



Fuel Variance

Hidden Costs, Hidden Causes and What to Do About Them

WHITE PAPER

October 2019

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Something isn't adding up, and you may not even know it. Due to a variety of factors, the amount of fuel you receive and the amount you dispense to consumers may not be the same. This difference is called *fuel variance* — the difference between the recorded and actual amounts of fuel in your tanks at a given time. Physical fuel losses caused by theft or leaks are readily understood and accounted for. But there are hidden causes that are difficult to detect and equally challenging to manage. For many retailers, these less obvious causes aren't high on their list of concerns. But the effort to learn why they occur might just be worth it when it comes to their bottom lines.

With net profit percentages on fuel for most convenience stores (C-stores) typically in the low single digits, undetected and unmanaged fuel variances can have a notable impact on already slim profit margins. For a C-store that dispenses 200,000 gallons (757,082 liters) of fuel per month, an undetected variance of 0.15% could mean 300 gallons (1,136 liters) worth of lost revenue each month. That's as much as \$10,000 of lost revenue each year. If you're operating more than 10 stores, this scenario quickly scales to six-figure losses.

For this reason, many retailers are taking a closer look at fuel variance. If it's not yet on your radar, this article will help you understand its hidden causes and provide practical, easily implemented steps you may want to consider to mitigate its impact on your bottom line.

The Short Drop

It's good to know you're getting what you paid for. But if you're the victim of a "short drop," you're not. A short drop occurs when a transport is under-filled with fuel by the supplier, which could be due to meter drift at the terminal, or if the transport — intentionally or unintentionally — doesn't pump the entire fuel load you ordered into your tanks. In other words, when you've been shorted.

Your defense against short drops is a reliable, well-calibrated tank chart system. Whether you're measuring inventory by dipping tanks or with an automatic tank gauge, the measurements you take are only as good as the tank chart you reference and your processes for reconciliation. Measurement errors can occur due to tank chart inaccuracies, installation discrepancies and outside influences that affect a tank's shape. Many retailers turn to fuel equipment OEMs for charting software and variance analysis services to track data sufficiency and detect discrepancies. When combined with daily best practices in inventory reconciliation, these services can help retailers identify and correct fuel variances before they impact profitability.

What About Temperature?

You may be wondering about the effect of temperature on fuel variance. This is because colder fuel is denser, which reduces its volume. Because storage tanks are well-sealed and deep underground, changes in outside temperature have very little effect on the temperature of stored fuel. Thus, temperature is not generally a consideration when measuring and managing fuel variance. In some areas, where temperature drops can be extreme (e.g., Canada and Northern Europe), dispensers may be fitted with automatic temperature compensation devices to correct the temperature of the dispensed fuel, ensuring consistent volumes are dispensed.

Fuel Quality: What's Good for the Air Is Bad for Your System

Ironically, demand for cleaner, lower-emissions fuels contributes to fuel contamination, which in turn can lead to fuel variance. This relationship requires some explanation.

In many areas of North America, the ethanol content in gasoline has increased. Ethanol is an additive that cuts down emissions of carbon monoxide and other air pollutants. It also acts as a cleaning agent, so once it's in your tanks, it starts scrubbing. This may sound like a benefit, but it can lead to issues. As the ethanol cleans, it causes particles to break free into the gasoline. When these particles get into your fueling system, they can cause problems, such as clogging fuel filters and impacting the performance of your dispenser meters.

If you sell diesel, you pump ultra-low sulfur diesel (ULSD). Sulfur is a natural antimicrobial agent. When you take it out, a variety of hydrocarbon-utilizing microorganisms (called "HUMbugs") start growing. As the HUMbugs feed on the diesel in your tanks, they excrete acetic acid, which corrodes your tanks and creates clouds of particles. When these particles reach your dispenser, they can erode its components.



Combating Particles in Your Fueling System

Retailers typically deal with particles in two ways: tank cleaning and fuel filters. Preventive tank cleaning and maintenance are part of a C-store's life, a cost of doing business that can reduce the adverse effects of abrasive particles downstream. Fuel filters are another line of defense against contaminated fuel streams. Some retailers opt to use filters designed to intercept extremely small particles. While this can reduce the effect of particles downstream, the trade-offs of more frequent filter changes and lower flow rates at the nozzles can be costly for retailers and frustrating for consumers. Also, while many retailers diligently change their filters, this is often a task that is put off until low flow begins to impact customers. As such, the efficacy of filters, regardless of mesh size, is sometimes compromised.

Particles, Meter Drift and Fuel Variance

Which leads us to meter drift, perhaps the most under-appreciated contributor to fuel variance. This phenomenon occurs when components in the fuel-dispensing meter wear over time, which usually leads to fuel dispensers delivering higher volumes than what are recorded.* When this occurs, you're essentially giving away free gas. It is common to observe over-dispensing rates of 0.1 to 0.2% or more, which means hundreds of unmeasured (and unpaid for) gallons of gasoline could be dispensed each month.

When contaminated fuel reaches a meter, whether it's piston-style or axial flow, the meter's inner workings can wear down or be damaged. In piston-style meters, the pistons and internal valve can be affected. In axial flow meters, rotors and sealing surfaces can be damaged. In either case, component wear causes the meter to record less fuel than is being delivered. As the wear and tear increase, over-delivery worsens. While routine tank cleanings and fuel filter changes help, the meter can drift over time. Retailers combat this by using outside services to audit the actual amount of fuel being dispensed and recalibrate their meters accordingly. But as meters continue to wear, these calibrations occur on a more frequent basis, which means more costs and disruptions to operations. Eventually, it'll be time for a new meter.

Can a Meter Make a Difference?

Higher concentrations of particulates are a fact in today's fuel streams, so if you're using axial flow fuel meters, you'll need to apply aggressive filtering, as low as 2-micron mesh size, to ensure proper meter operation. These meters use a spindle screw rotor that rotates between the flutes and sealing services and are accurate when applied in very clean fuel streams, but the presence of any particulates can degrade performance and accuracy. The requirement for extremely small mesh size filters can mean more frequent filter changes. In addition, there's the potential for lower flow rates at the nozzles.

More commonly, you'll find piston-style meters — and for good reason. A piston-style meter is more tolerant of larger particles, delivering accurate readings and long life, while using a larger mesh size filter, typically 10 microns. The larger mesh size filter results in better flow at the nozzles while also reducing filter change frequencies. Because the meter must operate in the presence of some particulates, you should consider

heavy-duty designs. Inner components must withstand chemical, physical and biological contamination if the meter is to protect against fuel variance. Some meters are built with self-lapping materials, such as graphite deck plates and hard-coated rotary valves, that repair the erosion caused by small particles. You'll also want to consider a meter with built-in stroke control to reduce drift potential.

Tackle Fuel Variance With a Deeper Dive

Every system is different; the causes of fuel variance will vary and depend on different factors. While many are well-understood and easily detected, like theft and tank leakage, it's the hidden factors that might present the biggest opportunities for savings. By looking "deeper" into the system, whether it's your processes for tank charting, filter changes and meter calibration, or your choice of filters or meter type, you'll find new savings opportunities. You may even want to consider new monitoring technologies and services that can help you recapture lost revenue potential. When you're fighting for more margin to invest in your business, a little extra revenue might just be a welcome sight.

** While not the subject of this article, note that in some cases, improper calibration by a technician can lead to less fuel being dispensed, which can expose C-stores to fines for violating weights and measures standards.*