

EV BATTERY RECYCLING

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INTRODUCTION

Duration: 10 hours

This module provides an in-depth understanding of electric vehicle (EV) Battery Recycling, covering environmental and economic impacts, recycling techniques, regulatory policies, and emerging industry trends. The course is designed to equip learners with practical insights into sustainable battery management and innovative recycling technologies.

1. Introduction to EV Batteries

1.5 hours

- Growing demand for EVs and its impact on battery waste
- Key stakeholders in battery recycling (OEMs, recyclers, policymakers)
- Types of batteries used in EVs (Lithium-ion, Solid-state, etc.)
- Battery composition and key materials (Lithium, Cobalt, Nickel, Graphite, etc.)
- Importance of battery recycling in the EV ecosystem, with a focus on challenges and opportunities specific to the market

2. Environmental and Economic Impact

1 hour

- Challenges of battery waste management
- Environmental impact of improper disposal, particularly in growing EV markets
- Economic benefits of battery recycling (resource recovery, job creation, cost savings)
- Carbon footprint reduction through efficient recycling
- Long-term sustainability of EV battery materials and risk of material scarcity

3. Battery Recycling Processes

2 hours

- Collection and transportation of used batteries, including best practices and infrastructure challenges
- Pre-treatment (disassembly, sorting, and safety measures)
- Recycling methods:
 - Pyrometallurgical recycling (smelting) – High-temperature processing with material recovery limitations
 - Hydrometallurgical recycling (leaching) – Chemical-based extraction with high material recovery
 - Direct recycling (cathode-to-cathode regeneration) – Most sustainable method with potential cost benefits
- Comparison of recycling methods in terms of efficiency, cost, and sustainability
- Advancements in battery dismantling technologies

4. Battery Reuse and Second Life Applications

1 hour

- Repurposing EV batteries for energy storage
- Integration into solar and wind power systems
- Examples of real-world second-life battery applications in a growing EV market
- Safety and ethical considerations for second-life battery usage
- Data on repurposed EV batteries in renewable energy projects

5. Policies, Regulations, and Industry Standards

1.5 hours

- Regulations on battery recycling, focusing on recent policy developments and compliance requirements
- Battery Waste Management Rules and their impact on businesses and consumers
- Extended Producer Responsibility (EPR) and its role in sustainability

6. Challenges and Future Trends in Battery Recycling

1.5 hours

- Technological limitations and efficiency challenges
- Innovations in sustainable battery design (cobalt-free, solid-state), particularly in emerging markets
- The role of AI and automation in battery recycling, including sorting, material recovery optimisation, and process efficiency improvements
- Future advancements in non-lithium battery chemistries and their impact on recycling
- Ethical considerations and environmental safety concerns in battery recycling
- Role of blockchain in battery tracking and recycling transparency

7. Case Studies and Real-World Examples

1 hour

- Successful battery recycling initiatives (e.g., Attero Recycling, Lohum Cleantech, Tesla, Redwood Materials)
- Approach to battery recycling and startups in the sector
- Case study: Emerging battery recycling startups and their impact on the market
- Lessons learned from other industries
- Comparison of global vs. market-specific battery recycling approaches
- New research projects focused on next-gen battery recycling