Chapter VIII. ALTERNATIVE FUELS and ENERGY TECHNOLOGY

The DOE's continuing plans and programs in promoting alternative fuels and energy technologies (AFETs) remain as important measure in addressing the increasing demand of the transport sector and the country's high dependency on imported conventional fuels. The alternative fuel penetration in energy is mainly driven by the need to reduce greenhouse gas emission to improve air quality. Replacement of fossil fuels with alternative fuels is a key strategy in meeting our goals embedded in our Nationally Determined Contribution (NDC) to the Paris Agreement.

To expand and intensify the promotion of alternative fuels and energy technologies, the DOE formulated the Alternative Fuels and Energy Technologies Roadmap that envisions the successful adoption and commercialization of alternative fuels and emerging energy technologies (AFET). This endeavor will be carried out through coordination and collaborative partnership between the government and private sector in providing the enabling mechanisms and building-up local capacities.

A. ASSESSMENT

The roadmap provides a detailed outline of the strategic plans and actions required to create a country that is both efficient and environment-friendly in terms of energy utilization.

1. Policy Issuances

As a policy-making body, the DOE's primal responsibility lies in the formulation of policies and programs to ensure sustainable, secure, sufficient, and accessible energy supply to support the country's overall economic development.

In the short-term, issuance and harmonization of AFET-related policies with inter-agency jurisdiction/concern covered the following:

- Draft Department Circular (DC) on the Implementing Guidelines for Alternative Fuel Vehicles (AFVs) under Section 36 (Energy Efficiency)[106] of the 2017 Government Appropriations Act (GAA);

[106] Section 36 of GAA (Energy Efficiency). All NGAs, LGUs and government owned and controlled corporations (GOCC) shall embark on energy efficiency measures and adopt the use of energy efficient lighting, such as Light-emitting Diode (LED) lamp, in their office and school buildings, hospitals, markets, parks, street lights and other public places. Ten percent of the service vehicle fleet shall use more energy efficient and environment-friendly alternative fuel, such as electric vehicles (battery powered, hybrid, plug-in hybrid), auto-LPG, and natural gas as applicable.

- Draft DC Prescribing the Policy Framework on the Overall Development and Utilization of AFETs and AFVs;

- Draft DC on the Policy Guidelines and Regulatory Framework for the Development, Establishment, Operation, and Maintenance of Electric Vehicle Charging Stations (EVCS) in the Philippines;

- Signed four (4) Memoranda of Agreement (MOA) and 36 Deed of Donations with qualified local government units (LGUs) and national government agencies (NGAs) in Regions I, II, III V, IV-A, IV-B and ARMM regarding the deployment of 3,000 e-trikes (electric tricycles) under the Market Transformation through the Introduction of Energy Efficient Electric Vehicles Project.

- Signed a MOA and Deed of Donation with the Office of the President and the Department of Science and Technology-Philippine Council for Industry, Energy, and Emerging Technology Research and Development (DOST-PCIEERD) for hybrid electric vehicles and electric vehicles (HEV/EV) and;

- Draft Guidelines on the use of next generation vehicles.

- Facilitate the promulgation of the Philippine National Standards (PNS) 05:2019 by the Department of Trade and Industry-Bureau of Philippine Standards (DTI-BPS) as revised and updated by the Auto LPG Technical Working Group (TWG) under the supervision of the DTI-Technical Committee on Road Transport; and,

- Draft Department Order (DO) and Special Order (SO) in 2019 on the "Creation of the Special Financial Audit Team for the Alternative Fuels Fund under the Natural Gas Vehicle Program for Public Transport (NGVPPT).

2. *Legislative Advocacy*

The DOE supports various legislations/policies to further boost the promotion and adoption of AFETs. Relatedly, the DOE issued two Legislative Position Papers to wit: Inputs on pending bills related to AFVs presented at the House of Representatives (HOR) – Ecology Committee; and Inputs/Position Paper to the Implementing Rules and Regulations (IRR) of Excise Tax incentives for Alternative Fuel Vehicles, particularly hybrid and pure EVs, under the Tax Reform for Acceleration and Inclusion (TRAIN) Act Tax Reform for Acceleration and Inclusion (TRAIN) Act [107].

3. *Partnership / Leveraging*

As a necessary step towards sustainable, more efficient, and environmentally safe alternative fuels and energy technologies, there is a need to access public and private sector support, attract investments or establish partnerships to drive funding, financing, or competitive grants.

In 2018, the DOE entered into a partnership with DOST-PCIEERD through a MOA on the conduct of research and development (R&D) for the Prototyping of PNS[108]-compliant auto-LPG[109] jeepney; Field Demonstration of EV Fast Charging; and Development of Minimum Energy Performance (MEP) Protocol for EVCS. A MOA was also signed (DOE and DOST-PCIEERED) in 2019 for the

[107] Tax Reform for Acceleration and Inclusion (TRAIN) Act (RA 10963)
[108] Philippine National Standard
[109] Liquefied Petroleum Gas

"Prototyping of Solar-Assisted Plug-in Electric Motor-Power Boat." Likewise, in 2019, the DOE entered into a MOA with the Cavite State University (CvSU) on the conduct of various research and development activities for emerging energy technologies.

A Memorandum of Understanding (MOU) between the Federal Ministry for Transport, Innovation, and Technology of the Republic of Austria and DOE was drafted in 2019 on the areas of _____.

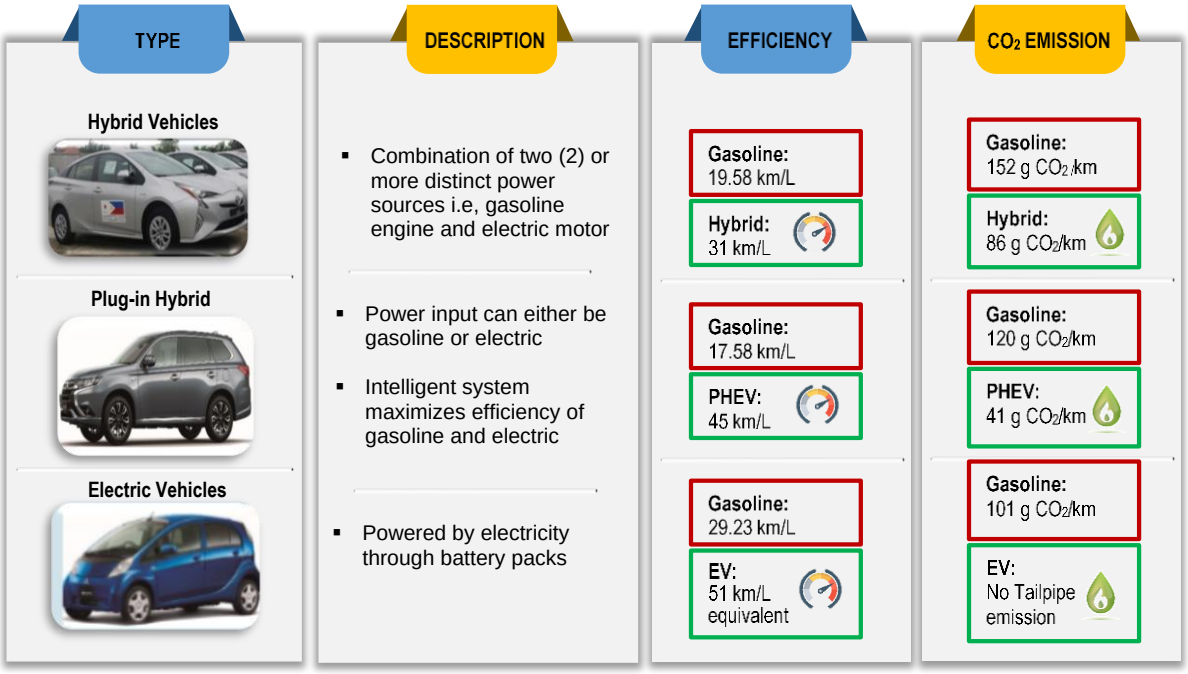
4. *Prioritization / Promotion*

The identified and promoted priority AFET activity in 2018 was the Solar Assisted Electric Motor Powered Bangca for Tourist and harnessing Human Kinetics for electricity production. The DOE, in partnership with the Philippine Information Agency (PIA), also promoted the identified AFET through the conduct of 18 information, education and communication (IEC) campaigns and three (3) promotional events nationwide.

In 2019, the DOE conducted 22 IECs on the promotion of research, development, demonstration, and utilization of AFETs as well as other promotional activities, specifically in NCR and Regions I, III and IV-A.

5. *Technology Demonstration*

To gain in-depth understanding of energy efficient technologies, the DOE organized a technology demonstration activity for the validation and pilot testing of AFETs with potential for commercialization. The conducted technology demonstrations are: a) ***hybrid vehicles*** using the combination of internal combustion engine (ICE) and electric motors as prime movers; b) ***plug-in hybrid***, similar to the hybrid, but utilizing a battery charger that could directly charge from a power outlet; and c) ***pure electric vehicle*** using only electric motors as prime mover and could charge directly from power outlet.



Further, two (2) technology assessments were completed to wit: the UP-ALAMAT's vehicle entry to the 2018 Shell Eco-Marathon whereby the recommendation for new body frame configuration and materials to reduce weight was made; and the Le Guider's (Philippines) locally converted EV

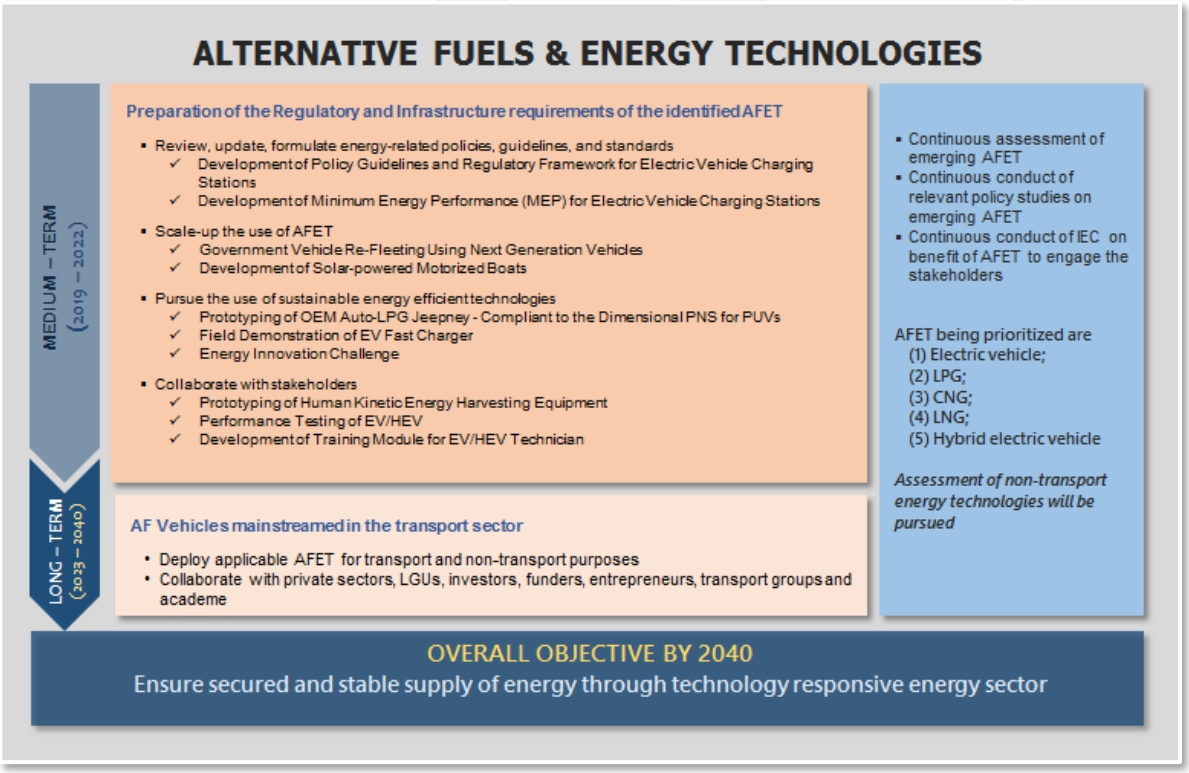
Model was developed with the recommendation to improve the transmission gear ratio to match with the electric revolution per minute (RPM) and torque. In addition, six (6) alternative fuel technologies were also pre-screened for assessment:

- Waste Cooking Oil Filtration Technology developed by Renergy Inc. to power EV charging stations;
- Biogas Production Technology using organic waste feedstock developed by BioGTS Inc.;
- Vanadium Flow Battery Storage developed by SenTek Inc.;
- Presentation of Kanasawa Engineering Systems on E-Trike Development in the Philippines;
- EV Charging Stations Technology by Hong Kong Jade Corporation; and,
- EV Charging Stations Technology by Nomura Research Institute.

B. PLANS AND PROGRAMS

With the overall objective of ensuring a secure and stable supply of energy through a technology responsive energy sector, the following Roadmap addresses regulatory and infrastructure requirements for the promotion and deployment of AFETs. Specific targets are also identified for the medium- to long-term planning horizons (*Figure 83*).

Figure 83. ALTERNATIVE FUELS & ENERGY TECHNOLOGIES ROADMAP (2019-2040)



Medium-Term

1. Review, update and formulate energy-related policies, guidelines, and standards

The DOE will establish concrete measures for the development of required infrastructure through a holistic approach to flourish the deployment of alternative fuel vehicles (AFV). The use of clean,

sustainable, reliable, affordable, and safe energy forms is essential in the mobility of the economy. Thus, the promotion of EVs and the establishment of charging stations.

Policy guidelines and regulatory framework for electric vehicle charging stations. Policy guidelines and regulatory framework will be developed to pave the way for the construction of support infrastructures (e.g. EVCS). Through these guidelines, the DOE will be able to provide alternative energy that would power not only homes and industries but also sustain the electric vehicles industry in the future.

Minimum Energy Performance for Electric Vehicle Charging Stations. As required by law, all manufacturers, distributors and dealers of household appliances, lighting products, vehicles and other energy-consuming products (including institutionally manufactured or sold products) shall comply with the PNS and Philippine Energy Standards and Labelling Program (PESLP), such as the MEP, among others. The MEP is set by the DOE for specific energy consuming products to include EVs and EVCS.

The DOE continuously gathers relevant information on EVs necessary for the establishment of the Protocol for MEP Certification on EVCS.

2. *Scale-up the use of AFET*

The country's heavy dependence on imported fuels makes it vulnerable to energy supply disruptions, global price fluctuations, and growing road transport emissions. Thus, one of the strategic priorities is the promotion of cleaner, indigenous, and optimized energy for the transport sector.

Government Vehicle Re-Fleeting Using Next Generation Vehicles. Motor vehicles are indispensable for the efficient and effective performance and delivery of essential government services. Several policies support the purchase and modernization of government vehicles, such as Section 36 of the GAA, Administrative Order No. 14[110], and the Energy Efficiency and Conservation Act of 2019 (EE&C Act)[111]. Anchored on the provision of Section 36, the DOE is working on the *issuance of rules and regulations governing the re-fleeting of government agencies towards the use of AFVs,* which specifically provide *the* guidelines on the procurement of AFVs for government offices. This is supported by Administrative Order (AO) 14 allowing all government offices to procure in the most efficient and economic manner, motor vehicles that are cost effective, fuel-efficient and environment friendly.

Further, the EE&C Act highlights the government-wide program called the "Government Energy Management Program (GEMP)," which mandates all government agencies to reduce their monthly consumption of electricity and petroleum products through efficient use of electricity efficiency and conservation of fuels for government vehicles, among others. Under this program, the DOE is looking for a more economical and cost-effective approach towards fleet acquisition of vehicles/shuttles and the savings generated from GEMP can be used to purchase vehicles with preference for AFVs. This is responsive to the preference for AFVs of all government offices, such as biofuels, natural-gas, solar and electric power.

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110 AO 14, s. 2018 provides for the Consolidation and Rationalization of the Rules on the Acquisition of Government Motor Vehicles, Adopting a Centralized System of Procurement Therefor, and for Other Purposes.

111 Under the GEMP's IRR, the use of alternative fuels in government vehicles is encouraged, among others, to help achieve at least 10.0 percent reduction in transport fuel consumption.

Development of Solar-powered Motorized Boat. A unique way to revolutionize sea transport is the development of solar-assisted motorized boat. The DOE entered into a MOA with the DOST-PCIEERD on the prototyping of the solar-assisted electric boat. To motorize our *bangcas*, the project will study the sourcing of its power directly from the sun with the use of solar rooftop panels and storage batteries. The solar photovoltaic panels provide for a clean, sustainable, and environment-friendly mode of water transport.

3. *Pursue the use of sustainable energy efficient technologies*

The use of sustainable energy efficient technologies is one of the major strategies to attain the primary goal of ensuring the country's energy security, while contributing to mitigating the adverse effect of increased energy utilization to the environment. Efforts on reducing dependence on imported fuels provide consumers the option to use alternative and advance technologies in lieu of conventional fuels, such as gasoline and diesel. Greater partnership with relevant stakeholders and recognizing the fundamental role of the private sector in pursuing the use of these energy efficient vehicle technologies is crucial in effectively implementing this government initiative.

Prototyping of OEM Auto-LPG Jeepney - Compliant to the PNS for Public Utility Vehicles (PUVs). In view of the escalating prices of petroleum products, the promotion of auto-LPG is being pursued as a viable option for transport fuel. Although it is a petroleum-based fuel, the price is much cheaper and stable as it is not considered as conventional fuel like gasoline and diesel. The promotion is aligned with the concept of providing continuous supply of fuels to the public, as well as lessening the impact of oil price fluctuations. Auto-LPG is clean and environment-friendly as it has lower GHG/toxic emissions compared with conventional fuels. However, safety and health concerns regarding its use need to be addressed. To discount health speculation on its use, the DOE conceptualized the prototyping of Original Engine Manufacturer (OEM) for auto-LPG jeepneys, which should be compliant with the PNS for PUVs in support of the PUV Modernization Program of the Department of Transportation (DOTr). The DOE will showcase the OEM auto-LPG jeepney to demonstrate the safe use and viability of auto-LPG as an alternative fuel for the public transport sector.

Electricity from Human Kinetics

Field Demonstration of EV Fast Charger. Another continuing project is the Field Demonstration of EV Fast Charger. The DOE entered into a MOA with the DOST-Science and Technology on Energy Application (STEA) for showcasing and demonstrating technologies that could energize electric vehicles faster than the usual charging methods. As charging infrastructure is vital to the growth of EVs, the DOE, together with its partner institutions, shall continue to build capacities on fast charging options as a support for EV industry mainstreaming in the transportation and energy industries.

Energy Innovation Challenge. To further develop AFETs, the energy sector will be more responsive to market conditions and current demand, with the goal of resorting towards more efficient technology evolution and innovation. This program is intended to ignite interest among stakeholders to create, design or conceptualize technological innovations on AFETs.

4. Collaboration with Stakeholders

The role of stakeholders in all phases of technology development from conceptualization and design, up to the implementation stage is critical. Their involvement, be it financial, technical or advisory, is significant to the success of energy technology program implementation. To ensure the development and exploitation of new energy technologies, the DOE is collaborating with relevant stakeholders on the following programs:

Prototyping of Human Kinetic Energy Harvesting Equipment. This program tends to use ambient energy to provide electricity for small and mobile equipment sourced or generated from human motion. Energy harvesting is now a development in power sourcing as it is always available, requiring no fuel or any logistical processes. For this, the DOE is collaborating with concerned government agencies and academic institutions in securing consultancy services for the full development of this project.

DOE Team inspecting the Toyota Prius Hybrid Electric Vehicle

Performance Testing of EV/HEV. In compliance with the PESLP and on the MEP requirement as mandated by the Energy Efficiency and Conservation Act, the DOE will continue to conduct performance testing of EVs in collaboration with DOST, UP-Diliman and the Cagayan State University. Performance testing is necessary to gather benchmark data for EV technology modeling and EV development programs, as well as for the development of the required MEP.

Performance testing of E-trike in Cagayan Valley

Development of Training Module for EV/HEV Technician. To help sustain the EV industry, the development of effective training modules for EV/HEV technicians is highly significant. This module will help produce well-trained technicians to have the necessary skills to repair electric vehicles safely from basic maintenance to full diagnostic and repair.

Long-Term

1. Alternative Fuel Vehicle mainstreamed in the transport sector

As petroleum products is vulnerable to supply disruptions and price volatility, and with adverse impact on the environment, mainstreaming of AFVs in the transport sector will help enhance supply security through fuel diversification. To achieve this objective, the DOE is working on the following initiatives:

Deploy applicable AFET for transport and non-transport purposes. As a long–term strategy, the DOE seeks to deploy applicable AFET for transport to further decarbonize the sector and reduce its dependence on oil. For non-transport purposes, the DOE shall continue to deploy identified

AFET through collaborative efforts with relevant stakeholders for the effective mainstreaming of AFETs in the market.

Collaborate with private sectors, LGUs, investors, funders, entrepreneurs, transport groups and academe. The successful adoption and commercialization of AFETs through strong collaboration and partnership with the private sector, LGUs, investors, funders, entrepreneurs, transport groups and academe with full government support shall be intensified.

2. *Continuing Government Initiatives*

Assessment of emerging AFET. Assessment of emerging energy technologies shall be undertaken regularly to reduce dependence on imported oil through fuel source diversification. The government shall then continue to encourage and provide support and cooperation to the private sector for investment generation across to maximize the benefits of alternative fuels, and advanced and emerging energy technologies.

Conduct of relevant policy studies on emerging AFET. To advocate and promote the use of AFETs, the DOE will strengthen research activities for its local adoption. This will come in the form of building up local capability for R&D and partnership with the DOST, state universities, and other research institutions.

Conduct of IEC on benefits of AFET to engage the stakeholders. The DOE shall continue to conduct IECs to create greater awareness and appreciation of the importance of cleaner AFETs, and efficient utilization of energy. By mainstreaming and encouraging the public to resort to AFET, it creates a long-term benefit to the people and the environment.

3. *Priority Alternative Fuels and Energy Technologies*

Following are various AFETs that will be promoted within the planning horizon:

Electric vehicles. To reduce dependence on transport sectors' annual petroleum consumption and for a cleaner environment, EVs shall be continuously promoted by encouraging investments especially in after sales services such as charging stations, parts and supply service centers, among others, to make it more commercially competitive and be integrated in the transportation network.

In particular, the **HEV** utilizes an electric motor and an internal combustion engine that work together or separately to propel the vehicle, while simultaneously charging the battery. It is a reliable and efficient transportation that supports the objective of the government for a more efficient, cleaner, and

Hybrid Electric Vehicle (HEV)

sustainable mobility. Although there are some challenges in the infrastructure to support its development, the DOE continues to encourage investments from the private sector to advance expansion of the HEV industry.

Auto-LPG. This supports the use of LPG as a clean alternative fuel for transportation and other equipment. The DOE shall continue to validate performance of LPG as a fuel for vehicles and formulate standards and policies to ensure public safety and welfare of the public. Likewise, research and studies for other application of LPG shall be undertaken.

Compressed Natural Gas (CNG). The commercial viability of CNG shall be demonstrated, as well as its technical requirements, market demand, and impact of incentives and public acceptance to the public transport sector. Policies and various fiscal and non-fiscal incentives shall be formulated and provided to cover the standards regarding the vehicle, refueling station, gas cylinder, and gas quality to support the implementation of the program.

4. Assessment of non-transport energy technologies will be pursued

Evaluation, testing and validation of emerging energy technologies for domestic application, specifically in the transport sector shall be given utmost attention. Also, the evaluation and validation of the following non-transport energy technologies will be conducted:

- Use of Smart control and sensors at home for energy savings;
- Grass-based biomass fuel (Bugang/Napier) for domestic cooking to address deforestation and reduce indoor pollution; and
- Alternative fuel derived from waste rubber and plastics.

5. Infrastructure Support

The government institution partners- *DOE, DOTr, DTI, DOST, Department of Environment and Natural Resources (DENR), and Department of Public Works and Highways (DPWH) and other relevant agencies* - are underway in the establishment of infrastructure support for the EV transport through close coordination and collaboration. Lawmakers have proposed bills to come up with policies, regulatory framework and incentives that will help sustain the development of the EV industry. The infrastructure measures will focus on: a) development of dedicated parking lots with installed charging stations in every public and private establishments; b) installation of public charging stations at gasoline stations, public buildings and establishments; and c) provision of green routes or alternate lanes where EVs and other alternative transport such as bicycles, e-bikes, e-scooters will exclusively pass through.

There are now several opened bicycle lanes in Metro Manila cities where bicycles and e-scooters traverse. Plans and programs are in progress in the provision of bicycle lanes in existing and future road plans of the DPWH. The LGUs will be mandated to create or identify the feasible green routes in their local public transport plan. When realized, this alternative mobility option will be convenient to the growing number of local residents who consider shifting their transport mode to bicycles, e-bikes and e-scooters in going around town/city or travelling from home to work.

C. INVESTMENT AND EMPLOYMENT OPPORTUNITIES

Electric Vehicle Industry

The EV market in the Philippines is segmented into e-tricycles/e-trikes, e-bikes/ motorcycles/scooters, e-jeepneys, e-quads, passenger EVs, and service vehicles. The market is projected to significantly grow over the next decade owing to the country's economic growth.

As a result of the intensive promotional activities and implementation of the DOE on the Market Transformation through Introduction of Energy Efficient Electric Vehicles (E-Trike) Project, the Project was able to catalyze the market by attracting fourteen (14) firms/companies/investors engaged in the business of electric vehicle manufacturing, assemblers and importers with a corresponding investment of **PhP562 Million** *(US$11.3 Million, at forex rate of US$1.00=Php49.544)* and generating about **1,050 direct jobs** from EV companies to support the creation of an electric vehicle industry in the country.

Table 58. GENERATED JOBS FROM E-VEHICLE COMPANIES

No.	Company Name	Employment	Project Location	Region
1	BEMAC Electric Transportation Phils., Inc.	206	Carmona, Cavite	IV-A
2	Emotors, Inc.	25	Binan, Laguna	IV-A
3	Gerweiss Motor, Inc.	43	Malay, Aklan	VI
4	K.E.A. Industrial Corporation	24	Bacoor, Cavite	IV-A
5	Pangea Phils., Inc.	175	Carmona, Cavite	IV-A
6	Phil-Etro EV, Inc.	97	Carmona, Cavite	IV-A
7	PhUV, Inc.	97	Caloocan, Metro Manila	NCR
8	PinoyAko Corp.	26	Cainta, Rizal	IV-A
9	PinoyAko Corporation	8	Mandaue City, Cebu	VII
10	Prozza Hirose Manufacturing, Inc.	42	Cebu City, Cebu	II
11	Ropali-Teco Corporation	115	Subic Freeport Zone, Subic, Zambales	III
12	Terramotors Philippines Corp.	27	Calamba, Laguna	IV-A
13	Tojo Motors Corp	41	Sta. Rosa, Laguna	IV-A
14	Le'Guider International E-Trike Electronics Assembly Philippines, Inc.	124	Bacoor, Cavite	IV-A
	Total Jobs Generated	**1,050 Jobs**		

Source: DTI-BOI 2019 data

Relatedly, based on DOE Investment Promotion Office (IPO) data, in 2016, there are forty-six (46) firms engaged in the EV industry with an initial investment of almost Php 1.2 Billion producing 9,000 units of EVs and giving an estimated 14,000 jobs to the Filipinos. More than 200,000 EVs are being envisioned by the Electric Vehicles Association of the Philippines (EVAP) to be on the road by year 2021 covering all types of EVs such as e-trikes, e-jeeps, e-shuttles, e-buses and e-cars for both public and private transportation as indicated in *Table 59.*

Table 59. ELECTRIC VEHICLE MARKET PROJECTION (2019-2021)

Vehicle Type	No. of Units Per Year			Total
	2019	2020	2021	
E-Trikes*	2,952	1,597	1,758	6307
E-Quads**	45	50	55	150
E-Jeeps	65	70	80	215
Other EVs (bus,trucks, etc.)	30	33	37	100

Source: EVAP and Philippine Electric Vehicle Industry Domestic Market Projection
Notes:
** Inclusion of the 3,000 e-trikes under the DOE E-Trike Project*
*** Defined as four-wheeled light electric vehicle for demonstration and non-commercial use*

With the government's support for sustainable development to the industry, the Department of Trade and Industry (DTI) implements **Executive Order No. 226** or the "*Omnibus Investments Code of 1987*" which provides Income Tax Holiday of six years to a maximum of eight years for new registered pioneering firms that will engage in the business of EVs, Alternative Fuels Vehicles, charging stations and environment/climate change-related projects as well as Duty Free importation of capital equipment, spare parts and supplies.

Executive Order 488 (s. 2006) was issued modifying the rates of import duty on components, parts and accessories for the assembly of hybrid, electric, flexible fuel and CNG motor vehicles to **zero rate**, thereby allowing e-vehicle manufacturers to import components at a more affordable price.

The Department of Finance (DOF) through the Bureau of Internal Revenue (BIR) implements TRAIN Act, which provides excise tax incentives for the following:

- Pure Electric Vehicles (EV) will be fully exempt from the excise tax on automobiles; and,
- Hybrid Vehicles will be taxed 50.0 percent of the applicable excise tax rates on automobiles.

Also, proposed **Senate Bill No. 1382 and House Bill 4075** will provide the national energy policy and regulatory framework for the use of EVs and the establishment of charging stations. This applies to the manufacture, importation, installation, utilization, and regulation of EVs, charging station, parts and components, and batteries. When enacted, this will provide a clear direction and related incentives that will give boost to the EV industry.