Future-Ready Mechanics: Aligning Indian Vocational Training with the EV Retrofitting Boom

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***Abstract*—As India accelerates toward its Net-Zero 2070 targets, the automotive sector faces a dual challenge: managing the scrappage of millions of End-of-Life Vehicles (ELVs) and bridging the acute shortage of technical workforce for the Electric Vehicle (EV) transition. This paper proposes a novel vocational curriculum focused on "EV Retrofitting"—the engineering conversion of internal combustion engine (ICE) vehicles into electric or hybrid systems. Drawing from the practical landscape of Industrial Training Institutes (ITIs), this study outlines a scalable, NSQF-aligned framework to upskill Diesel Mechanics, turning a potential job crisis into a "Green Collar" employment opportunity aligned with the National Vehicle Scrappage Policy.**

***Index Terms*—EV Retrofitting, Vocational Training, Scrappage Policy, Green Jobs, Skill India, Sustainable Mobility.**

I. INTRODUCTION

The Indian automotive landscape is undergoing a seismic shift. With the implementation of the Voluntary Vehicle-Fleet Modernization Program (V-VMP), or the Scrappage Policy, we are mandated to phase out unfit commercial and personal vehicles. However, scrapping is not the only solution. A significant percentage of these vehicles possess structurally sound chassis that, if retrofitted with electric powertrains, could serve as affordable entry points for zero-emission mobility in Tier-2 and Tier-3 cities.

As an instructor on the shop floor of Government ITI Durgapur, I have witnessed firsthand the anxiety of "Mechanic Diesel" trainees who fear their trade is becoming obsolete. This paper argues that the trade is not dying; it is evolving. The skills required to dismantle an engine, understand torque transmission, and mount gearboxes are the very foundation needed for EV retrofitting.

II. THE SKILL GAP IN THE "CIRCULAR ECONOMY"

While Original Equipment Manufacturers (OEMs) are training technicians for new EVs, the unorganized retrofitting sector is operating in a regulatory grey zone. Local garages are performing conversions often without adherence to AIS-123 (Automotive Industry Standards). The lack of formal training poses severe safety risks, particularly regarding high-voltage (HV) isolation and thermal management.

There is currently no standardized curriculum that specifically bridges the gap between scrapping and retrofitting. This paper proposes filling that void.

III. PROPOSED CURRICULUM ARCHITECTURE

The proposed course, titled "Certificate in EV Retrofitting & Hybrid Conversion," is designed as a 240-hour Short-Term Course (STC) for ITI Trainees. It moves beyond basic EV maintenance into "re-engineering."

3.1 Core Modules:

- De-pollution & Dismantling: Safe removal of ICE components (fuel tanks, exhaust systems) in compliance with CPCB guidelines, ensuring the vehicle is "clean" for conversion.
- Structural Analysis & Fabrication: Unlike standard service courses, this module teaches students to design and fabricate motor mounts and battery trays that maintain the vehicle's center of gravity—a critical skill for roadworthiness.

• Powertrain Integration: Hands-on coupling of 3-Phase Induction or BLDC motors with existing transmission systems, eliminating the need for complex gearbox replacements in budget retrofits.
• High-Voltage Safety & Compliance: A dedicated focus on RTO re-registration processes and safety audits required for obtaining the "Green Number Plate" for converted vintage or old vehicles.
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IV. PEDAGOGICAL INNOVATION: THE "REUSE-REBUILD" MODEL

We believe in "Wealth from Waste." The pedagogical approach for this course relies on sourcing condemned vehicles for training.
• Step 1: Trainees assess the "donor" vehicle.
• Step 2: They perform the ICE strip-down (learning recycling skills).
• Step 3: They install the EV kit (learning engineering skills).
• Step 4: They test the vehicle on dynos (learning diagnostic skills).
This cycle mirrors the real-world circular economy, ensuring students are not just "parts replacers" but "sustainability engineers."

V. POLICY RECOMMENDATIONS

To make this scalable, I recommend the following to the Ministry of Skill Development and Entrepreneurship (MSDE):
Recognition of Prior Learning (RPL): Thousands of roadside mechanics already possess intuitive knowledge of retrofitting. They should be certified under this framework to formalize the sector.
Retrofitting Labs in ITIs: Establishing "Brownfield EV Labs" where old engines are swapped for motors, rather than investing solely in expensive new EV cut-section models.

VI. CONCLUSION

The transition to electric mobility should not leave the traditional workforce behind. By integrating retrofitting into the national skill framework, we achieve a trifecta of benefits: we save the environment by recycling vehicle bodies, we provide affordable EVs to the masses, and most importantly, we give a futuristic career path to the Diesel Mechanic. As educators, our duty is to ensure that when the internal combustion engine turns off for the last time, our students are the ones turning on the electric switch.

ABOUT THE AUTHOR

Indranil Mukherjee is a celebrated vocational educator and Instructor at Government ITI Durgapur, West Bengal. A recipient of the National Teachers' Award (2025) from the Hon'ble President of India and the Utkarsha Bangla Excellence Award, he is known for his innovative "Edutainment" approach to technical training. His work focuses on modernizing the "Mechanic Diesel" trade to align with Industry 4.0 and sustainable energy goals.