

# LESSONS FROM THE TEXAS WINTER STORM:

How Data Centers Can Ensure Fuel Delivery During Weather Events and Emergencies, Maintain Fuel Efficiency Through Fuel Quality Practices, and Guarantee Facility Uptime When Running on Generator Power

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# 01

## INTRODUCTION

In February, 2021, Texas was hit by a catastrophic winter storm that lasted for a week. The entire state was paralyzed by snow, ice, and freezing cold, including south Texas cities such as Houston that normally don't get severe winter weather. As state utilities ordered rolling blackouts to relieve their overloaded power grids, many data centers in Texas were forced to switch over to emergency generator power. But some data centers struggled to stay operational and maintain uptime, due to problems with their generator fuel reserves. At some facilities, generators failed when their filters were clogged by gelling and icing of diesel fuel, brought on by the record-low temperatures. At other facilities, fuel deliveries were delayed due to Texas highways and fuel terminals being closed.

This white paper looks at the lessons that data centers learned from the Texas winter storm, in relation to fuel quality, delivery, and procurement. It looks at what data center owners can do to prepare their fuel supplies for the next event that might force their facilities to switch to generator power. It examines how fuel testing, fuel treatments, and fuel polishing can contribute to higher fuel efficiency, which can help to ensure that data center generators will function properly in emergencies such as extreme cold. Also, it looks at how relationships and contracting with national fuel providers can help data center owners to enable fuel delivery and procurement, even during prolonged weather events.

# 1. INTRODUCTION

In mid-February, 2021, the state of Texas endured the most catastrophic winter event in its history. Over a five-day period, from February 13-17, two very strong Arctic storms – named Uri and Viola by the Weather Channel – brought in snow, sleet, freezing rain, and extreme cold, effectively shutting down the entire Lone Star State. Even south Texas cities such as Houston and Galveston, which don't normally see severe winter weather, were paralyzed by heavy snowfall, ice storms, and record-low temperatures.

The winter storms wreaked havoc on the state's electrical systems. As power grids started to fail, the Electric Reliability Council of Texas (ERCOT) and the Southwest Power Pool (SPP) ordered rolling blackouts in an effort to reduce the strain brought

on by overwhelming demands for heating and energy. At one point, nearly 4.5 million Texas residents were without power. Additionally, roads throughout Texas were closed by snow and ice, water mains began to break, and water treatment centers shut down, prompting many cities to issue "boil water" orders.

For data centers and data center owners in Texas, the winter storms proved to be a major test of their resiliency, and their ability to keep their facilities operational and maintain uptime. Some Texas data centers were forced to go on generator power in response to rolling blackouts, while others voluntarily went on generator power for half-day or longer periods, to return multiple megawatts to the grid, allowing local utilities to redirect that electrical power to residential customers.

## 1.2 PROBLEMS ENCOUNTERED

But running on generator power offered new challenges. Many Texas data centers experienced problems that could be traced back to their generator fuel supply. These included:

1. Some data centers in central and south Texas suffered outages when their generators failed, due to gelling or icing in the fuel, caused by the freezing temperatures.
2. Along with the Texas roads and highways, many fuel terminals were shut down by the storm. These two factors delayed the delivery of new fuel shipments to data centers that were running on generator power.
3. This breakdown in fuel distribution brought on a shortage of fuel availability in Texas, leaving data center and Fortune 500 companies scrambling to find and buy fuel supplies from out-of-state providers.

In this white paper, we'll take an in-depth look at the Texas winter storms, and the lessons that data centers learned from this experience. We'll look at the challenges that data centers faced, in relation to generator fuel supplies, and fuel quality and efficiency. We'll also look at what some data centers who weathered the storms did right in preparing and managing their fuel supplies for this type of event.

Most importantly, we'll take a close look at what data center owners everywhere should do to prepare their fuel supplies for the next event, weather or otherwise, that may force their facilities to go on backup generator power.



## 2. WHY THE TEXAS WINTER STORMS WERE SO UNUSUAL

Before we look at the fuel-related problems of data centers, let's take a look at the reasons why the Texas winter storms were such an unusual weather event.

First, the Texas winter storms of February, 2021 were a multi-day emergency. The main storm, Uri, hit on February 13th, and the second storm, Viola, occurred on February 17th. Unlike hurricanes or tornados – which are catastrophic events, but are generally over within a day – the winter storms lasted for over a week. For data center owners and facility managers in Texas, this meant that they had to deal with the winter weather and its effects on a day-by-day basis. Over several days, their facilities were repeatedly hammered with snow, sleet, and freezing temperatures, and burdened with new rounds of rolling blackouts from local utilities.

Second, the Texas winter storms were a statewide event. For the first time ever, the National Weather Service issued Winter Storm Warnings for all 254 Texas counties. While hurricanes or tornados usually affect only one geographic area, the winter

storms affected the entire Lone Star State. Data center owners had to deal with the storm's effects and maintain uptime, not just at one facility or in one region, but at all of their Texas facilities, in all of their major markets (Dallas, Austin, Waco, San Antonio, Houston, etc.).

Finally, the winter storms affected cities in south Texas that don't normally get winter weather. Cities like Houston, San Antonio, and Austin saw their first significant snowfall in 35 years. Even beaches in Galveston and Corpus Christi were buried under several inches of snow, and boats on the Gulf of Mexico were covered in layers of ice. Many data centers located in the central and southern parts of the state were unprepared for the snow, ice storms, and extreme cold, or for the challenges of staying operational in such unusual weather conditions.



# 3. FUEL-RELATED PROBLEMS OF TEXAS DATA CENTERS

By their very nature, data centers prepare themselves well for emergencies. All data centers keep large reserves of diesel fuel on their property, usually storing it in enormous tanks, for the time when it is needed. If local utilities go down, the data center must be ready to immediately power up their emergency backup generators to maintain facility uptime.

But during the winter storms of 2021, many data centers in Texas found themselves facing unexpected problems and challenges related to their diesel fuel supplies. These problems included:

**FUEL GELLING & ICING**

**DELAYED FUEL DELIVERY**

**FUEL PROCUREMENT PROBLEMS**

# FUEL-RELATED PROBLEMS OF TEXAS DATA CENTERS

## 3.1 FUEL GELLING & ICING

Gelling occurs when paraffin wax in the fuel starts to crystallize, creating waxy deposits that clog a generator's filters, which prevents adequate fuel from reaching the engine. Every batch of fuel has its own specific gelling point, but gelling usually starts to occur when temperatures reach 20°F-25°F.

Icing is just what it sounds like; the water in the fuel begins to freeze. Icing can occur at temperatures as low as 30°F. Unlike gelling, icing is not readily visible. It does not show up on filters, but may plug them up just the same, causing your generator to shut down.

## 3.2 DELAYED FUEL DELIVERY

As the winter weather continued over several days, data centers on generator power started to burn through their fuel reserves. While many facilities in Texas did not reach the critical failure stage where fuel supplies were so low that maintaining uptime became a challenge, data center owners were scrambling to arrange deliveries of new fuel shipments to resupply their facilities.

In a state where oil production is THE major industry, obtaining fuel is usually very easy. Many data center owners have relationships with local fuel providers in Texas, and rely on them to make regular deliveries to top off reserve tanks at their Texas facilities. Before the winter storm, the owners assumed that these local providers could carry them through any emergency, especially if the provider had refineries and pumping stations just down the street or across town from their facilities (i.e. Houston refineries located near their Houston data centers).

During the winter storm, some data centers in central and south Texas reportedly had outages due to malfunctioning generators. Often, their generators failed because they hadn't "winterized" their fuel supply, to protect it from gelling or icing in extreme cold temperatures.

But during the weeklong storm, many local fuel providers in Texas were unable to make deliveries, for two reasons: First, not only were the fuel providers' offices and truck fleets shut down, but many refineries and fuel terminals were put out of action. Some refineries and terminals were offline due to the rolling blackouts, while others were unable to pump fuel into waiting trucks due to frozen pumps and valves.

Second, the daily snowfall, ice storms, and freezing temperatures closed roads to traffic throughout the state. Major highways like Interstate 10 and local roads were shut down for several days, then reopened, only to be shut down again the following day as a new round of winter weather came in. This made it near impossible for tanker trucks to transport fuel throughout Texas, and delayed resupply deliveries to data center facilities.

## 3.3 FUEL PROCUREMENT PROBLEMS

Not knowing how long the winter storms would last, or how long the rolling blackouts would continue after it was over, many data center owners started looking to out-of-state suppliers to purchase fuel. They contacted national fuel providers – only to be turned down, because these providers were allocating all available resources to deliver fuel to their regular, contracted customers in Texas.

Even Fortune 500 companies found that their name value and their ability to pay higher prices wasn't enough to get the fuel they needed from national suppliers. Often, they were competing for the same fuel supplies and fuel trucks as other Fortune 500 companies that had mission-critical facilities in Texas.

# 04

## BEST PRACTICES

# STEPS THAT DATA CENTER OWNERS SHOULD TAKE

The Texas winter storms forced many data centers to reevaluate their contingency plans regarding diesel fuel. If you are a data center owner, here are the steps you should take to prepare your fuel supplies for weather events and emergencies:

1. Follow Best Practices for fuel testing, treatment, and polishing, to maintain fuel quality and efficiency
2. Select a national fuel provider who can guarantee delivery to all of your facilities, even during weather events and emergencies
3. Ensure fuel procurement with contracted services through national providers



# PROBLEMS THAT HURT FUEL QUALITY & EFFICIENCY

Fuel quality and efficiency are essential to ensure that your generators work properly at that crucial moment when they are needed to maintain data center uptime. However, there are two problems that you should be aware of that can hurt fuel quality and efficiency – degradation and contamination.

## 4.1 FUEL DEGRADATION

In the past 10 years, EPA and federal regulations have required fuel companies to gradually reduce the sulfur content of their fuel, from 5000 parts per million down to 15 parts per million. This reduces carbon emissions from burning fuel, but the loss of sulfur also causes the fuel to degrade more quickly. Exxon Mobil states that diesel fuel starts to degrade only six months after being refined.

Most data center facilities store their fuel in huge tanks until it is needed. But over time, the stored fuel degrades, losing both its integrity and its reliability. The reduced sulfur content and overall fuel degradation increases the risk of contamination, and requires fuel held in long-term storage to be tested and treated more frequently.

## 4.2 FUEL CONTAMINATION

Seal leaks in the vents and fill cap of your fuel storage tank can cause water intrusion from rain water or humidity, which introduces condensation. When the amount of moisture in the fuel reaches a certain level, it increases the risk that the fuel will gel or freeze in extremely cold temperatures.

Also, there are several types of contamination that can hurt fuel quality. If left untreated, these forms of contamination can clog fuel filters, causing the generator to fail at a crucial moment.

Water intrusion introduces microbes, resulting in microbial contamination, which exists as a layer of organic slime that sits between the water and the fuel.

Water reacts with the inside of the steel storage tank, producing particles of rust.

Heating the stored fuel – either by cycling it through the generators, or from extreme hot weather outside the storage tank – causes thermal instability. This produces sediment in the fuel, made up of tiny pieces of tar known as asphaltenes or particulates, which settle at the bottom of the tank.

Many data center owners assume that if they simply refill their tanks with fresh fuel, it will take care of any contamination. But adding new fuel is the wrong strategy! Any fuel you add will be contaminated by the water and sediment left over in the tank from the previous fuel supply.

# THREE BEST PRACTICES TO MAINTAIN FUEL QUALITY

## 4.3 FUEL TESTING

Data center facilities frequently test incoming shipments of fuel, or test the fuel in their storage tanks, using a variety of familiar testing methods (white bucket, microbial, water). But these tests are often insufficient for determining if the fuel meets the standards that will ensure reliable operation of your generators.

To determine its true quality, you should have your diesel fuel professionally tested at a minimum of once a year, to make sure it meets American Society for Testing and Materials (ASTM) fuel standards. You should have fuel testing done at each of your facilities, and for each storage tank you have at each facility.

Also, you should include testing by an independent third-party laboratory, to ensure the tests are accurate and unbiased. (A national fuel provider can usually recommend or facilitate a reliable third-party testing facility.)

## 4.4 FUEL TREATMENT

You should regularly treat diesel fuel with chemical additives to maintain its integrity. These chemical additives will include things like detergents, lubricity agents, rust and corrosion inhibitors, stabilizers, anti-oxidants, metal deactivators, and asphaltene dissolution & dispersion agents. When added to diesel fuel, the chemical additives reduce moisture, and break up fine particulates, preventing them from clogging generator fuel filters.

Additionally, a fuel additive known as “Winterizer” will include anti-gel and anti-icing additives and flow improvers, which are designed to disperse water in the fuel, to prevent it from gelling or icing in extreme cold temperatures. It is highly recommended that you winterize your diesel fuel reserves at all your data center locations, even in areas that don’t normally get winter storms or freezing temperatures. (In general, the cost of winterizing fuel is less than 2% of your total fuel investment.)

## 4.5 FUEL POLISHING

Fuel polishing is an advanced filtration method in which diesel fuel is treated and cleaned, to bring it back up to ASTM standards. In fuel polishing, the fuel is run through special equipment at a high Gallon Per Minute (GPM) rate, which agitates the fuel and stirs up any sediment left behind by fuel burn-off or onboard polishing equipment. As the fuel circulates, it passes through a centrifuge that separates water from the fuel, and also passes through a series of special filters that remove particulates and microbials.

Fuel polishing may be recommended if third-party testing shows that fuel quality is below ASTM standards. But it should also be done when you commission brand-new underground or above-ground storage tanks, to clean out any sediment that may be present in the new tanks. Fuel polishing is also recommended during cleaning or maintenance of USTs or ASTs, or during tank-to-tank fuel transfers.

It is highly recommended that you hire a fuel provider who not only has the right equipment, but who also has a team of specially-trained workers to provide safe and efficient fuel polishing services. (Professional fuel polishing is more effective at cleaning the fuel than traditional onboard fuel polishing.)

## 4.6 ENABLING FUEL DELIVERY DURING EMERGENCIES

As a data center owner, you should, of course, have relationships with local fuel providers who can make general fuel deliveries to your facilities – but you shouldn't stop there! You also need to have a relationship with a national fuel provider who can overcome the problems of fuel delivery and procurement that might cripple a local provider during weather events or other emergencies.

During the Texas winter storm, the data center owners who had prior relationships with a national fuel provider fared the best. As roads opened up across the Lone Star State, the national fuel providers were able to bring in fuel shipments from the surrounding states, such as Louisiana, Arkansas, and Oklahoma. Some data centers in Texas received fuel shipments from as far away as Florida and Michigan.

[Here are the qualities you should look for in a national fuel provider:](#)

Your fuel provider should have the ability to deliver fuel on a nationwide level, to any of your data center locations within the United States. They should be licensed and insured to transport fuel in at least all 48 continental states. In an emergency, they should have the ability to bring in fuel from out-of-state.

Your provider should have a nationwide network of relationships and agreements with local fuel providers and fuel terminals, who can supply fuel to be delivered to your facilities whenever necessary.

In addition to their regular fleet, your provider should have a dedicated fleet of fuel trucks that are kept in reserve for emergency services. These trucks should have features (i.e. sleeper cabs, food and water supplies) that allow drivers to remain on-site at your facilities for several days.

Your provider should have special emergency equipment, such as pumps that can transfer fuel between trucks, or between tanks on your properties. They should also have an experienced team that is trained to perform safe fuel transfers, and trained to handle environmental containment of fuel spills.

These two qualities – the ability to keep trucks on-site, and to transfer fuel between trucks and/or tanks – can make a huge difference during emergencies, especially for sites with multiple data centers. Short trucks or tank wagons full of fuel can be kept “on standby” at the customer's property to resupply generators when needed, while a higher-capacity tanker truck can make resupply runs to the fuel terminals, returning with new fuel shipments, and transferring that fuel to the waiting tank wagons.

Finally, your provider should have Mobile Command Units (MCUs) to support its fleet of emergency fuel trucks in any situation. An MCU is a van- or trailer-based “office on wheels,” equipped with IT systems and redundant communications, including satellite communications that allow the unit to contact truck drivers even if local wireless towers are out of operation.

## 4.7 ENSURING FUEL PROCUREMENT

In terms of procuring fuel during an emergency situation, it's not enough to simply be a regular customer of a provider. When a weather event or other crisis brings a shortage of fuel availability to a certain area, national fuel providers will prioritize requests from customers with whom they have contracts over everyone else.

You should have a contract with a national fuel provider that guarantees on-demand fuel delivery to any of your U.S. data center locations, even during weather events or emergencies. The contract should specify in writing the terms and conditions of fuel delivery, including the penalties for the fuel provider (i.e. financial compensation) if they fail to meet those terms.



## 5. CONCLUSION

In the 21st century, serious weather events are becoming more frequent. At the time it happened, experts said that the Texas winter storm of February, 2021 was a “once in 75 years” event. But it seems as if every other year, America must deal with a natural disaster or emergency that experts describe as a “once in a century” event. Through hard experience, data center owners have come to understand the importance of anticipating events that “could never happen here,” and preparing their facilities to maintain uptime even the most extreme conditions.

All data centers have multi-level contingency plans. If utility power fails, you immediately switch your facility over to generator power. But generators are often the “last line of defense” in maintaining uptime. If your generator goes down,

your facility will also go down! That’s why it’s important to make sure that your generators are powered by uncontaminated top-quality diesel fuel that won’t gel or freeze in extreme winter cold. It’s also important to partner with a national fuel provider who can guarantee fuel delivery to all of your facilities, regardless of weather or disaster events. Taking these steps will help to ensure that your generators run properly and have sufficient fuel, and that your facilities will maintain uptime even in the longest and harshest of emergencies.



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