



LABOR MARKET INFORMATION

Electric Vehicle


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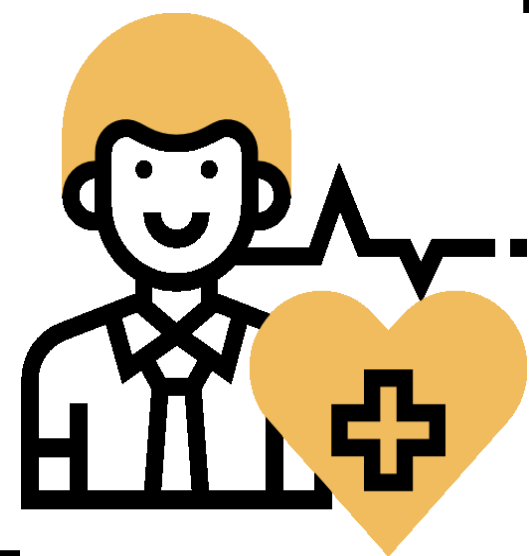
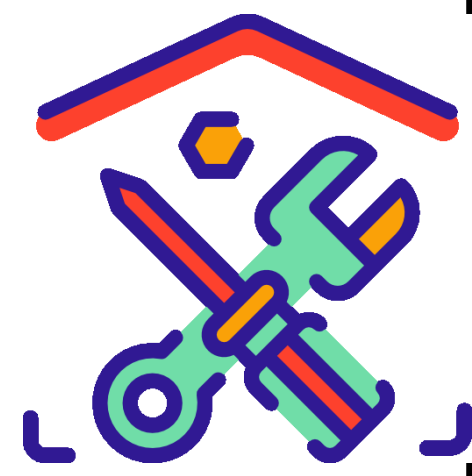
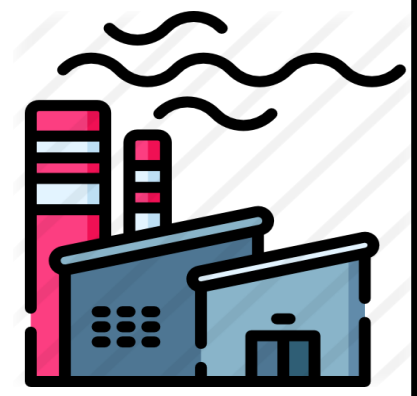
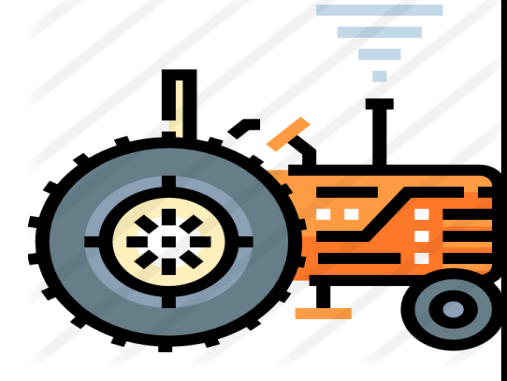
Electric Vehicle

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I. Background

- There is a general belief that electric vehicles pollute less than the conventional internal combustion engine (ICE) vehicles, even if the electricity, as their energy source, come from coal. It also comes cheaper in the long run, as a battery-electric or plug-in electric vehicle could result in cost-savings on fuel.
- The xEV (pronounced as “ex-EV”) ecosystem is composed of several types of vehicles that make use of powertrain technologies with varying degrees of electrification. Below are the types and their general characteristics:
 - *Battery Electric Vehicle (BEV)* – is an electric vehicle that runs entirely on battery power and is recharged from an electrical outlet.
 - *Plug-in Hybrid Electric Vehicle (PHEV)* – a PHEV contains an electric motor, battery and an ICE. PHEV batteries can be charged using a wall outlet or charging station, by the ICE, or through regenerative braking. It typically runs on battery power, and when power is depleted, it automatically switches over to use the ICE.
 - *Hybrid Electric Vehicle (HEV)* – an HEV combines the use of both a gasoline engine and a battery-powered electric motor. In an HEV, “the vehicle may be propelled entirely by electricity, entirely by gasoline, or by some combination of the two.” Unlike the PHEV which can be charged, an HEV does not have a charging port, and can only be refueled with gasoline.
 - *Mild HEV* – a mild HEV makes use of a smaller battery than an HEV. Its motor-generator can both create electricity and help boost the gas engine’s output, which can help in reducing fuel consumption.

BEV						
PHEV						
STRONG HEV						
MILD HEV						
ICEV						



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II. Global Trends

- The following are the major trends in the xEV ecosystem that are disrupting the automotive value chain:

Increasing xEV penetration

Largest EV Markets

1 st - China			Electric Cars – more than 5.1 million
2 nd - Europe			Electric two-wheelers - 260 million
3 rd - USA			Electric buses – 460,000

Source: Global EV Outlook 2018

Electric Vehicle Stock in ASEAN

Country	Electric Vehicle Stock	Reference Year	Source
Indonesia	<ul style="list-style-type: none"> ~1,000 electric cars ~3,000 electric two-wheelers 	2017	Solidiance (2018)
Singapore	<ul style="list-style-type: none"> 380 PHEV cars and LDVs 701 BEV cars and LDVs 32,545 HEV cars and LDVs 4 BEV buses 23 HEV buses 	2018	Land Transport Authority (2018)
Thailand	<ul style="list-style-type: none"> 122,631 HEVs and PHEVs 1,454 BEVs 	2018	EVAT (2016)
Vietnam	<ul style="list-style-type: none"> 1,086 electric cars 150,000 electric two-wheelers 	2015 2013	Nguyen and Nguyen (2015)

Source: Philippine Electric Vehicle Policy Analysis Report

Declining xEV Battery Prices

Factors

- Increase in Cell Manufacturing Process Yields
- Increase in Lithium Ion Battery Factory Utilization Rates
- Reduction in Active Material Costs
- Increase in Average Battery Energy density

Market factors other than manufacturing costs might have also played a role.

Source: Nomura Research Institute

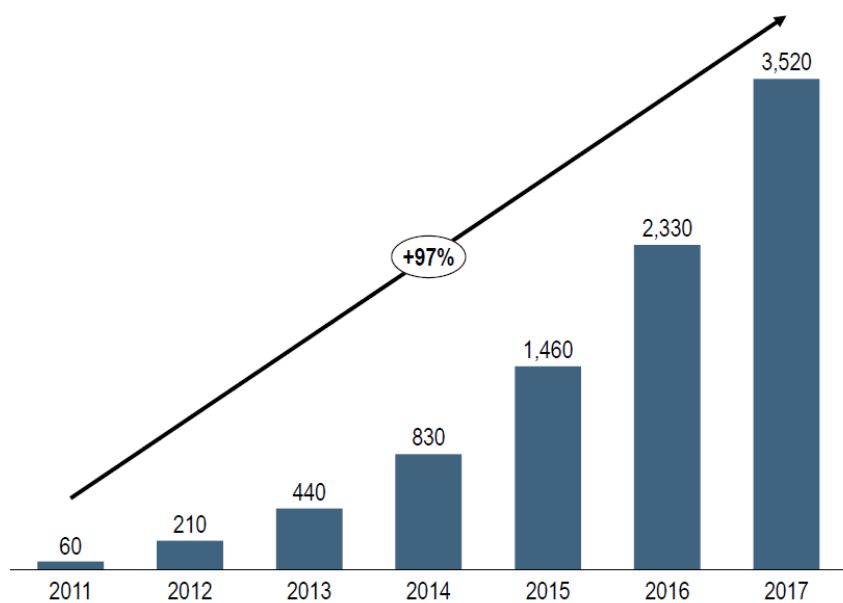


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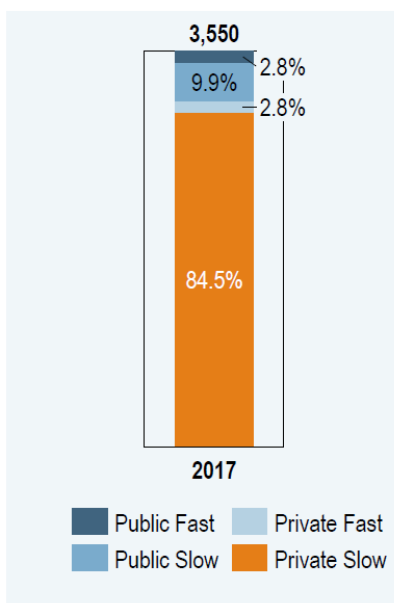
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Improving Charging Infrastructure

Total Charging Stations [Thousands, 2011-2017]






Share of charging stations [2017]






- Ideal number of charging points to support EV adoption remains to be universally agreed upon, with recommendations ranging from 0.04 to 0.125 vehicles per public charging point.
- Various business models have been globally adopted in the delivery of charging services, which includes: (i) EV sales and charging system installation; (ii) EV sales and access to charging facility; (iii) EV leasing or sales and battery rental or swapping service; (iv) public charging points; and (v) EV sharing programme.

Source: Nomura Research Institute; Philippine Electric Vehicle Policy Analysis Report

Regulations and Standards

Most Popular AC Charging Connector Types		
SAE J1772	Type 2 (Mennekes)	Tesla (USA)
		
North America and Japan	Europe and China	Tesla Vehicles

Most Popular DC Fast Charging Connectors		
CHAdeMO	CCS (North America)	CCS (Europe)
		
Nissan, Mitsubishi, Kia, Citroën, Peugeot	BMW, Daimler, Ford, Fiat Chrysler, General Motors, Honda, Hyundai, Volkswagen	

Source: Nomura Research Institute



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Increasing Focus on xEVs

- Countries worldwide including ASEAN have defined EV adoption targets, with others announcing ICEV sales restrictions, and a few countries planning to completely phase-out ICEVs in the future.
- Major global Original Equipment Manufacturers (OEMs) are pushing for hybrid and/or full electric vehicles



Source: Nomura Research Institute; Philippine Electric Vehicle Policy Analysis Report

Global EV Policies, Incentives, and Regulations

Country / Region	EV Target or Objective
Canada	- 10% zero-emission vehicle (ZEV) sales by 2025, 30% by 2030, and 100% by 2040 (Clean Energy Canada, 2019) - 75% of new LDVs will be HEVs, PHEVs or BEVs from 2019 - 80% of government fleet procured are ZEVs
China	- 5M EVs by 2020, including 4.6 million PLDVs, 0.2 million buses and 0.2 million trucks
European Union	- 15% sales of electric cars and plug-in hybrids by 2025; 30% by 2030
Finland	- 250,000 EVs by 2030
France	- Full electrification of new buses by 2025 - All electric cars nationwide by 2040 (Davies, 2017)
India	- 30% electric sales by 2030 - 100% BEV sales for urban buses by 2030
Ireland	- 500,000 EVs and 100% EV sales by 2030
Japan	- 20-30% electric vehicle sales by 2030
Mexico	- 30% electric car sales by 2030
Netherlands	- 10% electric car market share by 2020 - 100% EV sales by PLDVs by 2030 - 100% electric public bus sales by 2025 - 100% public bus stock by 2030
New Zealand	- 64,000 EVs by 2021
Norway	- 100% EV sales of PLDVs, LCVs and urban buses by 2025 - 75% EV sales in long-distance buses - 50% in trucks by 2030
Korea	- 200,000 EVs of PLDVs by 2020
Slovenia	- 100% electric sales by 2030
Sweden	- 30% electric car sales by 2030
United Kingdom	- 396,000 to 431,000 E-cars by 2020
United States	- 20% market share target for electric passenger vehicles by 2020, 50% by 2025

Source: Philippine Electric Vehicle Policy Analysis Report



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EV Adoption Targets in selected ASEAN countries

Country	Description	Date announced
Indonesia	2.1 million motorcycles and 2,200 electric cars by 2025	January 2019
Malaysia	1.2 million electric vehicles by 2036	March 2016
Singapore	1,000 BEVs by 2020 800 BEV taxis by 2022	June 2016 October 2018
Thailand	100,000 electric cars, 100,000 electric motorcycles, and 2,000 electric buses by 2030	August 2017
Vietnam	100,000 electric cars by 2020	August 2013

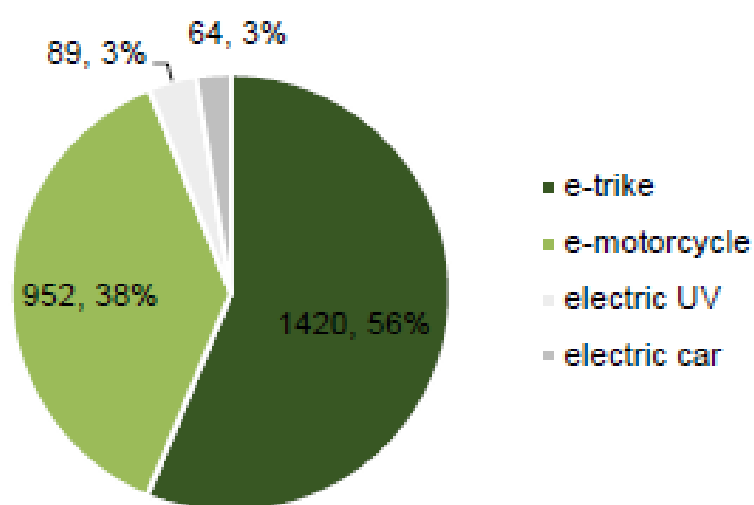
Source: Partnership on Sustainable Low Carbon Transport (2019, p. 5, 11-13, 16)

III. EV in the Philippines

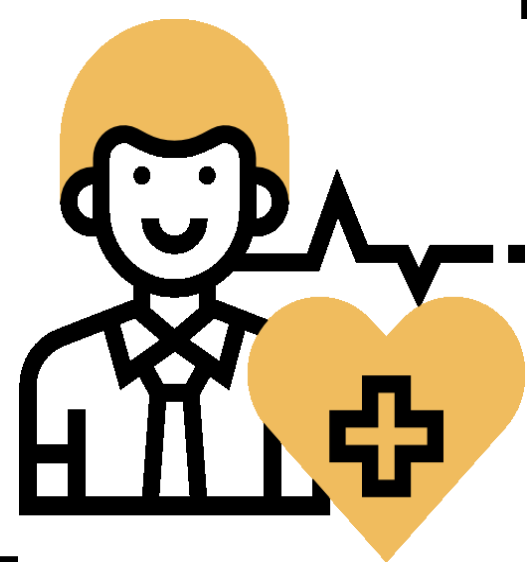
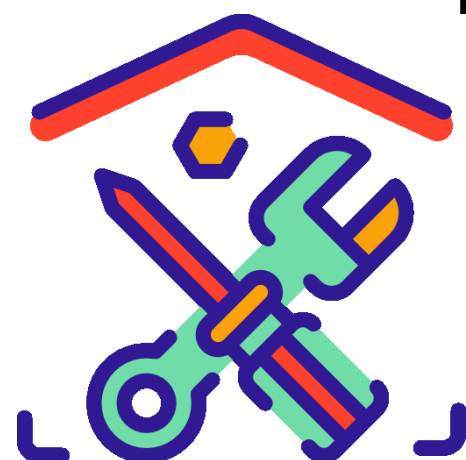
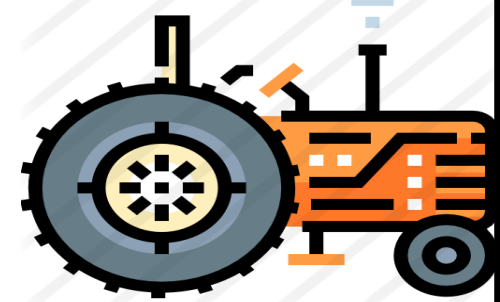
- Electric motorcycles and electric tricycles ('e-trikes') have the largest share in the number of EVs, with electric cars and electric utility vehicles (i.e. e-jeepneys) having only a minimal share, based on the 2017 data of the Land Transportation Office.

Recent E-Trike and E-Jeepney Deployments as of 31 May 2019

Locations	E-trikes	E-Jeepney
Metro Manila		
Las Pinas	100	13
Makati		15
Mandaluyong	5	
Manila	180	15
Muntinlupa	150	43
Paranaque		33
Quezon City	88	4
Luzon		
Antipolo	25	
Batangas		33
Bicol	97	
Cavite	38	2
Isabela	2	
Palawan	59	
Visayas		
Boracay	200	4
Cebu City		25
Tacloban		45
Mindanao		
General Santos	7	20
Marawi	200	
Country Total	1,151	252



Source: Philippine Electric Vehicle Policy Analysis Report

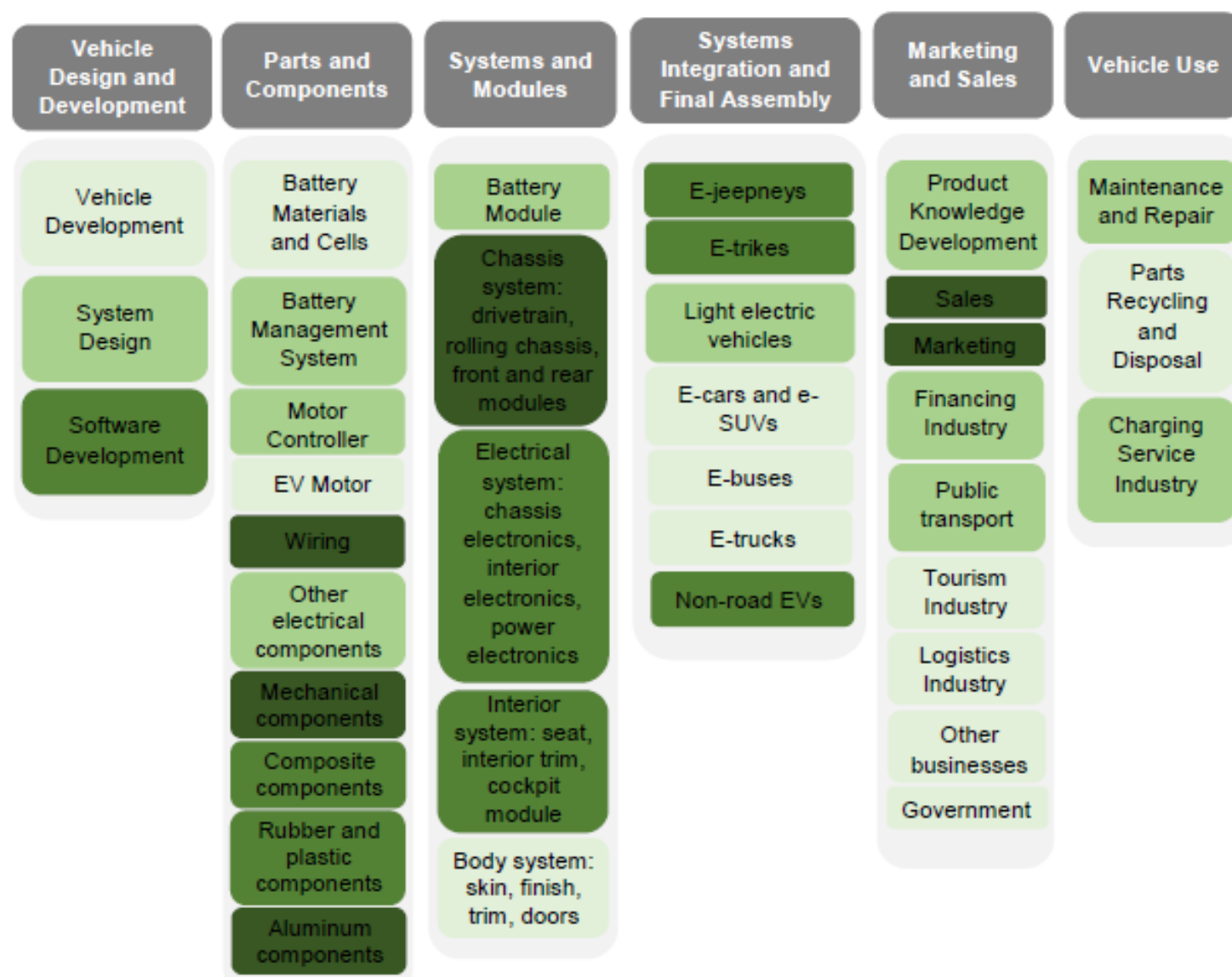


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Philippine EV Value Chain



- Vehicle Design and Development experience in the Philippines is confined to 'backyard-industry' produced jeepneys and tricycles. Developing this capacity in the local EV industry may contribute to the introduction of aesthetically modern, functional, reliable, and efficient light EVs (i.e. e-jeepneys, e-trikes, e-bikes), and even further into the heavier-duty EV segments (e.g. e-buses, e-trucks).
- On software development, a number of automotive software companies are present in the Philippines.
- The battery manufacturing industry in the country is limited to lead acid battery production and battery pack assembly.
- As to the Electronic and Electrical Components Manufacturing, nearly all manufacturers completely import main EV system components. There is also local capability in the design and production of all electric drive train components (e.g. EV motors, controllers, battery management system), as well as produce other electrical and electronic components including wire harnesses, switches, fuses, relays, and plugs and sockets.
- There is also local capacity in the production of mechanical parts as 38% of national automotive parts exports are mechanical in nature.
- Rubber and plastic automotive parts production is also present in the country.
- There is also capability in providing chassis parts and module assembly and also, interior system parts and assembly, including interior trim, seats, and cockpit module. Metal stamping capability is also present, but may not be adequate in serving a larger EV market.

Source: Philippine Electric Vehicle Policy Analysis Report



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Local EV Manufacturers

Company	Product
Philippine Utility Vehicle Corporation, Inc.	e-jeepney and e-trike
Tojo Motors Corporation	e-jeepney and e-trike
Star 8 Green Technology Corporation	e-jeepney and e-trike
Le' Guider International	e-jeepney and e-trike
Global Electric Transport / Pangea Motors	e-jeepney
BEMAC Electric Transportation, Inc.	e-trike
Eclimo Electric Management, Inc.	e-trike
EV Wealth, Inc.	e-trike
Eleia Green Vehicles	e-trike

Potential EV Markets



Public Transport



Tourism

Logistics



Government

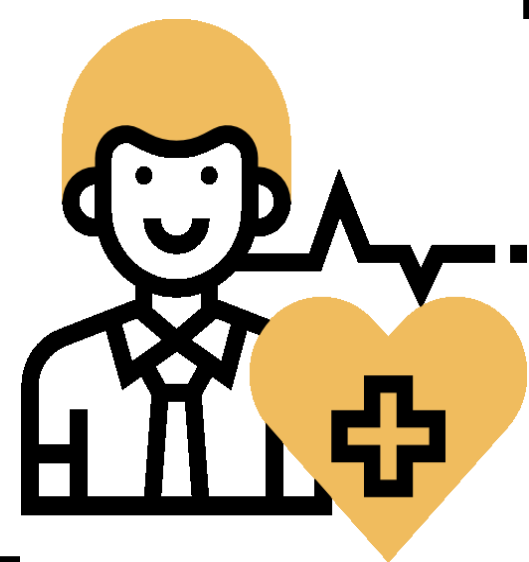
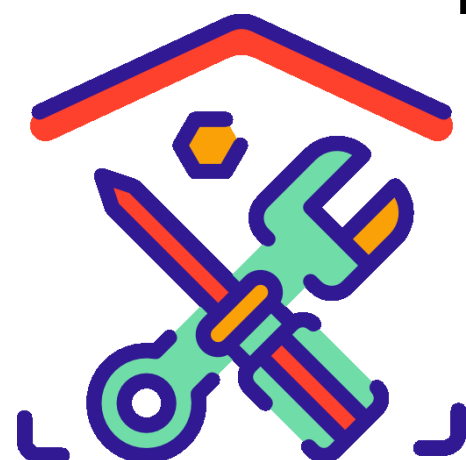
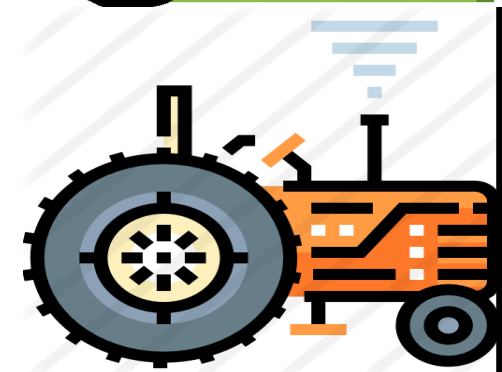
2-wheeler market



Projected EV Demand

- With tax incentives, annual PHEV sales could already reach 10,000 units by 2023, assuming all variants and models are made available. Without tax incentives however, 10,000 units could be reached only by 2030.
- Commercial, government, and public utility vehicles could create a significant demand for EVs can be influenced by policy.

Source: Philippine Electric Vehicle Policy Analysis Report



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EV Policies in the Philippines

- Department of Environment and Natural Resources: Vehicle emission leading factor contributing 69% of air pollution in PH; 90% of which comes from Metro Manila
 - Clean Air Act: phase-out Euro 2 to Euro 4 vehicle
 - PH government: promoting use of E-vehicles across the country, no clear policy like in China, Thailand and India
- Executive Order 488
 - zero tariffs for EV components & parts for assembly of hybrid, electric, flexible fuel & CNG motor vehicles
- Board of Investments Investment Priorities Plan
 - EV and charging stations: income tax holiday
- Department of Energy: E-trike project deploy 100K e-trikes nationwide to replace traditional gasoline-fed tricycles
- House and Senate Bills: excise duty exemption, VAT exemption for raw materials, parts & capital equipment to be used in EV manufacturing, priority in registration & issuance of plate number, exemption from unified vehicular volume reduction, free parking space, priority in PUV franchise application, space for charging stations

Source: Aldaba, R.M. Policy Directions for Next Generation Vehicles (xEV) Presentation

IV. Local EV Human Resource Requirements

- There is less direct employment in the local EV industry compared to the conventional vehicles due to fewer parts. There is a need to attract more investments in batteries and power electronics as these are the parts that are most valuable in the industry.
- The switch from internal combustion engine (ICE) to EVs will result to job reduction in the ICE industry but will be replaced by new jobs in the EV industry and its affiliates, but will require substantial re-training.
- If BEVs and PHEVs are locally produced it is expected to generated more jobs that creates more value than current generations from the supply chain of ICEVs in the country. Ditto with the localization of battery production.
- To develop the EV industry in the country, the report recommends the formulation and operationalization of an EV Human Resource Development Program to support both local and global requirements.

Source: Philippine Electric Vehicle Policy Analysis Report



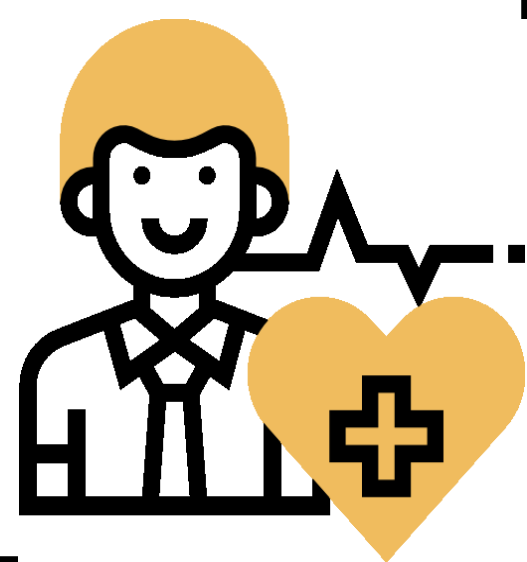
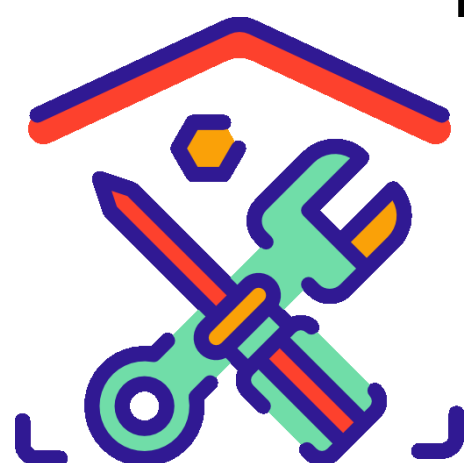
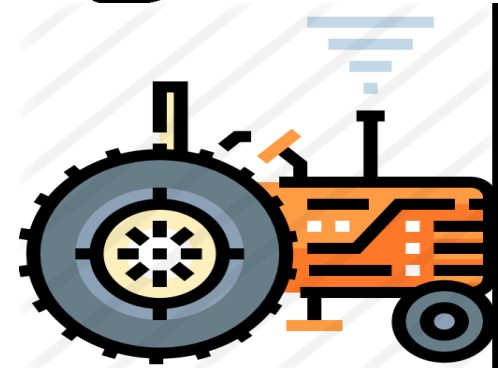
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EV Workforce Requirements (TVET)

Occupation	Description	Recommendations
<i>Parts and Vehicle Manufacturing</i>		
<i>Possible Base Program</i>		
EV Electrical Assembly Personnel	Preparation of wire harnesses and assembly of EV electrical systems	Automotive Electrical Assembly NC II, with additional specialist training on battery and EV safety
EV Mechanical Assembly Personnel	Assembly of EV mechanical systems	Automotive Mechanical Assembly NC II, with additional specialist training on battery and EV safety
EV Test Technician	Quality control testing of EV electrical and mechanical systems	No base program is available. Preparation of an appropriate TESDA training regulation is recommended.
<i>Vehicle Operations, Maintenance and Repair</i>		
<i>Possible Base Program</i>		
EV Fleet Manager	Supervision of EV dispatching and scheduling, maintenance, financials, charging service/battery swapping, personnel management, and terminal management	No program is currently available. Preparation of a training program covering safety concepts and practices is recommended.
EV Electrical Service Technician	Maintenance and repair of EV electrical systems	Automotive Servicing NC II
EV Mechanical Service Technician	Maintenance and repair of EV mechanical systems	Automotive Servicing NC I, with additional focus on EV safety
EV Driver	Operation of e-trikes, e-jeeps, and e-buses	No program is currently available. However, the TESDA driver certification training could be expanded to include topics on EV maintenance and EV safety and emergency response
EV Fleet and Depot Safety Officer	Implementation and oversight of safety practices in EV depots and EV operations	No program is currently available. Training programs on the storage and disposal of EV batteries and components, among others, is recommended
<i>Charging System Assembly and Installation</i>		
Electric Vehicle Supply Equipment (EVSE) Installation Technician	Installation of power supply systems and EVSE equipment, as per technical design	Electrical Installation and Maintenance NC II, with additional specialist knowledge on solar power installation
Charging Facility Manager / Safety Officer	Over-all supervision and safety of charging facilities and operation	Preferably a technical specialist with appropriate training on EVSE station and safety
Charging Service Personnel	EVSE safe operation	Currently, no training program is available, which would need to be developed
Technical Support Associate (for self-service charging)	Orientation support for EV owners and/or drivers on EVSE use	Currently, no training program is available, which would need to be developed
EVSE Repair and Maintenance	EVSE maintenance and repair, including troubleshooting of power line, as needed	Electrical Installation and Maintenance NC II, with specialist training on EVSE equipment
<i>Sales and Marketing</i>		
EV Sales Representative	Presentation, discussion of vehicle technical features, operation, and economics to prospective clients	Sales personnel, with orientation focused on EVs
EV Test Drive Support Staff	Test-drive support, including on-board testing, for clients	Must be a certified EV driver (see discussion above)
EV Customer Service Manager	Planning, direction, and coordination of after-sales requirements and activities, particularly on maintenance, with EV owners.	Current customer service managers may be tapped though orientation on the product and maintenance and repair processes involved would need to be conducted



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EV Workforce Requirements (TVET)

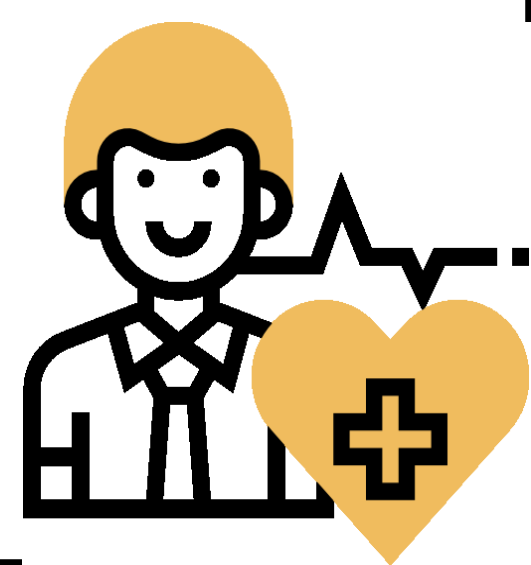
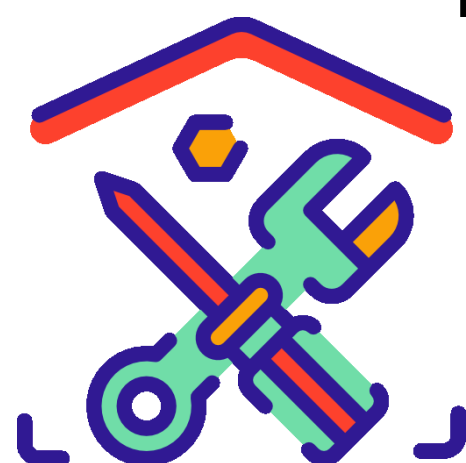
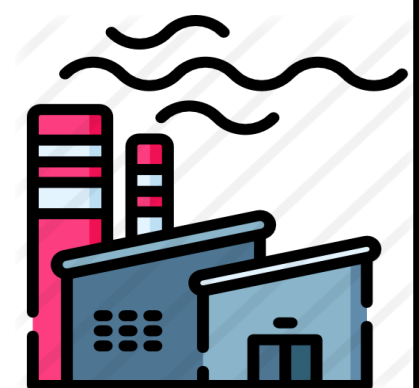
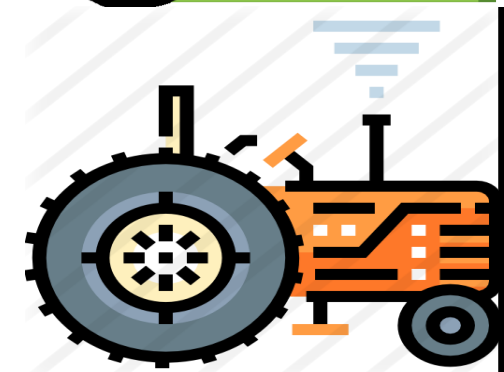
Occupation	Description	Recommendations
<i>Regulations</i>		
EV Standards Test Technicians	Implementation of testing processes as defined by the EV vehicle standards	Currently, no training program is available, which would need to be developed
Motor Vehicle Inspection System (MVIS) EV Testing Specialist	Implementation of testing processes as defined in the MVIS	
EV Environmental Officer (Battery Recycling)	Compliance monitoring on the safety and environmental requirements of EV battery and component storage and disposal	
<i>Emergency Response and Recovery</i>		
Rescue service personnel	Rescue and recovery of people in accidents and disasters	Upgrading and certification of concerned personnel
Medical emergency service personnel	Provision of immediate medical services on people involved in accidents and disasters	Upgrading and certification of concerned personnel
Vehicle Recovery and Handling personnel	Recovery of vehicles involved in accidents and disasters	Upgrading and certification of concerned personnel
Recommended industry positions subject to testing certification by TESDA		
EV Charging Technician EV Service Technician EV Testing Specialist EV Battery Technician		

Source: Philippine Electric Vehicle Policy Analysis Report

V. TVET Capacity

- Training Regulations

Occupation	Training Regulation
<i>Parts and Vehicle Manufacturing</i>	
EV Electrical Assembly Personnel	Automotive Electrical Assembly NC II
EV Mechanical Assembly Personnel	Automotive Mechanical Assembly NC II
EV Test Technician	none
<i>Vehicle Operations, Maintenance and Repair</i>	
EV Fleet Manager	none
EV Electrical Service Technician	Automotive Servicing NC II
EV Mechanical Service Technician	Automotive Servicing NC I
EV Driver	none
EV Fleet and Depot Safety Officer	none
<i>Charging System Assembly and Installation</i>	
Electric Vehicle Supply Equipment (EVSE) Installation Technician	Electrical Installation and Maintenance NC II PV Systems Installation NC II
Charging Facility Manager / Safety Officer	none
Charging Service Personnel	none
Technical Support Associate (for self-service charging)	none
EVSE Repair and Maintenance	Electrical Installation and Maintenance NC II



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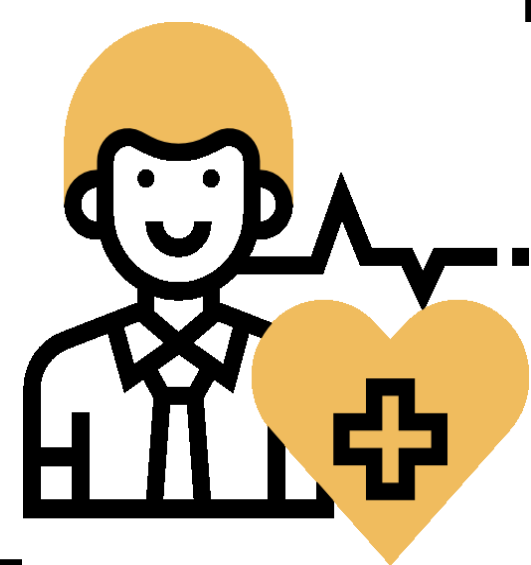
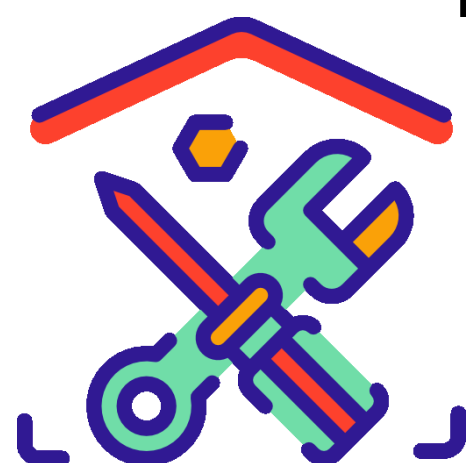
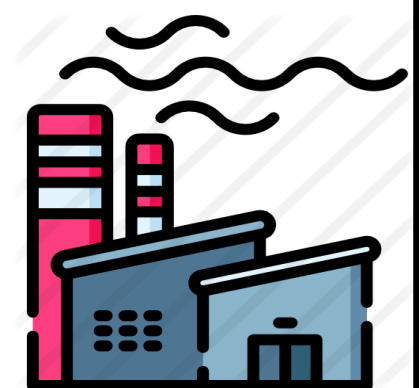
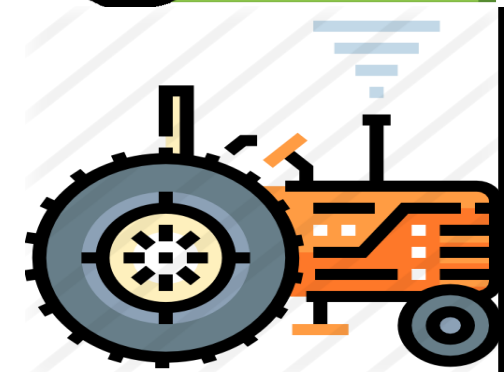
Occupation	Training Regulation
Sales and Marketing	
EV Sales Representative	
EV Test Drive Support Staff	
EV Customer Service Manager	Customer Services NC II
Regulations	
EV Standards Test Technicians	none
Motor Vehicle Inspection System (MVIS) EV Testing Specialist	none
EV Environmental Officer (Battery Recycling)	none
Emergency Response and Recovery	
Rescue service personnel	none
Medical emergency service personnel	Emergency Medical Services NC II
Vehicle Recovery and Handling personnel	none
Recommended industry positions subject to testing certification by TESDA	
EV Charging Technician	none
EV Service Technician	none
EV Testing Specialist	none
EV Battery Technician	none

- Based on the table above, out of the 26 occupations, 16 occupations do not have a corresponding training regulation.
- For those that have corresponding training regulation, the report recommends that additional specialist training be provided, such as battery and EV safety.
- Enrollment, Graduates, Assessed and Certified, FY 2018

Training Regulation	FY 2018			
	Enrolled	Graduates	Assessed	Certified
Automotive Electrical Assembly NC II	20	20	20	20
Automotive Mechanical Assembly NC II				
Automotive Servicing NC II	19,262	19,018	35,565	32,242
Automotive Servicing NC I	20,671	19,966	42,044	38,442
Electrical Installation and Maintenance NC II	22,066	21,835	50,757	44,306
PV Systems Installation NC II	392	339	498	435
Customer Services NC II	888	775	2,823	2,815
Emergency Medical Services NC II	2,012	2,127	2,745	1,935

- Number of Technical-Vocational Institutions and Assessment Centers, FY 2018

Training Regulation	TVIs	ACs
Automotive Electrical Assembly NC II	3	2
Automotive Mechanical Assembly NC II		
Automotive Servicing NC I	335	201
Automotive Servicing NC II	348	210
Electrical Installation and Maintenance NC II	310	271
PV Systems Installation NC II	13	12
Customer Services NC II	12	14
Emergency Medical Services NC II	20	14



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V. TVET Capacity

- Number of Trainers/National TVET Training Certificate (NTTC) Holders and Assessors, FY 2018

Training Regulation	NTTC Holders	Assessors
Automotive Electrical Assembly NC II	8	4
Automotive Mechanical Assembly NC II		
Automotive Servicing NC I	-	378
Automotive Servicing NC II	974	403
Electrical Installation and Maintenance NC II	1,603	582
PV Systems Installation NC II	57	16
Customer Services NC II	79	26
Emergency Medical Services NC II	79	29

VI. Analysis

- A list of human resource requirements for the EV industry has been provided but there is no data on the number of jobs needed for each of them. This information is necessary for TESDA's planning and programming in order to be responsive to the human resource needs of the industry. As the list of requirements, especially for those without existing training programs, there is a need to prioritize the training programs that will be established.
- For the human resource requirements with existing training programs, mechanisms on the enhancement of these programs based on the recommendations can be looked into.
- The Automotive Mechanical Assembly NC II has been determined as a requirement for the EV Mechanical Assembly Personnel. However, there is no registered program, no qualified trainer, and no qualified assessor.

VII. Conclusion/Recommendation

- Further research/consultation is necessary to gather employment data for each of the human resource requirements for the EV industry.
- There is a need to establish new training programs and to update existing training programs that will be responsive to the needs of the EV industry.
- TESDA needs to work with the industry players in the establishment and operationalization of the training programs that will fulfill the human resource requirements of the industry, such as qualifying the trainers and assessors, as well as the registration of institutions and enterprises that will implement the training programs.





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