Promotion of Low Carbon Urban Transport Systems in the Philippines (LCT) Project

Electric Vehicle Skills Mapping Report

PROMOTION OF
LOW CARBON
URBAN TRANSPORT SYSTEMS
IN THE PHILIPPINES

Promotion of Low Carbon Urban Transport Systems in the Philippines (LCT) Project

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I. Background

Globally, around 20% of CO_2 emissions are due to road transport. In the Philippines, the share is slightly higher. For context, 25% of emissions in the Philippines are from residential electricity use, another 20% is from commercial activities, while another 25% are from industry and construction activities.

What makes this more challenging is that transportation is a basic need. It is impossible to eliminate the daily movement of people and goods, considering how stretched-out our communities and lifestyles have become. We need to travel to go to school, to go to work, to shop, to relax, and many more.

The recent World Bank Group Philippines Country Climate and Development Report shows that the most impactful solution would be the adoption of electric vehicles (Evs) in the country. Conversion of up to 90% of public transport vehicles and 72% of private vehicles by 2050 can reduce up to 24.5% of emissions from transportation. Furthermore, utilizing electricity from 100% renewable sources can increase the reduction to an unprecedented 50% of emissions from transport. In comparison to other alternatives, aggressive developments in cycling and public mass transport infrastructure can only reduce emissions up to 2% and 3.4%, respectively. With this, it is arguable that electric vehicles could be the only viable solution to achieve our climate change mitigation targets through a Low Carbon Transport infrastructure.

EVs can emit significantly less pollution and greenhouse gases than conventional internal combustion engine (ICE) vehicles, even if the electricity used to charge them still comes from coal. This is because of the more efficient electric drivetrain with about 90% less mechanical parts in comparison to an internal combustion engine-powered vehicle. Some studies show that electric vehicles can be cheaper to own in the long run, as a battery-electric or plug-in electric vehicle could result in cost-savings, as well as reduced reliance on imports of crude and finished oil products. It can also result in a 20-30% reduction of greenhouse gases through power generation. The global EV market is seen to be growing due to the increasing adoption of EVs around the world.

The Philippines intends to take advantage of the benefits of this growing demand by developing the industry, along with the increase in the adoption of EVs in the country. The Philippine government has been supportive of the EV transition, as expressed through the following policies and programs:

A. PUVMP

The Public Utility Vehicle Modernization Program (PUVMP) was launched through the issuance of the Department of Transportation (DOTr) Department Order No. 2017-11 or the Omnibus Guidelines on the Planning and Identification of Public Road Transportation Services and Franchise Issuance or the Omnibus Franchising Guidelines (OFG). It targets public road transportation around the country to be “reliable, safe, accessible, environment-friendly, dependable, efficient and comfortable for its users.” It also specifies the implementation of a standard for modern jeepneys, which “should at least be Euro-4 and using PNS-compliant (Philippine National Standards) engines, LPG-powered, electronic, or hybrid.”

B. Executive Order (EO) No. 488

This EO is about the modification of "rates of import duty on components, parts and accessories for the assembly of hybrid, electric, flexible fuel and compressed natural gas vehicles, under Section 104 of the Tariff and Customs Code of 1978."

C. 2022 Strategic Investment Priority Plan

Memorandum Order No. 61 issued by the President of the Philippines is on the approval of the 2022 Strategic Investment Priority Plan. Among the investment priorities proposed under Tier II are the promotion of "a competitive and resilient economy" and "filling-in the gaps in the Philippines' industrial value chains", including those vital in the promotion of "green ecosystems". Under the green ecosystems, the "EV assembly, manufacturing of EV parts, components and systems, establishment and operation of EV infrastructure" are covered.

D. Electric Vehicle Industry Development Act (EVIDA)

The Electric Vehicle Industry Development Act (EVIDA), which has lapsed into law as of April 2022, is one of the most significant developments in the Philippine EV industry. The law covers aspects of the "manufacturing, assembly, importation, construction, installation, maintenance, trade,utilization, research and development, and regulation of electric vehicles, charging stations and related equipment, parts and components, batteries, and related support infrastructure."

The law defines EVs as a mode of transportation "with at least one (1) electric drive for vehicle propulsion." The types of EVs covered in the EVIDA are the "battery electric vehicle (BEV), hybrid electric vehicle (HEV), light electric vehicle, and a plug-in hybrid-electric vehicle (PHEV)."

Further, the EVIDA provides the following definitions of the different types of EVs:

1. Battery Electric Vehicle (BEV) refers to an electrically propelled vehicle with only a traction battery as power source for vehicle propulsion;
2. Hybrid-Electric Vehicle (HEV) refers to a vehicle with both a rechargeable energy storage system and a fueled power source for propulsion;
3. Light Electric Vehicles refer to BEVs weighing less than fifty kilograms (50 kg) such as electric scooters, electric bicycles, electric personal transport, and other similar vehicles;
4. Plug-in Hybrid Electric Vehicle (PHEV) refers to an HEV with a rechargeable energy storage system that can be charged from an external electric energy source.

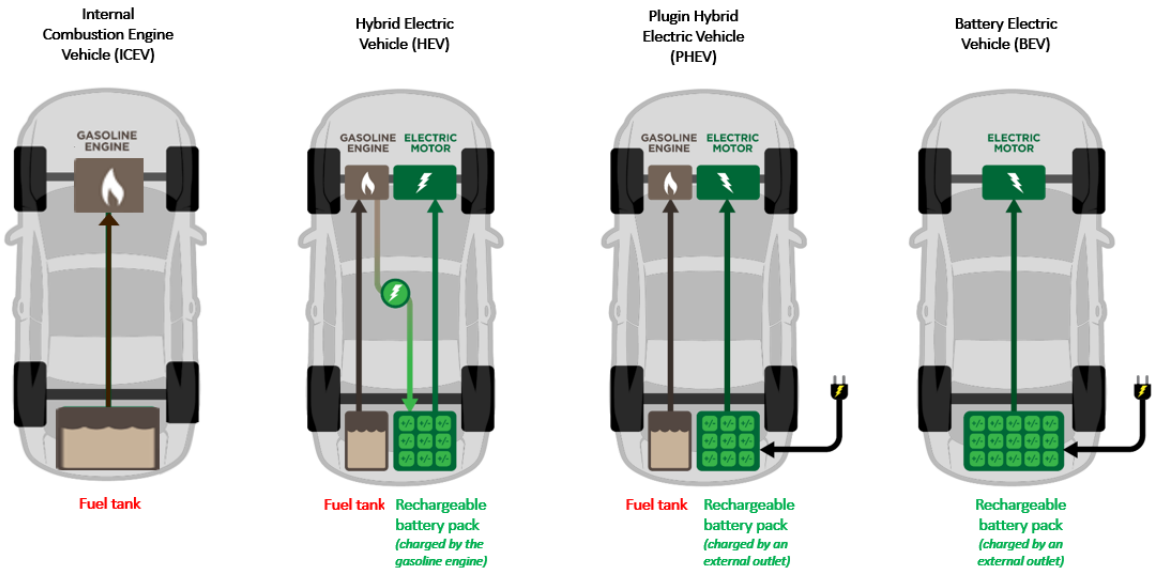

Figure 1: Illustration of the 3 major categories of EVs, as compared to a traditional internal combustion engine-powered vehicle.

> One of the objectives of the EVIDA is the "generation of employment opportunities for our local skilled workforce to sustain their livelihood."
>
> With this, the EVIDA indicates a provision under Section 6, which is on the development of a Comprehensive Roadmap for the Electric Vehicle Industry (CREVI), to accelerate the development, commercialization, and utilization of EVs in the country. One of the components of the CREVI is on human resource development which covers skills and capacity-building of needed personnel to support the development of the EV industry. The development and updating of the human resource development component of the CREVI has been tasked with the Department of Trade and Industry (DTI), in coordination with relevant government agencies such as the Department of Labor and Employment (DOLE) and TESDA.
>
> Sections 13, 14 and 16 of the EVIDA-IRR explicitly mentions that the DOTr, DTI and DPWH shall work with TESDA on the development and updating of relevant training programs for the EV industry. In addition, Section 31 of the EVIDA-IRR provides that EV users can avail of TESDA Training Programs on EV assembly, use, maintenance, and repair for its employees. For this purpose, the DOE in coordination with other NGAs and LGUs, shall issue guidelines for the effective implementation of this section.

Based on the statistics of availability of EVs as of March 2019, there were 1,511 units with 16 models of E-trikes, and 252 units with 21 models of E-Jeepneys (Electric Vehicle Association of the Philippines, 2019).

As of January 2023, the Land Transportation Franchising and Regulatory Board reported that there are 380 units of modern e-jeepneys used for public transport, with the following regional breakdown in the table below. The same list is visualized in Figure 2 below.

Table 1: Number of E-jeepneys used for public transportation by region.

Region	No. of E-Jeepneys
NCR	40
Region I	no data
Region II	15
Region III	15
Region IV-A	14
Region IV-B	no data
Region V	no data
Region VI	10
Region VII	100
Region VIII	80
Region IX	no data
Region X	no data
Region XI	no data
Region XII	86
CARAGA	20
BARMM	no data

Source: LTFRB (2023).

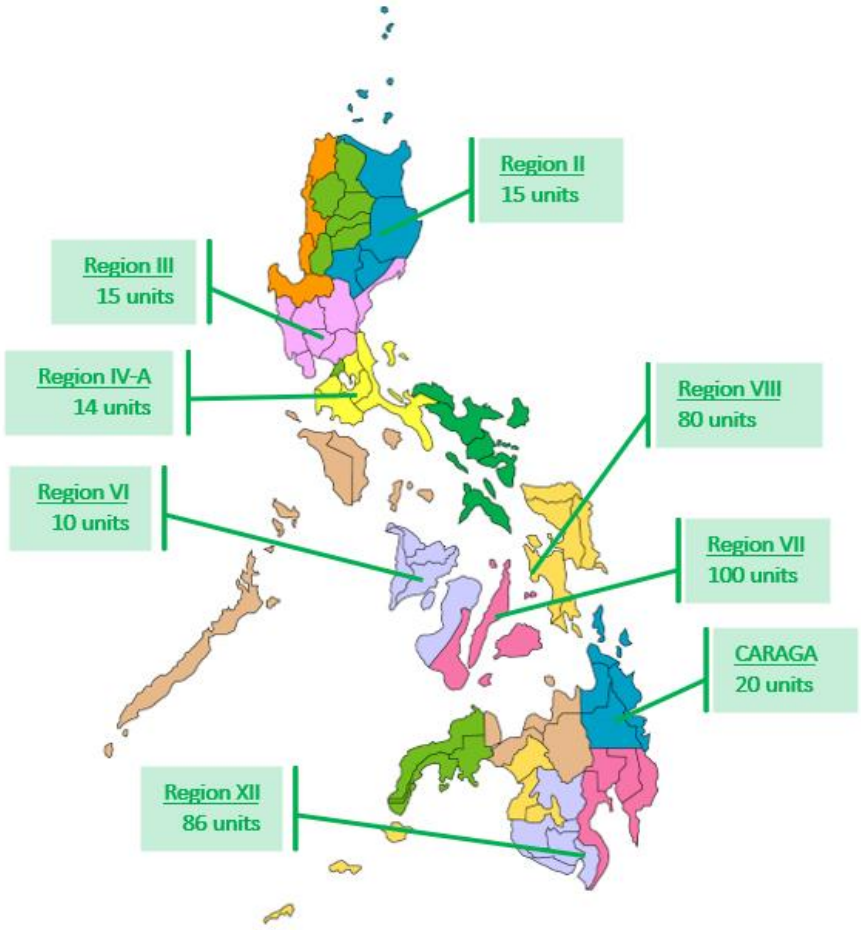

Figure 2: Regional distribution of electric jeepneys in the Philippines. (Source: LTFRB, 2023)

Below are some examples of EVs that are already available in the Philippine market by brand, model and type.

Table 2: Electric Vehicles available in the Philippine Market by Model and Type (not comprehensive, representative list only).

OEM	Model	Type		
		BEV	HEV	PHEV
BYD	Dolphin	1		
BYD	Atto3	1		
BYD	Tang			1
Nissan	Leaf	1		
Nissan	Kicks		1	
Mitsubishi	Outlander			1
Hyundai	Ioniq	1		
Toyota	Prius		1	
Toyota	Corolla Altis		1	

Toyota	Corolla Cross		1	
Toyota	Camry		1	
Toyota	Rav4		1	
Geely	Okavango		1	
Jaguar	I-Pace	1		
Suzuki	Ertiga			1
Star8	E-Jeepney	1		
Tojo Motors	E-Jeepney	1		

Source: Online search.

This initiative is part of the United Nations Development Programme - Low Carbon Transport (LCT) project. The primary objective of the UNDP-LCT project is to create an enabling environment for the commercialization of low carbon urban transport systems in the Philippines. The project has a number of initiatives, among which is capacity building which covers skills mapping and competency standards development.

TESDA, as the authority in technical education and skills development in the Philippines, ensures to address the needs of the industries in the development of its programs and standards. Relative to the agency's thrust towards demand driven TVET, TESDA aims to map the skills needs of the whole industry and analyze the subsectors to identify and validate information. Through this activity, TESDA, together with the relevant industry associations and concerned government agencies assessed the current and future skills needs as well as initiate training programs to develop skills requirements needed by the EV Industry.

II. Objectives

The skills mapping activity intends to collect information on the current situation of the EV industry in order to determine the necessary training-related support and programs.

Specifically, it intends to:

1. Determine the challenges and opportunities in the local EV industry;
2. Present and validate the skills map to the local EV industry; and
3. Determine the priority skills requirements for the industry.

III. Respondents

The standard skills mapping questionnaire for the local EV industry that was developed by TESDA was rolled out in three ways i.e., offline (editable file filled out by the respondents), online (using Zoho survey tool) and through one-on-one direct interviews (via Zoom or in-person).

The first deployment of the online survey was sent to 86 companies through various channels: 41 through the Electric Vehicle Association of the Philippines (EVAP) membership list and 45 from the United Nations Development Program-Low Carbon Transport (UNDP-LCT) email list. A second deployment of the survey was planned afterwards with an expanded EV sector jobs list, and this was sent back to the 10 companies who have already responded during the first deployment, and to 15 new participants who attended the UNDP LCT Investment Forum. The total number of

companies and individuals invited to participate in the online survey was 101, with a response rate of 12.9% (13 responses).

Additionally, 14 companies and individuals were invited for in-depth one-on-one interviews, of which 5 agreed to participate.

Overall, this skills mapping report represents the feedback of 18 companies and individuals from the local electric vehicle industry, with an overall response rate of 15.65%.

The list of respondents is provided in Table 4 below.

The respondents are categorized based on the nature of their business/industry as defined by the respondents themselves. They were then further categorized into a prospective EV sector by the study proponents. All the respondents are either already in the EV business or are currently in the traditional automotive/transportation business who are planning to get into EVs in the near future. For those who are not yet in the EV line of business, the assignment to an EV sector is "prospective" only, based on their current line of work.

The survey respondents have an average of 17.1 years of experience in the Automotive Sector and 4.4 years of experience in the Electric Vehicle sector.

Figure 3 below describes the local EV Value Chain considered in this study, while Table 3 describes each subsector in detail.

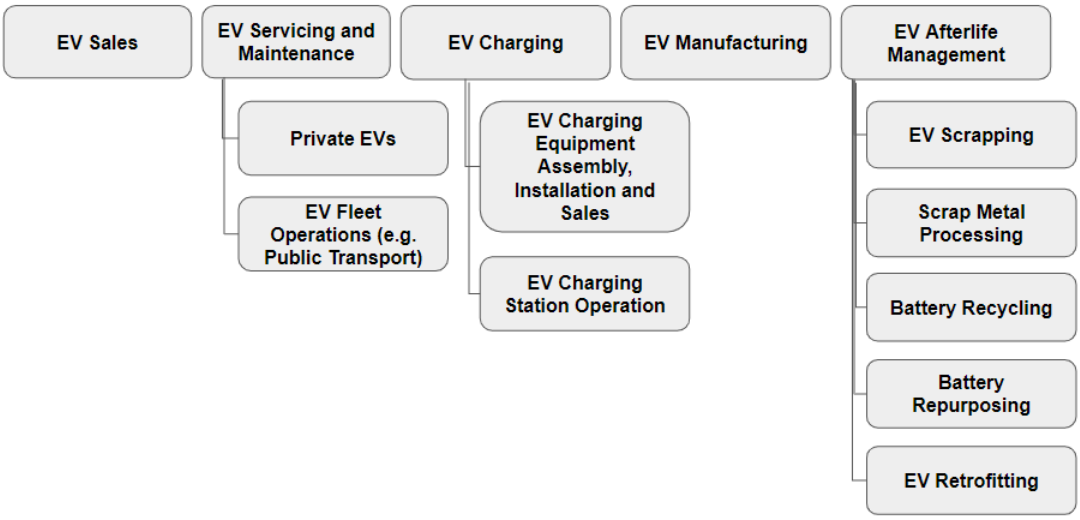

Figure 3: The local EV Value Chain considered in the study. (Source: UNDP Consultants)

Table 3: List of EV Subsectors identified for this study.

EV Sector	Description	No. of Respondents
EV Servicing and Maintenance (for Private Vehicles)	This primarily pertains to private car companies selling electric vehicles in the country. The companies are expected to be capable of performing maintenance, diagnostic and repair services on their own electric vehicle models. Respondents in this category include Nissan, Chery, Foton and Hyundai.	5
EV Fleet Operations (e.g. Public Transport Cooperatives)	This pertains primarily to Public Transport Cooperatives who are currently operating an electric jeepney fleet. Based on interviews, most of these cooperatives also perform their own maintenance and repair activities on the electric jeepneys. Respondents on this subsector include South Metro Transit Cooperative (Metro Manila), First Novo Vizcayano Travellers Transport Cooperative (Nueva Vizcaya) and Ladotransco Multipurpose Cooperative (General Santos).	5
EV Manufacturing	This pertains to companies who are involved in the manufacturing, fabrication and assembly of electric vehicles, or at least some of their major components.	6
EV Charging Equipment Assembly, Installation and Sales	This pertains to companies which are involved in the assembly, installation and/or sales of EV charging equipment. The primary respondent here is CHRG EV Inc., a local EV Charging Solutions company.	2
EV Charging Station Operation	This pertains to companies which are involved in the operation of EV Charging Stations.	1
EV Sales	This pertains to companies involved in the sales of EVs in the Philippines. The aftersales portion is covered separately by the EV Servicing and Maintenance subsector above.	7
EV Scrapping	These are components of the EV Afterlife Management sector. While there are no local respondents directly on this line of business, they have been included on the list to obtain the opinion of experts from other related sectors, and to help inform the local EV industry. A few respondents indicated that they are confident enough to comment on these subsectors, and thus their inputs were considered in this study.	0
Scrap Metal Processing		0
Battery Recycling		0
Battery Repurposing		0
EV Retrofitting		0

Table 4. List of respondents.

Name of the Company	Nature of Industry / Business (As defined by the respondent)	Prospective EV Sector based on the Value Chain (Categorized by the study proponents)	Mode of Response
Marshal Metal and Electrical Products Company	Electrical Fabrication	EV Manufacturing	Online survey
Delta Electronics Int'l Singapore Pte Ltd	EV Charging Solutions and Energy Infrastructure Solutions	EV Charging Equipment Assembly, Installation and Sales	Online survey
TDG Trading EVOxTerra	Private E-car distributor and maintenance	EV Servicing and Maintenance (for private cars); EV Sales	Online survey
sunE	Public Transport & EV Assembly	EV Manufacturing; EV Sales	Online survey
Ladotransco Multipurpose Cooperative	Public Transport	EV Fleet Operations (e.g. Public Transport Cooperatives)	Online survey
Del Monte Motor Works, Inc.	Bus Body and Rear Truck Body Manufacturer	EV Manufacturing	Online survey
ToJo Motors Corp	E-Jeep Manufacturer	EV Manufacturing; EV Sales	Online survey
Trans Oriental Motor Builders Inc.	Vehicle Fabrication	EV Manufacturing	Online survey
Del Monte Motor Works, Inc.	Bus Body and Rear Truck Body Manufacturer	EV Manufacturing	Online survey
Transport COnnect Ltd.	Vehicle Importer/Exporter	EV Sales	Online survey

Hyundai Motors, Philippines	Private E-car distributor and maintenance	EV Servicing and Maintenance (for private cars); EV Sales	Off-line survey
Nissan	Private E-car distributor and maintenance	EV Servicing and Maintenance (for private cars); EV Sales	Zoom interview
Cherry and Foton	Private E-car distributor and maintenance	EV Servicing and Maintenance (for private cars); EV Sales	Zoom interview
CHRG EV Inc	Manufacturing, installation and maintenance of EV Chargers	EV Charging Equipment Assembly, Installation and Sales; EV Charging Station Operation	Zoom interview
First Novo Vizcayano Travellers Transport Cooperative	Public Transport	EV Fleet Operations (e.g. Public Transport Cooperatives)	Zoom interview
South Metro Transport Cooperative	Public Transport	EV Fleet Operations (e.g. Public Transport Cooperatives)	In-person interview
Aerostar1 Transport Multi-Purpose Cooperative	Public Transport	EV Fleet Operations (e.g. Public Transport Cooperatives)	Online survey
Unlad Star Transport Cooperative	Public Transport	EV Fleet Operations (e.g. Public Transport Cooperatives)	Online survey

IV. Highlights of the Survey

Challenges and Opportunities

The EV industry in the Philippines faces several challenges, as well as opportunities for growth and development, of which the following are key according to the respondents:

Table 5: Challenges and Opportunities in the local EV Industry.

Areas	Challenges	Opportunities
Economic	Lack of charging infrastructure	Encourages a new era of competition
	Tariff, taxes and import duties on EVs	Savings on fossil fuel, especially considering recent fuel price hikes
	Financing companies' confidence on EVs	Investment opportunity in power producing companies
	Lack of incentives from EVIDA law	Incentives provided by the EVIDA law
	Affordability of EVs	Low cost of operation
	Limited competent suppliers and availability of spare parts	Opportunity to establishment new EV assembly plants, parts manufacturers, etc.
		Convenience of charging at home and at the same time, the business opportunity of setting up EV charging stations
		Takes advantage of the country's strength in the software and ICT sector
Employment	Limited industry players and human resources	Creates more green jobs
	Lack of experienced and skilled human resources in the local EV industry	Skilled technicians will have opportunities to enter the global EV market
	Low skills threshold in the traditional TODAs and JODAs, limiting their opportunities outside traditional public transport operations	More employment opportunities to support the growing EV industry, such as in manufacturing, charging stations, battery swapping facilities, etc.
	Poor compensation and benefits provided by local companies (i.e. urging skilled workers to go abroad)	New job openings with the entry of new brands/companies in the local automotive industry (e.g. BYD)
Education	Lack of EV related modules in current engineering courses in colleges and universities.	Opportunity to create new and upgrade existing college degrees to address the needs of this industry
	Limited training programs	Research opportunities for the local automotive industry
	Availability of equipment and trainers	Skills transfer from foreign OEMs
	Right awareness about EVs in market	Additional knowledge to be gained with entry of new technology
Skill	Lack of skills in assembly of EV components (e.g. battery, EV drivetrain, etc.)	Enhance existing skillset/s of current automotive technicians

	Requirement of different skillsets as compared to ICE vehicles	
	Lack of skills in power electronics design	
	Limited training programs	
Others	Challenge on routing of green vehicles to avoid competition with other modes, e.g. tricycles and traditional UVs	Business opportunity for manufacturing and disposal/recycling of batteries
	Overheating and disposal issues of batteries	Increased motivation for improvement in the country's renewable energy infrastructure
	Earthing issues in residential areas	Creation of additional sales & after sales services
	Quality of products	Better environment (i.e. less pollution)
	Doubt in technology	

Source: Commissioned survey and interviews.

Discussion on the key challenges:

Economic

- Limited infrastructure: The country currently lacks the infrastructure needed to support the widespread adoption of EVs, such as charging stations and battery swapping stations.
- High cost: EVs currently are more expensive than traditional gasoline-powered vehicles, making it difficult for many consumers to afford. Further, financing and insurance companies still lack confidence on EVs regarding their resale value and usable life estimation. This affects financing and insurance for EVs.
- Limited local production: The majority of EVs available in the Philippines are imported, which can make them more expensive and can also limit the growth of local manufacturing and assembly industry.

Employment

- Limited workforce with experience: The lack of skilled workers is the major issue pointed by all the respondents and observed by all OEMs, charging infrastructure providers and EV related service providers.
- Compensation/salary: The compensation and benefits provided by local companies are less, urging potential candidates to prefer to work abroad for better pay.
- Reskilling of the traditional workforce: Currently, the skill level of traditional jeepney and tricycle operators and drivers is low, limiting their opportunities outside the traditional industry. This must be addressed to minimize the social impacts of an EV transition in the local public transport sector.

Education

- Lack of EV-related education: The country currently lacks EV-related engineering courses in colleges and universities and hence impacts the technical knowledge, industry development and employment in the sector.
- Limited training: There are limited training programs as well as limited training providers and hence affects the overall skill development in the industry.
- Awareness and confidence: There is limited awareness, as well as confidence on EVs, creating concerns on range anxiety, safety, battery life and the future of the industry.

Skill

- Lack of adequate skills: The lack of adequate or specialized skills in EV industry including that in manufacturing, assembly of EV components (e.g. battery, EV drivetrain, etc.), charging infrastructure operations, emergency repairs/troubleshooting and maintenance is one of the major challenges impacting the growth of the overall industry in Philippines.
- Limited equipment and hands-on experience: The limited research and development capability, equipment and training programs impact the ability needed to understand the complex technology used in EV design and production.

Others

- Safety issues: The fear of battery explosions, overheating and disposal issues affects the safety-related confidence of the user. Further, there are other technical issues including reliable earthing in residential areas. This issue has surfaced from the experience of early adopters of the new technology, after not being able to charge their EVs at home due to lack of reliable earthing/grounding.
- Quality and Service: The majority of the EV components/parts in the Philippines are imported and hence people are doubtful about the quality and their corresponding after sales services.
- Conflicts within the industry: The EV industry faces conflicts and resistance from overcrowded TODAs / JODAs due to financial and adoption issues. The local e-jeepney subsector is clamoring for the urgent establishment of “Green Routes” that will give e-jeepneys a dedicated route, where they won’t have to compete with tricycles, traditional jeepneys, and other utility vehicles. This will reduce the risk for the cooperatives taking the leap to e-jeepneys.

Discussion on the key opportunities:

Economic

- Savings: The widespread adoption of EVs can bring environmental and economic benefits, such as reduced air pollution, lower greenhouse gas emissions, and lower fuel costs. Further, adoption of EVs will reduce dependencies on imported fossil fuels which are generally costlier and are sensitive to global market fluctuations.
- Investments: There will be ample opportunities for investment in new EV companies and for setting-up new manufacturing plants related with EV, batteries and components.
- Convenience: The EVs can be charged at home and hence could be more convenient and cost

effective.

- Exports: The Philippine EV industry can cater to the increasing demand across the ASEAN countries by exporting the EV and related components.

Employment

- More employment opportunities: The EV industry has tremendous potential for employment creation in the near future. Further, the experienced and skilled workforce may get better compensation and opportunity for global employment as green jobs are expected to increase.
- Local production: Developing a local EV manufacturing and assembly industry could create jobs and reduce costs by reducing the need to import vehicles.

Education

- New degree programs: There is ample opportunity to create new EV-related degree programs to the existing curriculum and provide specialized degrees in colleges and universities along with well-equipped laboratories.
- Knowledge transfer: Additional knowledge will be gained by the local automotive industry with entry of new and advanced technology.

Skills

- Enhance and upgrade skills for better employability: The current automotive technicians can enhance and upgrade their existing skillset/s, making them more employable in other related industries as well.

Others

- Government support: The government has shown support for the development of the EV industry, with plans to promote the use of EVs and to establish charging stations throughout the country.
- Increasing demand: As concerns about air pollution and climate change grow, the demand for EVs is likely to increase, providing opportunities for growth.
- Cost-effective: Electric vehicles are becoming more cost-effective as technology improves and economies of scale are achieved through increased production.
- Renewable energy potential: The Philippines has excellent renewable energy resources, which can be used to power electric vehicles, reducing dependence on fossil fuels.
- Urbanization: Urbanization is increasing and so is the need for sustainable transportation solutions such as EVs to curb pollution and traffic congestion.

Overall, the local EV industry is projected to grow rapidly with the increasing demand and government support. It is anticipated that the local EV manufacturing and assembly industry, and possibly the export of EV components and vehicles will follow.

Skills Requirements

Full List of Identified Jobs in the EV Subsectors

The full list of EV jobs and skills identified in each subsector is on the table below. To aid in the transition and growth of the local EV industry, even some of the non-technical, non-vocational (e.g. engineering and managerial), and non-EV jobs (e.g. cashiering, sales) have been included on the list.

Table 6: Full list of skills identified in the study.

Subsector	Jobs/Skills/Qualifications	
EV Sales	Marketing Professional / Sales Agent	Inventory Personnel
	Sales Engineer	Trainer
	Sales Manager	Cashier/Accountant
	Procurement Staff	Admin Assistant
EV Servicing and Maintenance (for private vehicles)	Electrical Service Technician	Charger Operator
	Mechanical Service Technician	Charging Equipment Technician
	EV Technician (combined mechanical and electrical)	Charging Equipment Installer
	Driver	Trainer
	Safety Officer	Cashier/Accountant
	Service Foreman	Admin Assistant
	Service Advisor	

EV Charging Equipment Assembly, Installation and Sales	Charger Design Engineer	Charger Operator
	Charger Design Technician	Equipment Sales Personnel
	Charger Assembly Technician	Sales Manager
	Charging Equipment Installation Technician	Project Manager
	Charging Equipment Installation Engineer	Procurement Staff
	Installation Supervisor	Trainer
	Service Foreman	Cashier/Accountant
	Charger Equipment Service Technician	Admin Assistant
EV Charging Station Operation	Charging Equipment Service Technician	Supervisor
	Charging Equipment Installer	Site Manager
	Charger Operator	Procurement Staff
	Project Manager	Trainer
	Equipment Sales Personnel	Cashier/Accountant
	Equipment Engineer	Admin Assistant
EV Fleet Operations (e.g. Public Transport Cooperatives)	Chief Mechanic / Service Foreman	Charging Equipment Technician
	Electrical Service Technician	Safety Officer
	Mechanical Service Technician	Driver
	EV Technician (combined electrical and mechanical)	Trainer
	Fleet Manager	Cashier/Accountant

	Battery Technician	Admin Assistant
	Charger Operator	
EV Manufacturing	Electrical Engineer	Manufacturing Engineer
	Electrical Technician	Test Engineer
	Electronics Technician	Test Technician
	Electronics Engineer	Warehouse staff
	Mechanical Engineer	Parts inventory staff
	Mechanical Technician	Delivery staff
	Automotive Engineer	Driver
	Automotive Technician	Project Manager
	Welder	Fabrication Supervisor
	Carpenter / Wood Fabricator	Shop Supervisor
	Metal Fabricator	Procurement Staff
	Mold Technician	Trainer
	Automotive Painter	Operations Manager
	Battery Technician	Accountant
	Battery Engineer	Finance Manager
	Industrial Designer	Admin Assistant

	Industrial Engineer	
EV Scrapping	EV Disposal and Recycling Specialist	EV Dismantler
	Body Compacting machine operator	Valuation Specialist
	Crane / Hoist Operator	Waste Collection Workers
Scrap Metal Processing	Plant & Machine Operator	Production, Material and Warehouse Manager
	Scrap Workers/Sorters (Dismantling Technician)	
Battery Recycling	Battery Testing Technicians	Plant & Machine Operator
	Warehouse manager	Material Sorting / Battery Dismantling Technician
Battery Repurposing	Battery Repurposing Engineer	Repurposed Battery Pack Logistics Manager
	Battery Testing Technicians	Plant & Machine Operator
	Battery Pack Dismantling Technicians	Material Sorting / Battery Dismantling Technician
	Battery Pack Re-Assembling Technicians	
EV Retrofitting	Welder	Machining Technician
	Logistics Manager for Spares and Kits	Waste Treatment Machine Operator
	Electric Vehicle Service Technician	

Source: UNDP Consultants.

Technical Skills

The results of the prioritization survey are provided in Table 8. For job/skill, the participants were requested to (1) assess the urgency (i.e. needed in the next 1 to 3 years, 3 to 5 years, or not urgently needed); (2) comment on the shortage of workers (i.e. Low, Medium, High); and (3) provide insights on the reasons, constraints and recommended action.

It is important to note that TESDA has a criterion for recommending a skill requirement for either Competency Standard (CS) or Training Regulation (TR) development. Only those which are urgently needed (either in the next 1 to 3, or 3 to 5 years) and have HIGH shortage of workers can be recommended for TR development. The rest of the urgently needed skills are automatically recommended for CS development. This decision matrix is shown on Table 7 below.

Table 7: TESDA Decision Matrix for Competency Standard (CS) and Training Regulation (TR) Development.

Assessing the shortage of workers	Years the job/skills are immediately needed	
	Needed in the next 1-3 years	Needed in the next 3-5 years
Low (100 or less workers)	CS	CS
Medium (100-500 workers)	CS	CS
High (500 or more workers)	TR	TR

Source: TESDA Circular No. 001 series of 2023.

Due to the long and comprehensive list of skills considered in this study, it is deemed necessary to screen the results shown in Table 8 to ensure that the message is communicated clearly in this report. The jobs, skills and qualifications which were marked as “Not immediately needed” by at least 25% of the respondents, and those with a rating of 30% and lower with regards to shortage of workers have been excluded from Table 8.

The complete information on the rest of the jobs, skills and qualifications can be found in Appendices 1 and 2.

Table 8: Priority skills and recommended actions from the surveys and interviews.

Subsector	Jobs / Skills / Qualifications	Urgency: Jobs Needed in		Shortage of Workers			Reasons / Constraints in filling-up the skills requirements	Recommended Action
		1-3 yrs	3-5 yrs	Low	Med	High		
EV Sales	Trainer	Yes			Yes		Prefer to work abroad.	Support the deployment of the existing Trainers Methodology Level I (In-Company Trainer)
EV Servicing and Maintenance (for private vehicles)	Electrical Service Technician	Yes				Yes	Prefer to work abroad.	For TR development
	Mechanical Service Technician	Yes			Yes		Prefer to work abroad.	For CS development
	EV Technician (combined mechanical and electrical)	Yes				Yes	Prefer to work abroad.	For TR development
EV Charging Equipment Assembly, Installation and Sales	Charger Design Engineer	Yes				Yes	No qualified applicants.	For integration in related higher education degree programs.
	Charger Design Technician	Yes				Yes	Prefer to work abroad.	For TR development
	Charger Assembly Technician	Yes				Yes	Seek higher pay.	For TR development
EV Charging Station Operation	Charging Equipment Service Technician	Yes				Yes	No qualified applicants.	For TR development
	Charging Equipment Installer	Yes				Yes	Prefer to work abroad.	For TR development
	Charger Operator	Yes			Yes		Prefer to work abroad.	For CS development

	Trainer	Yes			Yes		Prefer to work abroad.	Support the deployment of the existing Trainers Methodology Level I (In-Company Trainer)
EV Fleet Operations (e.g. Public Transport Cooperatives)	Electrical Service Technician	Yes				Yes	Prefer to work abroad.	For TR development
	Mechanical Service Technician	Yes			Yes		No qualified applicants.	For CS development
	EV Technician (combined mechanical and electrical)	Yes			Yes		Prefer to work abroad.	For CS development
	Battery Technician	Yes				Yes	No qualified applicants.	For TR development
	Charger Operator	Yes				Yes	No qualified applicants.	For TR development
	Safety Officer	Yes				Yes	No qualified applicants.	For TR development
EV Manufacturing	Battery Technician	Yes			Yes			For CS development
	Battery Engineer	Yes			Yes			For integration in related higher education degree programs.
	Test Engineer	Yes			Yes			For integration in related higher education degree programs.
	Test Technician	Yes			Yes			For CS development
Battery Recycling	Battery Testing Technicians	Yes				Yes		For TR development

EV Retrofitting	Logistics Manager for Spares and Kits	Yes			Yes		No qualified applicants.	For CS development
	Electric Vehicle Service Technician	Yes			Yes		Prefer to work abroad.	For CS development

Source: Commissioned survey and interviews.

Priority Skills

Highest priority skills are the EV Technician (combined mechanical and electrical); Charger Design Engineer, Trainer, Battery Technician, Battery Engineer, Test Engineer, and Test Technician positions. It is interesting to note that the Trainer position is in demand from multiple subsectors, particularly EV Sales and EV Charging Station Operations. For this requirement, it is encouraged that the existing Trainers Methodology Level I (In-Company Trainer) of TESDA be deployed.

In this skills mapping exercise, the proponents explored separating the electrical and mechanical skillsets and also combining them. The results of the survey and of the parallel interviews conducted revealed that it is desirable to have a combined electrical and mechanical skillset. This gave rise to what is called the EV Technician position in this report. This was further verified during the Validation Workshop, and more information on this is provided in the corresponding discussion further into this report.

Coincidentally, the dedicated Electrical Service Technician still appeared high in demand, while not so much for the Mechanical Service Technician as this skillset can be provided by existing technicians knowledgeable with traditional vehicles. However, the interviewees raised the concern of traditional mechanical technicians with regards to electrical safety. According to the interviewees, particularly from the EV Fleet Operations (e.g. Public Transport Cooperatives) subsector, most mechanical technicians would decline servicing their vehicles once they find out that it is an electric vehicle due to fear of being electrocuted. Thus, it is also recommended to develop a short course on Basic EV Troubleshooting and Safety to address this. This short course can also address the need of non-technical/non-hands-on positions in the local EV sector, such as Sales Professionals, Service Advisors, and Safety Officers.

It is also reflected in this skills mapping exercise that there is an urgent need for a skilled workforce in the charging and battery sectors. Particularly, there is a need for Charger Design Engineers and Technicians, Charger Assembly Technicians, Charging Equipment Service Technicians, Charger Equipment Installer and Charger Operators. There is also a need for Battery Technicians both from the EV Fleet Operations and EV Manufacturing subsectors. A related skill, Battery Testing Technician, is also needed in the Battery Recycling Subsector.

Relevance of existing TESDA Programs and the need for new ones

According to one of the respondents from the Charging Subsector during the interview, they require their installation technicians to take the Electrical Installation and Maintenance NC II course. The respondents also agree that there is currently a low-to-medium availability of Charger Design Engineer and Technicians in the market. Currently, a related skillset is being provided by the Electronic Products Assembly and Servicing NC II course, so it may be explored to further expand this skillset.

Based on the interviews conducted, the EV subsectors are able to get by and they are able to figure out how to fill-in the skill gaps on their own, by providing their own in-house training on top of requiring other existing TESDA programs (e.g. Automotive Servicing NC II). However, they still emphasize the need to create new training programs, perhaps to standardize the competencies and to create a larger applicant pool for their requirements.

Constraints in filling-up the Required Positions

Currently, there is low availability and mostly no qualified applicants for highly technical positions. Furthermore, people with highly technical skills would prefer to work abroad. Also, as in most other industries, other positions which seem to be easier to fill (e.g. procurement staff, accountants, admin staff, supervisors, and some technician positions) also become challenging because people seek higher pay. The currently small size of the EV sector also creates challenges on the work schedule and preferences of positions such as marketing and sales professionals. People look for more secure and stable jobs.

Other Technical Skills

The other technical skills identified by the respondents for some positions are as follows:

Table 9: Other technical skills required by the stakeholders.

Job	Skill
EV Electrical Service Technician	Battery & charging knowledge Troubleshooting Skills
EV Mechanical Service Technician	Electromechanical Knowledge Mechanical troubleshooting
EV Driver	Computer literate Emergency troubleshooting EV controls
EV Safety Officer	Knowledge of environmental and safety laws Maintenance audit for EV performance
EV Service Foreman	Electrical & mechanical troubleshooting Maintenance audit for EV performance
Customer Service Engineer	Electrical & mechanical troubleshooting EV product knowledge Computer literacy
Charging Equipment Installer	Battery and charging knowledge Electrical & mechanical troubleshooting Computer literacy
Charging station operator	Battery and charging knowledge

	Electrical & mechanical troubleshooting Computer literacy
Charging Equipment and Battery Technician	Battery and charging knowledge Mechanical troubleshooting Computer literacy
EV Fleet Operations Manager	Business economics Computer literacy

Source: Commissioned survey and interviews.

Soft and Essential Skills

According to the respondents, the following are the soft skills/attributes they desire from workers in the e-car service/EV charging industry. In addition to the ones mentioned in the table below, there is also a general comment from the respondents that customer handling skills are also relevant for each position.

Table 10: Soft or essential skills required by the stakeholders.

Job Description	Skill #1	Skill #2
EV Electrical Service Technician	Communication & Presentation Skills	Leadership Skills
EV Mechanical Service Technician	Communication & Presentation Skills	Leadership Skills
EV Service Foreman	People Skills	Leadership Skills
Customer Service Engineer	Problem solving skills	People Skills
EV Fleet Operations Manager	People Skills	Problem Solving Skills

Source: Commissioned survey and interviews.

Skills Related to the Fourth Industrial Revolution

The following are some of the actions that have been taken by the respondents who reported that their industry/sector is ready for 4IR:

- Use of technology for advanced ways of understanding the vehicle condition, such as use of diagnostic tools during troubleshooting.
- Training of personnel on the use of advanced vehicle troubleshooting tools.
- Use of technology for more efficient financial management systems.
- Use of technology to control the performance of EVs (e.g. speed limiter).

Specific examples provided by the respondents include the following:

1. Battery testing and impedance spectroscopy
2. Digital Signal Processing
3. Use of special diagnostic tools. These are programs/software used to understand the condition of the car for troubleshooting.
4. Internet of Things (IoT)
5. Embedded Neural Networks
6. Power Conversion (e.g. GaN HEMTs - Gallium Nitride Transistor)
7. Software Development
8. Automation and diagnostics
9. GPS monitoring
10. Networking and debugging of wifi for remote monitoring of charging stations
11. Automatic fare collection system
12. Familiarity with self-driving technologies
13. Interconnectivity of charging stations

Readiness of EV Industry for 4IR

Based on the identified emerging skills in the EV industry/sector relevant to 4IR, 56.3% of the respondents were of the view that their industry/sector is ready for it, whereas 37.5% of the respondents reported that their industry/sector is not yet ready. 6.2% did not respond to this question.

Table 11: Response of stakeholders with regards to 4IR readiness.

Response		Yes	No	No Response
1	Established plans to address the requirements	56.3%	37.5%	6.2%
2	Started some initiatives/programs in terms of training and development of the human resource	56.3%	37.5%	6.2%
3	Started some initiatives/programs for the acquisition of equipment and materials relevant for the requirements	56.3%	37.5%	6.2%

Source: Commissioned survey and interviews.

Possible Providers of the Program

As per the respondents, the following are the recommended and possible training providers of the programs that will be implemented. It should be noted that some of the companies below are respondents of the survey, and they have indicated their interest to become one of the first trainers of the recommended programs.

- Technical Education and Skills Development Authority (TESDA)
- South Metro Transport Cooperative (expressed interest)

- CHRG EV Inc (expressed interest)
- pManifold EV Academy (expressed interest)
- TTi Global (recommended)
- e-Sakay (recommended)
- De La Salle University (recommended)
- Cavite State University (recommended)
- Star8 (recommended)
- Cooperative Development Authority (recommended)
- Office of Transport Cooperatives (recommended)
- OEMs (internal training programs for in-house staff)

Other Affected Sectors/Sub-industries

Some of the jobs and skills requirements in the emerging EV industry are cross cutting among various industries. Understandably, the most relevant sub-industry to EV-skilled persons is Electrical and Electronics. This is followed by Automotive and Land Transportation, Manufacturing, Utilities and HVAC.

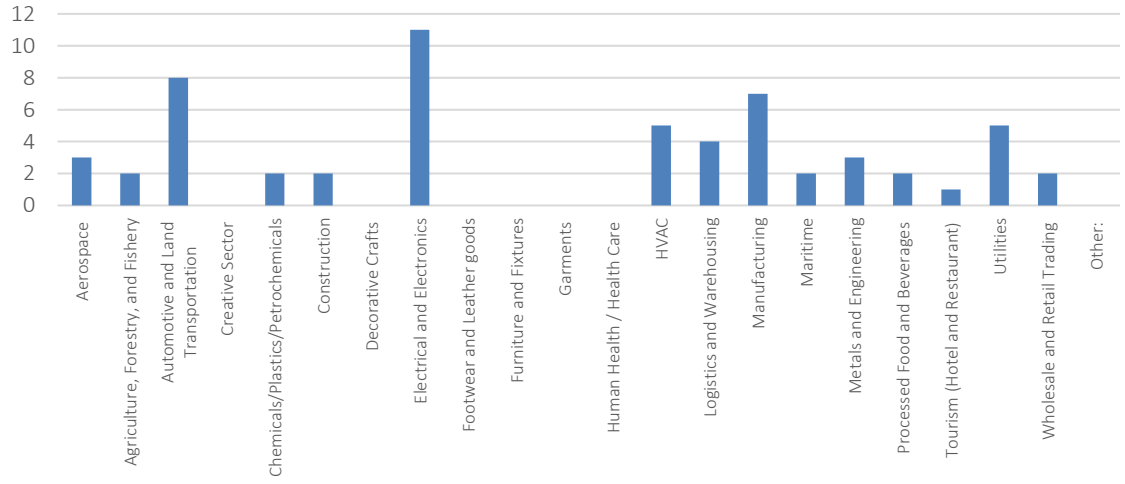

Figure 4: Other industry where EV-skilled personnel may be employed. (Source: Commissioned survey and interviews)

V. Mapping of Skills Requirements vis-a-vis Existing TR

As mentioned, some of the technical jobs/skills requirements of the industry already have existing Training Regulations. These are summarized below.

Table 12: Equivalent qualifications for the job/skills in the Automotive Industry.

Value Chain	Job/Skills	Corresponding TR/CS *(Reference: https://bit.ly/CorrespondingTRandCS)*
EV Sales	Trainer	Trainers Methodology Level I (Trainer/Assessor)
		Trainers Methodology Level I (In-Company Trainer)
	Cashier/Accountant	Customer Services NC II
EV Servicing and Maintenance (for private vehicles)	Electrical Service Technician	Automotive Servicing (Electrical Repair) NC II
		Automotive Electrical Assembly NC II
	Mechanical Service Technician	Automotive Mechanical Assembly NC II
	Driver	Driving NC II
	Charging Equipment Technician	Electrical Installation and Maintenance NC II
	Charging Equipment Installer	Electrical Installation and Maintenance NC II
	Trainer	Trainers Methodology Level I (Trainer/Assessor)
		Trainers Methodology Level I (In-Company Trainer)
	Cashier/Accountant	Customer Services NC II
EV Charging Equipment Assembly, Installation and Sales	Charging Equipment Installation Technician	Electrical Installation and Maintenance NC II
	Charger Equipment Service Technician	Electrical Installation and Maintenance NC II
	Trainer	Trainers Methodology Level I (Trainer/Assessor)
		Trainers Methodology Level I (In-Company Trainer)
	Cashier/Accountant	Customer Services NC II

EV Charging Station Operation	Charging Equipment Service Technician	Electrical Installation and Maintenance NC II
	Charging Equipment Installer	Electrical Installation and Maintenance NC II
	Trainer	Trainers Methodology Level I (Trainer/Assessor)
		Trainers Methodology Level I (In-Company Trainer)
	Cashier/Accountant	Customer Services NC II
EV Fleet Operations (e.g. Public Transport Cooperatives)	Electrical Service Technician	Automotive Servicing (Electrical Repair) NC II
		Automotive Electrical Assembly NC II
	Mechanical Service Technician	Automotive Mechanical Assembly NC II
	Driver	Driving (Passenger Bus/Straight Truck) NC III
	Trainer	Trainers Methodology Level I (Trainer/Assessor)
		Trainers Methodology Level I (In-Company Trainer)
	Cashier/Accountant	Customer Services NC II
EV Manufacturing	Electrical Technician	Automotive Servicing (Electrical Repair) NC II
	Electronics Technician	Electronic Products Assembly and Servicing NC II
	Mechanical Technician	Automotive Mechanical Assembly NC II
	Automotive Technician	Automotive Servicing NC I
		Automotive Servicing NC II
		Automotive Servicing (Chassis Repair) NC II
		Automotive Servicing (Electrical Repair) NC II
		Automotive Servicing (Engine Repair) NC II
		Automotive Servicing NC III
		Automotive Servicing NC IV
	Welder	Shielded Metal Arc Welding (SMAW) NC I

		Shielded Metal Arc Welding (SMAW) NC II
		Shielded Metal Arc Welding (SMAW) NC III
		Shielded Metal Arc Welding (SMAW) NC IV
		Gas Metal Arc Welding (GMAW) NC I
		Gas Metal Arc Welding (GMAW) NC II
		Gas Metal Arc Welding (GMAW) NC III
		Flux Cored Arc Welding (FCAW) NC I
		Flux Cored Arc Welding (FCAW) NC II
		Flux Cored Arc Welding (FCAW) NC III
		Gas Tungsten Arc Welding (GTAW) NC II
		Gas Tungsten Arc Welding (GTAW) NC IV
		Submerged Arc Welding (SAW) NC I
		Submerged Arc Welding (SAW) NC II
		Gas Welding NC I
		Gas Welding NC II
	Carpenter / Wood Fabricator	Carpentry NC II
		Carpentry NC III
	Automotive Painter	Automotive Painting NC II
		Automotive Body Painting/Finishing NC II
	Warehouse staff	Warehousing Services NC II
	Driver	Driving NC II
		Driving (Passenger Bus/Straight Truck) NC III
		Driving (Articulated Vehicle) NC III
	Trainer	Trainers Methodology Level I (Trainer/Assessor)
		Trainers Methodology Level I (In-Company Trainer)

VI. TVET Capacity

Table 13 below shows the total number of enrolled, graduate, assessed, and certified (EGAC) from 2020 to 2022 by qualification with training regulation (WTR) that are relevant to the electric vehicle industry.

Table 13: Total Number of Enrolled, Graduated, Assessed, and Certified by Qualification (WTR): 2020 - 2022.

Corresponding TR/CS	**Coverage** *Last three (3) years: 2020-2022*			
	Enrolled	Graduates	Assessed	Certified
Trainers Methodology Level I (Trainer/Assessor)	21,382	18,279	13,007	9,373
Trainers Methodology Level I (In-Company Trainer)				
Customer Services NC II	477	526	1,625	1,506
Automotive Servicing (Electrical Repair) NC II	44	0	529	503
Automotive Electrical Assembly NC II	216	187	0	0
Automotive Mechanical Assembly NC II	53	53	1	1
Driving NC II	115,844	110,853	150,760	141,622
Electrical Installation and Maintenance NC II	67,439	66,479	98,658	90,848
Driving (Passenger Bus/Straight Truck) NC III	1,898	1,676	12,179	11,543
Electronic Products Assembly and Servicing NC II	23,931	24,947	31,563	28,407
Automotive Servicing NC I	11,881	12,538	21,530	20,067
Automotive Servicing NC II	9,571	9,448	24,784	22,417
Automotive Servicing (Chassis Repair) NC II	0	0	582	566
Automotive Servicing (Engine Repair) NC II	20	2	1,657	1,641
Automotive Servicing NC III	132	101	800	750

Automotive Servicing NC IV	138	67	783	737
Shielded Metal Arc Welding (SMAW) NC I	61,345	65,443	69,052	65,236
Shielded Metal Arc Welding (SMAW) NC II	71,737	75,221	99,200	93,491
Shielded Metal Arc Welding (SMAW) NC III	3,363	3,587	3,595	3,498
Shielded Metal Arc Welding (SMAW) NC IV	299	285	414	394
Gas Metal Arc Welding (GMAW) NC I	177	145	213	188
Gas Metal Arc Welding (GMAW) NC II	2,711	2,862	3,316	3,245
Gas Metal Arc Welding (GMAW) NC III	23	31	32	32
Flux Cored Arc Welding (FCAW) NC I	81	71	27	27
Flux Cored Arc Welding (FCAW) NC II	266	239	620	616
Flux Cored Arc Welding (FCAW) NC III				
Gas Tungsten Arc Welding (GTAW) NC II	3,154	3,634	4,593	4,481
Gas Tungsten Arc Welding (GTAW) NC IV				
Submerged Arc Welding (SAW) NC I				
Submerged Arc Welding (SAW) NC II				
Gas Welding NC I	50	49	37	37
Gas Welding NC II	13	27	0	0
Carpentry NC II	23,139	24,207	26,565	25,381
Carpentry NC III	116	131	273	263
Automotive Painting NC II				
Automotive Body Painting/Finishing NC II	12	12	0	0
Warehousing Services NC II	13	0	0	0
Driving (Articulated Vehicle) NC III	202	200	5,926	5,612

Source: TESDA Training Management Information System, TESDA Certification Office

Table 14: Total Number of Assessment Centers, Competency Assessor, Registered Programs, NTTC Holder (as of December 2022).

Corresponding TR/CS	Infrastructure (As of 2022)			
	Registered Programs	Trainers (NTTC Holder)	Assessment Centers	Assessors
Trainers Methodology Level I (Trainer/Assessor)	286		117	145
Trainers Methodology Level I (In-Company Trainer)			3	0
Customer Services NC II	12	78	8	24
Automotive Servicing (Electrical Repair) NC II	8	144	20	31
Automotive Electrical Assembly NC II	3	3	1	0
Automotive Mechanical Assembly NC II			0	0
Driving NC II	694	2095	368	740
Electrical Installation and Maintenance NC II	490	1476	249	498
Driving (Passenger Bus/Straight Truck) NC III	31	206	77	127
Electronic Products Assembly and Servicing NC II	288	737	120	194
Automotive Servicing NC I	196		95	209
Automotive Servicing NC II	225	581	44	145
Automotive Servicing (Chassis Repair) NC II	10	143	16	30
Automotive Servicing (Engine Repair) NC II	14	149	22	33
Automotive Servicing NC III	7	92	10	13
Automotive Servicing NC IV	3	53	5	7
Shielded Metal Arc Welding (SMAW) NC I	569		314	425

Shielded Metal Arc Welding (SMAW) NC II	784	2249	379	693
Shielded Metal Arc Welding (SMAW) NC III	58	324	46	70
Shielded Metal Arc Welding (SMAW) NC IV	4	59	7	10
Gas Metal Arc Welding (GMAW) NC I	17		7	9
Gas Metal Arc Welding (GMAW) NC II	56	336	38	87
Gas Metal Arc Welding (GMAW) NC III	3	12	3	5
Flux Cored Arc Welding (FCAW) NC I	7		2	0
Flux Cored Arc Welding (FCAW) NC II	15	130	14	19
Flux Cored Arc Welding (FCAW) NC III		1	1	0
Gas Tungsten Arc Welding (GTAW) NC II	74	323	47	85
Gas Tungsten Arc Welding (GTAW) NC IV			0	1
Submerged Arc Welding (SAW) NC I			0	0
Submerged Arc Welding (SAW) NC II			0	1
Gas Welding NC I	1		1	2
Gas Welding NC II	4	1	2	2
Carpentry NC II	230	579	111	245
Carpentry NC III	6	48	10	23
Automotive Painting NC II		2	1	0
Automotive Body Painting/Finishing NC II	3	5	0	3
Warehousing Services NC II	1	1	2	0
Driving (Articulated Vehicle) NC III	5	65	38	41

Source: TESDA Training Management Information System, TESDA Certification Office

VII. Validation Workshop

A validation workshop was conducted on 20 April 2023 via Zoom. Including the proponents of the study, the workshop was well-represented across various key stakeholders and agencies with 32 participants. The breakdown is shown on the table below. It is important to note that some attendees identify with more than one category/sub-sector.

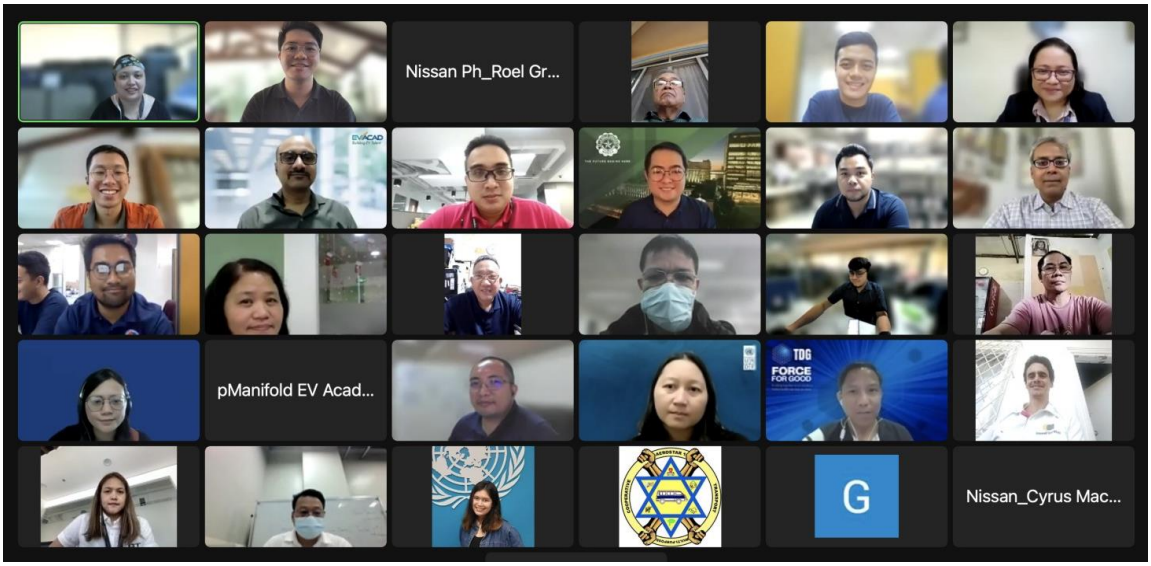

Figure 5: Screenshot of participants from the EV Skills Mapping Validation Workshop.

Table 15: Breakdown of participants in the EV Skills Mapping Validation Workshop.

Category	Description	No. of Participants
TESDA	The workshop was facilitated by the TESDA Planning Office and attended also by representatives from the Qualifications and Standards Office.	5
Government Agency	Representatives from the Department of Energy, Department of Trade and Industry and Department of Transportation.	3
Development Agency	Sponsoring development agency, the United Nations Development Programme.	4
Consultants	Individual consultants to the project, Dr. Neil Stephen Lopez from De La Salle University, and team from pManifold EV Academy, India, led by Rahul Bagdia and Vikrant Vaidya.	4
EV Charging	EV Charger design assembly and sales company CHRG EV Inc.	1
EV Fleet Management	Public transport cooperatives, particularly South Metro Transport, Unlad Star Transport, and Aerostar1 Transport.	3

EV Manufacturing	Vehicle manufacturers and/or assemblers, particularly, Tojo Motors and Trans Oriental Motor Builders.	2
EV Sales	Representatives from EV distribution business, particularly Nissan Philippines, TDG Trading, SunE, and Tojo Motors.	8
EV Servicing and Maintenance	Representatives from the private car sector, particularly from Nissan Academy and TDG Trading.	6
Other	There were two (2) industry representatives which were not identified properly.	2

On Challenges and Opportunities

During the first part of the workshop, the government agencies reiterated the prohibitive costs of electric vehicles. However, with the help of the EVIDA, they are confident that market forces will resolve these issues. Additionally, they believe the opportunity now is very good for local stakeholders to step up to manufacture and assemble local components for EVs.

On the other hand, representatives from the public transport cooperatives raised the issue of technology familiarity, durability and reliability. From the business perspective, they also raised the challenge of having limited suppliers to choose from and assurance of after sales support. They also reiterated the urgency for the development of green routes to reduce, if not eliminate, competition on the road for electric jeepneys, making the investment more practical and profitable.

Lastly, the EV Sales subsector talked about the high cost of electricity, which makes selling private EVs difficult, the need for the government to expand renewable energy generation, and the need for the government to increase the demand for EVs from the government sector.

On Skills Requirements

The DOTr representatives floated the idea of using the existing Driving NC II to train e-jeepney Drivers. Perhaps an additional module may be added to orient drivers with the basic operation and troubleshooting of simple electric vehicles.

The manufacturing subsector requested that the existing Automotive Mechanical Assembly NC II be imbued with basics of electro-mechanical systems since the electric vehicle drivetrain is heavily electrical. This position should have a good understanding of how electrical power is converted into mechanical power. Furthermore, the EV servicing and maintenance subsector shared that an EV technician should have (1) basic knowledge of EV components and systems; (2) ability to diagnose and troubleshoot issues; (3) ability to perform repair and maintenance; and (4) ability to provide good customer service.

On Recommendations

A Single EV Technician Position

During the in-depth interviews with the industry, the idea of creating a technician position with a combined mechanical and electrical skillset was floated. This skill requirement, referred to as "EV Technician" in this report, reflected high priority in the survey. The proponents tried to validate this with the stakeholders, and the consensus was that it really does make sense to just combine the two skillsets. The private EV sector emphasized that while there are levels in their technician positions (i.e. the skill requirement becomes more specific as the rank goes higher), the end goal is still to have a holistic technician with knowledge of the whole vehicle, in preparation for a future supervisory position. Furthermore, having a combined skillset will make the person more hirable, making it easier to find jobs. This will also make it faster for all the stakeholders as they will not need to take a separate certification for electrical and mechanical. Thus, the consensus is to pursue a combined EV Electrical and Mechanical position, that will be referred to as EV Technician. During the Functional Analysis process, the proponents will further study if an entirely new training program will be needed, or if the existing Automotive Servicing TRs can be built upon.

On Separating Battery and Charging Technicians

The consensus of the stakeholders is to separate the battery and charging equipment technician positions. Maintaining and working on the batteries should not be the primary responsibility of a technician, but of the supplier. Also, a combined skillset might be beneficial to fleets which operate on a battery swapping system, but this is not necessarily what all cooperatives practice. Thus, the conclusion is to separate the two positions (i.e. Battery Technician and Charging Equipment Technician), while prioritizing the Charging Equipment Technician position and including battery monitoring and safety basics on it.

On Separating the Hybrid Electric and Battery Electric Vehicle positions

The TESDA prioritized the Automotive Servicing - Hybrid Vehicles position way back in 2015. This was brought up to the stakeholders during the validation workshop to confirm if the requirements for the hybrid electric vehicle technicians overlap significantly with battery electric vehicle technicians, and thus, if the training provisions can be combined. The opinion of the stakeholders is that the hybrid drivetrain is complicated and should not be combined with BEV training. The training on the hybrid drivetrain is a standalone course, while the full-electric BEV drivetrain is simpler. Thus, the conclusion is that the two skillsets should not be merged together.

Introductory modules on EV basics for non-hands-on positions

The stakeholders validated the need for introductory training modules on EV basics targeted for non-hands-on positions, such as Safety Officers, In-Company Trainers, Sales Professionals, etc.

VIII. Way Forward

Having considered the findings from this skills mapping survey activity and the corresponding validation workshop, below are the recommendations.

Table 16: Summary of recommendations from the skills mapping activity.

Recommendation	Office in Charge
• Provide support to build the infrastructure needed to implement the following existing Training Regulations: o Automotive Servicing (Electrical Repair) NC II o Electrical Installation and Maintenance NC II o Driving NC II o Driving (Passenger Bus/Straight Truck) NC III o Trainers Methodology Level I (In-Company Trainer) o Customer Services NC II o Automotive Mechanical Assembly NC II o Automotive Painting NC II o Electronic Products Assembly and Servicing NC II o Warehousing Services NC II o Various Welding TRs (see Appendix 2)	Industry Associations, Companies, TESDA
• Develop TRs on the following requirements: o EV Technician o Electrical Service Technician o Charger Design Technician o Charger Assembly Technician o Charger Equipment Service Technician o Charging Equipment Installer o Battery Technician o Charger Operator o Safety Officer	Industry Associations, Companies, TESDA
• Develop a CS on the following requirements: o Chief Mechanic / Service Foreman o Fleet Manager o Mechanical Service Technician o Battery Testing Technicians o Logistics Manager for Spares and Kits o Battery Pack Dismantling Technicians o Battery Pack Re-Assembling Technicians	Industry Associations, Companies, UNDP, TESDA

○ Logistics Manager for Spares and Kits ○ Battery Pack Re-Assembling Technicians ○ Fabrication Supervisor ○ Inventory Personnel ○ Metal Fabricator ○ Mold Technician ○ Shop Supervisor ○ Test Technician	
• For integration in existing higher education degree programs: ○ Charger Design Engineer ○ Battery Engineer ○ Test Engineer	Industry Associations, Companies, UNDP, CHED, HEIs
• Develop short courses on the following requirements: ○ Basic EV Troubleshooting and Safety ○ Equipment Sales Personnel ○ Marketing Professional / Sales Agent ○ Parts inventory staff ○ Admin Assistant ○ Procurement Staff ○ Cashier	Industry Associations, Companies, UNDP, TESDA
• Prioritize the implementation of training programs for the e-jeepney sector, specifically in Regions II, III, IV-A, VI, VII, VIII, XII, CARAGA and NCR, where a strong presence of the local EV industry is currently present.	Industry Associations, Companies, UNDP, TESDA, LGUs

Priorities

As confirmed during the validation workshop, the priority is the development of a CS/TR for the EV Technician (combined mechanical and electrical) position. In consideration of the urgency and of the limited market for this skillset as of now, a CS may be prioritized first and the corresponding TR may follow after the local market has shown growth in the next few years, as the provisions of the EVIDA Law take full effect.

Furthermore, there is also a strong interest in the Charger Equipment Service Technician and

Battery Technician positions. These may be prioritized also following the EV Technician position. Likewise, a CS may be prioritized first, in line with letting the local EV market grow first.

Specific Recommendations

1. **In the development of the EV Technician CS/TR, a primary consideration is that it should be able to meet the entry level requirements of private e-car companies (e.g. Nissan, Chery and Foton) and sufficient enough to service public transport EV operators (e.g. E-Jeeps).** This should be at least NC Level II. The material developed by Cavite State University and the Department of Energy (i.e Pure Battery Propelled Electric Vehicle Servicing Level II) will be reviewed to see if it can be used to meet this requirement. The revisions needed will be based on the following functional mapping activity.

   Currently, private e-car companies rely on retraining existing technicians to give them the skillset necessary to repair and maintain the e-cars they are selling. For an automotive technician position, the common entry level requirement is an NC Level II from TESDA on Automotive Servicing. The proposed new certification course should be able to match this current entry level requirement and at the same time, also cover basic EV knowledge, giving private e-car companies the benefit of saving on retraining costs. However, it must be acknowledged that detailed know-hows are extremely brand and model specific, and most likely IP-protected, and thus can only be taught by the private companies themselves upon hiring.

   On the other hand, the skills to be imparted on this certification course should be balanced in such a way that it should be enough to allow the graduates to maintain and service public transport EVs (i.e. electric jeepneys) immediately. Electric jeepneys are typically less sophisticated technologically, compared to private e-cars. Thus, it should be possible to find a balanced scope for the training which will be able to address both requirements.

2. **The eventual training programs for the battery and charging technicians should be at least an NC Level II course.** Based on the surveys and interviews conducted, the following are the skills needed for this job:
   - Assemble a basic EV charger.
   - Install an EV charger.
   - Operate and maintain an EV charger (including troubleshooting).
   - Assemble and disassemble a basic EV battery (w/ knowledge on power electronics).
   - Charge, maintain, monitor and analyze the performance of an EV battery (i.e. to determine if the battery needs replacing already).

   It is likely that a standalone industry for EV batteries could thrive in the near future, e.g. companies focused solely on the operation of charging facilities, battery swapping stations, assembly and repair of EV batteries. The batteries make up a huge portion of the cost of electric vehicles (~30% to 50%), creating a huge business opportunity for it. Furthermore, battery issues make up a huge part of the reported challenges by the early adopters of e-Jeeps in the Philippines. The maintenance and care of EV batteries and chargers on their own

require a unique set of sophisticated skills beyond that of electric vehicle servicing. Thus, it is reasonable to recommend the development of separate training programs for EV charging equipment and battery technicians.

3. Develop a short course covering Basic EV Technology, Safety and Basic Troubleshooting. This does not need to be a certification course. It is targeted to address the training needs of EV drivers, EV safety officers, EV sales personnel, EV mechanical technicians, EV fleet managers, etc. This is for all other priority positions where hands-on EV skills are not imperative. Based on the study conducted, a good orientation on EV technology is also essential for these positions. However, since the said positions would not necessarily perform hands-on work on EVs on a daily basis, and since it is expected that they would also be working with certified EV technicians within the company, they would not need to take a certification-level course. Furthermore, the materials taught in this short course could be directly lifted from some modules found in the EV technician and charging/battery technician courses. It could be arranged later on with TESDA for these short course units to be credited towards obtaining the full certification course, if so desired by the trainee.

To conclude, the technical education and skill development for the EV industry in the Philippines is a multi-faceted effort that requires collaboration between the government, academic institutions, and private sector. It is essential to provide training, education, and research opportunities to ensure that there is a skilled workforce available to design, produce, and maintain EV technology in the Philippines. Additionally, the government could provide incentives for companies to invest in training and skill development programs for their employees.

IX. Appendices

Appendix 1 - Complete List of Skills Recommended for Training Regulation Development

Value Chain	Job/Skills	Urgency (U) Needed in the next:		Shortage of Workers (S)[1]			Ranking Remarks	Corresponding TR/CS Reference: https://bit.ly/CorrespondingTRandCS	Coverage Last three (3) years				Infrastructure (As of 2022)			
		1 - 3 years	3 - 5 years	Low	Medium	High			Enrolled	Graduates	Assessed	Certified	Registered Programs	Trainers (NTTC Holder)	Assessment Centers	Assessors
EV Servicing and Maintenance (for private vehicles)	Electrical Service Technician	TRUE	FALSE	FALSE	FALSE	TRUE	High	Automotive Servicing (Electrical Repair) NC II	44	0	529	503	8	144	20	31
								Automotive Electrical Assembly NC II	216	187	0	0	3	3	1	0
	EV Technician (combined mechanical and electrical)	TRUE	FALSE	FALSE	FALSE	TRUE	High									
	Safety Officer	TRUE	FALSE	FALSE	FALSE	TRUE	High									
EV Charging Equipment Assembly, Installation and Sales	Charger Design Technician	TRUE	FALSE	FALSE	FALSE	TRUE	High									
	Charger Assembly Technician	TRUE	FALSE	FALSE	FALSE	TRUE	High									
EV Charging Station Operation	Charging Equipment Service Technician	TRUE	FALSE	FALSE	FALSE	TRUE	High	Electrical Installation and Maintenance NC II	67,439	66,479	98,658	90,848	490	1476	249	498
	Charging Equipment Installer	TRUE	FALSE	FALSE	FALSE	TRUE	High	Electrical Installation and Maintenance NC II	67,439	66,479	98,658	90,848	490	1476	249	498
EV Fleet Operations (e.g.	Chief Mechanic / Service Foreman	TRUE	FALSE	FALSE	FALSE	TRUE	High									

Public Transport Cooperatives)	Fleet Manager	TRUE	FALSE	FALSE	FALSE	TRUE	High									
	Battery Technician	TRUE	FALSE	FALSE	FALSE	TRUE	High									
	Charger Operator	TRUE	FALSE	FALSE	FALSE	TRUE	High									
	Charging Equipment Technician	TRUE	FALSE	FALSE	FALSE	TRUE	High									

Source: Commissioned survey and interviews.

[1] Shortage is based on the number of workers needed, i.e. Low (100 or less workers); Medium (101 to 499 workers); and High (500 or more workers).

Appendix 2 - Complete list of Skills Recommended for Competency Standards Development

*Following the TESDA decision matrix only. For the final recommendation, please refer to the section "Way Forward". Some have been demoted to "short courses" only, or referred to HEIs (e.g. engineering and managerial positions).

Value Chain	Job/Skills	Urgency (U) Needed in the next:		Shortage of Workers (S)			Ranking Remarks	Corresponding TR/CS Reference: https://bit.ly/CorrespondingTRandCS	Coverage Last three (3) years				Infrastructure (As of 2022)			
		1 - 3 years	3 - 5 years	Low	Medium	High			Enrolled	Graduates	Assessed	Certified	Registered Programs	Trainers (NTTC Holder)	Assessment Centers	Assessors
EV Sales	Marketing Professional / Sales Agent	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Sales Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Sales Manager	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Procurement Staff	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Inventory Personnel	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Trainer	TRUE	FALSE	FALSE	TRUE	FALSE	High	Trainers Methodology Level I (Trainer/Assessor)	21,382	18,279	13,007	9,373	286		117	145
								Trainers Methodology Level I (In-Company Trainer)							3	0
	Cashier/Accountant	TRUE	FALSE	FALSE	TRUE	FALSE	High	Customer Services NC II	477	526	1,625	1,506	12	78	8	24
	Admin Assistant	TRUE	FALSE	FALSE	TRUE	FALSE	High									
EV Servicing and Maintenance (for private vehicles)	Mechanical Service Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Automotive Mechanical Assembly NC II	53	53	1	1			0	0
	Driver	TRUE	FALSE	TRUE	FALSE	FALSE	Medium	Driving NC II	115,844	110,853	150,760	141,622	694	2095	368	740

	Service Foreman	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Service Advisor	FALSE	FALSE	FALSE	TRUE	FALSE	Low									
	Charger Operator	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Charging Equipment Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Electrical Installation and Maintenance NC II	67,439	66,479	98,658	90,848	490	1476	249	498
	Charging Equipment Installer	TRUE	FALSE	FALSE	TRUE	FALSE	High	Electrical Installation and Maintenance NC II	67,439	66,479	98,658	90,848	490	1476	249	498
	Trainer	TRUE	FALSE	FALSE	TRUE	FALSE	High	Trainers Methodology Level I (Trainer/Assessor)	21,382	18,279	13,007	9,373	286		117	145
								Trainers Methodology Level I (In-Company Trainer)							3	0
	Cashier/Accountant	TRUE	FALSE	TRUE	FALSE	FALSE	Medium	Customer Services NC II	477	526	1625	1506	12	78	8	24
	Admin Assistant	TRUE	FALSE	TRUE	FALSE	FALSE	Medium									
EV Charging Equipment Assembly, Installation and Sales	Charger Design Engineer	TRUE	FALSE	FALSE	FALSE	TRUE	High									
	Charging Equipment Installation Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Electrical Installation and Maintenance NC II	67,439	66,479	98,658	90,848	490	1476	249	498
	Charging Equipment Installation Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Installation Supervisor	FALSE	FALSE	FALSE	TRUE	FALSE	Low									
	Service Foreman	FALSE	FALSE	FALSE	TRUE	FALSE	Low									
	Charger Equipment Service Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Electrical Installation and Maintenance NC II	67,439	66,479	98,658	90,848	490	1476	249	498
	Charger Operator	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Equipment Sales Personnel	TRUE	FALSE	FALSE	TRUE	FALSE	High									

	Sales Manager	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Project Manager	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Procurement Staff	FALSE	FALSE	FALSE	TRUE	FALSE	Low									
	Trainer	TRUE	FALSE	FALSE	TRUE	FALSE	High	Trainers Methodology Level I (Trainer/Assessor)	21,382	18,279	13,007	9,373	286		117	145
								Trainers Methodology Level I (In-Company Trainer)							3	0
	Cashier/Accountant	FALSE	FALSE	FALSE	TRUE	FALSE	Low	Customer Services NC II	477	526	1625	1506	12	78	8	24
	Admin Assistant	FALSE	FALSE	FALSE	TRUE	FALSE	Low									
EV Charging Station Operation	Charger Operator	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Project Manager	FALSE	FALSE	FALSE	FALSE	TRUE	Low									
	Equipment Sales Personnel	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Equipment Engineer	FALSE	FALSE	FALSE	FALSE	TRUE	Low									
	Supervisor	FALSE	FALSE	FALSE	TRUE	FALSE	Low									
	Site Manager	FALSE	FALSE	FALSE	TRUE	FALSE	Low									
	Procurement Staff	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Trainer	TRUE	FALSE	FALSE	TRUE	FALSE	High	Trainers Methodology Level I (Trainer/Assessor)	21,382	18,279	13,007	9,373	286		117	145
								Trainers Methodology Level I (In-Company Trainer)							3	0
	Cashier/Accountant	FALSE	FALSE	FALSE	TRUE	FALSE	Low	Customer Services NC II	477	526	1625	1506	12	78	8	24

	Admin Assistant	FALSE	FALSE	FALSE	TRUE	FALSE	Low									
EV Fleet Operations (e.g. Public Transport Cooperatives)	Electrical Service Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Automotive Servicing (Electrical Repair) NC II	44	0	529	503	8	144	20	31
								Automotive Electrical Assembly NC II	216	187	0	0	3	3	1	0
	Mechanical Service Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Automotive Mechanical Assembly NC II	53	53	1	1			0	0
	EV Technician (combined electrical and mechanical)	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Safety Officer	TRUE	FALSE	FALSE	FALSE	TRUE	High									
	Driver	TRUE	FALSE	TRUE	FALSE	FALSE	Medium	Driving (Passenger Bus/Straight Truck) NC III	1,898	1,676	12,179	11,543	31	206	77	127
	Trainer	TRUE	FALSE	FALSE	TRUE	FALSE	High	Trainers Methodology Level I (Trainer/Assessor)	21382	18279	13007	9373	286		117	145
								Trainers Methodology Level I (In-Company Trainer)							3	0
	Cashier/Accountant	FALSE	FALSE	FALSE	TRUE	FALSE	Low	Customer Services NC II	477	526	1,625	1,506	12	78	8	24
	Admin Assistant	FALSE	FALSE	FALSE	TRUE	FALSE	Low									
EV Manufacturing	Electrical Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Electrical Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Automotive Servicing (Electrical Repair) NC II	44	0	529	503	8	144	20	31
	Electronics Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Electronic Products Assembly and Servicing NC II	23,931	24,947	31,563	28,407	288	737	120	194

	Electronics Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Mechanical Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Mechanical Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Automotive Mechanical Assembly NC II	53	53	1	1			0	0
	Automotive Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Automotive Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High	Automotive Servicing NC I	11,881	12,538	21,530	20,067	196		95	209
								Automotive Servicing NC II	9,571	9,448	24,784	22,417	225	581	44	145
								Automotive Servicing (Chassis Repair) NC II	0	0	582	566	10	143	16	30
								Automotive Servicing (Electrical Repair) NC II	44	0	529	503	8	144	20	31
								Automotive Servicing (Engine Repair) NC II	20	2	1,657	1,641	14	149	22	33
								Automotive Servicing NC III	132	101	800	750	7	92	10	13
								Automotive Servicing NC IV	138	67	783	737	3	53	5	7
	Welder	TRUE	FALSE	TRUE	FALSE	FALSE	Medium	Shielded Metal Arc Welding (SMAW) NC I	61,345	65,443	69,052	65,236	569		314	425
								Shielded Metal Arc Welding (SMAW) NC II	71,737	75,221	99,200	93,491	784	2249	379	693
								Shielded Metal Arc Welding (SMAW) NC III	3,363	3,587	3,595	3,498	58	324	46	70
								Shielded Metal Arc Welding (SMAW) NC IV	299	285	414	394	4	59	7	10

								Gas Metal Arc Welding (GMAW) NC I	177	145	213	188	17		7	9
								Gas Metal Arc Welding (GMAW) NC II	2,711	2,862	3,316	3,245	56	336	38	87
								Gas Metal Arc Welding (GMAW) NC III	23	31	32	32	3	12	3	5
								Flux Cored Arc Welding (FCAW) NC I	81	71	27	27	7		2	0
								Flux Cored Arc Welding (FCAW) NC II	266	239	620	616	15	130	14	19
								Flux Cored Arc Welding (FCAW) NC III						1	1	0
								Gas Tungsten Arc Welding (GTAW) NC II	3,154	3,634	4,593	4,481	74	323	47	85
								Gas Tungsten Arc Welding (GTAW) NC IV							0	1
								Submerged Arc Welding (SAW) NC I							0	0
								Submerged Arc Welding (SAW) NC II							0	1
								Gas Welding NC I	50	49	37	37	1		1	2
								Gas Welding NC II	13	27	0	0	4	1	2	2
	Carpenter / Wood Fabricator	TRUE	FALSE	TRUE	FALSE	FALSE	Medium	Carpentry NC II	23,139	24,207	26,565	25,381	230	579	111	245
								Carpentry NC III	116	131	273	263	6	48	10	23
	Metal Fabricator	TRUE	FALSE	TRUE	FALSE	FALSE	Medium									
	Mold Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Automotive Painter	TRUE	FALSE	TRUE	FALSE	FALSE	Medium	Automotive Painting						2	1	0

								NC II								
								Automotive Body Painting/Finishing NC II	12	12	0	0	3	5	0	3
	Battery Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Battery Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Industrial Designer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Industrial Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Manufacturing Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Test Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Test Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Warehouse staff	TRUE	FALSE	TRUE	FALSE	FALSE	Medium	Warehousing Services NC II	13	0	0	0	1	1	2	0
	Parts inventory staff	TRUE	FALSE	TRUE	FALSE	FALSE	Medium									
	Delivery staff	TRUE	FALSE	TRUE	FALSE	FALSE	Medium									
	Driver	TRUE	FALSE	TRUE	FALSE	FALSE	Medium	Driving NC II	115,844	110,853	150,760	141,622	694	3001	368	740
								Driving (Passenger Bus/Straight Truck) NC III	1,898	1,676	12,179	11,543	31	206	77	127
								Driving (Articulated Vehicle) NC III	202	200	5,926	5,612	5	65	38	41
	Project Manager	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Fabrication Supervisor	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Shop Supervisor	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Procurement Staff	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Trainer	TRUE	FALSE	FALSE	TRUE	FALSE	High	Trainers Methodology	21382	18279	13007	9373	286		117	145

								Level I (Trainer/Assessor)								
								Trainers Methodology Level I (In-Company Trainer)							3	0
	Operations Manager	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Accountant	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Finance Manager	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Admin Assistant	TRUE	FALSE	TRUE	FALSE	FALSE	Medium									
EV Scrapping	EV Disposal and Recycling Specialist	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Body Compacting Machine operator	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Crane / Hoist Operator	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	EV Dismantler	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Valuation Specialist	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Waste Collection Workers	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
Scrap Metal Processing	Plant & Machine Operator	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Scrap Workers/Sorters (Dismantling Technician)	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Production, Material and Warehouse Manager	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
Battery Recycling	Battery Testing Technicians	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Warehouse manager	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									

	Plant & Machine Operator	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Material Sorting / Battery Dismantling Technician	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
Battery Repurposing	Battery Repurposing Engineer	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Battery Testing Technicians	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Battery Pack Dismantling Technicians	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Battery Pack Re-Assembling Technicians	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Repurposed Battery Pack Logistics Manager	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Plant & Machine Operator	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Material Sorting / Battery Dismantling Technician	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
EV Retrofitting	Welder	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Logistics Manager for Spares and Kits	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Electric Vehicle Service Technician	TRUE	FALSE	FALSE	TRUE	FALSE	High									
	Machining Technician	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									
	Waste Treatment Machine Operator	FALSE	TRUE	FALSE	TRUE	FALSE	Medium									

Source: Commissioned survey and interviews.