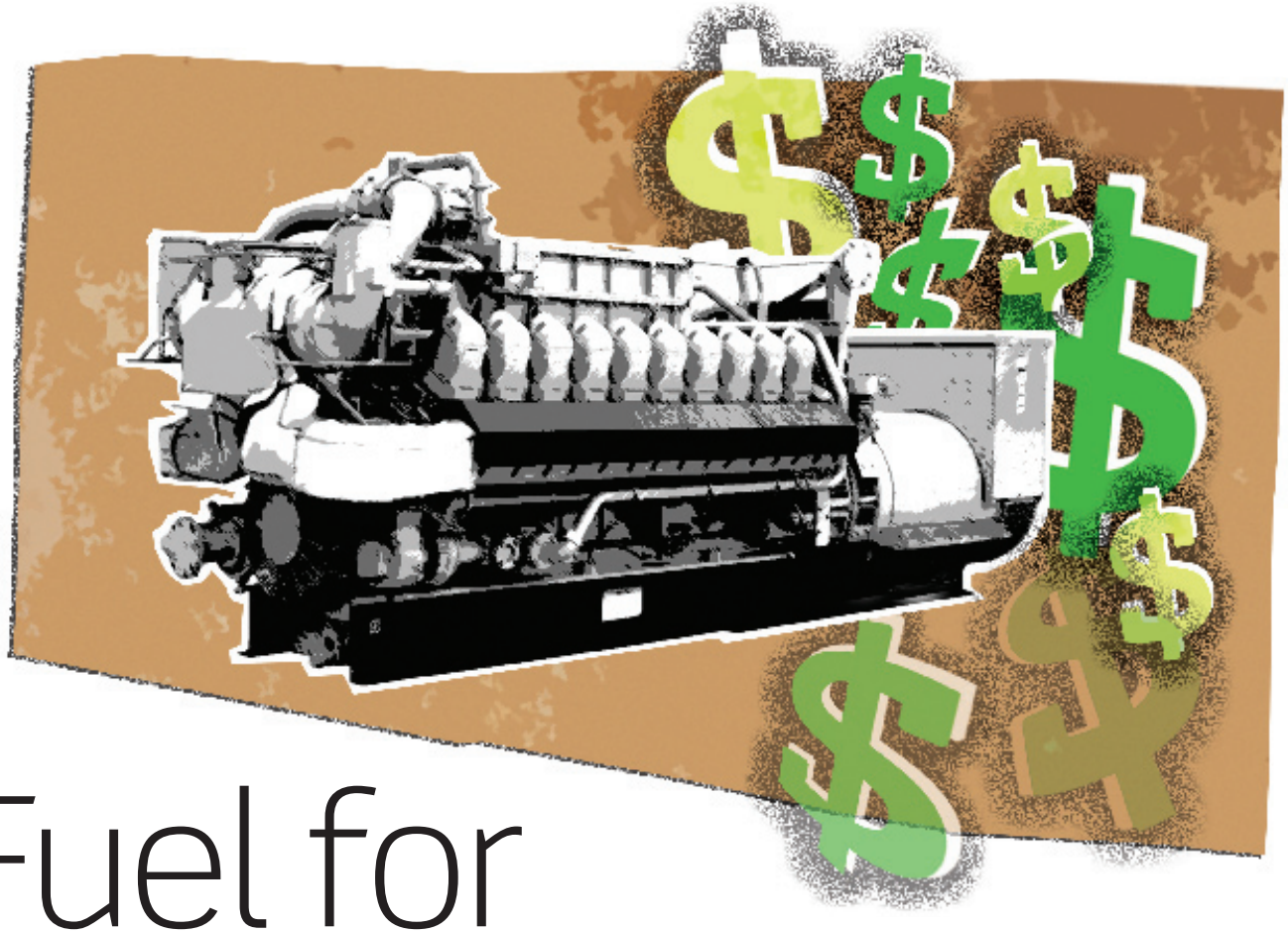
CERIUM DIOXIDE
- Fuel efficiency
- Minimising soot



Fuel for thought

GO_2 MAY BE NEW TO THE SUPERYACHT SECTOR, BUT ITS PROMISE OF A MORE EFFICIENT FUEL BURN IS ROOTED IN YEARS OF RESEARCH

DIANE M BYRNE REPORTS

Two milliseconds — that's how long it takes for the combustion process to occur in a diesel engine. In that incredibly short amount of time a lot has to happen, and a lot can go wrong — with potentially enormous consequences. Too much air and you don't get an efficient fuel burn. Too much unburned fuel and you get wasted diesel exiting the engine as harmful soot. And even when you do manage to get the right ratio of air and fuel you might still not be getting the most out of your mix.

So a nine per cent boost in fuel burn efficiency (along with a third less soot) would be great for the environment — and your budget. According to US firm Cerion Energy all of this can be achieved by simply using its new GO_2 diesel additive.

Combustion efficiency

Cerion Energy's work with nanoparticles has broken down notions of what's possible in the realm of controlling the rate of chemical reactions necessary for efficient combustion.

Despite the fact that the superyacht sector is new to Mick Stadler and most of his team, he has a clear understanding of what captains and owners need to hear.

"The main question any superyacht captain has is 'If I use this material on my boat, will my warranty go down the tubes?'" says Stadler.

The answer, he avows, is no. Cerion Energy conducted its research on static generators and truck engines, then workboat and locomotive engines — totaling around 240 different vehicles and vessels. They were all chosen because they're heavy-duty diesel vehicles, many of which were manufactured by Detroit Diesel and Caterpillar.

Stadler and his fellow scientists and researchers met with both engine companies to explain that GO_2 doesn't alter the fuel to parameters outside their specified acceptance levels.

"The diesel fuel isn't out of spec because cerium dioxide is present as a catalyst, in low concentrations," Stadler explains. "Therefore it never adversely affects the engine's components. In fact, cerium dioxide is a good scavenger of oxygen, foraging in oxygen-rich sections of the fuel-air mix and bringing the element to areas where it's lacking. In addition,

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since cerium dioxide removes soot from the combustion chamber, it significantly reduces engine scoring and general wear and tear on the engine. As for mixing ratios, one gallon of GO_2 treats 4,000 gallons of diesel."

Cerion Energy is working on a next-generation iteration as well.

A natural choice

The results of the fuel optimiser's scavenging action are certainly impressive.

After achieving consistent results with workboat owners and other clients, Cerion Energy decided to extend its outreach into the superyacht industry. Stadler says that it was a natural choice: "Some superyacht diesel engines are about the same size as locomotive engines."

If a nine per cent average efficiency boost doesn't sound like much, consider this. In early January, fuel prices at superyacht marinas in Antigua ranged from US$4 to US$4.60 per gallon. Similar prices were found in St. Maarten and the British Virgin Islands. Take a theoretical 45m yacht with a 92,000lt (24,304 gallon) fuel capacity. Clearly the cost savings adds up in a hurry.

Cerion's fuel optimiser, GO_2

Cerion Energy's efforts in the industry are still at an early stage, though the company started working with the owner and captain of a Pershing 88 last autumn. Several other superyacht owners and builders have also expressed interest in trying the GO_2 additive. Among them is the owner of a new 45m equipped with many energy-efficient and 'green' components. Another is the owner of a high-speed 60m with a huge fuel-burn rate that has smoky exhaust issues.

Time will tell whether Cerion Energy's efforts in trying to persuade the superyacht industry will actually pay off. But if they do, GO_2 may just become the go-to source for what captains and owners want — efficient and less-expensive operations.

TEST RESULT

According to Stadler, fuel burn's efficiency increases by eight to 13 per cent, with nine per cent being about average. Furthermore, there's 30 per cent less soot and a 35 per cent increase in lubricity as a result of the lower soot. US Environmental Protection Agency-approved Portable Emissions Units (PEMS) and side-by-side testing of twin-engine-powered tugboats in New York Harbor, among other vessels and places, have helped confirm these statistics. In fact, the tugboats were tested by having untreated fuel run through one engine and fuel containing the GO_2 additive run through the other.

THE SCIENCE

It all started in 2004, when Oxonica, a company spun off from the UK's Oxford University, determined that it was feasible to make a specific particle, called cerium dioxide, small enough to be added to diesel fuel for better fuel burn. Cerium dioxide has a variety of uses, including as an oxygen-storing additive, which makes it ideal for combustion engines.

Measuring in nanometers

The Oxonica team knew that cerium dioxide was already capable of being reduced to anywhere from 10 to 70 nanometers, but they were convinced further research could get it below 10. (A nanometer is one billionth of a meter; to put it into perspective, a human hair is about 50,000 nanometers in diameter.) This, despite the prevailing literature that held that it was impossible to optimise the particle below five nanometers.

Mick Stadler of Cerion Energy

Enter Mick Stadler, then the executive director of the Rochester Institute of Technology's (RIT) Center for Entrepreneurship Technology Incubator. Based in New York, RIT is among the most highly regarded universities in the United States. Stadler learned of Oxonica's research through a friend at Kodak, the famed film company, which the Oxonica team approached, due to its technological acumen.

Creative catalyst

"They thought that if they had the time and resources, they could make something happen," Stadler says of Oxonica. When Kodak's corporate office turned Oxonica down, Stadler and a friend and fellow scientist-researcher, Ken Reed, saw an opportunity. They did enough research and experimentation that by February 2007, they formed Cerion Energy, focused on creating a fuel-borne combustion catalyst smaller than five nanometers.

In true researcher fashion, Stadler and Reed did more than just form the company. They partnered with seven major universities, including RIT, to study and test the possibilities. Over the past four years, Cerion Energy experimented with 20 iterations of the fuel product they now call GO_2 ("go to") before finally establishing the "sweet spot," in Stadler's words, for uniformity of particle size and performance: 2.5 nanometers. Why so many repetitions? "The crystal strain has a tendency to want to break apart as the particle size get smaller," he explains.

Stadler is a rarity among scientists. He has a knack for explaining head-spinning concepts in layman's terms. He says that when there's too much oxygen in one part of the fuel-air mixture, Cerion's GO_2 will strike a balance in a matter of "pico-seconds," aka "a thousand-million times faster than a second".