





Mahindra-Swaraj (Mohali)	Preet Agro, Nabha (Patiala)	SML-ISUZU (Ropar)	Indofarm (Baddi, H.P)	Sonalika Tractors, (Hoshiarpur)
Team Visited				
<ol style="list-style-type: none"> 1. Prof. R M Beloker (PEC) 2. Dr. Sarbjeet Singh (PEC) 3. Prof. S K Mangal (PEC) 4. Er. S K Soni (PEC) 5. Dr. Sanjeev Soni, Sr. Principal Scientist (CSIO) 6. Er. Narinder Singh, Principal Scientist & Principal ISTC (CSIO) 7. Er. Ashish Gaurav, Principal Scientist (CSIO) 8. Er. Ankush Gawri, Sr Manager, TEC (Panjab University) 9. Dr. Gurpreet Singh, Manager, TEC (Panjab University) 10. Prof. Navin Kumar, Dean R&D (IIT Ropar) 11. Prof. Manu Sharma (Panjab University) 12. Prof. H K Sardana (previously with CSIO) 13. Dr. Shankar Sehgal (Panjab University) 14. Dr. Parveen Goyal (Panjab University) 	<ol style="list-style-type: none"> 1. Prof. R M Beloker (PEC) 2. Dr. Sandeep Salodkar (PEC) 3. Er. Tejinder Singh Saggu (PEC) 4. Dr. Sanjeev Soni, Sr. Principal Scientist (CSIO) 5. Er. Narinder Singh, Principal Scientist & Principal ISTC (CSIO) 6. Sh. Ashish Gaurav, Principal Scientist (CSIO) 7. Er. Ankush Gawri, Sr Manager, TEC (Panjab University) 8. Prof. Navin Kumar, Dean R&D (IIT Ropar) 9. Prof. Manu Sharma (Panjab University) 	<ol style="list-style-type: none"> 1. Prof. R M Beloker (PEC) 2. Er. Sanjeev Gupta (PEC) 3. Prof. N M Suri (PEC) 4. Dr. Sanjeev Soni, Sr. Principal Scientist (CSIO) 5. Er. Narinder Singh, Principal Scientist & Principal ISTC (CSIO) 6. Er. Ashish Gaurav, Principal Scientist (CSIO) 7. Er. Ankush Gawri, Sr Manager, TEC (Panjab University) 8. Dr. Gurpreet Singh, Manager, TEC (Panjab University) 9. Prof. Navin Kumar, Dean R&D (IIT Ropar) 10. Prof. Manu Sharma (Panjab University) 	<ol style="list-style-type: none"> 1. Prof. R M Beloker (PEC) 2. Prof. S Selodkar (PEC) 3. Dr Ankit Yadav (PEC) 4. Dr. Sanjeev Soni, Sr. Principal Scientist (CSIO) 5. Er. Narinder Singh, Principal Scientist & Principal ISTC (CSIO) 6. Er. Ashish Gaurav, Principal Scientist (CSIO) 7. Er. Ankush Gawri, Sr Manager, TEC (Panjab University) 8. Dr. Gurpreet Singh, Manager, TEC (Panjab University) 9. Prof. Navin Kumar, Dean R&D (IIT Ropar) 10. Prof. Manu Sharma (Panjab University) 11. Prof. H K Sardana 	<ol style="list-style-type: none"> 1. Prof. R M Beloker (PEC) 2. Prof. S Selodkar (PEC) 3. Er. S K Soni (PEC) 4. Dr. T S Saggu (PEC) 5. Prof. Navin Kumar, Dean R&D (IIT Ropar) 6. Prof. Manu Sharma (Panjab University) 7. Prof. H K Sardana (Previously with CSIO)
				

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R&D infrastructure presently existing				
<ol style="list-style-type: none"> 1. Steady state test bed 2. Transient test bed 3. Vibration shaker 4. Fatigue testing setups 5. Climate chambers 6. Transmission test bed 7. 17 skoftwares like team center, NX ideas, Hyperworks, LMS virtual lab, creo, Magna, Ansys, GT suite, Romax, LS-Dyna, LM scada, Kisoft, Autodesk 	<ol style="list-style-type: none"> 1. Eddy current based dynamometer 2. Smoke meter 3. Fuel consumption meter, 4. 5 gas analyzer 5. blow-by meter 6. Transmission test rig (instrumented with vibration sensor, noise sensor, rpm sensor) 	<ol style="list-style-type: none"> 1. 2 nos. of 330 kW Transient test bed with BS6 emission analyzers (NABL accredited). 2. 2 nos. of 240 kW Eddy current based dynamometer test bed. 	<ol style="list-style-type: none"> 1. 3D modeling softwares 2. Prototype development shop 3. Noise meter 4. Coordinate Measuring Machine (CMM) 5. Engine testing rig 	<ol style="list-style-type: none"> 1.3D modeling softwares 2. Analysis softwares like Nastran, Siemens NX, Romex etc. 3. Prototype development shop 4. Static Engine test-bed (performance and emission) 5. Vibration shaker (Saraswati dynamics) 6. Fatigue testing rig
R&D being presently done				
<ol style="list-style-type: none"> 1. ECU calibration 2. Engine upgradation for Trem 5 3. Related to Electrical Tractor 4. NVH 5. Fatigue 	<p>Engineers of company in association with FEV are calibrating their engines (ECU optimization)</p>	<ol style="list-style-type: none"> 1. BS6 Diesel IOBD 2 2. BS6 CNG IOBD 2 3. Hydraulic Brake ESC (Electronic stability control) 4. Air Brake ESC (Electronic stability control) 5. Endurance braking system (Retarder system) 6. FAPS (Fire alarm and protection system) 	<ol style="list-style-type: none"> 1. Compliance to BS Trem IV regulation 2. New smaller tractors (15 HP) 	<ol style="list-style-type: none"> 1. Electrical tractor with 17 KW 3-phase motor 2. ECU calibration 3. NVH 4. Biodiesel testing with blending

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R&D manpower currently engaged				
About 100 engineers (15 with PG degrees, 2 with PhD)	Around 10 people in R&D with B.Tech/B.E qualification	About 70 B.Tech engineers spread over various subgroups to manage the ongoing production and compliance/ regulatory activities. Some are M.Tech engineers. About 4-5 engineers are doing PhD from IIT Ropar.	25 Engineers. 4-5 M.Tech Engineers	712 B.E/B.Tech engineers, 10 M.Tech/M.E, 1 PhD
R&D work presently being outsourced				
<ol style="list-style-type: none"> 1. Battery Management System (to Curtis) 2. Related to Electrical Vehicle 3. Engine of small tractor 	<ol style="list-style-type: none"> 1. Engine calibration for power and emissions 2. Engine of 25 HP tractor is being imported 3. Projects being done with iCATS, ARAI, FEV etc 4. R&D work worth Rs 7 Crores/annum is outsourced 	<ol style="list-style-type: none"> 1. Mainly Engine calibration and tuning, Exhaust gas treatment module etc to Bosch. 	<ol style="list-style-type: none"> 1. FEA related 2. CFD related 3. Simulations, load analysis (dynamic/static) 4. Transmission analysis 5. Engine upgradation to meet emission norms (crores/engine) 6. ECU calibration 	<ol style="list-style-type: none"> 1. Failure analysis to Magna 2. Electrical tractor to Tata-Elxi 3. Cost saving to Accenture 4. Engine related issues to FEV, Ricardo 5. Emission related issues to Bosch 6. Other than tractor issues to L&T

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R&D work that may come in future from Industry to R&D Centre that is being envisaged in Chandigarh region				
<ol style="list-style-type: none"> 1. Development of digital twin for electrical vehicle 2. Development of electric powertrain 3. Battery technology: development, testing and charging 4. Motors and controllers: selection and optimization 5. Hydrogen fuel cell technology 6. Precision farming 7. Autonomous tractors 8. Driver assist features 9. IoT and 5G enabled vehicles/machines 10. NVH 	<ol style="list-style-type: none"> 1. Localization of 25 HP engine 2. Development of Hydrostatic Transmission (HsT) 3. Engine calibration (Setting optimal parameters in ECU software) 4. Noise reduction jobs 5. Weight reduction of Engine block 6. Gear box design 7. Vibration reduction jobs 8. FEA-Structural & Thermal 9. CFD 10. Automotive electronics, ECU development 11. Related to Electrification (Electrical Tractor) Roll Over Protection System (ROPS) design 	<ol style="list-style-type: none"> 1. Vehicle performance and fuel economy optimization through 1-D simulation approach. 2. Engine calibration optimization for improved performance and emission through 1-D simulation. 3. CAE/ Simulation in following areas-Bus body structure NVH optimization, Bus structure and Truck cargo light weighting, Vehicle ride comfort and Fatigue life optimization. 4. Simulation based Electro-Magnetic Compatibility study among sensors and electronic/electrical parts. 5. Design upgradation of parts with alternative/ low cost materials for cost saving and weight reduction. 6. RLDA (road load data acquisition) of specific route for predicting damaging cycle for vehicle analysis. 7. Multi-layered cybersecurity frameworks for existing IOT (internet of things) network system. 8. 'Driver controls' position and 'passengers sitting' posture optimization with Aesthetic & Ergonomics design approach. 9. Vehicle styling based on scientific approach/inspired. 10. Improvement in CNG engine technology and fuel system. 11. Feasibly of conversion of existing CNG engine to LNG engine. 12. Hydrogen based combustion engine. 13. Bio fuel/Dual fuel engine Study and evaluating the impact of bio fuel blending on existing engine parts. 14. Multi-layered cybersecurity frameworks for upcoming internet of things (IOT) and autonomous vehicle network system. 15. Use of CNG engine in electric power generation 	<ol style="list-style-type: none"> 1. R&D centre should have cloud of latest softwares (FEA, CFD, Kisoft etc) and Indofarm can outsource analysis/simulation work or can use these softwares of this centre on payment basis. 2. Engine upgradation to meet latest emission norms 3. ECU calibration 4. After treatment solutions 5. Adoption of Bio-diesel (Biodiesel availability is needed) 6. Roll over Protection (RoP) development 7. Electrical Vehicle related 8. Hybrid vehicle related 9. New technology adoption 10. Ergonomics, comfort of driver 11. Noise, Vibration and Harshness (NVH) related 12. Turnkey solutions 	<ol style="list-style-type: none"> 1. Design of driveline 2. Hydraulic systems 3. Design of power train of tractor above 120 HP 4. Design of engine of tractor above 120 HP 5. Engine upgradation 6. ECU calibration 7. Electrical tractor 8. Materials related 9. Materials compatible with Bio-diesel 10. Weight optimization 11. Telematics 12. Failure analysis