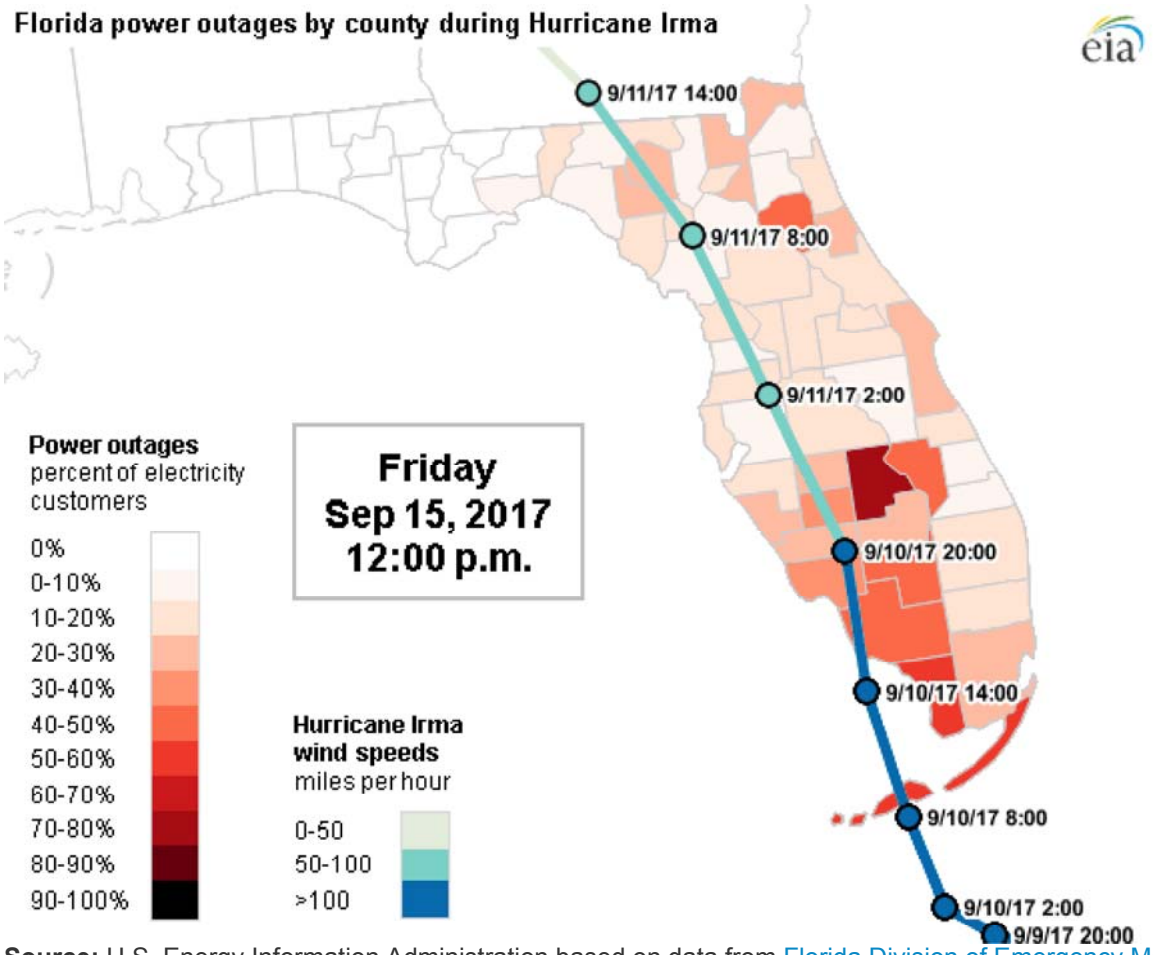


Source: U.S. Energy Information Administration based on data from Florida Division of Emergency Management and NOAA National Hurricane Center

Hurricane Irma struck Florida on September 10, 2017, and knocked out power to 6.7 million electricity customers—64% of all customer accounts in the state—according to reports compiled by the Florida Division of Emergency Management. About 100,000 customers (1% of the state total) remained without power as of September 19.

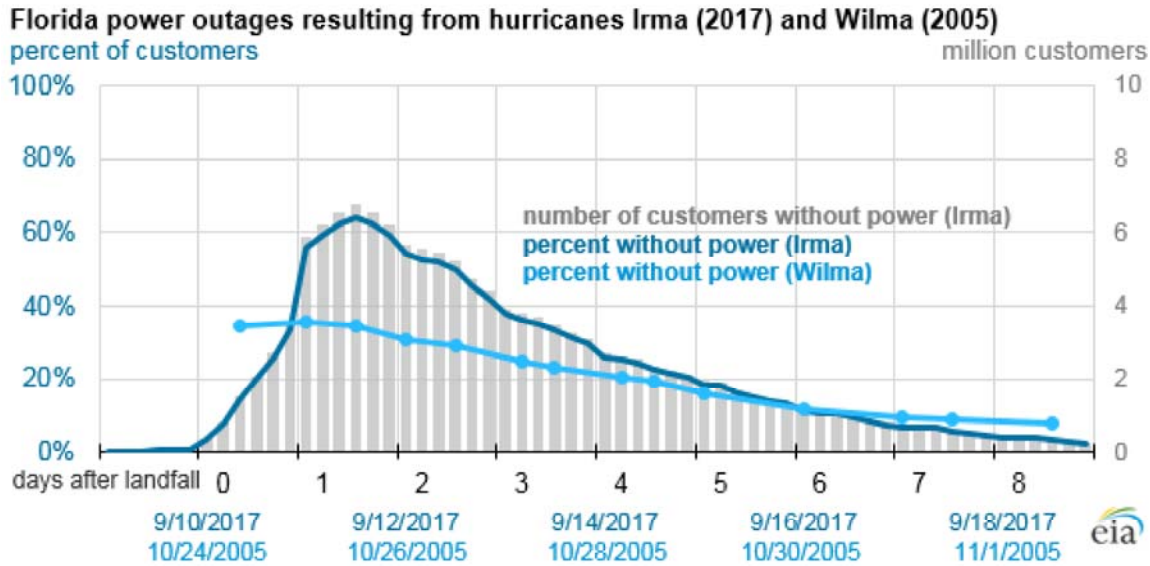
The count of customers reflects the number of billed accounts or individual meters. The number of people affected by power outages is larger than the customers affected because more than one person may be covered by a single electric bill. Hurricane Irma also knocked out power to at least 1.3 million customers in Georgia and close to half a million customers in other states, but nearly all hurricane-related outages in states other than Florida have since been resolved.

Hurricane Irma followed the western coast of Florida after first making landfall in the continental United States in the Florida Keys. Irma was the first major hurricane to hit Florida since Hurricane Wilma in 2005. Wilma was a Category 3 hurricane with similar intensity to Irma when it made landfall in the United States at almost exactly the point of Irma's second landfall near Marco Island.



Source: U.S. Energy Information Administration based on data from Florida Division of Emergency Management and NOAA National Hurricane Center

Power outages in Florida rose slowly on September 10, but they increased rapidly overnight as Hurricane Irma traveled up the state. About 15% of customers were without power at noon on September 10, and power outages peaked at 3:00 p.m. on September 11, affecting 64% of customers. In contrast, Hurricane Wilma moved quickly across the southern part of the state, knocking out power to 36% of customers in Florida.



Source: U.S. Energy Information Administration based on data from Florida Division of Emergency Management and U.S. Department of Energy Situation Reports

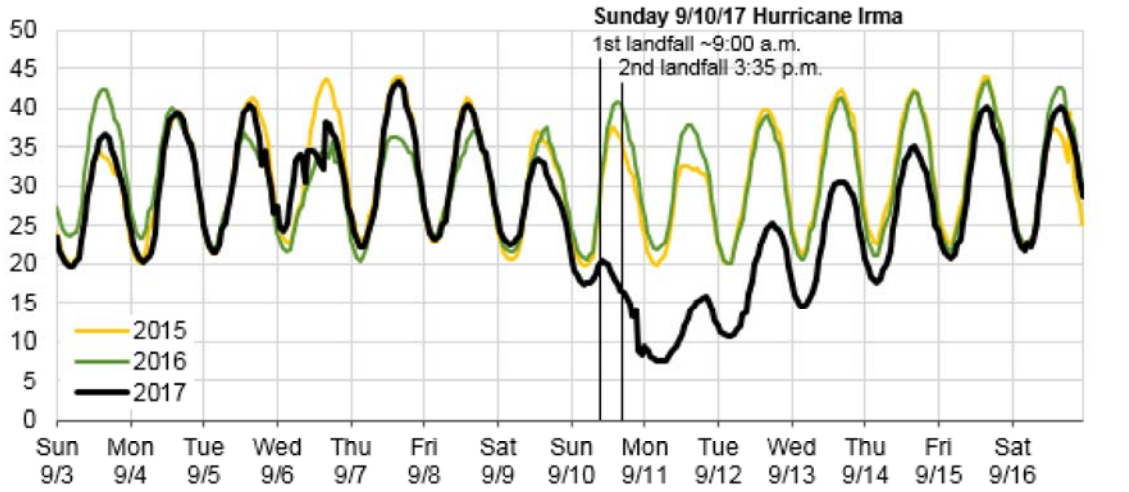
Although the percentage of Florida customers without power during Irma was significantly higher than during Wilma, the rate of electric service restoration has been more rapid. Five days after Irma's landfall, the share of customers without power had fallen from a peak of 64% down to 18% (a recovery rate of about 9% of customers per day). Power outages during Wilma declined from 36% of customers to 16% by the fifth day after landfall (an average recovery rate of about 4% of customers per day). Based on information in the U.S. Department of Energy's situation reports, nearly 60,000 power company employees from the United States and Canada were involved in restoration efforts after Hurricane Irma.

Since 2005, Florida Power & Light and other utilities in the state have made significant investments to improve their hurricane preparedness. These utilities have upgraded electric infrastructure, including replacing wooden utility poles with concrete poles. Utilities have also deployed smart grid technologies, which provide more timely and more accurate information about outages and can help utilities better target restoration efforts.

Power outages were widespread across the state during Hurricane Irma, but some counties were more affected than others. At the height of the storm on September 11, there were 12 counties in Florida that had 90% or more of their electricity customers without power. Power was restored to most of these customers relatively quickly. However, even one week after landfall, four counties in the southwestern part of the state had power outages that affected more than 20% of electric customers.

After the hurricane made landfall, demand for electricity during the early hours of September 11 fell to 7.2 gigawatts (GW), which is 64% lower than the power demand during the same hours in 2016. By the afternoon of Friday, September 15, power demand in Florida had risen to 38.1 GW, close to the level of demand during the same week last year.

Florida hourly electricity demand, September 2015-2017
gigawatts (previous years aligned by week number & day of week to 2017 data)



Source: U.S. Energy Information Administration, U.S. Electric System Operating Data

Hurricane Irma also affected Florida's two nuclear power plants, which are among the largest power plants in the state. One reactor at the Turkey Point nuclear power plant in south Florida was shut down as a precaution before the hurricane arrived. The other nuclear reactor at the plant was later shut down because of a mechanical issue. The St. Lucie nuclear power plant remained operating, although at reduced levels. All of Florida's reactors had safely returned to full power by September 18.

Principal contributors: Tyler Hodge, April Lee

U.S. Energy Information Administration

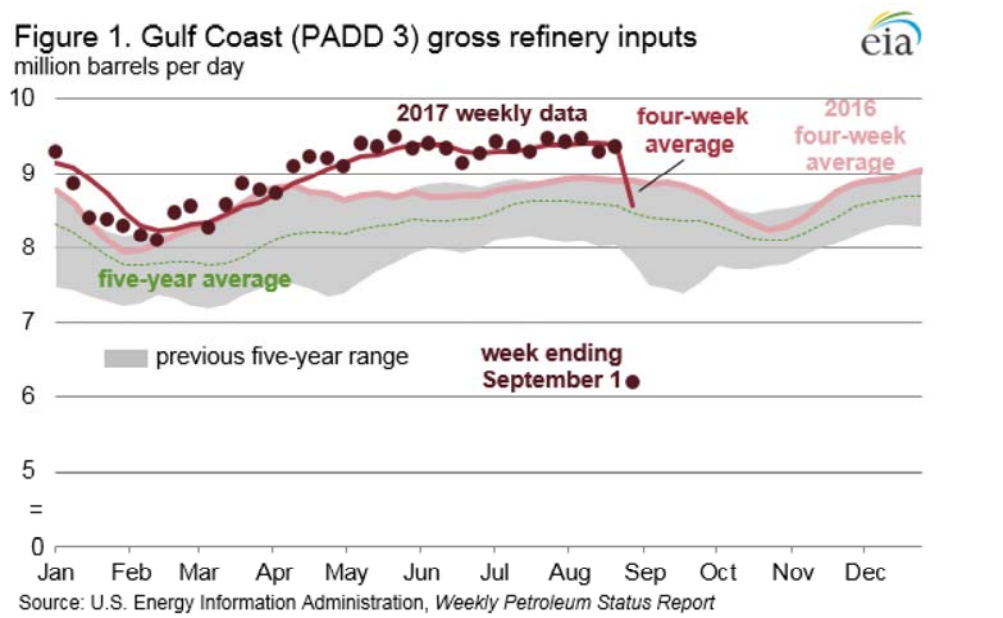
This Week in Petroleum

Release date: September 8, 2017 | **Next release date:** September 13, 2017

Hurricane Harvey disrupts U.S. Gulf Coast refineries, infrastructure, and supply chains

With its landfall near Corpus Christi, Texas as a Category 4 storm two weeks ago on August 25, 2017 and subsequent path along the Gulf Coast, Hurricane Harvey caused substantial disruptions to crude oil and petroleum product supply chains and prices because of the high concentration of petroleum infrastructure in the Gulf Coast, Petroleum Administration for Defense District (PADD) 3. Just over half of all U.S. refinery capacity is located in PADD 3; Texas alone represented 31% of all U.S. refinery capacity as of January 2017. These refineries supply petroleum products to local markets, domestic markets on the East Coast (PADD 1) and in the Midwest (PADD 2), and international markets. As of March 2017, PADD 3 accounted for 49% of total U.S. working crude oil storage capacity and over 40% of working storage capacity for both motor gasoline and diesel fuel. Furthermore, PADD 3 represented 62% of total U.S. crude oil production in 2016, with an additional 18% coming from the Federal Offshore Gulf of Mexico.

Hurricane Harvey's most significant effect on petroleum markets was to curtail refinery operations in Texas. Refinery operations are largely dependent on a supply of crude oil and feedstocks, electricity, workforce availability and safe working conditions, and outlets for production. As a result of Hurricane Harvey, many refineries in the region either reduced runs or shut down in its aftermath. For the week ending September 1, 2017, gross inputs to refineries in PADD 3 fell 3.2 million barrels per day (b/d) (-34%) from the previous week and were down 2.8 million b/d (-31%) from the same time last year. Four-week average PADD 3 gross refinery inputs fell to just above that measure's five-year average of 8.5 million b/d (Figure 1). Outages and reduced runs resulted in PADD 3 refinery utilization falling from 96% to 63%, while other areas of the country remained virtually unchanged.



In addition to refineries, many crude oil and petroleum product pipelines reduced operations or shut down. The most prominent of these was the Colonial Pipeline system, a 2.5 million b/d petroleum product pipeline consisting of approximately 5,500 miles of pipeline that consistently operates at or near full capacity. Colonial connects 29 refineries and 267 distribution terminals, carrying gasoline, diesel, and jet fuel from Houston, Texas to New York Harbor. Decreased supplies of petroleum products available for the pipeline in Houston and Port Arthur, Texas, forced Colonial Pipeline to curtail operations and ship intermittently for a brief period of time before continuous operations at reduced rates were restored on September 6.

Disruption to Colonial Pipeline supplies reduced PADD 1 total motor gasoline inventories by 2.2 million barrels to 60.5 million barrels for the week ending September 1. Of this drawdown, 2.1 million barrels occurred in the Lower Atlantic (PADD 1C) states. This draw is less than a previous outage of the Colonial Pipeline in September 2016, when PADD 1C inventories fell nearly 6 million barrels.

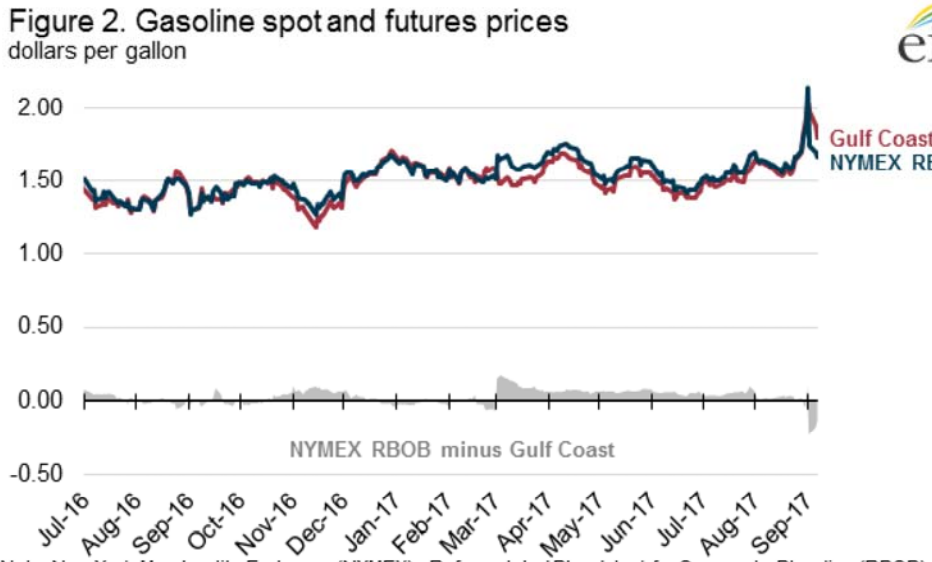
Another logistical complication was created when the ports of Corpus Christi and Houston-Galveston were closed to ship traffic as a result of the storm. Large volumes of crude oil and refined products are both imported and exported through these ports.

In PADD 3, the net result of all these events led to Gulf Coast crude oil inventories to build by 1.7 million barrels for the week ending September 1, 2017. With refinery operations on the Gulf Coast disrupted, crude oil inventories in Cushing, Oklahoma also increased by 800,000 barrels.

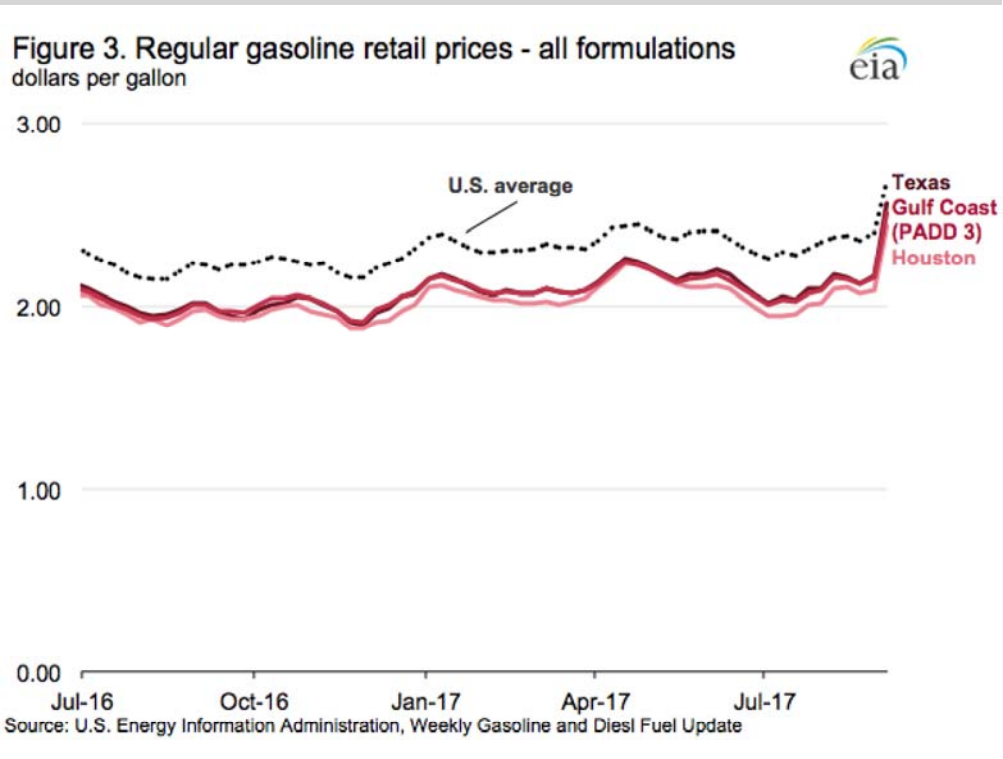
The net effect on PADD 3 motor gasoline inventories because of impaired refinery runs and transportation options was a draw of 60,000 barrels to 82.4 million barrels for the week ending September 1, 2017, but inventories remain 9.2 million barrels (13%) higher than the five-year average.

Both crude oil and gasoline prices were influenced by the effects of Hurricane Harvey. Because of lower refinery runs and limited reductions in crude oil production, West Texas Intermediate (WTI) crude oil futures prices on the New York Mercantile Exchange (NYMEX) decreased from $48 per barrel (b) on August 25 when Hurricane Harvey made landfall, to $46/b on August 30. WTI crude oil futures prices have since increased, reaching $49/b on September 6.

By contrast, gasoline futures as well as wholesale and retail prices for gasoline increased because of the impacts on refineries and pipeline infrastructure. On the Gulf Coast, the wholesale price of gasoline increased from $1.66 per gallon (gal) on August 25, 2017 to $2.05/gal on August 31. The benchmark Reformulated Blendstock for Oxygenate Blending (RBOB) gasoline NYMEX futures price increased from $1.67/gal to $2.14/gal over the same period (Figure 2).



As a result of the changes in wholesale and futures prices, retail prices for gasoline also increased. The U.S. average regular retail gasoline price increased $0.28/gal to $2.68/gal between August 28 and September 4, 2017. The PADD 3 and Houston, Texas prices both increased $0.35/gal to $2.51 per gallon and $2.43/gal, respectively. The statewide Texas average regular retail gasoline price increased $0.40/gal to $2.56/gal (Figure 3).



Unlike previous significant Gulf Coast hurricanes, such as Katrina (2005), Gustav (2008), and Ike (2008), Hurricane Harvey had a more westward path, with the strongest effects of the storm mostly missing the largest concentration of offshore oil and gas production facilities. The Bureau of Safety and Environment Enforcement estimates that approximately 2.0% of Gulf of Mexico platforms were evacuated as of September 4, representing shut-in oil production of 121,484 b/d. According to the Texas Railroad Commission and other public sources, EIA estimates the highest on-shore crude oil production outages of approximately 500,000 b/d occurred around August 25 and 26.

The outcomes from Hurricane Irma are likely to be very different. While Hurricane Harvey impacted a major source of U.S. transportation fuels supply, demand in unaffected areas remained intact. Irma, which is projected to impact Florida and potentially the Eastern Seaboard, will likely disrupt demand centers.

Because of the displacement, evacuations, and other safety measures initiated as a result of the Hurricane Harvey, some respondents to EIA's surveys may not have been able to submit data within the reporting window. EIA has and will continue to work diligently with respondents to ensure robust and accurate statistics.

U.S. average regular gasoline and diesel retail prices increase

The U.S. average regular gasoline retail price increased 28 cents from the previous week to $2.68 per gallon on September 4, up 46 cents from the same time last year. The East Coast price rose nearly 39 cents to $2.72 per gallon, the Gulf Coast price rose 35 cents to $2.51 per gallon, the Midwest price rose 23 cents to $2.54 per gallon, the Rocky Mountain price rose 14 cents to $2.61 per gallon, and the West Coast price rose over 11 cents to $3.02 per gallon.

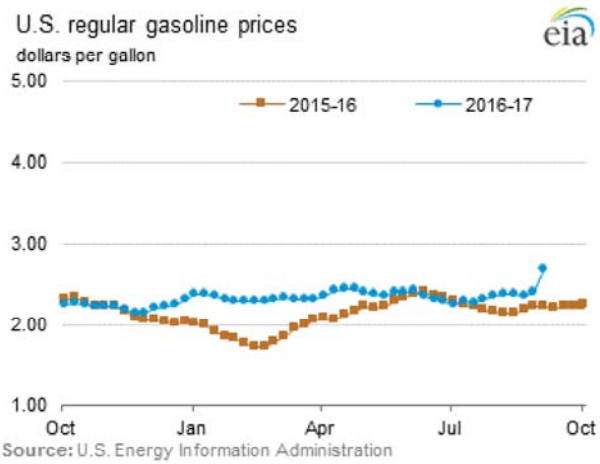
The U.S. average diesel fuel price increased 15 cents to $2.76 per gallon on September 4, 35 cents higher than a year ago. The Gulf Coast price rose 19 cents to $2.62 per gallon, the East Coast price rose over 16 cents to $2.79 per gallon, the Midwest price rose 14 cents to $2.71 per gallon, the West Coast price rose 13 cents to $3.04 per gallon, and the Rocky Mountain price rose 8 cents to $2.80 per gallon.

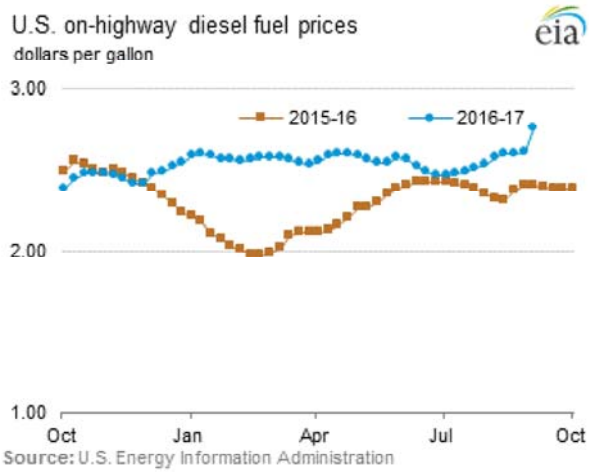
Propane inventories gain

U.S. propane stocks increased by 6.3 million barrels last week to 79.9 million barrels as of September 1, 2017, 19.2 million barrels (19.4%) lower than a year ago. Gulf Coast, Midwest, East Coast, and Rocky Mountain/West Coast inventories increased by 4.5 million barrels, 1.4 million barrels, 0.3 million barrels, and 0.2 million barrels, respectively. Propylene non-fuel-use inventories represented 4.3% of total propane inventories.

For questions about This Week in Petroleum, contact the Petroleum Markets Team at 202-586-4522.

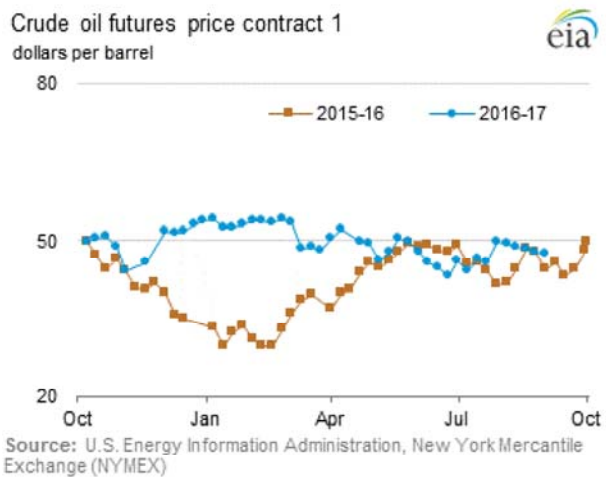
Retail prices *(dollars per gallon)*



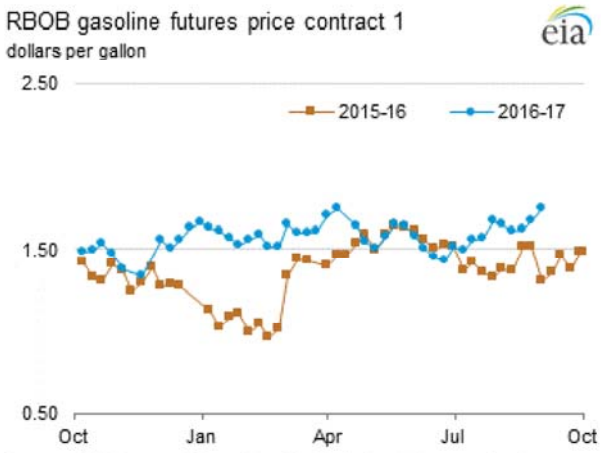


	Retail prices	Change from last	
	09/04/17	Week	Year
Gasoline	2.679	0.280	0.456
Diesel	2.758	0.153	0.351

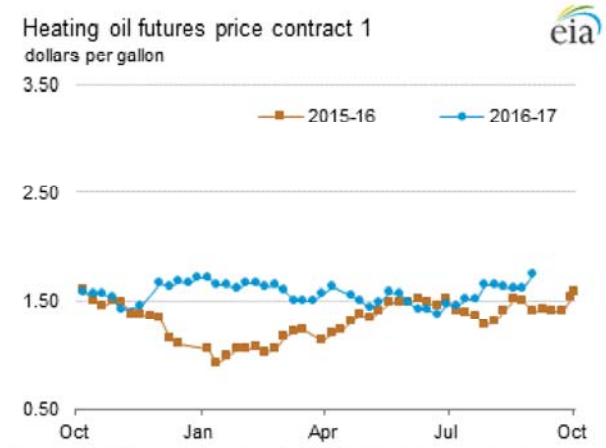
Futures prices *(dollars per gallon*)*



Source: U.S. Energy Information Administration, New York Mercantile Exchange (NYMEX)



Source: U.S. Energy Information Administration, Thomson Reuters

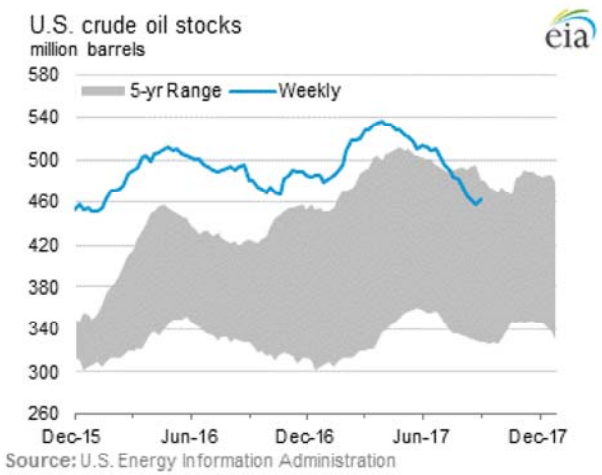


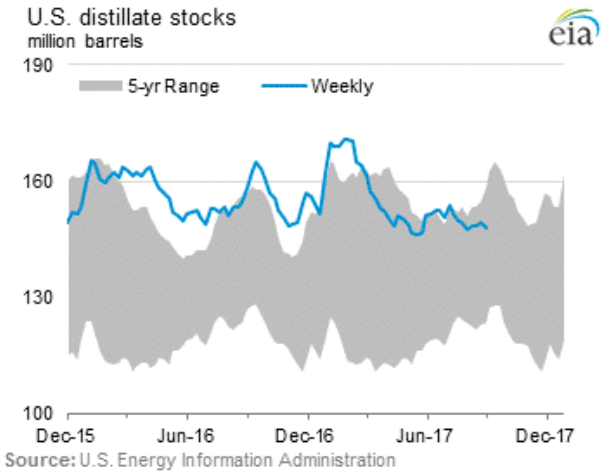
Source: U.S. Energy Information Administration, Thomson Reuters

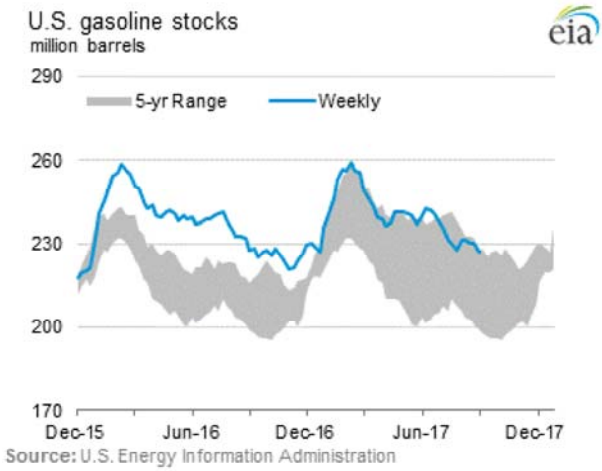
	Futures prices	Change from last	
	09/01/17	Week	Year
Crude oil	47.29	-0.58	2.85
Gasoline	1.748	0.081	0.446
Heating oil	1.747	0.125	0.337

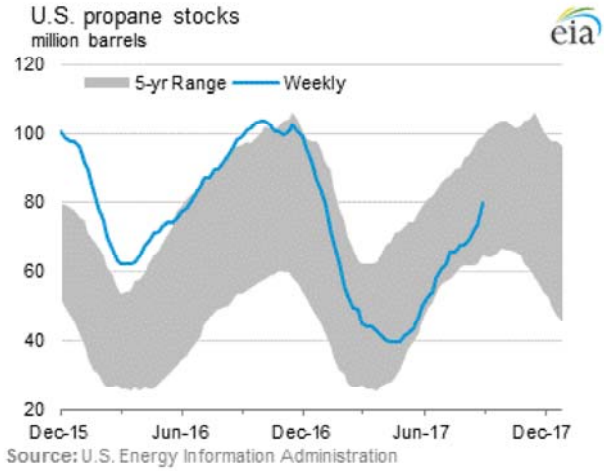
***Note:** Crude oil price in dollars per barrel.*

Stocks *(million barrels)*









	Stocks	Change from last	
	09/01/17	Week	Year
Crude oil	462.4	4.6	-18.4
Gasoline	226.7	-3.2	-1.1
Distillate	147.8	-1.4	-10.4
Propane	79.899	6.346	-19.228

Exhibit F: List of EIA's Disruption Analysis Articles

Source	Publication date	Title	Link
Today in Energy	September 20, 2017	Hurricane Irma cut power to nearly two-thirds of Florida's electricity customers	https://www.eia.gov/todayinenergy/detail.php?id=32992
Today in Energy	September 15, 2017	Hurricanes Harvey and Irma lead to higher gasoline prices in Florida	https://www.eia.gov/todayinenergy/detail.php?id=32932
Natural Gas Weekly Update	September 14, 2017	Natural gas spot prices at Henry Hub decrease slightly during the days after Hurricane Harvey	https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2017/09_14/
Today in Energy	September 13, 2017	Hurricane Harvey caused electric system outages and affected wind generation in Texas	https://www.eia.gov/todayinenergy/detail.php?id=32892
This Week in Petroleum	September 13, 2017	Hurricane Irma prompts high gasoline demand as it disrupts Florida's supply chain	https://www.eia.gov/petroleum/weekly/archive/2017/170913/includes/analysis_print.php
Today in Energy	September 11, 2017	Hurricane Harvey caused U.S. Gulf Coast refinery runs to drop, gasoline prices to rise	https://www.eia.gov/todayinenergy/detail.php?id=32852
Today in Energy	September 8, 2017	Hurricane Irma may cause problems for East Coast energy infrastructure	https://www.eia.gov/todayinenergy/detail.php?id=32832
Today in Energy	September 6, 2017	U.S. average retail gasoline prices increase in wake of Hurricane Harvey	https://www.eia.gov/todayinenergy/detail.php?id=32792
Today in Energy	September 1, 2017	Hurricane Harvey adds uncertainty to gasoline prices for the upcoming Labor Day weekend	https://www.eia.gov/todayinenergy/detail.php?id=32752
Today in Energy	August 25, 2017	Hurricane Harvey headed for area with significant oil, natural gas infrastructure	https://www.eia.gov/todayinenergy/detail.php?id=32652
Today in Energy	August 24, 2017	California increased electricity imports and natural gas generation during solar eclipse	https://www.eia.gov/todayinenergy/detail.php?id=32632
Today in Energy	August 23, 2017	Northwest heat wave leads to record levels of summer electricity demand	https://www.eia.gov/todayinenergy/detail.php?id=32612
Today in Energy	August 7, 2017	Solar eclipse on August 21 will affect photovoltaic generators across the country	https://www.eia.gov/todayinenergy/detail.php?id=32372
Today in Energy	July 28, 2017	California's Aliso Canyon natural gas storage facility cleared to resume partial operation	https://www.eia.gov/todayinenergy/detail.php?id=32252
Natural Gas Weekly Update	July 27, 2017	Record July temperatures in California coincide with price rise at regional natural gas trading hubs	https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2017/07_27/
Southern California Daily Energy Report	June 22, 2017	Temperature-driven increases in natural gas demand contribute to higher spot gas prices in Southern California	https://www.eia.gov/special/disruptions/socal/summer/#commentary
Today in Energy	March 22, 2017	Record precipitation, snowpack in California expected to increase hydro generation in 2017	https://www.eia.gov/todayinenergy/detail.php?id=30452
Today in Energy	March 9, 2017	Warm weather leads to first recorded natural gas storage injection in February	https://www.eia.gov/todayinenergy/detail.php?id=30272
Today in Energy	November 21, 2016	EIA creates winter version of its daily energy dashboard for Southern California	https://www.eia.gov/todayinenergy/detail.php?id=28852

Exhibit F: List of EIA's Disruption Analysis Articles

Source	Publication date	Title	Link
Today in Energy	November 8, 2016	Colonial Pipeline restarts Line 1, resumes gasoline shipments to U.S. Southeast	https://www.eia.gov/todayinenergy/detail.php?id=28692
Today in Energy	October 17, 2016	Hurricane Matthew caused millions of customers to go without power	https://www.eia.gov/todayinenergy/detail.php?id=28372
Today in Energy	September 30, 2016	Pipeline disruption leads to record gasoline stock changes in Southeast, Gulf Coast	https://www.eia.gov/todayinenergy/detail.php?id=28172
This Week in Petroleum	September 21, 2016	Pipeline shutdown disrupts gasoline supply in the Southeast	https://www.eia.gov/petroleum/weekly/archive/2016/160921/includes/analysis_print.php
Today in Energy	September 15, 2016	Electricity customers' service restored in Tallahassee after Hurricane Hermine	https://www.eia.gov/todayinenergy/detail.php?id=27952
Today in Energy	September 12, 2016	EIA data show average frequency and duration of electric power outages	https://www.eia.gov/todayinenergy/detail.php?id=27892
Today in Energy	April 25, 2016	Strong El Niño helps reduce U.S. winter heating demand and fuel prices	https://www.eia.gov/todayinenergy/detail.php?id=25952
Today in Energy	February 1, 2016	Natural gas leak at California storage site raises environmental and reliability concerns	https://www.eia.gov/todayinenergy/detail.php?id=24772
Today in Energy	January 29, 2016	Winter storm knocks out power for more than a million customers	https://www.eia.gov/todayinenergy/detail.php?id=24752
Today in Energy	January 22, 2016	Upcoming winter storm may cause problems for East Coast energy infrastructure	https://www.eia.gov/todayinenergy/detail.php?id=24652
Today in Energy	October 2, 2015	Hurricane Joaquin may cause problems for East Coast energy infrastructure	https://www.eia.gov/todayinenergy/detail.php?id=23192
Today in Energy	April 9, 2015	California's continued drought, reduced snowpack mean lower hydropower output	https://www.eia.gov/todayinenergy/detail.php?id=20732
Natural Gas Weekly Update	March 26, 2015	Cold temperatures, low prices lead to record-high winter power burn	https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2015/03_26/
This Week in Petroleum	March 18, 2015	Cold winter weather increases Northeast distillate demand, but conditions are moderating	https://www.eia.gov/petroleum/weekly/archive/2015/150318/includes/analysis_print.php
Today in Energy	June 12, 2014	Gulf of Mexico 2014 production shut in by storms seen higher than last year	https://www.eia.gov/todayinenergy/detail.php?id=16671
Today in Energy	February 7, 2014	Reduced water supply forecast affects hydropower outlook in Pacific Northwest	https://www.eia.gov/todayinenergy/detail.php?id=14931
Today in Energy	January 21, 2014	Northeast and Mid-Atlantic power prices react to winter freeze and natural gas constraints	https://www.eia.gov/todayinenergy/detail.php?id=14671
Today in Energy	January 17, 2014	Cold weather led to record-high natural gas storage withdrawals	https://www.eia.gov/todayinenergy/detail.php?id=14651
This Week in Petroleum	January 15, 2014	Midwest propane markets tighten further on cold weather	https://www.eia.gov/petroleum/weekly/archive/2014/140115/twipprint.html

Exhibit F: List of EIA's Disruption Analysis Articles

Source	Publication date	Title	Link
This Week in Petroleum	September 8, 2013	Hurricane Harvey disrupts U.S. Gulf Coast refineries, infrastructure, and supply chains	https://www.eia.gov/petroleum/weekly/archive/2017/170908/includes/analysis_print.php
Today in Energy	July 9, 2013	EIA releases energy infrastructure map with real-time storm information	https://www.eia.gov/todayinenergy/detail.php?id=12011
Today in Energy	May 31, 2013	Hurricane effects on oil and natural gas production depend on storm trajectory, strength	https://www.eia.gov/todayinenergy/detail.php?id=11491
Today in Energy	February 1, 2013	Weather and other events can cause disruptions to gasoline infrastructure and supply	https://www.eia.gov/todayinenergy/detail.php?id=9811
Today in Energy	November 13, 2012	Despite customer outages, wholesale electric markets operated during Hurricane Sandy	https://www.eia.gov/todayinenergy/detail.php?id=8750
Today in Energy	November 9, 2012	Electricity restored to many in the Northeast but outages persist	https://www.eia.gov/todayinenergy/detail.php?id=8730
This Week in Petroleum	November 2, 2012	Update on Hurricane Sandy Impacts	https://www.eia.gov/petroleum/weekly/archive/2012/121102/twipprint.html
Today in Energy	September 13, 2012	EIA survey shows Gulf Coast plants recovering from hurricane outages	https://www.eia.gov/todayinenergy/detail.php?id=7950
Today in Energy	August 28, 2012	Worst drought in decades could affect U.S. energy markets	https://www.eia.gov/todayinenergy/detail.php?id=7730
Natural Gas Weekly Update	July 28, 2012	Tropical Storm Debby Shuts In Gulf of Mexico Production	https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2012/06_28/
Today in Energy	April 19, 2012	Natural gas prices near 10-year low amid mild weather, higher supplies in winter 2011-12	https://www.eia.gov/todayinenergy/detail.php?id=5910
Today in Energy	October 6, 2011	Winter supply disruptions from well freeze-offs can rival effects of summer storms	https://www.eia.gov/todayinenergy/detail.php?id=3390
Today in Energy	September 9, 2011	Texas Heat Wave, August 2011: Nature and Effects of an Electricity Supply Shortage	https://www.eia.gov/todayinenergy/detail.php?id=3010
Today in Energy	May 31, 2011	Coal stocks at power plants are likely sufficient despite river flooding	https://www.eia.gov/todayinenergy/detail.php?id=1590
Today in Energy	February 11, 2011	New Texas wholesale power market weathers extreme cold	https://www.eia.gov/todayinenergy/detail.php?id=90