

ACERT diesel engines

A huge gamble pays off big time for Caterpillar

Necessity," Plato said, "is the mother of invention." That was certainly the case in 2001 when Caterpillar stunned the diesel engine market by announcing it was abandoning research and development of cooled-exhaust gas recirculation technology in its bid to meet the EPA's 2002 emissions requirements. Almost every other diesel engine manufacturer in the world was touting cooled EGR – a system that recirculates diesel exhaust back into the engine's combustion chamber to reduce oxides of nitrogen (NOx) – as the only viable solution to meeting the stringent government guidelines.

The problem was, from Caterpillar's view, cooled EGR was nothing but a stopgap solution – and one that would never work for the company's bread-and-butter yellow iron machines – when off-highway emissions mandates arrived in 2005 for Tier III "nonroad" engines from 175 to 750 horsepower. Furthermore, Caterpillar felt cooled EGR engines would not deliver performance, fuel economy, reliability or durability levels on par with pre-2003 on-highway diesel engines. Cat engineers thought they could develop an alternate solution, using new technology and refining existing Caterpillar components and systems. Even better, engineers felt this new design would deliver performance in all crucial areas identical to pre-2003 engines.

But the gamble for Caterpillar was huge. To suddenly shift course after more than 20 years studying, investing in and designing alternate technology paths (including cooled-EGR research) created a lot of soul searching and discussion, says John Campbell, director, on-highway engine products. "It was not an easy decision," he says. "To be blunt, we recognized that the future of Caterpillar's very survival – particularly in the on-highway engine business – was hanging in the balance. A wrong decision on our part would have been catastrophic."

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Although its engineers were confident they could make ACERT technology work, Campbell points out that taking such a risky approach would have been impossible without the support of everyone at Caterpillar, from the board of directors all the way to the factory floor. "When we decided what our approach should be," Campbell says, "it was a challenging discussion to sit down with our company and executives, tell them the amount of time we needed and



Caterpillar abandoned cooled EGR research to pursue a different emissions solution in 2002.

the amount of money we were going to have to spend. We knew we couldn't get ACERT developed by the EPA's deadline, and that would cause some controversy in the industry. But once they were convinced we could do it, our executive office supported us 100 percent."

Tana Utley, director of engineering, says Cat simply saw an opportunity where others didn't. "Some companies might have seen the consent decree as a real negative, but we saw it as a big opportunity to get a competitive advantage with our technology investments and extend our leadership position in the engine market. We also saw an opportunity to leverage this technology into

our off-road machines. And we saw it as a big building block for meeting 2007 emissions requirements.

SCHEDULING INVENTIONS ALONG THE WAY

ACERT uses Caterpillar HEUI and MEUI hydraulic and electronic fuel injection systems to provide highly flexible fuel injection options, allowing higher injection pressures at lower engine speeds. Sophisticated computer algorithms identify the optimum settings for the lowest possible NOx emissions, fuel economy and power. Conventional, waingated turbochargers – used in series – are coupled with hydraulic-assist valve control for flexible air management in the engine.

“To make ACERT work, we had to bring four technologies – fuel systems, air systems, electronics and aftertreatment – together as a combustion system in a whole new way,” Campbell explains. “The daunting challenge was we also knew we were going to have to schedule some inventions along the way to make it work. When we were done, Cat ended up with more than 240 patents that we either received or applied for various elements of the system.”

It was hardly a solo effort. Campbell and Utley are speaking for more than 250 Caterpillar engineers, technicians and designers who were involved in ACERT’s development. And that’s not counting scientists, professors and experts from universities and laboratories around the

world consulted as Cat worked to make ACERT diesels a reality.

For Campbell, his proudest moment came the day the EPA issued its emissions-compliant certification for the first ACERT C15 engine. “Others were telling them that ACERT was all smoke and mirrors,” he says. “So they were making sure we didn’t have any ‘defeat devices’ in our systems that would disable the

emission-reducing technology out in the field. But when the EPA certified that we were delivering the emissions levels we said we would, and the level of performance and reliability we’d promised our customers, it was a great day. That was a heck of a moment here in our facility.”

For Utley, her proudest moment was a bit more down to earth. Not long after the new engines had gone out for testing with truck fleets, she went to lunch with some trucking company executives visiting Cat’s engine development center.

About a third of the way through lunch, one of the trucking executives turned to Utley and said, “You know, we have some of your ACERT engines being tested in our fleet right now.”

Utley swallowed hard and thought, *Oh gosh, what’s he going to say?* “I like them a lot,” her guest told her. “They’re running really well. They’ve got the same fuel consumption just like you guys said they would.”

It was, Utley admits, a rather simple compliment. “But,” she says, “I just felt so good when he said that. My heart rate went down, and I just felt so proud of everyone at Cat, because we’d done what we set out to do.”



John Campbell and Tana Utley are just two of more than 250 Caterpillar engineers, technicians and designers who contributed to the 2003 ACERT low-emission diesel engine.

Editor's comments

Climb in the cab of a heavy-duty truck fitted with a Cat C15 ACERT engine, and the first thing you notice is, well, nothing. And that’s the whole point.

Two years ago, no one outside of Cat thought they could do it. It’s rare these days to see a corporation bet the farm, so to speak, and pursue a better, long-term solution. The huge development obstacles faced by Cat designers would stand alone as a great story of technological achievement. But add to that the fact that Cat had the courage to back its engineers in the face of long odds and stiff opposition from competitors and governmental agencies shows why ACERT truly deserves this honor.

– Jack Roberts