

MDEC – ROUNDTABLE FORUM – OCTOBER 8, 2010

**TIER 4 DIESEL ENGINES AND ALTERNATIVE POWER
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Some 14 people from the mines, suppliers, engine manufacturers and OEMs attended.

REVIEW

The pre-conference workshop was held on Oct. 5th and 3 different engine manufacturers delivered papers on their Tier 4 solutions. Darcy Thompson from John Deere spoke of how traps and filters will help Deere achieve Tier 4 compliance. Greg Tremaine from Deutz Corp. spoke on how traps and filters will allow Deutz to reach the Tier 4 emission levels. Andrew Suda from MTU discussed the ammonia strategy that MTU is using for its Tier 4 solutions. The conference also heard some papers from Olli Matikainen on Hybrid Underground Loaders, Bruce Hodgins on High Power Natural Gas Technology and David Willick on Underground Electric Trucks. These 3 papers on alternative technologies were very well received with our group and Olli attended the roundtable proceedings.

The discussion opened up around **hydrogen power**. The U.S. Dept. Of Energy has a CAT hydrogen power machine. And there have been a couple of underground loaders put into use in '03/'04. There was also a hydrogen locomotive tried in a Canadian mine, but not sure what happened to that project. The group agreed that the cost of the hydrogen machines was way too high to justify their use. Hatch had an 80 hp fuel cell that was \$50,000 USD. The safety issue surrounding fuel cells was also raised. The cells themselves might be safe, but what about storing or buying hydrogen, how safe is that aspect?

Natural Gas was mentioned next, and the consensus was NOT for use in gaseous mines, and the metal, non-metal mines have a daily use only policy, which keeps any natural gas tanks from being stored below ground. Once again the danger of this fuel outweighs any advantage this fuel may provide to the mines.

Biodiesel is a buzz word of the decade, and had its own section during the workshop. The only comments were the diesel engines need to be optimized to run on bio-diesel. Nothing higher than B10 was out there today, but B20 and higher was coming soon.

Synthetic fuel was touched on, Methanol is being produced, but no mines were using it today. And other synthetic derivatives were available, but all still to new or unknown for any mine to attempt to use.

Electric Trucks was a good discussion, with 3 trucks under test at Holdbrook Gold. The main ramps are good, but these trucks require smooth roads to run on. No bouncing over rough roads, the sensitive electronic equipment cannot stand the rough ride. This condition leads to one of the 3 trucks always in the shop for repairs. The original unit had a battery back-up power in case of electronic failure, but now they use a small diesel engine as backup power. There is also some sparking from the overhead pantograph connection in this system. This may cause some concern in areas with explosive items.

Battery systems were seen as too weak, not enough power to do the underground job. Until batteries can be developed to deliver the power required to move 60 tons, then most applications are just people movers. Also, a safety point was raised...can a rescue operator use certain equipment, ie. the jaws-of-life, to cut someone out of a battery powered machine without causing injury to themselves? Interesting question.

Hybrids garnered a good deal of discussion. MTI sees regulation problems with hybrids. Is it diesel or is it not. Braking systems also need to be adjusted with these new machines. Batteries are moving from nickel metal to lithium ion and the power is increasing. The overall cost seems higher, but the benefit is near-zero emissions.

Diesel engines with urea underground are already in place, and the mines seem ready to accept another liquid at the filling station. Urea or ammonia will be brought below for the new equipment. The big issue is the high NO₂ levels underground with the new T4i engines coming next year. This slip will be solved with better traps and filters for T4 final, but engines in the 75-750 hp range will be difficult to reach underground emission levels. Each machine will require a filter that matches exactly its application. Some companies are stocking older engines for replacement instead of using any of the interim engines. Also, Mercedes Benz is discontinuing its engine line-up by 2015, with MTU taking over building its industrial engines by then.

Engines are being purchased in advance of the coming regulations. Blocks of discontinued engines are becoming rare and hoarding has begun. Many customers are looking at regulations that can help them through interim Tier 4 levels. Flex rules allow OEMS to build up to 700 machines over 7 years with older engines. By taking advantage of the flex rules, some companies might be able to skip the interim emission levels altogether. The military and mines are exempt from EPA rules. This may assist with the regulation that insists on the destruction of old blocks in a replacement engine situation. That block may still be of some use underground. The average age of the equipment underground in some mines is 22 years.

Ventilation on demand was a topic at the conference and is happening now in some mines. Monitoring is becoming much more advanced and is allowing this strategy to become more acceptable.

Natural gas is cheaper than biodiesel. Biodiesel is very expensive in Australia. Shell is now building a huge fuel conversion plant in the Gulf region to use the Fischer-Trach biofuel from natural gas. This fuel is better than biodiesel as it is a much more defined fuel. This may well be the fuel of the future.

J.P. Ouellette
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