PRE-FEASIBILITY ASSESSMENT

ELECTRIC VEHICLES IN NIGERIA

Introduction

As the world actively pursues deliberate paths toward the creation of a more sustainable future, there is an increased emphasis on the role of state and non-state actors, corporate bodies and individuals in realizing the climate goals we have set ourselves. There is overwhelming evidence that the environmental damage caused by one country, industry, or a person affects all, to which effect we must all act together by taking responsibility for the creation of a greener planet. And there are rallying calls through the likes of the Sustainable Development Goals and the Paris Agreement, for all to step forward and act now.

Today, petroleum meets over 95% of global transportation demands; however, a sustainable world means the future of Energy companies will increasingly be based on a diversified portfolio that must include renewable energy in various forms, as oil and gas become less fashionable to investors and future workforce. We are already witnessing a significant shift, across the world, in institutional investments, with some of the world's largest investment management firms and banks boldly reducing business dealings with or completely divesting from companies that do not have active plans to improve their Environmental, Social and Governance (ESG) metrics.

It is against this backdrop that Oando has made it's first foray into renewable energy, as the journey begins for the redefinition of the future of our business and our role in the achievement of a carbon neutral world.

This document presents a pre-feasibility study assessment of opportunities within the Electric Vehicle Value Chain in Nigeria.

As a company that has always been invested in how Nigerians can through collaboration move the economy forward, we have taken the step of sharing this preliminary research of Nigeria's renewable energy space with the general public.

Our belief; if as a nation we are to pivot substantially into renewables then we must start to create platforms that will enable the growth and diversification of sector players. One of the ways we can do this is via knowledge sharing. Our objective in sharing this pre-feasibility assessment is to act as the first stage of research for interested individuals and businesses to determine and select the most technically and economically viable space they can play in.

ELECTRIC VEHICLES

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Executive Summary

Nigeria & Oando

Unstable global oil prices, an evolution of global and local polices in favor of "cleaner" energy sources, and a consequent shift in financiers' interest has accelerated the need for oil and gas companies, inclusive of Oando PLC to explore a portfolio diversification strategy towards renewable energy.

As the world transitions from fossil fuels into more renewable sources of energy (Solar, Wind, Geothermal, Tidal etc.), energy providers in the fossil fuel space must rapidly evolve to adapt to a new market reality or face disruption. One such disruption is the growth of electric vehicles to replace internal combustion engine vehicles a major swing consumer of fossil fuels.

Leveraging on the abundance of solar energy, growing financier interest in funding renewable energy projects in Africa as well as the FGN's interest in developing and executing solar power projects for rural and institutional electrification there are abundant opportunities for interested private actors to commit to an environmental sustainable Nigeria.

Introduction

The continued push for a world focused on Sustainable Development and the Energy Transition Act are increasingly tuning and shifting attention to transforming the global energy sector from fossil-based to zero-carbon by the second half of this century. The United Nations with its pledge to end poverty has provided an excellent roadmap aimed at protecting the planet and ensure prosperity for all by 2030.

The Oil and Gas industry is responding with operations models that seek to reduce carbon emissions, and with the Environmental, Social, and Corporate Governance-ESG framework, investors are putting increasing amounts of their funds in high sustainability and societal impact opportunities.

Renewables are essential in the drive towards universal access to affordable, sustainable, reliable and modern energy. Of the three end uses of renewables—electricity, heat, and transport—the use of renewables grew fastest with respect to electricity, driven by the rapid expansion of wind and solar technologies.

In Q1 2020, global use of renewable energy in all sectors increased by about 1.5% relative to Q1 2019, showing that renewable electricity has been largely unaffected while demand has fallen for other forms of energy.

The United Nations has set the pace with a plan that proposes an integrated approach to realize rapid results and progress, accelerating proven innovative solutions and partnerships. Over the next 10 years, the UN Climate Action targets:

- Carbon emissions: Absolute and per capita reductions of 25% by 2025 and 45% by 2030.
- Electricity consumption: Per capita reductions of 20% by 2025 and 35% by 2030.
- Renewable energy: 40% by 2025 and 80% by 2030 of consumed electricity.
- Commercial air travel: Per capita emissions reductions of 10% by 2025 and 15% by 2030.
- Climate neutrality: 100% of unavoidable carbon emissions are offset yearly from 2019 via certified carbon credits.
- Operational efficiencies: demonstrated long term economic benefits from the Plan implementation.
- Sustainable Development co-benefits: demonstrated increase in climate smart infrastructure and other sustainable development benefits to local communities from Plan implementation

This report provides an assessment of the solar power value chain, its technologies, opportunities and potential obstacles.

Developing the EV Business

The EV business / value chain development refers to the development and deployment of technologies to support the manufacturing of EV car components and the charging of the EVs. The main elements of these value chain are;

- Manufacturing of EV Power Train and other Sub-Systems
- Assembly of EV Cars, Distributorship and Sales
- Electricity Generation, Transmission and Distribution Infrastructure
- Manufacturing of EVSE and Other EV charging system components
- Charging Infrastructure (Private and Public)
- E-Mobility ServicesDevelopment of the EV charging business has been slow due to uncertainty around policy direction and timing; No one wants to invest in stranded assets.
- Investors must partner up with other stakeholders to define the development of EV

THE EV CHARGING BUSINESS

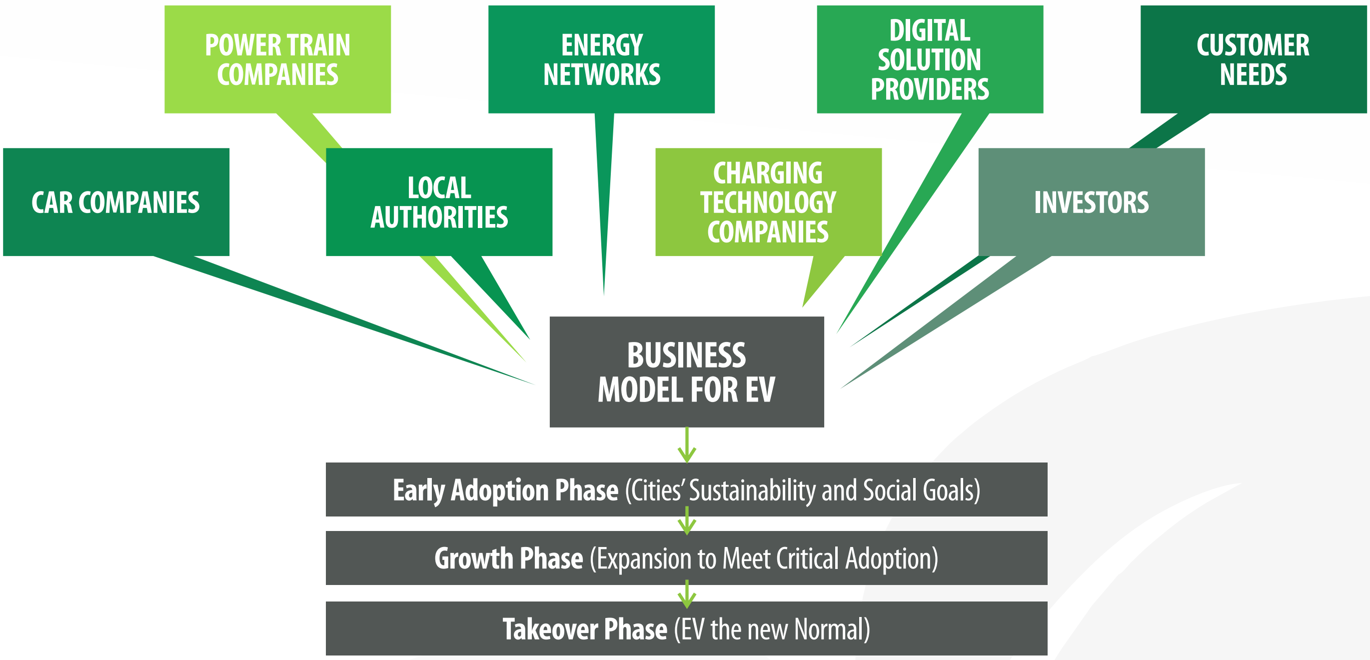
Development of the EV charging business has been slow due to uncertainty around policy direction and timing; No one wants to invest in stranded assets.
Investors must partner up with other stakeholders to define the development of EV

Most Importantly:
Investors must build infrastructure around existing demand

Developing an understanding of where the demand is coming from and how consumers will use EVs will be critical in sizing, scaling and shaping the right infrastructure. Outside the **"Home Charging Model",** two other models have been defined

Mode 1: The Destination User
Airports, Car parks, business parks and major office spaces. The target is areas where users will leave their cars for long periods of time.

Model 2: The Hub User
This targets fleets of cars, Taxis, buses, emergency vehicles, delivery trucks. This relies on the development of charging hubs around cities.



Opportunity Description

Global EV Market Size

NUMBER OF EVs ON THE ROAD IN 2010

0.002% of Global Car Stock

17,000

NUMBER OF EVs ON THE ROAD AS OF 2019

7.2 million

1% of Global Car Stock

Number of EVs on the road as of 2019

GROWTH AND SALES TREND

The global electric vehicle fleet expanded significantly over the last decade, underpinned by supportive policies and technology advances.

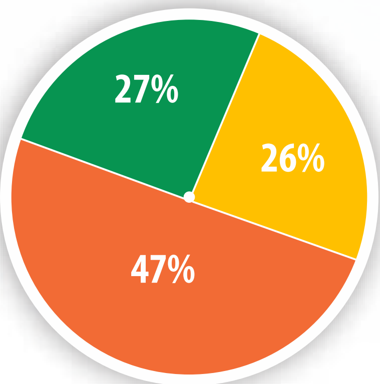
- In 2019, **2.1 Million** EVs were sold (2.6% of global car sales)
- Total EV as of 2019: **7.2 Million** (1% of global car stock)
- According to the SPC scenario, this will be 140 Million by 2030 (7% of global car stock)
- 9 countries have more than 100,000 EVs on the road today
- Although light passenger vehicles are the most popular EVs, 2-3 wheelers and light public and commercial vehicles are becoming popular

Europe has the Strongest Market Penetration

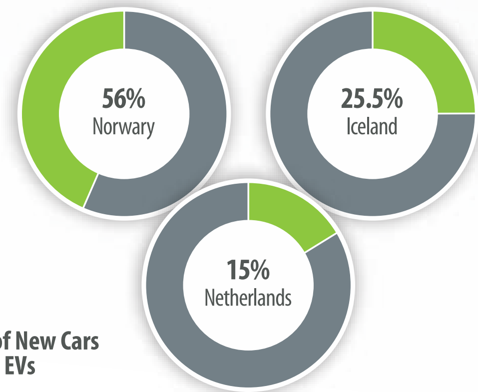
47% of all EVs are in China (Largest Market Share)

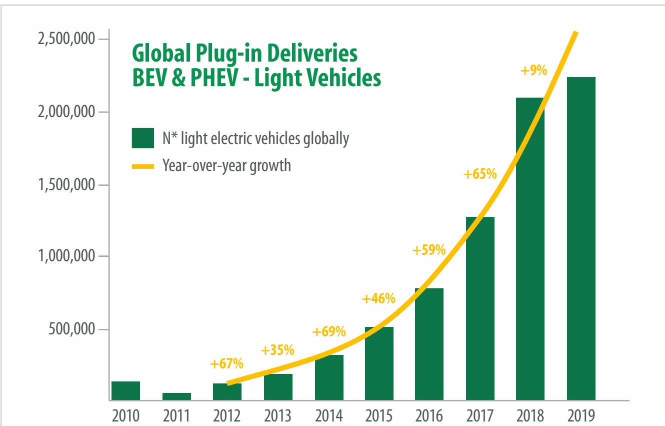
EV Units by Area

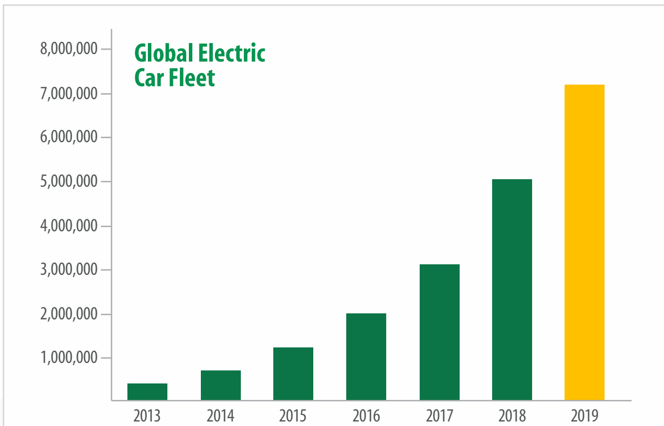
- US (1.1million units)
- Europe (1.2million units)
- China (2.3million units)



Leading Countries (Share of Sales of New Cars Running on Electricity)







Growth and Trends of EV

VEHICLE TYPE TRENDS
Transport modes other than passenger cars are also electrifying

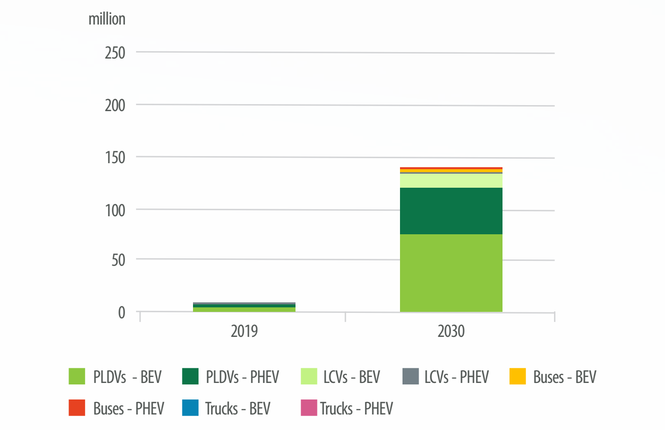
Two/Three Wheelers

- Electric mobility options have expanded to include E-scooters, E-bikes, Electric mopeds, and Electric Tricycles, which are now available in over 600 cities and across 50 countries globally
- The growth of two/three wheelers is driven by their popularity in China, India and other densely populated countries.
- The battery swap method of recharging is also efficiently suited for 2/3 wheelers making adoption easier

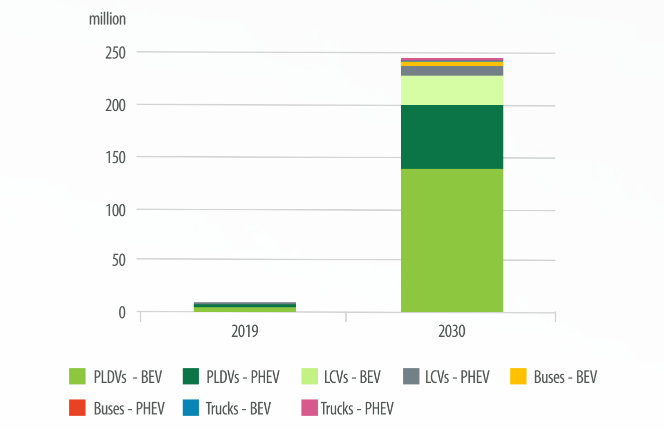
Light Commercial Vehicles

- Light commercial electric vehicles are also being deployed as part of a company or public authority fleet.
- Electric buses are also becoming popular with countries aiming to electrify most of their public transportation networks (Chile aims for 2040)

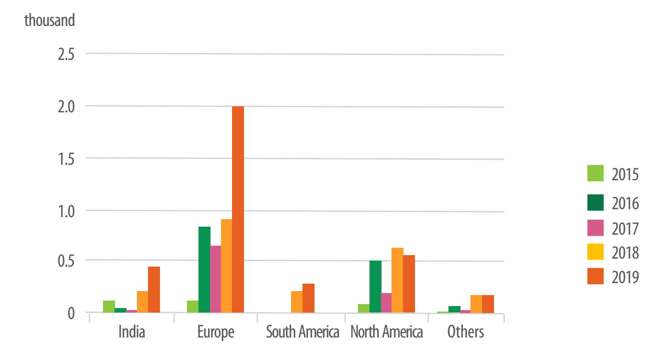
Global EV Stock in the Slated Policies Scenario, 2019 and 2030



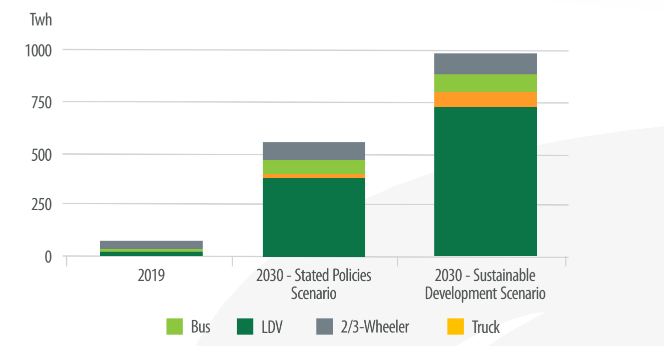
Global EV Stock in the Sustainable Development Scenario, 2019 and 2030



New Electric Bus Registrations by Country/Region, 2015 - 2019



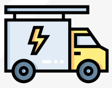
Electricity Demand from the Electric Vehicle Fleet by Mode, 2019 and 2030



Two/Three Wheelers
350 Million in circulation

Light Commercial Vehicles
380,000 in circulation

Electric Buses
500,000 in circulation



Electric Trucks
6000 in circulation

Global Market Outlook

The electrification of transportation is the new frontier of mobility and the trends exist to prove it. Other key changes/trends to note are:

Car companies have embraced EV and there are expected to be at least 21+ New EV brands in 2021 alone

- Nissan targets 1million EV & hybrid sales by FY 2023
- Renault expects 10% of its total sales to be EV in 2023 (Renault Zoe is one of the best-selling EV cars in Europe)
- Daimler plans to introduce 10 Pure electric and 40 hybrid models into its car manufacturing portfolio
- Volkswagen plans to have electrified all models of their cars by 2030 and have the entire company CO2-neutral by 2050

Utilities, Power and Other Energy companies have increased their investment in EV charging Infrastructure (~$1.7billion) and over $100 billion has been earmarked to be invested into battery and EV car manufacturing from 2018 till date.

Political and Government support is also on the rise

- In the USA, Biden has expressed support for EV adoption, targeting 500,000 new public charging outlets and restoring EV tax credits
- The UK government has made moves to bring forward its ban on fossil fuel vehicles to 2030

Private commercial companies are making changes to their fleet

- DHL has pledged to reach 70% clean operation of last-mile pick-ups and deliveries by 2025
- DB Schenker wants to make its transport activities in EUROPE emission free by 2030

As the price parity between ICE and EVs gets even closer (~2-3years), these trends act as signaling devices for the rest of the market that EVs are here to stay. It thus puts pressure on competitors, stakeholders and investors to act faster or risk being left behind

The EV Market outlook presently has two widely recognized scenarios

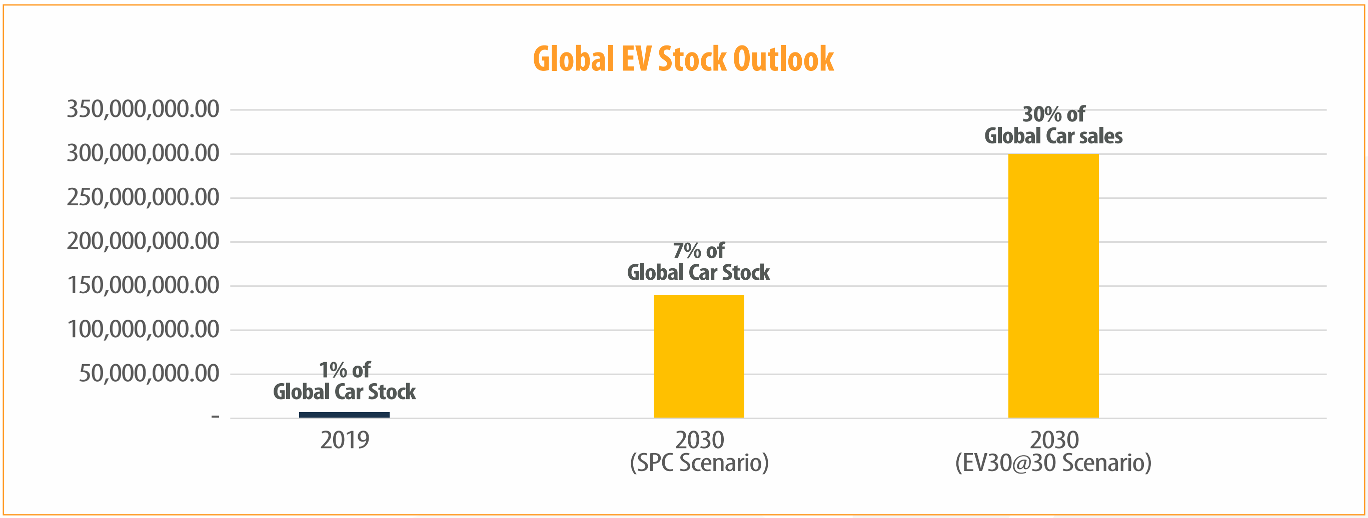
1. **The State Policies Scenario:** This reflects the impact of existing policy frameworks and today's announced policy intentions on the EV market by the year 2030. It suggests that by 2030:

- Global EV stock (excluding two / three wheelers) will be 140 million
- Global EV stocks will account for 7% of global vehicle fleet

2. **EV30@30 Scenario:** This is a Clean Energy Ministerial Campaign which aspires to help governments achieve a reduction in GHG via the transportation sector by supporting the sales share of EVs. The campaign aspires that:

- Global EV sales would be 30% of global car sales by 2030
- Global EV sales would reach 43 million per annum

Time, new data and new policies will tell how these predictions will unfold.



EV in Africa and Nigeria

Africans want Electric cars, but they are still too expensive for most car owners says a survey carried out by auto-trader. The survey also collated drivers and resistors for EV adoption in Africa as shown in the table:

In Africa, South Africa first started the adoption of EVs with the introduction of the Nissan Leaf in 2014. **Currently there are estimated 1000 EVs in South Africa. EVs can also be found in Nairobi, Kenya, Uganda, Rwanda, Nigeria.**

EVs account for only 0.001 percent of car sales in Africa. Adoption techniques have been to use EVs for Ride – hailing services.

Charging Infrastructure: South Africa has the most developed charging infrastructure in Africa with investments of over 2MUSD going into the electric power way project.

Mindshift is necessary and vital for the adoption of EVs in Africa

However, The middle east and Africa are expected to register a CAGR of about 6.80% from 2020 -2025 (Dubai aims to have 30% of road transport as Evs by 2030)

Drivers	Resistors
Anticipated fuel savings 40-70%	Higher upfront costs (Including high import tariffs and no form of subsidies)
Rapidly growing urbanization	Current lack of charging infrastructure
Opportunities provided by micro-mobility and gig economies	EV range limitations (Range Anxiety)
Lower lifetime running costs (EVs cheaper to maintain than ICE)	High electricity prices
Overcome fossil fuel scarcity (a problem in SSA)	Grid electricity supply instability (Impact of load shedding)
Environmental concerns; Desire for greener mobility	Charge time
Less Noise pollution	On-going lack of enabling policies - tax incentives and subsidies
Impending global regulations which would impact local automotive markets	No political will to support EV production / Imports and infrastructure development
Positive Image	Existing ICE "useable life"

Two and Three Wheelers expect faster growth in Africa. The UN is currently supporting projects in:
Ethiopia, Morocco, Kenya, Rwanda and Uganda.

Major Brands Introduced to Africa

- **BMW Mini-Cooper SE**
- **Jaguar I-Pace**
- **Nissan Leaf**
- **BMW i3**
- **Volkswagen E-Golf**
- **Hyundai Kona & Ioniq**

EV Assembly Plants unveiled in Africa (2018 – 2020)

- **Kampala** (Uganda)
- **Kigali** (Rwanda)
- **Lagos** (Nigeria)
- **Addis Ababa** (Ethiopia)

Main Partner Companies

- **Volkswagen**
- **Hyundai**

EV in Africa and Nigeria

In Nigeria, Hyundai and Stallion group have taken the first big step towards electric vehicle deployment and adoption in Nigeria by unveiling the first locally assembled EV electric car with a 64-kWh battery pack that allows a 300 miles (482 km) drive on single charge.

The Entrance of EV into the Nigerian space has come with many challenges, yet many opportunities. With the country's current power condition/realities comes many questions begging for answers:

- **Where is the power source going to come from?**
- **How will the generated power be distributed?**
- **How are the vehicles going to be charged?**
- **Would EV owners charge in their homes or at public stations?**
- **Who will own and operate public charging stations?**

It has however become imperative that these questions be met with solutions that would directly speak to the challenges presented with the peculiarity of our business terrain.

HYUNDAI KONA ELECTRIC: LAUNCHED IN LAGOS IN 2020

Number of EVs in Nigeria. *Unknown*

Not including HEVs like the Older generation PRIUS

Can Nigeria Sustain an EV Industry?

With an electricity access rate of 60% and a national electricity grid that relies on load shedding (rolling blackouts) to manage demand and supply of electrical power, Nigeria as a country may not be positioned for the emergence of electric vehicles. Beyond the cost of EVs, this is and will be the major resistor to the adoption of EVs on a large scale to Nigeria. Without the right energy infrastructure in place to meet the new demand for electricity that EVs will bring, Owning EVs in Nigeria will start of as a luxury for the elite as they will either

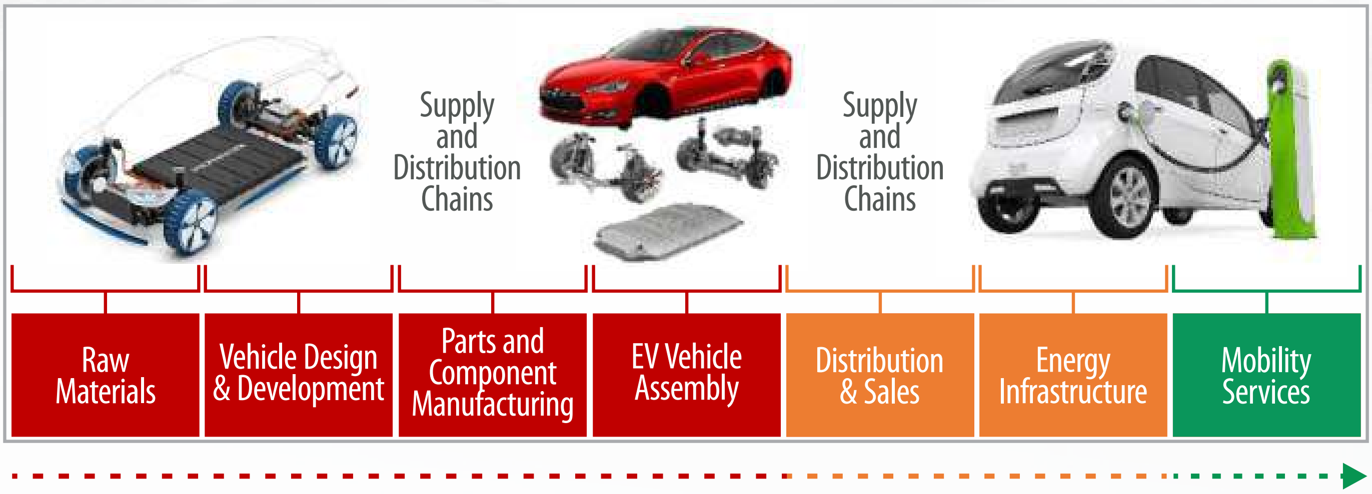
- Provide their own "fuel" (electricity) for Level 1 or Level 2 charging at homes (Sources: PHCN + Diesel/Petrol Generators + Maybe solar).
- Pay a premium to charge at privately/Government owned public charging stations - Level 2 or DC Fast Charge if the existing power supply can indeed support it.

For EVs to become a means of transport on a large scale in Nigeria,

- Power generation, transmission and distribution capacity needs to be upgraded and expanded.
- EV pricing needs to be nearly as affordable as fossil fuel powered vehicles.
- Cost of power per distance traveled needs to be more affordable than liters of fuel per distance traveled.
- Gas powered and Solar EV charging stations will need to be part of the Energy source mix.

Market Entry Strategy

Market Entry Approach



UPSTREAM

- High Technological advancement requirements
- Global & Established incumbents increasing capacity
- High Entry barriers (Including safety & manufacturing standards)
- Tough Quality expectations
- High Electrical Power requirement

MIDSTREAM

- Lower Entry Barrier
- Requires strong partnerships
- Lower capital reqauirement
- Multiple Supply Chains
- Medium Technological know-how

DOWNSTREAM

- Lowest Entry Barrier
- Multiple Supply Chains
- Low Tech Requirement
- I.T requirement
- Requires EV adoption

Risk Assessment

Risks and Mitigation Measures

TECHNICAL

Key Risk Indicators	Mitigation Measures
• Limited experience in the sector • Limited local technical expertise (Electric Vehicle Supply Equipment Supplier (EVSE-S) and Charge Point Operator (CPO) and as an E-mobility Service Provider) - lack of knowledge required to develop, produce, replicate and control the technological principles in the product/service	• Seek working partnerships and technical alliances with renowned international players in this sector. This is to augment local skill sets, gain new competitive skills and eventual technology and knowledge transfer that will have a lasting effect on the brand's product market positioning
• Slow development of the EV charging business due to uncertainty around policy direction, timing and inherent technology limitations of range (One-Time Travel Distance at Full Charge) which is envisaged to cause range anxiety for local long-distance travellers	• Seek to drive policy changes/support within this sector. It is envisaged that investor confidence would be gained by a robust and stable policy framework and long-term national objectives and targets backed up by sound market forecasts • Policy approaches to promote the deployment of EVs in relation to a variety of measures such incentives for zero- and low-emissions vehicles, economic instruments that help bridge the cost gap between electric and conventional vehicles and support for the phased deployment of charging infrastructure • The number of charging stations in the long-run can reduce the limited range problem and technological advancement has also seen the battery swap method of recharging growing which decreases charging time

FEEDSTOCK RESOURCE

Key Risk Indicators	Mitigation Measures
• Inadequate local electricity supply and infrastructure to sustain the Electronic Vehicle business/Industry. With low electricity access rates and a national electricity grid that relies on load shedding to manage demand and supply of electrical power, Nigeria as a country may not be positioned for the emergence of electric vehicles	• Build infrastructure around existing demand. An in-depth understanding of current and potential demand would be critical in strategically sizing, scaling and shaping the right infrastructure. A phased approach to adopting home, office and other public charging models would be defined • From the technical analysis, it is expected that initial adopters would provide their own fuel (electricity) for Level 1 or Level 2 charging at home (Sources: PHCN + Diesel/Petrol Generators + solar) or pay a premium to charge at private / Government owned public charging stations – Level 2 or DC Fast Charge if the existing power supply can support it

Risks and Mitigation Measures

FEEDSTOCK RESOURCE

Key Risk Indicators	Mitigation Measures
• Inadequate local electricity supply and infrastructure to sustain the Electronic Vehicle business/Industry. With low electricity access rates and a national electricity grid that relies on load shedding to manage demand and supply of electrical power, Nigeria as a country may not be positioned for the emergence of electric vehicles	**For EVs to become a means of transport on a large scale in Nigeria,** • Power generation, transmission and distribution capacity needs to be upgraded and expanded • EV pricing needs to be nearly as affordable as fossil fuel powered vehicles • Cost of power per distance travelled needs to be more affordable than liters of fuel per distance travelled • Gas powered and Solar EV charging stations will need to be part of the Energy source mix
• Limitations caused by non-existent nature of public charging stations - A sufficient number of charging stations is a prerequisite for EV adoption. The lower number of charging networks is recognized as a limiting factor for consumers to buy EVs. The public and private sectors are reluctant to invest in charging stations as the number of EV users is still insufficient and, conversely, potential EV users hesitate from purchasing EVs due to the insufficient number of charging stations	• Build infrastructure around existing demand. An in-depth understanding of current and potential demand (drive office policies to adopt EVs as official cars in line with ESG sustainability adoption by public companies) and how consumers will use EVs is critical in strategically sizing, scaling and shaping the right infrastructure. A phased approach to adopting home, office and other public charging models would be defined • Technological advancement has also seen the battery swap method of recharging growing which decreases charging time and is also efficiently suited for 2/3 wheelers making adoption easier • Seek to drive policy changes / support within this sector
• Supply chain risks – with the near-term entry strategy of exploring the downstream and mobility service component of the Electric Vehicle value chain as an Electric Vehicle Equipment Supplier, Charge Point Operator and an E-mobility Service Provider, material logistics coupled with an optimal sourcing strategy is key to gaining immediate competitive advantage	• Leverage technical partners relationship with component manufacturers • Build strategic relationships and comprehensively assess EV components supply chain partnerships whilst expanding supply optionality and having alternative back up suppliers • Perform in-line and pre-shipment inspections on components for quality control assessments • Maintain module/component delivery timelines through a risk based logistics strategy

Risks and Mitigation Measures

OUTPUT AND END USE

Key Risk Indicators	Mitigation Measures
• Slow adoption due to consumer perceptions about EVs e.g. infrastructure to support adoption, long range travel concerns - limits regarding driving distance with a single charge, higher pricing compared to CVs, charging times etc	• Social factors, particularly consumer understanding of the attributes of EVs, are being recognized as significant influencing variables for users choosing EVs over Cvs • As the popularity and adoption of EVs is significantly dependent on user acceptance, sensitization efforts and EV user education should be planned to significantly drive adoption from a quality, environmental awareness/benefits and long-term financial savings (maintenance costs) perspective
• Evaluate optimal profitability of e- mobility product or service of different streams within the value chain in order to make final investment decision	• Economic and financial models must evaluate the optimal profitability of the service within the different streams of the value chain from which a final investment decision can be made

ECONOMICS AND FINANCING

Key Risk Indicators	Mitigation Measures
• The relatively higher price of EVs compared to that of conventional vehicles (CV) serves as a critical local and regional barrier	• Transport modes other than passenger cars are also going electric guaranteeing cheaper options e.g Electric mobility options have expanded to include E-scooters, E-bikes, Electric mopeds, and Electric Tricycles, available in over 600 cities and across 50 countries globally • Help Government drive the Implementation of economic policies /incentives that help bridge the cost gap between electric and conventional vehicles & support for the early deployment of charging infrastructure coupled with other policy measures that increase the value proposition of EVs (such as parking waivers or lower toll or parking fees) • In-depth understanding of current and potential demand (help drive office and Government policies to adopt EVs as official cars in line with ESG sustainability adoption by public companies and government parastatals) whilst sensitizing the public on the environmental and medium to long term financial benefits of EV adoption (limited maintenance costs, lower carbon emissions etc)
• Limitations in market penetration rate, demand and profitability due to slow rate of adoption in Nigeria and Africa at large coupled with higher electricity price for charging battery as well as replacement cost • Low rate of market penetration compared to CVs to justify immediate commercial gains due to various cost and non-cost factors	• Development of detailed economic and financial models to evaluate optimal strategies to drive market penetration rate, demand and profitability of product /service within the different streams of the value chain from which a final investment decision can be made

Risks and Mitigation Measures

ECONOMICS AND FINANCING

Key Risk Indicators	Mitigation Measures
• Significant initial capital investment and access to finance - financial capabilities of project sponsor	• Identify local and international intervention funds and grants and be positioned accordingly to access these funds
• Eligibility to access identified funds and grants	• Perform a thorough assessment of all identified funds/grants' eligibility criteria and be strategically positioned to access same • If there are any time or experience-based barriers for fund/grant prequalification, consider partnership/technical alliances with companies that meet the set criteria
• Alternative funding barriers	• Development of a project economic model that shows the viability of the project
• Perceived high cost of doing business in Nigeria and impact on the overall value creation potential of the project/ investment	• Development of a business model that seeks to optimize the commercialization of the energy/power output with a focus on cost optimization and profitability • Development of a detailed project evaluation and commercial optimization/margin profit analysis which guarantees sustainability and profitability

GOVERNMENT AND REGULATORY

Key Risk Indicators	Mitigation Measures
• Limited policy support/traction from a regulatory perspective creating a near uncertain environment for major investors and entrepreneurs within this space In addition there are currently no tax credits for renewable energy as the Nigeria government is still in the process of developing a robust set of policies to encourage and incentivize solar power or general renewable energy development locally	• For Nigeria to expand in the electric mobility industry, Government would need to use a variety of measures such as, a revamp of the electricity supply infrastructure, institute procurement programmes to kick-start demand and stimulate automakers to increase the availability of EVs on the market, provide incentives for an initial roll out of publicly accessible charging infrastructure, fuel economy standards coupled with incentives for zero and low-emissions vehicles, economic incentives that help bridge the cost gap between electric and conventional vehicles & support for the early deployment of charging infrastructure coupled with other policy measures that increase the value proposition of EVs (such as parking waivers or lower toll or parking fees). Increasingly, policy support has to be extended to address the strategic importance of the electric vehicle technology value chain • Investor confidence can be gained by a robust and stable policy framework & long-term national objectives and targets, backed-up by sound market forecasts • Seek to drive policy changes/support within this sector. It is envisaged that investor confidence would be gained by a robust & stable policy framework and long-term national objectives and targets backed up by sound market forecasts

Conclusive Information

Carbon Credits in Nigeria

Introduction

- Developed under the Kyoto Protocol;
- Establishes the Clean Development Mechanism ("CDM") applicable to developing countries
- The CDM allows Annex B Countries to execute/finance emissions reduction projects, including renewables (such as a solar power project, waste to power) in developing countries. Such projects can earn them saleable certified emission reduction ("CER") credits.

Eligibility

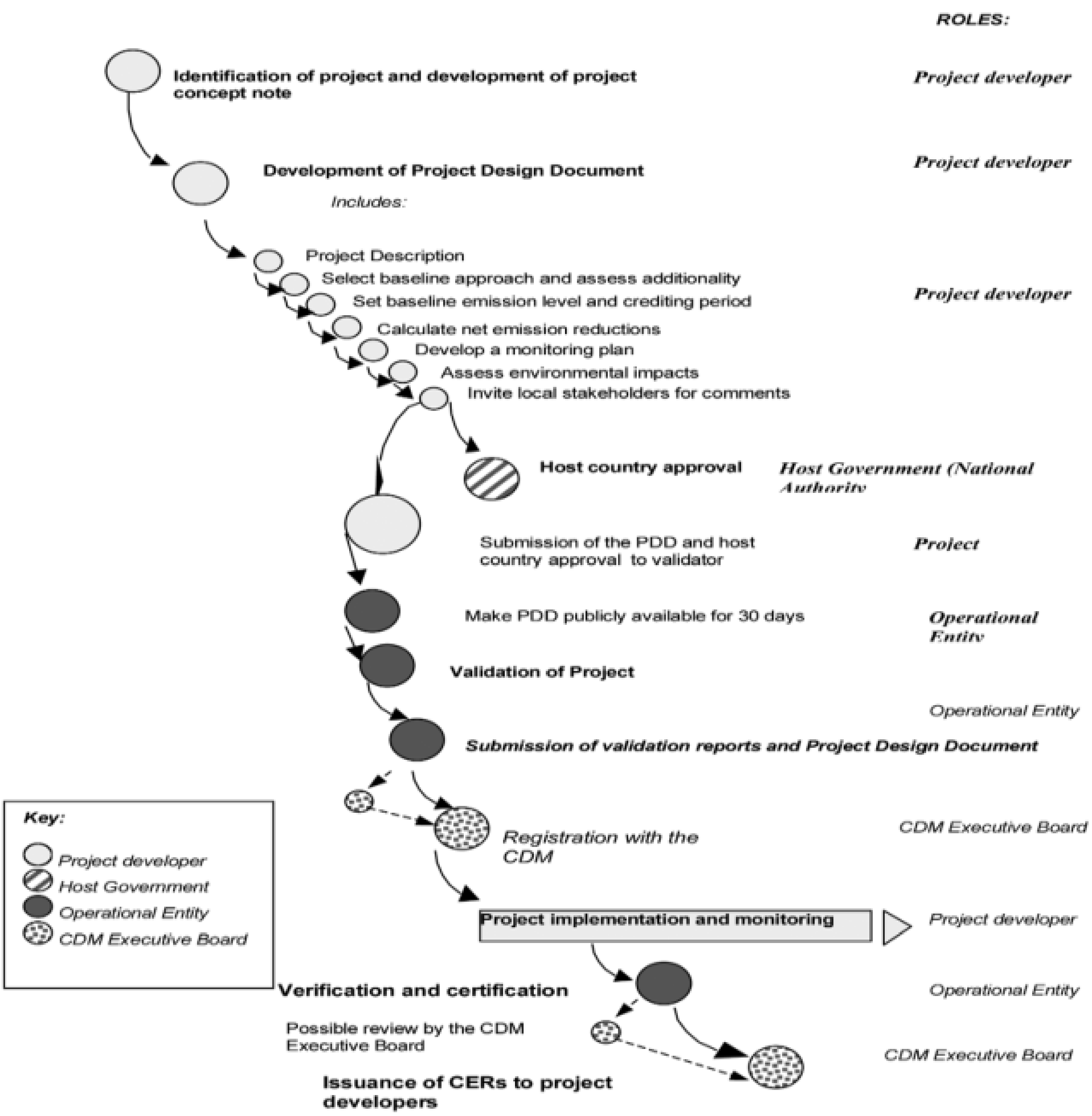
CDM project must:

- Have long term climate change benefits
- Achieve Reductions in emissions that are additional to any that would occur in the absence of the CDM project

Administration

- Presidential Implementation Committee for CDM, which was established under the auspices of the Federal Ministry of Environment;
- Companies creating projects, in developing countries, which actively reduce GHG emissions become eligible for carbon credits and then can raise funds, by selling them to a company exceeding its allowance on an exchange.
- Income from Carbon credit trading are tax exempt.
- Carbon credit prices are affected by forces of demand and supply, risks – project, sovereign, credit, etc

CDM Process flow



CBN Intervention Fund - Other Strategic Subsectors

Introduction

- Set up by the CBN in January 2016
- Funding for the agriculture, manufacturing, mining, solid minerals and other strategic subsectors
- For green and brown (expansion) projects - priority for local content, fx earnings and for job creation
- Trading activities shall not be accomodated

Other Key Points - Upstream

- Types – (i) Term Loan for acquisition of plants and machinery and (ii) Working Capital
- Tenor - Maximum of 10 years (1 year for Working Capital on a 1 year roll-over basis)
- Interest rate – 9%
- Moratorium – 1 year
- Eligibility – Borrower must be registered under CAMA

Real Sector Support Facility (initially for N300bn)

Appendix

Technical

Electric Vehicles (EVs)

PRODUCTION CAPACITY BASIS

Electric Vehicles (EVs) are vehicles that are driven by an electric motor instead of an internal combustion engine.
EVs are basically divided into 4 major categories:

- BEV (Battery Electric Vehicle)
- EREV(Extended Range Electric Vehicle)
- PHEV(Plug-In Hybrid Electric Vehicle)
- HEV (Hybrid Electric Vehicle)

The classification above is dependent on the Power Train Configuration

GENERAL OPERATING PRINCIPLE

Electric Vehicles (EVs) are driven primarily by a battery pack which stores the electrical energy that powers the electric motor. EV batteries are charged by plugging the vehicle to an electric power source. (Note: Although EV charging may contribute to air pollution, the U.S EPA categorizes BEVs as Zero-Emission vehicles because they produce no direct exhaust or tailpipe emissions).

KEY COMPONENTS AND SYSTEMS

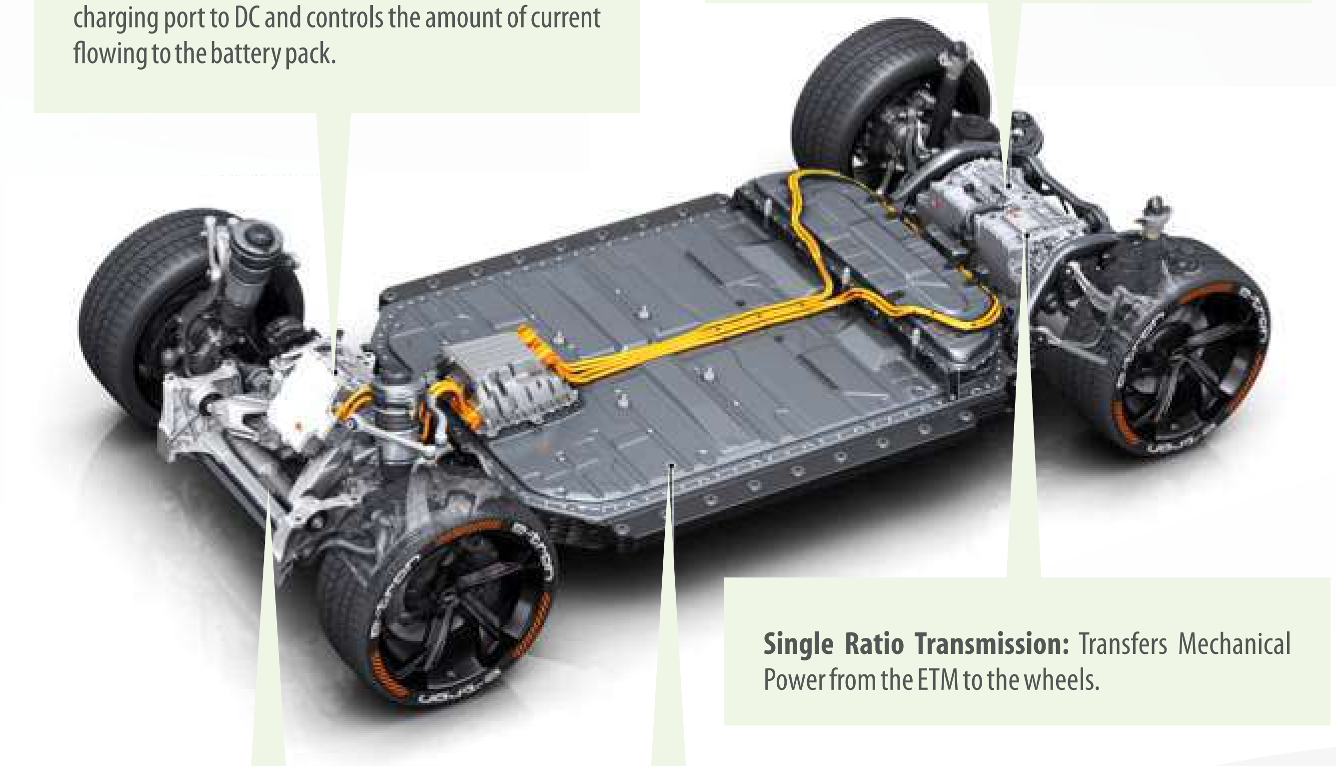
Auxillary Battery Pack	Charging Port	Onboard Battery Charger or AC - DC Converter	Transmission (Electric)	Power Electronics Controller
Traction Battery Pack	DC - DC Converter	Thermal System (Cooling)	Other Operational Systems	Electric Traction Motor (Engine)

EV Powertrain

The Powertrain is that part of the EV that provides power to the vehicles. Powertrain refers to the set of components that generate the power required to move the vehicle and deliver it to the wheels.

The Electric Traction Motor: This converts electrical energy to mechanical energy, that is delivered to the wheels via single ratio transmission.

The On-board Charger: Converts AC received from charging port to DC and controls the amount of current flowing to the battery pack.



Single Ratio Transmission: Transfers Mechanical Power from the ETM to the wheels.

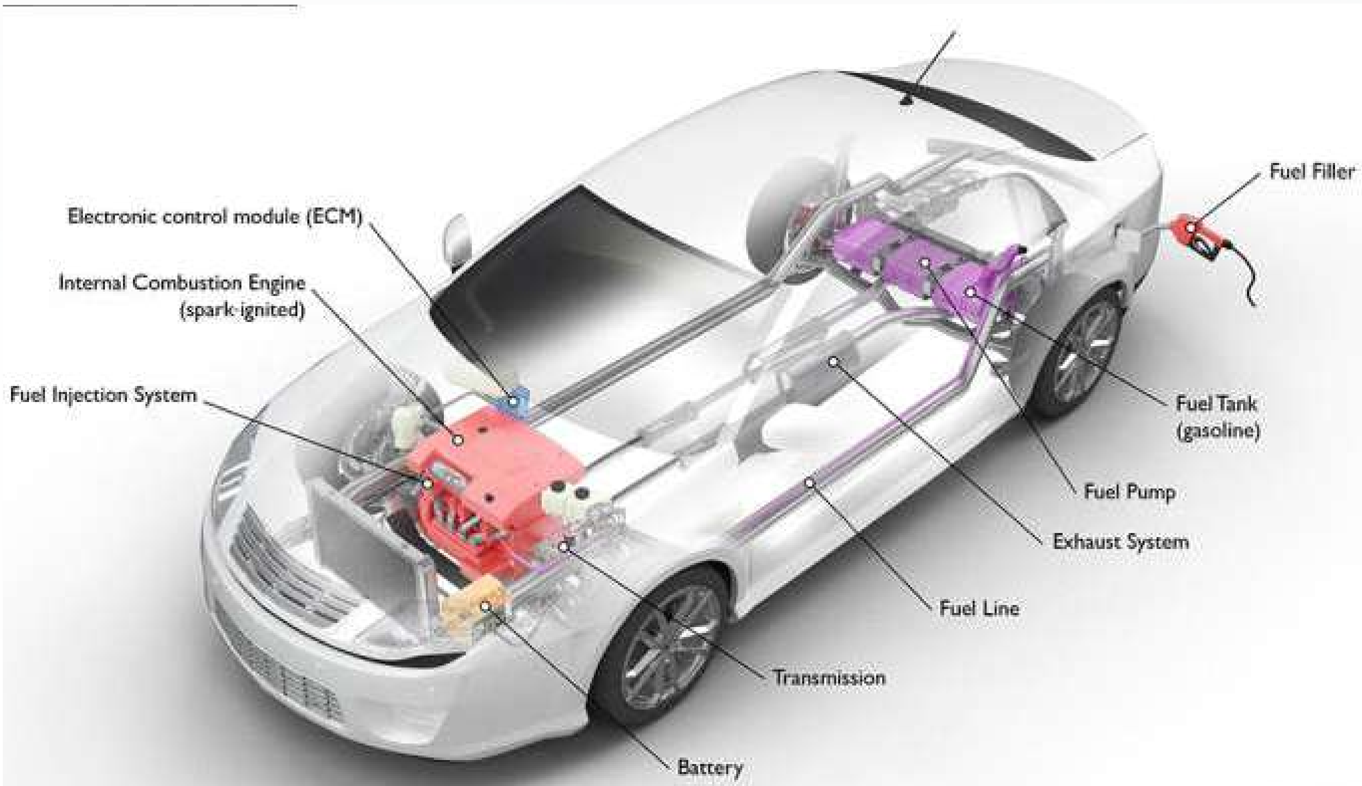
The Charging Port: connects the onboard charger to an external Power source.

The Battery Pack: made up of multiple lithium-ion cells and stores the energy needed to run the vehicle. Battery pack provides direct current (dc) output.

Powertrain Comparison

GASOLINE VEHICLE

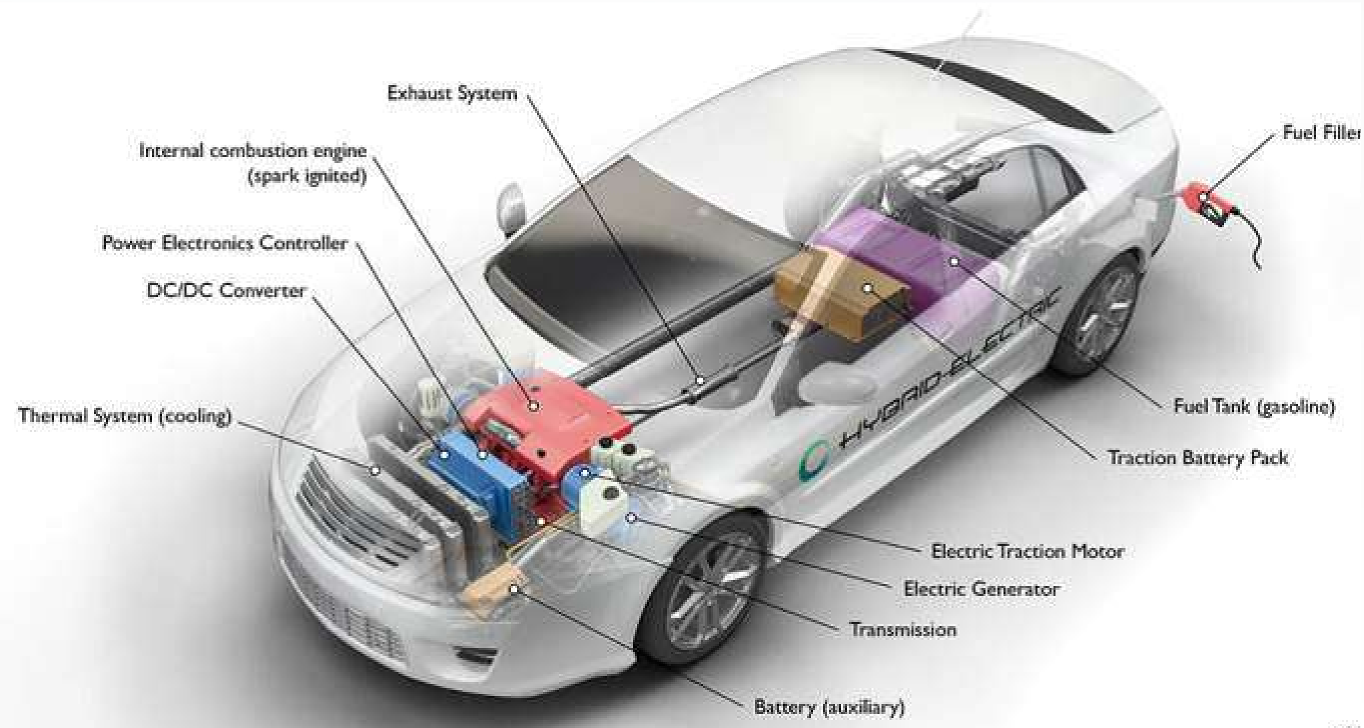
- Spark-Ignited Internal Combustion Engine
- Battery provides electricity for vehicle electronics/accessories
- Fuel System (Fuel injection System, Fuel line, Fuel pump, Fuel tank)
- Transmission transfers mechanical power from the engine to drive the wheels
- ECM – Fuel mixture, Ignition timing, emissions, operations, safeguards, troubleshooting



Powertrain Comparison

HYBRID ELECTRIC VEHICLE

- Spark-Ignited Internal Combustion Engine
- Electricity generator generates electricity from rotating wheels while braking to charge traction battery
- Electric Traction Motor uses power from the traction battery to drive / Power the car at low speed / Idle
- Fuel System (Fuel injection System, Fuel line, Fuel pump, Fuel tank)
- Transmission transfers mechanical power from the engine to drive the wheels
- Power electronics controller – manages flow electrical energy

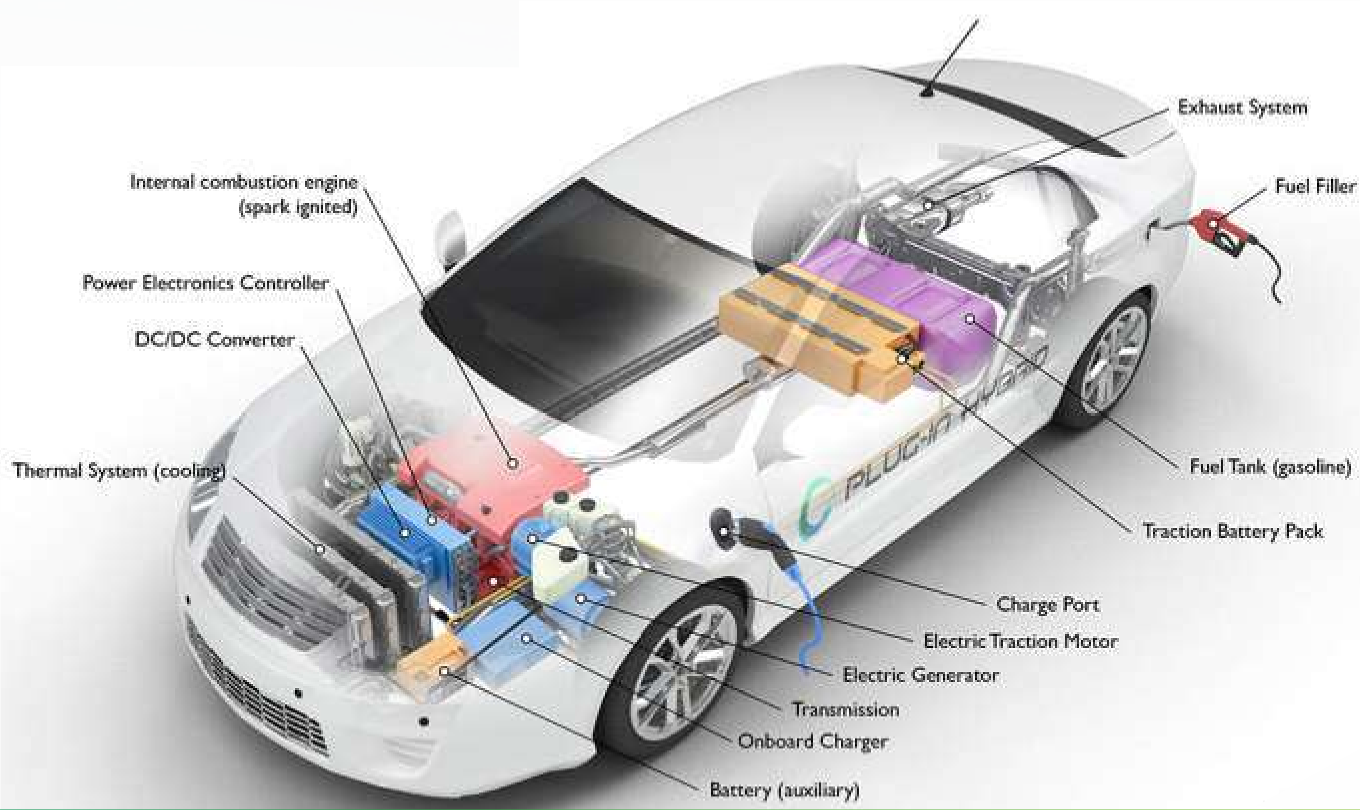


Powertrain Comparison

PLUG-IN HYBRID ELECTRIC VEHICLE

PHEVs have one major difference from the HEVs – Traction battery pack can be charged through regenerative braking, Wall outlets or charging equipment, and by the internal combustion engine

- Traction battery packs are slightly bigger
- An onboard charger and charging port have also been introduced

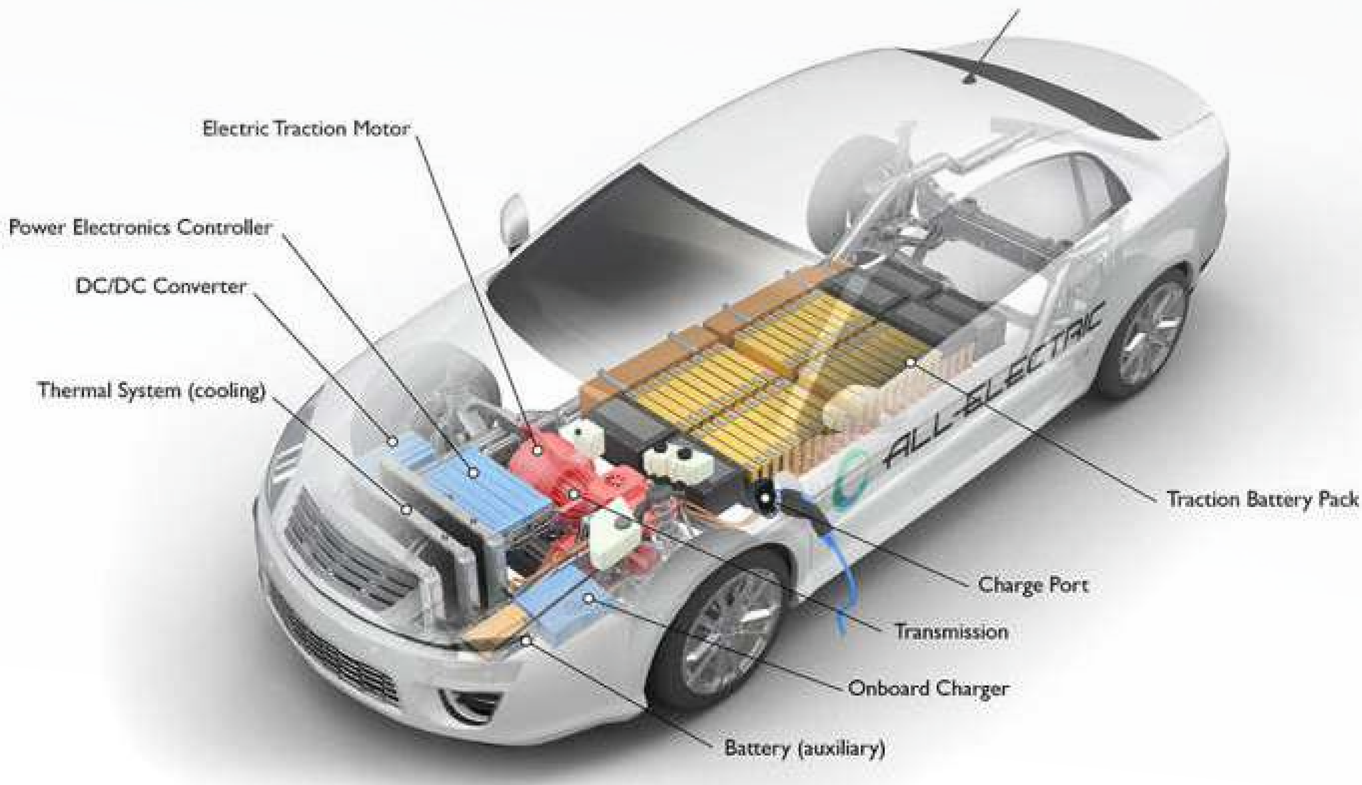


Powertrain Comparison

ALL-ELECTRIC VEHICLE

Also Known as BEVs – these vehicles operate entirely on electricity store in an on-board traction battery pack. They are charged from external electrical power sources. The major difference between BEVs and PHEVs or HEVs is the complete absence of an internal combustion Engine and fuel system

- The Electric Traction Motor is also scaled up

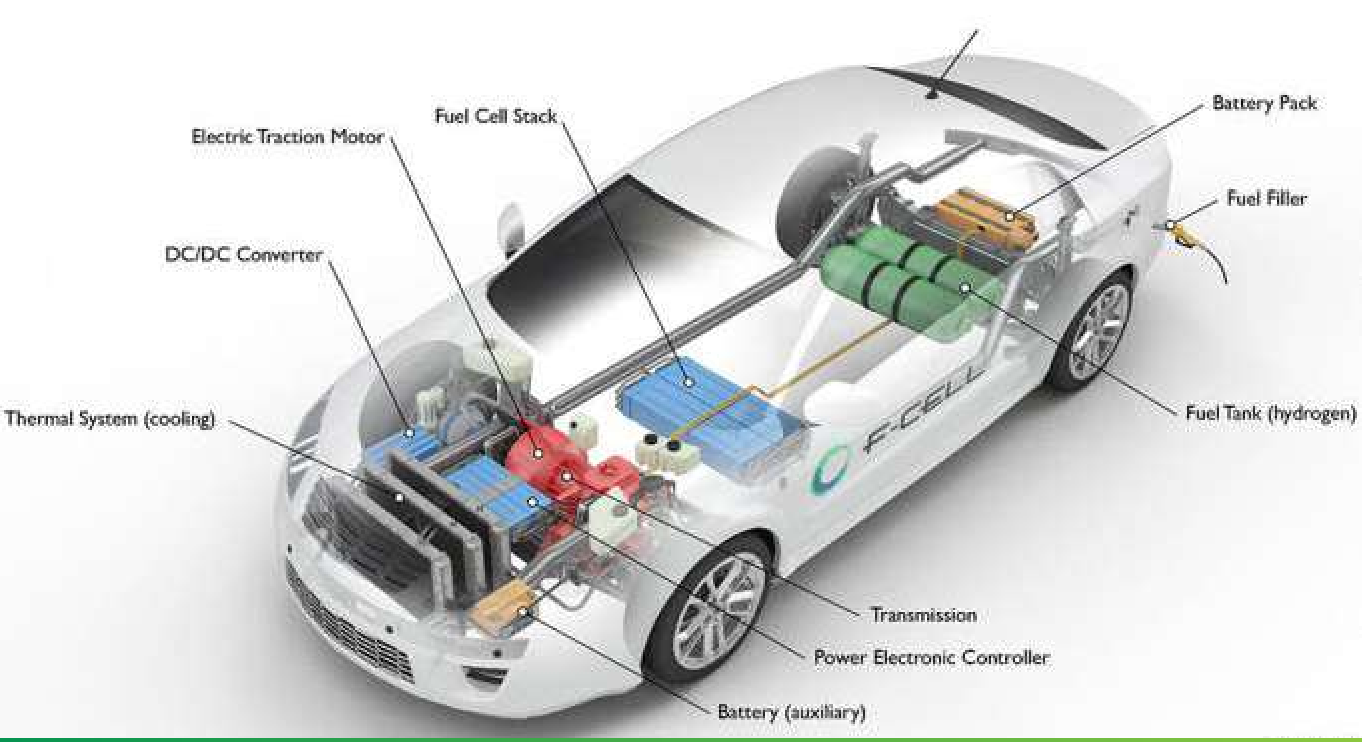


Powertrain Comparison

HYDROGEN FUEL CELL VEHICLE

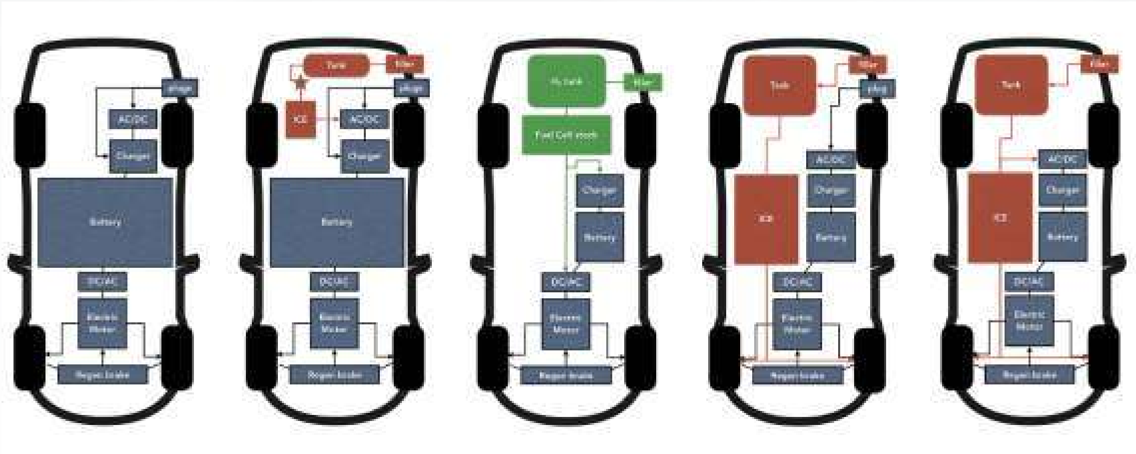
The hydrogen fuel cell electric vehicle uses electricity to power an electric motor, but this electricity is generated by a hydrogen fuel cell.

- The Fuel cell stack is an assembly of individual membrane electrodes that use hydrogen and oxygen to produce electricity (It is an electrochemical reaction – with water as a by product)



Powertrain Comparison

POWER TRAIN COMPARISON FOR EVs



	BEV	BEV + REx	FCEV	PHEV	HEV
EXAMPLE	Tessa Model S	BMWi3	Toyota Mirai	Mini Countryman Plug-in	Toyota Prius
ENERGY EFFICIENCY	73%	73%	22%	60%	54%
GEAR SHIFT	No	No	No	Yes	Yes
ENGINE	AC Induction/ Synchronous	AC Synchronous	AC Synchronous	AC Synchronous	AC Synchronous

EV Part Manufacturing

ELECTRIC MOTORS AND CONTROLLERS

BATTERY CELLS IN A MODULE

BATTERY PACK HOUSING

As with conventional Internal Combustion engines, Electric vehicles are made up of different parts and systems that are designed, Built and tested for assembly into the functional cars brought by customers.

Outside the standard parts of an automobile, Two main systems require manufacturing for a successfully built EV.

The Electric Motor and Controller: The controllers are responsible for managing the voltages and currents running from external electric supply, to the battery, to the electric motor and to other systems. The electric motors convert electrical energy into mechanical motion for propulsion. These systems are typically designed by car companies for manufacture in-house or by third-party manufacturers.

The Battery Storage System: This is made up of several connected battery cells enclosed in a specially designed housing which typically forms part of the chassis of the electric vehicle as shown in the images below. The Battery Cells are typically purchased from a battery manufacturer by the EV manufacturer in the required dimensioning that allows for easy configuration and scalability.

BATTERY MODULES ASSEMBLED IN THE CONSTRUCTED HOUSING

BATTERY AS PART OF THE CHASSIS

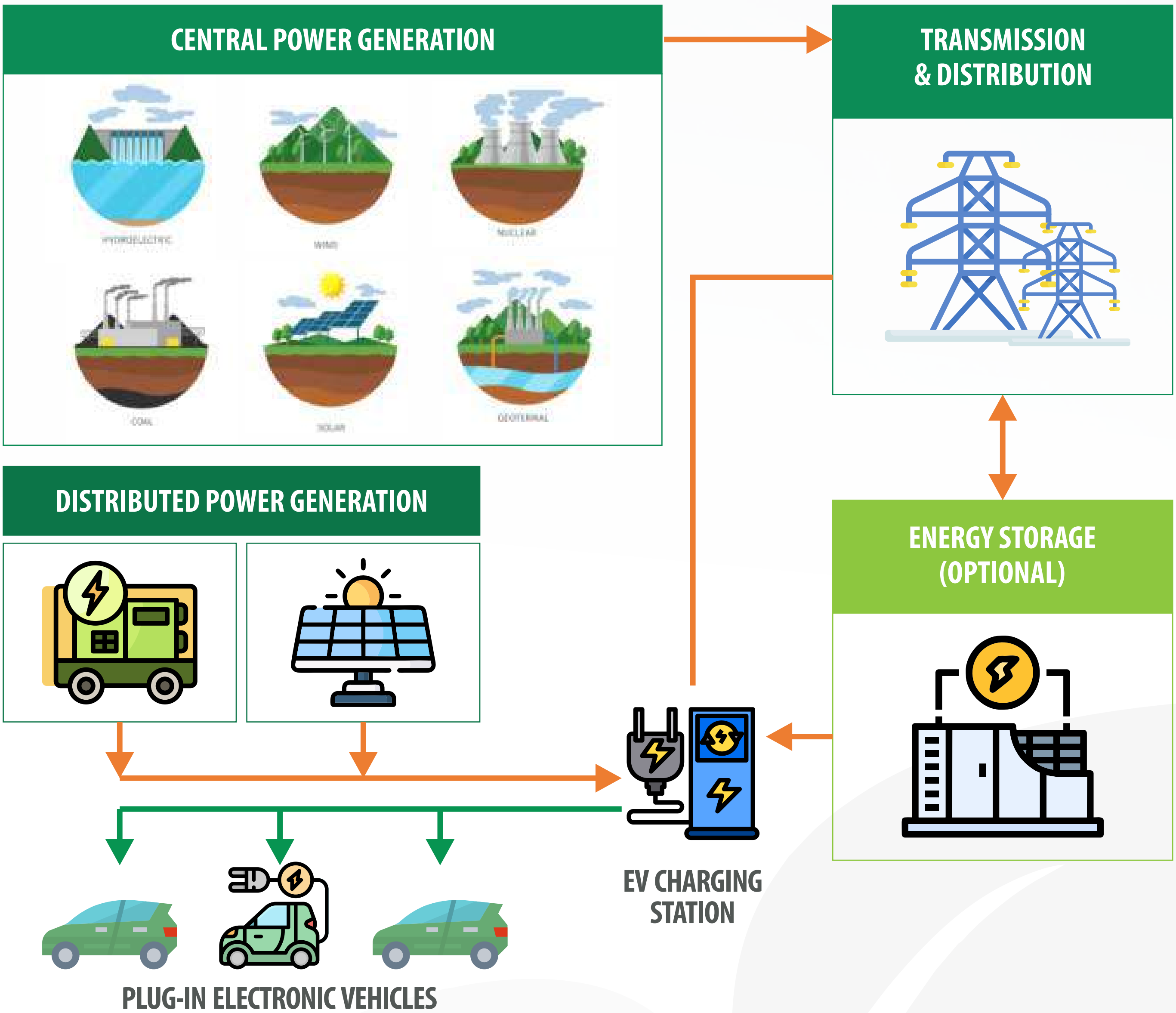
EV Energy Infrastructure

The EV Energy Infrastructure development refers to development and deployment of technologies to support the charging of electric vehicles across its increasing range of applications. The main elements of these infrastructural need include:

- Electricity Generation, Transmission and Distribution Infrastructure
- Charging Infrastructure (Private and Public)
- Smart Metering (Incl. Bundled Energy Solutions)

Key Stakeholders typically include:

- Energy supplier or GENCO
- DISCO
- Charge point Operator (CPO)
- Charge Location Owner
- Mobility Service Providers (MSP)
- Roaming Platform Provider
- EC Driver or Fleet Manager



EV Charging

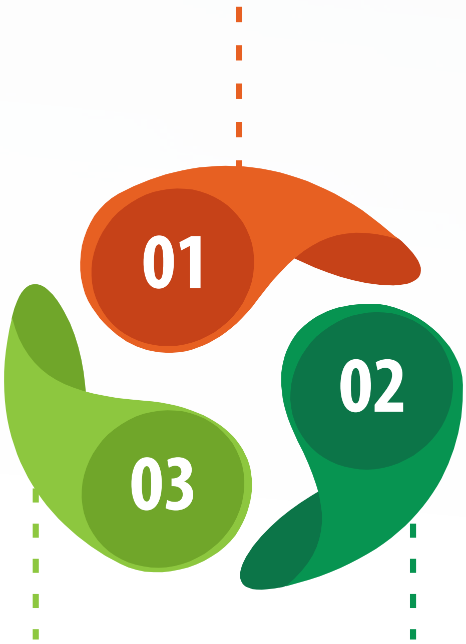
EV Cars require their batteries to be charged upon depletion after use. EV charging is done with an EVSE – Electric Vehicle Supply equipment required to condition and transfer energy from the constant frequency, constant voltage supply network to the direct current, variable voltage EV traction battery bus for the purpose of charging the battery: There are generally three ways of charging:

- Conductive Charging
- Inductive Charging
- Battery Swapping

Conductive Charging

Is a charging method where the battery is connected by a cable and plugged directly into an electricity source or charging unit. It is further classified into

- Level 1 Charging (Home / Public) – 120V
- Level 2 Charging (Home / Public) – 240V
- Level 3 Charging (Public) – 480 V



Battery Swapping

Is a method where discharged batteries are swapped with fresh - fully charged batteries at a swapping station

Inductive Charging

This method of charging works through electromagnetic transmission without any contact between the EV and the charging infrastructure.

There are two further classifications

- Static
- Charging Lanes

EV Conductive Charging

CONDUCTIVE CHARGING

Conductive charging system use direct contact between the EV connector and charge inlet. The cable can be fed from a standard electrical outlet or a charging station. The main drawback of this solution is that the driver needs to plug in the cable, but of course this is only a connection issue

The Conductive Charging Method has different Charging levels. The Charging level describes the " power level" of a charging outlet and there are three levels in charging technology.

LEVEL 1 CHARGING

This is the first level of EV charging and it is simply charging from a standard 120V AC household outlet.

EV users who do not drive very far each day tend to find this sufficient.

LEVEL 2 CHARGING

This is the second level of EV charging and it supplies >200V AC. It provides a foster rate of charge, nearly 3-4 times the rate of a level 1 charger.

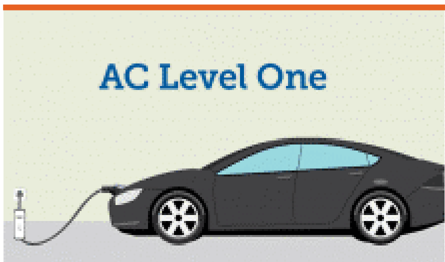
Level 2 chargers can be single or three phase power.

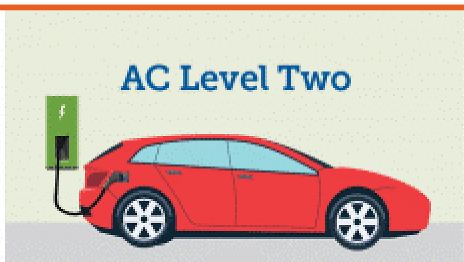
Level charging requires specialized electric vehicle supply equipment and cables. This could be home wall mount systems or public charges installed for commercial use.

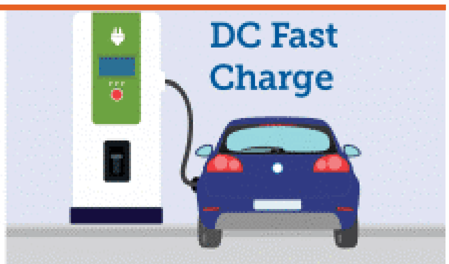
DC FAST CHARGE (SOMETIMES REFERRED TO AS LEVEL 3 CHARGING)

DC fast charging uses direct current (DC) available in much higher voltages (as high as 800V). This allows for rapid charging. How ever, DC fast chargers are expensive, and the current needed to use them is not always readily available.

DC fast chargers have a charge rate that allows them to charge most cars fully in about 30 minutes.



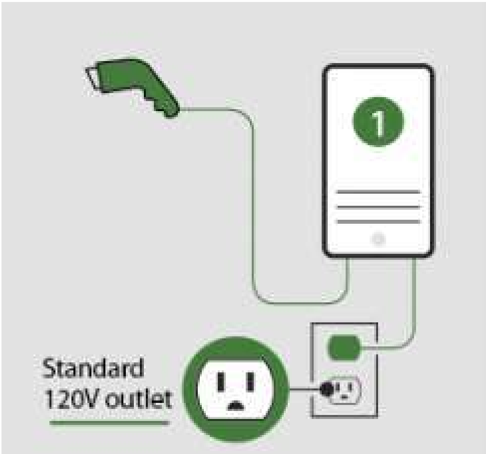
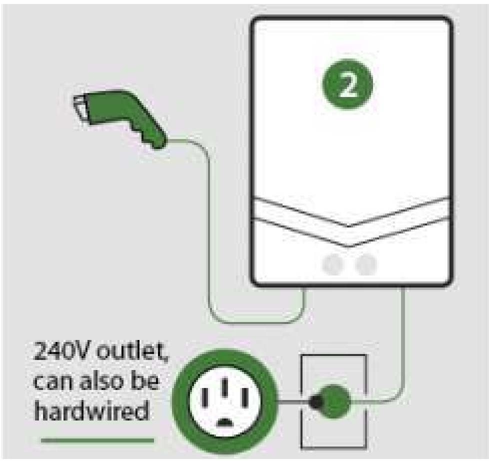
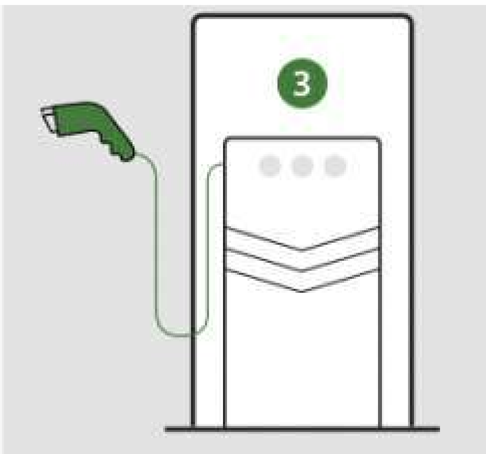




VOLTAGE 120v 1-Phase AC	**VOLTAGE** 280v or 240v 1-Phase AC	**VOLTAGE** 280v or 480v 3-Phase AC
AMPS 12-16 Amps	**AMPS** 12-30 Amps (Typ 32 Amps)	**AMPS** <125 Amps (Typ 60 Amps)
CHARGING LOADS 1.4 to 1.9KW	**CHARGING LOADS** 2.5 to 19.2KW (Typ 7kW)	**CHARGING LOADS** <90KW (Typ 50kW)
CHARGE TIME FOR VEHICLE 3-5 Miles of Range Per Hour	**CHARGE TIME FOR VEHICLE** 10-20 Miles of Range Per Hour	**CHARGE TIME FOR VEHICLE** 80% Charge in 20-30 Mintues

EV Conductive Charging

CONDUCTIVE CHARGING

LEVEL 1 **120V**		Adds 5 miles per hour of charge*	Residential Use
LEVEL 2 **240V**		Adds 20-60 miles per hour of charge*	Residential & Commercial Use
LEVEL 3 **480V** *DC Fast Charger*		Adds 60-100 miles per 20 minutes of charge*	Commercial Use

EV Conductive Charging

HOME CHARGING - LEVEL 1

As the popularity of EVs grow, EV batteries become more efficient at battery power utilization and Charging efficiency and speeds increase, it is predicted that EV car owners will prefer to charge their EVs at home with either a Level 1 or Level 2 Home charger. This is further driven by the cost of charge. It is cheaper to charge at home than at public stations.

SAMPLE TESLA LEVEL 1 CHARGERS

LEVEL 1 HOME CHARGERS

Level 1 home chargers plug directly to wall sockets and have a low rate of charge. This is measured in range per hour. Thy provide between 5-8 km per hour charge rate.

- They are typically supplied with the car ($0 Purchase & Installation Cost)
- Takes about 20hrs to fully charge a 200 km range EV

LEVEL 1 HOME CHARGER IN USE

Cost of charging is dependent on electricity tariff in the Owners Location

EV Conductive Charging

THE BOSCH POWER MAX LEVEL 2 HOME CHARGER

HOME CHARGING - LEVEL 2

Level 2 Home chargers increase the rate of charge (they are 4 – 10times faster than Level 1 chargers. Level 2 chargers provide between 12-60 miles per hour charge rates

- They are sold separately from the car
- Requires specialize installation service (By OEM or certified Electricians)

Rating: 240 Volt Level 2 charger; 16Amps Charging current

- **$ 500 - $800** RRP depending on size
- Installation: **$1,000 – 3,000** incl. Permits
- Faster charge time (4-5 hours for full charge of 200km Range EV)

Also available in larger sizes with faster charging times

WALL MOUNTED LEVEL 2 HOME CHARGER IN USE

EV Conductive Charging

A DUAL PORT – PEDESTAL MOUNTED LEVEL 2 PUBLIC CHARGER

PUBLIC CHARGING - LEVEL 2

Public charging stations allows EV drivers to charge their cars on the road when they need to travel longer distances than allowed by the full range of the EVs. These public chargers are typically found near restaurants, shopping centers, general or office parking spots and other public locations. Their locations are usually available on digital mapping platforms

LEVEL 2 PUBLIC CHARGERS

Level 2 public chargers increase the rate of charge, they are 4 – 10 times faster than Level 1 chargers. Level 2 chargers provide between 12-60 miles per hour charge rates
Rated: 3-20 kw; 240V, 16Amps Charging Current
(Find Purchase Cost below: Installation cost average: **$1k - $4k**)

TYPICAL COSTS FOR LEVEL 2 PUBLIC CHARGERS

FLEET

BASIC WALL MOUNT **$500 - $1000**

WORKPLACE

BASIC PEDESTAL **$1200 - $1700**

PEDESTAL WITH LOW LEVEL DATA COLLECTION **$1800 - $2700**

COMMERCIAL

PEDESTAL WITH ADVANCE FEATURES **$3000 - $8000**

EV Conductive Charging

PUBLIC CHARGING – DC FAST CHARGERS

Level 3 public chargers increase the rate of charge (they are 20-40 times faster than Level 1 chargers, and 8-10 times foster than most Level 2 chargers.

They are sold separately from the car

- Requires specialize installation service (By OEM or certified Electricians)
- They are not available for residential use and are typically used for commercial applications

Typical Rating:
50 KW – 480V
Takes 30-45 mins for 200km range

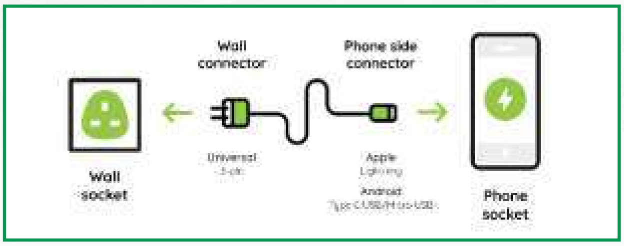
Price Range:
$10,000 - $50,000

Installation costs Ranges (Dual Port):
$4,000 - $20,000
Depending on presence of existing infrastructure

NOTE:

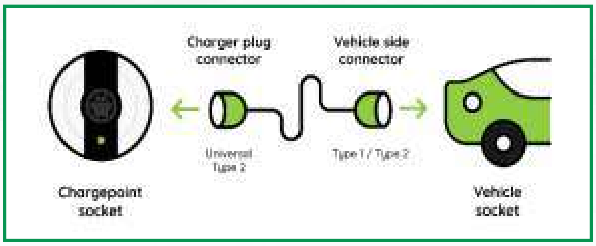
- Not all cars can charge with Level 3 chargers.
- They require unique charging connectors and power train architecture
- View following slides for more on the subject

EV Charging Connectors



If you can relate to this
<------------------

You can understand this
------------------->



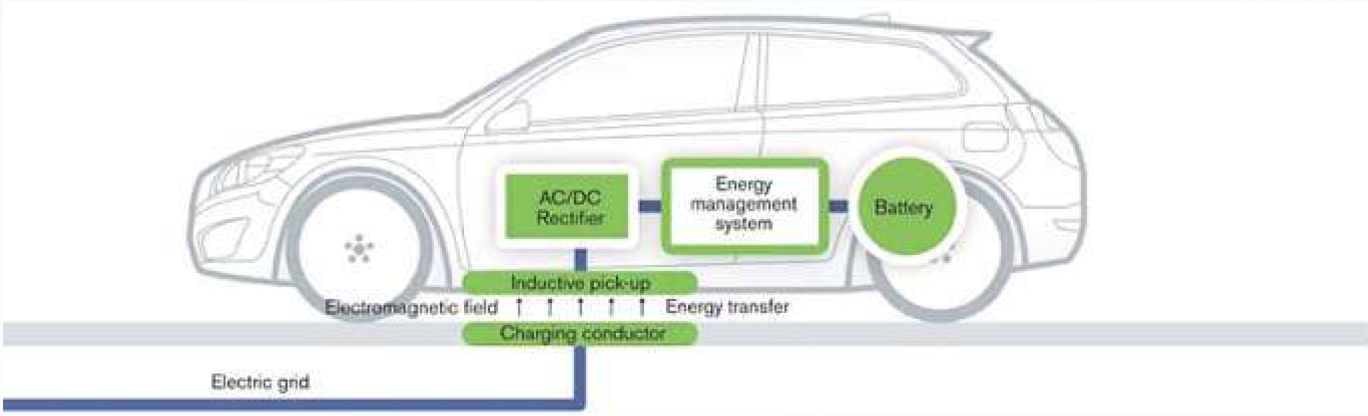
It is important to note that we cannot possibly talk of EV charging without the Charging cables. Similar to phone charging cables, EV charging cables tend to have two connectors, one that plugs into the vehicle socket and the other into the charge point. However, some charge points could have Charging connectors "Tethered".

The type of connector required varies by vehicle and the power rating ("speed") of the charge point.

- Electric vehicles either have a Type 1 or Type 2 socket for slow/fast charging and CHAdeMO or CCS for DC rapid charging.
- Most slow/fast charge points have a Type 2 socket. Occasionally they will have a cable attached instead.
- All DC rapid charging are tethered with mostly a CHAdeMO and a CCS connector.

EV Charging: Inductive

INDUCTIVE (WIRELESS) CHARGING



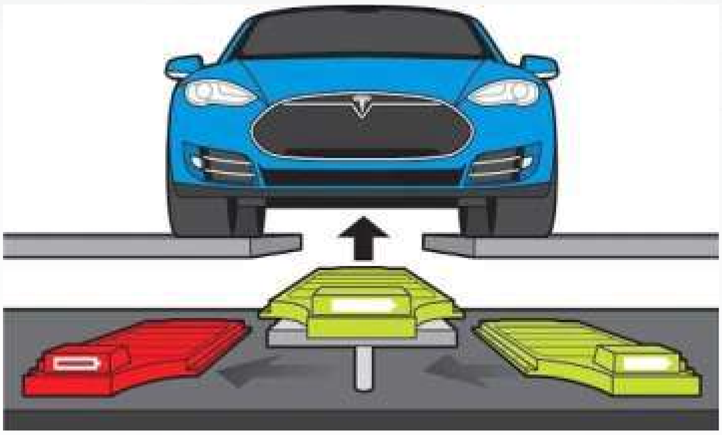
Inductive charging uses an electromagnetic field to transfer energy between two objects. Electricity is transferred through an air gap from a magnetic coil in the charger generating an alternating electromagnetic field (usually fixed on the ground or charging platform) to a second magnetic coil fitted to the car. All the driver needs to do is park in the right place to align both coils and charging will begin. These two induction coils in proximity combine to form an electrical transformer.

- Advanced Inductive Chargers like the Halo by Qualcomm and others by BMW and tesla can provide a Level charging experience
- Only about 10% of power is lost using inductive charging
- The Inductive pads can be purchased and fitted to most new Evs
- They cost between $1,500 - $3,000 and require professional installation

EV Charging

BATTERY SWAPPING

Battery swapping is simply the concept of swapping an already discharged battery pack with a fully charged battery eliminating the delay involved in waiting for the vehicles battery to charge. This is usually carried out in battery swapping stations (BSS).



Battery swapping has had a couple of false starts. Better Places launched in 2005, pioneering BSS. They could only get Renault on board – couldn't get other car manufacturers or gas stations to buy into deploying them. Tesla also launched a battery swap service in 2013 and shut it down in 2016. BSS are expensive to build, maintain and the cost of battery replacements tend tot fall to manufacturers.

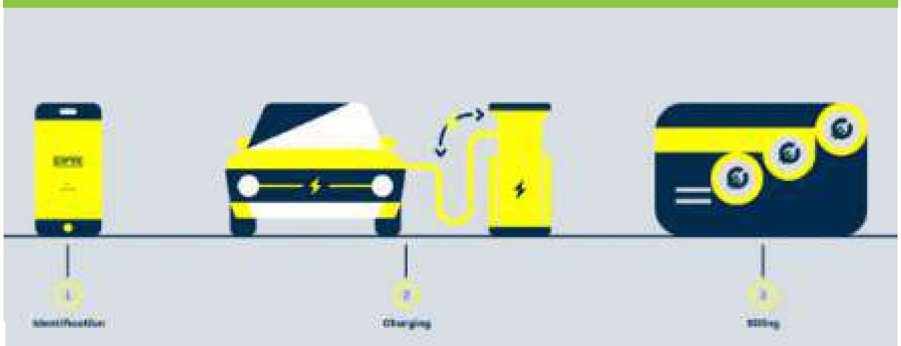
More recently a company in China NIO has set up 125 battery swapping stations for its E-vehicles. Offering battery swapping for free as a buy incentive to its potential customers. This tech is expected to be phased out as range and charge time continue to be improved.

BATTERY SWAPPING HAVE FOUND HUGE APPLICATIONS IN OTHER MOBILITY SOLUTIONS SUCH AS THE YAMAHA + GOGORO SMART SCOOTER

Smart Charging

SMART CHARGING

IDENTIFY. CHARGE. PAY. (ALL WHILE USING DATA TO IMPROVE SERVICE)



SMART EV CHARGING FEATURES

- Find available charging stations for your EV
- Charge faster with BMS included
- Charge Safer
- Save money with network incentives, discounts and benefits

BENEFITS TO MUNICIPALITIES AND UTILITY OPERATORS

- Grid stability from the ability to control charging remotely and to match grid availability, energy production and consumption
- Energy management and consumption data

SMART CHARGING BENEFITS TO BUSINESSES AND CHARGING OPERATORS

- Monitor and control EV charging remotely
- View usage statistics and data
- Manage and monitor charging station issues
- Make changes to pricing packages and charging station information conveniently
- Seamless energy metering
- Seamless billing (on-site or offsite)
- Improved billing offerings (pay-as-you-use or subscriptions)
- Manage electricity consumption at stations (great for managing peak and off-peak pricing of power consumed)
- Better asset function and integrity management
- Asset life extension

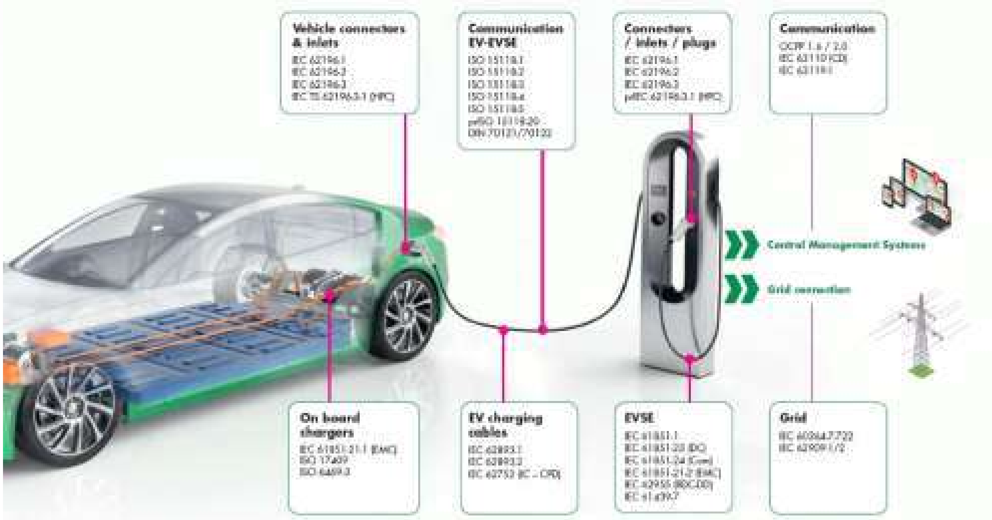
EV R&D and Standards

The advancements in Electric vehicles Hass primarily been as a result of funded research in research in Power Electronics, Electric Motors and battery storage systems. These key research areas make it possible to develop electric drive technologies (Power Trains) that meet mobility performance on par with conventional car propulsion systems.

Research efforts are mainly trying to achieve the following

- Reduction in cost, weight and volume of key components including the energy storage
- Improvements in performance, efficiency and reliability
- Development of innovative modular and scalable designs
- Improvement in manufacturability
- Acceleration of commercialization

EV INFRASTRUCTURE STANDARDS



> **EV companies are in a race to develop the most cost friendly and efficient power train in the market and thus they keep some of their developed technologies proprietary**

As the electrification of the automotive industry continues to progress, car designers and manufacturers, charging service providers and the power industry have come together to standardize components and infrastructure surrounding the safe operations and maintenance of the vehicles.

The 3 major areas currently receiving these attentions are

EV Batteries

- Range, weight and size considerations
- Functional and electrical safety
- Environmental and performance testing

EV Charging

- Communication protocols
- Market specific requirements and
- Wireless and inductive charging development

EV Electronics and Components

- ISO and IEC Standards considerations
- Inverters, converters, and on-board chargers
- Connectors, plugs, charging cables, etc.

Drivers and Resistors

GROWTH FACTOR

The main growth factors for the development and deployment of EVs are as follows:

Technological Advancements

- Improvements in battery technology will reduce cost of EV production
- Improved energy density will also increase range and efficiency
- Improved chargers will lead to less time for battery charging and increase adoption in both first and third world countries

Price of Raw Materials (Battery and Charging Components)

- A reduction in price of raw materials such as Cobalt, lithium, silicon and other battery and charging related materials will lead to a further drop in EV manufacturing cost and sales price

Energy and Charging Infrastructure

- Improvements in power stability, availability, generation and transmission will aid the deployment of EV charging infrastructure across a wider network.
- The availability of power in conditions suitable for Fast charging will also influence the adoption of EVs especially in third world countries

Incentives and Policies

This includes but not limited to;

- Purchase Subsidies (including ICE trad-in incentives and Purchase financing)
- Infrastructural development financing
- Tax breaks and Credits
- Hardware and mobility service standards and mandates
- Import and export regulations
- Emission policy and sustainable development goals / Targets

Market Readiness (Investors, Manufacturers, End Users, EMSPs, Governments)

- As policies and incentives continue to be deployed, market readiness will be signaled, and investors interest will grow as the uncertainty in the market is mitigated
- The environmental and sustainability objectives of governments backed by policy and political will would make it halt growth in each market locality
- The Perception of people will also be a huge factor. Manufacturers and other key stakeholders must engage in end user education. The availability of varieties in car type, function and design will also encourage adoption.

EV Related Policies

Governmental International and local policies play a huge role in the adoption of Evs. Some of the most effective policies that have been implemented to date across some of the major EV markets are as seen in the table below. As the adoption of EVs increase, it is only a matter of time until the rest of the world catches up.

A SHIFT FROM DIRECT INCENTIVES TO POLICY

At the start of the EV technology growth path, due to the high cost of manufacturing it was essential that fiscal incentives and subsides be extended to both EV manufacturers and Users. Some these incentives included:

- Purchase subsidies
- Purchase financing
- Scrappage bonuses
- Infrastructural development financing
- Federal tax credits

With technology improvements in Battery Efficiency, Battery charging, and the Energy infrastructure which have led to an overall decrease in the cost of manufacturing, purchasing and maintaining an EV there are indications of a continuing shift from direct subsidies to policy approaches that rely more on regulatory and other structural measures – including zero-emission vehicles mandates and fuel economy standards –which will set clear, long-term signals to the auto industry and consumers that support the transition to EV in an economically sustainable manner.

Policies need to be tailored to support a market transition respective to the locality in question.

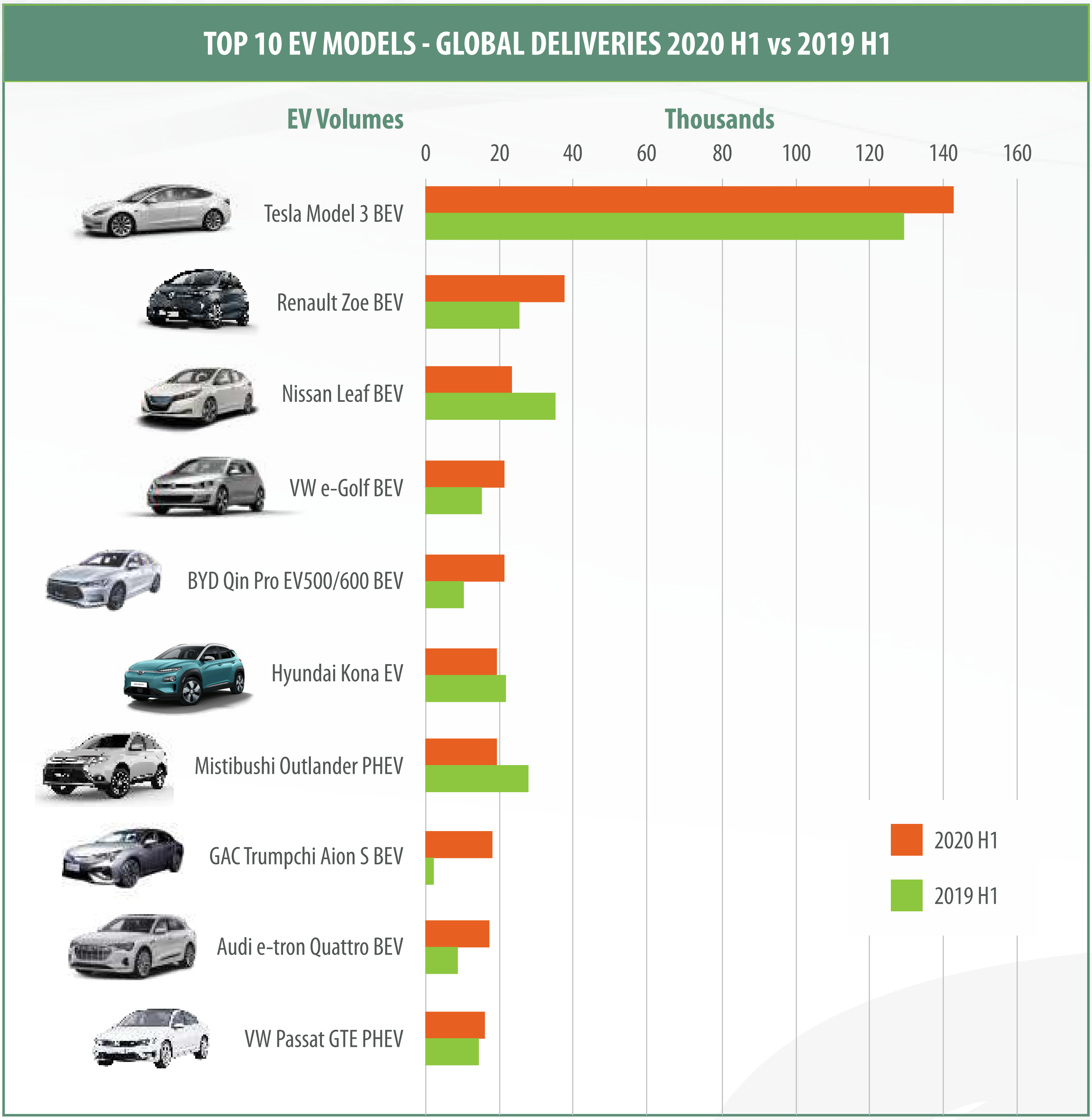
EV-Related Policies in Selected Regions

		Canada	China	EU	India	Japan	US
Regulations (Vehicles)	ZEV Mandate	✓*	✓				✓*
	Fuel Economy Standards	✓	✓	✓	✓	✓	✓
Incentives (Vehicles)	Fiscal Incentives	✓	✓	✓	✓		✓
Targets (Vehicles)	ZEV Mandate	✓	✓	✓	✓	✓	✓*
Industrial Policies	Subsidy	✓	✓			✓	
Regulations (Chargers)	Hardware Standards**	✓	✓	✓	✓	✓	✓
	Building Regulations	✓*	✓*	✓	✓		✓*
Incentives (Chargers)	Fiscal Incentives	✓	✓	✓	✓		✓*
Targets (Vehicles)		✓	✓	✓	✓	✓	✓*

*Indicate that the policy is only implemented as a state/province/local level

** Standards for chargers are a fundamental prerequisite for the development of EV supply equipment. All regions listed here have developed standards for chargers. Some (China, EU, India are monitoring specific standards as a minimum.

Top EV Cars & Makers



Top EV Cars & Makers

There are many car manufacturers now playing in the EV space. These Car makers are mainly from the USA, Germany, France, South Korea, Japan and China. Most are existing car makers while a few are new car companies strictly in the EV business.

CAR COMPANY & BRANDS

TESLA	Tesla Model 3 (BEV) Tesla Model S (BEV) Tesla Model X (BEV)
NISSAN	Nissan Leaf (BEV)
BMW	BMW i3 (BEV)
HYUNDAI	Keona Electric (BEV)
CHEVROLET	Bolt EV (BEV) Volt (PHEV)
RENAULT	Zoe (BEV)
Volkswagen	ID3 (BEV) E-Golf (BEV) Passat GTE (PHEV)
Audi	e-tron (BEV)
HONDA	Honda e (BEV)
KIA	E-Niro (BEV) Soul EV (BEV)

Top EV Cars & Makers


TESLA - MODEL S


NISSAN - LEAF


BMW -i3


HYUNDAI - KONA ELECTRIC


HONDA - E


AUDI - E TRON


CHEVROLET - BOLT


KIA - NIRO


PEUGEOT - E208


VOLKSWAGEN - E GOLF


NIO - ES8


RENAULT - ZOE

SOME OTHERS

- PORSCHE - TAYCAN
- JAGUAR - I PACE
- FORD - MUSTANG MARCH E

Legal and Regulatory Framework

Applicable Laws and Regulatory Institutions: Electric Vehicle

Nigerian Electricity Regulatory Commission (NERC)	The regulator of the electricity industry and generally responsible for enforcement of the EPSRA and such other related or incidental matters.
Standard Organisation of Nigeria (SON)	Issues the Mandatory Conformity Assessment Programme ("MANCAP") Certificate for all locally manufactured products in Nigeria to ensure they conform to the relevant Nigerian Industrial Standards (NIS) before being presented for sale in Nigeria or exported Also issues the Standards Organisation of Nigeria Conformity Assessment Programme ("SONCAP") Certificate for all products imported into Nigeria. The SONCAP Certificate will be required for components or equipment imported for use in installing power systems in Nigeria
National Office for Technology Acquisition and Promotion (NOTAP)	Registers contracts for the transfer of foreign technology to Nigerian parties as well as every agreement in connection with the use of trademarks, use of patented inventions, supply of technical expertise, the supply of basic or detailed engineering, and the supply of machinery and plant, among others
Nigerian Electricity Management Services Agency (NEMSA)	Carries out electrical inspectorate services in Nigeria's electricity supply industry and ensures that all major electrical materials and equipment used in Nigeria are of the right quality and standards, among other powers
National Agency for Food and Drug Administration and Control (NAFDAC)	responsible for regulation and control of the importation, export, manufacture, advertisement, distribution, sale and use of, among others, chemicals. To the extent that we would import, manufacture or utilize chemicals in the manufacturing process, NAFDAC's permit will be required

Other Authorization or Institutions that May be Applicable - Electric Vehicle

Authorization	Purpose	Issuing Authotiry
Environmental Impact Assessment (EIA) certificate	Confirms that an EIA of the EV or battery manufacturing project or operation of the charging station has been adequately done and provisioned for	Federal Ministry of Environment
NEMSA Certificate	Required for the components to be deployed in the EV, batteries and charging stations	Nigerian Electricity Management Services Agency
Building & Construction Permits	Required for the construction at the Project site	Various land and physical planning agencies of various states
Factories licence	Required for occupation of any premises as a factory	Director of Factories, Ministry of Labour
NAFDAC Certificate	Required for importation or use of industrial chemicals for the manufacturing of the EV, batteries or charging stations	National Agency for Food and Drug Administration and Control
NESREA	Import new electrical/ electronic equipment; also required during the construction of the Project site for waste generation and management	National Environmental Standards Regulation Enforcement Agency
NOTAP Registration	Required for agreements with foreign partners for technology transfer, such as, use of trademarks, patented inventions, technical/management, technological expertise, etc	National Office for Technology Acquisition and Promotion
Import Related Permits	Required for the components of the EV, batteries charging stations that would be imported.	Central Bank of Nigeria; Standards Organisation of Nigeria
Import Clearance Certificate	The importation (and clearing from the ports) of fully assembled generators, knocked-down parts imported for domestic assembling or spare parts	Nigerian Customs Service (NCS)

References

American Century Investment. (July 2020). ESG Focus - The Acceleration of Electric Mobility. American Century.

Anthony Black, J. B. (2019). PRISM: Electric two-wheelers in Africa Markets, Production and Policy. Cape Town.

ARUP. (2021, January 01). The Electric Vehicle revolution: why it's already time to invest in the grid. Retrieved from https://www.arup.com/perspectives/the-electric-vehicle-revolution-why-its-already-time-to-invest-in-the-grid

BEAMA. (2015). A Guide To Electric Vehicle Infracstructure. Retrieved from www.beama.org.uk: https://www.beama.org.uk/static/uploaded/5e9d2696-bec8-4179-956bedf5655a0272.pdf

Cagla Unal, E. Y. (January, 2018). A REVIEW OF CHARGING TECHNOLOGIES FOR COMMERCIAL ELECTRIC VEHICLES. Research Gate.

Castellano, M. S. (November, 2015). Costs Associated With Non-Residential Electric Vehicle Supply Equipment. U.S Department of Energy.

CleanTechnica. (2021, May 12). South Africa Has One Of The Highest Ratios Of Public EV Charges To Ev's In The World. Retrieved from cleantechnica.com: https://cleantechnica.com/2021/05/12/south-africa-has-one-of-the-highest-ratios-of-public-ev-chargers-to-evs-in-the-world/

DEKRA. (2018, October 09). E-mobility Testing. Retrieved from www.dekra-product-safety.com: https://www.dekra-product-safety.com/en/solutions/testing-inspection/e-mobility-testing

Gogoro. (n.d.). The Smarter Way Forward: Swap & Go. Retrieved from www.gogoro.com: https://www.gogoro.com/

Green Policy Platform. (n.d.). Electric Two Wheelers in Africa. https://www.greengrowthknowledge.org/sites/default/files/Electric%20two-wheelers%20in%20Africa.

Holmes, G. S. (n.d.). Electric Automobile . How Products are Made, http://www.madehow.com/Volume-5/Electric-Automobile.html.

ICCT. (January 24, 2019). US Charging Gap. ICCT.

iea. (June, 2020). Global EV Outlook 2020: Entering the decade of electric drive. Technology Report.

iea. (May, 2018). Global EV Outlook 2018 : 3 million and counting.

IRENA. (2019, May). Innovation Outlook. Retrieved from Smart Charging for Electric Vehicles: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Innovation_Outlook_EV_smart_charging_2019.pdf

Jasprit S Gill, P. B. (2014). Infrastructure Cost Issues Related to Inductively Coupled Power Transfer for Electric Vehicles. South Carolina: Elsevier B.V.

John Coulter. (2019, August 23). BEV, EREV, PHEV, HEV – What Do They Mean? Here's Your Electric Vehicle Dictionary. Current EV.

Kane, M. (October 21, 2018). 120-kW Wireless Charging Proves 97% Efficient. INSIDEEVs.

Lilly, C. (2020, April 03). Zap-Map. Retrieved from www.zap-map.com: https://www.zap-map.com/charge-points/connectors-speeds/

Littlefuse. (2019). EV Charging Infrastructure. Retrieved from www.littelfuse.com: https://www.littelfuse.com/~/media/electronics/market_presentations/littelfuse_evi_ev_charging_infrastructure_presentation.pdf.pdf

Mathieu, L. (September 2018). Roll-out of public EV charging - Is the chicken and egg dilemma resolved? Transport Environment, https://www.transportenvironment.org/sites/te/files/Charging%20Infrastructure%20Report_September%202018_FINAL.

McKinsey & Company. (2018, October). Charging Ahead : Electric Vehicle Infracstructure Demand. Retrieved from micksey.com: https://www.mckinsey.com/~/media/McKinsey/Industries/Automotive%20and%20Assembly/Our%20Insights/Charging%20ahead%20Electric-vehicle%20infrastructure%20demand/Charging-ahead-electric-vehicle-infrastructure-demand-final

Mordor Intelligence. (2021). MIDDLE EAST & AFRICA ELECTRIC VEHICLE MARKET - GROWTH, TRENDS, COVID-19 IMPACT, AND FORECASTS (2021 - 2026). Gachibowli Hyderabad, Telangana: Mordor Intelligence.

Mubasher. (2020, September 09). Dubai to raise electric, hybrid vehicles to 30% by 2030. Sustainable Investment , pp. https://www.zawya.com/mena/en/business/story/Dubai_to_raise_electric_hybrid_vehicles_to_30_by_2030-SNG_184180646/.

MURIUKI, C. (December 3, 2019). Rwanda and Uganda lead East Africa in switch to electric cars. THE EXCHANGE: Africa's Investment Gateway, https://theexchange.africa/countries/uganda/rwanda-and-uganda-lead-east-africa-in-switch-to-electric-cars/.

Netherlands Enterprise Agency. (2019, January). Electric vehicle charging: Definitions and Explanation. pp. https://www.rvo.nl/sites/default/files/2019/01/Electric%20Vehicle%20Charging%20-%20Definitions%20and%20Explanation%20-%20january%202019_0.pdf.

Ojambo, L. M. (2020, August 11). Africa's First Electric Bus Plant Will Industrialize Uganda While Fighting Pollution. Bloomberg Green, pp. https://www.bloomberg.com/news/articles/2020-08-11/africa-s-first-electric-bus-plant-industrializes-a-region.

Olisah, C. (November 14, 2020.). Sanwo-Olu launches Nigeria's first electric car, to complete Lagos-Badagry expressway. Nairametrics, https://nairametrics.com/2020/11/13/sanwo-olu-launches-nigerias-first-electric-car-to-complete-lagos-badagry-expressway/.

ONE WEDGE. (2018, February 19). An EV taxonomy. Retrieved from onewedge.com: https://onewedge.com/2018/02/19/an-ev-taxonomy/

Point, P. (2021, June 04). EV Charging Connector Types and Speeds. pp. https://pod-point.com/guides/driver/ev-connector-types-speed.

Pontes, J. (February 4, 2021). Global Electric Vehicle Top 20. Clean Technica.

QUALCOMM. (2011). No Fuss, Just Wireless: Wireless Charging For Electric Vehicles. London: Qualcomm.

Renishaw. (n.d.). Electric vehicle manufacturing. Retrieved from www.renishaw.com: https://www.renishaw.com/en/electric-vehicle-manufacturing--45350

Rick Wolbertus, R. v. (December 2016). Benchmarking Charging Infrastructure Utilization. Research Gate.

Rockwell Automation. (n.d.). Electric Vehicle Production. Retrieved from www.rockwellautomation.com: https://www.rockwellautomation.com/en-gb/industries/automotive-tire/electric-vehicle-production.html

Sika Automotive. (n.d.). ELECTRIC VEHICLE ASSEMBLY SOLUTIONS. Retrieved from automotive.sika.com: https://automotive.sika.com/en/solution-products/electric-vehicle-assembly-solutions.html

Tadesse, A. G. (2020, July 27). Ethiopia showcases first locally-assembled electric car. Retrieved from www.aa.com.tr: https://www.aa.com.tr/en/africa/ethiopia-showcases-first-locally-assembled-electric-car/1924109

Tyilo, M. (2019, October 28). How geared up is South Africa for electric vehicles. Retrieved from dailymaverick.co.za: https://www.dailymaverick.co.za/article/2019-10-28-how-geared-up-is-south-africa-for-electric-vehicles/

U.S Department of Energy. (n.d.). Energy Efficiency & Renewable Energy : Alternative Fuels Data Center. Retrieved from https://afdc.energy: https://afdc.energy.gov/vehicles/electric_basics_hev.html

Ulrich, L. (May 13, 2021). How Is This A Good Idea?: EV Battery Swapping. IEEE.

United Nations . (n.d.). Electric Mobility Projects in Africa. Retrieved from www.unep.org: https://www.unep.org/explore-topics/transport/what-we-do/electric-mobility/electric-two-and-three-wheelers

United Nations. (2003). Going through the CDM Process. In The Clean Developement Mechanism: A User's Guide (pp. 20 - 34). New York.

United Nations. (n.d.). Department of Management Strategy, Policy and Compliance. Retrieved from UN Secretatriat adopts climate action plan : https://www.un.org/management/news/un-secretariat-adopts-climate-action-plan

United Nations. (n.d.). Electric two and three wheelers. Retrieved from unep.org: https://www.unep.org/explore-topics/transport/what-we-do/electric-mobility/electric-two-and-three-wheelers

Vermont Energy Investment Corporation. (June, 2014). Electric Vehicle Charging Station Guidebook: Planning for Installation and Operation. Burlington.

Vinit Kumar, V. R. (2019). PV Based Off-Grid Charging Station for Electric Vehicle. Science Direct, https://www.sciencedirect.com/science/article/pii/S2405896319305488.

VIRTA. (2021). The Global Electric Vehicle Market in 2021: Statistics and Forecasts. Retrieved from virta.global: https://www.virta.global/global-electric-vehicle-market

Wood Mackenzie. (2020, September). Electric Vehicle Insights.