WRI INDIA — ROSS CENTER

SHAKTI SUSTAINABLE ENERGY FOUNDATION

ELECTRIC MOBILITY FORUM

ENGAGE
Connecting Big Ideas To Action

Cell Propulsion

Retrofitted EVs: Status, Potential & Challenges

About Us

- Mobility technology company developing powertrain components, integrated electric powertrains for electric commercial vehicles (LCVs, HCVs, etc) & 4W, and connectivity modules for vehicle IoT.
- 30 member engineering team working out of a leased 20,000 sq ft facility located at Bommasandra, Bangalore.
- Commercialized BMS, Motor Drives, Chargers, and Connectivity modules for low voltage (48V - 96V) light electric vehicles.
- Scaling up our offerings for high voltage, high power (600V, 100kW) heavy commercial vehicles.

The Core Team

Nakul Kukar

Co-founder & CEO;
7 years experience @ISRO with vehicle engines and electric aircrafts.

Paras Kaushal

Co-founder & COO;
6 years experience @ISRO with engine ignition systems, Thermal & energy storage systems

Supratim Naskar

CTO;
7 years experience @ISRO with Launch Vehicle Structures, Spacecraft Mechanisms & Space Robotics

Status of EV retrofit market in India

- EV Retrofit supplementary to new EV production.
- Highly nascent with lots of policy ambiguity at both national and state level.
- Lower barrier to entry compared to new vehicle production due to clarity on technology landscape and certification requirements.
- Addressable Market potential of more than 100 billion USD for conversion of HCVs to electric.

Major Problems addressed by EV Conversion Technology

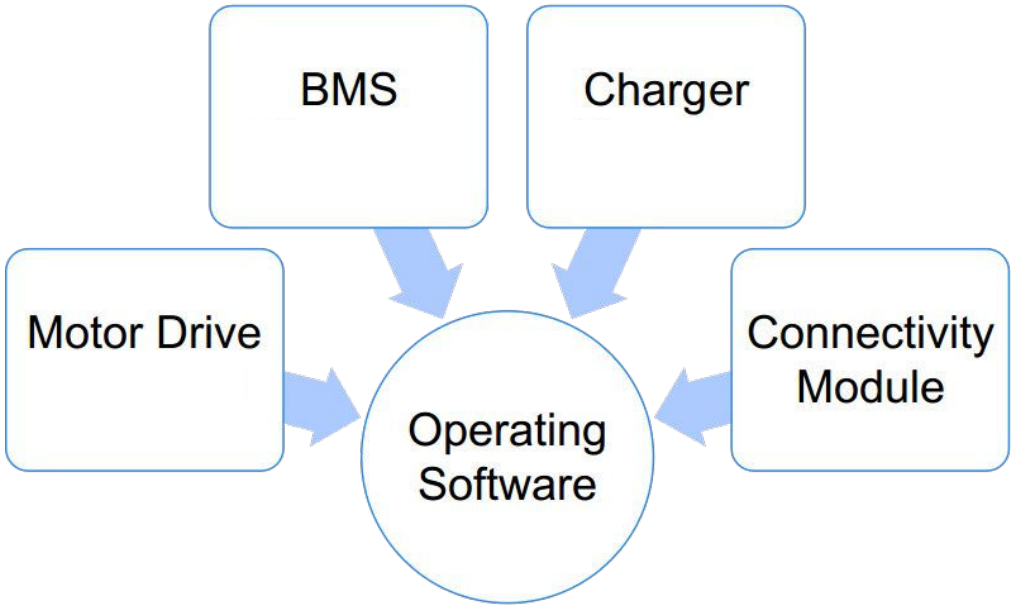
- Lack of ***indigenous technology*** for developing EV components adapted for Indian (tropical) climate conditions
- Low availability of ***customized*** EV components at required voltages, power ratings, and price
- Expensive ***pricing*** of new EVs.
- Lack of ***awareness*** among customers about EVs leading to lack of commitment to transition to fully electric fleets.

Case Example

Cell Propulsion is developing powertrain components for electric commercial vehicles

- Elements of a Powertrain:
  - **Hardware:** Electric motors, motor drives circuit board, battery packs, BMS circuit board, Charger Circuit board, Connectivity Module
  - **Software:** Motor Controller firmware, BMS Firmware, Charger firmware, Connectivity software stack, and Operating software layer.

- The operating software integrates all the individual components into an intelligent system called powertrain which drives the vehicles and delivers required performance.



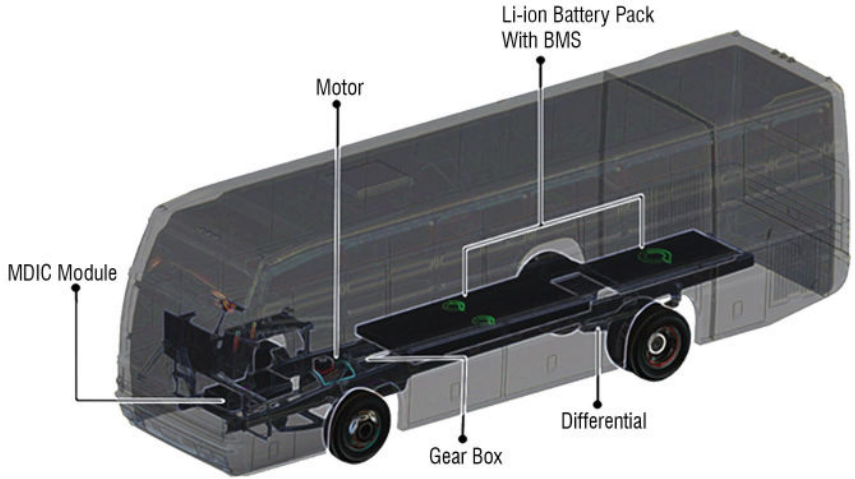
Technical & economic viability of EV retrofitting in India

- AIS-123 and our products described above give us ample confidence on the technical feasibility of converting vehicles to electric.
- Efforts required to make this commercially viable.
- Need to devise unique business models to drive adoption for EV retrofitting - Revitalization of classic cars, creation of a “pre-owned EV” market/platform, etc.
- Lack of subsidy under FAME-2 for EV retrofitting a major deterrent to achieve cost parity with new ICE Vehicles.

Our Solution

Cell Propulsion is developing integrated powertrains for retrofitting of electric buses.

e-Bus (12m, 16ton) Powertrain Specifications	
Nominal Power	150 kW (750Nm @1900rpm)
Peak Power	200 kW
Operating Voltage	500V - 600V
Battery Capacity and Range	125kW-hr for 150km 200kW-hr for 200km 250kW-hr for 250km
Battery Cycle Life	5000 at 0.8C max Charge and 1C max Discharge
Top Speed	80 km/hr



Potential & challenges in retrofitting of Buses

- Number of buses on Indian roads to increase from current 1.5million to 3million by 2030.
- Over next 3-4 decades, all of these have to be replaced/ upgraded to electric.
- Only a mix of new eBuses supplemented by retrofitted Buses can meet this demand.
- Local production/supply chain of cells, advanced electric motors, and cost are the major challenges for large scale conversion of Buses to electric.
- In long term, major technological improvements are also required to enable electrification of long distance inter-city buses.

Thank You