



Liquid fuels infrastructure in northern New Jersey

Credit: Keith Meyers/The New York Times

Liquid Fuels



Lines form outside of a gas station in Sunnyside, Queens after Sandy.

Credit: Brian Kingsley

Liquid fuels keep New York City on the move. Every day, approximately 3.4 million gallons of gasoline and diesel fuel course through engines as vehicles move through the streets of the city, logging over 22 million miles and transporting passengers, consumer goods, supplies, equipment, and personnel to their various destinations. This potent energy source powers the 57,000 taxis, limos, liveries, and other “for-hire” vehicles that provide up to 650,000 rides per day. It fuels most of the 5,600 MTA busses serving over 2.1 million riders daily, along with the 26,000 vehicles of the Police, Fire, Sanitation, and other departments. And it ensures that the private cars among the 2 million vehicles registered in New York City stand at the ready to get New Yorkers across the five boroughs to where they need to go.

Liquid fuels do more, though, than just power vehicles. Over 10,000 buildings in the city use heating oil to keep homes warm and showers hot, consuming up to 6.6 million gallons on the coldest days. The three major airports serving New York fill planes with 6 million gallons of jet fuel daily. Moreover, although natural gas fires most of the city’s power and steam generators, almost all of these facilities are also capable of switching to liquid fuels during shortages of natural gas. Because liquid fuels are both energy dense (meaning they produce a large amount of energy from a relatively small amount of volume) and easily portable on

ships, through pipelines, in trucks, and even in hand canisters, they provide the flexibility needed during disruptions to other energy sources.

And yet, for all of the flexibility of liquid fuels, during Sandy, failures occurred across the supply chain that brings this precious resource to New York and the larger metropolitan region. Refineries and terminals lost power and were damaged, and pipelines shut down—all of which led to the widespread gas station closures that, for many New York drivers, have become among the most vivid memories of the post-storm period. Despite the early conclusion many reached that these closures were due primarily to power outages that prevented stations from pumping gas, the larger problem turned out to be that stations simply had no gas to pump. The station closures, and the long lines at the stations that did have gas, not only frustrated drivers, limited mobility, and slowed economic activity, they also hampered recovery efforts. Lack of fuel made it more challenging for ambulances to respond to emergencies. It made it harder for utility workers to restore electricity. It delayed doctors and nurses who were trying to treat patients. It interfered with the ability of relief workers to reach the hardest hit areas of the city. In short, the storm and its aftermath highlighted just how dependent New York City is on gasoline, diesel fuel and heating oil—

and underscored the vulnerabilities in the fuel supply infrastructure.

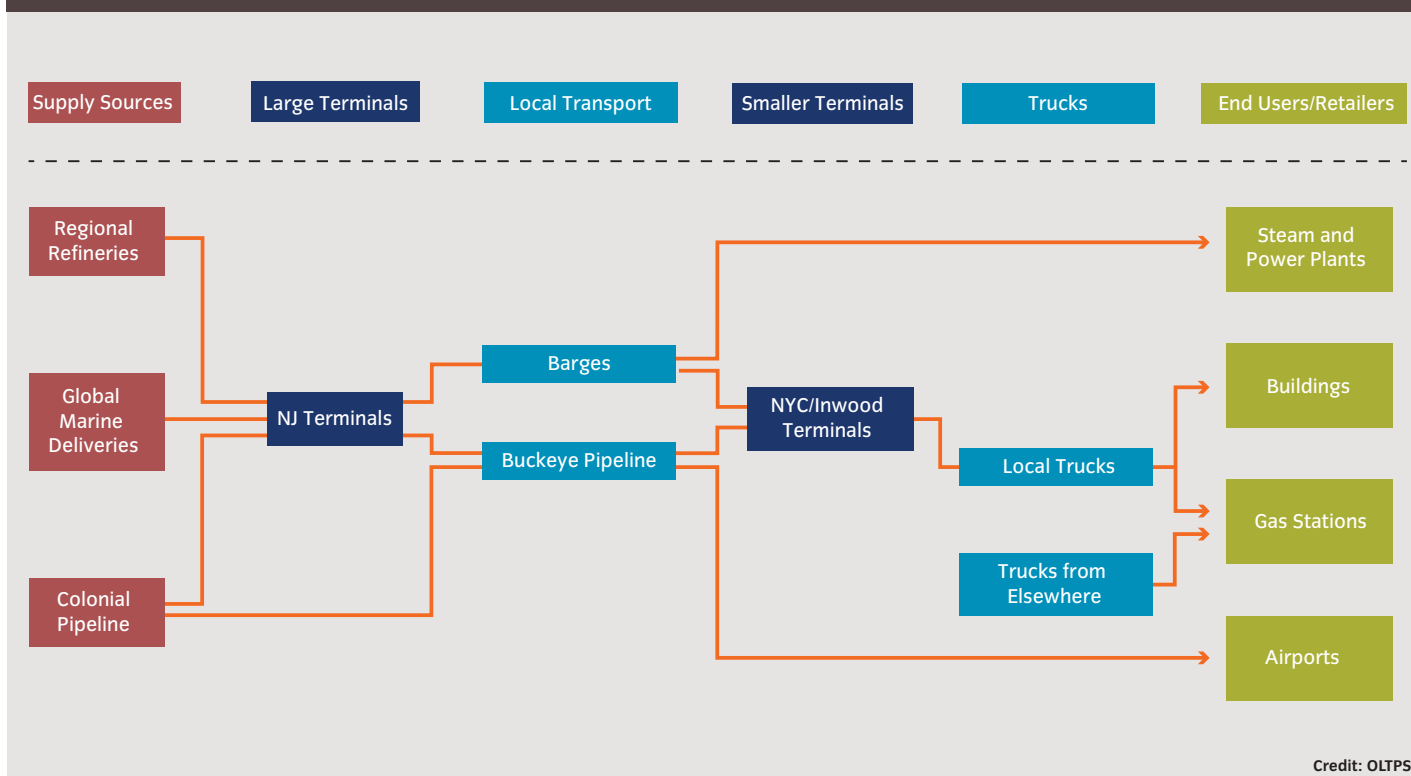
In keeping with the overarching goals of this report, which are to limit the impacts of climate change and enable New York to bounce back after extreme weather events, the City will seek to strengthen the liquid fuels supply chain so that fuel networks can quickly recover after disruption. To do so, the City is proposing ways to harden infrastructure along this supply chain, to increase redundancy and fuel supply flexibility, and to ensure that supply is always available for vehicles critical to the city’s infrastructure, safety, and recovery after extreme weather events.

How the Liquid Fuels System Works

The New York metropolitan area is the largest liquid fuels hub on the East Coast and one of the largest in the country. Liquid fuels reach New York City after traveling through a supply chain via assets spread across many owners. There is little regulatory oversight with respect to infrastructure climate resilience, and almost no operational information is shared by owners, either with each other or third parties.

Liquid fuels generally enter the New York City market from three major sources: regional refineries, pipelines that originate at refineries in

Liquid Fuels Supply Chain



the Gulf Coast region, and marine fuel tankers that arrive from refineries all over the world. Regional refineries and pipelines each provide 35 to 40 percent of New York City's supply. Marine tankers supply the balance.

Refineries separate crude petroleum into finished liquid fuels for consumer use. Currently one refinery in northern New Jersey and four refineries in the Philadelphia area provide over 42 million gallons per day of regional refining capacity serving the Northeast market. These refineries require large amounts of electricity to operate, mostly relying on power delivered by utilities.

The Colonial pipeline is a major conduit for New York City and the Northeast with a maximum capacity of 37 million gallons per day. This pipeline transports fuels from refineries as far away as the Gulf Coast region to a major hub in Linden, New Jersey. The Buckeye pipeline then brings fuels from the Colonial line, refineries, and terminals in the Linden area to New York City and Long Island terminals, as well as directly to JFK and LaGuardia airports. Fuel is propelled through these pipelines by pumping stations, which are powered by electricity delivered by utilities.

As for the marine tanker network, these vessels deliver fuels to and ship fuels via New York Harbor. In 2010, 8.7 billion gallons were im-

ported from other countries, while over 12.6 billion gallons were exported abroad. In the New York area, the movement of these marine tankers occurs mainly along the waterways between Staten Island and New Jersey.

Once liquid fuels arrive in the New York area via pipeline, regional refineries, or marine tankers, they are stored and sold from terminals mainly concentrated in a few waterfront areas in New Jersey and around the city. Large terminals, which receive shipments from pipelines and tanker ships, supply small- and medium-sized terminals via barge or pipeline. The small- and medium-sized terminals blend in mandated additives, such as ethanol, or performance- and brand-based additives. Truck racks then are used to load liquid fuels from terminal storage tanks onto trucks, which then supply gas stations and buildings.

Approximately 800 gas stations are located throughout New York City. These stations have an estimated 14.6 million gallons of storage capacity in underground storage tanks—enough capacity to satisfy approximately four days' worth of demand. However, since not all stations' storage tanks are full at all times, the city generally has much less than four days' worth of fuel supply on hand.

Over 500 of the gas stations in New York City are associated with seven major brands. Most

of these stations are franchised. Under traditional retail fuel franchise agreements, these stations are obligated to source fuel from designated suppliers and to sell only specific formulations of gasoline and diesel. By contrast, the retail fueling stations selling fuel under the Hess brand are corporate-owned. However, as of the writing of this report, Hess has announced that it intends to sell its retail network to focus on other aspects of its business. Regardless of ownership structure, gas stations traditionally operate on thin profit margins from their core business of selling gasoline and diesel fuel.

The City has its own transportation fueling sites for government use. Of its 414 total sites, 16 are located Upstate and serve the Department of Environmental Protection (DEP) vehicles in the City's watershed areas. The majority (240) of the City's sites are at Fire Department of New York (FDNY) facilities. Overall, the City has storage capacity for 1.2 million gallons of fuel—a two weeks' supply for City vehicles—though, again, not all tanks are always full.

Given the Northeast's dependence on heating fuels, the US Department of Energy (DOE) maintains a home heating fuel reserve in case of major supply disruptions. This reserve is stored in fuel terminals in Connecticut, Massachusetts, and New Jersey, and contains over 42 million gallons of ultra-low sulfur diesel

meant to be used in buildings, but able to be used in diesel-fueled vehicles.

With respect to other sectors in New York, each of these acquires and stores fuel in a different way. For example, as mentioned above, airports generally receive jet fuel directly via pipelines that feed large on-site tanks. Buildings accept truck deliveries of heating oil, pumped directly

into their fuel storage tanks. For the most part, power and steam generators receive liquid fuel shipments via barges, which replenish large tanks used for on-site storage.

Regulation of the Liquid Fuel Supply

Responsibility for the regulation of the fuel supply infrastructure, and the transportation and consumption of fuel, is divided among Federal,

State, and City agencies. These agencies have promulgated a variety of rules affecting supply in New York City. For example, regulations from the US, New York State, and New York City Departments of Transportation determine how fuel is transported into and around the city. Meanwhile, the US Environmental Protection Agency (EPA), NYS Department of Environmental Conservation (NYSDEC), and DEP all regulate

Transportation and Consumption Regulations Affecting Liquid Fuels		
Law or Regulation	Administered by	Description
NYC biodiesel requirement	DEP	Requires a minimum of 2% biodiesel in all heating fuels used in buildings.
NYC heating oil sulfur regulation	DEP	Requires #4 and #6 heating oils in buildings to have lower sulfur content.
Transportation height and weight restrictions	NYS DOT, NYCDOT	Restricts vehicles above certain heights, weights, and lengths on designated roadways and bridges.
Truck route regulations	NYCDOT	Restricts freight truck vehicle traffic through certain roadways.
Transportation of flammables through tunnels	Port Authority, the MTA, FDNY	Restricts transportation of flammable liquids through tunnels.
On-road vs. off-road diesel requirement	NYS DOT	Treats fuels that are used for on-road (transportation) use and off-road (heating) use differently for tax purposes, even if they are chemically the same. Off-road fuel is tinted red and is prohibited for on-road use.
NYS heating oil sulfur regulation for NYC	NYSDEC	Requires #2 heating oil to have no more than 15 ppm sulfur content in New York City.
Local formulation requirements	EPA	Requires the use of reformulated gasoline blendstock for oxygenate blending (RBOB) in NYC, LI, Westchester, Orange, Putnam, and Rockland Counties to improve air quality by reducing ground level ozone.
Vapor pressure requirement	EPA	Requires the reduction of the vapor pressure of gasoline in summer months, thus reducing volatile organic compounds (VOCs) that lead to ground level ozone.
Federal sulfur requirement	EPA	Requires ultra low sulfur diesel (ULSD), with less than 15 parts per million (ppm) sulfur specification, for highway diesel fuel. Requires low sulfur (500 ppm) and ULSD fuel to be phased in for non-road, locomotive, and marine engines from 2007–2014.
Vapor recovery systems requirement for fuel loading/unloading	EPA	Requires bulk gasoline and marine loading terminals and associated truck racks to use vapor recovery or vapor combustion devices during fuel loading and unloading for both emissions and safety.
Jones Act (Merchant Marine Act of 1920)	US DHS	Requires that all goods transported by water (including fuels) between US ports be carried in US-flagged ships, constructed in the United States, owned by US citizens, and crewed by US citizens and US permanent residents.
Driver hours-of-service (HOS) regulations	US DOT	Allows delivery truck drivers to drive a maximum of 11 hours after 10 consecutive hours off duty.

the chemical composition of fuels sold and consumed within the city. In addition, the Jones Act, originally passed in 1920, restricts foreign-flagged vessels from delivering fuel supply from domestic sources. Of note, none of these entities set regulations that are expressly designed to address the threats to the fuel supply chain by climate-related risks, such as storm surge. (See chart: *Transportation and Consumption Regulations Affecting Liquid Fuels*)

What Happened During Sandy

Disruptions occurred at nearly every level of the fuel supply chain, reducing all fuel flow into and within the New York metropolitan area. Most of the infrastructure affected was located in New Jersey, where a combination of extended power outages and direct damage from storm surge, for a time, nearly dried up New York City's fuel supply.

Despite widespread failures throughout the supply chain during and after Sandy, a lack of available information on the operational status of terminals, pipelines, refineries, and other key infrastructure delayed situational awareness for several days. Duplicative efforts among different governmental entities to secure information further delayed diagnosis of the cause of the supply disruptions and resulted in conflicting reports and, at least initially, responses that did not properly address the underlying issues.



Regional Refineries, Operational Status After Sandy												
Refinery	Location	Operating Capacity (thousand bbl/day)	Operational Status, Days After Sandy									
			0	+1	+2	+3	+4	+5	+6	+7	+8	+9
Hess	Port Reading, NJ	70										
Phillips 66	Linden, NJ	238										
Sunoco	Philadelphia, PA	335										
PBF	Delaware City, DE	182										
PBF	Paulsboro, NJ	160										
Monroe Energy	Trainer, PA	185										

Pipelines, Operational Status After Sandy											
Pipeline	Operational Status, Days After Sandy										
	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	
Colonial											
Buckeye											

Shut Reduced operations Operational

Source: US DOE

New York Metropolitan Area Fuel Terminals, Operational Status After Sandy



Hurricane Sandy dramatically reduced output at refineries that supply New York City. While Philadelphia refineries were not greatly affected by the storm and reopened fairly quickly, two northern New Jersey refineries were closed for extended periods. The owners of these regional refineries partially shut down their facilities before the storm to minimize damage to equipment, eliminating 35 to 40 percent of the region's total supply capacity preemptively. Despite this prudent preparation, storm surge damage to electrical equipment at two of the six refineries delayed their restarting, reducing regional refining capacity by 26 percent. Although both refineries eventually reopened several weeks later, one of the two subsequently was permanently closed, due to market conditions. (See chart: *Regional Refineries, Operational Status After Sandy*)

The Colonial and Buckeye pipelines also were impacted by Sandy, shutting down for four days due to extensive power outages in New Jersey. This reduced total supply in the region by another 35 to 40 percent. Even after backup power generators were deployed and utility power was restored, it is likely that the flow of fuel through these pipelines still did not reach pre-storm levels for several days because of bottlenecks at the terminals that they supplied. (See chart: *Pipelines, Operational Status After Sandy*)

Of all of the ways in which Sandy interfered with the liquid fuel supply chain in the New York region, perhaps the most significant was the damage to the area's terminals. This damage

took multiple forms. For example, docks at some terminals were destroyed, making it impossible for those terminals to ship or receive fuel. In many cases, damage to electrical equipment reduced the capacity of impacted terminals to dispense fuel to delivery trucks that service gas stations. Additionally, damage to storage tanks at several terminals resulted in spills into area waterways totaling some 460,000 gallons of fuel around the city. And, as a result of the large amount of storm-related debris in the harbor immediately following Sandy, the US Coast Guard placed restrictions on port traffic for days until the waterways were deemed safe for use. As a result, even if a terminal were otherwise able to operate, many were still, for a period, unable to dispense or receive tanker and barge shipments, reducing supply capacity by an additional 20 to 25 percent. Overall, for three days after Sandy, all fuel terminals in the New York metropolitan region were completely out of service. Even 10 days after the storm, only 79 percent were operational. (See chart: *New York Metropolitan Area Fuel Terminals, Operational Status after Sandy*)

The closures of terminals meant that many gas stations had no supply. However, supply agreements required franchised gas stations to source their fuel only from those facilities. Accordingly, even where alternative sources of fuel may have been available, these stations could not take advantage of them. One significant exception to this during Sandy was gas stations owned by Hess, which had the ability to source fuel from corporate-owned terminals

outside of the region. As a result, Hess stations received more frequent fuel shipments and remained open on average twice as long daily as other gas stations.

Another barrier to the restoration of fuel availability was local, State, and Federal regulations relating to the transportation and consumption of liquid fuels, which restricted supply from entering the city. For example, New York State's price-gouging law, which was meant to prevent predatory price increases during emergencies, may actually have had the perverse effect of constraining fuel supply due to its lack of clarity. This is because this law, prohibiting an "unconscionably excessive" price increase, made it unclear to retailers how much of a price increase would be considered price gouging, preventing them from temporarily raising prices at the pump. This would have allowed retailers, in turn, to pay the additional transportation costs associated with sourcing fuel from other regions.

With little or no fuel to sell to customers, stations all across New York City were forced to close—even though, unlike in New Jersey and on Long Island, 90 percent of the stations in the city were outside of the areas that experienced widespread power outages. In fact, most drivers in New York City were able to find a station that had access to adequate power within a five mile radius after the storm, except those in the Rockaways. (See map: *Retail Gas Stations, Electrical Network Shutdowns, and Sandy Inundation Area*)

Because of the post-Sandy fuel shortage, however, within one week of Sandy's landfall, less than 20 percent of stations were able to sell fuel at any given time. During that time, even after receiving fuel shipments, in many cases, stations would end up selling out in short order. For many drivers, this meant spending hours searching around the region for stations with gas, often waiting in long lines at the few that remained open—only, in some cases, to have those stations run out before every customer had a chance at the pump. Because demand was concentrated at fewer stations, the presence of New York City police officers was required at gas stations to maintain order and direct traffic. (See chart: *New York City Gas Stations by Point-in-Time Operational Status*)

As significant as the impact of the fuel shortage was on the general population, even more seriously, personnel and entire fleets that were critical to storm response had difficulties refueling. This was true of utility technicians essential to power-restoration efforts, hospital staff, nonprofit relief workers, and other critical personnel. In each case, these important individuals were also forced to spend hours either

searching for open gas stations or waiting in line, delaying emergency response and restoration efforts citywide.

The fuel supply disruption also affected power and steam plants in and around the city. As the storm approached, Con Edison called upon power plants within the city to switch to liquid fuels preemptively in case of a natural gas disruption. Eventually, as the area's fuel supply issues emerged, some power and steam plants actually had difficulty obtaining adequate fuel shipments, in some cases, coming close to depleting their fuel supplies.

In response to the fuel shortage, the City worked with the State and Federal governments and with private industry to put in place a variety of measures to restore supply, with a goal of prioritizing fuel for emergency responders, then for private fleets critical for infrastructure restoration and relief, and finally for the general public.

One example of the steps that the City took to bring supply and demand back into balance was a waiver of regulations on the transportation and consumption of fuels within New York City. The City, State, and Federal governments also worked together to secure a waiver of a series of relevant restrictions, including the Jones Act, local gasoline formulation requirements, gasoline vapor pressure requirements, on-road diesel requirements, diesel sulfur requirements, biodiesel requirements, and certain transportation restrictions. While these actions all took place within a few days of the storm and led to additional supply entering the system, the depletion of service station inventories continued to occur too quickly for the supply chain to “catch up,” resulting in continued shortages.

Therefore, 11 days after the storm and consistent with steps taken in New Jersey and Long Island, Mayor Bloomberg issued an Executive Order for the rationing of gasoline—the first in New York City since the 1970s. Pursuant to the Executive Order, drivers of vehicles with license plates ending in odd numbers were permitted only to fuel on odd-numbered days, while those with plates ending with even numbers or letters were permitted to fuel only on even-numbered days.

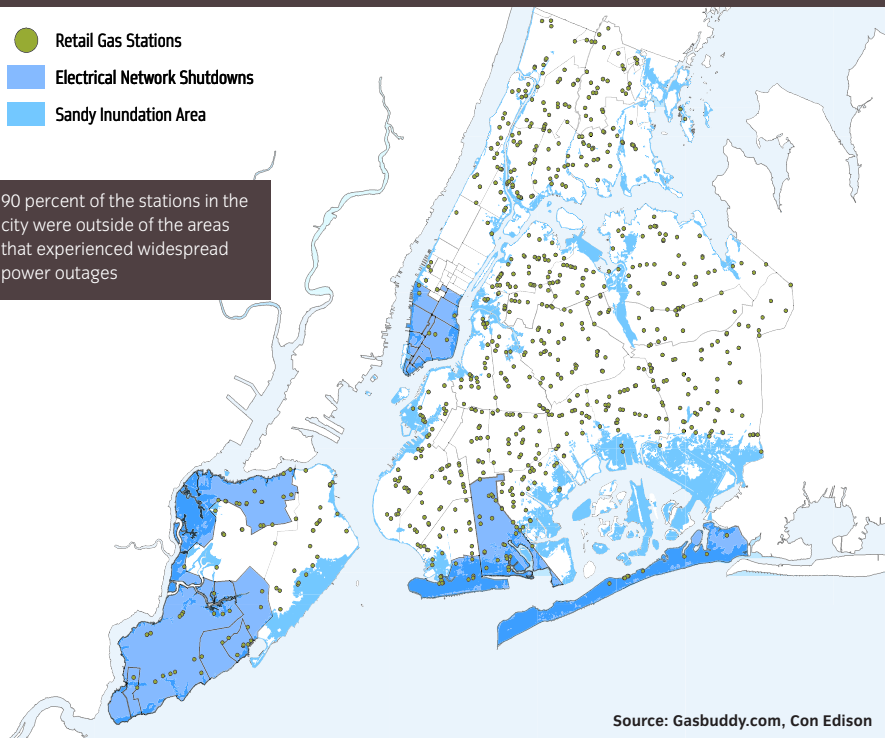
The US Department of Energy also began releasing supply from the Northeast Home Heating Oil Reserve. The ultra-low sulfur diesel contained in the reserve, which was meant to be used in buildings for heating, was made available for use in vehicles, helping to reduce the area's diesel shortage.

The City also identified groups deemed critical to storm response and in need of fueling assistance. These groups included City staff from uniformed

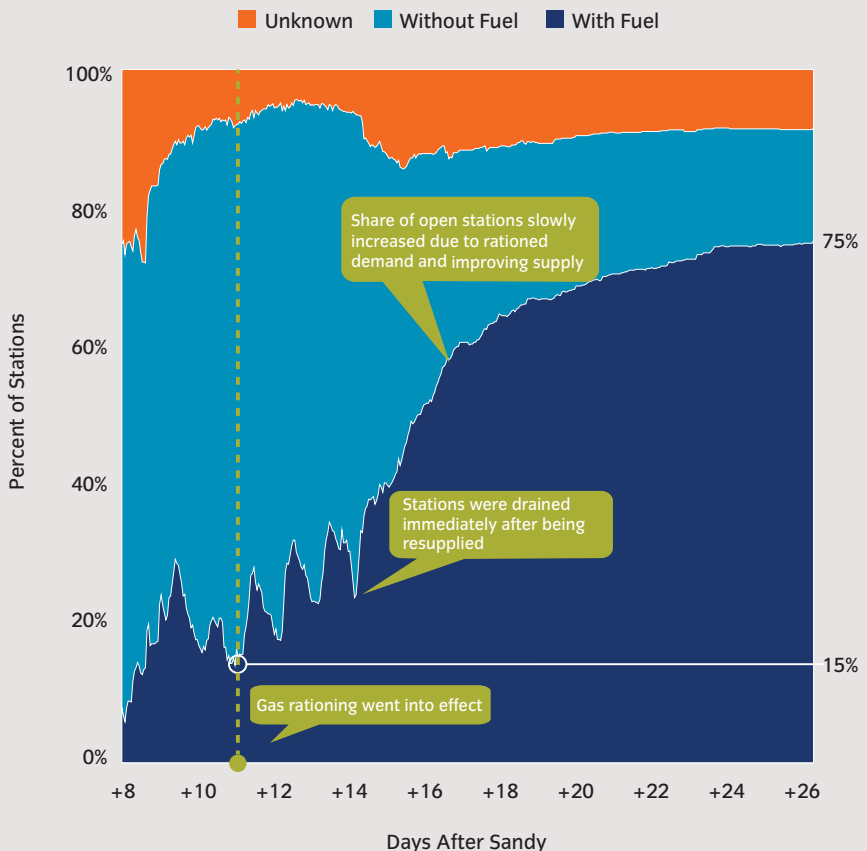
Retail Gas Stations, Electrical Network Shutdowns, and Sandy Inundation Area

- Retail Gas Stations
- Electrical Network Shutdowns
- Sandy Inundation Area

90 percent of the stations in the city were outside of the areas that experienced widespread power outages



New York City Gas Stations by Point-in-Time Operational Status



Source: Gasbuddy.com

Risk Assessment: Impact of Climate Change on Liquid Fuels

Major Risk Moderate Risk Minor Risk

Hazard	Scale of Impact			Comments
	Today	2020s	2050s	
Gradual				
Sea level rise				Low-lying infrastructure could be vulnerable to minor damage with significant sea level rise
Increased precipitation				Minimal impact
Higher average temperature				Minimal impact
Extreme Events				
Storm surge				Most terminals and refineries are in floodplains; flood risks will become worse over time
Heavy downpour				Minimal impact
Heat wave				INDIRECT: Increased likelihood of power outages could disrupt operations of supply infrastructure
High winds				INDIRECT: Increased likelihood of power outages could disrupt operations of supply infrastructure served by above-ground lines



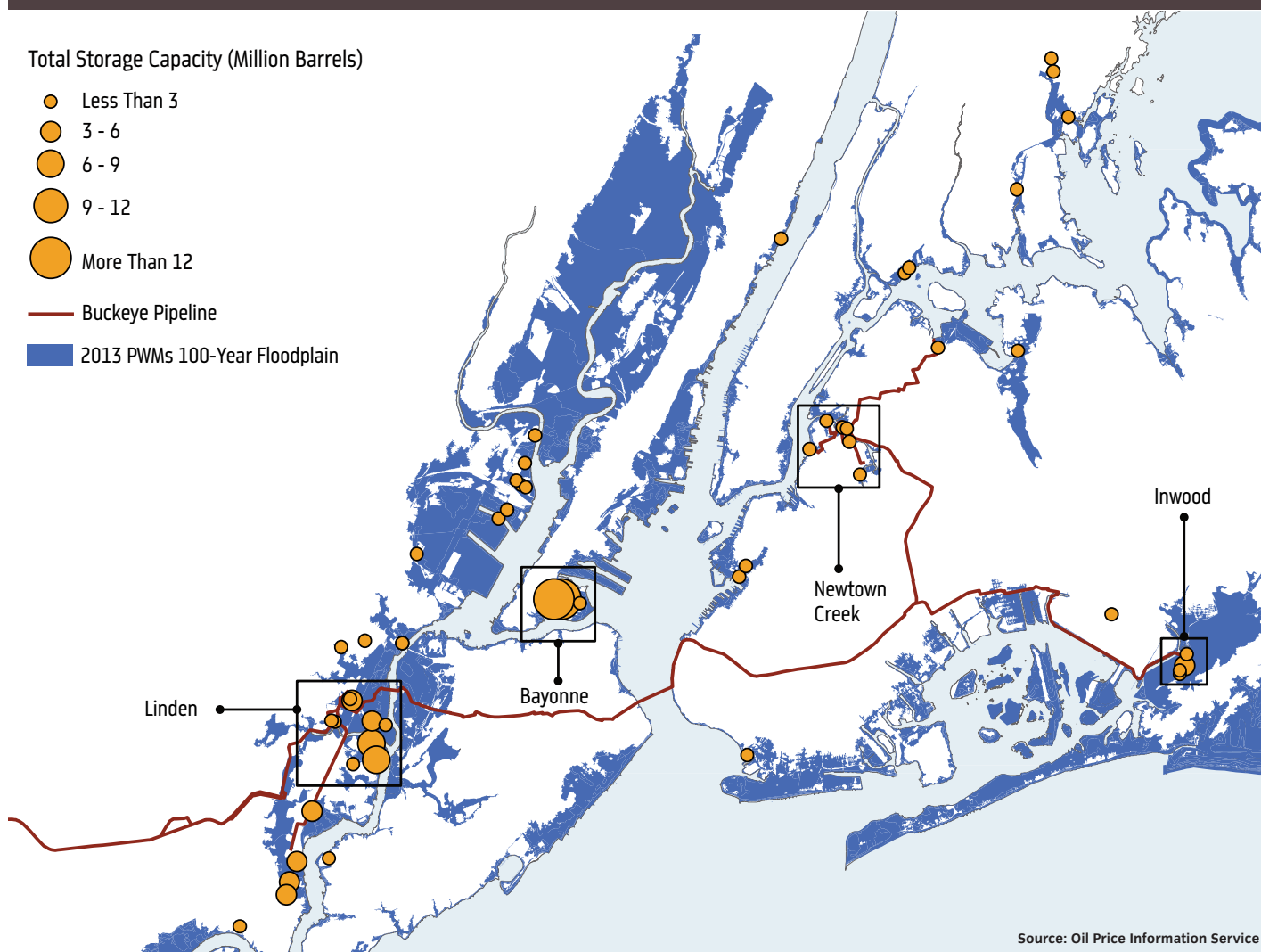
Fuel terminals between Newark Liberty International Airport and Port Elizabeth in northern New Jersey

Credit: Keith Meyers/The New York Times

agencies, doctors and nurses, and electricians and other skilled tradespeople. To fuel their vehicles and the vehicles of others, the City worked with the New York National Guard, the US Defense Logistics Agency, the US Department of Energy, the National Park Service, and the City's fuel vendors to set up an emergency fueling station at Floyd Bennett Field in Brooklyn. A total of 450,000 gallons of fuel were supplied to over 25,000 vehicles from this station. The assisted vehicles included private ambulances, Access-a-Ride vehicles, food trucks supporting storm response efforts, and utility trucks. In a complementary effort, the New York National Guard and the Department of Citywide Administrative Services (DCAS) also conducted fuel missions to fill gas cans to supply emergency electrical generators.

Another fuel-related effort in the aftermath of Sandy was one undertaken by the City, which involved working with the fuel vendors to increase fuel deliveries for City fleets. As a result of these efforts, the City's two primary vendors ended up delivering supplies that exceeded normal fuel deliveries by 65 percent. The City also made arrangements to fuel emergency and critical storm response vehicles at 10 Hess retail stations across the city. The NYPD monitored the Hess sites, ensuring that critical vehicles were able to access fuel without having to wait in line.

Regional Liquid Fuel Terminals



What Could Happen in the Future

The risks that extreme weather events pose to the liquid fuels supply chain are, as Sandy showed, serious if not addressed. The systematic failure that occurred as a result of Sandy's storm surge revealed that there are already significant challenges today. These challenges will only be exacerbated by climate change in the future.

Major Risks

Given the existing locations of key terminals, pipelines, and refineries, and the importance of waterfront access for the movement of fuels into New York City, the greatest risk to the liquid fuel supply is storm surge. Of the 39 fuel terminals in the New York metropolitan area, nearly all lie within FEMA's 100-year floodplain. The same is also true of the refinery in northern New Jersey as of the writing of this report. As

the climate changes, the frequency of the most intense hurricanes is likely to increase, potentially increasing the risk to these facilities. (See map: *Regional Liquid Fuel Terminals*.)

Not only do extreme weather events cause direct damage to key liquid fuel assets in the region, they also disrupt the power infrastructure critical to the functioning of terminals, refineries, and pipelines. Although utilities must meet current reliability standards, the increased frequency and severity of heat waves and storm surges associated with the most intense coastal storms are likely to increase the frequency of power disruptions throughout the region that would, in turn, render key refineries, pipelines, and terminals inoperable (see Chapter 6, *Utilities*). Given the high energy requirements of pipelines and refineries, backup generation may only provide limited operability during utility power outages. Additionally, if power were out for more than a

few hours, refineries would quickly shut down, after which it would take weeks to restart them. Gas stations and terminals, which generally do not have on-site backup generation, also are fully reliant on utility power.

Other Risks

High winds present moderate risks to the liquid fuels supply chain. Wind events could result in direct damage to refineries, which have tall distillation columns that are critical to the processing of crude oil. In addition, if wind events affect the availability of utility-supplied electric power, they will also impact terminals, refineries, pipelines, and gas stations.

This chapter contains a series of initiatives that are designed to mitigate the impacts of climate change on New York's liquid fuel supply. In many cases, these initiatives are both ready to proceed and have identified funding sources assigned to cover their costs. With respect to these initiatives, the City intends to proceed with them as quickly as practicable, upon the receipt of identified funding.

Meanwhile, in the case of certain other initiatives described in this chapter, though these initiatives may be ready to proceed, they still do not have specific sources of funding assigned to them. In Chapter 19 (*Funding*), the City describes additional funding sources, which, if secured, would be sufficient to fund the full first phase of projects and programs described in this document over a 10-year period. The City will work aggressively on securing this funding and any necessary third-party approvals required in connection therewith (i.e., from the Federal or State governments). However, until such time as these sources are secured, the City will proceed only with those initiatives for which it has adequate funding.

Storm surge, storm- or heat wave-driven power outages, and other natural or manmade disasters can cause disruptions in the supply of liquid fuels. The City will seek to minimize the frequency and severity of disruptions by increasing the resiliency of key infrastructure. However, in recognition of the fact that it is not possible to prevent all disruptions, the City also will seek to minimize the impacts of such disruptions by improving restoration times. Finally, in the event of a significant, lengthy and widespread fuel supply disruption, the City will prepare for a work-around of the normal supply chain to maintain operations that are necessary to restoration and relief while the normal chain is being restored.

Strategy: Seek to harden the liquid fuels supply infrastructure

The fuel supply infrastructure is vulnerable to extreme weather events, which are likely to become more frequent and more severe in the future. Hardening of key assets would decrease disruptions and allow for faster restoration of operations.

Initiative 1

Call on the Federal government to convene a regional working group to develop a fuel infrastructure hardening strategy

The fuel supply shortage after Sandy was caused mainly by damage to infrastructure in New Jersey, where the City and State of New York have no regulatory or legislative authority. Owners are not required by any existing regulations to harden infrastructure against climate change impacts. In fact, due to the highly dynamic and competitive nature of the fuel industry, suppliers often do not have the resources and long-term outlook necessary to make their waterfront assets more resilient against threats such as storm surge and power loss.

The City, therefore, will call on the Federal Hurricane Sandy Rebuilding Task Force and the US Department of Energy to convene the necessary stakeholders to ensure that key infrastructure is hardened. The City also will call on the Columbia University Center on Global Energy Policy to join this effort. In addition to the City, participants in this effort should include the State of New York, the State of New Jersey, and private owners of key assets. The Office of Long-Term Planning and Sustainability (OLTPS) will begin working with these parties immediately to develop a strategy that will achieve the goal of hardening pipelines, refineries, and terminals critical to maintaining fuel supplies in the region.

Initiative 2

Develop a reporting framework for fuel infrastructure operators to support post-emergency restoration

There currently are no requirements to report information on the operational status of terminals, pipelines, refineries and gas stations. In an emergency, not being able to access the information needed to gain a comprehensive understanding of the regional challenges will hamper recovery and restoration. The City will call on and work with the Federal government and private industry to develop streamlined reporting protocols for operators, as well as automated sensors and other information technology (IT) systems that will monitor the operational status of these facilities. OLTPS and the New York City Economic Development Corporation will begin working immediately with the US DOE to develop these systems and an information-reporting framework for these facilities, in a manner that is sensitive to the industry's need for security and confidentiality.

Initiative 3

Work with Buckeye and New York State to safely build pipeline booster stations in New York City to increase supply and withstand extreme weather events

Many existing pumping stations along pipelines are not hardened against extreme weather. Before Sandy, Buckeye had proposed the installation of a booster station to increase flow into New York City for economic reasons. This booster station also would help bring additional supply to New York City in emergency situations. New York State has advocated for the building of a booster station to increase supply during shortages. The City also will advocate for the building of a new booster station if design specifications meet the necessary legal, safety, and resiliency standards, and all necessary commercial terms could be secured. OLTPS will begin working immediately with Buckeye and New York State to ensure that a booster station, once installed, will be designed to withstand climate change impacts to the greatest extent possible.

Initiative 4

Work with New York State to provide incentives for the hardening of gas stations to withstand extreme weather events

Although lack of power supply at gas stations was not the primary cause of fuel shortages after Sandy, a widespread power outage in the city would cripple gas station operations, making gasoline and diesel unavailable. New York State's 2013–2014 budget requires retail fuel stations within a half-mile of controlled access roads and designated evacuation routes to invest in equipment that would allow them to connect generators quickly in the event of a power loss, and to enter into supply contracts for emergency generators.

The City will support the State in the design and implementation of the generator connection program, an effort that will include working with the New York State Energy Research and Development Authority (NYSERDA), which was directed to develop an incentive program to minimize the financial impact of the budget requirements. In addition the City will work with the State to assess the vulnerability of gas stations on the Rockaway Peninsula, an area of the City in which gas stations are not required to comply with the State budget requirements, but should, due to its geographic isolation.

Because the aforementioned program does not require any other hardening measures against flooding or other climate-related risks, OLTPS will work with NYSERDA, retail gas stations, and the State legislature to seek to develop effective hardening incentive programs for key retail fueling stations in vulnerable areas, including the Rockaways, by 2014.

Initiative 5

Ensure that a subset of gas stations and terminals have access to backup generators in case of widespread power outages

As previously mentioned, gas stations are vulnerable to widespread power outages, which could prevent them from operating. In New York State's 2013–2014 budget, NYSEDA was directed to develop a generator pool program for gas stations. The Office of Emergency Management (OEM) will assist NYSEDA, the Federal Emergency Management Agency, and the US Army Corps of Engineers (the USACE) in developing such a pool and in creating a pre-event positioning plan to enable the ready deployment of generators to impacted areas immediately in the wake of a disaster.

Strategy: Enhance the ability of the supply chain to respond to disruptions

One reason restoration of fuel supply was so slow after Sandy was the lack of redundancies and market flexibility needed to respond to such disruptions. As Sandy also showed, the impacts of a supply disruption can be blunted through market and regulatory changes.

Initiative 6

Explore the creation of a transportation fuel reserve to temporarily supply the private market during disruptions

Even if the fuel supply chain is hardened, the possibility of widespread disruption to supply still exists. In the event of such a disruption for an extended period of time in and around the city, a transportation fuel reserve for the City, State, or region would assist in restoration and relief efforts. The City will work with Federal and State governments, and the Columbia University Center on Global Energy Policy to evaluate the feasibility and cost of such a program. Such a program would complement the already existing Northeast Home Heating Oil Reserve, managed by the US DOE in Connecticut. In 2013 and 2014, OLTPS will work with the US DOE, New York State, and surrounding state governments on this effort.

Initiative 7

Call on New York State to modify price-gouging laws and allow flexibility of gas station supply contracts to increase fuel availability during disruptions

There is a lack of clarity in New York State's price-gouging laws during the very limited circumstances of a widespread disruption of fuel supplies in the New York region. This uncer-

tainty results in retail fuel station owners' unwillingness to raise prices after such a disruption to pay for supply from outside of the region. The City estimates that a \$0.33 increase in fuel prices after Sandy (a premium of approximately 10 percent) would have allowed stations to cover the additional transportation costs to bring fuel into the city from as far as Charlotte, North Carolina. Another challenge during Sandy was that many retail fuel stations were bound by franchise agreements to source fuel only from certain suppliers, which were either not operational or had insufficient supplies after the storm. These contractual obligations prevented station owners from temporarily sourcing fuel from different suppliers.

A solution to the problem posed by the State's price-gouging laws would be to allow a controlled increase in prices during fuel supply emergencies, while still ensuring fair pricing. A solution to the problem posed by retailers' franchise agreements, meanwhile, would be the inclusion of a "force majeure" clause in fuel supply contracts that would allow franchised stations to source fuel on a temporary basis from any wholesaler if a retailer's usual suppliers are unable to deliver.

OLTPS will, therefore, work with New York State to seek legislation in 2013 and 2014 that would permit controlled increases in fuel prices during and after extraordinary weather events, and that would mandate a "force majeure" clause in all fuel supply contracts and franchise agreements, in each case, to be exercised only during a liquid fuels shortage, as declared by the Governor.

Initiative 8

Develop a package of City, State, and Federal regulatory actions to address liquid fuel shortages during emergencies

Various regulations relating to the transportation and consumption of fuels in New York City limit the flexibility of the market to respond to disruptions. The City will work with the State and Federal governments to prepare an "off-the-shelf" package of regulatory measures for use in the event of a liquid fuels shortage. A list of such waivers that would be issued rapidly across different levels of government would allow supply-demand imbalances in the fuel supply to be mitigated more quickly. The waiver of the Jones Act, for example, would allow foreign-flagged ships to deliver fuel into the region. Waivers of the City's fuel sulfur requirements and the local formulation requirements would allow fuel that is normally consumed upstate and elsewhere to be shipped into and sold within New York City. A waiver of the on-road diesel fuel requirement would allow heating fuel to be used in vehicles. The imposition of fuel rationing would further allow the retail fuel supply to stabilize.

OEM and DCAS will, therefore, develop and regularly maintain a fuel-rationing plan and package of regulatory waivers and modifications that would be put in place immediately after the declaration of a liquid fuels shortage, as declared by the Mayor. OEM will further work with the State and Federal governments to develop complementary measures. OEM will update the City's plan and package on an annual basis.

Strategy: Improve the City's ability to fuel first responders and private critical fleets

The City must be able to respond quickly to a fuel supply disruption, providing continuous fueling to vehicles that are critical for emergency response, infrastructure rebuilding, and disaster relief. These vehicles include emergency responders, utility restoration fleets, medical personnel vehicles, electricians and other skilled trades workers, construction vendors, private ambulances, wheelchair accessible transportation vehicles, food supply trucks supporting relief efforts, and City government staff from uniformed agencies.

Initiative 9

Harden municipal fueling stations and enhance mobile fueling capability to support both City government and critical fleets

During a widespread disruption to the retail liquid fuels market, the City must be able to bypass the supply chain by using its own network of gas stations and mobile fueling trucks. This will ensure continued service at City-owned fueling sites and mobile fueling operations for City-owned fleets, as well as select critical fleets that are privately owned. The City, through DCAS, will procure additional mobile fueling trucks, generators, light towers, forklifts, and water pumps to permit the City to harden its own fuel supply infrastructure and put in place emergency fueling operations immediately following a disruption in the supply chain.

In the event of a prolonged disruption, the City must ensure that it does not deplete its own fuel supply for first responders and critical fleets. Currently, the City owns almost two weeks of fuel storage capacity for its own normal usage, and much less when fueling privately-owned vehicles. Therefore, DCAS also will also issue a request for expressions of interest in 2014 in order to evaluate the different options for sourcing fuel during emergencies.