ESCAP
Economic and Social Commission for Asia and the Pacific

Introducing Just Transition

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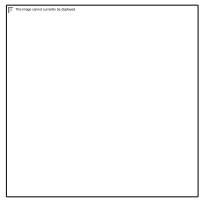
Just Transition

Just



Transition

Transition

"Transition" refers to change in the ways things are done.

Examples of transitions include:

- **Energy Transition:** Moving from fossil fuels to renewable energy
- **Mobility Transition:** Shifting to electric mobility

These transitions involve changes in technologies, industries, jobs, and infrastructure, which can significantly affect workers and communities.

Net change in employment across green sectors by 2030

Just

"Just" refers to fairness, equity, and social inclusion in the process of economic and environmental change.

How can we ensure that the transition does not disproportionately harm certain groups and brings everyone along?

- **Protecting workers and livelihoods** that may be affected
- **Providing social protection and reskilling opportunities**
- **Ensuring inclusive decision-making** so that cleaner air, new jobs, and improved mobility are shared broadly.

In Asia and the Pacific

66%

Of the workforce is in informal employment

6.4%

Share of women employed in the transport sector

43%

Of people in positions that are vulnerable to climate change

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What does that mean for electric mobility?

A **just transition in electric mobility** means ensuring the move to electric vehicles improves environmental outcomes while protecting workers, creating new opportunities, and ensuring that the benefits of clean mobility are shared fairly across society and accessible to all.

Project Highlights

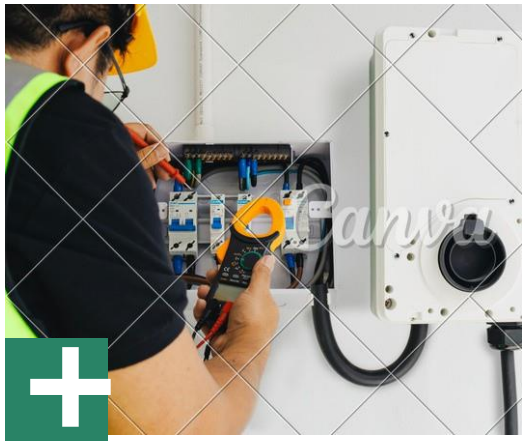
4
MULTI-STAKEHOLDER ROUNDTABLES
Government, private sector, academia, and CSOs

EV VOCATIONAL TRAINING PILOT
Developing a Vocational Training Course for E-Mobility

170
STUDENTS ENGAGED
Empower E-Mobility Challenge
Presented ideas to improve transport infrastructure

50+
YOUTH IN WORK PLACEMENTS
Work shadowing opportunities with leading companies

The EV transition is not only a technological shift, but a labour transformation.



New Opportunities

Emerging Green Jobs

- EV charger installation
- EV maintenance and repair
- EV fleet management

Emerging Risks

- Skills gap in electrical systems and high-voltage safety
- Digital skills barriers
- Limited access to training of informal workers
- Gender-based exclusions

Impact Analysis Study

The study examines how the EV transition is reshaping urban labour markets in Bangkok and identifies the skills, barriers, and policies needed for a just workforce transition.

- **Map** urban EV value chain and changing occupations
- **Identify** emerging skills and at-risk worker groups
- **Examine** barriers to training access
- **Develop** actionable strategies for the BMA

Urban EV Value Chain-Analysis Framework

Private sector

01. Installation & Deployment

Installing chargers

02. Operation

Charging operation and transport services (Public transport and fleet)

03. Maintenance

Charging and EV diagnostics and maintenance.

04. End-of-Life & Decommission

Battery recovery, parts reuse, and safe disposal.

Stage 1: Installation – Key Activities

Main labour activities in EV charging infrastructure installation

Site Preparation & Civil Works (Public Charging Stations)

Civil workers prepare foundations, cable routing, and electrical layout for public charging stations.

Charger Installation and Electrical Setup

Electricians and technicians install chargers, wiring, and safety systems.

Key Workforce Roles

- Electrical engineers / technicians
- EV charger installers

Stage 1: Installation
Key Skills & Gaps

Key Skills	Key Gaps
• **Troubleshooting** – Determining causes of operating errors and deciding what to do about it • **Operation and Control** – Controlling operations of equipment or systems • **Installation** – Installing equipment, machines, or wiring to meet specifications • **Critical Thinking** – Using logic and reasoning to evaluate alternative solutions • **Complex Problem Solving** – Identifying complex problems and developing solutions • **Coordination** – Adjusting actions in relation to others' activities • **Quality Control Analysis** – Conducting tests and inspections to evaluate quality or performance	• Rise of "Unskilled Labor": General electricians or air-con technicians often perform installations without • specialized EV training, leading to high fire risks. (especially in Home EV-charger installation) • Gap in High-Voltage Safety: Lack of foundational knowledge in high-voltage • circuits and electrical safety protocols among installers. • Certification Deficit: Significant • shortage of technicians holding official government • certifications (MEA/PEA) specifically for EV infrastructure.

Source: O*NET Occupational Database (U.S. Department of Labor).

Stage 2: Operation – Key Activities

Main labour activities in EV charging infrastructure installation

EV Fleet Operations

- Charging coordination and vehicle scheduling
- Monitoring vehicle performance and battery status
- Managing drivers, staff training, and safety compliance
- Digital monitoring (real-time alerts, battery health, efficiency)

Electric Public Transport Services

- Operating e-buses, e-taxis,and e--tuk-tuks,
- Managing routes, dispatch, and charging cycles
- Drivers operate vehicles according to assigned schedules

Charging Station Operations

- Charger monitoring and status management
- User support and payment assistance
- Charging coordination and station management
- Data monitoring and system management
- Basic troubleshooting

Key Workforce Roles

- Transportation managers
- EV drivers
- Dispatch coordinators

Stage 2: Operation
Key Skills & Gaps

Key Skills	Key Gaps
• **Active Listening** – Giving full attention to what others are saying and understanding information clearly • **Coordination** – Adjusting actions in relation to others' activities and operational requirements • **Operations Monitoring** – Watching indicators and operational conditions to ensure systems work properly • **Critical Thinking** – Using logic and reasoning to evaluate alternative solutions and operational decisions • **Time Management** – Managing time and schedules for transport operations and logistics coordination • **Complex Problem Solving** – Identifying operational problems and developing appropriate solutions • **Operation and Control** – Controlling and operating vehicles or systems safely	• **Driver Capability Gap:** Limited familiarity with EV-specific driving practices, charging optimization, • and vehicle software interfaces. Fleet operators also face shortages of trained drivers and must provide repeated training when switching between different • EV models.

Stage 3: Maintenance – Key Activities

Technical maintenance activities for EV vehicles and charging infrastructure

EV Vehicle Maintenance

1. Routine Service & System Diagnostics

- Scheduled inspection and system checks
- Thermal and ventilation system monitoring
- Basic diagnostics and preventive maintenance

2. Roadside Repair

- Emergency diagnostics
- Safety handling procedures
- Towing support if required

3. Repair at Garage

- Advanced mechanical and electrical repairs beyond routine servicing
- External systems: body, wheels, exterior components
- Internal systems: battery and electronic systems

Charging Infrastructure Maintenance

Maintenance activities to ensure EV charging stations operate safely and reliably

- Inspection of charging equipment
  Repair and replacement of faulty components

Key Workforce Roles

- EV technicians
- Charging technicians

Stage 3: Maintenance
Key Skills & Gaps

Key Skills	Key Gaps

• **Repairing** – Repairing machines or systems using the needed tools
• **Troubleshooting** – Determining causes of operating errors and deciding what to do about it
• **Operations Monitoring** – Watching gauges, dials, or other indicators to ensure machines operate properly
• **Equipment Maintenance** – Performing routine maintenance on equipment and determining maintenance needs
• **Critical Thinking** – Using logic and reasoning to evaluate alternative solutions
• **Quality Control Analysis** – Conducting tests and inspections to evaluate performance or quality
	• **Lack of Electrical Expertise:** Independent garages can perform mechanical repairs but lack the expertise to handle high-voltage electrical systems
	  • **Theory-Heavy" Education Gap:** Vocational graduates often lack hands-on experience because educational institutions lack actual EV units and diagnostic tools.
	  • **Safety Risks in Repair:** High risk of electrical hazards for technicians who have not been formally trained in battery module handling
	• **Urgent Demand for A/C Specialists:** High short-term need for technicians specialized in EV air-conditioning and thermal management

Source: O*NET Occupational Database (U.S. Department of Labor).

Stage 4: End-of-Life (EoL) – Key Activities

Technical maintenance activities for EV vehicles and charging infrastructure

Collection & Pre-Processing

Collect, inspect and dismantle EVs and chargers before recovery processes.

- De-installation, collection and transport
- Vehicle and battery inspection
- Initial dismantling and component sorting

Key Workforce Roles

- Hazardous materials removal workers
- Recycling collection drivers
- Recycling and reclamation workers
- Recycling coordinators

Component Recovery & Recycling

Separation of EV components for reuse, recycling, or safe disposal

Salvage Vehicle Parts

- Reuse of functional parts (e.g., doors, glass)
- Refurbishment and repair
- Material recycling (metal and plastics)
- Disposal of non-recyclable residues

Salvage Battery

- Second-life battery applications (e.g., solar storage)
- Recycling of valuable metals (e.g.,lithium)
- Safe disposal of hazardous battery materials

Salvage Chargers

- Reuse of parts (e.g., LCD screens, charging guns)
- Recycling of copper, steel, and plastics
- Safe disposal of e-waste

Stage 4: End of Life
Key Skills & Gaps

Key Skills	Key Gaps
• **Equipment operation & monitoring** – Operating and monitoring dismantling and recycling machinery • **Problem solving & decision making** – Identifying faults and selecting appropriate recovery or recycling actions • **Quality inspection & safety control** – Ensuring safe dismantling and compliance with safety • standards **Communication & coordination** – Coordinating with recycling teams and logistics staff • **Work planning & time management** – Managing dismantling tasks and recycling workflows	• **Dismantling Expertise Shortage:** Limited expertise in safely dismantling high-voltage batteries and managing hazardous materials. • **Safety Training Gap:** Technicians in traditional scrap markets lack formal training on battery circuit safety and fire prevention. • **Second-Life Knowledge Gap:** Insufficient training programs for assessing battery health for "Second-Life" applications (e.g., Energy Storage Systems).

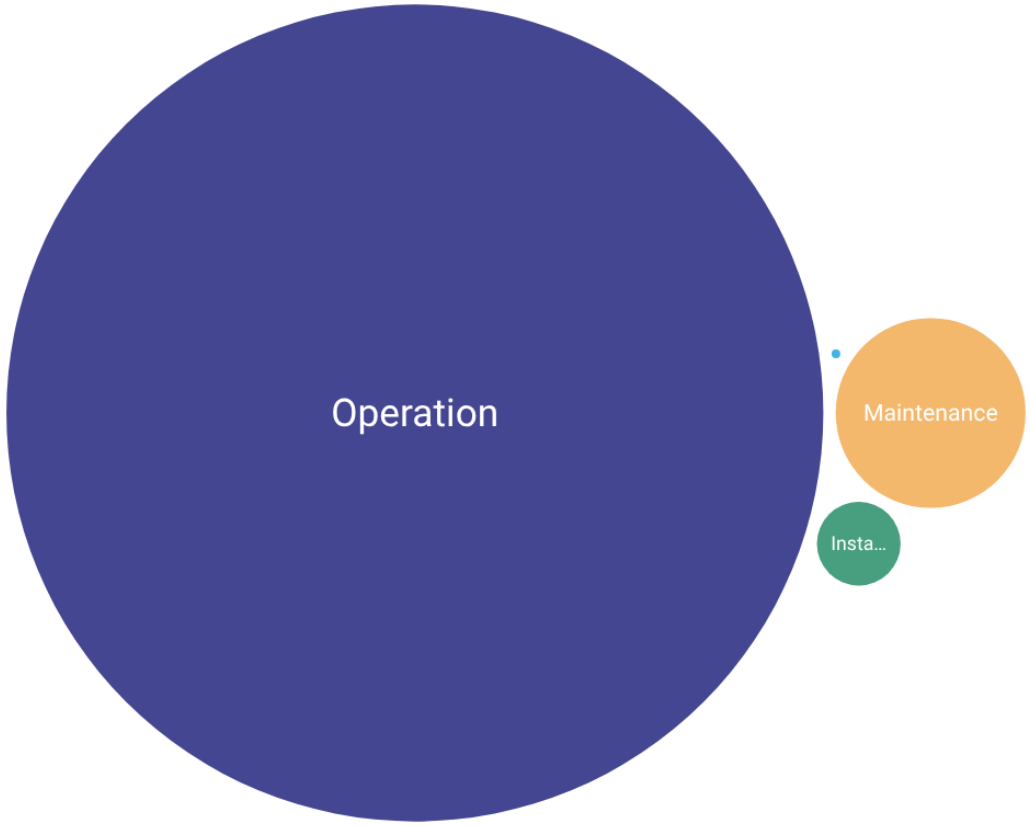
Source: O*NET Occupational Database (U.S. Department of Labor).

Estimated EV Workforce in Bangkok (2025)

Total estimated workforce:≈ 20,000 jobs

- Operation stage dominates employment
- Drivers account for the largest share of EV jobs

Stage	Jobs	Share
Installation	200	1%
Operation	17,000	94%
Maintenance	1,000	14%
End-of-Life	Negligible	~0%



Note: Excludes back-office roles (e.g., dealers, collection services, grid management, backend systems, and platform operations).

Future Job Positions in Urban EV Industry

Short term (1–2 years) (Immediate Needs)	Medium term (~5 years) (Advanced Technology & Expertise)	Long term (10+ years) (Circular Economy & Battery Management)
• **EV Repair Technicians –** high-voltage safety, component replacement • **Charging Infrastructure Staff –** install, test, maintain EV chargers • **EV Training Instructors –** deliver new EV/high-voltage skill courses • **After-Sales Service Staff:** Personnel supporting sales and customer relations for EV brands	• **High-Voltage Electronics Specialists** – power electronics, ECB boards • **Software Engineers & Coders –** automation, auto-pilot systems • **Charging Network Software Technician:** Oversees charging station networks and backend	• **Advanced EV Software Technician:** High-level roles required for the oversight and inspection of technologies, such as auto-pilot/autonomous driving systems • **Technicians and specialists in battery recycling, battery repair, reuse, and safe disposal:** require advanced training in chemistry etc.

Distributional Impacts and Vulnerable Groups

Mostly in ICE value chain

Workers in ICE dealers that transition into EV dealers

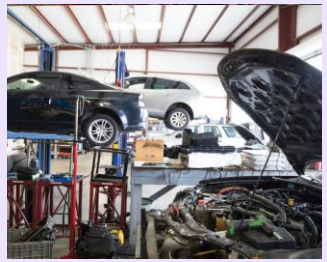
EVs require less maintenance, so ICE dealers switching to EVs will likely reduce their workforce.

CNG installation garages

EV adoption reduces people's interest in gas installation, which negatively affects gas conversion garages.

ICE Taxi Drivers

ICE taxis face higher fuel and maintenance costs, while passengers prefer EVs for lower fares—reducing ICE drivers' competitiveness and income.

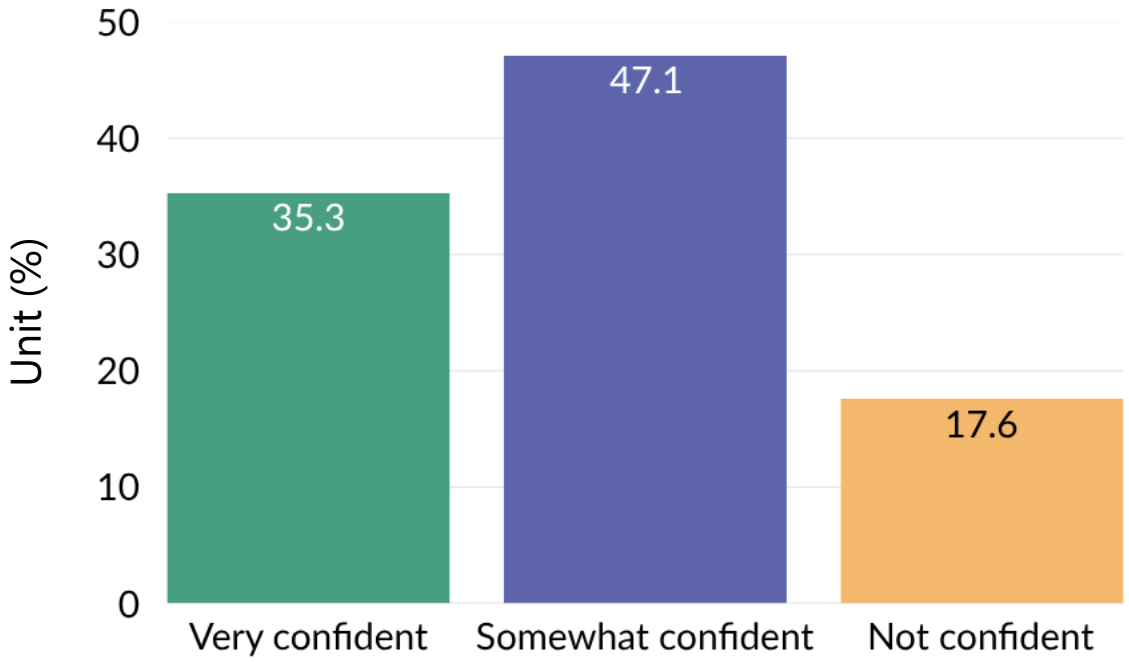


ICE garages

- Limited capital for EV tools
- Slow access to training information
- Without EV skills → risk losing customers and income

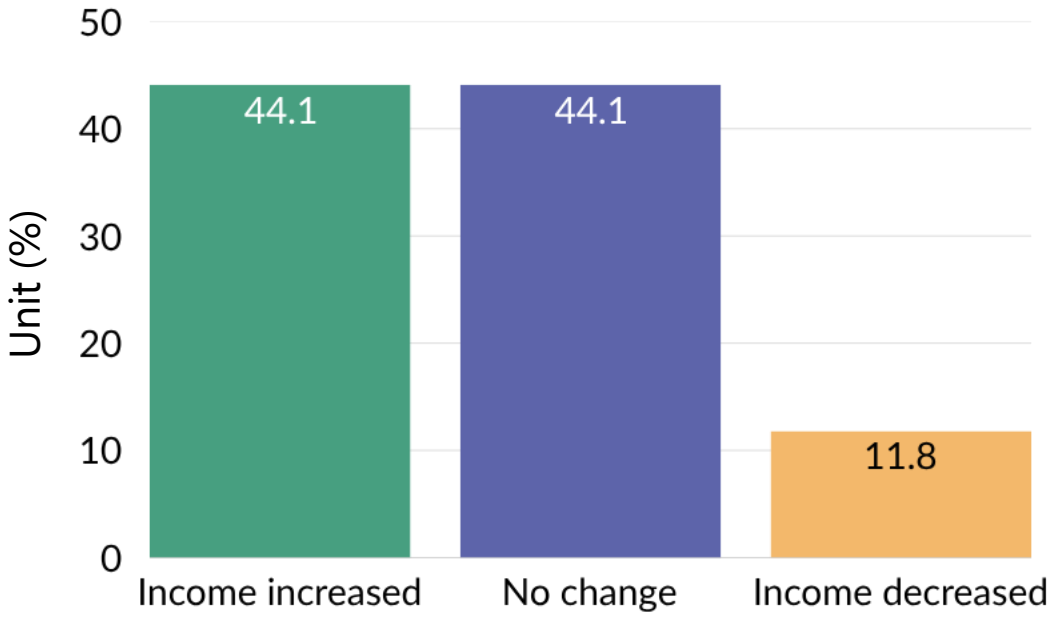
Worker Self-Assessment and Readiness

High-Voltage Safety Confidence



Indicates a persistent safety training gap

Income Change After EV Transition

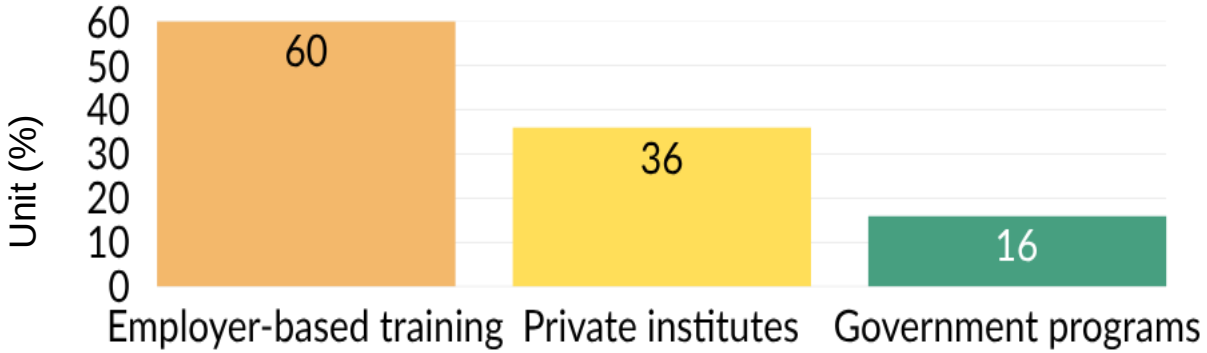


Despite higher technical demands, EV work does not consistently offer wage premiums

Worker Self-Assessment and Readiness

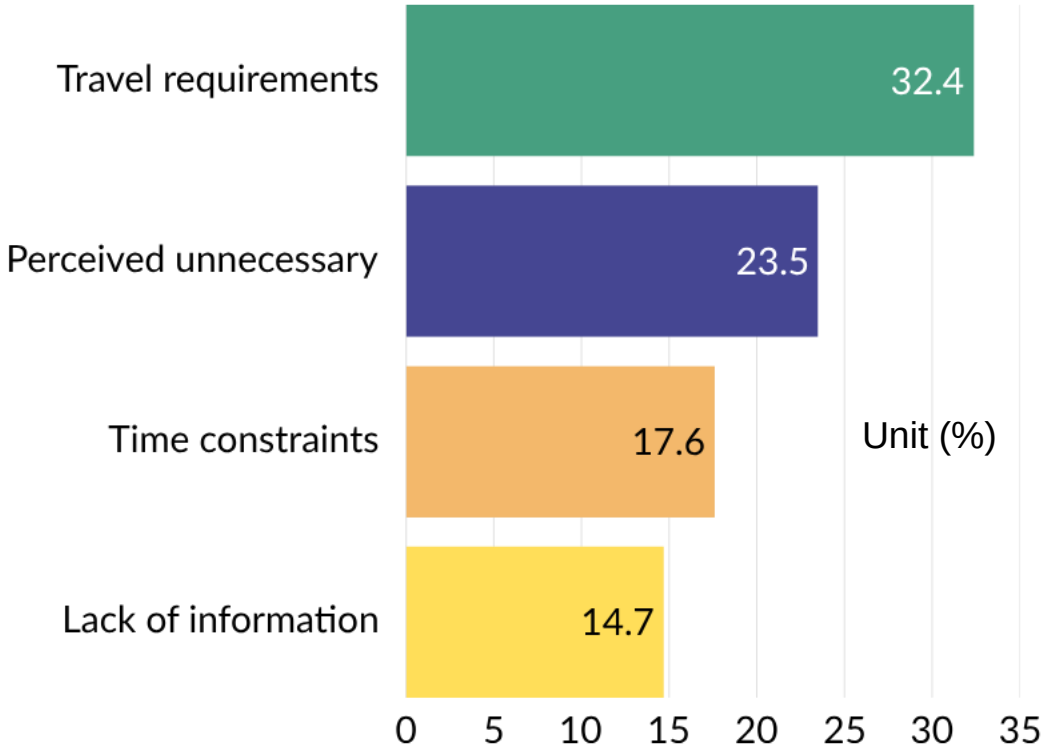
Training providers

Around 62% of EV workers surveyed had received EV training. Of these, EV training currently depended heavily on firm-based provisions



Structural Barriers to Training

Key obstacles are not just cost



Where the Skill Gap Really Lies

Safety-Critical Gap

- Safety risks concentrated in maintenance, where workers increasingly interact with high-voltage systems
- Many workers report limited confidence in these systems
- All while supply of technicians is limited

Incentive Gap

- EV jobs are more technically complex than ICE jobs
- However, wage outcomes remain weakly differentiated
- Many workers report no income increase

Access Gap

- Training opportunities are uneven across employment types (formal/informal)
- Workers in large firms have better access to training
- Informal workers face barriers such as time constraints, travel distance and lack of institutional connections

Coordination Gap

- National strategies and policies are in place
- Certification systems and implementation at the city level are still evolving
- ESCAP is supporting coordination locally within this national context

Institutional Landscape of EV Training Pathways

EV-related skills in Thailand are currently developed through four main training pathways

Informal / Self-learning

- Learning through peer networks and trial-and-error
- Flexible but lacks formal certification and safety training

Public and Government Training

- Mostly free and publicly accessible
- Focus on standards and basic HV safety, though practical
- training remains limited.

Training from Manufacturer

- Brand-specific programs
- Access restricted to authorized technicians (not enough
- for real repair tasks, and technical data access)

Private Training Providers

Examples: All EV Services, DIYguru

- Advanced training in battery repair and diagnostics
- High cost (e.g.~400 USD per module)

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