

Introduction event Tembo 4x4 e-LV electrical Landcruiser at FD 4x4 Centre

Imagine a light vehicle for the mining industry. Ready for the toughest conditions, with power and reliability to get the job done and worry-free maintenance? Most probably you have the classic Toyota Land Cruiser HZJ on your mind. These workhorses have what it takes, with only one problem: the emissions from the diesel engine. As of the 22nd of June 2016 this is no longer a problem. In the workshop of FD 4x4 Centre in Bergeijk, the Netherlands we presented the worlds' first Tembo 4x4 e-LV Electric Land Cruiser for mining and industry.

Guests from all over the world came to Bergeijk for the presentation of the first Electric Land Cruiser created for use in the industry. Mining companies from Ireland, Germany and representatives from Canada and Australia had a chance to have a close look at the vehicle, speak with the engineers and to drive this first model themselves. To allow for a full insight into the project all engineers and everyone involved was present.

Electric Light Vehicle for mining:

Frank Daams, FD 4x4 Centre 'Last year this project started when Boliden told me about the issues they face with the emissions and ventilation in the Tara mines,' says Frank Daams of FD 4x4 Centre in his opening speech. 'Like any employer, they want to guarantee a safe

and healthy workplace for their workforce and the emissions from the trusty 4.2 diesel engine had become a problem.'

Thinking about a solution Frank found out about the first prototype of an electrical Land Cruiser. 'Immediately I knew this was the solution, but it needed a high quality conversion suitable for the toughest conditions.' Frank brought a team of engineers together to work on the project.

FD 4x4 Centre decided to build a second car under the Tembo 4x4 brand. 'We took the requirements of the mining industry as a starting point. Our goal was to improve on the reliability of the Toyota and create a new vehicle that is capable of working harder with less wear and tear on the drivetrain, lower maintenance costs and less downtime - basically to build the ideal workhorse for the mining industry.'

'The strength of the Toyota is its simplicity,' We replaced the engine and gearbox with an electric motor, bringing the number of parts down considerably. Bolted directly to the transferbox together with the inverter and charger, the motor gets its power from a 37 KWH battery pack under the bonnet. The total package is no less than 200 kg lighter than the original engine.

During the presentation the Tembo 4x4 e-LV Electric Toyota Land Cruiser is driven onto a ramp in the workshop lifted into the air for a look at the engine. Quickly everyone scrambles under the car, curious to see the changes that have been made. Representatives of mining companies from all over the world came to see this: a Toyota Chassis

with a German engineered electrical motor, ready to take on the toughest conditions.

‘All parts come from series production by large manufacturers and are used in large numbers in the automotive industry, The engine and the electronics are waterproof and dust resistant, and an upgraded version of the one used in the Audi eTron models. Cooling for the high voltage electrical parts comes from a heat exchanger that also cools or heats the cabin of the car. Theoretically it should be able to operate under water.’

‘We put a lot of effort into making maintenance as easy as possible,’
‘If you ever have to replace the it, the engine and transferbox can be removed together. Undo six bolts on the chassis, both driveshafts and several connectors - that is it. In less than an hour you can mount a new engine and send the vehicle back to work!’

The expected range is 150 kilometer on road and up to 80 kilometers offroad. The car can reach 150 kmh, keep a speed of 35kmh even on 15% gradients and all parameters of the engine can be controlled for safety, battery life or other purposes. For instance it is easy to limit the maximum speed on a level road and to allow more torque on steep climbs. Charging time can be as fast as 15-20 minutes for a full charge, depending on the equipment.

Response from the audience

‘This is the way forward,’ Mike Pedue of Ausco Products says. ‘All the mines have to deal with emissions regulation. As they become deeper ventilation becomes more of an issue, accounting for 1/4 to 1/3 of the total cost of the mine. It limits your productivity.’

When you've reached the maximum of your ventilation you can only send a car in as soon as one comes out.' With a lot of the heavy equipment already converted the Tembo 4x4 e-LV Electric Land Cruiser will be well received, he says. 'It's the right product at the right time!'

Smooth vehicle

Driving an electric car is a different experience, with little sound and no fumes. 'Incredible, this car is so smooth!' says Peter Budesheim of K+S GmbH after he returns from the first testdrive. 'The power is so nicely regulated, with this you will never break an axle!' He has already made up his mind about the concept. 'We visited during the development process and have bought the first car to come after this one, a short wheelbase model. We are here to see the final product and drive it, and so far we are impressed with the results.'

Better working conditions

Lars Rickfelder, responsible for procurement and maintenance within K+S GmbH shares his thoughts after a testdrive: 'Driving this car is nice, but more important are the results on the workplace. The amount of nitrogen dioxide needs to go down, we want the working environment to be as clean as possible.' At 8 different sites, K+S has at least 1000 vehicles in duty. They will be replaced in the forthcoming years. 'We are standardising our equipment as much as possible, to benefit from the economy of scale and to be in control of our maintenance costs. As part of that operation we try to become a completely emissions free mining company.'

Solution for charging

‘After today it is clear that we need to think about a complete solution for charging,’ Peter Budesheim explains. ‘Imagine 200 cars coming back after a shift, and you have 1 hour to charge their 37 kWh batteries. It requires proper infrastructure, we have to think about the energy supply inside the mines, where to charge at which voltage.. For ten cars you would not make big changes, but bigger numbers make such investments more sensible.’

Easy to drive

‘This will work, you can feel the power behind it!’ Steve Hein from Acces Industrial in Canada is surprised by the effect the electric motor has on the Land Cruiser. ‘Canada has a lot of mining and this is a highly regulated field. Having such electrical vehicles is a plus for the workers. The power is easy to manage, especially offroad it will be an easy drive. The dashboard is excellent, with all the information you need in one clear display, and it has all the options for fleet management and maintenance that you need.’ Acces Industrial will offer the Tembo 4x4 e-LV Electric Land Cruiser in Canada, both as a complete vehicle and as an upgrade to the existing fleet.

Low maintenance costs

‘In Australia, this is the way to go,’ Travis Seeley, general manager of Autoline and Mammoth sees a bright future. ‘It is not only regulation that plays a big role, it is the impact of ventilation as well. We sell exhaust systems and parts for the Toyota Land Cruiser and we see our customers struggle with the need for breathable air in underground mining. Also with the lower number of parts we expect the maintenance costs to go down considerably.’ For the Australian market it is a very interesting vehicle and Travis is proud to be part of

this new project, offering the Tembo 4x4 e-LV Electric Toyota Land Cruiser to the Australian market.

Meeting the standards

‘It’s like freewheeling down a hill!’ says John Corren from New Boliden Tara Mine with a big smile on the face. He is impressed by the vehicle and proud to be part of its conception. ‘Emissions is a big thing in our mine, we need a solution like this. At the moment we check all equipment for the emissions and it becomes more and more difficult for us to meet the standards we would like to have in the mine.’

Enthusiastic about the drive, soon the practical questions surface. ‘We are very curious to see how this car will work in the Tara Mines,’ says Martin Bowden, responsible for the machinery in the New Boliden Tara Mine. ‘The conditions are very hostile. Basically you are driving on bare rock, through mud and water. Corrosion is a big problem, the water gets everywhere. With long climbs up to 17% it will put some strain on the battery as well. I want to see it work!’ The Tembo 4x4 e-LV Electrical Land Cruiser will get its introduction at New Boliden Tara Mine soon.

Ready for production

Frank Daams from FD 4x4 Centre explains the next steps: ‘With the prototype ready we can do the finetuning, to get the best results from the engine and battery together with the feedback from the first customers. Also the preparation for the first production run starts, as the first Tembo 4x4 e-LV Electric Land Cruisers have been sold!’