TRUCKING EFFICIENCY EXECUTIVE SUMMARY:
Confidence Findings on the Potential of 6x2 Axles Report

The fuel costs faced by the tractor-trailer industry have been swiftly and steadily rising over the past decade. By 2012 diesel fuel costs reached $0.64 per mile, surpassing even the combined cost of wages and benefits for the drivers. This recent surge in fuel prices has reshaped the economics of trucking, and the industry is in need of solutions if it is to stay profitable.

Fortunately, a myriad of technologies which show strong potential for achieving cost-effective gains in fuel efficiency for Class 8 trucks are readily available on the market today. Unfortunately, the industry's uptake of such technologies has been stymied by a multitude of barriers, central among those being a lack of data about the true performance gains offered by these technologies, and, what's more, a lack of confidence in the data that does publically exist today. In order to overcome those barriers and facilitate the industry's trust in and adoption of the most promising fuel-efficiency technologies, the North American Council for Freight Efficiency (NACFE) has partnered with the Carbon War Room (CWR) to form the Trucking Efficiency Operation. The Operation's work has begun with a series of Confidence Reports, of which this report on 6x2 axles is the second.

This report focuses on these axle technologies because they stand to increase fuel efficiency by 2.5%. Specifically, this report documents the confidence that the North American Class 8 trucking industry should have in whether or not it is economically rational for them to specify and buy tractors with a 6x2 axle configuration. Based on the claims of 6x2 manufacturers, along with some anecdotal data, NACFE's initial research into a variety of fuel-efficiency technologies suggested that 6x2 systems will offer cost-effective fuel savings to the vast majority of fleets. But although such single-axle drive tractors are widely used in European trucking and have been for some time, their penetration into the North American market thus far has been very slow, and today they make up only 2.3% of new line haul tractor sales.

In looking into possible reasons for such low adoption rates, the aforementioned market barrier of a lack of data and confidence was found to be particularly applicable to the situation of 6x2 systems.

BY 2012 DIESEL FUEL COSTS REACHED $0.64 PER MILE, SURPASSING EVEN THE COMBINED COST OF WAGES AND BENEFITS FOR THE DRIVERS.

The test findings, which are explored in depth in the report, are summarized in this table:

	NACFE @ PIT			OEMS		Fleets				
	#1	#2	#3	Volvo	Freightliner	Con-way	XXX	UPS	Nussbaum	YYY
Truck Description	KW w/Dana Axles -Mod 1	KW w/Dana Axles -Mod 2	Volvo 6x2 w/Meritor Axle	Converted Volvo 6x4	Converted Cascadia 6x4	Kenworth 6x2, 6x4	FL Columbia 6x2, 6x4	Mack Pinnacle Day cabs	Volvo	ProStar+
Test Type	Type II	Type II	Type III	Mod Type II	Mod Type IV	Freight Miles	Freight Miles	Same route each day	Freight Miles	Freight Miles
Number of Units (6x2, 6x4)	1,1	1,1	1,1	1,1	1,1	1224, 59	7,11	1,1	10,4	27, 112
Test Date	Jun-13	Jun-13	Jun-13	12-Jul	Nov-12	Jan-12 to Dec-12	Jun-10 to May-11	Jun-12 to Jun-13	Apr-13	Jan-13 to Apr-13
MPG Delta	**1.9%**	**2.8%**	**2.3%**	**1.6%**	**2.2%**	**3.2%**	**3.9%**	**4.6%**	**4.0%**	**1.9%**
Avg	**2.3%**			**1.9%**		**3.5%**				

Fuel Economy Test Results

TRUCKING EFFICIENCY EXECUTIVE SUMMARY:

Confidence Findings on the Potential of 6x2 Axles Report

Numerous market research studies, including some conducted by NACFE, suggest that fleets trust the experience of other fleets more than any source of information besides their own. And yet, prior to the publication of this report, there was very limited data on the actual experience of early-adopting fleets with 6x2 systems.

BY ANALYZING THESE VARIOUS SETS OF TEST DATA, TRUCKING EFFICIENCY FINDS THAT FLEETS CAN BE CONFIDENT THAT THEY WILL ENJOY ABOUT A 2.5% REDUCTION IN FUEL USE, AND PAYBACK ON INVESTMENT IN ABOUT 20 MONTHS, BY ADOPTING CURRENTLY AVAILABLE 6X2 AXLE TECHNOLOGIES.

Thanks to an extensive series of interviews, and permission from the industry to publish their preexisting test results, this confidence report marks the first and only place where the actual data of various fleets' experiences with 6x2s is shared publically. This report also represents the first time that a variety of different sources of data and testing results are collected and shared in one place, side-by-side, making the findings of this report not only more compelling but also more likely to be relevant to a range of fleets and truck owners.

Seven sets of existing testing data, five from fleets and two from OEMs, are presented in this report. That data is supported by three additional sets of track tests on 6x2 performance that NACFE commissioned in the course of conducting its research. Along with the test results themselves, this report supplies details on the testing protocols used in each case, so that readers can better judge which tests are most applicable to their own needs or duty cycles.

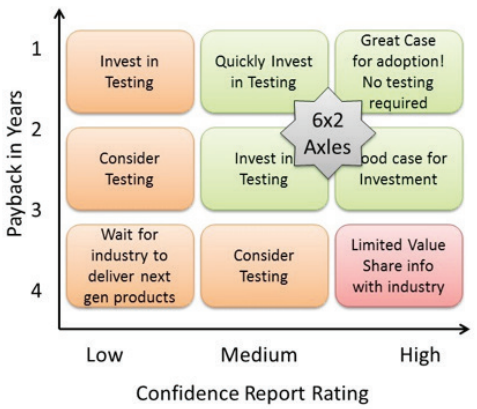
Additional interviews were conducted with 6x2 technology manufacturers and other stakeholders in the sector to round out the conclusions drawn from this test data.

By analyzing these various sets of test data, Trucking Efficiency finds that fleets can be confident that they will enjoy about a 2.5% reduction in fuel use, and payback on investment in about 20 months, by adopting currently available 6x2 axle technologies.

In sum, this report places the 6x2 technology near the top-right quadrant of the Trucking Efficiency Confidence Matrix, giving it a medium-to-high Confidence Rating – meaning that Trucking Efficiency is confident in that the existing data, given its the breadth and accuracy, does demonstrate that 6x2s will have an acceptably short payback period as to justify their widespread adoption by the industry:

This Confidence Rating indicates that Trucking Efficiency is highly confident that 6x2 axle configurations offer significant fuel-efficiency gains. Besides fuel-savings, other benefits of 6x2s include weight reduction, lower maintenance costs and improved truck stability.

Along with discussing the benefits of 6x2s, this report catalogues the concerns most commonly cited as reasons not to adopt 6x2s, including challenges of traction, overall tire wear, resale value, and driver acceptance. These are indeed justified concerns. However, this report considers each concern individually, and concludes that the benefits of 6x2s today outweigh these concerns for a variety of reasons. For example, new technologies



Payback and Confidence

For more information, contact
Mike Roeth at 260.750.0106, mroeth@carbonwarroom.com and/or visit www.nacfe.org

TRUCKING EFFICIENCY EXECUTIVE SUMMARY:
Confidence Findings on the Potential of 6x2 Axles Report

for automatic load shifting, limit the traction difference between a 6x2 and a 6x4, and therefore Trucking Efficiency recommends such technologies be automatically specified for any 6x2 tractor.

To complement these new figures for the average predicted efficiency gains offered by 6x2 axle systems, this Confidence Report includes a Payback Calculator, with which individual fleets or truck owners can more accurately predict the gains that they themselves would experience with a 6x2 configuration. Users input various figures and details specific to their operations, and duty cycles, and receive a tailored picture of whether or not 6x2 axles are going to be right for their operations.

Unlike many other such calculators, the Payback Calculator presented in this Confidence Report considers both the benefits or savings and the challenges or costs posed by 6x2s in determining its results. The goal of the Payback Calculator is not to provide complete and thoroughly accurate data of how 6x2s will perform for a given fleet, but rather to suggest whether users should seriously explore the technology for themselves, perhaps by specifying on a few of their trucks, or otherwise investing in their own rounds of testing.

Along with the results of the Payback Calculator, fleets can use this Confidence Report as an initial decision-making tool by considering whether the best practices for 6x2 performance detailed here are relevant to or replicable in their own operations.

Future research should attempt to verify some initial findings, also discussed in the report, around the much greater potential efficiency gains offered by installing a suite of complementary technologies, which Trucking Efficiency has dubbed the "6x2 package." The report also gives some initial findings of the impact of 6x2 axles on tire wear, but additional test data is needed to strengthen those numbers.

Additionally, Trucking Efficiency is always seeking to expand the data or case studies that we can provide to the industry. We invite you to share with us your own experiences with 6x2 axle systems – whether you have adopted them already, are considering doing so, or have chosen not to pursue them at this time.

It is the hope of the Trucking Efficiency Operation that this report will catalyze significant new interest in the 6x2 axle technology as a way to increase fuel efficiency and obtain other benefits.

TO COMPLEMENT THESE NEW FIGURES FOR THE AVERAGE PREDICTED EFFICIENCY GAINS OFFERED BY 6X2 AXLE SYSTEMS, THIS CONFIDENCE REPORT INCLUDES A PAYBACK CALCULATOR, WITH WHICH INDIVIDUAL FLEETS OR TRUCK OWNERS CAN MORE ACCURATELY PREDICT THE GAINS THAT THEY THEMSELVES WOULD EXPERIENCE WITH A 6X2 CONFIGURATION.

About Operation Trucking Efficiency

Operation Trucking Efficiency is a joint effort between NACFE and the Carbon War Room to double the freight efficiency of North American goods movement by 2016 through the elimination of market barriers to information, demand and supply.

Worldwide, the heavy-duty freight trucks emit 1.6 gigatons of CO_2 emissions annually – 5.5% of society's total greenhouse gas emissions. These emissions are the result of the trucking sector's dependence on petroleum-based fuels. From a global

For more information, contact
Mike Roeth at 260.750.0106, mroeth@carbonwarroom.com and/or visit www.nacfe.org

TRUCKING EFFICIENCY EXECUTIVE SUMMARY:
Confidence Findings on the Potential of 6x2 Axles Report

perspective, truck manufacturing is a growth market which will likely see up to 33 million new units built by 2015. But this growth, though profitable, could result in massive increases in trucking's emissions – unless the trucking sector improves its fuel efficiency as fast as it expands.

With fuel prices continuing to rise, the adoption of efficiency technologies by all classes of trucks and fleets offers significant cost-savings to the sector while reducing emissions. For example, for a typical heavy-duty truck in the United States, a 5% reduction in fuel-use gained through improved efficiency offers yearly savings of over $4,000. Technologies capable of conferring such gains are relatively cheap to implement and widely available on the market. Many have the potential to be retrofitted onto existing trucks.

But in spite of the potential cost savings, even the most promising of these technologies are not yet being widely adopted by the North American trucking industry. Operation Trucking Efficiency finds that the following market barriers are responsible for this:

Lack of Confidence in the Data on Efficiency Technologies – New technologies abound, but fleet owners lack cross-comparable, credible, and widely available data proving their potential performances. Often the only existing data are producer claims, which fleets put low trust in. Fleets worry that savings will be less than promised, and that technologies will negatively impact their operations.

Information is Not Shared – When fleets do independently test a technology, the tests are expensive and time-consuming, leading to 18-month average implementation times and low purchase quantities. Fleets tend to test in parallel, rather than sharing their test results or otherwise collaborating in obtaining performance data, resulting in an unnecessary duplication of cost and effort.

This Confidence Report series from Operation Trucking Efficiency was born out of not only the identification of these barriers, but also conversations with the industry, which made it clear that the elimination of these barriers requires a credible and independent source of information on fuel efficiency technologies and their applications. The Confidence Reports aim to serve of the first such source on the

About the Carbon War Room

The Carbon War Room is a global nonprofit, founded by Sir Richard Branson and a team of like-minded entrepreneurs, that accelerates the adoption of business solutions that reduce carbon emissions at gigaton scale and advance the low-carbon economy. The organization focuses on solutions that can be realized using proven technologies under current policy landscapes.

Working collaboratively in sectors where we have proven that profitable emission-reduction opportunities exist, the Carbon War Room aims to create well-functioning, high-growth, and low-carbon marketplaces by launching Operations in those sectors. The War Room's current Operations include Maritime Shipping Efficiency, Green Capital for Energy Efficiency in the Built Environment, Renewable Jet Fuels, Smart Island Economies, and Trucking Efficiency.

For more information, please visit www.carbonwarroom.com.

About NACFE

The North American Council for Freight Efficiency will drive the development and adoption of efficiency-enhancing, environmentally-beneficial, and cost-effective technologies, services, and methodologies in the North American freight industry by establishing and communicating credible and performance-based benefits. The Council is an effort of fleets, manufacturers, vehicle builders and other government and non-government organizations coming together to improve North American goods movement.

More can be learned about the NACFE at www.nacfe.org.

For more information, contact
Mike Roeth at 260.750.0106, mroeth@carbonwarroom.com and/or visit www.nacfe.org