INNOVATIVE TRANSPORT AND ENERGY SOLUTIONS IN EAST AFRICA

Providing tailored and cost-effective energy solutions for carbon footprint reduction.

INTRODUCING: ELECTRIC OFF-ROAD VEHICLES
The transport sector is one of the largest global emitters of CO2, SOx and NOx, contributing not only to global warming, but also pollution and groundwater acidification, which have hazardous effects on the local wildlife and plant vegetation. What if the high cost of both fuel and environmental degradation could be eliminated in a resource- and cost-effective way by introducing green vehicles, without long development time or unrealistic demand of investments? What if changes could be made to existing vehicles, eliminating emissions and fuel costs, making them fully sustainable? Opibus is proud to announce our conversion technology that enables diesel/petrol off-road vehicles to be converted to full electric drive, while maintaining (and even improving) performance and reliability.

SMART AND INTEGRATED SOLAR ENERGY SYSTEMS USING THE LATEST LITHIUM TECHNOLOGY
East Africa has an unlimited potential of thriving on energy from the sun, increasing energy availability and independence while at the same time reducing carbon footprint. Sadly, out-dated components and systems are repressing the sustainable development, efficiency and spreading of solar power in East Africa, and it’s time to do something about it. Opibus offers smart and integrated solar energy systems for off-grid applications in the tourism- and telecommunication industry. With the latest lithium storage technology and control systems we can provide customers with a cost-effective, reliable and sustainable solution that can be tailored to fit any application.

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OPIBUS MEANS RESOURCES IN LATIN

WE WANT TO MAKE GREEN TECHNOLOGY ACCESSIBLE
We at Opibus have the vision to initiate an acceleration of sustainable energy- and transport development in East Africa by introducing the latest technology, previously unavailable due to lack of knowledge and investment. This by offering a tailored full suit package for our customers’ energy needs, including converting their fossil driven vehicles to electric, installing charging infrastructure and providing high technology off-grid energy storage/generation systems to reduce carbon footprint. Transitioning away fossil fuel in vehicles and energy generation will not only result in health and environmental benefits but also economical. Fuel prices have surged during the last 30 years and will continue to do so, progressively increasing costs for transport and energy. With the Opibus solution, customers can connect to an off-grid solar system and utilize electricity both for their energy usage and vehicles, resulting in immense savings. Cost-effectiveness is one of our foundations since it allows technology and development to spread and be accepted faster, amplifying the change we are aiming to accomplish.

Opibus is a registered Kenyan Limited company, with full operational certification. The technology originates from several years of extensive research and development in Sweden together with European developers and suppliers.

MEET THE OPIBUS TEAM

WE ARE CONSTANTLY GROWING
To date, our organization consists of 20 persons, whereas 14 are electrical and mechanical engineers (M.Sc and B.Sc) fully devoted to conversions and technology development. The company facility is based in Nairobi, off Mombasa Road.

A majority of the current directors have previous experience and background from the electric vehicle industry as well as East Africa. Consequently, Opibus has an extensive network in the region spreading to Europe and Asia, with both contacts and suppliers in the electric vehicle- and renewable energy industry.

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ELECTRIC OFF-ROAD VEHICLES

Our conversion process turns fossil fuel driven vehicles into electric vehicles.

THE CONVERSION PROCESS STEP BY STEP

The conversion process turns traditional ICE vehicles into electric vehicles by exchanging the drive train. Components in the existing drive train such as the combustion engine and fuel tanks are removed to make room for an electric motor, batteries and power electronics. The system is designed to retain the performance and functions of the previous ICE engine as well as weight properties to ensure that the vehicle operates and behaves as normal or superior to before the conversion. The full conversion is done in approximately one week.

STEP 1 - Choose suitable vehicles

Suitable vehicles are chosen from the customers fleet. The condition of the vehicles can range from factory new to having faulty engines and gearboxes since these components will be changed anyway. At the moment we focus on Land Cruiser model HZJ 79 and Land Rover Defender 90/110, both regular and extended for safari use.

STEP 2 - Conversion process begins

When the vehicles arrive at our workshop they are thoroughly cleaned and inspected to ensure that original functionalities have been matched after the conversion is completed. The process takes approximately one week per vehicle with extra time for optional refurbishment and extension of the chassis for safari use.

STEP 3 - Disassembly and installation

Engine, fuel tanks and other combustion related components are removed to give room for mounting of the new electric motor, batteries and power electronics. Functionalities such as power steering, 4WD and driving in shallow water are retained.

STEP 4 - Testing and inspection

The electric conversion is performed according to international standards and Kenyan law, going through both extensive testing and quality control from our side, but also government inspections before approval.

STEP 5 - Connecting to energy system

The dimensioned and tailored solar energy system provided by Opibus, or the customers existing one, is connected to smart charging stations providing electricity to the vehicles in accordance with the demand and supply of the system. Several charging solutions can be chosen from to fit all customers’ need.

STEP 6 - Start using your new EV!

Now you’ve successfully introduced electric vehicles to your business with the advantages of clean power, increased performance, lower running costs and silent operation! With our service agreement you can have 24/7 support and dedicated mechanics in your area to limit your downtime to a minimum if something happens.

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8 ADVANTAGES WITH CONVERTING TO ELECTRIC

Exchanging the drive train and converting vehicles to electric comes with a lot of advantages, where the common denominator for these being fossil fuel independency. Fuel is associated with high cost, air pollution and carbon emissions which all could be avoided by using an alternative power source. Electricity has high energy quality and can easily be generated from several energy sources where solar power is one of the most popular ones in East Africa.

Eco-friendly with Zero Emissions

The fully electric vehicle has no exhaust pipe, and does not emit any hazardous gases or substances to the passengers or surrounding ecosystems. All components are chosen for their low environmental impact and quality, whereas for example the electric motor is made with industrial precision, and is proven to have the lowest social and environmental impact possible.

Silent and Smooth

The electric motor is nearly silent in operation, which means driving becomes a whole new and quiet experience that minimizes disturbance on wildlife and ecosystems. In the safari tourism, guests can enjoy the raw nature without a rumbling engine, and for park-rangers and surveillance purposes, this can be optimal when for example chasing poachers.

Reliable and Safe

The electric motor has only one moving part, in comparison to the combustion engine that consists of thousands. This means the risk of something breaking down is reduced significantly. Owing to removal of the gearbox, costly maintenance and break-down risks are also avoided. Opibus electric conversions have full compliance with international safety- and policy standards for electric vehicles.

Reducing Running Costs

In almost all cases, fuel is the largest cost for operating a vehicle where maintenance is a close second. An electric vehicle uses no fuel and its components do not require any regular maintenance, which reflects savings of more than 80% per year in comparison to using a vehicle with an ICE engine. Depending on driving distances and maintenance needs for the original fossil fueled vehicle, this corresponds to savings up to $8000 per year.

Increased Performance

Using an electric motor gives the advantage of having constant peak torque right at the tip of the pedal, starting from 0 RPM. This means the driver has full force of the motor at disposal already from stationary, whereas a traditional combustion engine delivers peak torque at around 2500 RPM. The total efficiency of the electrical motor is 94-96%, in comparison to around 20-30% for a combustion engine.

Interchangeable Between Vehicles

The whole system is designed to be modular with high adaptability, allowing for upgrades such as adding battery capacity after the conversion is done. With the design of the system in mind it is even possible to move the whole drivetrain, including batteries and power electronics to a new vehicle. Our technology makes it possible to invest, not only in one vehicle, but a drivetrain that lasts through several chassis.

Lifespan

The electric system and motor has a lifespan longer than the chassis itself, where the only limiting factor is the battery packs. These can still handle thousands of recharging cycles, making them deemed to last more than 200 000 km.

River Crossings

Components in the electric drive train are mounted in water proof boxes, allowing for the same water submersibility as the original model. A converted off-road vehicle will therefore still be able to do river crossings.
THE COMPLETE OPIBUS SOLUTION
A full suit package covering everything from sun to electric drive.

BUSINESS MODEL
Opibus offers a complete and tailored solution for electric off road transport, suitable for customers aiming for sustainability, high performance and cost reduction. Our concept ensures long term operation and satisfaction through a business model including three parts.

- **Electric Conversions**
  Off road vehicle conversions of Toyota LandCruiser HZJ79 and Land Rover Defender 90/110, regular or extended.

- **PV/Storage Systems**
  Installation of smart and integrated solar energy systems, tailored for your facility and electric off road vehicles.

- **Service and Support**
  Service agreements on all products to ensure minimum operational downtime and support if anything happens.

**CHARGING**
The vehicles can be charged from any regular power outlet (3 kW), or with our charging station up to 35 kW. The conversion follow international standards and will be compatible with all future charging stations in East Africa.

**FLEET MANAGEMENT**
Optional to equip our integrated and smart communication unit to remotely monitor vehicle data, performance and position in real-time. Easing fleet management by tracking driver’s behaviour and energy usage.

**SMART AND INTEGRATED**
Integrated and complete energy systems for expansion of existing ones or use for our electric off-grid vehicles. The system can be implemented partially if requested, and programmed to fit the customer’s schedule for energy use.

**ADAPTABLE**
Modular and tailored conversion compatible with different components (see Appendix 1.2). Possible to perform upgrades such as increasing battery size, mounting solar panels on hood or installing small portable diesel generator for extending range.

**LATEST BATTERY TECHNOLOGY**
Storage systems using lithium ion phosphate (LiFePO4) batteries instead of lead acid batteries have 5 times longer lifespan and 4 times more energy density, making them both cost- and space-effective in comparison. Fully customizable voltage output and storage capacity. Designed to be non-flammable and reliable.

**ASSISTANCE**
Real-time health status of the drive train allows for our mechanics to proactively schedule maintenance, or assist remotely in case of minor problems occur. Otherwise dedicated mechanics will be able to help on location.

**WARRANTY AND SPARES**
Components in the drive train are eligible for manufacturers’ warranty within normal usage, and Opibus warrants 24 months on the workmanship. Spare parts will be supplied through our workshop in Nairobi. Repairs are also possible.

**SAFETY STANDARDS**
Opibus conversions are fully compliant with Kenyan law and regulations, accepted by both NTSA and KEBS. Inspections, logbook entries and speed governor will be handled through NTSA.

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# APPENDIX 1 - CONVERSION SPECS

Specification sheet for electric off-grid vehicles.

<table>
<thead>
<tr>
<th><strong>BATTERY SIZES AND TYPE:</strong></th>
<th>From 30 kWh / LiFePO4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MOTOR:</strong></td>
<td>100 kW / 180 kW</td>
</tr>
<tr>
<td><strong>GEARBOX:</strong></td>
<td>The 5-speed gearbox is removed and the 4WD transfer case transmission with high/low gear is kept.</td>
</tr>
<tr>
<td><strong>TORQUE (HIGH/LOW):</strong></td>
<td>1128 / 2582 Nm (torque on wheels).</td>
</tr>
<tr>
<td><strong>TOP SPEED:</strong></td>
<td>Electronically limited to the country's laws of speed. Unlimited top speed is otherwise &gt;120 km/h.</td>
</tr>
<tr>
<td><strong>RANGE (UP TO):</strong></td>
<td>Range depends on battery size, vehicle weight, terrain and driving style. Reference from 70 km/h on asphalt road with a weight of 2.7 tons.</td>
</tr>
<tr>
<td></td>
<td>30 kWh - 140 km</td>
</tr>
<tr>
<td></td>
<td>50 kWh - 245 km</td>
</tr>
<tr>
<td></td>
<td>70 kWh - 350 km</td>
</tr>
<tr>
<td><strong>BRAKING:</strong></td>
<td>Regenerative motor braking using brake pedal sensor. Secondary emergency using hydraulic or vacuum disk brakes. Power braking retained with electric vacuum pump.</td>
</tr>
<tr>
<td><strong>WATERPROOF DESIGN:</strong></td>
<td>Power electronic and batteries are mounted in a waterproof casing so that river crossings can be performed.</td>
</tr>
<tr>
<td><strong>POWER STEERING:</strong></td>
<td>Power steering is retained with electric motor assistance.</td>
</tr>
<tr>
<td><strong>CHARGING STATION:</strong></td>
<td>10 kW - 35 kW. Charge from any outlet or international standard station (single-phase ac/three-phase ac/dc).</td>
</tr>
<tr>
<td><strong>USER INTERFACE:</strong></td>
<td>The gauges in the dashboard are adjusted to show parameters for the electric propulsion.</td>
</tr>
<tr>
<td></td>
<td>Optional 7&quot; touchscreen in center console to see all vital electric vehicle data, control charging and use maps. Through the touchscreen you can choose different driving modes, such as eco/normal/sport.</td>
</tr>
</tbody>
</table>

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APPENDIX 2 - ANNUAL SAVINGS

Annual savings using an electric off-road vehicle compared to a conventional vehicle.

SAVINGS DEPEND ON SEVERAL ASPECTS
The savings depend on several aspects, and need to be individually calculated for different types of vehicle usage. The model below gives a brief understanding of the potential savings, assumed for a vehicle driving intermediate distances. The longer the driving distance, the larger the savings.

<table>
<thead>
<tr>
<th>DRIVING DISTANCE</th>
<th>40 000 km/year (109 km/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIESEL PRICE</td>
<td>$0.98 / L</td>
</tr>
<tr>
<td>DIESEL CONSUMPTION</td>
<td>1.7 L / 10 km</td>
</tr>
<tr>
<td>TOTAL DIESEL PRICE</td>
<td>$1.67 / 10 km</td>
</tr>
<tr>
<td>ELECTRICITY PRICE</td>
<td>$0.18 / kWh</td>
</tr>
<tr>
<td>ELECTRICITY CONSUMPTION</td>
<td>2.2 kWh / 10 km</td>
</tr>
<tr>
<td>TOTAL ELECTRICITY PRICE</td>
<td>$0.4 / 10 km</td>
</tr>
<tr>
<td>ANNUAL COST FOR DIESEL</td>
<td>$6 680</td>
</tr>
<tr>
<td>ANNUAL COST FOR ELECTRICITY</td>
<td>$1 600</td>
</tr>
<tr>
<td>YEARLY DIFFERENCE IN FUEL COST</td>
<td>$5 080</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SERVICE INTERVAL</th>
<th>5000 km</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVERAGE COST PER SERVICE</td>
<td>$250</td>
</tr>
<tr>
<td>ANNUAL SERVICE COST</td>
<td>$2 000</td>
</tr>
</tbody>
</table>

| ANNUAL OPERATIONAL COSTS DIESEL | $8 680  ($6 680 + $2 000) |
| ANNUAL OPERATIONAL COSTS ELECT. | $1 600                      |
| ANNUAL SAVINGS WITH CONVERSION | $7 080                      |

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