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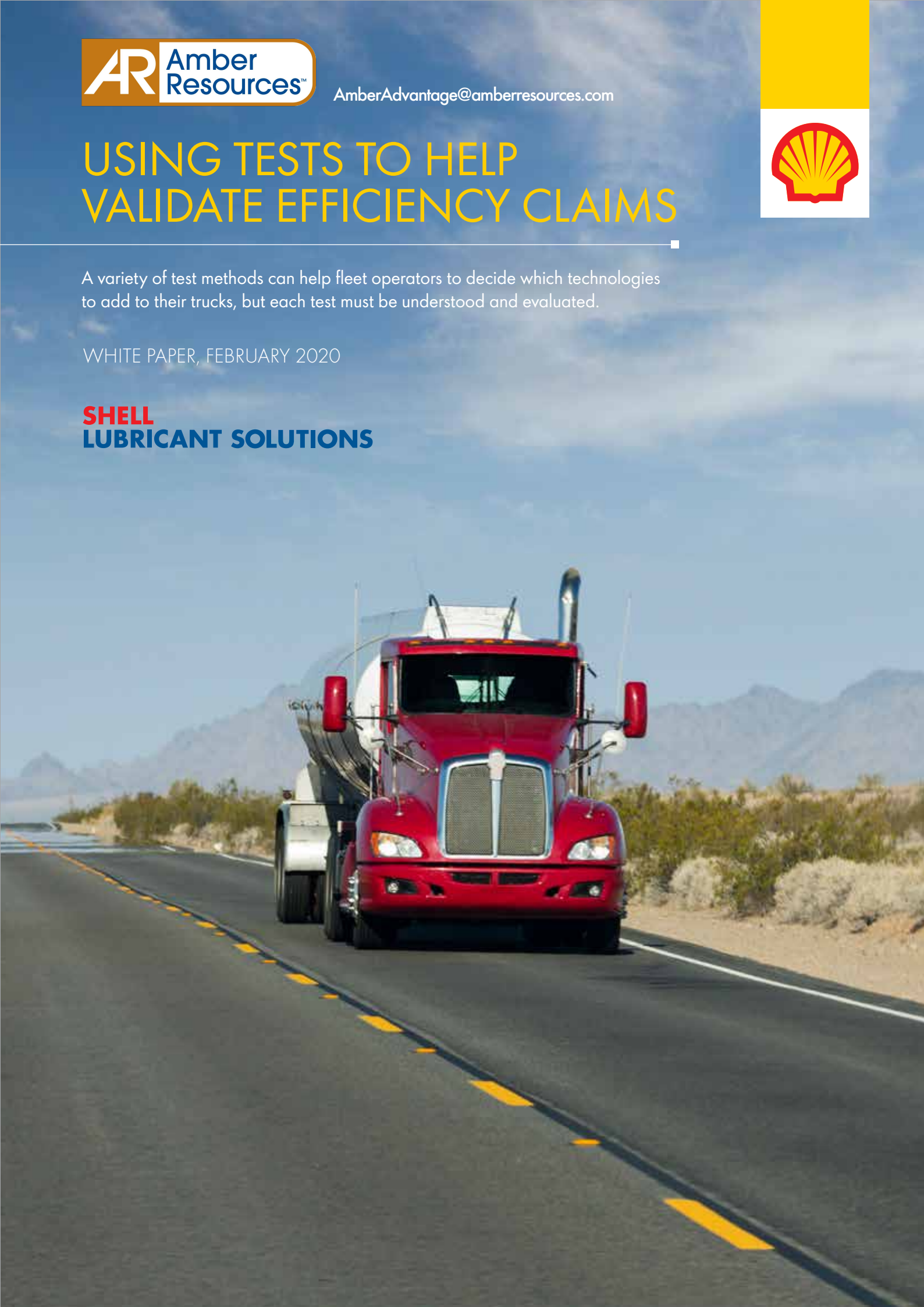
USING TESTS TO HELP VALIDATE EFFICIENCY CLAIMS

A variety of test methods can help fleet operators to decide which technologies to add to their trucks, but each test must be understood and evaluated.

WHITE PAPER, FEBRUARY 2020

SHELL
LUBRICANT SOLUTIONS



There are many technologies on the market today to help fleet operators to improve their freight ton efficiency. However, not every technology is right for every fleet. Many test methods are also available to help fleet operators to validate efficiency claims, thereby supporting their decision making.

The context and applications of each test method are unique, so understanding their challenges and benefits will enable fleet operators to make better investment decisions, no matter which technology they are considering.

The five main test methods are:

1. **computer modeling/ computational fluid dynamics analysis.** A computer and specialized system-evaluation software package are used to model the performance of a complete vehicle, individual component or technology.
2. **wind tunnel testing.** A scale model of a vehicle such as a tractor trailer (or in some cases a full-size vehicle) is placed in a wind tunnel, where the environmental conditions can be controlled to obtain repeatable test results. The size of the wind tunnel test section and its type (open versus closed) dictate the size of the model: scales typically range from 1:10 to 1:1.
3. **track testing**. Every efficiency technology can be tested using the track testing method. The results depend on the test facility configuration and the ambient conditions. Track tests offer useful insights, as they use real vehicles on roads and thus incorporate many real-world factors. However, the test protocols still control many operational and environmental factors, as track testing is generally conducted with just a few iterations and with low net mileage.
4. **on-road testing.** A tractor trailer unit is taken onto a highway and its performance is evaluated over a statistically significant number of miles with an acceptable level of repeatability. On-road testing measures the net effect of all the factors influencing the performance of the entire vehicle.
5. **fleet composite evaluation testing.** This entails data collection over a long period of time, which can normalize seasonal and other variable factors. Spotting trends over multiple years can highlight overall improvements for fleets, but it will be difficult to attribute those gains to one particular change among a vast array of ongoing improvements to operations and equipment.

Testing low-viscosity lubricants

Shell performs a wide range of validation testing. For example, to determine the fuel economy benefits of low-viscosity lubricants, Shell commissioned a field trial at a certified independent test house using six trucks equipped with diesel engines from Cummins, Detroit, Paccar, Navistar, Mack and Ford. Six oils were tested, including reference and prototype oils. The mileages and conditions of the vehicles were matched, industry-standard drive cycles were used and the measurements were repeated and averaged over 24 days. The experiments were carefully designed to ensure that differences in fuel use were statistically significant at the 95% confidence level.

The results showed a 2.6% fuel economy benefit for Shell Rotella 10W-30 CK-4 lubricant compared with a standard 15W-40 oil.[1] A prototype 0W-20 oil showed even stronger fuel economy benefits.

[1] Clevenger, S.: "Low-viscosity engine oils will support push for improved fuel economy, Shell says," *TTNews* (2018): www.ttnews.com/articles/low-viscosity-engine-oils-will-supportpush-improved-fuel-economy-shell-says.com

“**THE RESULTS** SHOWED A 2.6% FUEL ECONOMY BENEFIT FOR SHELL ROTELLA 10W-30 CK-4 LUBRICANT COMPARED WITH A STANDARD 15W-40 OIL.[1]”

A key issue in testing is the degree to which innumerable real-world factors can cause actual performance to deviate from what was recorded under controlled test conditions. Fleet operators must carefully analyze the options available and compare them against their own duty cycles and operations to determine which technologies offer the fastest payback times. Having realistic expectations for payback time, and especially how this may change in relation to changes in fuel prices or other aspects of operations, will enable the fleet operator to develop a stronger overall financial plan.

The key challenges involved in a direct comparison of various performance testing data are:

- variance among testing methods: different methods test for different things, with different parameters, controls and assumptions;
- extrapolating test results: fleet operators struggle to apply the results of a controlled test to their own operations;
- the need to attribute efficiency gains precisely: it can be difficult to attribute a change in performance to a single technology, particularly in the real world;
- using older data: technologies, vehicles and duty cycles are constantly changing, but test methodologies cannot always keep up;
- confusion between precision and accuracy, two key concepts in determining efficiency that are widely misunderstood and often misused: precision is the ability to repeat a test or analysis and get the same result; and accuracy, also called bias, refers to how closely a test value matches the real-world value; and
- the complexity of the calculations and the variables measured: test methodologies require expert design by specialists, but the data end users cannot be expected to possess a similar level of expertise.

Despite these challenges, all five test methods can provide important relative performance indicators that can help in prioritizing investments in efficiency technologies. There is no single “correct” method for fuel economy evaluation. Each method entails certain costs and complexities that the fleet operator needs to consider. If the operator is commissioning its own testing, the cost-to-benefit ratio will be paramount in choosing the method.

The phrase “you get what you pay for” can be very true with testing. Cheap and fast methods generally increase the risk that the data will be of limited application. At the other end of the scale, expensive methods may not guarantee any better credibility if they are misapplied or if their results are misunderstood.

A large number of test verification results for various technologies are already available from manufacturers and fleet operators, but some of them are private. If all parties shared the best available, robust data, it would help other fleets to make informed decisions.

To get the best input for efficiency technology decisions, the fleet operator needs to understand the scope, context and constraints of the test method under consideration and how its results will translate to real-world performance. To assess the benefits of a new technology accurately, the operator also needs to quantify the current performance of its fleet.

Fleet operators do not need to determine the exact value of the performance or payback that a technology offers. However, they should establish the percentage change that the technology promises and determine how different their performance will be if they adopt it.

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