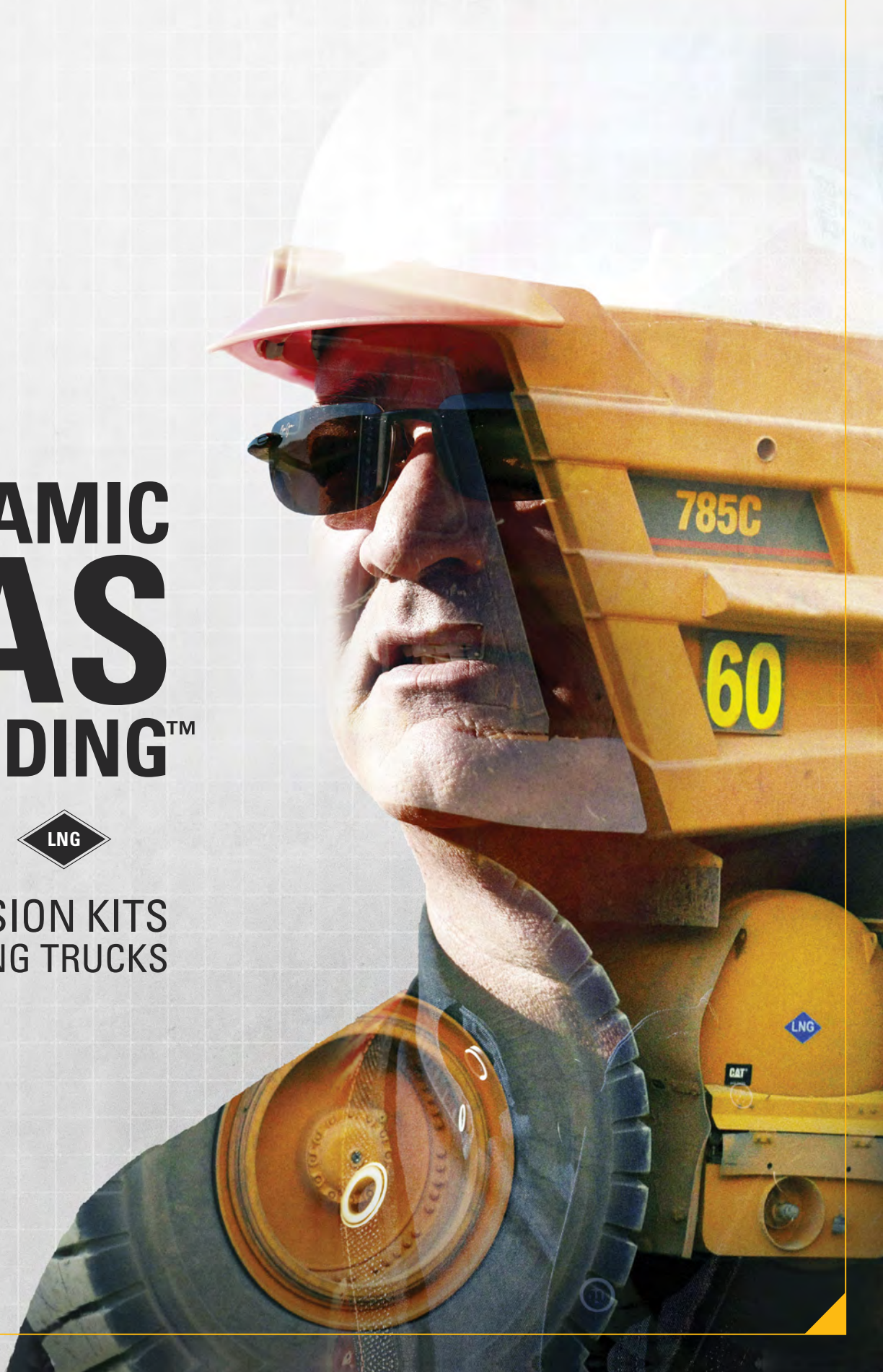




DYNAMIC GAS BLENDING™



CONVERSION KITS
FOR MINING TRUCKS



2

GET TO KNOW WHAT CAN SAVE YOU MILLIONS.

You may have heard about Dynamic Gas Blending™ (DGB)—displacing diesel gas and using LNG on your mining trucks. But with the magnitude of savings now proven with this technology, it's time to get more familiar. In the brochure outlined below, you'll get everything you need to know: statistics on savings, real customer success stories and exactly how DGB reduces your mine production cost.

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See the stats that matter on the next page.

4 10 Million Hours of Proof

When you see what they're saving—you'll believe it.

5 The Basics of DGB & LNG

It's not rocket science, but it is a proven technology.

6 Beneath the Hood

The magic is in how this all works.

7 Support Beyond the Iron

Check out how our experts help every step of the way.

8 Explore More or Talk with Us Today

We have exciting resources that can help you visualize savings.



LNG

3

NUMBERS YOU CAN'T IGNORE



*Let's get right to it...
What does it save me?*

The number to remember:

30%

LESS FUEL COSTS

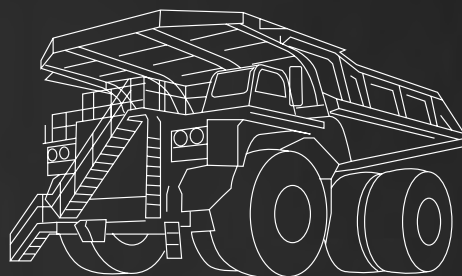
(when using LNG over diesel)

So how often is that?

- ◆ **Replace up to 85%** diesel with LNG (peak)
- ◆ **Replace 60-65%** diesel with LNG (cycle average)

Those numbers get even bigger when you consider your fleet:

- ◆ A typical fleet of 40 haul trucks spends roughly \$30 million/year on diesel fuel. Using DGB at 65% cycle diesel displacement and lower LNG fuel cost, that fleet saves \$10 million per year on fuel—a 30% fuel cost savings.
- ◆ For one truck, that is an average savings of \$200,000/year. Depending on the size of your fleet, that adds up. It's an investment that truly pays for itself.



Doesn't a new technology mean more maintenance?

Actually, adopting DGB means extending engine life since natural gas burns cleaner than diesel. DGB maintenance cost is low (<5%) since it uses simple components and is done during your routine PCR schedule.



So... how does the machine perform?

The short answer is the same as your diesel truck. Our mining customers using DGB have experienced the same productivity, payload and performance as their diesel truck fleet.



Does DGB impact fuel emissions?

Yes it does. For trucks using DGB, you can expect to see **30% less emissions**. Protecting our land, complying with regulations—two more big reasons to adopt DGB.

Where Do These Numbers Come From?

We're glad you asked. On the next page, you can see specific customer studies that support the savings of DGB.

10 MILLION HOURS OF PROOF

DGB may be new to mining, but this proven technology has over 10 million operating hours. Testing and customer trials have resulted in zero recordings of unplanned downtime related to DGB. Below are production statistics from mine sites throughout the world that have adopted DGB as early as January 2016.



Gold Mine – Tuprag, Turkey

- ◆ This customer has installed DGB on 785C trucks.
- ◆ Since installation, they've reached 55% average fuel displacement, and achieved an operating cost reduction of **\$30/hour**.



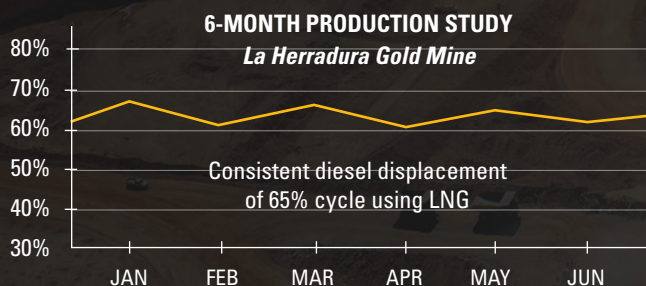
Phosphate Ore Mine – Idaho

- ◆ This customer performed a 5,000-mile test using LNG on a 785C.
- ◆ They achieved **65% fuel displacement** from diesel to LNG.
- ◆ They achieved **30% savings**, with the same truck performance and mine as diesel trucks.



Gold Mine – La Herradura, Mexico

- ◆ Two trucks with DGB have run since May 2016 with over 25,000 hours.
- ◆ They've also achieved **65% fuel displacement** from DGB to LNG. The DGB trucks have performed at the same level as diesel-only—and they are converting their entire fleet of trucks to DGB.
- ◆ Below is a chart of the diesel displacement this customer achieved over a 6-month study. Through this displacement, they were able to save nearly 30% on fuel costs.



THE BASICS OF DGB & LNG

Cliff notes:

LNG is the cost-saving fuel source, and DGB is the technology that allows LNG to save your operation money. But the more you understand each of these, the more you will see that the two can bring your mine site big savings.

DGB

Dynamic Gas Blending 101

Dynamic Gas Blending (DGB)

/dē-gē-bē/ noun

1 : A technology that vaporizes liquid fuel into natural gas, and replaces use of diesel fluid with liquified natural gas (LNG) when possible.



With system integration, advanced controls and ICPS, DGB automatically maximizes the amount of LNG used to displace diesel fuel—while maintaining the same performance as diesel.

- ◆ This allows you to achieve the lowest possible fuel cost without sacrificing machine production.



The key to higher savings is the amount of LNG fuel that displaces diesel fuel. This is referred to as diesel displacement.

- ◆ The average cycle diesel displacement is 60 to 65%.
- ◆ LNG fuel tends to cost 25 to 50% less than diesel fuel and is available in many parts of the world including North and South America, Australia, Russia and Europe.



DGB technology is currently available for 785C and 793D Cat® Mining Trucks.



Mine Site Note:

To leverage the potential savings, DGB requires a fueling station on-site.

LNG

Liquified Natural Gas 101

Liquified Natural Gas (LNG)

/el-en-gē/ noun

1 : An efficient energy source primarily composed of methane, used in DGB to replace diesel fuel when possible.



LNG is available at an affordable cost, with favorable impact to the environment. Investment is minimized because energy companies are willing to invest in the necessary infrastructure to deliver LNG to mine sites.



Readily available and a commercially accepted fuel process due to the fact that many are already aware of LNG as a less expensive fuel source than diesel.



Safety Facts:

- ◆ As safe as using diesel fuel
- ◆ Cold fuel handling with PPE. Not flammable as a liquid.
- ◆ Narrower flammability range vs. diesel
- ◆ Beyond safety hardware on the machine, education and training are also available.

IT'S UP TO

30%

LESS EXPENSIVE
THAN DIESEL.

HOW DOES THIS ALL WORK?

LET'S GET BENEATH THE HOOD.

We've covered the why and the what, but you may be wondering, "How does all of this work?"

Below are the steps of the process and diagrams of the tank and engine that make fuel displacement happen.

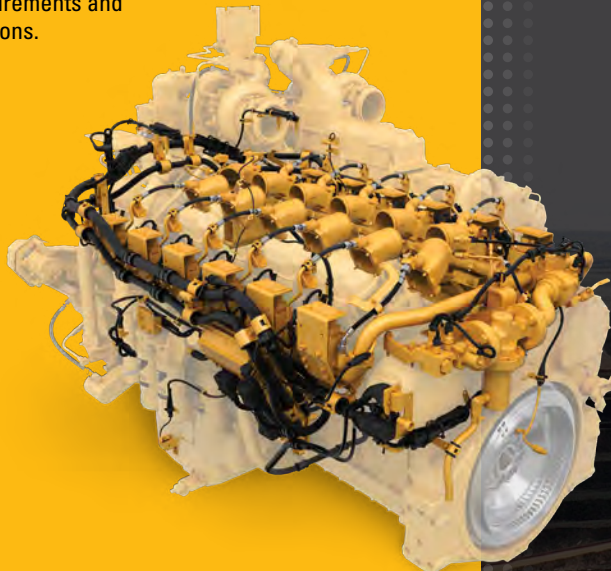
- 1 While diesel engines utilize compression ignition, causing heat that ignites fuel, natural gas engines utilize spark ignition. DGB technology offers a combination of both diesel and gas for your machine's fuel.
- 2 The technology automatically runs on both fuels and displaces diesel with liquified natural gas that's stored on the truck. If needed, the system will revert back to 100% diesel only operation. By only using diesel based on demand of the working conditions, the DGB machine performance is identical to that of diesel only.
- 3 How? The technology software on the engine and fuel tank communicates with the hardware to achieve reliability and determine performance substitution levels. This communication is accomplished through DGB ECM Controls on the engine that are integrated with diesel ECM controllers.
- 4 The software on the engine communicates with one DGB fuel tank, integrated with both diesel and LNG fuel sources, that has an economizer/regulator that optimizes the fuel source while the machine is running. The simple-install tank is CE certified, meets ASME requirements and is built to withstand harsh conditions.



STARTS AND
IDLES ON DIESEL



NATURAL GAS
REPLACES DIESEL



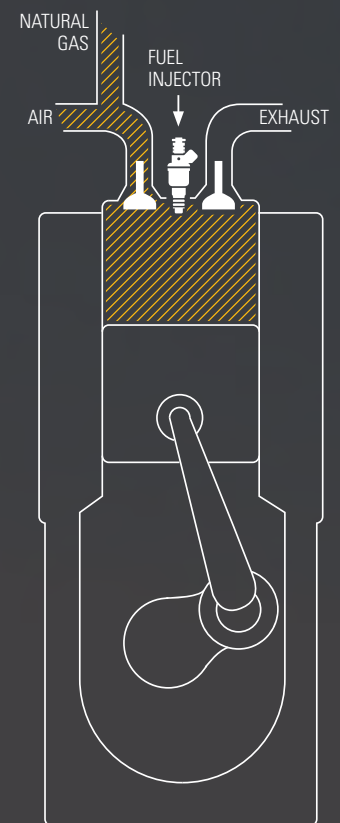
Below are diagrams of the engine and the tank, and the key components that make this gas blending possible.



DIESEL
ENGINES UTILIZE
COMPRESSION
IGNITION



NATURAL
GAS ENGINES
UTILIZE SPARK
IGNITION



*If your left brain is looking for more information, spec sheets are available at: **Cat.com/DGBmining**. Fill out the form to request a consultation with a Cat® DGB LNG expert.*

CATERPILLAR SUPPORT THROUGHOUT SUPPORT BEYOND THE IRON

Adopting DGB on your mining trucks brings equipment reliability you expect from Caterpillar, including: engine kit, chassis kit, LNG tank, diesel tank and more. Beyond the iron, you can count on Caterpillar and dealer support to deliver efficient and trustworthy gas blending solutions to your mine site.

What kind of support?

Well, it's a process to set up a new fuel source that can save you millions. Caterpillar knows that, and knows the best ways to get set up. Just as we have for mine sites around the world, our team will work with you every step of the way.



Project Feasibility

From cost analysis to the economic payback model, we're here to make sure DGB investment brings a positive impact to your bottom line.



Identifying Project Partners

When it comes to your LNG fuel supplier, a fueling station partner, or any other stakeholder—we're here to help identify the right project partners to put your project in a position to succeed.



Mine Integration

Safety training, location of the fuel station, optimal areas for DGB trucks—it all plays into increasing your fuel displacement percentage, which means a better return on your DGB investment.



Implementation

When the DGB kit is shipped, our dealer support team is there to ensure the installment goes smoothly and efficiently.



WANT TO KNOW MORE?

EXPLORE MORE OR TALK WITH US TODAY.

*Adopting a new fuel source is a big decision—that's why there are plenty of resources to help you see the value. By visiting **cat.com/DGBmining** you can find a series of helpful resources listed below.*



La Herradura Customer Video

See how one mine site has gone above and beyond in adopting DGB, and what their operators have to say about fuel cost savings and machine performance.



Fuel Savings Calculator

By using our interactive calculator, you can enter a few quick inputs and see how much money your mine site could save each year with DGB.



Additional Downloads

Whether production studies, spec sheets or more information on our implementation process, you'll find plenty of resources that will help you when considering DGB.

When you're ready to talk business about DGB on your mine site, our experts and Cat® dealers are here to provide consultation. You can fill out a form on our website, and you'll be contacted for the next steps.

A. - WHY DGB | B. - WHY BELIEVE IT | C. - WHAT IT IS | D. - HOW IT WORKS | E. - HOW TO ADOPT IT | **F. - YOUR RESOURCE**