POWER EYE

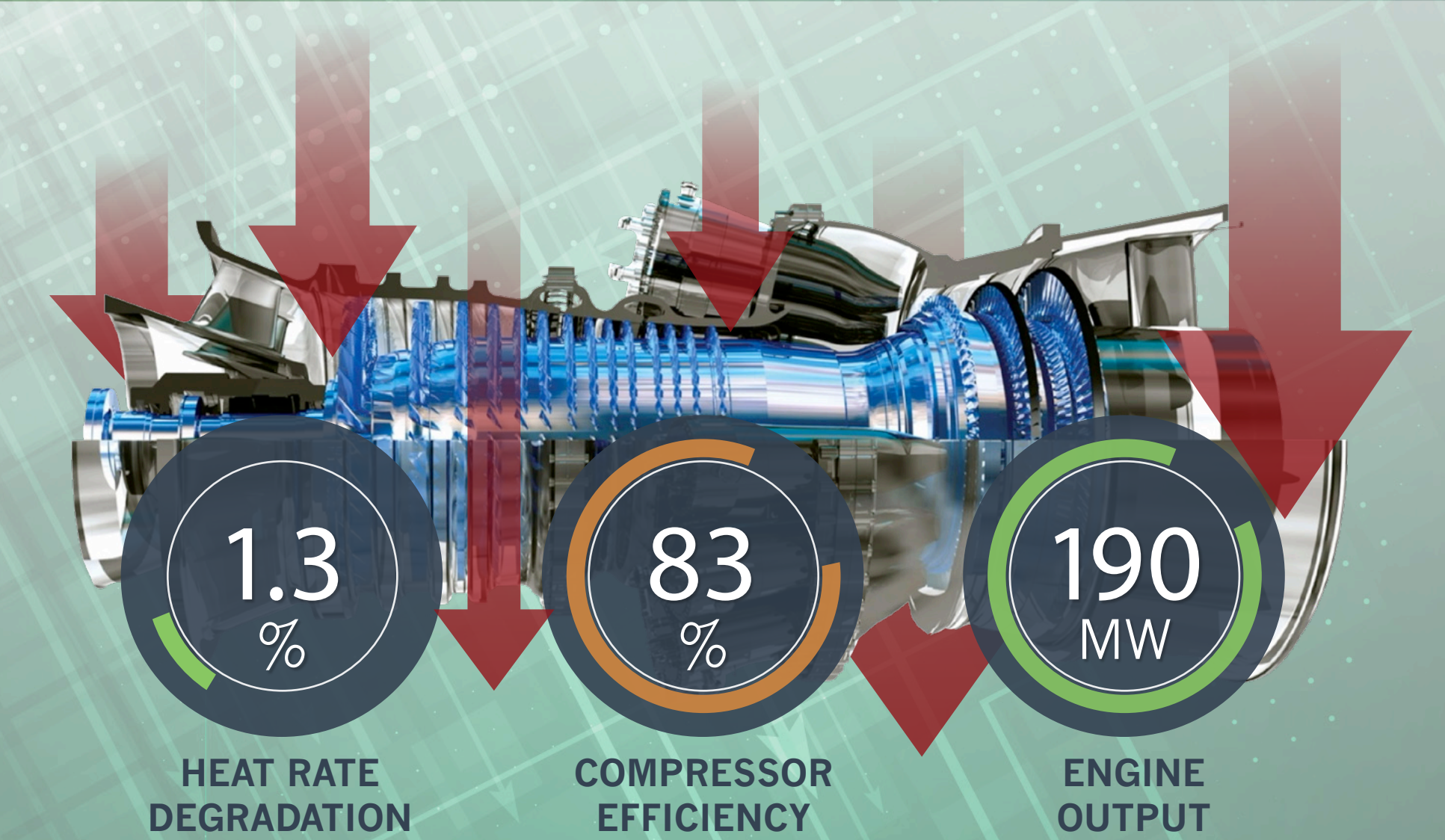
5 WAYS THE CHANGING CONDITIONS AT YOUR FACILITY CAN AFFECT THE OUTPUT OF YOUR GAS TURBINES

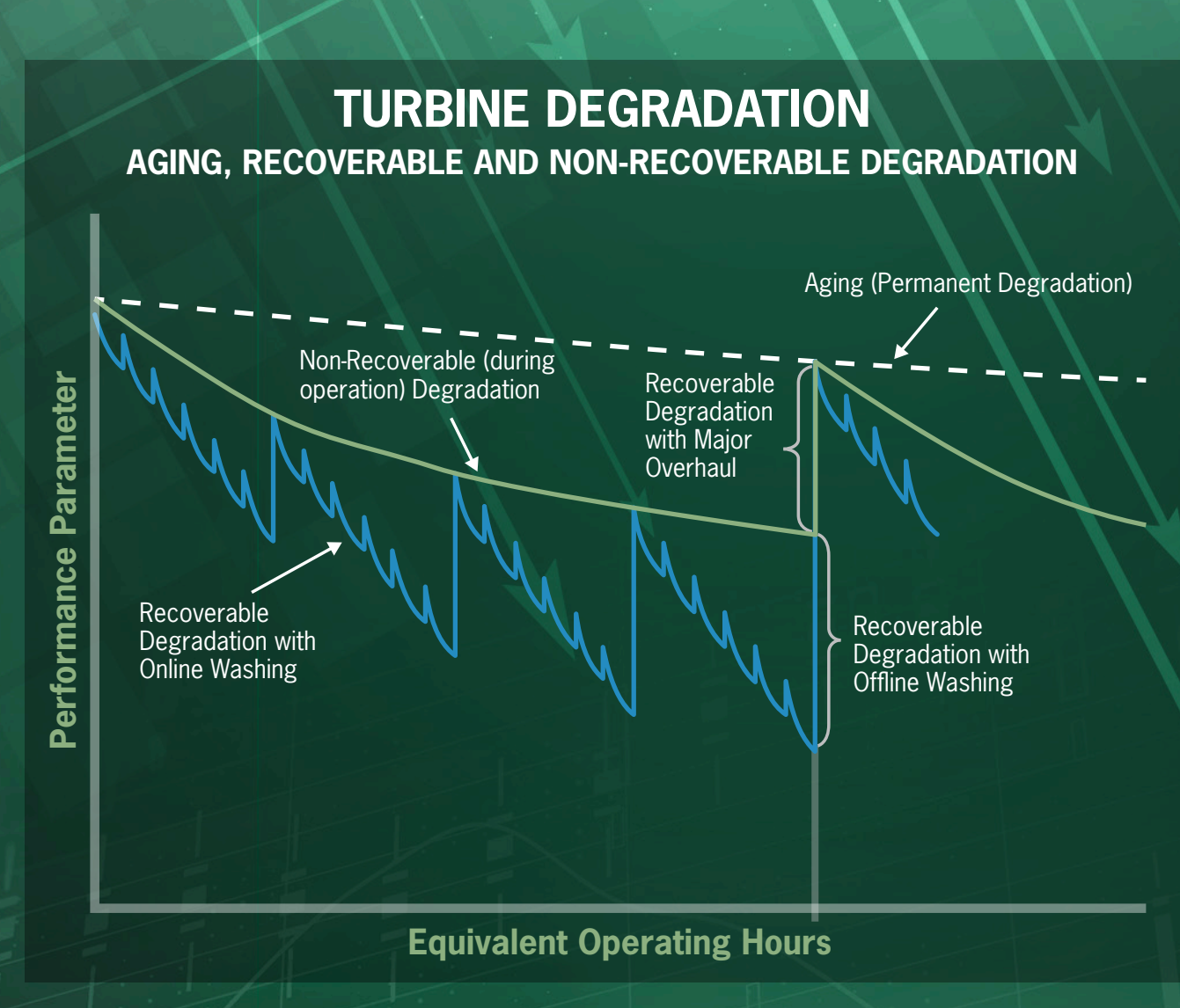
Even though the local site conditions around your facility may seem stable or predictable, it is actually a shifting and changing system. Many variables are in constant flux, and simply measuring one or two (e.g., temperature and relative humidity) doesn't give you the total picture you need. Careful and constant monitoring of ALL conditions is critical if you want to predict how your filters, and your engines, are going to react.

This infographic highlights some of these changing conditions at your facilities and how they can impact the output of your gas turbines.

1 CURRENT STATE OF THE ENGINE

This is one of the most important variables to understand in order to accurately predict the impact of all other conditions on engine output. Logically, as turbine engines age, the power output drops. This is due to non-recoverable degradation – aging and wear and tear over time. So your five-year-old turbine that produced 200 MW when it was new may now only produce 190 MW in its best state.





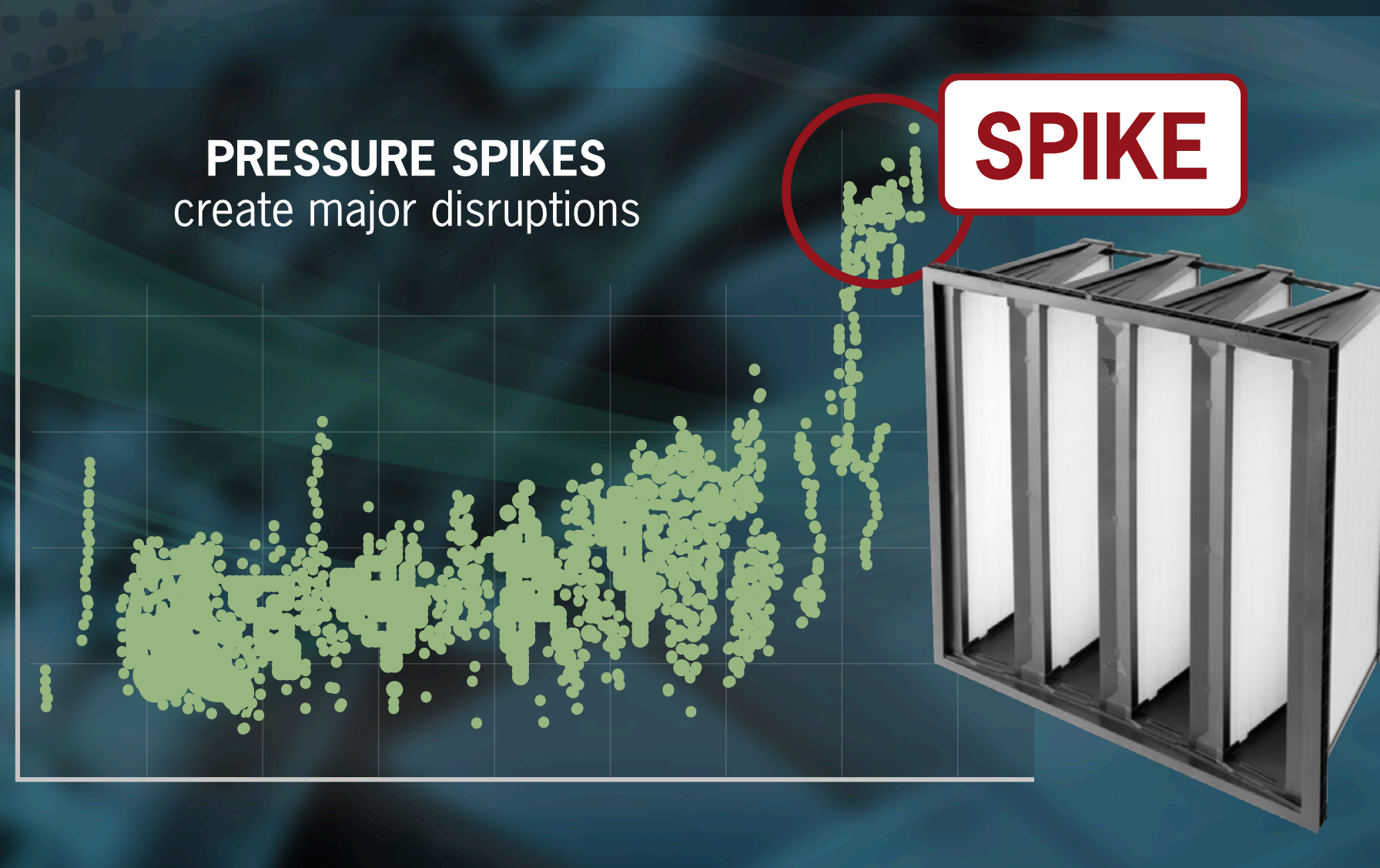
In addition to non-recoverable degradation, your engines are also subject to a certain amount of recoverable degradation caused by fouling. Dust and contaminants build up on internal engine parts and power output is compromised. Offline water washes can restore a percentage of that lost output. This graph shows the impact of both recoverable and non-recoverable degradation.

Source: ASSESSMENT OF GAS TURBINE AND COMBINED CYCLE POWER PLANT PERFORMANCE DEGRADATION Hepperle, N., Therkorn, D., Schneider, E., Staudacher, S., 2011, ASME paper GT2011-45375

Knowing the current state of your engines – and how they react to the influences of filter pressure drop, air temperature, density, relative humidity, etc. – gives you the baseline data you need to accurately calculate what your power output will be.

FILTER PRESSURE DROP 2

It is generally understood that as filters age and load with dust and contaminants, they clog and cause an increase in pressure. This puts a strain on engines and will eventually require a filter change to maintain optimum engine output. But it's important to understand that filter pressure drop is not a constant. Instead, it can increase at varying rates based on different conditions.

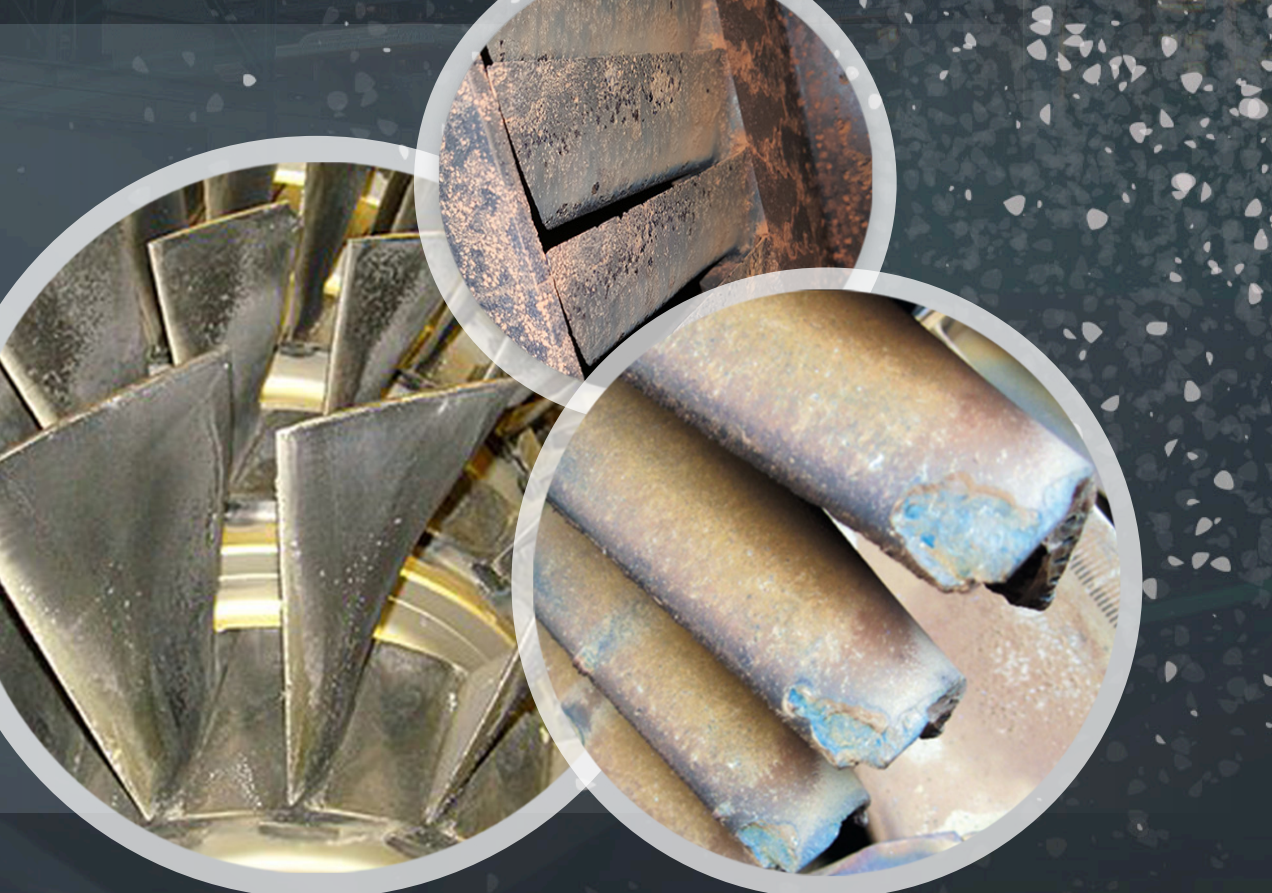


Filter pressure drop can be subjected to rapid, daily fluctuations with different amplitudes based on filter type, age, type of contaminants and relative humidity variation.

3 PARTICULATE LOAD

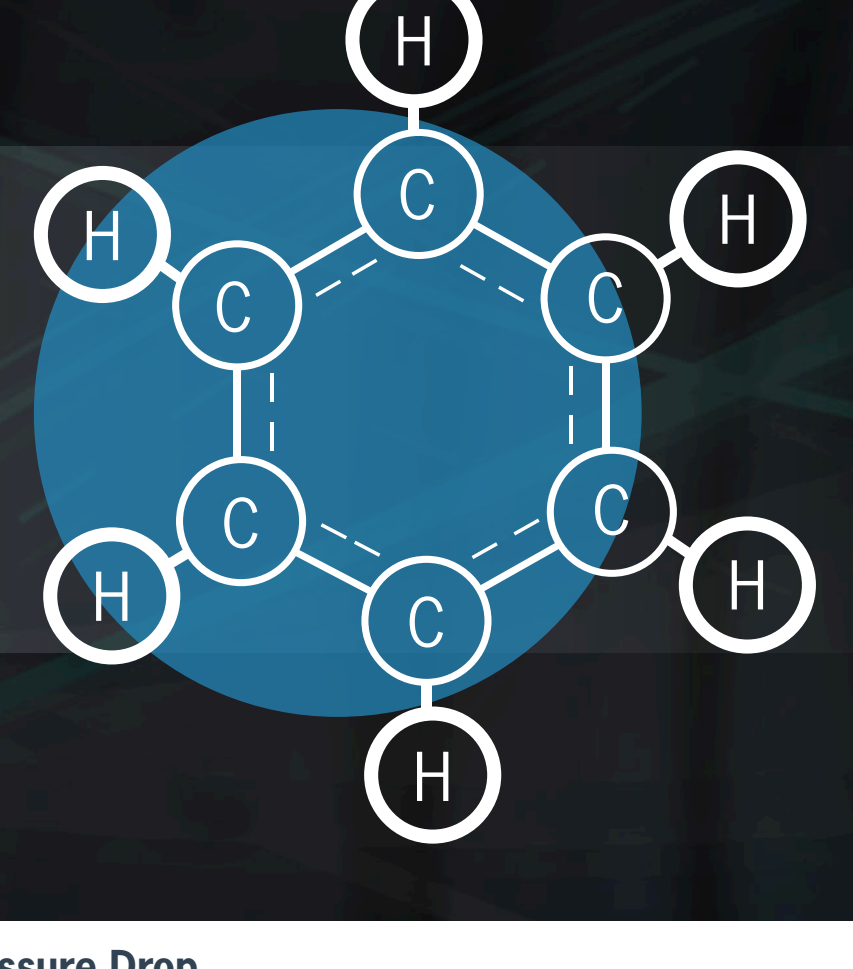
Ambient dust in the air can have the greatest impact on the condition of your filters and the performance of your engines. When combined with other variables like humidity, the effect of dust on your filters can multiply – causing dangerous increases in pressure. And while variables like temperature and humidity are easy to measure, quantifying dust is much more abstract and difficult. Large fluctuations in the particulate load are usually invisible to the naked eye, so careful and constant monitoring is key.

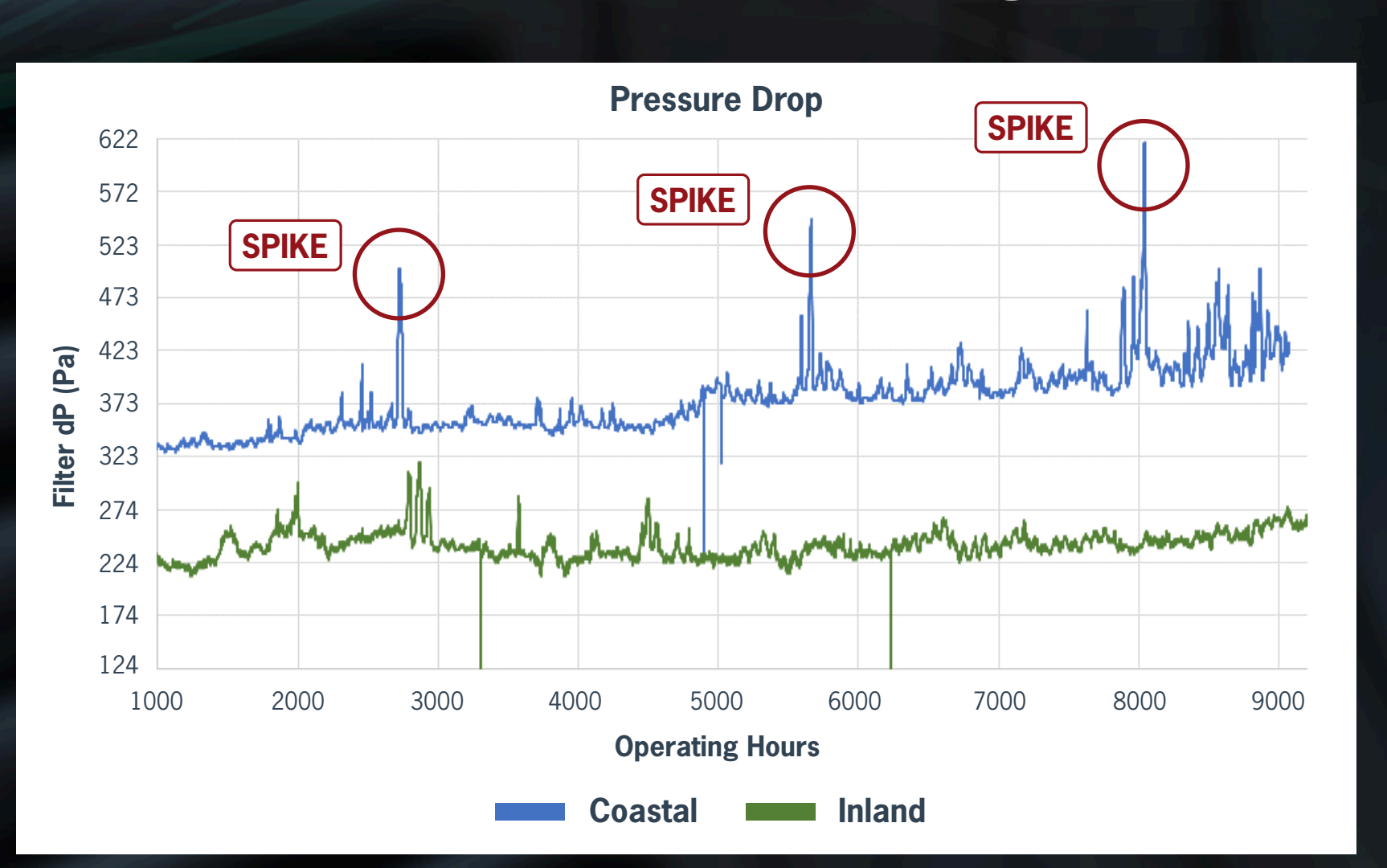
Dust is directly linked to recoverable engine degradation. The higher the ambient dust concentration in the air, the more dust will get through the filters. That dust attacks internal parts, which can result in erosion, fouling, plugging of cooling channels and corrosion that robs your engines of power.



Industrial activity and new construction in the area around your facility can add dust and other pollutants to the air that threaten filters and engine parts.

Hydrocarbons are fine, sticky dusts that can speed up the degradation process for your engine. They can also clog filters quickly and cause dangerous increases in pressure drop.

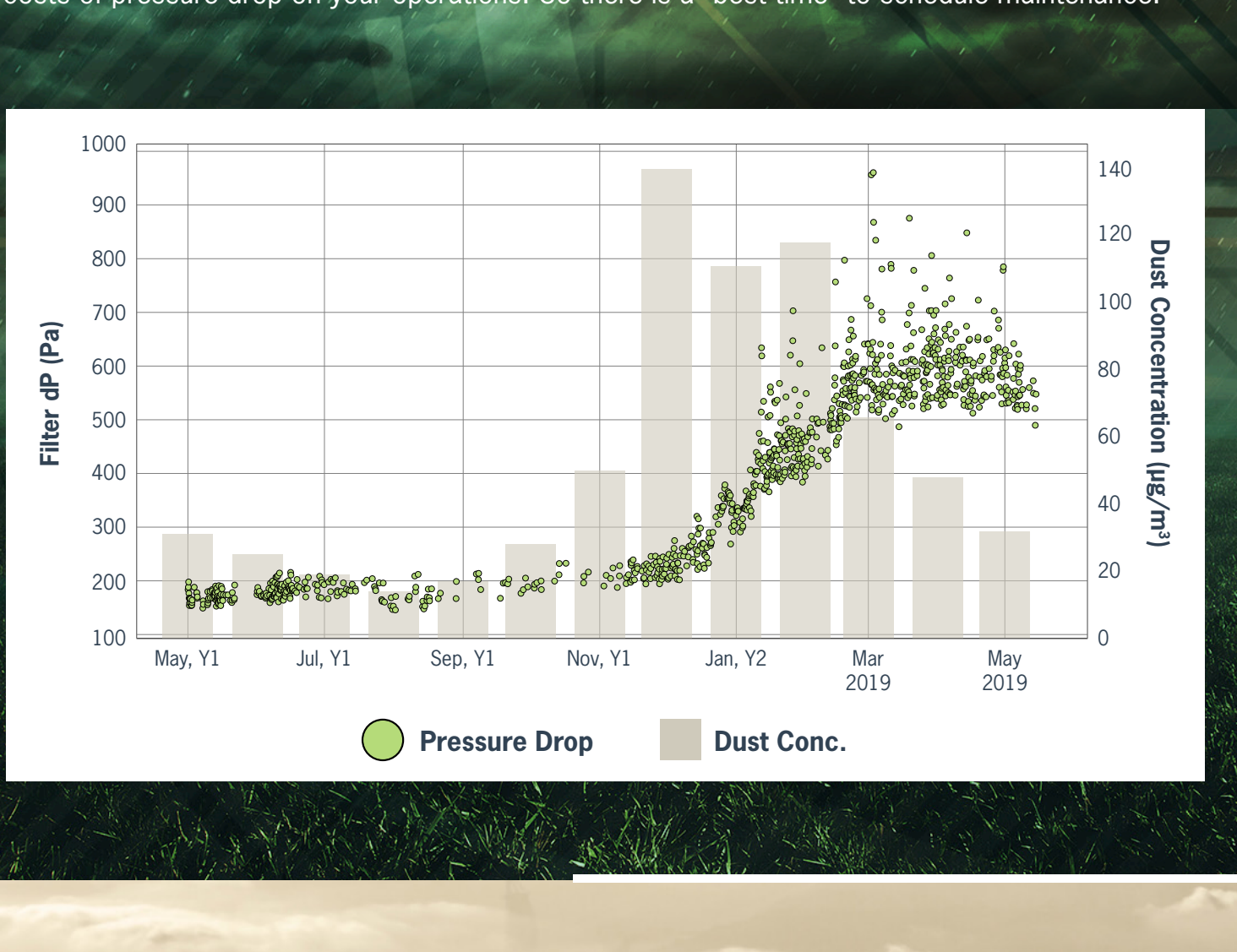




The impact of ambient dust may vary greatly from site to site. This chart compares the pressure drop trends for a coastal facility vs. an inland facility. You can see that in this example, the inland facility has an overall lower and more steady pressure drop, while the coastal facility has an overall higher pressure drop marked by frequent spikes.

SEASONAL CHANGES 4

If you are making decisions about filter selection and changeout schedules based on average dust concentrations over the year, you should reconsider. You can make more financially sound decisions once you better understand the variance of ambient dust levels throughout the year at all of your locations. Dust and other conditions are not static, and neither are the costs of pressure drop on your operations. So there is a "best time" to schedule maintenance.



Pressure drop (dP) is a function of the ambient dust. The rate of increase of dP varies directly with change in ambient dust load.

Sandstorm

Certain regions are subjected to seasonal sand storms that can have a devastating impact on your operational performance. If your system was not designed for these extreme conditions, your plant is at higher risk of trips or de-rating as filter pressure drop could increase at unexpected rates.

Fog

If, however, your environment is prone to seasonal or overnight fog, your dust-loaded filters become much more susceptible to pressure drop spikes, which increases the risk of tripping or de-rating your turbines.

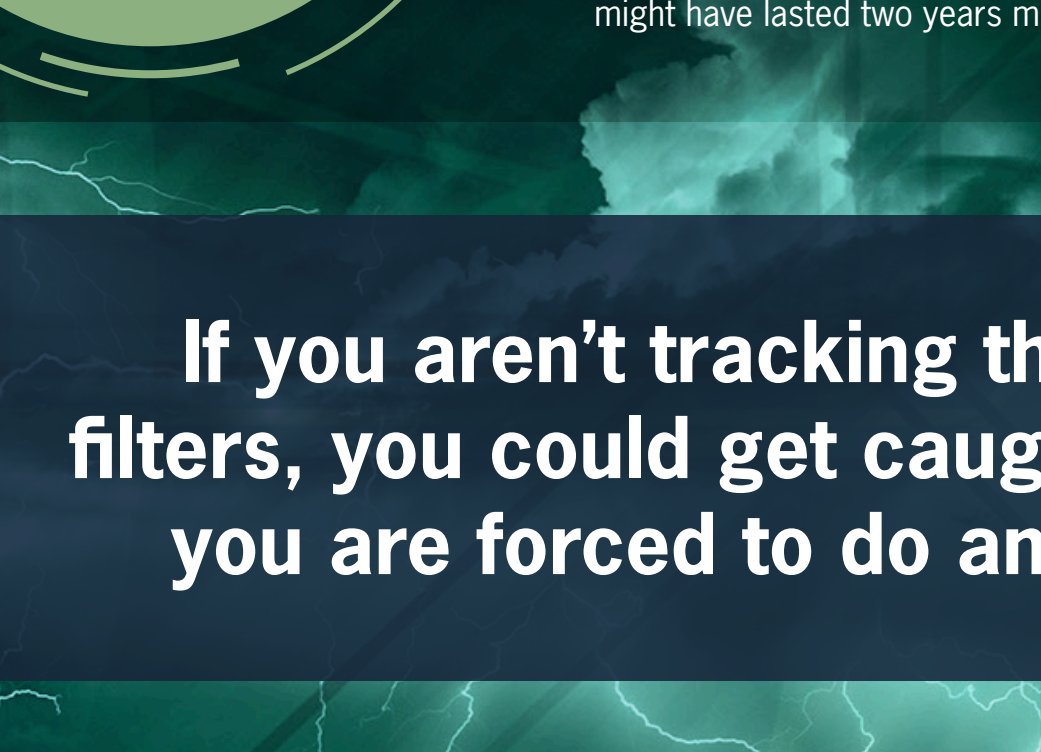
Pollen

Pollen is a pollutant that many of facilities don't focus on very much, but it can have a big impact. Seasonal plumes put a lot of sticky/fluffy pollen particles in the air that can increase the particulate load and force a filter change ahead of schedule.

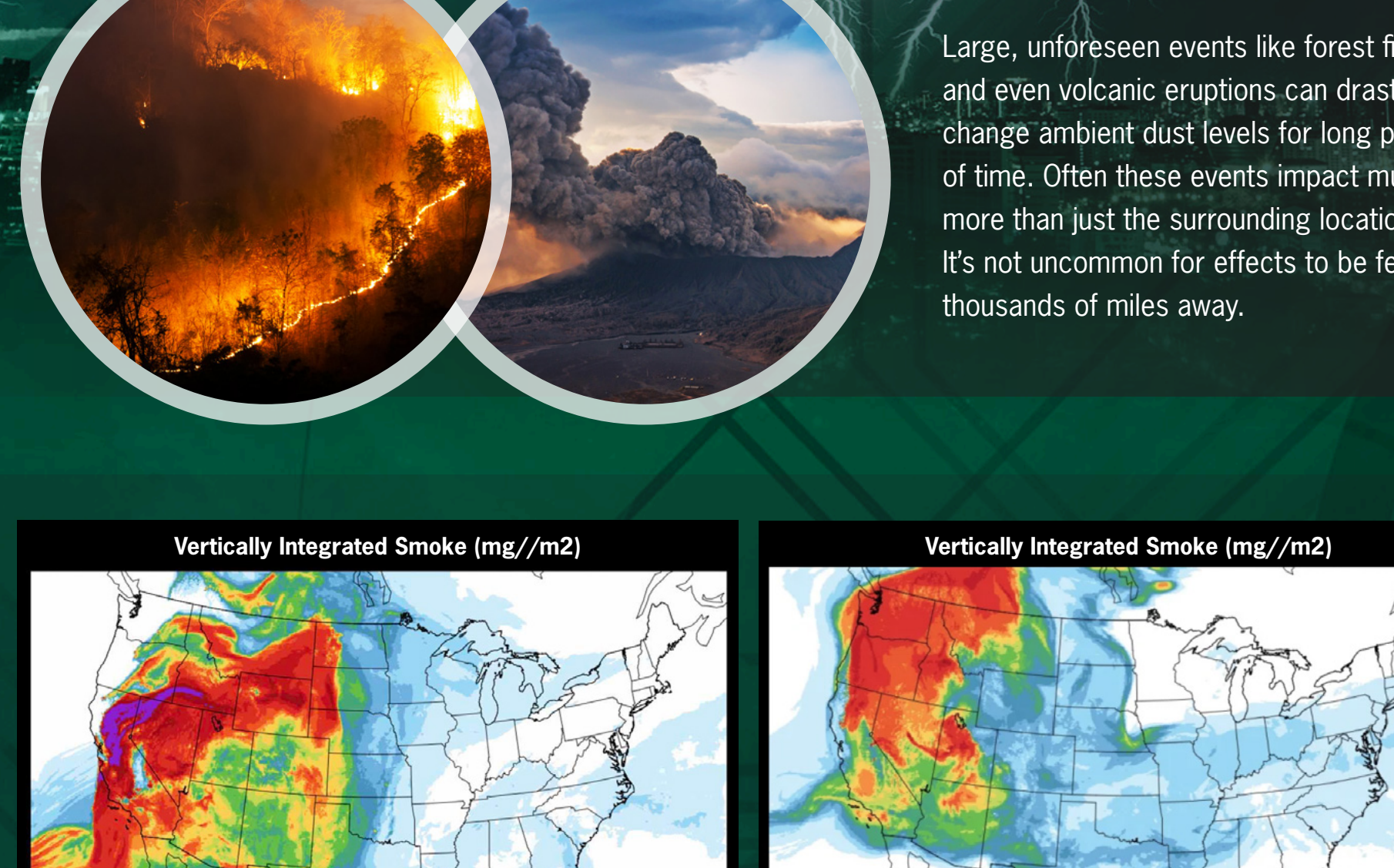
5 NATURAL EVENTS

Just because you've never had a problem at your facility before doesn't mean that you never will. Environments change. Natural events can drastically change the conditions and easily disrupt your timing for a filter changeout. Your filters that might have lasted two years may suddenly need to be replaced much earlier.

If you aren't tracking the condition of your filters, you could get caught in a situation where you are forced to do an unplanned outage.



Large, unforeseen events like forest fires and even volcanic eruptions can drastically change ambient dust levels for long periods of time. Often these events impact much more than just the surrounding locations. It's not uncommon for effects to be felt thousands of miles away.



These radar images show how the smoke from large forest fires in California can send plumes of particulates into the atmosphere that impact air quality up to 3,000 miles away.

Images courtesy of the National Oceanic and Atmospheric Administration

Much more common, tropical storms bring unusually large amounts of moisture and rain to very large geographic areas. And climate change is increasing the severity of these storms year after year.

Your power plants are subject to a complex system of constantly changing variables. There's no way to predict what will happen. But with PowerEye, you can predict how all of these variables will affect your filters and your engines. The key is constant, careful monitoring. PowerEye arms you with the data you need – at all times – to make the best, most financially sound decisions about filter management and engine output.

www.Camfil.com/PowerEye

camfil POWER SYSTEMS