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# FACTS ABOUT MAXXFORCE™ ADVANCED EGR

## WHY WE CHOSE ADVANCED EGR:

We created a solution based on the belief that compliance should completely be the OEM's responsibility – not the customer's. (See chart on next page.)

- Reduces operational expenses
- No hassle with added equipment and urea

### Long-Term Viability

- European counterparts are turning to EGR after years of experience with SCR, citing simplicity for its customers
- SCR's added equipment raises questions about resale value with evidence that Advanced EGR could become the solution of choice in the future

### The Green Factor

- Both Advanced EGR and SCR comply with emissions standards, but the carbon footprint should be considered as well. Consider the energy required for the production, distribution, infrastructure and manufacturing for a solution that requires an additional fluid (urea).
- We've been rewarded by the EPA for achieving lower emissions before they were required, which resulted in credits to apply toward developing a 2010-compliant, superior technology for reducing emissions. So not only have we had lower emissions for years, but we've also been able to use them for your advantage.
- EGR is compliant from the moment you turn the key. Compare this to SCR, where there are gaps in NOx control: when the urea tank is frozen, empty, filled with the wrong fluid or tampered with.

## HOW ADVANCED EGR WORKS:

**MaxxForce Advanced EGR exclusively delivers by handling it all inside the engine.**

- Same technology used industry-wide today to reduce emissions, and we've produced over 200,000 EGR engines that have been proven over 9 million miles
- Works by recirculating cooled diesel exhaust back into the engine, reducing emissions before they come back out
- Made possible through our exclusive technology:
  - **Advanced Fuel Injection Technology** to break fuel into a finer mist that burns more completely
  - **Proprietary Combustion Bowl Design** leading to more complete combustion
  - **Advanced Air Management** featuring dual turbochargers and an increased EGR rate to reduce NOx generation through slower, cooler combustion
  - **Improved Electronic Calibration** that continuously maximizes the fuel-air mix

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## HOW IT BENEFITS CUSTOMERS:

	Lower operating costs	Less hassle
<b>No urea required</b>	<p>No urea costs, which are still unknown, but have been seen as high as \$12/gallon</p> <p>No costs for installation of tanks at your shop</p>	<p>Temperature range of 12° F and 122° F can make truck inoperable</p> <p>Widespread availability of urea is uncertain</p>
<b>Integrated truck/engine solution</b>	<p>Our industry-leading aerodynamics and truck/engine integration will continue to deliver top fuel efficiency</p>	
<b>No added componentry</b>	<p>Increased payload capacity of 200–300 pounds because there's no extra componentry</p> <p>No potential downtime caused by after-treatment equipment</p>	<p>No worries about packaging the equipment around the truck body</p> <p>No maintenance</p> <p>No extra parts to stock</p>
<b>No training or operation oversight</b>	<p>No added costs and time for training drivers and technicians</p> <p>No chance of driver error = no downtime if vehicle becomes disabled when urea tank runs dry</p>	
<b>Stable trade-in value</b>	<p>SCR could have a significant affect on trade-in values if newer EGR technology becomes the technology of choice and companies migrate to this option in the future</p>	

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## DO NOT GET THE FACTS WRONG!

SEVERAL OF OUR COMPETITORS HAVE NOT BEEN TELLING THE TRUTH WHEN IT COMES TO 2010 EMISSIONS. SO IT'S TIME TO CLEAR THE AIR.

What our competitors are saying	The truth
SCR will not have an operational disadvantage to EGR	SCR will require drivers to refuel tanks every 3,000–5,000 miles. It will also require drivers to fill two tanks, which will take more time. SCR will require additional maintenance, service and support vs. EGR. And with SCR, customers will risk “derating,” where the truck can only operate below a certain speed if the driver allows the urea tank to run empty. These are all operational disadvantages.
SCR is the simpler, more proven technology approach	All in all, SCR is a very complex system for everyone involved. Because of the new lights and warnings in the driver interface, additional training will be required for all operators and service personnel. Technicians servicing trucks will require additional training on the SCR system components and wiring. More parts will need to be stocked, and the additional complexity means more opportunities for the system to malfunction.  The SCR system in Europe is also not directly transferable to the U.S. given tighter regulations.
Navistar is using credits to meet 2010 requirements	Actually this is true, but here's the rest of the story: the EPA supports the collection and use of credits because it actually contributes to cleaner air. Navistar has helped keep the environment cleaner by exceeding the standards for emissions. Moreover, no company that collects and uses credits gets all the credits back (one for one). In fact, 20 percent of the credits are held back. In other words, if a company generated 100 credits, they are only able to use 80 of those credits in the future. The balance is a contribution to the environment.
Navistar will run out of credits	Navistar is committed to the path of EGR, now and in the future. As of 2012, credits will no longer be allowed to certify engines to the 0.2g/bhp-hr standard. By that time, we will have fine-tuned our engine systems and calibration to meet the standard at the tailpipe without credits or other additional aftertreatment hardware.

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What our competitors are saying	The truth
Temperatures should not be an issue	<ul style="list-style-type: none"><li>▪ Urea freezes at 12° F (that's -11° C). Vehicles equipped with an SCR system may require a heater for the tank to maintain the temperature and prevent the urea from freezing.</li><li>▪ In addition to the issues of freezing, urea begins to break down at 85° F, or 30° C, so storage tanks must be insulated and shielded from direct sunlight.</li><li>▪ At 122° F, urea gives off ammonia gas.</li><li>▪ The higher the storage temperature, the shorter the shelf life. Vehicles in southern states that sit for extended periods in the sun (school buses, trucks on dealer lots, etc.) will most likely need to drain the urea solution tank and refill before being put into service.</li></ul>
Urea is just like handling window washer fluid	Urea is corrosive to aluminum (it will etch aluminum wheels). Some proposals include a 2.5 gallon dispenser of urea. At 9 lbs a gallon, that's more than 22 lbs that drivers will haul to the tank and be careful not to spill. A 15-gallon urea tank would take six containers of urea for a fill up.
You will have to call a phone number to find somewhere that sells urea	This is true. Our competitors are encouraging their customers to dial 1-800-DIESELS, which will tell you where to find urea.

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What our competitors are saying	The truth
Navistar has not yet shown their 2010 solution in public	Navistar introduced their 2010-compliant MaxxForce Big Bore engine this past February at the World of Concrete Show in Las Vegas and the 2010-compliant MaxxForce DT at the NTEA Work Truck Show in Chicago. As of March 2009, there are currently over 25 vehicles in validation and testing.
EGR isn't EPA compliant; SCR is. Therefore, EGR is bad for the environment.	The EPA Banking and Trading program clearly states that manufacturers can go to .5 NOx if they have credits to use and that manufacturers need to be at .2 NOx if they do not have credits. Navistar leadership decided several years ago that they would bring cleaner engines to market sooner, and are now taking advantage of credits from the EPA Banking and Trading program to deliver Advanced EGR technology to customers ahead of its competitors.
Navistar will have a dirty engine	Navistar has been a leader in clean diesel technology on many fronts; we were the first to market with electronic emissions controls in 1994, the first to introduce the Green Diesel Technology® in 2000, with the first diesel engine with emissions equal to natural gas, and, most recently, the first to mass-produce a diesel-hybrid electric vehicle. The fact is, Navistar will be fully compliant with clean air standards in 2010 without the use of additional complex aftertreatment.
SCR gets better fuel economy than EGR	SCR systems are projected to offer a slight improvement in fuel mileage. However, they also require the addition of urea. Navistar estimates that the cost of urea will negate the benefits of the fuel economy improvement with the SCR system.  Customers also need to look at overall operating cost vs. fuel economy. Customers need to account for the cost of urea, increased downtime due to the additional maintenance to the SCR systems, additional time it will take a driver to fill and maintain two tanks and more importantly, whether the truck and engine already have a fuel economy advantage. In the end, Navistar believes that the Advanced EGR solution will have an operating cost advantage.



## QUESTIONS AND ANSWERS ON 2010 EMISSIONS

### **1. I have heard quite a bit about SCR technology with regards to 2010 emissions. Isn't SCR a more realistic and pragmatic way of meeting these requirements?**

We believe that SCR is a transitional approach and that customers have a better choice with our MaxxForce Advanced EGR solution. Even in Europe, where SCR has been used to meet less stringent emissions requirements, companies are transitioning to EGR as the next step in their emissions control strategy. SCR puts the burden of compliance largely on the customer because the vehicle must have an adequate supply of urea at all times. There is also the additional cost of operation issues such as reduced payload due to the additional weight of SCR components and urea.

The path we are following will meet the 2010 requirements by using advances that build on the technologies we are using today – proven technologies such as advanced fuel injection, air management, electronic controls and proprietary combustion technology without the operational costs and inconvenience associated with SCR.

### **2. Will Navistar use credits to meet 2010 emissions requirements for NOx? What does that mean to me? Is it possible credits will run out before advanced EGR is ready?**

- 1) Our products will be fully compliant with EPA emissions standards in 2010 and beyond.
- 2) The EPA encourages engine manufacturers to build cleaner, more environmentally friendly engines sooner through the incentive of credits. Since 2004, as we looked ahead to the next rounds of emissions standards, we made a strategic business decision to deliver engines that went beyond the EPA recommendations. Banking of credits is an accepted practice and, in fact, has environmental benefits as it incents companies to exceed the emissions standards currently in place. Because our trucks exceeded emissions requirements, we have built up credits that will allow us to deliver a more practical and user-friendly technology to our customers.
- 3) Using credits is not a new approach. In fact, no medium- or heavy-duty truck engine manufacturer could have met the 2007 standard for NOx without the flexibility inherent in the EPA's credit system.
- 4) Navistar and any other company that collects and uses credits does not get all the credits back (one for one). A percentage of them are held back. In other words, if a company generated 100 credits, they are only able to use 80 of those credits in the future. The balance is that company's contribution to the environment.



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### **3. How do we handle the issue of states like California and Colorado that may require trucks to meet the .2 NOx standard without credits?**

No final decision has been made regarding the ability of states to supersede EPA guidelines. We recognize that this situation could arise and we are working diligently to ensure that the best interests of our customers are represented.

### **4. Other OEMs have told me that SCR will enable improvements in fuel economy. You are telling me that fuel economy will remain the same in your trucks. Isn't this a good reason to choose SCR?**

Fuel consumption is only one part of a truck's total operating cost. In an SCR solution, 2–4 gallons of urea will be required for every 100 gallons of diesel fuel burned. So, even with a several percentage point gain in fuel economy with SCR, we expect our Advanced EGR solution to be competitive.

The price of urea is also of significant concern given the uncertainty of truck stops investing in bulk supply capabilities. Early reports, such as one featured in a recent *Transport Topics*, indicate that a number of truck stop owners have not finalized their plans for selling urea and do not have immediate plans to invest in bulk storage units. Even those that are further along seem to be leaning toward selling urea in containers.

Customers should also see the big picture regarding fuel economy. For example, do other factors such as the aerodynamics of the vehicle provide a significant advantage in fuel economy? Navistar is proud to be a leader in fuel economy performance with trucks like the International ProStar and our MaxxForce engines.

As we move forward, we will be focused on optimizing total fuel economy while minimizing customer impact, and we believe that we will have competitive results with our solution.

### **5. Does MaxxForce Advanced EGR mean your trucks will be priced lower than the competition?**

While we have not yet determined pricing for our 2010-compliant products, we believe that our Advanced EGR solution will be competitive with the SCR solution offered by other OEMs.

### **6. What will be the impact on the residual value of a used truck (SCR vs. EGR)?**

We believe that the demand for used trucks with SCR technology will certainly fall, given these trucks offer higher operating costs and more hassle to the drivers and maintainers.

We expect trucks featuring MaxxForce Advanced EGR will have a much higher residual value. Why? We believe that the solution to reducing emissions in 2010 and beyond lies in EGR technology. We are not alone. European truck manufacturers Scania and MAN are offering EGR-only engines to meet upcoming European emissions requirements.

### **7. What is the expectation on truck delivery times as we get closer to 2010?**

As the 2009 order board begins to fill, we will be in communication with you about delivery of 2010 orders.

### **8. Are you developing a 15-liter MaxxForce? If so, when will it be launched?**

We are developing our own 15-liter MaxxForce engine. Information was shared at the Mid-America Trucking Show in March.



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## 9. Will MaxxForce engines be EPA compliant 1/1/10?

As with all our emissions programs in the past, we intend to file for official certification with the EPA several weeks before the launch of our engines. The time between the filing and the actual launch date allows the EPA to review the information and seek clarifications, which are part of the normal certification process.

## 10. Will Cummins engines with SCR be available in International trucks in 2010? How does Cummins' decision to use SCR impact International trucks?

We have a long-standing relationship with Cummins and look forward to the opportunity to work with them in the future. Navistar has announced its strategy to use Advanced EGR in its products beginning in 2010, while Cummins has changed its original direction and announced its intent to use SCR to meet 2010 EPA emissions requirements. We have announced plans to launch our own Advanced EGR MaxxForce 15-liter engine.

## 11. Is it 100% certain that Navistar will not be using SCR at all?

Yes, Navistar will use MaxxForce Advanced EGR engines exclusively to meet the 2010 emissions requirements.

## 12. Are there any initial cost estimates of the 2010 emissions solutions? Will we have a price advantage with these engines if we are not going to SCR?

While we have not yet determined pricing for our 2010-compliant products, we believe that our Advanced EGR solution will be competitive with the SCR solution offered by other OEMs.

## 13. For those fleets and owner/operators that use biodiesel fuel, will anything with the 2010 in-cylinder with Advanced EGR be affected?

We fully expect that MaxxForce Advanced EGR 2010 technology engines will be compatible with biodiesel blends in compliance with ASTM standards just as today's engines are. Navistar currently has published guidelines for customers to use up to B20 and we are verifying that our 2010 engines will be acceptable within these guidelines.

## 14. What is the technology that permits you to meet the standards, other than increased EGR?

There are two key technologies. The first is high fuel injection pressure capability at low engine speeds to retain fuel economy, performance and emissions with an increase in the rate of EGR. The fuel systems on all MaxxForce engines have this capability. The second is an increase in the EGR rate.

There are four enablers to MaxxForce Advanced EGR:

**Advanced fuel injection technology** – Our next-generation fuel injection systems are capable of delivering a finer mist of fuel into the cylinder multiple times per cycle and at higher pressures.

**Proprietary combustion bowl design** – Our redesigned combustion bowl combines with the higher fuel injection pressure to create a finer mist of fuel spread more evenly in the combustion bowl, resulting in a more complete and cleaner combustion.

**Advanced air management** – Dual two-stage turbochargers combined with an increased EGR rate slows combustion and lowers the temperature, generating less NOx in-cylinder.

**Engine calibration strategies** – Increases in computing power now allow the engine controller to continuously calculate the optimum mix to achieve maximum power and efficiency in many different situations.



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## **15. Will the Advanced EGR gas be filtered? Is the EGR introduced in the clean side of the turbo?**

The exhaust gas recirculation circuit is the same as today's engine and is not filtered. The key is high pressure fuel injection, which ensures complete combustion with minimum soot loading. Particulate matter and NOx emissions reduction is achieved in-cylinder.

## **16. What testing has been done to date with this system, specifically related to the increase in EGR?**

We are in the process of completing validation testing of our engine performance and reliability in lab and in the field. The focus is on providing the end-users with a product that is an industry-leader in all customer attributes like fuel economy, drivability and overall performance. The technologies for our 2010 engines are refinements of known and proven technologies that have been validated in actual customer hands for the past few years. The 2010 engines will have completed 5.5 million miles of field test miles by Job 1 in multiple customer and development vehicles across various applications.

## **17. What will be the size of the urea tanks on trucks?**

Typical competitive urea tanks are expected to be 15–20 gallons for heavy trucks and 10–15 gallons for medium trucks and buses.

## **18. How much does a gallon of urea weigh?**

A mixed solution of 32.5% urea in deionized water is expected for SCR vehicles. It weighs 9.1 pounds per U.S. gallon.

## **19. Are there cold weather issues with SCR? Please explain.**

Urea freezes into a non-usable state at 11° F; however, when it is thawed it is usable. SCR vehicles will require heated and insulated urea tanks and the urea filling station infrastructure will also need heat capability, inside storage and/or heated lines to fuel islands. SCR competitors claim vehicles outside in very cold weather will start and move away even with frozen urea because cold engines do not produce NOx emissions requiring urea reduction. Their claim is an electric heater at the line from the tank will thaw urea quickly enough to provide adequate urea supply as needed. This sounds cumbersome and there are rumors of cold weather issues in Europe, which we are investigating.

## **20. Will Navistar run out of credits?**

Navistar is committed to the path of EGR, now and in the future. By 2012, we will have fine-tuned our engine systems and calibration to meet the standard at the tailpipe without credits or other additional aftertreatment hardware.