eMobi Newsletter

An EV Lab Periodical

इमोबी

भारतीय तंत्रज्ञान संस्था मुंबई
भारतीय प्रौद्योगिकी संस्थान मुंबई
Indian Institute of Technology Bombay

C1973 EV LAB
सी १९७३ ईवी प्रयोगशाला

Vol.1 | Issue.01 | 2025 Qtr.1

About EV Lab

C1973 EV Powertrain Lab

C1973 EV Powertrain Lab at IIT Bombay, a donation project by class of 1973 B.Tech. batch, leads innovation in electric mobility, advancing critical EV technologies like motors, motor controllers and battery management systems. With equipment including CNC milling machines and active dynamometers, the lab specializes in prototyping and testing advanced solutions. Collaborating with industry through I-APP, the Industry-Academia Partnership Program, C1973 EV Lab offers interdisciplinary education programs to develop skilled professionals for the fast-growing electric mobility segment.

I-APP

The Industry-Academia Partnership Program is designed to provide a platform for collaboration between C1973 EV Powertrain Lab at IIT Bombay and the industrial partners involved in electric vehicle and its ancillary businesses to promote innovation and development of sustainable mobility solutions as well as to provide engineering training for human resource deployable in EV ecosystem.

Industry Collaboration Avenues

- **Transfer-of-Technology**
- **Research & Development Projects**
- **I-APP Activities & Events**
- **Established Student Fellowship**
- **Sponsored Projects**
- **Corporate Social Responsibility Contributions**
- **Educational & Training Programs**

EV Lab Management

Prof. Sandeep Anand
Dept. of Electrical Engineering,
IIT Bombay

Message from the Professor-In-Charge

The global transition to electric mobility demands collaboration between industry and academia, providing right training environment for the innovators working in EV ecosystem and a platform to advance growth. This collaboration ensures the provision of the right training environment, offering hands-on experience through research projects that lead to patents and technology transfer. At C1973 EV Powertrain Lab, we provide platform for such synergies through our different programs like Industry-Academia Partnership Program (I-APP), e-Post Graduate Diplomas & Master of Engineering courses, training programs and hands-on research experience.

We invite professionals from EV industry to collaborate with us in developing deployable solutions and taking the Indian EV ecosystem forward.

Internal Management Committee

Prof. Sandeep Anand

Prof. Kishore Chatterjee

Prof. Sandip K. Saha

Prof. Bharat K. Suthar

EV Lab Team

Mr. Gopikrishnan T.
Program Director

Abhilasha Sinha
Associate Program Manager
Industry Relations

Divyanshi Patil
Associate Program Manager
Educational Outreach

Aakash Sonawane
Technical Associate
Lab Services

C1973 EV LAB
IIT Bombay

YouTube

EV Lab Services

C1973 EV LAB

C1973 EV Powertrain Lab at IIT Bombay: Driving Innovation in Electric Vehicle Technologies

C1973 EV Powertrain Lab at IIT Bombay is a hub for pioneering research and innovation, dedicated to revolutionizing the electric vehicle (EV) landscape. With state-of-the-art facilities and cutting-edge equipment, the lab focuses on developing advanced solutions to enhance the performance, efficiency, and sustainability of EV powertrains.

EV Lab hosts an extensive range of resources, including advanced power supplies, diverse battery systems, vertical CNC machining tools, Wire EDM (Electrical Discharge Machining), battery cyclers, high-end oscilloscopes, precision multimeters and other essential electrical measurement equipment. It also features a high-power Motor and Electrical Assembly (MEA) test bench, enabling comprehensive performance validation and optimization of EV powertrain components under real-world conditions.

Our Deliverables

Research & Development

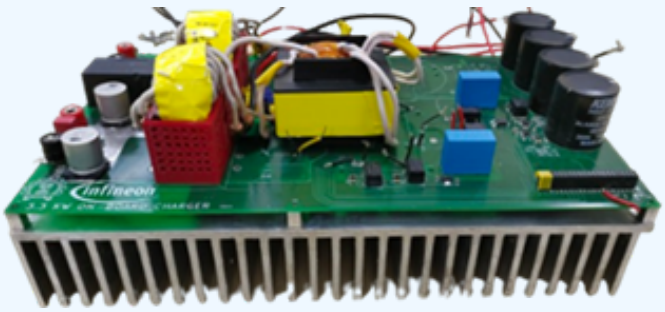
Design and development of power electronics & E-machines (motor, inverter, charger) by aligning with research trends and government policies. Engaging with industry to boost powertrain efficiency, enhance battery management and deploy sustainable mobility solutions.

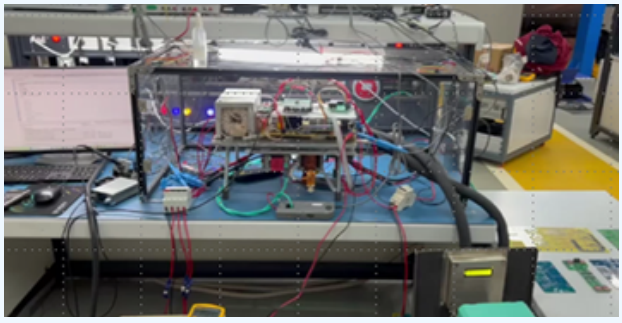
Education & Talent

Bridging the skill gap by developing courseware, delivering training program, upskilling professionals and nurturing future leaders in the EV sector through experiential learning and case study based projects.

Lab Facilities & Services

Service offering to industry, academia and research associates for best utilization of lab facilities comprising machine, equipment and device.





Research and Development Focus Area

C1973 EV Powertrain Lab's mission is to impact EV technology field by developing frugally robust design of products and solutions related to E-mobility ecosystem. Key focus areas of research include:
Motor Controllers: Designing next-generation controllers to enhance motor efficiency and reliability for a variety of EV applications.

- **Motor Controllers**: Designing next-generation controllers to enhance motor efficiency and reliability for a variety of EV applications.
- **Battery Management Systems (BMS):** Developing advanced systems for State of Charge (SoC) estimation, cell balancing, thermal management and ensuring safety and longevity of EV batteries.
- **High-Power MEA Test Bench:** Testing and validating motors, inverters, and powertrain components for high-performance EV applications, ensuring industry-grade reliability and robustness.
- **Battery Chargers:** Innovating compact, efficient and fast-charging solutions tailored to meet the needs of the growing EV ecosystem.
- **Integrated EV Solutions:** Delivering unified power electronic interfaces to reduce redundancy, enhance system efficiency and lower product cost.
- **Emerging Research Trends:** Incorporating Wide Bandgap (WBG) devices, Machine Learning workflows, and novel topologies to develop cutting-edge technologies for high-efficiency and high-density EV systems.
- **Integrated EV Solutions:** Delivering unified power electronic interfaces to reduce redundancy, enhance system efficiency and lower product cost.
- **Emerging Research Trends:** Incorporating Wide Bandgap (WBG) devices, Machine Learning workflows, and novel topologies to develop cutting-edge technologies for high-efficiency and high-density EV systems.

Industry Collaboration and Offerings

EV Lab actively collaborates with industry players and research establishments to deliver technology solutions that meet the specific needs of the EV market. Our expertise includes:

- **Customized Motor and Controller Design:** Tailored solutions to optimize performance and efficiency for diverse EV applications.
- **Charger Technologies:** Reliable and efficient designs for both on-board and off-board charging infrastructure.
- **Integrated Systems Development:** Compact, multi-functional solutions for powertrain electronics.

Through these collaborations, EV Lab contributes significantly to India's Make-in-India initiative, fostering indigenous development and reducing reliance on imported EV technologies.

e-Post Graduate Diploma in E-Mobility

About

The e-Postgraduate Diploma (ePGD) in E-mobility from IIT Bombay equips professionals with cutting-edge expertise in electric vehicle (EV) technology through a comprehensive, six-course curriculum. Designed and delivered by IIT Bombay's esteemed faculty, this synchronous ePGD covers foundational concepts in electric vehicle design followed by advanced topics such as battery technology, electrical drives and their control, power electronics, grid integration, styling, design and manufacturing technologies for electric vehicles. The curriculum emphasizes on conceptual and practical learning, through a series of live and interactive sessions. With an in-person graduation ceremony held at the IIT Bombay campus, this credit-bearing diploma requires the candidates to successfully complete 36 credits that can be saved in the Academic Bank of Credits (ABC), fostering continued academic growth.

ePGD Highlights

- Lateral Hiring
- Alumni Status
- Lectures by IIT Bombay Faculty
- Graduation at IIT Bombay Campus
- Hands-on Learning through Industry-Relevant tools

Know More

Who is this ePGD for?

- Early to mid-career professionals who want to upskill themselves and advance their career in the EV industry
- Scientists and R&D professionals who want to build cutting-edge solutions for the growing EV market
- Entrepreneurs who want to enhance their technical skills to lead the next EV startup effectively
- Academicians and educators who want to equip themselves with the latest knowledge to inspire the next generation of EV professionals
- Recent graduates who want to launch their career in the EV industry with a solid foundation in electric mobility

Email inquiry : office.evlab@ee.iitb.ac.in epgd.ev@eo.iitb.ac.in

Register Now

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Event Overview

E-Mobility Tech Day

Friday, 13 Sep 2024

In a vibrant celebration of innovation and collaboration, the E-Mobility Tech Day, hosted by the C1973 EV Powertrain Lab at IIT Bombay, marked a defining moment for the institution's commitment to sustainable transportation. With a remarkable convergence of over 200 participants—including distinguished industry leaders, visionary policymakers, esteemed academicians, and ambitious students—the event became a beacon of the collective effort required to propel India's electric mobility revolution.

Among the event's many luminaries, the stage was graced by Prof. Abhay Karandikar, Secretary of the Department of Science and Technology, and Dr. Anita Gupta, Head of the Centre for Excellence in Science & Technology (CEST), DST. Their visionary speeches framed the day's discourse, illuminating pathways to bridge technological divides and strengthen indigenous innovation in India's development in EV ecosystem.

The event also witnessed the formalization of key Memoranda of Understanding (MoUs) with leading industry players, including Dana India, Forvia Hella, and TapFin. These partnerships epitomize the growing enthusiasm for collaborative research and workforce development, underscoring the pivotal role of academic-industry synergies in driving the future of electric vehicle technologies.

Power Electronic in EV

Monday, 16 Dec 2024

The workshop on "Revolutionizing Mobility through Next Generation Power Electronics," held on December 16, 2024, at IIT Bombay, brought together experts to explore advancements in power electronics for the future of mobility. The inaugural session began with a welcome address by Prof. Harish K. Pillai, Head of the Electrical Engineering Department, followed by a talk by Prof. Kishore Chatterjee, who highlighted IIT Bombay's significant contributions to E-Mobility. Dr. Brij Singh from John Deere and Michael J. Schreuder, Deputy Principal Office, U.S. Consulate General, Mumbai, emphasized the importance of international collaboration in advancing the field.

The technical session featured distinguished speakers such as Prof. Victor Veliadis (Executive Director & CTO, PowerAmerica), Dr. Babak Parkhideh (Professor, ECE UNC, Charlotte), Dr. Sanjeet Dwivedi (Senior Consultant, RDT Engineers, Denmark), Prof. Pallavi Bhardwaj (Assistant Professor, IIT Gandhinagar), Prof. Jin Wang (Professor, ECE OSU, Columbus), and Dr. Danan Dou

Chief Technologist, Power Systems, John Deere). The topics covered included SiC power chip fabrication, reliability monitoring of WBG converters, power electronics for hydrogen production, EV battery optimization, high-voltage power electronics for transportation, and the role of electricity in energy conversions.

The event provided a unique opportunity for collaboration, the exploration of cutting-edge technologies, and hands-on learning through lab visits, all contributing to shaping the future of power electronics in mobility.

Collaboration Overview

Industrial-Academia Partnership Program (I-APP)

Affiliate Partners

*For startups with less than 5 years or up to 100 Cr Turnover

- EV Career Day (Members only)
- Branding on EV Lab and EV Lab events
- Exclusive access to EV lab facilities at discounted fee
- Regular Technical Seminars
- Quarterly Newsletters
- Regular Industry Webinars & Presentations
- Quarterly member exclusive workshop to exchange ongoing research & innovation
- Reserved seats for short-term training program

Associate Partners

- EV Career Day (Members only)
- Branding on EV Lab and EV Lab events
- Exclusive access to EV lab facilities at discounted fee
- Regular Technical Seminars
- Quarterly Newsletters
- Regular Industry Webinars & Presentations
- Quarterly member exclusive workshop to exchange ongoing research & innovation
- Reserved seats for short-term training program
- Degree program discounts for PGDs & M Eng. on E-Mobility
- Opportunity to co-suggest EV related research.

Principal Partners

- EV Career Day (Members only)
- Branding on EV Lab and EV Lab events
- Exclusive access to EV lab facilities at discounted fee
- Regular Technical Seminars
- Quarterly Newsletters
- Regular Industry Webinars & Presentations
- Quarterly member exclusive workshop to exchange ongoing research & innovation
- Reserved seats for short-term training program
- Degree program discounts for PGDs & M Eng. on E-Mobility
- Opportunity to co-suggest EV related research.
- Become a member of EV Power Train lab advisory board

Benefits

- Early Access To Intellectual Property Rights
- Access To Train Your Employees On EV Lab Facilities
- Helps to understand Industries' requirements and Priorities

- Engagement With Researcher's Team
- Focused Session With Students & Faculty To Promote Exchange of Ideas and Innovation
- Chance To Offer Students Internships and Future Employment

- Member Exclusive Quarterly Workshop
- Multiple Emersion Programs

Sponsorship Partners (1 Year)

- EV Career Day (Members only)
- Branding on EV Lab and EV Lab events
- Regular Technical Seminars
- Quarterly Newsletters
- Regular Industry Webinars & Presentations
- Quarterly Member Exclusive Workshop to Exchange Ongoing Research & Innovation

One-Day Sponsorship

- Stalls for the event

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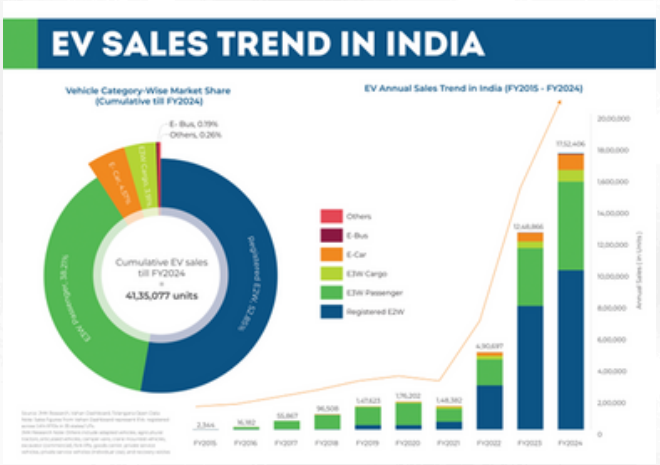
Consumer perspectives on electric vehicles: Trends and insights

8 Nov 2024

The Indian EV market is rapidly growing. It is estimated to reach a value of $34.8 billion by 2024 and $120 billion by 2030, driven by advancements in technology, environmental awareness and fuel prices. While the government aims for 30% EV penetration by 2030, adoption stays uneven across demographic and vehicle types. Compact, affordable, and well-suited for congested city traffic, electric scooters are becoming the preferred choice for urban commuters and quick commerce.

3-wheelers (3Ws), especially for public transport, are gaining ground due to low operating costs—₹2-3 per km versus ₹6-8 for traditional fuels. However, in rural areas, adoption is slower due to limited charging infrastructure, service and range concerns. 4Ws, while showing modest growth with just 4.9% of total car sales in 2024, are facing challenges due to high upfront costs and concerns over charging infrastructure and resale value. Urban and metropolitan areas are leading EV adoption due to better infrastructure and government incentives. In contrast, rural areas are running behind, with limited charging stations and concerns about vehicle reliability on rough roads. However, electric 3Ws (e3w) are gaining traction commercially due to lower running costs.



EV sales trend in India, JMK Research & Analytics. Annual India EV Report Card: FY2024

Drivers across e2w, e3w and e4w segments share varied perspectives. e2w drivers in urban areas highlight better handling and maneuverability, making EVs ideal for traffic and deliveries. They are satisfied with the low running costs, home charging, and overall performance. e3w drivers, particularly in urban settings, praise the savings in fuel and maintenance but face challenges with rural infrastructure as well as poor build quality from some manufacturers. e4W drivers recognize the environmental and fuel benefits, but remain concerned about high upfront costs, resale value, and charging dependency on long trips. Across all segments, drivers show concern regarding the need for better infrastructure, long range, greater availability of better-build vehicles, expansive and reliable service network and more affordable pricing to drive adoption of EVs.

About the Author

Aditya Singh, founder of TapFin, is an accomplished entrepreneur with over 20 years of experience in EV financing, technology, and business development. An MBA from XLRI Jamshedpur and an IT graduate from Delhi University, he co-founded CreditMate and successfully led it for five years until its acquisition by Paytm. Aditya's data-driven approach and expertise in data science, strategy consulting, and international banking and payments—gained from roles at EY, KPMG, Cedar Consulting, and ICICI Bank—position him as a versatile leader advancing EV financing solutions across India.

About our partner

TapFin is a tech-driven, full-stack platform focused on advancing the sustainability ecosystem. TapFin delivers tailored solutions, including EV financing, leasing, lending and insurance, designed to empower businesses in achieving sustainable growth. By combining advanced technology with a deep commitment to green financing, TapFin supports companies across diverse sectors in accessing the resources they need to drive eco-friendly innovation and expansion.

HIL Validation of Power Plant Controller Model

There is an increasing requirement to supply Inverter Based Resource (IBR) models compiled using the actual code used in inverter-controls to facilitate detailed electro-magnetic transient (emt) studies. Similarly, emt models of Power Plant Controllers (PPC) which are commonly used for managing these utility-scale renewable energy plants are also required by the utilities. However, validation of these models against the performance of actual hardware controller is rarely provided. It is generally assumed that the model based on the actual controller source code or identical block-diagram performs identical to the hardware controller. However, this assertion without validation may not be acceptable to all end-users since the simulation platform and the hardware are two significantly different environments. Validation via field tests is usually narrow in scope. The hardware-in-loop (HIL) validation using a real-time digital simulator is a well-accepted, flexible and cost-effective method for a thorough validation.

Use Case

RTDS® is a world renowned real-time digital simulator for HIL testing of power system controls and protection systems. This article discusses a unique use case where the RTDS simulator was used for validating a PSCAD™ model of Nor-Cal Control's PPC against its General Electric PLC based hardware controller. In addition, the testbed can also be used as a productivity tool for a wide range of functions from testing a PPC concept in the R&D phase to System Acceptance Test (SAT) of a fully assembled power plant controller and protection system.

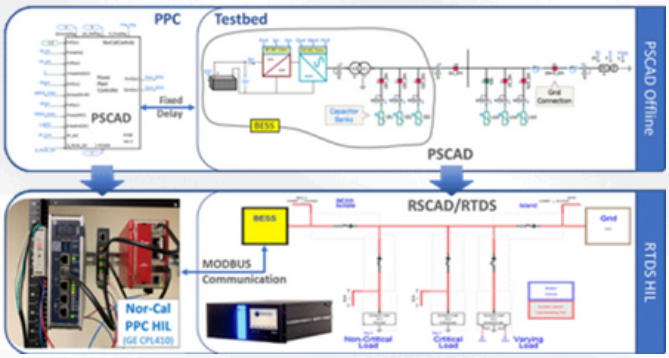


Fig. 1: Testbed setup

Validation Results

The PPC dynamics were validated while it is managing a battery energy storage system (BESS) plant. First, the BESS plant response without the PPC was compared in both PSCAD and RTDS platforms to establish a common baseline. Then the PPC model and PLC were introduced as shown in Fig. 1. The following plots show the results of various validation tests conducted. PSCAD results are overlaid with the corresponding RTDS HIL responses. HIL PPC communicates with the RTDS via MODBUS. This aspect is omitted in a typical PSCAD study. However, to better align the two results, the communication was modelled in PSCAD as a fixed delay using the average MOBUS delay observed from the HIL setup. The phase shift in the dynamic response between the two simulations is caused by the differences between the actual MODBUS delays (random) in RTDS simulation and the fixed delay in PSCAD. The two responses agree very well on all aspects despite these differences. This shows that the PSCAD model is an exceptionally good representation of the hardware PPC and its settings.

Partners' Advertorial

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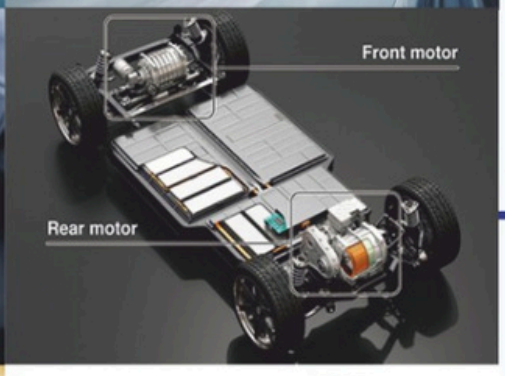
INDUSTRY'S PROVEN SOLUTIONS FOR HIGH - ACCURACY POWER ANALYSIS



Advanced Current Sensors Technology AC/DC

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POWER ANALYZER PW6001

POWER ANALYZER PW3390

POWER METER PW3337

POWER QUALITY ANALYZER PQ3198

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Pune

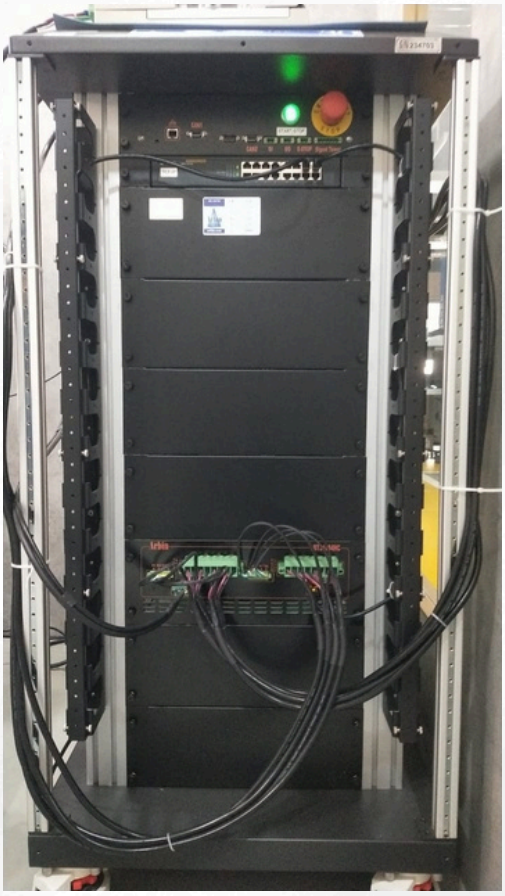
Social Media

Website **YouTube** **LinkedIn**

EV Lab Infrastructure

Regenerative Grid Simulator

Wire Cut EDM



Battery Cycler

CNC Milling Machine

I-APP Collaboration Calendar

5 Apr, Jul, Sep, Dec, 2025

Member Exclusive Workshops

May, 2025

Technical Seminar

8 Aug, 2025

EV Tech Day

Q1, Q2, Q3, Q4, 2025

Quarterly Newsletters

Apr, Jul, Oct, 2025

Webinars & Presentations

14 Nov, 2025

EV Career Day

TBA, 2025

Short Term Training Programs

C1973 EV Powertrain Lab

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