THE OWNERSHIP COST MODEL OF ELECTRIC VEHICLE CHARGING STATION TO POWER ENVIRONMENTALLY FRIENDLY TOURISM

DOKRAK INSAN

A Thesis Submitted to the Graduate School of Naresuan University
in Partial Fulfillment of the Requirements
for the Doctor of Philosophy in Renewable Energy
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Thesis entitled "The ownership cost model of electric vehicle charging station to power environmentally friendly tourism"

By Dokrak Insan

has been approved by the Graduate School as partial fulfillment of the requirements for the Doctor of Philosophy in Renewable Energy of Naresuan University

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Academic Paper Ph.D. Dissertation in Renewable Energy, Naresuan University, 2022

Keywords Charging station, Energy model, Business model, Break-even point, Net Present station, Internal Rate of Return, Payback Period, Carbon dioxide ($CO2$), Particulate Matter (PM2.5), Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV)

ABSTRACT

There is a growing demand for electric vehicle (EV) charging stations due to the growing number of people buying electric vehicles. This means that demand for electric vehicle charging stations is also increasing. With the participation of the business and government sectors, the Thai Government, under the Thai government energy conservation plan for 2015-2036, is encouraging investment in the production and importation of electric vehicles. This includes the development of more efficient electric vehicles that can travel long distances without the need to recharge the battery. The number of electric vehicles rose in the period from 2017 to December 2021 as follows; battery powered EVs (BEV) 11,382 units, (PHEV) 31,145 units and HEV 196,582 units: a total of 239,109 units. According to the Electric Vehicle Association of Thailand, in September 2021 there were 693 electric charging stations operational in Thailand with 2,285 charging plugs available.

This research is a simulated study of a business model for the development and expansion of electric vehicle charging stations that analyzes the reduction of the cost of constructing charging stations and evaluates the cost of electric vehicle charging station ownership. This business model analyzes the reduction in investment and operational costs and the suitability of the location of EV charging stations. The growth in demand for EV charging stations to accommodate the growing number of electric vehicles, requires efficient and safe charging technologies that satisfy the needs of EV owners in different situations.

This research looked at three scenarios based on the modeling of possible market shares. Scenario 1 includes normal EV charging stations only which would normally be installed in shopping malls, restaurants, and residential condominiums, Scenario 2 includes quick EV charging station design only which would usually be found in gas stations, vehicle logistics centers and department stores, and Scenario 3 includes both normal and quick EV charging stations. Scenario 2 and 3 by implication are available to the public whereas Scenario 1 is for private use. The breakeven point (BEP), net present value (NPV), internal rate of return (IRR) and payback period (PB) were determined for each scenario and the differences were analyzed. The results were as follows. Scenario 1 has the lowest cost but the longest cost recovery time and low net profit. Scenario 2 has the highest charging cost, highest investment cost, but shortest payback period, of the three scenarios.

This study can help analyze costs and provide guidelines for investment decision-making on the installation of EV charging stations. These EV charging station scenarios can help in predicting and comparing the net profit margins of the business models.

ACKNOWLEDGEMENTS

The success of this research resulted from the support of many professors who helped guide them. It gave me the motivation to complete the research work. I would like to take this opportunity to express my gratitude to all teachers.

First of all, I would like to express my deepest gratitude to my advisor, Assistant Professor Dr. Prapita Thanarak, for her valuable and helpful advice. It was a crucial moment for mercy to guide me throughout my studies. Appreciation to the Co-advisor, Associate Professor Dr. Wattanapong Rakwichian, and Assistant Professor Dr. Parichart Rachapradit for close-up support and encouragement in my studies. My heartfelt thanks to dissertation examiners for the master's help and suggestions about my dissertation. I would like to thank my father, mother and my wife for all contributions throughout the duration of this research.

Thank you, School of Renewable Energy and Smart Grid Technology (SGtech), Naresuan University, Thailand.

Dokrak Insan

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CHAPTER I

INTRODUCTION

The electric vehicle transportation industry is overgrowing due to increasing consumer demand. They were born from residents of large cities, packed with more than 300 million tons of carbon dioxide per year, using petrol vehicles on the road combined with the enormous carbon dioxide emissions from industry and households.

There is a limited amount of petroleum fuel running out in many countries. Pure electric vehicles using clean energy are discussed as an alternative to eliminating the problem. Thailand is trying to develop an electric vehicle with better performance, such as reducing engine noise. Production of batteries for electric vehicles.

Easier to operate the electric vehicle on long trips, reducing costs and international cooperation in promoting research development and investment in the EVs industry and in the number of charging stations. Electric vehicle charging station are the essential infrastructure that must be prepared to create the correct knowledge and understanding of electric vehicles. It is another issue that all business stakeholders must consider the common interests of the environment. The Thai government has announced an energy conservation plan for 2015-2036. According to the Electric Vehicle Association of Thailand report, in September 2021, there are 693 electric charging stations, the number of plugs is 2,285 chargers, the cumulative number of electric vehicles between 2017 and 2021 in Decamber 2021. BEV 11,382 units, PHEV 31,145 units and HEV 196,582 units, total 239,109 units. The number of electric vehicles with such charging stations represents a limitation in customer demand not yet balanced.

For daily commuting to work or nature tourism, green spaces also include the issue of energy conservation and environmental protection. It is a journey for reducing environmental pollution, helping to keep nature modern and easily accessible both internationally. Many agencies have started to campaign and educate each other about reducing global warming. Currently, both in large cities, rural areas, and high-altitude areas caused by forest fires causing the number of trees to die down, the number of trees decreases every year. The natural condition is unbalanced, with bald mountains increasing every year. It affects more hot weather, less rain, or when it rains heavily, landslides can be flooded due to the changing environment of the trees.

Smart City is an urban society that smartly uses modern technology and innovation. To help develop the country under the concept of livable city development, safe environment, pollution, modernity, people in the city live happily and sustainably by creating the city in parallel with other areas such as economy and technology creation. To increase service efficiency and manage travel in large cities. To reduce costs and use of resources by emphasizing the participation of business, government, and people while maintaining a balanced, pollution-free environment. To focus on optimizing the use of electric vehicles without affecting the environment or using clean energy as an alternative.

Smart Economy focuses on optimizing and streamlining business operations, building connections and collaborations, and bringing innovation to development. To transform the business by pushing the target city into a business center based on innovative smart transportation and communication systems.

Smart Mobility focuses on enhancing the accessibility of public transport systems, providing convenient transportation and safety, optimizing logistics management, including energy-saving and environmentally-friendly vehicle sharing, and keeping cities safe from global warming. The electric car market will increase, possibly from importing to the Chinese electric car market during the first market opening in Thailand. Moreover, the use of 0% import tax measures, reduced excise taxes, and steps to motivate Thailand people to buy electric cars from the Thai-China free trade agreement. The factor supporting the market growth in the future will be the ability of the government and private sectors to increase the confidence of consumers to use electric vehicles in the market. In particular, the networking of charging stations to cover is an interesting measure to increase charging stations and the cost of charging electric vehicles. Based on the existing review and current situation, there is still a lack of a business model that will help strengthen or guide investors interested in owning charging stations. The technical process of production costs, expenses, tax rates, and electric cars is small; it will not be enough to use the service. The breakeven point on the cost of investing in electric vehicle charging stations was one of business decision-making. This research explored the investment and idea of the ownership cost model of electric vehicle charging stations to power environmentally friendly tourism. It is a part that supports each type of Smart City, Smart Economy, and Smart Mobility to have the basic integrity of the city's development and the public system.

OBJECTIVES OF RESEARCH

1. To determine the cost factors and various equipment electric vehicle charging station for using the service with electric vehicle.

2. To design the electric vehicle charging station business to affect the investment decision of the electric charge station in Phitsanulok province route to Phetchabun province.

3. To analyze the investment of the owner's cost for a market share of electric vehicle charging stations, plug-in hybrids, hybrids and comparing environmental impacts on cable routes Phitsanulok province to Phetchabun province.

THE SCOPE OF THE RESEARCH

This research focused on cost factors and various equipment of electric vehicle charge station investment as the pattern service stations of the electric charger for electric vehicle and hybrid cars as follows detail;

1. Analyzing the working principle of the electric vehicle charging station system and electric power supply characteristics. Comparison of the advantages and disadvantages of the three electrical systems. The technical summary and financial value which has various details.

2. Design and install electric vehicle charging stations for ease of use and no environmental impact.

3. Study, analyze, compare costs business model of electric charging stations, product, price, place, and process for the features of electric vehicle charging stations affecting the investment decision of the owner market share of electric vehicle charging stations for road trips Phitsanulok Province to Phetchabun Province.

EXPECTED BENEFITS OF RESEARCH

1. Analysis of cost factors, investment projects, the ownership cost model of electric vehicle charging station to power environmentally friendly tourism affecting the investment decision of the electric charge service station Phitsanulok province road to Phetchabun Province.

2. The study results affected the decision to use the information as an investment guideline and marketing strategy. The market share manages the electric charging station business to benefit the operators.

3. Result of the project in the breakeven point business model for investment in electric charge stations used to suit the location and not affect the environment Phitsanulok province road to Phetchabun Province.

CHAPTER II

LITERATURE REVIEW

CHARGING STATION COST

The cost analysis of electric vehicle charging stations studied various research agencies.

Assignment of drivers to develop each charging station. There are integer programming models that have been developed to answer and define problems. Three schemes are used that identify problems and to increase the charging current of the plug-in electric vehicle electric vehicle station good for in the network.[1]

Study of charging electric cars at night. For users who stay in residences. Three different electric vehicle charging scenarios have been considered. Grid network electricity consumption through grid-connected PV systems with electric energy storage batteries. Combined with electrification, the PV system is connected to the grid network with storage batteries while serving the consumer. Two services were examined in anticipation of purchasing an electric vehicle as an alternative to gasoline-powered vehicles.[2]

The electricity bill goes up much higher if the electricity rate is low for the required tariff. Costs are reduced with the increased utilization of electricity in high-volume charging stations. Unlike charging stations with no need for electricity, consumer-based charging stations can reduce the cost of electricity. It's a great opportunity to save on electricity costs based on existing rates, for example, fast charging is time-consuming. There is a large number of consumers for electric charging stations with a large number of plug-in stations.[3]

Multilevel charging station positioning is one method of development. Various methods are used to assess the boundary segment and classify the charging station under a hexagonal group of methods and algorithms. In the study, the novelty of the method was to assess the capacity of electric vehicle use at the macro level and at the service point of charging stations on a micro scale.[4]

Using models to analyze the effects of electric vehicle charging where there is no control on the load profile system in the housing It was found that absolute load increased up to 8.5 times depending on the load infrastructure. The annual power demand factor will double.[5]

The aim was to find a cost-effective way to manage the limited battery range. Availability of public-based fast charging infrastructure. Aims at German passenger cars that are licensed by commercial owners as it is an important first market for electric vehicles. The results of a fast charging infrastructure are worth the investment. This makes the proportion of electric vehicles important with low infrastructure requirements. Commercial electric vehicles can compete with longer battery ranges.[6]

There is a comparison with the charging infrastructure. Battery cost calculation affects PEV market share. no change with Electric vehicle charging infrastructure and its importance in PEV market dynamics. Simulating electric vehicle charging infrastructure at public points has an impact on promotion PEV for emerging markets PEV than in the mature market from PEV.[7]

Discounted payback period verification of investment costs. The results of the proposed system analysis can reduce the demand from filling. BESS and reduce electricity costs from using PV. However, the proposed method cannot be repaid within a reasonable period of time based on the price. PV and battery prices that are currently available. The survival of the economy in the 5 to 10 year time frame is likely to be better than expected. If you consider the continued price drop will occur as technological advances develop faster.[8]

Developing models to analyze the impact of different charging technologies, insurance contracts, and other factors. It affects the profits of electric vehicle-sharing service providers. The operator's demand comes from the number of customers driving under the service member. Operating expenses such as parking, electricity, battery charging and insurance contracts already included in the form.[9]

In a fragmented analysis method to independently study the charging and normal system loads. This section includes the analysis of the electric power system network. First, analyze to calculate the average, maximum, minimum fluctuation of the charging system load. Using the Monte Carlo Method and Getting the Vehicle's Calculation Scale and the regulation law of the function while being charging.[10]

The total cost of owning more than two car markets has not yet been compared to the past cost analysis. This research provides a more comprehensive assessment of the total cost of owning a conventional vehicle. Electric vehicle plug-in hybrids and hybrids in 3 countries such as the UK, USA and Japan.[11]

For the results of the important impact of the TCOC data. Determined weight with difference in value and driving ban with Internal combustion engine vehicle and the average annual mileage has an important effect on the decisions of battery electric vehicles.[12]

Judging by the number of motorists, the Italian population owns an electric car garage and drives an electric vehicle in urban areas. Using the cheapest BEV, the price is competitive with competitors while there is no subsidy on HEV use. For the Italian population up to 11.8% of drivers do not drive diesel and petrol vehicles. As it has driven the regular distance in one year.[13]

Having a multilevel perspective to show that Norway's motivations and policies have evolved considerably over the past 25 years. To balance through good interactions between the international landscape. the presence of a national good governance network regime model and conservation specific groups. in order to be able to use it to open up a world of opportunities This led to the development and capacity building of BEV. Both consolidating into ICE's ownership regime since 2016. Changes have been made for BEV incentives to support the use of electric vehicles since 1990.[14]

For calculating the cost and sales of electric vehicles is about examining the importance of the financial incentive role to reduce TCO. To increase the sales of electric vehicles, an electic and internal combustion engine licensed will be taken. Compare and cross between European countries. The actual amount of electric vehicle price used in the calculations is the initial incentive for each model in each country. The review has a negative correlation with different TCO sales in the car segment with ICE comparisons the potential impact on electric cars has a lower TCO. Higher sales and lower price response than electric vehicles is small.[15]

For a detailed analysis of annual data to consider the location of electric vehicle charging infrastructure at public points and electric vehicle ownership rates. In focusing on the area where the first public electric vehicle charging infrastructure is installed during the specified period. To build the first public electric vehicle charging station in most rural areas began to be used. On average, electric vehicle ownership in rural areas has increased 1.5 percentage points, or 200%, over the past five years.[16].

Based on experience for the charging infrastructure in Norway. It has had the most advanced EV market in the world through developments in the past. Study sponsored lesson of public points for electric charging station services and the business model of electric vehicle charging service providers at private areas. The study focused mainly on the electric vehicle fast charging infrastructure. From the consumer perspective, electric vehicle charging stations are also important and with the result of an EV owner in Norway.[17]

Batteries for electric vehicles can provide energy and may have more important emissions than internal combustion engine vehicles. In Norway there is a long history of developments in research and automotive user incentives from the government for the BEV. The BEV market in Norway allows checking BEV options. of consumers in detail. of government support influenced by vehicle data, prices and incentives.[18]

For investigating alternatives to improve the net present value of electric vehicle charging infrastructure investments. In the past, energy storage in batteries on the road and the sale of energy for electric cars. A cross-port dock-style lithium-ion battery minimizes demand for peak power. But the charging system for cross-shore vessels has a negative net present value.[19]

An investigation of the impact of electric vehicle charging systems on the grid in the present and future times. Pay attention to the relevance of using a very fast electric charger. The possibility of systems with grid disturbances is examined for flexibility in the power system management area. The benefits of electric vehicle charging station models have been examined on the effects of charging point operators and electric vehicle owners. The research supports the ambitions of accelerating the launch of electric charging stations and increasing the number of cost-effective charging points. There are implications related to the shift to fossil-free transport and the electrification of locally produced renewable energy.[20]

Transnova, a collaboration between government departments and electric vehicles service users' association. To develop an open electric vehicle database, it is possible to create their own services for everyone according to that standard.[21]

Analysis of the cross-regional and municipal electric vehicle sales of Norway. To analyze these with local demographics and incentives to determine what factors lead to the increase in electric vehicle trauma. Summary of electric vehicle charging infrastructure access to electric vehicle charging stations located next to major cities. It provides regional income and forecasts for electric vehicle sales growth.[22]

The results of the study present the current e-mobility situation in Norway and Italy. The technical characteristics of electric vehicles and electric vehicles business are analyzed. There is a policy to support national incentives for the electric vehicle market. Electric vehicle technical connector type and electric vehicle charging propagation.[23]

In past studies it was found that the increasing number of electric vehicles will have a greater impact on urban air quality pollution. Higher dependence on oil has been created for Western countries. Most people from different countries All over the world, incentives are being launched to promote the use of electric engines. Change the solution to manage environmental problems, pollution, oil dependence and cleaner air quality.[24]

An on-going analysis of battery electric vehicles in Norway. For to focus on measures adopted electric power to support the transformation from classic cars. Consider checking the correlation with various policy measures. For the infrastructure of battery electric vehicle and the improvement of electric vehicle technology.[25]

The route analysis for electric vehicles at the national level is a wide range of problems. This makes analyzing the path of electric vehicles a complicated task. Identifying strategies for success is very important. for separating carbon from the transport sector and eliminating pollution.[26]

Participation in a Norwegian demonstration project on electric vehicle charging. Intelligence aims to make charging more flexible. Theoretical concepts from home are used and different charging methods are analyzed. To understand the relationship between the complexity of everyday life and the flexibility of electric vehicle charging users in a systematic way.[27]

There has been a shift to using electric vehicles for non-emissions transportation. This could result in an increase of 1.5 million electric cars by 2030, resulting in an increase of 4 TWh of energy demand. 3% of electricity consumption in Norway. This time, the increasing number of electric vehicles will not be much of an energy problem. That could be a problem of charging station capacity for the distribution network. If all households are charging their normal electricity consumption simultaneously.[28]

Many problems concerning the charging infrastructure have appeared. Developing strategies to manage this problem efficiently is essential for the charging infrastructure. One problem is the queuing times at EV charging stations; another is power-demand management.[29]

Electric charging station with mobile platform and robots working together. Navigation for detection by connecting the electrical wires from the wall socket to the car. Wall plug when the car battery charger reaches the required level to operate the electric charging system.[30]

CHARGING STATION SYSTEM

Overview of Research to calculate Electric Vehicle. Charging Station Costs Conducted a study for Electric Vehicle charging station mode and safety. There are 4 modes of electric vehicle charging at present.

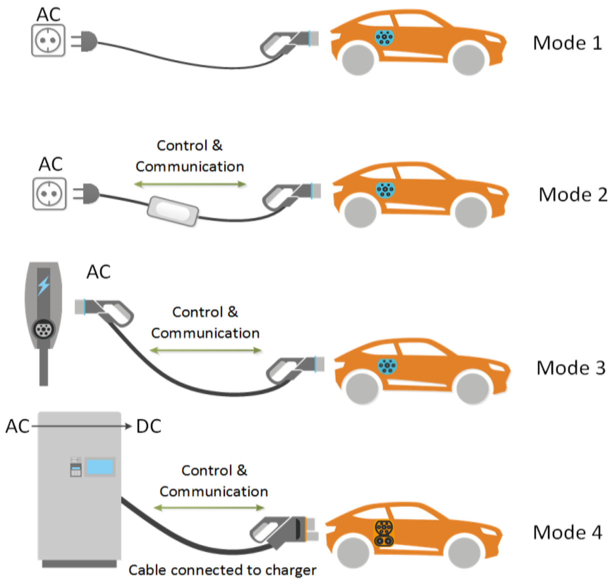
Mode1 is an alternating current charging directly between the power plug connected to the electric cable into the car's electrical socket. There is no leakage protection device and signal cable to communicate with the vehicle. For safety reasons, mode one charging is prohibited.

Mode2: It is an alternating current charging between the use of an electrical plug with a signal cable to communicate with the car's charging system. Moreover, a leakage protection device can control charging with the electric cable.

Mode3: It is an alternating current charging system. It is connected to the mains only. There is a signal cable to communicate with the car's charging system. A leakage protection device and a control unit are attached to the charger system installed.

Mode4: A DC charging installed to connect the wires to the mains. A charger converts alternat current to direct current and connects directly to the car battery system. A communication cable with the vehicle and a fault protection device and control unit is built into the charger system installed.

FIGURE 1 ELECTRIC VEHICLE CHARGING STATION MODE AND SAFETY



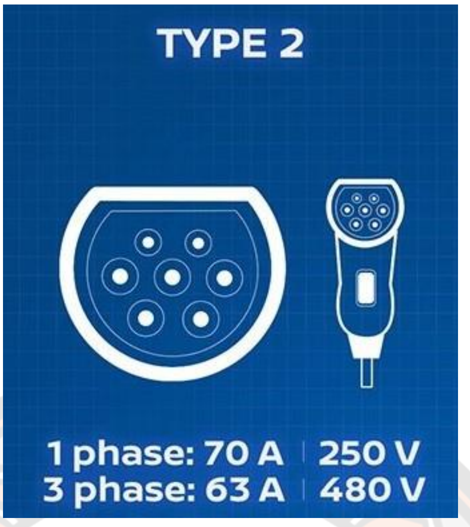
Source [https://deltrixchargers.com/about-emobility/charging-modes/]

Electric vehicle charging stations have different types of outlets. Used in Thailand currently three types.

1. PLUG NORMAL CHARGER AC TYPE 2

Regular charging AC is an electric vehicle charging system, AC TYPE 2.

FIGURE 2 PLUG NORMAL CHARGER AC TYPE 2

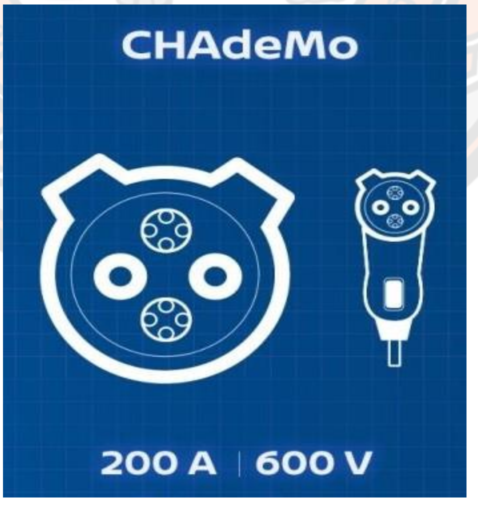


source [https://www.nissan.co.th/experience-nissan/Nissan-EV/EV-charger-type.html]

2. PLUG QUICK CHARGER DC CHADEMO

DC charger electric fast charging for charging electric cars is similar to DC CHAdeMo.

FIGURE 3 PLUG QUICK CHARGER DC CHADEMO



source[https://www.nissan.co.th/experience-nissan/Nissan-EV/EV-charger-type.html]

3. PLUG QUICK CHARGER DC CCS TYPE2

DC charger electric fast charging is a charging electric vehicle for CCS Type 2.

FIGURE 4 PLUG QUICK CHARGER DC CCS TYPE2

Source[https://www.nissan.co.th/experience-nissan/Nissan-EV/EV-charger-type.html]

The charging station may be in one electric charging cabinet. There are three outlets: AC type2, Normal charger, DC CHAdeMo, DC CCS Type2, Quick charger.

FIGURE 5 NORMAL CHARGER ACTYPE2 AND QUICK CHARGER DC CHADEMO, CCS TYPE2

Source [https://www.pmk.co.th/shop/ev-charger]

FIGURE 6 **AC(TYPE2) DC CHADEMO AND DC CCS(TYPE2)**

Source [https://www.pmk.co.th/shop/ev-charger]

ELECTRIC VEHICLE CHARGING STATION 3 SCENARIO

Scenario 1. Normal Charger AC TYPE 2, charger size 22 kWh, number of 6 outlets

Conventional EVs charging system AC Charger is an EVs charging AC TYPE 2, charger size 22 kWh. According to the wall box charger power and size battery, a conventional charger takes about 180-240 minutes to charge. It is popular with electric vehicles in Thailand, Japan, and European countries. The price will start around 50,000 – 200,000 baht.

FIGURE 7 NORMAL CHARGER AC TYPE2,

Source [https://www.eaanywhere.com/ac]

Scenario 2. Quick charger type CHAdeMo and DC CCS TYPE 2, DC charger size 50 kWh, for six outlets.

Fast-charging electric vehicle DC charger is a DC CHAdeMo is charging electric vehicle charger size 50 kWh, widely used for Japanese electric vehicles, and a DC CCS TYPE 2 charger used in the European, American, and European areas. Thailand has much charging power, making it possible to charge quickly. It will take about 40-60 minutes to get both images. Prices start from 500,000 -1,000,000 baht.

FIGURE 8 QUICK CHARGER DC CHADEMO AND CCS TYPE 2

Source [https://chargingshop.eu/product/abb-terra-54-dc-50kw-fast-charging-station/]

Scenario 3. Normal Charger AC TYPE 2, AC charger 22 kWh, six outlets and Quick charger type DC CHAdeMo and DC CCS TYPE 2, DC charger 50 kWh number of 6 outlets, total 12 outlets.

TRANSFORMER

The transformer defines alternatives divided into three scenarios.

Scenario 1: Transformer size 315 kVa to support the charging station system, 6 outlets AC TYPE2, 22 kWh, 227,000- 277,000 baht.

Scenario 2: Transformer 630 kVa to support Quick charger system numbers of 6 outlets DC CHAdemo and CCS TYPE2 size 50 kWh. The price is about 354,000-400,000 baht.

Scenario 3: Transformer 1000 kVa to support the charging station system Normal charger 6 outlets and Quick charger 6 outlets on station numbers of 12 outlets AC Type2 charger 22 kWh, DC CHAdemo and DC CCS TYPE2 charger 50 kWh price about 455,000-561,000 baht.

FIGURE 9 TRANSFORMER FOR ELECTRIC VEHICLE CHARGING STATION

Source [https://www.7-mars.com/category/18071]

Comparison of electric vehicle charging standards. In the use of dynamic charging services and electric vehicles on the grid (V2X). Affects the design of the electric charging system response time. in the flexibility of charging electric vehicles from renewable energy sources. For the buffer capacity required to experiment with dynamic charging, Chademo and CCS/COMBO are used. In the presentation for EVs sharing the fundamental difference between the two standards.[31]

An evaluation between the two charging standards compared. First typeInternational Electrotechnical Commission (IEC) Type 1 and Type 2. To combine research supporting local application requirements and consideration of technique alternatives. The use of the 2 AC and Combo 2 charging systems is the national standard for public point electric vehicle charging infrastructure in Singapore in the analysis.[32]

The importance of electric propulsion is the use of electric vehicles, electric vehicles. The power to drive is mainly from electric motors, drawing power from rechargeable energy storage devices. The EV receives electricity plugged into the electrical grid and stores it in the battery charge. EV charger It is an electrical device that converts alternating current energy into direct current with a controlled system. To power the battery storage devices and provide power for the operation of the electric vehicle system.[33]

Electric propulsion has an impact on the power system combined with power quality issues. It is relevant to modify the SONEL PQM-700 Power Quality Analyzer to measure and analyze power quality parameters during slow charging of electric vehicles.[34]

A two-scenario reviewed 5-year and 10-year model. A business study shows a 10-year fast charging station can result in a high return on investment profit. At the same time, investing for only 5 years is too risky to invest.[35]

The use of networks is an important factor in promoting electric vehicles. The results are quite substantial with most charging incidents occurring. Distribution of information in a few charging stations in the area around the Latvian capital. Including electric vehicle charging incidents in all charging stations. In remote electric vehicle charging stations, more distribution was observed with the analysis of electric vehicle charging behavior of EV users.[36]

Equilibrium causes unbalanced elements to occur. Power compensation results in a better power factor. The reduction in reactive power and the unbalance as a result of power compensation takes into account the sinusoidal current supply method.[37]

The use of high power DC chargers (HPC) with battery charging for electric vehicles. It is charged while the stationary battery energy storage system. There is an integrated system where more quality and efficiency can be built. For eliminating the duplication of work in multiple BESS and HPC components used together.[38]

In general definitions and standards the electric vehicle charging scheme refers to the electric vehicle charging type/mode, plug-in type, power system and communication system protocol. The benefit of electric vehicle owners who are obsessed with electric vehicles.[39]

Model type of EVs charging station, EVs charging method, plug per charging mode. Test standards and certifications have been established for safety. The current state of domestic standards is related to international standards.[40]

The objectives for mapping the needs for a country's infrastructure use the information obtained from the latest data. Developed to facilitate the application of the resulting directive in alternative energy fuel infrastructure applications. The main objective is to use the registration information and technical requirements of the energy system supplied by the manufacturer.[41]

For different DC charging process, electric charging station from the manufacturer, normal use and the occurrence of error cases. are measured and analyzed Shows the DC charging station. The manufacturers have to respond to different behaviors on and off at different times of the machine.[42]

In intelligent vehicle to grid charging and electric vehicle charging from photovoltaic (PV) panels. No charging required plug and electric vehicle charging system on the road. electric smart charging This allows the electric vehicle to be recharged and uses renewable energy to increase the cost of charging. It is a good utilization of grid infrastructure, bidirectional electric vehicle charger, guided by V2G technology electric vehicle can store energy in battery, used for energy arbitrage and electric demand management.[43]

Electric Vehicle Market in India and Supply Situation Equipment and chargers for electric vehicles. Various devices are supplied worldwide AC and DC systems. In the proposed economic model setting up shopping mall based electric vehicle charging infrastructure in India as per Indian government regulations.[44]

Batteries can be supplied with plug-in technology from a variety of sources, directly connected to the grid system or from the battery. after charging The position can be extended in conjunction with the battery. The connection between the battery position point and charging has air conditioning and smart switch via grid/battery system. separate for every point.[45]

The basics of electric vehicles and electric charging are presented here. In the three largest electric vehicle market areas, USA, EU and Asia. A study was conducted to determine what types of electric vehicles should be sold between 2013 and 2015. The market share of the chargers was also examined. Electric chargers available in 3 markets.[46]

The new approach involves charging stations directly connected to medium-voltage power lines. This eliminates the process of converting multi-stage power electronics and low-frequency transformers. In summary, the benefits of the technology are used to consider the extremely fast charging rate. It identifies key technological gaps in wide acceptance of electric chargers.[47]

Visualization of technical design requirements and requirements to be considered for electric vehicle charging stations, receptacles and transmission plugs. For infrastructure based on Swedish standards for low-voltage installations. For the design of the electric charging system and the construction of the charging system installation in accordance with European requirements.[48]

The developed charging infrastructure for electric vehicles in Poland is expected in the coming years. Come to new energy charging points of 6,000 service points providing power below 22 kilowatts. The creation of 400 high-power charging points provides more than 22 kilowatts of energy.[49]

Much research has focused on the development of fast DC chargers. and off-board Able to quickly recharge electric vehicle batteries. The use of service transformers at the charging installation points in existing fast charging architectures increases the cost and size of the charging system. This complicates the installation process of the system as it connects directly to the medium voltage line.[50]

The situation in the automotive industry faces increasing social pressure with government regulations to help reduce emissions and develop clean, sustainable technologies for PVS applications. Electric vehicle charging technology in the global electric vehicle market with the main determinants of the charging point placement infrastructure.[51]

Understanding electric vehicle charging technology. In conducting detailed research, DC fast chargers using the CHAdeMO protocol. The project included building and testing an open source 12kW DC charger using the CHAdeMO protocol to understand the technology.[52]

Analysis of unequal distribution of electric vehicle charging stations in Berlin. Various data show more dense access to urban infrastructure networks. Infrastructure distribution is unequal but the infrastructure utilization results are relatively equal locally.[53]

The electric vehicle charging infrastructure has evolved. In the UK it is vital to deliver very low emissions electric vehicles. It has been converted to a low emissions power system in the near term. To principle on the global landscape of electric vehicle infrastructure to lead the development of electric vehicles in the UK.[54]

Currently, the installation of DC Charging, Combined Charging System or CHArge de Move, is the standard for DC charging in Japan. The installation will provide a maximum charging power of 50 kW. The launch of the Supercharger of Tesla will see an increase in fast charging systems with charging powers above 100 kW.[55]

The current battery usage is insufficient for traveling. As a result, electric vehicles have to be charged for a short distance of about 150 kilometers. Departure and arrival times are scheduled for electric charging services. Therefore, electric cars are better suited to city buses than regular cars on schedule.[56]

Workplace charging locations and public charging locations. Home charging and workplace charging systems are designed according to building control regulations. Public charging points are inspected according to the rules of general reconstruction plans. [57]

Analysis at the charging mode of each electric charging station. According to Spanish regulations and the type of connectors required at each charging station. The current electric vehicle's access to charging stations to the charging system points is assessed and the development of new strategies for the use of electric charging stations is assessed.[58]

Integer Programming Format for Determining the Number of Charging Stations and the Location of the Fast Charger is used in OWECS. The relocation of electric vehicles and battery availability presents a time-battery area-level network model that tracks the battery level of each electric vehicle. As the number of stations increases, the number of relocation variables created will also increase. This renders the model invalid for the problem instances encountered in OWECS with reality.[59]

Characteristics of electric charging station service points and methods of charging electric vehicles with AC and DC power. For the impact assessment, the focus is on the flow of active and reactive electrical energy. There is a proportion of the harmonics of the current and the effect on the grid voltage imbalance for distribution.[60]

Electric vehicle infrastructure and electric charging are the main growing requirements in the electric vehicle market. Current situation with lack of charging infrastructure and rising battery prices.It is the main problem in adapting electric vehicles. The analysis describes the factors affecting the scaling of EVs. The existing charging infrastructure in India has the standard for electric charging. It is a growing challenge for electric vehicles, electric charging infrastructure and electric vehicle development needs.[61]

Testing the business model in the market for electric vehicle charging ownership and operation of electric vehicle charging infrastructure. This results in limited direct investment towards traders resulting in investment incentives in the electric vehicle charging infrastructure market in Greece. which operates not economically, focusing on sustainability and environmental protection, reducing pollution.[62]

Advances in OBC Solutions Integrated electric vehicle powered machinery. Talking about OBC techniques Integrated system integration with auxiliary power modules of electric vehicles. Wireless charging system models, future charging strategies and work on charging infrastructure will be discussed in the OBC trend summary.[63]

A summary of the strong points of charging stations and the weak aspects of the current architecture applied to electric vehicles and charging stations. The lecture on technology for batteries focuses on a new mode of transport.[64]

Firstly, it defines a new conceptual framework of mobility electric vehicle. Second, it reports the importance of diversity to the spatial key differences in fast charging arrangements. Both have paid relatively little attention to today, emphasizing that it is the basis for determining the ability of an individual to travel long distances with an electric vehicle. Third, focusing on the development of charging points is mainly limited to large urban areas and strategic road network. In which the current policy focuses on strengthening the infrastructure of the electric charging station BEV.[65]

BUSINESS MODEL

Competitive business model analysis of electric charging networks in the United States, Japan. For mobile services France, Norway. The study emphasizes the importance of partnerships between the electric charging network industry to determine the value chain. New and ecosystem overview, creating and capturing network value. The results provide practical insights for electric vehicle companies. To evaluate an innovative business model of business. Contribution is a process framework for designing a business simulation in an ecosystem process.[66]

The underlying business models and the evolutionary developments indicate that responsible companies and entrepreneurs tend to support business model innovation differently. The evolution of business models represents an incremental change introducing service-based components. Initially from entrepreneurship in product development, over time there seems to be a convergence of business models in incumbents and operators delivering low-cost utility vehicles.[67]

Product development is necessary to compete with companies of high-tech industries; the product has a limited life range. For this reason, new products are standard in the development industry. At the request of the higher authority of the company, they talked about the development of a "mobile" EV charging station, where AC and DC EVA already existed in some countries before EV charging station but did not even have it in Sweden.[68]

The industry's business model in the transport network company sets the criteria and location for the electric vehicle fleet used for sharing electric vehicles. in the ability to charge electric vehicles according to low-income communities. The project summarizes the estimated cost of the pilot project, the expected income from the investment. The length of time the project provides rebates to the public to incentivize the private sector to install electric vehicle charging stations in designated locations.[69]

The existing road construction process to consider the integrated factors, including policy issues. Has been adapted to the needs for smart grids directly and generally. Not considering the efforts to make a road plan, measurement of expert decisions for priority of support. Show the path to overcome obstacles and achieve benefits. The use of strategies that are most likely to achieve the specified goals.[70]

Old business models are not suitable for e-Business. In the first study, proposing the IoT E-Business model is a special design. IoT E-Business. Second design, many elements with traditional electronic business models. Three words about the transactions of intelligent systems and data paid on IoT With the help of trade, P2P. There is a promise of blog and smart with comprehensive system design.[71]

BMI has pushed the marketing industry and cultural boundaries of BMDS. To support the expansion of the system through new technology and business model. Make it in line with the current regime. There is an attempt to change the regime to propose the analysis around the company level. System level to explore specific groups that can be recommended to the SR At a specific point of the change period.[72]

Two dendrogins developed of technology that have electricity changes and the increase of system efficiency, electrical management system and product life cycle. Can be used as a guideline for sustainable policies for environmental protection of electric vehicles. Which helps electric car manufacturers to adjust the structure of electric vehicles.[73]

BM change results about the hesitation for traditional utilities to fix BM. In which each utility of electric power wants to create BM extensions. There is an innovation activity in subsidiaries or creating a prototype partner. About BM changes Is an overview of the smart energy market of the present for private households. Can be used as a starting point for BM innovation of energy utilities.[74]

Study focuses on the basis and business mechanisms of RAs of the electric market. The first step is to review literature and to make the latest projects that are covered with the focation of RAs. In the electric market and the difference from other markets RAs business model. The analysis is a system of resources on basic data in order to develop marketing strategies and processes in debt. RAs that exists all over the world will be compiled and compared to understand the status of the final development.[75]

The result of inappropriate business model, electric car and supply chain that compromise the production of electric vehicles. In the market, it is found that electric cars will change the traditional vehicle sales chain. For Distribute electric cars in society directly to the sales methods through distributors. As for revenue from maintenance and fuel structure, it is still necessary to use a new form. Operations and methods that are suitable for electric vehicles.[76]

For parameters, it depends on the spread of electric hybrid vehicles. In the United States and Japan. There are two different network formats. BMS Battery rental patterns and procurement of electric vehicle vehicles. In order to analyze the network format affects you, the innovation of imitations in the form, resulting in different spread results, can search for the appropriate network format. BMS for electric vehicles are suitable for market conditions in the area.[77]

Entrepreneurs are equipped with electricity facilities and electric car manufacturers. Focusing on reducing financial burdens and risks in bringing electric cars, including purchasing power through hire purchasing and sharing of vehicles. For separating electric car maintenance fees and car batteries. In the experience of Shenzhen, it is unique that cannot be easily repeated in the government's stable financial status. There are two lessons that give interest in other cities around the world. Supporting motivation for electric vehicles to avoid narrow driving problems. Second, the development of innovative business models has mobilized both public and private resources to distribute risks.[78]

Electric vehicles and duties for individual electric cars. There are different and custom efficiency in order to manage the electric vehicle, the grid system that will be inspected. The future development of the electric vehicle is connected to independent driving and the movement combined with the results of the integration of the electric vehicle network of the future. For the benefit of the development of electric internet systems in the future. Increase the challenge of future development of electric vehicles. The infrastructure of the grid system to facilitate the electric vehicle system.[79]

The framework of the integrated decision, assessing the ability to make profit in a participatory business. The use of forms of efficiency, multidisciplinary work processes that include marketing and operations. Show education and electric car battery design. There is a network of Fast-CS position directly DC. In Michigan City, the expected profits can stimulate both government and private sectors.[80]

Current cost level details of electric vehicle charging for electric charging machines in the United States. Purchase and installation of charging and electric prices will be determined. The real tax rate of the country at $ 0.15/kwh of the electric vehicle, battery and $ 0.14/kwh of the hybrid electric vehicle.The cost varies greatly for the nature of charging and the cost of electric vehicle charging equipment.[81]

A review of business model guidelines for categorizing innovations in the electric vehicle ecosystem. To study various types of Tesla Motors 1. Electric vehicle development innovation 2. Battery development innovation (3) Electric vehicle charging system development innovation 4 . Innovation development into the ecosystem for electric vehicle.[82]

The innovative business model of the electric charging station is better, offering transportation services to consumers through multiple miles to apply for membership. Which has the cost of electric vehicles that have received subsidies from the position of the project. Entering partners with electric car manufacturers, battery manufacturers and renewable energy manufacturers, renewable energy sources. To increase the energy of the electric charging station everywhere, it is better. Better place to try to eliminate the indirect greenhouse gas emissions of electric vehicles.[83]

The awareness of the responsible parties for the main and secondary business models of V2G. The type of stakeholder has a sense of twelve types and the relevant electric vehicle business. Electric automotive manufacturers, battery manufacturers, electric vehicles. Electric power supplier, service providers, transmission systems and distribution systems, electric vehicles. Service provider groups, public transport service providers in second hand and secondary markets.[84]

Platform business model that offers the potential of electric energy storage management services. For appropriateness, dynamic energy supply and demand can be matched in response to the flexibility of user interests through the grid. The Horizon

2020 INVADE project has built a cloud-based platform to facilitate energy storage services. Distribution grid system with multiple workflow frameworks for innovative business models.[85]

Basically to describe how to provide both potential customers and the advantages of DSO. The business model is detailed as it has been developed for three concepts. Costs, revenues and includes all expenses that may be influenced by qualitative or quantitative data from the number of electric vehicles or regulated charging.[86]

Innovative business model with the use of electric vehicles and using renewable energy from renewable energy to treat pollution. The reference to wind energy is primarily a mutual advocacy and contribution to policies aimed at saving the environment, reducing carbon emissions. In practice, adhering to the theory level, summarizes the theory of business models for necessity with a broad perspective on value creation. Value capture. To gain a broader understanding of the model for achieving social the structure of barriers to organizational development and technical innovation is understood to achieve the goal.[87]

The main aim is to create new intelligent networking features. There are several possible business models that vary from developer to developer. It has been assessed based on the analytical framework of business model innovation. Conclusion proposes to improve the OECD transport model. To integrate into the concept of network operator business model.[88]

Challenge point about selling electric cars in India. The data was analyzed and collected through various sources. Secondary data provides insights and coverage of electric vehicles and what is happening around the world and in India.[89]

Its main aim is to provide a technological overview with today's modernity and to lead the vast informational literary world. A more significant and comprehensive comparison is made to the synthesis of insights. A positive review of the future of electric vehicles. In road transport, new technologies are used in accordance with constantly evolving rules, societies, behaviors and business models. To support the transition to convenient and clean transportation solutions effective quality and the price is not high for everyone.[90]

To replace a zero-gas vehicle electric vehicle. To help reduce environmental pollution that forms smog and reduce greenhouse gas emissions. For the protection of human health is important. More than a million active EVs are on the road in the US market. EVs are a turning point from cost to decline with continued innovation and scaling. with the emergence of full use of electricity that is appropriate. Three key elements are very important while still being well-correlated: 1. Lower battery costs 2. Increased good battery performance 3. Everywhere. [91]

Summary the valuable lessons learned in the Tesla and River simple electric vehicle sustainable transport project. Business Model Utilizing State-of-the-Art Technology with Commercial Opportunity. Effective for future research in order to be able to expand and expand the business. Talks about examining the business model for the autonomous electric vehicle industry.[92]

There are a number of factors preventing the sale of PEV: 1. Protection from local city governments 2. Uncertainty for electric vehicle technology that supports and encourages consumers to pay more 3. In investment. Slower charging station infrastructure than expected 4. Conservative investment behavior of electric vehicle and battery manufacturers for the federal government. This reduces the barriers of foreign companies to a slight increase in sales. Policy requirements for incentives and strategies related to investments. To overcome the electric vehicle consumer and electric vehicle industry in the resistance and lack of electric charging infrastructure of electric vehicle charging stations.[93]

The policy shows incentives to play an important role in reducing environmental emissions and increasing awareness of the development of electric vehicles. The important role of government in supporting institutional operators for stimulation and supervision. Retirement policies have yielded favorable results with models for reducing CO2 emissions and increasing the adoption of electric vehicles compared to normal business situations. The main conclusion is that the pattern is directly and indirectly beneficial to urban traffic. The use of electric vehicles depends on government support.[94]

The new electric vehicle business model is quite challenging. The study attempts to analyze the potential of the electric vehicle market and business strategies. In Bangladesh ranks through Strengths, Weaknesses, Opportunities, Threats and Threats Analysis. in an analytical hierarchical process to analyze various strategies Possible guiding solutions prove sensitivity analysis.[95]

Operate electric vehicle charging to service users of electric vehicle charging stations for residential homes, convenience stores, and department stores. Charging station cost guidelines were taken for the cost analysis study of electric vehicle charging stations from various research agencies. Individual electric vehicle charging stations, a development model developed to determine the problem, was used to maximize the overall number of accurate plug-in electric vehicles. According to the situation, different electric vehicle charging cases are considered; low electricity consumption rates make electricity bills higher, especially the small number of electric cars. However, costs will drop sharply as utilization increases for high-utilization charging stations.They choose rates with on-demand charging stations. Compared to unwanted rates for cost savings based on available rates. to charge during peak hours and the wattage of the station with a variety of plugs to find a cost-effective way for the availability of fast charging infrastructure in public places. The study did not compare the cost of ownership in more than two EVs markets or analyzes of historical electric vehicle costs. This research provides a more comprehensive estimate of the total cost of ownership of electric vehicle, plug in hybrid and hybrid.

Charging station system electric vehicle calculation research overview, study electric vehicle charging station mode and safety. Currently, there is an electric vehicle charging mode. The comparison of charging standards in different charging applications influences the design of the response time charging system. The charging flexibility from renewable energy sources, experimental results of compatible electric vehicle charging. The fundamental show differences between the two standards with a comparative assessment. A power quality analyzer is used to measure and analyze power quality parameters during slow charging. A high return on investment results in different DC charging processes being measured and analyzed to determine how other manufacturers' DC charging stations react differently to switch-off behavior or shutdown times. Smart charging station of electric vehicles is expected to allow greater penetration of electric vehicles and renewables. Reduce charging costs and provide better utilization of grid infrastructure. Electric vehicle market situation and EV supply equipment and globally available chargers (for both AC and DC) economic models are proposed for EV charging infrastructure setups.

The business model analyzes competing business models for electric charging networks, the importance of cross-industry partnerships in configuring new value chains, and the ecosystem perspective on creating and capturing value, using actionable insights for EVs company to evaluate innovative business models. The business model has evolved to show a series of more favorable changes that introduce a component to the service. In a product development business model, it is necessary to compete with companies in the high-tech industry. The expected income from investments and a proposed public rebate program incentivize the private sector to install electric vehicle charging stations.

CHAPTER III

RESEARCH METHODOLOGY

TABLE 1 NOMENCLATURE METHODOLOGY

Nomenclature

Scenario 1 = Normal Charger 6 outlets
Scenario 2 = Quick Charger 6 outlets
Scenario 3 = Large charger Normal and Quick 12 outlets

$NC_{AC22(1=n)}$ = Normal Charger 1-6 outlets
$insur_{AC22}$ = Insurance Electric
fee_{AC22} = Fee Electric
ec_{AC22} = Electric charge
pt_{AC22} = Power transformer
$other_{AC22}$ = Other expense 30%

$QC_{DC50(1=n)}$ = Quick Charger 1-6 outlets
$insur_{DC50}$ = Insurance Electric
fee_{DC50} = Fee Electric
ec_{DC50} = Electric charge
pt_{DC50} = Power transformer
$other_{DC50}$ = Other expense 30%

$EVNC_{AC}$ = Electric Vehicles Normal Charging on Time
$BEV_{AC(1=n)}$ = Battery of Elextric Vehicles AC (1=n)
$EVNC_{AC22}$ = Electric Vehicles Normal Charging Head Size AC22

$EVQC_{DC}$ = Electric Vehicles Quick Charging on Time
$BEV_{DC(1=n)}$ = Battery of Electric Vehicles DC (1=n)
$EVQC_{DC50}$ = Electric Vehicles Quick Charging Head Size DC50

FC = Fixed cost
P = Price
VC = Variable cost

I = Investment cash outflow
C = Cash inflow
r = rate interest
t = period

Investment = Cash flow investment
Profit = Income

BEP = Break even point
NPV = Net Present Value (NPV)
IRR = Internal Rate of Return
PB = Payback Period

ENERGY MODEL

This electric vehicle charging station study aims to understand the scenario of electric vehicle charging stations that use different services in need of speed and convenient service using three design features.

Scenario1 Design a normal charging station using an electric vehicle charging station. The charging time is relatively slow, approximately 180-240 minutes.

Scenario2 Design an electric charging station with a Quick charging station that takes about 40-60 minutes for fast charging.

Scenario3 There are two types of electric vehicle charging stations, Normal charging stations and Quick charging stations, which combine both types of electric vehicle charging stations to serve both fast and slow customers. To compare the cost of EVs charging stations from the Design of 3 types of EVs charging stations.

Scenario 1: Design a normal charging station component to analyze the equipment used to calculate the cost of charging stations per station. There are 6 outlets of AC 22 kW chargers in each charger.

Scenario 1 = Electric Vehicles Cost Normal Charger …(1)

$$1 = NC_{AC22(1)} + .. NC_{AC22(1=n)} + insur_{AC22} + fee_{AC22} + ec_{AC22} + pt_{AC22} + other_{AC22}$$

$NC_{AC22(1=n)}$ = Normal Charger 1-6 outlets

$insur_{AC22}$ = Insurance Electric

fee_{AC22} = Fee Electric

ec_{AC22} = Electric Charge

pt_{AC22} = Power transformer

$other_{AC22}$ = Other express 30%

Scenario 2: Design a quick charging station component to analyze the equipment used to calculate the cost of charging stations per station. Each item has 6 outlets of DC 50 kW chargers.

Scenario 2 = Electric Vehicles Cost Quick Charger …(2)

$$1 = QC_{DC50(1)} + .. QC_{DC50(1=n)} + insur_{DC50} + fee_{DC50} + ec_{DC50} + pt_{DC50} + other_{DC50}$$

$DC_{DC50(1=n)}$ = Quick Charger 1-6 outlets

$insur_{DC50}$ = Insurance Electric

fee_{DC50} = Fee Electric

ec_{DC50} = Electric Charge

pt_{DC50} = Power transformer

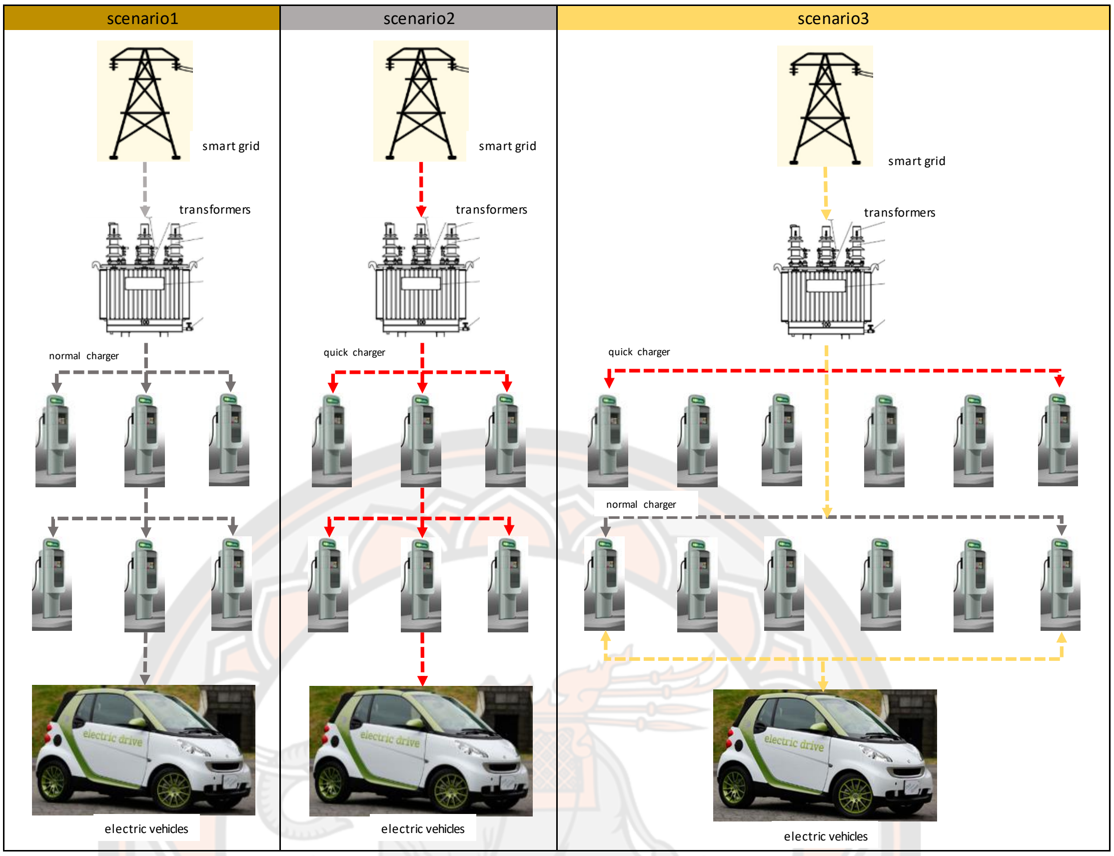
$other_{DC50}$ = Other express 30%

Scenario 3: Design the normal charging station components. Each charger has 6 outlets of AC 22kW and Quick charging stations. Each item has a DC 50kW of 6 outlets to analyze the equipment used to calculate the cost of the next charging station. The station has 12 outlets.

Scenario 3 = Large charger Normal and Quick 12 outlets …(3)

1= [Scenario 1 + Scenario 2]

FIGURE 10 ELECTRIC VEHICLE CHARGING FLOWS CHART



1. EV Charger for the car park at Department store, Restaurant and Residential

- Normal Charging station

Scenario 1 = Normal Charger 6 outlets

There is no need to rush when charging for customers with regular electric vehicle charging; there are 6 outlets. Pay for customers who use the parking area residential condominium, department store, and restaurant.

- AC Destination 22 kW 32A

$$EVNC_{AC} = \frac{BEV_{AC(1=n)} \quad h}{EVNC_{AC22}}$$

$EVNC_{AC}$ = Electric Vehicles Normal Charging on Time

$BEV_{AC(1=n)}$= Battery of Electric Vehicles AC (1=n)

$EVNC_{AC22}$ = Electric Vehicles Normal Charging Head Size AC22

2. EV Charger for the car park at the Convenience store, Coffee cafe and Oil station

- Quick charging station

Scenario 2 = Quick Charger 6 outlets

For customers who need to recharge their electric vehicle in a hurry and take less time, there are charger 6 outlets. Electric vehicle charging points are available to customers who use convenience stores and gas stations.

- DC Quick charger 50kW 100A

$$EVQC_{DC} = \frac{BEV_{DC(1=n)} \quad h}{EVQC_{DC50}}$$

$EVQC_{DC}$ = Electric Vehicles Quick Charging on Time

$BEV_{DC(1=n)}$= Battery of Electric Vehicles DC (1=n)

$EVQC_{DC50}$ = Electric Vehicles Quick Charging Head Size DC50

3. EV Charger for the car park at the Department store and Oil station

- Normal Charging station and Quick charging station

Scenario 3 = Large charger Normal and Quick 12 outlets

To support customers who use regular and express services in EVs charging services. An EVs charging station with a large service point is installed in the current oil station or electric vehicle parking station with various vehicles. The charging station will need more facilities such as coffee shops, restaurants, souvenir shops, clothing stores, and convenience stores.

Scenario 3 = AC Destination 22 kW 32A + DC Quick charger 50kW 100A

BUSINESS MODEL

Electric vehicles are currently being developed to use energy-saving electric vehicles in the transportation sector. They do not cause pollution to the environment from petroleum fuels, causing much pollution. Therefore need to change environmentally friendly fuels. Such as using electric vehicles as pure energy without pollution to the environment or a vehicle called EV (Electric Vehicle). This study is about the cost analysis, breakeven point, net present value, internal rate of return, and payback period.

Conclusion: There are cost-effective electric vehicles that use modern technology, suitable for investment in electric vehicle charging stations to replace fuel stations using current services. Including the analysis of the model of the charging station business for investment in EVs charging stations.

1. BREAK-EVEN POINT (BEP)

To be used to evaluate the breakeven point at the position of the amount of income equal to the cost of investment Therefore no profit or loss in the business. The formula used for BEP analysis consists of Price, Fixed cost, Variable cost. The basic unit formula calculates BEP, the amount of investment required to achieve a breakeven point in this study. For using the equation (1)

$$BEP = \frac{FC}{P-VC} \qquad ..(4)$$

FC = Fixed cost

P = Price

VC = Variable cost

In calculating BEP, the investment project period is 10 years, divided into 3 analysis stations Scenario1 service, breakeven point calculation results 118.23 months or 9.85 years. Scenario2 is the calculation of breakeven point 59.79 months or 4.98 years. Scenario3 is the calculation of breakeven point 52.53 months or 4.38 years. Based on the BEP analysis, Scenario3 breakeven point is the shortest investment point and the fastest return on investment in all 3 Scenarios.

2. NET PRESENT VALUE (NPV)

NPV is used to calculate net cash flow comparing electric vehicle charging stations. In each charging station investment, the charging stations throughout the life of the acquisition are equal by using the NPV equation. The present value of the net benefit is an investment assessment, generating profits for each net cash situation. The charging station received is the present value. NPV is a value variable. That shows the profitability of electric vehicle charging stations.

NPV > 0 : Investment projects are suitable for investment

NPV < 0 : The project is not eligible for investment.

NPV = 0: Investment project can provide the best investment and use the equation 5

$$NPV = -I + \sum_{i=1}^{T} \frac{c_i}{(1+r)^i} \quad ..(5)$$

I = Investment cash outflow

C = Cash inflow

r = Rate interest

t = Period

To get an investment project that provides the best investment possible from the NPV calculation. From the NPV investment analysis, the investment project is for 10 years. I is the cash out for investment, C is the cash inflow, r is the interest rate to be received, t is the investment period.

3. INTERNAL RATE OF RETURN (IRR)

IRR is the projected interest rate as the project profit margin for that investment.

NPV = 0, and IRR represents the actual rate ate of return of the project. Analysis using equation 6

$$0 = -I + \sum_{i=1}^{T} \frac{c_i}{(1+IRR)^i} \quad ..(6)$$

I = Investment

C = Cash flow

IRR = Internal Rate of Return

t = Period

IRR Investment Project Analysis Results for 10 years Scenario1 with a return rate of 0.27% Scenario2 with a return rate of 15.19% Scenario3 with a return rate of 18.75% Scenario3 Project Suitable for Investment.

4. PAYBACK PERIOD (PB)

PB Payback period is a year or month based on when cash flows from investment projects can be profitable. Cash flow paid from net investment at the beginning of the project. Because the project has an investment model in the first year to receive returns every year, considering the number of years to receive a return worth the investment. Risky projects require a payback period of more than five years. Analysis using equation 7

$$Paybak\ period = \frac{Investment}{Profit} \quad ..(7)$$

Investment = Cash flow investment

Profit = Income

PB investment project analysis results in 10-year duration Scenario1 is with return Payback period 9.85 years Scenario2 with return Payback period 4.98 years Scenario3 with return Payback period 4.38 years. Scenario3 Project Suitable for investment.

Assumption of business model electric vehicle charging station was designed in 3 Scenarios to analyze costs and equipment investment, installing electric vehicle stations brings the information to consider BEP NPV IRR and PB.

THE METHODOLOGY ASSIGN VARIABLE CHARGING STATION

Scenario1 Normal charging station, customized design 6 outlets, AC size 22 kw, ABB brand, price about 990,000 baht, calculated power transformer size 315 kVA, price about 227,910 baht, electric insurance price 126,000 baht, com fee price 1,260 baht, electric charge price 10,000 baht, other expense price 68,373 baht and total 1,423,543 baht.

Scenario2 Quick charging station, customized design 6 outlets, DC size 50 kw, SETEC brand, price about 3,060,000 baht, calculated power transformer size 630 kVA, priced about 354,063 baht, electric insurance price 252,000 baht, com fee price 2,520 baht, electric charge price 10,000 baht and other expense price 106,218.90 baht total 3,784,801.90 baht.

Scenario3 Normal charging Design 6 outlets and Quick charging Design 6 outlets total 12 outlets available in both AC 22 kw Brand ABB and DC size 50 kw Brand SETEC total price approximately 4,050,000 baht calculated Power transformer size 1000 kVA price approximately 455,606 baht ,Electric insurance price 400,000 baht, com Fee price 4,000 baht, Electric charge price 10,000 baht and Other expense price 136,681.80 baht total 5,056,287.80 baht.

[Data ABB is taken from www.pmk.co.th/shop/ev-charger, SETEC data is taken from www.alibaba.com//trade/search, Transformer data is taken from http://transformae.wordpress.com, electric data insurance, com fee, electric charge taken from www.pea.co.th and other expense 30% set-up cost according to transformer price] data year 2019

THE METHODOLOGY ASSIGN VARIABLE INCOME AND EXPENSE

Scenario1 Income Normal charging station 6 outlets charging schedule 10 hours @ 50 baht income 90,000 bant/month. Expense electricity based on the number of electricity units multiplied by the unit price multiplied by the number of hours 60,492.59 baht, Salary 15,000 baht and Rent place 18,000 baht total expense 93,492.59 baht, profit before tax -3,492.59 baht/month.

Scenario2 Income Quick charging station 6 outlets charge schedule 10 hours units@ 8 baht calculated based on number of electricity units multiplied per unit price multiplied by hours paid income 547,200 bant/month. Expense electricity based on number of electric units multiplied by unit price times number of hours 325,245.50 baht, Salary 15,000 baht and rent place 18,000 baht, total expense 358,245.50 baht, profit before tax 188,954.50 baht/month.

Scenario3 Income Normal charging 6 outlets and Quick charging 6 outlets total 12 outlets 2 types charge schedule 10 hours hour @ 50 baht income 90,000 bant/month and charge units@ 8 baht calculated by the number of electricity units multiplied by the unit price multiply the number of hours paid income 547,200 bant/month, total income 637,200 baht. Expense electricity calculated by the number of electricity units multiplied by the unit price multiplied by the number of hours 385,447.71 baht, salary 30,000 baht and rent place 36,000 baht, total expense 451,447.71 baht, profit before tax 185,752.29 baht/month.
Information : From asking the owner of the current gas station, the service time is 10 hours per day.
[Expense electricity information taken from www.pea.co.th] data year 2019

TABLE 2 COST INVESTMENT MODEL EVS CHARGER

Cost Investment	Scenario 1	Scenario 2	Scenario 3
Model EV Charger	Normal 6 Outlets	Quick 6 Outlets	Normal and Quick 12 Outlets
Cost EV charger station	990,000	3,060,000	4,050,000
Electric insurance	126,000	252,000	400,000
Com fee	1,260	2,520	4,000
Electric charge	10,000	10,000	10,000
Power transformer	227,910	354,063	455,606
Other expenses	68,373	106,219	136,682
Total	1,423,543.00	3,784,801.90	5,056,287.80

Assumption, income cost, and net profit, resulting from investment action, data analysis, electric car charging rate takes about 10 hours a day—divided 3 Scenario Normal Charger, Quick Charger and Normal + Quick. To calculate the study of the opening period, the same is different: the speed of the electric car charging and thinking of income according to the electric charge.

TABLE 3 INCOME AND EXPENSES MODEL EVS CHARGER

Income and Expenses	Scenario 1	Scenario 2	Scenario 3
Model EV Charger	Normal 6 Outlets	Quick 6 Outlets	Normal and Quick 12 Outlets
Time Charger	10 hr.@50 Bth.	10 hr.8 Bth.@kwh	10 hr.@50 Bth.and 8 Bth.@kwh
Income	90,000	547,200	637,200
Expenses electric	60,493	325,245	385,448
Employee	15,000	15,000	30,000
Rent Place	18,000	18,000	36,000
Total	(3,492.59)	188,954.50	185,752.29

Net profit margin compared to the electric car charging station. Analyze expenses compared to income from the investment operation; the electric car charging rate takes about 10 hours a day. To calculate the analysis of the same opening period differently, the speed of charging electric cars, thinking of income according to the charging time, is calculated as a percentage. According to the Normal Charger, Quick Charger, and Normal + Quick scenario.

TABLE 4 NET PROFIT COMPARE INCOME MODEL EVS CHARGER

Net profit compare income	Scenario 1	Scenario 2	Scenario 3
Model EV Charger	Normal 6 Outlets	Quick 6 Outlets	Normal and Quick 12 Outlets
Time Charger	10 hr.@50 Bth.	10 hr.8 Bth.@kwh	10 hr.@50 Bth.and 8 Bth.@kwh
Income	100	100	100
Expenses	104	65	71
Net profit	-4	35	29

Each analysis of scenario BEP / Month break-even point the shortest period, NPV / Bath the highest net value, IRR / Percent the most yield, PB / year the shortest duration.

TABLE 5 ANALYSIS BEP, NPV, IRR AND PB

Analysis	Scenario 1	Scenario 2	Scenario 3	
BEP	N/A	50,476	98,811	vehicle
NPV	N/A	10,147,721	8,640,121	baht
IRR	N/A	59.34%	42.84%	%
PB	N/A	1.67	2.27	year

Time on charger

There are two types of electric vehicle charging stations, normal charge and quick charge, which are used to charge electric vehicles using the EV charger cabinet that converts AC to DC in the normal charge type, charging via an onboard charger, and quick charge, supplying DC directly to the electric vehicle battery. The time it takes to charge varies according to the size of the electric charger and battery size kWh electric vehicle.

$$\textit{Time on charger} = \frac{B\_kWh}{AC\_DC\_kW} \quad ..(8)$$

B_kWh = Battery kWh for Electric Vehicle

AC_DC_kW = AC or DC Fast Charging Station kW

TABLE 6 STUDY EVS BATTERY SIZE FOR TIME ON CHARGER

BEV	Battery Size kWh	Charging % 80	Time Charge / kW 22 AC / min	Time Charge / kW 50 DC / min	Scenario1 /outlets 6 EV / Per Day	Scenario2 /outlets 6 EV / Per Day	Scenario3 /outlets 12 EV / Per Day
MG	44.5	35.60	97.09	42.72	37	84	121
Tasla	62	49.6	135.27	59.52	27	60	87
Porsche	79	63.2	172.36	75.84	21	47	68
MINI Cooper	32.6	26.08	71.13	31.30	51	115	166
NISSAN	40	32	87.27	38.40	41	94	135

A study of EVs charging stations calculates the number of EVs for 10 hours of service/charging stations. There will be enough electric cars to break-even point: Net present value yield and return period. To analyze 5 Brands of electric cars with different battery sizes, selecting the sales of electric cars is relatively high in 2020-2021. The number of electric vehicles is more than other electric car models; the MG EV will have a Battery size of 44.5 kWh. At the same time, it will enter the battery-size charging station, which can charge approximately 80% of the electricity according to the size of Battery Scenario1 of 37 EV, Scenario2 of 84 EV, and Scenario3 amount 121 EV. The number of electric cars more or less depends on the battery size of each electric vehicle. Moreover, the number of electric vehicles currently running.

TABLE 7 CO2 IMPACT DISTANCE PHISANULOK TO KHAO KOH

distance	wangthong-keknoi	75	km							Year 2564
distance	keknoi-Asean	30	km	105km						
CO_2 = g/km	100	150	200	200	200	200	200	200	200	200
	Car <7 person	Car >7 person	Car small	Car Middle	Car Big	Car 4 wheels	Car 6 wheels	Car 10 wheels	Trailer	Semi trailer
wangthong-keknoi	2599	2912	6	4	72	918	197	99	67	47
keknoi-Asean	1899	196	9	11	5	3429	172	34	44	15
	4498	3108	15	15	77	4347	369	133	111	62
Total vehicle	12,735									
wangthong-keknoi	19,492,500	32,760,000	90,000	60,000	1,080,000	13,770,000	2,955,000	1,485,000	1,005,000	705,000
keknoi-Asean	5,697,000	882,000	54,000	66,000	30,000	20,574,000	1,032,000	204,000	264,000	90,000
CO_2	25,189,500	33,642,000	144,000	126,000	1,110,000	34,344,000	3,987,000	1,689,000	1,269,000	795,000
CO_2=g/105km	102,295,500			EV 5%	2.88 %		28,083.57	ppm	381	vehicle
g/km	974,242.86			EV10%	5.77 %		56,167.14	ppm	762	vehicle
1 g=1000ppm	974,242,860	ppm								

https://data.go.th/en/dataset/vk2564

Information of the department of highways for the year 2021, the amount of travel by car from Wang Thong District Phitsanulok Province to Khao Kho District Phetchabun Province. (Distance of 105 kilometers) starting from Wang Thong - ASEAN (Lom Sak) number of cars 12,735 vehicle calculates CO_2 emissions according to the size of the ICE machine <2000 (car seats no more than 7 people) = 100g/km , >=2000 (sitting car more than 7 people) =150 g/km, >light trucks or more = 200g/km. Assessment of impacts arising from the conversion of ICE to EV in the Khao Kho tourist area According to the data analysis, CO_2 emissions = 974,242.86 g/km. Hypothetically having 5% Electric Vehicle (only ICE <2000, >=2000 and light trucks) will result in a 2.88% reduction in CO_2 or CO_2 reduction 28,083.57 ppm/gkm, and if the assumption of 10% electric vehicle (only ICE <2000 , >=2000 and light trucks) would result in a 5.77% reduction in CO_2, or 56,167.14 ppm/gkm of CO_2 reduction if there was a lot of EV running. how much will cause environmental balance, more fresh air.

SENSITIVITY ANALYSIS COST INVESTMENT CHARGING STATION

Sensitivity Analysis of the electric vehicle charging station investment project. To analyze the risks consider the impact of various factors on changes in costs and income. The break-even point may be changed, net present value, rate of return and payback period. To analyze investment projects and the uncertainty of the current economic conditions that affect investment decisions. Therefore, the sensitivity of electric vehicle charging station investments must be analyzed.

Scenario1 : In the 10 hour per day analysis, scenario1 has a negative NPV and the IRR cannot be calculated, the project is unsuitable for investment and cannot be clearly compared. Scenario1 is therefore suitable for an introduction to the use of electric vehicle charging stations, which may be free or promotional charging services in an environmentally sound area.

TABLE 8 SCENARIO1 ANALYSIS NPV AND IRR

Analysis	Investment Cost		Price		Expense Electricity		Ft		9 Hr	11 Hr
	10%	-10%	10%	-10%	10%	-10%	10%	-10%		
NPV	8.47%	-8.47%	-39.48%	39.48%	26.43%	-26.43%	-0.03%	0.03%	13.07%	-13.07%
IRR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Scenario2 : In the 10 hour per day analysis scenario2, with a positive NPV and an IRR greater than the cost of financing, it is an investment-friendly project. To make the data analysis more realistic, there is a high profit potential. Therefore, a sensitivity analysis of the charging service time of 10 hours per day was analyzed. Compared to 9 and 11 hours of electric charging service time per day. An increase and decrease in the positive and negative ratio of investment costs is assumed to increase by 10%, resulting in a negative NPV of 3.73%, a negative IRR of 5.62%. If a decrease in investment costs by 10% results in an increase in NPV of 3.73%, an IRR of 6.81%. Make it known that the increase or decrease in investment costs affects NPV and IRR. The charge price increases by 10%, causing NPV plus 39.76%, IRR plus 17.66%. If the charge price decreases by 10%, NPV decreases to negative 39.76%, IRR decreases to negative 18.13%. Makes me know if the price drop has a high impact on the NPV and IRR values. Electricity charge increases by 10%, causing NPV to be negative 23.64%, IRR negative to 10.69%. If charging electricity bill decreases by 10%, NPV is positive 23.64%, IRR is positive 10.53%. It lets you know if your electricity bill increases. Can have a negative impact on NPV and IRR. A 10% increase in Ft negative leads to 0.02% NPV positive, 0.01% positive IRR. A 10% decrease in Ft charge raises 0.02% NPV negative, 0.01% positive IRR. But if Ft is positive then NPV and IRR are opposite, so we know if Ft has negative effect on NPV and IRR. Scenario2 Based on a comparative analysis of the increase in the price of charging fees and the decrease in the cost of electricity. Compared to 9 and 11 hours of charging time, they have higher NPV and IRR values.

TABLE 9 SCENARIO2 ANALYSIS NPV AND IRR

Analysis	Investment Cost		Price		Expense Electricity		Ft		9 Hr	11 Hr
	10%	-10%	10%	-10%	10%	-10%	10%	-10%		
NPV	-3.73%	3.73%	39.76%	-39.76%	-23.64%	23.64%	0.02%	-0.02%	-16.15%	16.15%
IRR	-5.62%	6.81%	17.66%	-18.13%	-10.69%	10.53%	0.01%	-0.01%	-7.28%	7.21%

Scenario3 : In the 10 hour per day analysis scenario3, with positive NPV and IRR greater than the cost of financing, it is an investment-friendly project. To make the data analysis more realistic, there is a high profit potential. Therefore, a sensitivity analysis of the charging service time of 10 hours per day was analyzed. Compared to 9 and 11 hours of electric charging service time per day. An increase and decrease in the positive and negative rate of investment costs is assumed to increase by 10%, resulting in a negative NPV of 5.85%, a negative IRR of 4.30%. If a decrease in investment costs by 10% results in an increase in NPV of 5.85%, an IRR of 5.17% is assumed. Make it known that the increase or decrease in investment costs affects NPV and IRR. The charge price increases by 10%, causing the NPV value to increase by 54.38%. The IRR value increases by 15.78%. If the charge price decreases by 10%, the NPV value decreases by negative 54.38%. The IRR value decreases to negative 16.72%. reduce. It has a high impact on NPV and IRR. Electricity charge increases by 10%, resulting in negative NPV of 32.90%, negative IRR of 9.94%. If charge of charge of electricity decreases by 10%, NPV is positive 32.90%, IRR is positive 9.61%. This lets you know if your electric bill increases. Can have a negative impact on NPV and IRR. If Ft is negative, a 10% increase makes NPV positive 0.03%. IRR is positive 0.01%. If Ft charge decreases 10%, NPV is negative 0.03%, IRR is 0.01% positive. Adding NPV and IRR is opposite each other, so we know if Ft has a negative effect on NPV and IRR.

TABLE 10 SCENARIO3 ANALYSIS NPV AND IRR

Analysis	Investment Cost		Price		Expense Electricity		Ft		9 Hr	11 Hr
	10%	-10%	10%	-10%	10%	-10%	10%	-10%		
NPV	-5.85%	5.85%	54.38%	-54.38%	-32.90%	32.90%	0.03%	-0.03%	-21.51%	21.51%
IRR	-4.30%	5.17%	15.78%	-16.72%	-9.94%	9.61%	0.01%	-0.01%	-6.44%	6.31%

Summary : The sensitivity analysis increases and decreases in investment cost, service cost, electricity cost and ft. charging time of 9 and 11 hours. Start the hypothesis and analysis of Scenario 1, 2 and 3. The results of the analysis are as follows. Scenario2 is the first model Business Model electric vehicle charging station interested in investment, value for money and return on ownership of the business. Scenario3 is second only to Scenario2 with Business Model electric vehicle charging station, interested in investment, value for money and good return. Scenario1 is an investment-friendly disregard as the NPV is negative and the IRR cannot be calculated and therefore does not support investment. But if it is a secondary promotion electric vehicle in order to lay the basis for using electric vehicle for customers interested in receiving electric vehicle charging station service, Scenario1 is recommended. Due to low investment cost, not for profit focus is to help society, reduce pollution, protect the environment. The limitation of electric vehicle charging station equipment is still a new market, must be imported from abroad, may be one of the factors that cause high investment costs, thus affecting NPV and IRR.

TABLE 11 BUSINESS MODEL CANVAS

KEY PARTNERS		KEY ACTIVITIES	VALUE PROPOSITONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
MEA PEA EGAT Bank PTT PT Bangchak Esso Shell BMW	Central BigC Lotus FamilyMart .7-11 Coffee Café Restaurant GWM MG	Service Research and Development Software Development Maintenance and Building of Charging station Design Charging station	Charger Station Quality and Standard Price standard and Security Open 24 hours Convenience location Service Normal charger Electric Vehicle charging on Residential, Hotel and Deparment store Service Quick charger Electric Vehicle charging on Oil station, Convenience store and Restaurant	Call center Discounts Referral to Member Maps charging station and Location Enviromentaly APP Order Time	Electric Vehicle Users Tourist and Travel Company Employee Government Officer Domectic
		KEY RESOURCES		**CHANNELS**	
		Raw materrial Reputation Capital Crew Tools		APP charging station Website of charging station Line facebook Telephone Google Maps	

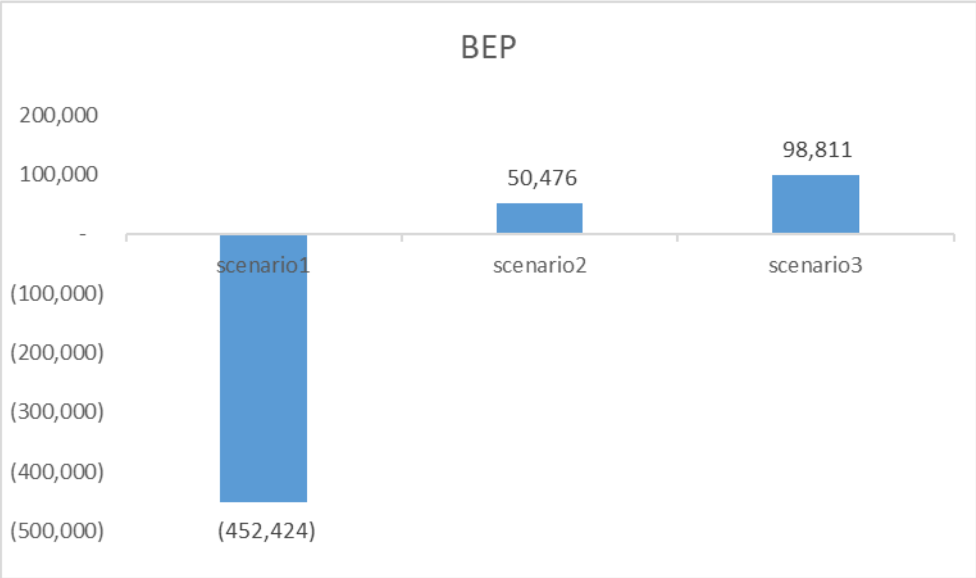
COST STRUCTURE			REVENUE STREAMS
Cost Electric Cost Charging Station Cost System Electric	Employee salary Product cost Taxes	Rent Station Raw material cost	Income Charging Electric Vehicle Advertising Revenue

CHAPTER IV

RESULT OF RESEARCH

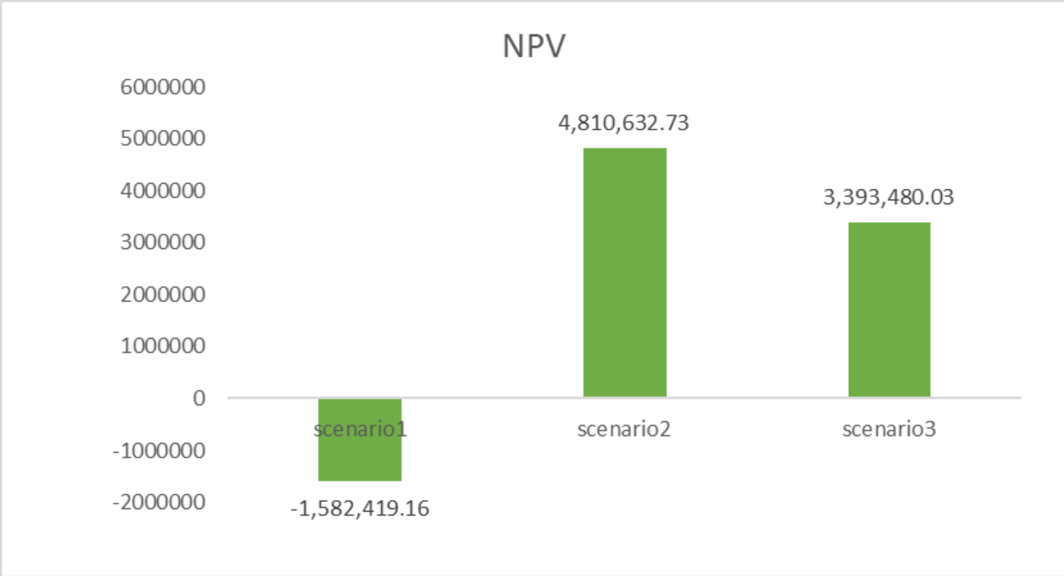
The analysis results are divided into scenarios to analyze each detail of the cost to the net worth, the rate of return, and payback period For investment, electric vehicle charging stations.

TABLE 12 BREAKEVEN POINT (BEP)



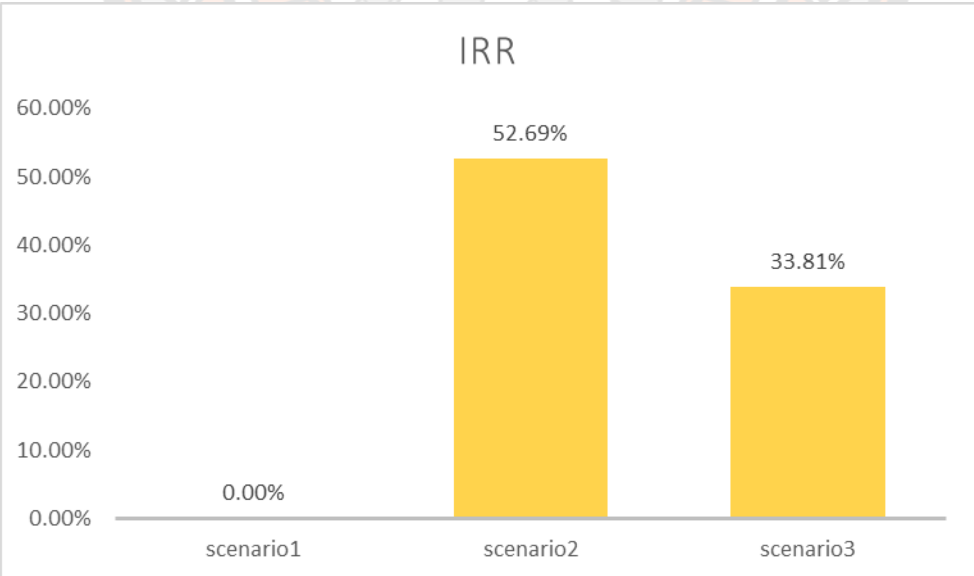
In calculating the BEP from the comparative analysis of situations 1, 2, and 3 of the investment, have a breakeven point suitable for the return of the investment. Situation2 requires a minor investment to meet the breakeven point requirements.

TABLE 13 NET PRESENT VALUE (NPV)



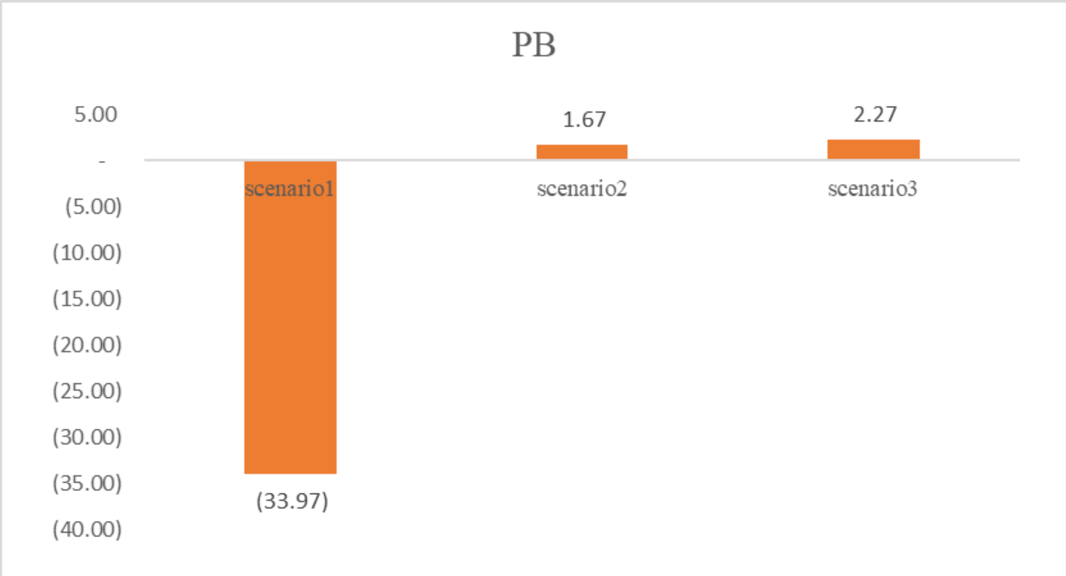
The NPV analysis for scenarios 1, 2, and 3 of the investment provides the fastest and best current cash value, namely Investment scenario2, while scenario 1 provides the lowest current cash value.

TABLE 14 INTERNAL RATE OF RETURN (IRR)



IRR analysis in investment scenarios 1, 2, and 3 provides the best return rate. Investment scenario 2, while scenario1 provides the lowest return, < 0.0%. The return is the fastest and higher than scenario2, and scenario1 gives the least return.

TABLE 15 PAYBACK PERIOD (PB)



PB analysis in investment scenarios 1, 2, and 3 provides the fastest and best payback period. Investment scenario 2 has a better payback period than scenario 3, and scenario 1 uses the payback period the most.

Expenses cost electric vehicle charging station. The analysis is calculated as a percentage of the total cost of each item of EVs charging station equipment costs.

The graph shows that the EVs charging station has the highest cost in the expenditure category, electric insurance, electric charge, power transformer, etc.

TABLE 16 SCENARIO1 EXPENSES COST EVS CHARGING STATION

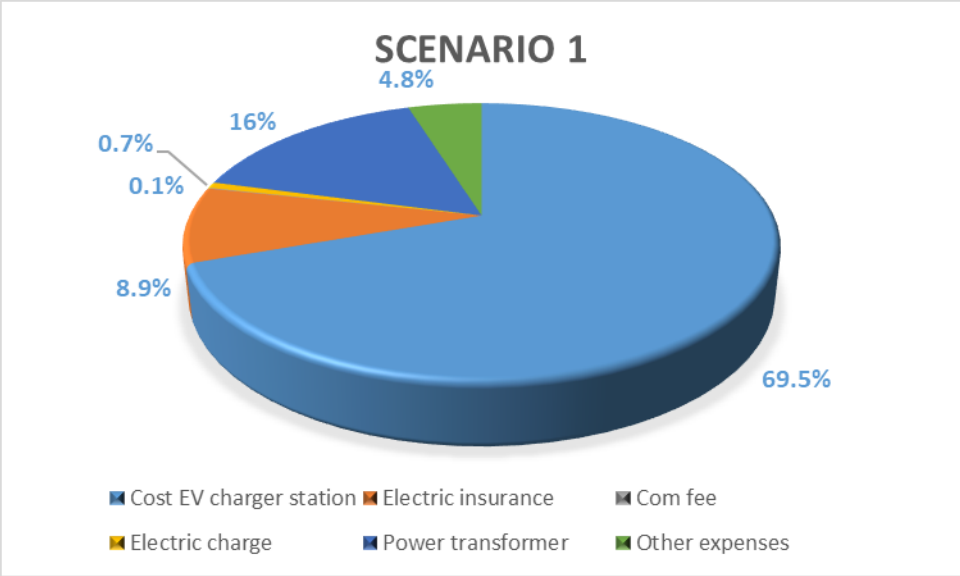


TABLE 17 SCENARIO2 EXPENSES COST EVS CHARGING STATION

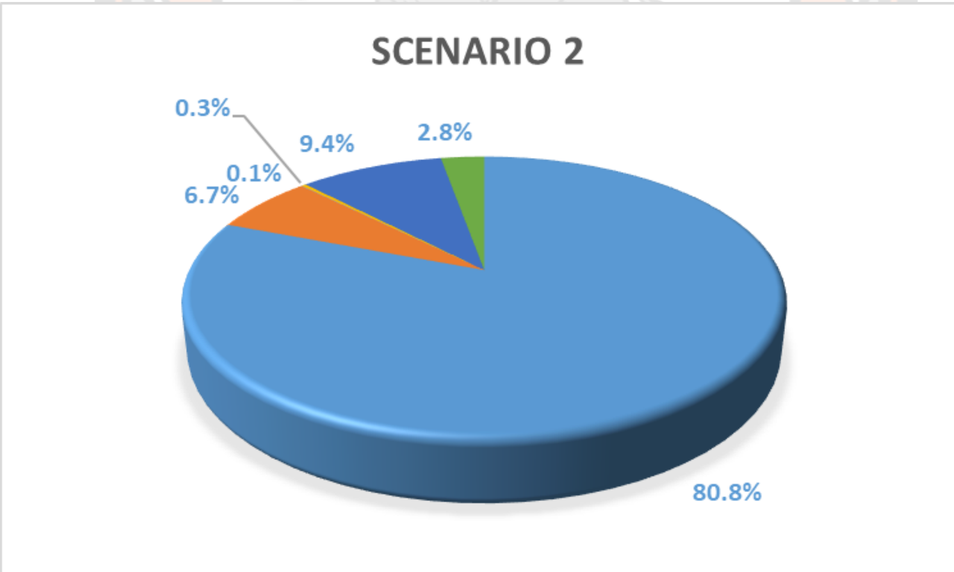
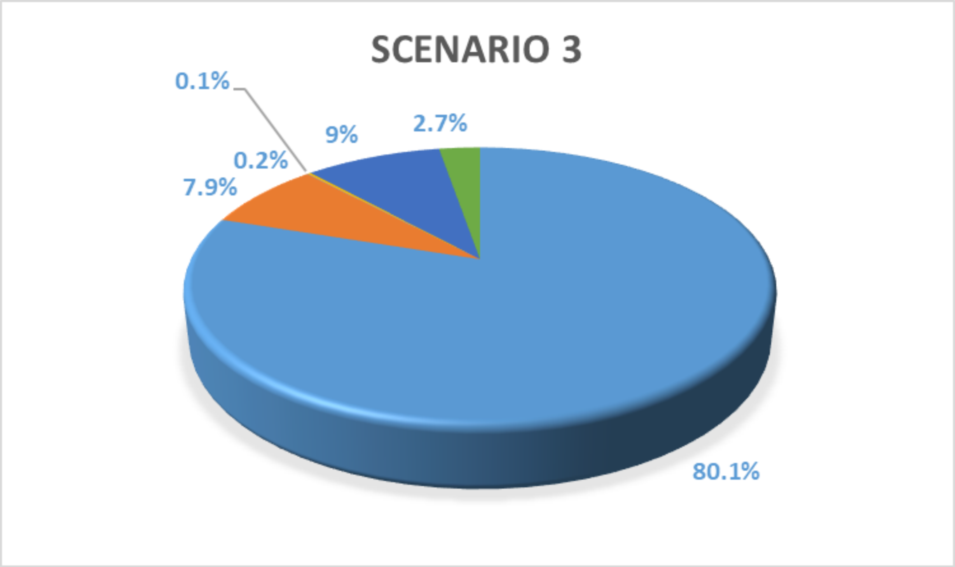


TABLE 18 SCENARIO3 EXPENSES COST EVS CHARGING STATION


SCENARIO 3
0.1%
9%
2.7%
0.2%
7.9%
80.1%

SWOT ANALYSIS

To run a successful business, a SWOT analysis requires a three scenario SWOT Analysis table for the company.

TABLE 19 SWOT FOR CHARGING STATION SYSTEM

Analysis	Strength	Weakness	Opportunity	Threat
Charging station system	Fast charging stations are also in high demand especially Segnario 2-3	Lack of personnel with expertise in the system electric vehicle station	Easy to expand installation space as it is a small business. Long travel distances are still very demanding Secnario 1 and Segnario 2-3 is still in high demand. Can charge electricity quickly.	Equipment and tools must be ordered from abroad and in the country there are few
	Segnario1 Easy to design and install lower cost due to small business.	Segnario2-3 will require a system administrator.	Electric vehicle charging stations are a new business. Experts are few and difficult to get into by competitors.	Segnario2-3 will require a system administrator causing additional costs
	Locations where electric vehicle charging stations are installed also have a lot of demand.	Have depreciation and the maintenance cost is quite high device failure may not be a replacement for Segnario2-3.	Government support for electric vehicles and electric charger equipment, both Segnario 1-3	Electric chargers are rapidly changing in price, making them cheaper quickly making them easy to compete.
	The number of electric chargers is small and the competition is not high.	Long investment period may have equipment that is not update and there has been a rapid technological change.	Open to the private sector to do the electric charging station businessIt easily and Segnario1 can install and develop software by yourself.	There is still no serious financial support.
	Equipment, tools, assets are owned by the entity. Manage expenses and services easily.	The cost of charging station equipment is high.	Fast charging stations have not yet been installed. The size is large enough to meet the needs.	The cost of electricity and maintenance costs is high.

TABLE 20 SWOT FOR SERVICE AND BUSINESS MODEL

Analysis	Strength	Weakness	Opportunity	Threat
Service and Business Model	Customers find convenient service points on App Map quickly and easily in community and business areas Segnario 1-3	A large service point has a large cost. high and the charging price can't compete with competitors	Prepare EV charging station mapping Customers can easily access	Currently, there are a small number of electric charging station operators due to the insufficient number of electric vehicles for investment.
	Long-distance electric vehicle customers want electric charging station service for continuous convenience to drive an electric vehicle Segnario 2-3	Must compete with the original gas station directly and may be less effective about the cost of charging electricity.	Electric vehicle association government agency and the Ministry of Energy promote support Increase the number of electric vehicles and electric charging stations.	Electric charging stations will have more competitors from electricity producers and gas stations Convenience stores, hotels, restaurants can be bought and installed be bought and installed to serve to serve customers easily.
	Customer base from transportation registered electric vehicles all companies and the department of land transport	A larger company might make it work can be delayed in adjusting various strategies.	There has been a development in the production of electric vehicles in the country to expand the automobile manufacturing industry.	Consumers using electric vehicles can install services at their homes, reducing the number of electric vehicle charging stations.
	Build relationships with all electric vehicle companies private sector, government, state enterprise, condominium and department stores to install an electric charging station serving Segnario 1 , coffee shops and shops convenience to purchase, install like Segnario 2	Problems with procurement and high costs maybe more big.	Reduce the import of electric vehicles into the country to increase the production of electric vehicles in the country and add more skilled workers.	Electric vehicles are expensive, causing fewer customers to use charging services and inflation slows the purchase of electric vehicles. Petrol vehicles are also cheaper than electric vehicles.
	Incentive measures for electric vehicle users financial measures (Exempt from tax/low tax rate waiver of road usage fees for parking)	Promote investment in electric vehicle charging stations concentrated in the central area.	Consumers have reduced import tariffs to stimulate. Promote the use of electric cars to reduce environmental pollution.	
	Location near energy sources and customers Many still need fast charging stations. Secnario2-3	Employees lack knowledge of electric vehicle systems still unable to compete with competitors	There is a project to develop a charging station development plan electric vehicles and promote the purchase of electric vehicles.	
	The electric charging station has a high quality standard. Doing a comprehensive business, installing , repairing, maintaining the system.		The number of electric vehicles has increased due to the punitive measures for vehicles with emit large amounts of greenhouse gases and has a high tax rate (VAT vehicle registration tax annual car tax)	
			Reduce the import tax on electric vehicles and excise tax reduction to save the environment Zero Emission Vehicle	

TABLE 21 SWOT FOR INVESTMENT FINANCE COST

Analysis	Strength	Weakness	Opportunity	Threat
Investment finance cost	Relatively high annual profit for the Secnario 2-3 Quick charger electric vehicle charging station is a good investment for a quick return time.	Secmario 1 Electric Vehicle Charging Station the electric vehicle charging system takes a long time, has a low income, and makes the return slower than the Secmario 2-3.	Government, Ministry of Energy and Financial Institutions Provide investment support at low interest rates.	Price of equipment and installation tools continually declining, causing competitors easy to make sales and profits of electric charging station
	Investments can be borrowed because financial institutions support businesses to protect the environment.	In areas with a small number of electric vehicles, the number of electric vehicle charging stations is relatively small, thus increasing the cost.	Model Secmario 2-3 Electric vehicle users have a high demand for service due to their fast and safe charging.	High impact on electricity cost
	There are still few electric vehicle charging stations. Few competitors can return faster.	Parking spaces are not yet ready to invest to install electric vehicle charging stations	Can generate income from electric vehicle charging stations parking spaces, shopping malls, convenience stores restaurants, educational institutions and condominiums	Low electricity and service charge rates for electric vehicle charging station
	Installation in shopping malls convenience store restaurants, educational institutions and condominium, parking area can be invested convenient electric vehicle charging station make money from parking places can save station construction cost	Investors are reluctant to invest due to the small number of electric vehicles.	Standard regulations have been updated to support development of electric charging stations for both dedicated service stations and the form installed inside the building	

FIVE FORCES

Five Forces Analysis to compare charging stations three scenarios In a five-item analysis, each business has different management characteristics: new entrants, substitutes, buyers, suppliers, and competitors.

TABLE 22 FIVE FORCES FOR EVS CHARGING STATION

Analysis	Scenario 1	Scenario 2	Scenario 3
New entrants	high Many competitors are easy to get in and require low investment.	low There are few competitors who come into this business because they require quite a lot of investment.	low Competitors are hard to come by as they require large investments and have a large variety of convenience stores.
Substitutes	high Customers can buy and install by themselves at home save cost PHEV electric vehicles can be used with gas station	low The installation is difficult, requires specialist supervision and the cost of installing the system and the charger is high.	low Installation must be controlled and supervised by experts. Installing an electric charging station
Buyers	low There are quite a lot of customers, the cost is cheap. Charging time takes a long time. Customers will charge their own electricity before leaving the house.	high Many customers demand high-cost fast chargers as long-term charging times are required on intercity highway roads.	high Many customers want fast but expensive chargers for the convenience and necessity for long-distance travelling.
Suppliers	middle The number of sellers is small and they are imported from abroad. High price and cost but easy to install.	low There are a small number of sellers and imported from abroad must have an expert engineer to supervise.	low There are a small number of sellers and imported from abroad must have an expert engineer to supervise.
Competitors	high There is a lot of competition as it is very affordable, there is quite a lot of quality inspection, consulting and installation.	low There is little competition due to the high cost of charging station equipment and the need for engineers to control the installation.	low There is little competition due to the high cost of charging station equipment and the need for engineers to control it.

4P OR MARKETING MIX

Study of an electric vehicle charging station for business success marketing mix or 4P is a product, price, place, and promotion.

Analyze all four business plans, standard electric charging system, safe, reasonable price, located near the community. Moreover, there is a discount on charging electricity for three scenarios.

TABLE 23 4P OR MARKETING MIX EVS CHARGING STATION

Product	Price	Place	Promotion
Effective electric automotive charging stations Quality, safety standard, easy to pay Secnario 1, the price is not easy to install Secnario 2-3 High price requires control engineer.	Expensive due to most imported equipment from foreign.	SCENARIO 1 charging station is Normal Charger Installed in the mall, condominium	Re-apply, load the app, charge electricity 1 time
The electric vehicle charging station is easy to use, convenient for both installation and service. The supplier is reliable, has a standard system, and is foreign.	Device management is adjusted according to the u to the usage time of continuous charging equipment.	SCENARIO 2 charging station is Quick Charger Installed according to the electric car charging station convenience store	Electricity charge reduction garden 10 times, free 1 time according to the charging time
There is a system control and care for the electric charging station continuously Secnario 1-3	The cost of electric charging stations is affordable, stipulated in accordance with PEA, MEA, EGAT and ERC regulations.	SCENARIO 3 charging station is Normal Charger and Quick Charger has 2 large forms Installed according to the electric car charging station, oil pump the large parking center has a souvenir shop convenience store.	Recommend and tell a friend free charge 5 times / car.
Brand electric charger has certified and from the government agency.	Discount for the first service And recommend to tell the new customer	Target Market Divided by condominium area Convenience store, government office building Department stores and gas stations	Advertising facebook, Line, Instagram, youtube, google and app charger station
SERVICE 24 HR customers. For convenience To use the service	Offer Price is the base price at Pea Mea. And EGAT serves with customers		

TABLE 24 BUSINESS MODEL CANVAS

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
MEA Central PEA BigC EGAT Lotus Bank FamilyMart PTT .7-11 PT Coffee Café Bangchak Restaurant Esso GWM Shell MG BMW	Service Research and Development Software Development Maintenance and Building of Charging station Design Charging station	Charger Station Quality and Standard Price standard and Security Open 24 hours Convenience location Service Normal charger Electric Vehicle charging on Residential, Hotel and Deparment store Service Quick charger Electric Vehicle charging on Oil station, Convenience store and Restaurant	Call center Discounts Referral to Member Maps charging station and Location Enviromentaly APP Order Time	Electric Vehicle Users Tourist and Travel Company Employee Government Officer Domectic
	KEY RESOURCES		**CHANNELS**	
	Raw materrial Reputation Capital Crew Tools		APP charging station Website of charging station Line facebook Telephone Google Maps	

COST STRUCTURE			REVENUE STREAMS
Cost Electric Cost Charging Station Cost System Electric	Employee salary Product cost Taxes	Rent Station Raw material cost	Income Charging Electric Vehicle Advertising Revenue

BUSINESS MODEL CANVAS

1. Value Propositions

Strengths: There is a quality charging system and standardized charging station certification from government agencies PEA, MEA, and ERC are open 24 hours a day.

At present, the former gas station has a large vacant area. The electric vehicle charging station can be rented because it is suitable to install an electric vehicle charging station to make it easy for drivers to park and easily recognize them.

Because nowadays most drivers still use petrol cars and know about gas stations. Two types of chargers will be installed during the first phase, a Normal charger and a Quick charger at the petrol stations.

The optional add-on will install an electric charging station at Convenience stores, and restaurants will use a Quick charger to charge electricity; it takes only 40-60 minutes to charge, and areas of shopping malls, hotels, and residential condominiums. Install an electric charging station with a Normal charger. Charging time is not urgent; it takes from 180-240 minutes.

Scenario1. Normal charger for customers who have a normal electric vehicle charging, there is no need to rush for a long time when charging the electric bill. Chargers 6 outlets pay for customers who use the service will be installed in the parking area condominiums, residences, hotels, and department stores.

FIGURE 11 NORMAL CHARGING STATION AC TYPE2 NUMBER OF 6 OUTLETS

Source [https://www.alamy.com/bangkok-thailand-october-22-2020-electric-vehicle-charger-station-or-ev-charging-station-for-charge-ev-battery-at-basement-floor-car-parking-lot-o-image384278719.html]

Scenario2. Quick chargers are installed in electric vehicle charging stations or the current gas station.

Convenience stores and restaurants (quick) such as McDonald's or KFC charging time will take approximately 40-60 hours.

For customer service customers who come to electric vehicle charging stations in a hurry, charging time 6 outlets are charging points for customers who use convenience stores and oil stations. Electric vehicle charging stations in some countries such as Norway are installed like gas stations.

FIGURE 12 QUICK CHARGER DC CHADEMO AND CCS TYPE 2 FOR 6 OUTLETS

Source [https://ondigitalshop.com/bjorn-nyland-presents-fast-charging-station-of-the-future/]

Scenario3. Normal charger 6 outlets and Quick charger 6 outlets are two electric vehicle charging stations with large service points.

To make customers convenient to choose normal and fast charging installed in the current oil station or motorway travel point. There is a spacious area with a variety of cars and trains.

The charging station area will have additional facilities such as coffee shops, restaurants, souvenir shops, clothing stores, and convenience stores to support customers who use regular and express services to charge electric vehicles.

FIGURE 13 NORMAL CHARGER 6 OUTLETS AND QUICK CHARGER 6 OUTLETS

Source [https://www.greencarreports.com/news/1128610_electrify-america-finishes-first-cross-country-fast-charging-route-for-evs]

2. Customer Segments

Customer groups focusing on electric vehicle drivers, tourists, travelers, company employees, civil servants, and families can charge with an electric vehicles, sedan, or SUV.

3. Customer Relationships

Focus on easy accessibility for convenience. There is a call center service. There is an App Location and Maps station to easily travel to the charging station. Customers who regularly receive service have added value using discounts referrals to member service. This electric vehicle charging station is also promoted as an electric charging station to protect the environment.

4. Channels

The electric vehicle charging station has an app order time charging service to reserve a queue for service. There is a website of charging stations in line, Facebook, and google maps. So that customers can receive benefits in a variety of channels, the location of the electric vehicle charging station should be on the main road. There is a high volume of traffic in the car.

5. Revenue Streams

The electric charging station will have income charging electric vehicles and payment from advertising revenue at the electric charging station and the website of the charging station.

6. Key Partners

Electric vehicle charging stations are integrated with PEA, MEA, ERC, EGAT, BANK, PTT, PT, Bangchak, Esso, Shell, CENTRAL BigC Lotus's, 7-11, FamilyMart, Restaurant, and Coffee cafe.

7. Key Activities

Emphasis on comprehensive quality service with research and development. Software Development takes care of Maintenance, Building charging station, and designing new charging stations.

8. Key Resources

Investments must use personal funds in whole or in part because part of them will request a credit line from the bank at 30: 70 or 50:50.

For liquidity in investment in expanding the area, there is a service point covering the value for customers, suitable for a distance of 50-100 kilometers.

Employees have training, knowledge, and experience to understand electric vehicles' work systems and charging processes. The equipment is installed at the electric vehicle charging station.

9. Cost Structure

The cost of electricity is calculated, electric vehicle charging stations, electrical infrastructure systems—employee payroll, tax payable, and electric charging station rental fee.

CHAPTER V

CONCLUSION

Based on model energy and business model, according to the charging station situation model, starting from the analysis.

Scenario1 Normal charger 6 outlets is a normal charging system and time. They were installed to charge electricity in shopping malls, restaurants, and residential condominiums. The cost is low, the price is low, and the payback period is time-consuming due to the low net profit margin.

Scenario 2 Quick charger 6 outlets is a fast-charging station for electric vehicles that takes very little time to charge the battery fully. Charging costs are high. High investment cost and has a fast payback period Install electric charging points in front of convenience stores and the current gas station,

Scenario3 is an electric vehicle charging station with a normal charger, 6 outlets, and a quick charger, 6 outlets total of 12 outlets, and fast, available within minutes. It is installed to take up a large area like the current gas station various service shops such as coffee shops, restaurants, souvenir shops, clothing stores, and convenience stores.

The analysis in the business model used in the study calculates BEP, a project period of 10 years, is divided into 3 scenarios. BEP analysis results of investment scenarios 1, 2, and 3 breakeven point, investment scenario2 has the shortest optimal investment and the fastest return on investment. IRR analysis in investment scenario2 provides the best rate of return on profit. Calculation of NPV in investment scenario 3 gives the most immediate current cash value.

In the analysis, the best PB in investment scenario2 has a short payback period. The Three Investment Scenario Model Summary: Investment Scenario2 is the investment's net present value with the best results, the 10-year IRR investment analysis results. Investment Scenario2 is suitable for investment. The results of the analysis of the 10-year PB investment project Scenario2 is ideal for investment.

The government is policy is to support the production of EVs, reduce taxes, establish EVs charging stations and drive investment in the electric vehicle industry. The booster will increase the number of EVs or charging stations. This will increase the number of EVs and improve charging stations. The rise of electric vehicles and charging stations needs to be widely distributed across the country. The payback rate will be faster; the investment cost will be lower. However, the growth rate of electric vehicles and electric charging stations is still relatively slow, requiring more government stimulation.

Solution scenario electric vehicle charging station from scenario normal Charger analysis normal charging system to install electric charging stations in department stores, restaurants and condominiums, housing, lowest costs, lowest income and shortest return period. Scenario Quick Charger is a fast-charging station with a high cost. High charge fee And the duration of the fastest cost, installation of electric charging stations, convenience stores, and gas stations. Scenario mixed with structure, use large areas, current gas stations. There are coffee shops, restaurants, souvenir shops, clothing stores, and many convenience stores. The investment must depend on the number of EVs increasing but the number of electric vehicles. If it is by the government policy, support electric vehicles in 2030, the number of electric cars increased to 1.20 million units, suitable for investment. There is still a low growth rate, not ideal for investment.

SWOT analysis results, the strengths of fast charging stations are still in high demand, especially the Segnario 2-3, the number of electric vehicle chargers is small, but not very competitive. Weaknesses: The high cost of equipment charging station Secnario2-3 will require a specialist to maintain the system. Furthermore, the number of electric cars is small, not enough for investment.

Five Forces, a normal charge 22 kWh electric vehicle charging station, may have many competitors easily accessible. As for the 50 kWh Quick charge, the price is relatively high and difficult to compete with. scenario2-3 Customers are demanding fast charging because it takes less time.

4P or Marketing Mix Characteristics of electric charging stations. The inexpensive Scenario1 can be purchased and installed to charge your own home, while the expensive Scenario2-3 should be charged at an electric charging station because the price is very high. Electricity charging prices are not much different as the government sector regulates them. The location of the electric charging station plays a vital role in supporting customers to install convenience stores, restaurants, and department stores while shopping and discounts on electricity prices, focusing on additional services, charging electricity five times, getting one free, or charging electricity with a discount coupon for a fresh coffee while riding an electric vehicle.

Impact CO2 of using electric cars on tourism routes in Wang Thong District Phitsanulok Province to the route Khao Koh District, Phetchabun Province. It was assumed that the number of electric vehicles increased by 5% with a reduction in CO2 emissions of 2.88%, but the assumption of an increase in electric vehicles of 10% had a decrease in CO2 emissions of 5.77%. Based on the data, the more EVs run, the greater the balance in the clean air environment.

The sensitivity analysis increases and decreases in investment cost, service cost, electricity cost and Ft charging time of 9 and 11 hours. The results of the analysis are as follows. Scenario2 is the first model Business Model electric vehicle charging station interested in investment, value for money and return on ownership of the business. Scenario3 is second only to Scenario2 with Business Model electric vehicle charging station, interested in investment, value for money and good return. Scenario1 is an investment-friendly disregard as the NPV is negative and the IRR cannot be calculated and therefore does not support investment. But if it is a secondary promotion electric vehicle in order to lay the basis for using electric vehicle for customers interested in receiving electric vehicle charging station service, Scenario1 is recommended. Due to low investment cost, not for profit focus is to help society, reduce pollution, protect the environment. The limitation of electric vehicle charging station equipment is still a new market, must be imported from abroad, may be one of the factors that cause high investment costs, thus affecting NPV and IRR.

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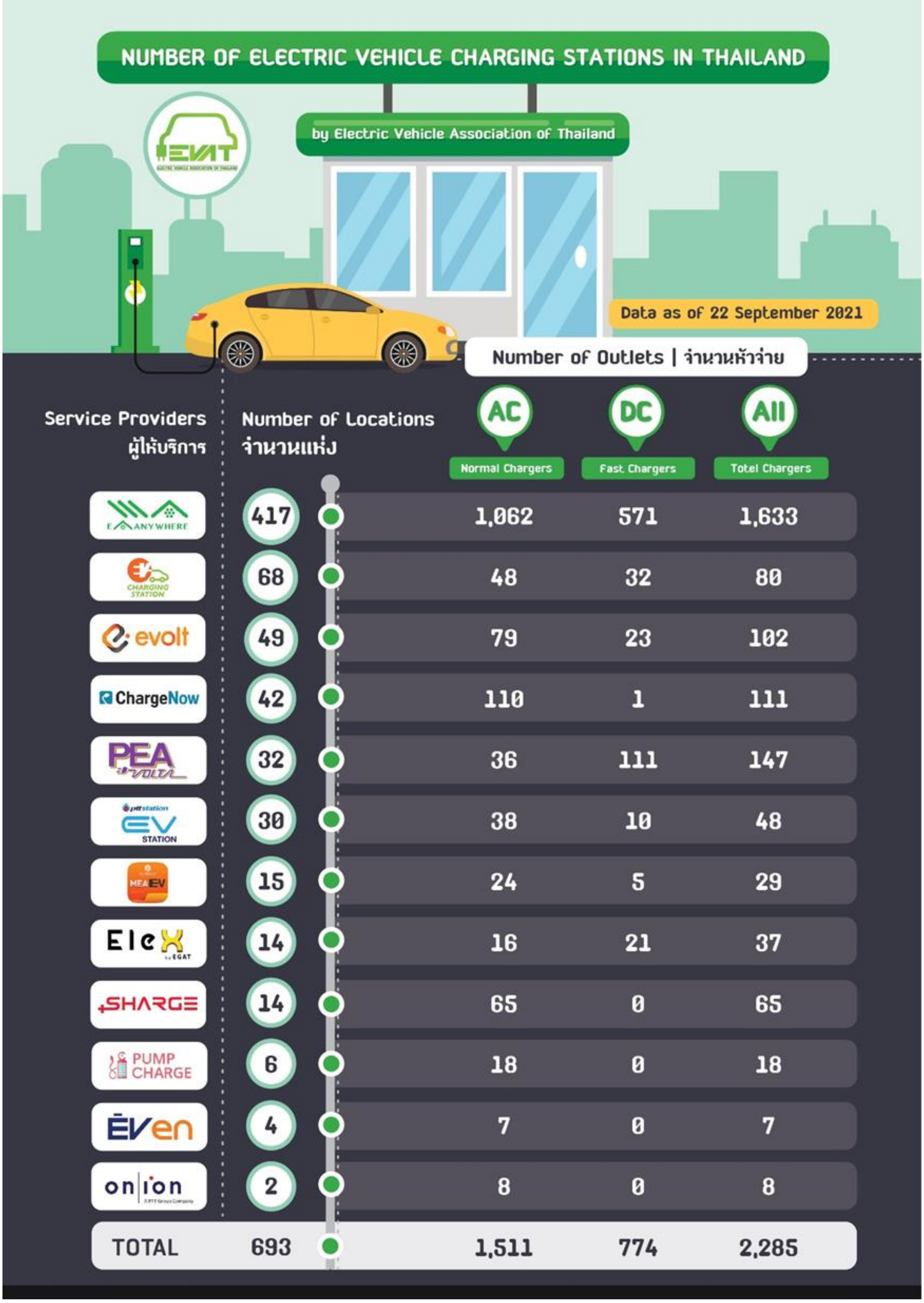
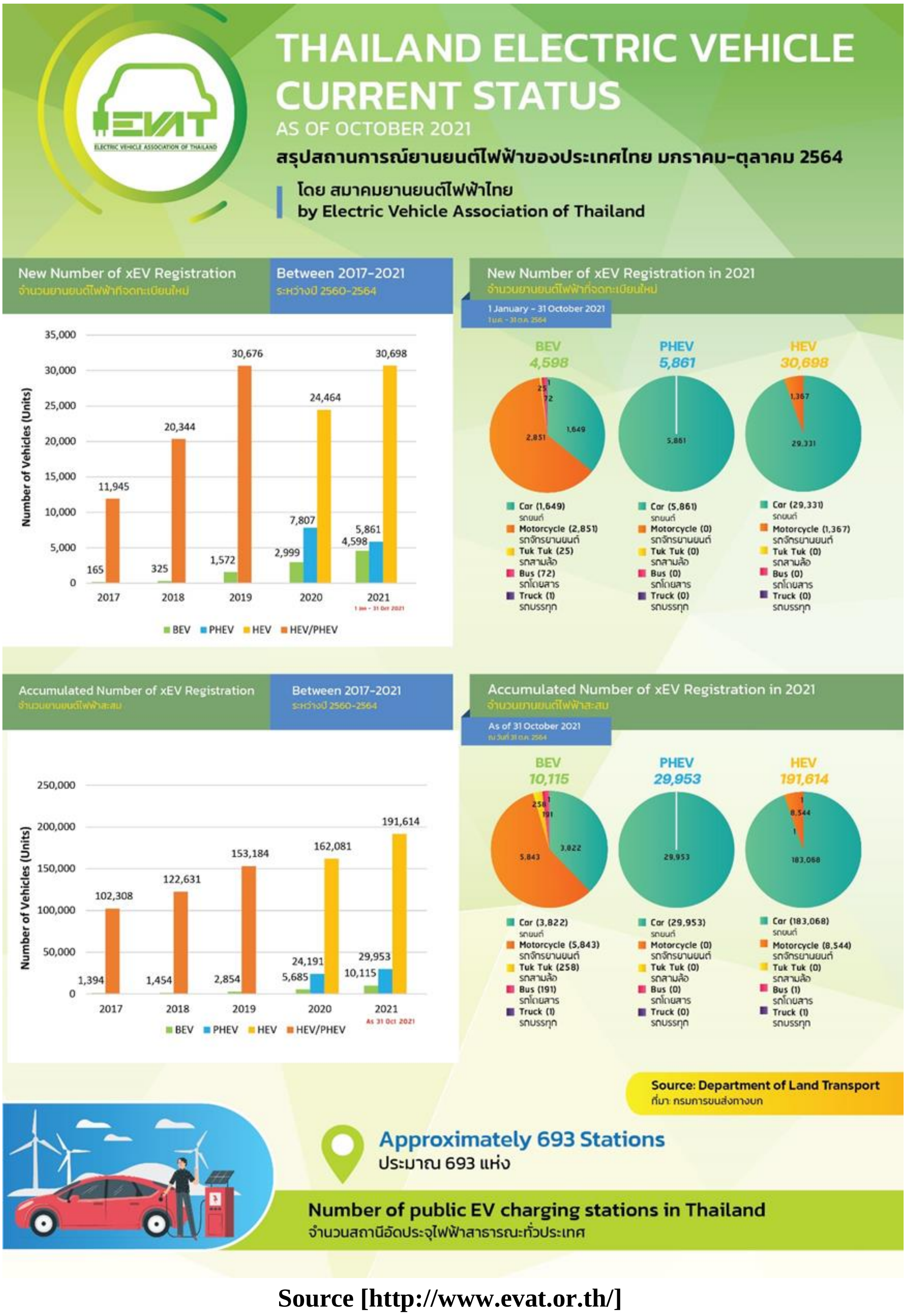
APPENDIXES

APPENDIXES



Service Providers ผู้ให้บริการ	Number of Locations จำนวนแห่ง	AC Normal Chargers	DC Fast Chargers	All Totel Chargers
EA ANYWHERE	417	1,062	571	1,633
CHARGING STATION	68	48	32	80
evolt	49	79	23	102
ChargeNow	42	110	1	111
PEA VOLTA	32	36	111	147
ptt station EV STATION	30	38	10	48
MEA EV	15	24	5	29
EleX by EGAT	14	16	21	37
SHARGE	14	65	0	65
PUMP CHARGE	6	18	0	18
EVen	4	7	0	7
on ion	2	8	0	8
TOTAL	693	1,511	774	2,285

Source [http://www.evat.or.th/]



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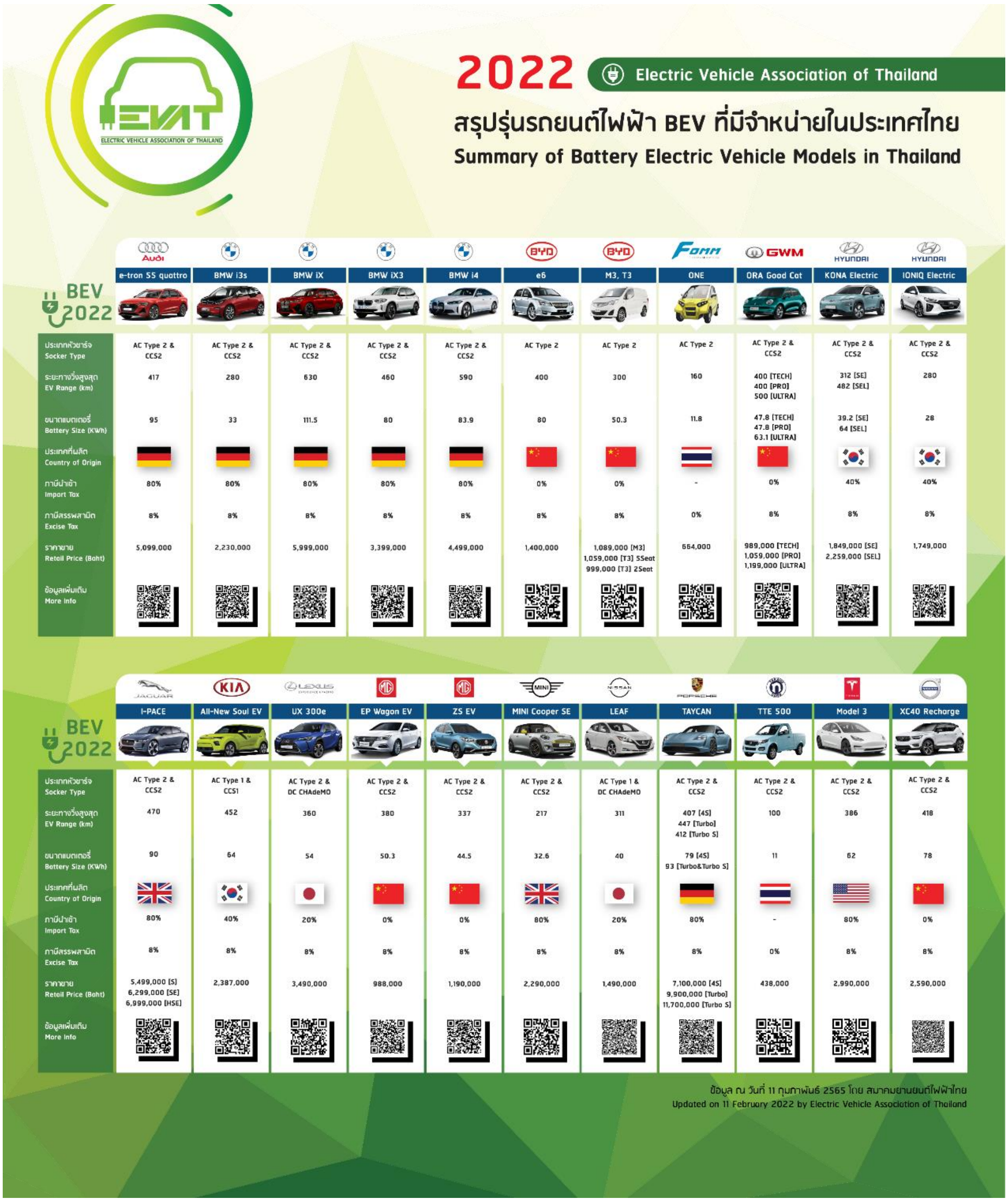

2022 Electric Vehicle Association of Thailand

สรุปรุ่นรถยนต์ไฟฟ้า BEV ที่มีจำหน่ายในประเทศไทย

Summary of Battery Electric Vehicle Models in Thailand

BEV 2022

	e-tron 55 quattro	BMW i3s	BMW iX	BMW iX3	BMW i4	e6	M3, T3	ONE	ORA Good Cat	KONA Electric	IONIQ Electric
ประเภทหัวชาร์จ Socker Type	AC Type 2 & CCS2	AC Type 2 & CCS2	AC Type 2 & CCS2	AC Type 2 & CCS2	AC Type 2 & CCS2	AC Type 2	AC Type 2	AC Type 2	AC Type 2 & CCS2	AC Type 2 & CCS2	AC Type 2 & CCS2
ระยะทางวิ่งสูงสุด EV Range (km)	417	280	630	460	590	400	300	160	400 [TECH] 400 [PRO] 500 [ULTRA]	312 [SE] 482 [SEL]	280
ขนาดแบตเตอรี่ Battery Size (KWh)	95	33	111.5	80	83.9	80	50.3	11.8	47.8 [TECH] 47.8 [PRO] 63.1 [ULTRA]	39.2 [SE] 64 [SEL]	28
ประเทศที่ผลิต Country of Origin											
ภาษีนำเข้า Import Tax	80%	80%	80%	80%	80%	0%	0%	-	0%	40%	40%
ภาษีสรรพสามิต Excise Tax	8%	8%	8%	8%	8%	8%	8%	0%	8%	8%	8%
ราคาขาย Retail Price (Baht)	5,099,000	2,230,000	5,999,000	3,399,000	4,499,000	1,400,000	1,089,000 [M3] 1,059,000 [T3] 5Seat 999,000 [T3] 2Seat	664,000	989,000 [TECH] 1,059,000 [PRO] 1,199,000 [ULTRA]	1,849,000 [SE] 2,259,000 [SEL]	1,749,000
ข้อมูลเพิ่มเติม More Info											

BEV 2022

	I-PACE	All-New Soul EV	UX 300e	EP Wagon EV	ZS EV	MINI Cooper SE	LEAF	TAYCAN	TTE 500	Model 3	XC40 Recharge
ประเภทหัวชาร์จ Socker Type	AC Type 2 & CCS2	AC Type 1 & CCS1	AC Type 2 & DC CHAdeMO	AC Type 2 & CCS2	AC Type 2 & CCS2	AC Type 2 & CCS2	AC Type 1 & DC CHAdeMO	AC Type 2 & CCS2	AC Type 2 & CCS2	AC Type 2 & CCS2	AC Type 2 & CCS2
ระยะทางวิ่งสูงสุด EV Range (km)	470	452	360	380	337	217	311	407 [4S] 447 [Turbo] 412 [Turbo S]	100	386	418
ขนาดแบตเตอรี่ Battery Size (KWh)	90	64	54	50.3	44.5	32.6	40	79 [4S] 93 [Turbo&Turbo S]	11	62	78
ประเทศที่ผลิต Country of Origin											
ภาษีนำเข้า Import Tax	80%	40%	20%	0%	0%	80%	20%	80%	-	80%	0%
ภาษีสรรพสามิต Excise Tax	8%	8%	8%	8%	8%	8%	8%	8%	0%	8%	8%
ราคาขาย Retail Price (Baht)	5,499,000 [S] 6,299,000 [SE] 6,999,000 [HSE]	2,387,000	3,490,000	988,000	1,190,000	2,290,000	1,490,000	7,100,000 [4S] 9,900,000 [Turbo] 11,700,000 [Turbo S]	438,000	2,990,000	2,590,000
ข้อมูลเพิ่มเติม More Info											

ข้อมูล ณ วันที่ 11 กุมภาพันธ์ 2565 โดย สมาคมยานยนต์ไฟฟ้าไทย

Updated on 11 February 2022 by Electric Vehicle Association of Thailand

Source [http://www.evat.or.th/]

การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

ประกาศการไฟฟ้าส่วนภูมิภาค

เรื่อง อัตราค่าบริการอัดประจุไฟฟ้าสำหรับสถานีอัดประจุยานยนต์ไฟฟ้าของ กฟภ.

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เนื่องด้วย การไฟฟ้าส่วนภูมิภาค (กฟภ.) มีความต้องการจะให้บริการอัดประจุไฟฟ้ากับผู้ใช้ยานยนต์ไฟฟ้าในประเทศ จึงขอประกาศอัตราค่าบริการอัดประจุไฟฟ้า สำหรับผู้ใช้ยานยนต์ไฟฟ้าที่เข้ามาใช้บริการอัดประจุไฟฟ้าในสถานีอัดประจุไฟฟ้าของ กฟภ. โดยกำหนดอัตราค่าบริการอัดประจุไฟฟ้าตามประเภทเครื่องอัดประจุไฟฟ้าและช่วงเวลาของการใช้ (Time of Use : TOU) โดยคิดค่าบริการตามหน่วยพลังงานที่ผู้ใช้ยานยนต์ไฟฟ้าอัดประจุไฟฟ้าด้วยอัตราแบบส่งเสริมและสนับสนุนให้เกิดการใช้ยานยนต์ไฟฟ้าตั้งแต่เดือน มกราคม ๒๕๖๕ เป็นต้นไป ดังนี้

ประเภทเครื่องอัดประจุไฟฟ้า	อัตราค่าบริการอัดประจุไฟฟ้า (รวมภาษีมูลค่าเพิ่ม) (บาท/หน่วย)	
	Peak	Off Peak
เครื่องอัดประจุไฟฟ้ากระแสตรง (DC Charger)	๗.๗๒๗๖	๔.๓๔๕๑
เครื่องอัดประจุไฟฟ้ากระแสสลับ (AC Charger)	๗.๗๒๗๖	๔.๓๔๕๑
กำหนดช่วงเวลาของการใช้ (Time of Use : TOU) อ้างอิงตามประกาศการไฟฟ้าส่วนภูมิภาค เรื่อง การกำหนดช่วงเวลาสำหรับอัตราตามช่วงเวลาของการใช้ Time of Use (TOU)		

ประกาศ ณ วันที่ **๒๑** ธันวาคม พ.ศ. ๒๕๖๔

(นายศุภชัย เอกอุ่น)

ผู้ว่าการการไฟฟ้าส่วนภูมิภาค

Source [https://www.pea.co.th/]

การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

ประกาศการไฟฟ้าส่วนภูมิภาค

เรื่อง อัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้า
ภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority

ด้วย คณะกรรมการนโยบายพลังงานแห่งชาติ (กพช.) มีมติเมื่อวันที่ ๑๙ มีนาคม ๒๕๖๓ เห็นชอบแนวทางการกำหนดอัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority หรือการใช้ไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้ามีความสำคัญเป็นลำดับรองเมื่อเปรียบเทียบกับการใช้ไฟฟ้าเพื่อวัตถุประสงค์อื่น และสามารถควบคุม ปรับลด หรือตัดการใช้ไฟฟ้าของสถานีอัดประจุไฟฟ้าได้ เมื่อมีข้อจำกัดด้านความจุไฟฟ้าของระบบจำหน่ายไฟฟ้า เพื่อไม่ให้มีผลกระทบต่อผู้ใช้ไฟฟ้ารายอื่น และรักษาความมั่นคงของระบบไฟฟ้า โดยให้ใช้เป็นระยะเวลา ๒ ปี หรือจนกว่าจะมีประกาศโครงสร้างอัตราค่าไฟฟ้าใหม่ โดยคณะกรรมการกำกับกิจการพลังงาน (กกพ.) ได้พิจารณาอัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้าภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority และได้มีมติเมื่อวันที่ ๒๔ กุมภาพันธ์ ๒๕๖๔ ดังนี้

๑. เห็นชอบการกำหนดอัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าแบบ Low Priority ประกอบด้วย ๓ ส่วน คือ ค่าพลังงานไฟฟ้า ค่าบริการรายเดือน และค่า Ft

๒ เห็นควรให้การไฟฟ้าฝ่ายจำหน่ายดำเนินการ เมื่อข้อปฏิบัติทางเทคนิคของการไฟฟ้าฝ่ายจำหน่ายตามพื้นที่รับผิดชอบมีผลบังคับใช้ และให้ดำเนินการเป็นระยะเวลา ๒ ปี หรือจนกว่าจะมีประกาศโครงสร้างอัตราค่าไฟฟ้าใหม่ ทั้งนี้ เป็นไปตามมติ กพช. เมื่อวันที่ ๑๙ มีนาคม ๒๕๖๓

ดังนั้น เพื่อให้เป็นไปตามมติ กพช. และมติ กกพ. ดังกล่าว การไฟฟ้าส่วนภูมิภาค (กฟภ.) จึงขอประกาศอัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้าภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority ดังนี้

๑. อัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้าภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority คือ อัตราค่าไฟฟ้าที่กำหนดให้คิดกับผู้ใช้ไฟฟ้าที่มีคุณสมบัติต่อไปนี้

๑.๑ มีการใช้ไฟฟ้าเพื่อประกอบกิจการสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้า ภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority (สามารถควบคุมปรับลดหรือตัดการใช้ไฟฟ้าของสถานีอัดประจุไฟฟ้าได้เมื่อได้รับแจ้งจาก กฟภ.) โดยต่อผ่านเครื่องวัดไฟฟ้าเครื่องเดียว ทั้งนี้ต้องไม่มีอุปกรณ์ที่ไม่เกี่ยวข้องกับสถานีอัดประจุไฟฟ้าต่อเชื่อมอยู่

๑.๒ มีการติดตั้งอุปกรณ์อัดประจุไฟฟ้าตามมาตรฐานและข้อกำหนดของ กฟภ.

๑.๓ มีใบอนุญาตประกอบกิจการจำหน่ายไฟฟ้าสำหรับการอัดประจุไฟฟ้าให้กับยานยนต์ไฟฟ้าหรือหนังสือรับแจ้งการประกอบกิจการพลังงานที่ได้รับจากยกเว้นไม่ต้องขอรับใบอนุญาตประกอบกิจการจำหน่ายไฟฟ้าจากสำนักงานคณะกรรมการกำกับกิจการพลังงาน แล้วแต่กรณี

๒. การคิดค่าไฟฟ้า...

Source [https://www.pea.co.th/]

๒. การคิดค่าไฟฟ้าให้คิดตามกรณีดังนี้

๒.๑ กรณีที่ไม่ผิดเงื่อนไขการบริหารจัดการแบบ Low Priority ให้คิดค่าพลังงานไฟฟ้าในอัตรา ดังนี้

	ค่าพลังงานไฟฟ้า (บาท/หน่วย)	ค่าบริการ (บาท/เดือน)
ทุกระดับแรงดัน	๒.๖๓๖๙	๓๑๒.๒๔

๒.๒ กรณีที่ผิดเงื่อนไขการบริหารจัดการแบบ Low Priority ให้คิดค่าพลังงานไฟฟ้าในอัตราตามช่วงเวลาของการใช้ (Time of use : TOU) ดังนี้

	ค่าพลังงานไฟฟ้า (บาท/หน่วย)		ค่าบริการ (บาท/เดือน)
	Peak	Off Peak	
แรงดัน ๒๒ – ๓๓ กิโลโวลท์	๕.๑๑๓๕	๒.๖๐๓๗	๓๑๒.๒๔
แรงดันต่ำกว่า ๒๒ กิโลโวลท์	๕.๗๙๘๒	๒.๖๓๖๙	๔๖.๑๖

๓. ในกรณีที่ผู้ใช้ไฟฟ้าไม่สามารถปฏิบัติตามข้อกำหนดทางเทคนิคได้ การไฟฟ้าส่วนภูมิภาคจะเปลี่ยนไปคิดค่าไฟฟ้าตามโครงสร้างค่าไฟฟ้าเช่นเดียวกับผู้ใช้ไฟฟ้ารายปกติทั่วไป

๔. อัตราค่าไฟฟ้าประเภทนี้มีผลบังคับใช้ตั้งแต่ค่าไฟฟ้าประจำเดือน เมษายน ๒๕๖๔ เป็นต้นไป จนถึงค่าไฟฟ้าประจำเดือนมีนาคม ๒๕๖๖ หรือจนกว่าจะมีประกาศโครงสร้างอัตราค่าไฟฟ้าใหม่

<u>หมายเหตุ</u>

๑) ข้อกำหนดช่วงเวลาอัตรา TOU

Peak	Off Peak
เวลา ๐๙.๐๐น.- ๒๒.๐๐ น. วันจันทร์ – ศุกร์ และวันพืชมงคล	เวลา ๒๒.๐๐ น. – ๐๙.๐๐ น. วันจันทร์ – ศุกร์ และวันพืชมงคล เวลา ๐๐.๐๐ น. – ๒๔.๐๐ น. วันเสาร์ – อาทิตย์ , วันแรงงานแห่งชาติ, วันพืชมงคล

๒) อัตราค่าไฟฟ้าข้างต้น ยังไม่รวมค่า Ft และภาษีมูลค่าเพิ่ม

๓) กรณีติดตั้งเครื่องวัดไฟฟ้าทางด้านแรงต่ำของหม้อแปลงซึ่งเป็นสมบัติของผู้ใช้ไฟฟ้า ให้คำนวณกิโลวัตต์และหน่วยคิดเงินเพิ่มขึ้นอีกร้อยละ ๒ เพื่อครอบคลุมการสูญเสียในหม้อแปลงไฟฟ้าซึ่งมิได้วัดรวมไว้ด้วย

๔) ค่าใช้จ่ายในการขอใช้ไฟฟ้าเป็นไปตามระเบียบที่การไฟฟ้าส่วนภูมิภาคกำหนด

๕) รายละเอียดที่เกี่ยวข้องกับอัตราค่าไฟฟ้าสามารถ Download ได้ที่ www.pea.co.th หรือสอบถามเพิ่มเติมได้ที่ การไฟฟ้าส่วนภูมิภาคในพื้นที่ หรือสำนักงานใหญ่ การไฟฟ้าส่วนภูมิภาค โทรศัพท์ ๐-๒๕๙๐-๙๑๒๕ ๐-๒๕๙๐-๙๑๒๗ และ ๑๑๒๙ PEA Call Center โทร ๑๑๒๙

จึงเรียนมาเพื่อทราบโดยทั่วกัน

ประกาศ ณ วันที่ ๑๕ มีนาคม พ.ศ. ๒๕๖๔

(นายสมพงษ์ ปรีเปรม)
ผู้ว่าการการไฟฟ้าส่วนภูมิภาค

Source [https://www.pea.co.th/]

ประกาศการไฟฟ้าส่วนภูมิภาค

เรื่อง อัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้า
ภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority

ด้วย คณะกรรมการนโยบายพลังงานแห่งชาติ (กพช.) มีมติเมื่อวันที่ ๑๙ มีนาคม ๒๕๖๓ เห็นชอบแนวทางการกำหนดอัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority หรือการใช้ไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้ามีความสำคัญเป็นลำดับรองเมื่อเปรียบเทียบกับการใช้ไฟฟ้าเพื่อวัตถุประสงค์อื่น และสามารถควบคุม ปรับลด หรือตัดการใช้ไฟฟ้าของสถานีอัดประจุไฟฟ้าได้ เมื่อมีข้อจำกัดด้านความจุไฟฟ้าของระบบจำหน่ายไฟฟ้าเพื่อไม่ให้มีผลกระทบต่อผู้ใช้ไฟฟ้ารายอื่น และรักษาความมั่นคงของระบบไฟฟ้า โดยให้ใช้เป็นระยะเวลา ๒ ปี หรือจนกว่าจะมีประกาศโครงสร้างอัตราค่าไฟฟ้าใหม่ โดยคณะกรรมการกำกับกิจการพลังงาน (กกพ.) ได้พิจารณาอัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้าภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority และได้มีมติเมื่อวันที่ ๒๔ กุมภาพันธ์ ๒๕๖๔ ดังนี้

๑. เห็นชอบการกำหนดอัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าแบบ Low Priority ประกอบด้วย ๓ ส่วน คือ ค่าพลังงานไฟฟ้า ค่าบริการรายเดือน และค่า Ft

๒. เห็นควรให้การไฟฟ้าฝ่ายจำหน่ายดำเนินการ เมื่อข้อปฏิบัติทางเทคนิคของการไฟฟ้าฝ่ายจำหน่ายตามพื้นที่รับผิดชอบมีผลบังคับใช้ และให้ดำเนินการเป็นระยะเวลา ๒ ปี หรือจนกว่าจะมีประกาศโครงสร้างอัตราค่าไฟฟ้าใหม่ ทั้งนี้ เป็นไปตามมติ กพช. เมื่อวันที่ ๑๙ มีนาคม ๒๕๖๓

ดังนั้น เพื่อให้เป็นไปตามมติ กพช. และมติ กกพ. ดังกล่าว การไฟฟ้าส่วนภูมิภาค (กฟภ.) จึงขอประกาศอัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้าภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority ดังนี้

๑. อัตราค่าไฟฟ้าสำหรับสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้าภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority คือ อัตราค่าไฟฟ้าที่กำหนดให้คิดกับผู้ใช้ไฟฟ้าที่มีคุณสมบัติต่อไปนี้

๑.๑ มีการใช้ไฟฟ้าเพื่อประกอบกิจการสถานีอัดประจุไฟฟ้าของยานยนต์ไฟฟ้า ภายใต้เงื่อนไขการบริหารจัดการแบบ Low Priority (สามารถควบคุมปรับลดหรือตัดการใช้ไฟฟ้าของสถานีอัดประจุไฟฟ้าได้ เมื่อได้รับแจ้งจาก กฟภ.) โดยต่อผ่านเครื่องวัดไฟฟ้าเครื่องเดียว ทั้งนี้ ต้องไม่มีอุปกรณ์ที่ไม่เกี่ยวข้องกับสถานีอัดประจุไฟฟ้าต่อเชื่อมอยู่

๑.๒ มีการติดตั้งอุปกรณ์อัดประจุไฟฟ้าตามมาตรฐานและข้อกำหนดของ กฟภ.

๑.๓ มีใบอนุญาตประกอบกิจการจำหน่ายไฟฟ้าสำหรับการอัดประจุไฟฟ้าให้กับยานยนต์ไฟฟ้าหรือหนังสือรับแจ้งการประกอบกิจการพลังงานที่ได้รับจากยกเว้นไม่ต้องขอรับใบอนุญาตประกอบกิจการจำหน่ายไฟฟ้าจากสำนักงานคณะกรรมการกำกับกิจการพลังงาน แล้วแต่กรณี

Source [https://www.pea.co.th/]

๒. การคิดค่าไฟฟ้าให้คิดตามกรณี ดังนี้

๒.๑ กรณีที่ไม่ผิดเงื่อนไขการบริหารจัดการแบบ Low Priority ให้คิดค่าพลังงานไฟฟ้าในอัตรา ดังนี้

	ค่าพลังงานไฟฟ้า (บาท/หน่วย)	ค่าบริการ (บาท/เดือน)
ทุกระดับแรงดัน	๒.๖๓๖๙	๓๑๒.๒๔

๒.๒ กรณีที่ผิดเงื่อนไขการบริหารจัดการแบบ Low Priority ให้คิดค่าพลังงานไฟฟ้าในอัตราตามช่วงเวลาของการใช้ (Time of use : TOU) ดังนี้

	ค่าพลังงานไฟฟ้า (บาท/หน่วย)		ค่าบริการ (บาท/เดือน)
	Peak	Off Peak	
แรงดัน ๒๒ - ๓๓ กิโลโวลท์	๕.๑๑๓๕	๒.๖๐๓๗	๓๑๒.๒๔
แรงดันต่ำกว่า ๒๒ กิโลโวลท์	๕.๗๙๘๒	๒.๖๓๖๙	๔๖.๑๖

๓. ในกรณีที่ผู้ใช้ไฟฟ้าไม่สามารถปฏิบัติตามข้อกำหนดทางเทคนิคได้ การไฟฟ้าส่วนภูมิภาคจะเปลี่ยนไปคิดค่าไฟฟ้าตามโครงสร้างค่าไฟฟ้าเช่นเดียวกับผู้ใช้ไฟฟ้ารายปกติทั่วไป

๔. อัตราค่าไฟฟ้าประเภทนี้มีผลบังคับใช้ตั้งแต่ค่าไฟฟ้าประจำเดือน เมษายน ๒๕๖๔ เป็นต้นไป จนถึงค่าไฟฟ้าประจำเดือนมีนาคม ๒๕๖๖ หรือจนกว่าจะมีประกาศโครงสร้างอัตราค่าไฟฟ้าใหม่

หมายเหตุ

๑) ข้อกำหนดช่วงเวลาอัตรา TOU

Peak	Off Peak
เวลา ๐๙.๐๐น. - ๒๒.๐๐ น. วันจันทร์ - ศุกร์ และวันพืชมงคล	เวลา ๒๒.๐๐ น. - ๐๙.๐๐ น. วันจันทร์ - ศุกร์ และวันพืชมงคล เวลา ๐๐.๐๐ น. - ๒๔.๐๐ น. วันเสาร์ - อาทิตย์, วันแรงงานแห่งชาติ, วันพืชมงคล

๒) อัตราค่าไฟฟ้าข้างต้น ยังไม่รวมค่า Ft และภาษีมูลค่าเพิ่ม

๓) กรณีติดตั้งเครื่องวัดไฟฟ้าทางด้านแรงต่ำของหม้อแปลงซึ่งเป็นสมบัติของผู้ใช้ไฟฟ้า ให้คำนวณกิโลวัตต์และหน่วยคิดเงินเพิ่มขึ้นอีกร้อยละ ๒ เพื่อครอบคลุมการสูญเสียในหม้อแปลงไฟฟ้าซึ่งมิได้วัดรวมไว้ด้วย

๔) ค่าใช้จ่ายในการขอใช้ไฟฟ้าเป็นไปตามระเบียบที่การไฟฟ้าส่วนภูมิภาคกำหนด

Source [https://www.pea.co.th/]

การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

สูตรการปรับอัตราค่าไฟฟ้าโดยอัตโนมัติ (Ft)

<u>ประจำเดือนกันยายน – ธันวาคม 2564</u>

ตามมติคณะกรรมการกำกับกิจการพลังงาน
เมื่อวันที่ 21 กรกฎาคม 2564

ค่า Ft

หน่วยละ

-0.1532 บาท

หรือ -15.32 สตางค์

(ยังไม่รวมภาษีมูลค่าเพิ่ม)

กองอัตราและธุรกิจไฟฟ้า **ฝ่ายนโยบายเศรษฐกิจพลังงาน**

Source [https://www.pea.co.th/]

การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

ชี้แจงค่า Ft สำหรับเรียกเก็บจากผู้ใช้ไฟฟ้า
ในใบเรียกเก็บเงินค่าไฟฟ้าประจำเดือน กันยายน – ธันวาคม ๒๕๖๔

คณะกรรมการกำกับกิจการพลังงาน (กกพ.) มีมติเมื่อวันที่ ๒๑ กรกฎาคม ๒๕๖๔ เห็นชอบค่าไฟฟ้าตามสูตรการปรับอัตราค่าไฟฟ้าโดยอัตโนมัติ (Ft) สำหรับเรียกเก็บจากผู้ใช้ไฟฟ้าในใบเรียกเก็บเงินค่าไฟฟ้า**ประจำเดือน กันยายน – ธันวาคม ๒๕๖๔ เท่ากับ -๑๕.๓๒ สตางค์ต่อหน่วย** (ไม่รวมภาษีมูลค่าเพิ่ม) โดยมีรายละเอียดการพิจารณาของ กกพ. ดังนี้

๑. เนื่องจากสถานการณ์ราคาเชื้อเพลิงที่ปรับตัวสูงขึ้น โดยราคาก๊าซธรรมชาติซึ่งเป็นเชื้อเพลิงหลักในการผลิตไฟฟ้าปรับตัวเพิ่มขึ้นตามราคาน้ำมันในตลาดโลกที่เพิ่มขึ้น ประกอบกับอัตราแลกเปลี่ยนที่อ่อนค่าลง ส่งผลให้ค่าเชื้อเพลิง ค่าซื้อไฟฟ้าและค่าใช้จ่ายตามนโยบายของรัฐ เท่ากับ -๕.๒๕ สตางค์ต่อหน่วย กกพ. จึงให้นำเงินบริหารค่า Ft จำนวน ๕,๙๑๐ ล้านบาทมาประกอบการคำนวณ ทำให้ค่า Ft สะสมในการคำนวณรอบนี้ เท่ากับ -๑๐.๐๕ สตางค์ต่อหน่วย ส่งผลให้ค่า Ft ที่คำนวณได้จริงประจำเดือน กันยายน – ธันวาคม ๒๕๖๔ เท่ากับ -๑๕.๓๐ สตางค์ต่อหน่วย เพิ่มขึ้นจากรอบก่อนหน้า ๐.๐๒ สตางค์ต่อหน่วย

๒. เพื่อเป็นการบริหารจัดการเสถียรภาพค่า Ft และบรรเทาผลกระทบต่อผู้ใช้ไฟฟ้าจากสถานการณ์ความไม่แน่นอนของระบบเศรษฐกิจทั่วโลกจาก COVID-๑๙ จึงพิจารณาให้ตรึงค่า Ft สำหรับเรียกเก็บจากผู้ใช้ไฟฟ้าเท่ากับ -๑๕.๓๒ สตางค์ต่อหน่วย

จึงทำให้ค่า Ft ขายปลีกสำหรับเรียกเก็บจากผู้ใช้ไฟฟ้าในใบเรียกเก็บเงินค่าไฟฟ้าประจำเดือน กันยายน – ธันวาคม ๒๕๖๔ เท่ากับ -๑๕.๓๒ สตางค์/หน่วย เท่ากับงวดที่ผ่านมา

****

Source [https://www.pea.co.th/]

อัตราค่าธรรรมเนียมการขอใช้ไฟฟ้า

<table>
<tr><th colspan="2">ขนาดมิเตอร์
(แอมป์)</th><th>ค่าประกัน
(บาท)</th><th>ค่าธรรมเนียม
(บาท)</th><th>ค่าธรรมเนียมต่อไฟ
(บาท)</th><th>ค่าส่วนเฉลี่ย
(บาท)</th><th>รวม
(บาท)</th></tr>
<tr><td colspan="2">5(15) แอมป์ 1 เฟส</td><td>300</td><td>107</td><td>321.00</td><td>-</td><td>728.00</td></tr>
<tr><td colspan="2">15(45) แอมป์ 1 เฟส</td><td>2,000</td><td>214</td><td>802.50</td><td>1,605</td><td>4,621.50</td></tr>
<tr><td colspan="2">30(100) แอมป์ 1 เฟส</td><td>5,000</td><td>428</td><td>1,605.00</td><td>5,350</td><td>12,383.00</td></tr>
<tr><td colspan="2">15(45) แอมป์ 3 เฟส</td><td>6,000</td><td>642</td><td>2,407.50</td><td>6,955</td><td>16,004.50</td></tr>
<tr><td colspan="2">30(100) แอมป์ 3 เฟส</td><td>15,000</td><td>1,284</td><td>4,815.00</td><td>17,655</td><td>38,754.00</td></tr>
<tr><td colspan="2">แรงต่ำประกอบ ซีที
1 เฟส</td><td>แอมป์ละ 100 บาท</td><td>1,000</td><td>2,500.00</td><td>50 A 33,000 บาท
เกิน 50 A คิดเพิ่ม
แอมป์ละ 100 บาท</td><td rowspan="4">*ค่าใช้จ่ายในการ
สับเปลี่ยน TOU
แรงดัน 200/380 V
เป็นเงิน 18,100 บาท

แรงดัน 22-33 kV
เป็นเงิน 19,260 บาท</td></tr>
<tr><td colspan="2">แรงต่ำประกอบ ซีที
3 เฟส</td><td>แอมป์ละ 300 บาท</td><td>3,000</td><td>7,500.00</td><td>100 A 33,000 บาท
เกิน 100 A คิดเพิ่ม
แอมป์ละ 300 บาท</td></tr>
<tr><td rowspan="2">มิเตอร์แรงสูง</td><td>แรงต่ำกว่า
90 เควี</td><td rowspan="2">หม้อแปลงเฉพาะราย
คิดเควีเอ ละ 400 บาท</td><td>ไม่เกิน 30 A 15,000 บ.
เกิน 30 A 20,000 บ.</td><td>ไม่เกิน 200 A 30,000 บ.
เกิน 200 A 40,000 บ.</td><td>หม้อแปลงเฉพาะราย</td></tr>
<tr><td>แรงดันตั้งแต่
69 เควีขึ้นไป</td><td>เควีเอ ละ 4 บาท แต่
ไม่เกิน 50,000 บาท</td><td>10,000 บาท</td><td>ไม่คิดส่วนเฉลี่ย</td></tr>
</table>

www.pea-omnoi.com

Source [https://www.pea.co.th/]

Price for installing electric vehicle charging stations

EVLunic - AC Wallbox Price list 2018

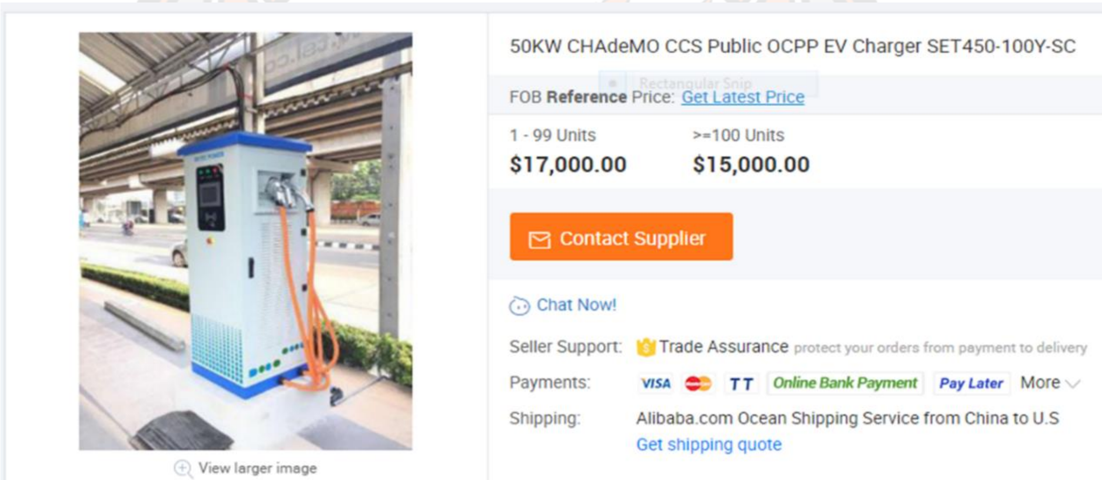
	Main type Name	ABB material code	Extended product type	Product name	Price
EVLuni	EVLunic B W4.6-T-0-0	6AGC070437	EVLunic B W4.6-T-0-0	wallbox type 2 AC, socket 4.6kW	70,000.00
EVLuni	EVLunic B W4.6-S-0-0	6AGC070438	EVLunic B W4.6-S-0-0	wallbox type 2 AC, socket with shutter 4.6kW	76,000.00
EVLuni	EVLunic B W4.6-G4-0-0	6AGC070439	EVLunic B W4.6-G4-0-0	wallbox type 2 AC, cable (4m) 4.6kW	78,000.00
EVLuni	EVLunic B W4.6-P4-0-0	6AGC070440	EVLunic B W4.6-P4-0-0	wallbox type 1 AC, cable (4m) 4.6kW	78,000.00
EVLuni	EVLunic B+ W22-T-0-0	6AGC070441	EVLunic_B+_W22-T-0-0	wallbox type 2 AC, socket 22kW	90,000.00
EVLuni	EVLunic B+ W22-T-R-0	6AGC070442	EVLunic_B+_W22-T-R-0	wallbox type 2 AC, socket 22kW, RFID	106,000.00
EVLuni	EVLunic B+ W22-T-K-0	6AGC070443	EVLunic_B+_W22-T-K-0	wallbox type 2 AC, socket 22kW, Key	100,000.00
EVLuni	EVLunic B+ W22-S-0-0	6AGC070444	EVLunic_B+_W22-S-0-0	wallbox type 2 AC, socket with shutter 22kW	97,000.00
EVLuni	EVLunic B+ W22-S-R-0	6AGC070445	EVLunic_B+_W22-S-R-0	wallbox type 2 AC, socket with shutter 22kW,	113,000.00
EVLuni	EVLunic B+ W11-G4-0-0	6AGC070446	EVLunic_B+_W11-G4-0-0	wallbox type 2 AC, cable (4m) 11kW	95,000.00
EVLuni	EVLunic B+ W11-G4-R-0	6AGC070447	EVLunic_B+_W11-G4-R-0	wallbox type 2 AC, cable (4m) 11kW, RFID	112,000.00
EVLuni	EVLunic B+ W22-G4-0-0	6AGC070448	EVLunic_B+_W22-G4-0-0	wallbox type 2 AC, cable (4m) 22kW	98,000.00
EVLuni	EVLunic B+ W22-G4-R-0	6AGC070449	EVLunic_B+_W22-G4-R-0	wallbox type 2 AC, cable (4m) 22kW, RFID	114,000.00
EVLuni	EVLunic B+ W22-G4-K-0	6AGC070450	EVLunic_B+_W22-G4-K-0	wallbox type 2 AC, cable (4m) 22kW, Key	108,000.00
EVLuni	EVLunic B+ W22-G6-0-0	6AGC070451	EVLunic_B+_W22-G6-0-0	wallbox type 2 AC, cable (6m) 22kW	102,000.00
EVLuni	EVLunic B+ W22-G6-R-0	6AGC070452	EVLunic_B+_W22-G6-R-0	wallbox type 2 AC, cable (6m) 22kW, RFID	119,000.00
EVLuni	EVLunic B+ W22-G6-K-0	6AGC070453	EVLunic_B+_W22-G6-K-0	wallbox type 2 AC, cable (6m) 22kW, Key	112,000.00
EVLuni	EVLunic B+ W4.6-P4-0-0	6AGC070454	EVLunic_B+_W4.6-P4-0-0	wallbox type 1 AC, cable (4m) 4.6kW	96,000.00
EVLuni	EVLunic B+ W4.6-P4-R-0	6AGC070455	EVLunic_B+_W4.6-P4-R-0	wallbox type 1 AC, cable (4m) 4.6kW, RFID	112,000.00
EVLuni	EVLunic Pro S W22-T-0-0	6AGC070456	EVLunic_Pro_S_W22-T-0-0	wallbox type 2 AC, socket 22kW	100,000.00
EVLuni	EVLunic Pro S W22-T-R-0	6AGC070457	EVLunic_Pro_S_W22-T-R-0	wallbox type 2 AC, socket 22kW, RFID	116,000.00
EVLuni	EVLunic Pro S W22-S-0-0	6AGC070458	EVLunic_Pro_S_W22-S-0-0	wallbox type 2 AC, socket with shutter 22kW	107,000.00
EVLuni	EVLunic Pro S W22-S-R-0	6AGC070459	EVLunic_Pro_S_W22-S-R-0	wallbox type 2 AC, socket with shutter 22kW,	123,000.00
EVLuni	EVLunic Pro S W11-G4-0-0	6AGC070460	EVLunic_Pro_S_W11-G4-0-0	wallbox type 2 AC, cable (4m) 11kW	108,700.00
EVLuni	EVLunic Pro S W22-G4-0-0	6AGC070461	EVLunic_Pro_S_W22-G4-0-0	wallbox type 2 AC, cable (4m) 22kW	111,000.00
EVLuni	EVLunic Pro S W22-G4-R-0	6AGC070462	EVLunic_Pro_S_W22-G4-R-0	wallbox type 2 AC, cable (4m) 22kW, RFID	127,000.00
EVLuni	EVLunic Pro S W22-G6-0-0	6AGC070463	EVLunic_Pro_S_W22-G6-0-0	wallbox type 2 AC, cable (6m) 22kW	115,000.00
EVLuni	EVLunic Pro S W22-G6-R-0	6AGC070464	EVLunic_Pro_S_W22-G6-R-0	wallbox type 2 AC, cable (6m) 22kW, RFID	131,000.00
EVLuni	EVLunic Pro S W4.6-P4-0-0	6AGC070465	EVLunic_Pro_S_W4.6-P4-0-0	wallbox type 1 AC, cable (4m) 4.6kW	109,000.00
EVLuni	EVLunic Pro S W4.6-P4-R-0	6AGC070466	EVLunic_Pro_S_W4.6-P4-R-0	wallbox type 1 AC, cable (4m) 4.6kW, RFID	125,000.00

Source [https://www.pmk.co.th/shop/ev-charger]

	Main type Name	ABB material code	Extended product type	Product name	Price
EVLuni	EVLunic Pro M W22-T-0-0	6AGC070478	EVLunic_Pro_M_W22-T-0-0	wallbox type 2 AC, socket 22kW	119,000.00
EVLuni	EVLunic Pro M W22-T-R-0	6AGC070479	EVLunic_Pro_M_W22-T-R-0	wallbox type 2 AC, socket 22kW, RFID	135,000.00
EVLuni	EVLunic Pro M W22-T-0-C	6AGC070480	EVLunic_Pro_M_W22-T-0-C	wallbox type 2 AC, socket 22kW, UMTS/3G	133,000.00
EVLuni	EVLunic Pro M W22-T-R-C	6AGC070481	EVLunic_Pro_M_W22-T-R-C	wallbox type 2 AC, socket 22kW, RFID, UMTS/3G	149,000.00
EVLuni	EVLunic Pro M W22-S-0-0	6AGC070482	EVLunic_Pro_M_W22-S-0-0	wallbox type 2 AC, socket with shutter 22kW	126,000.00
EVLuni	EVLunic Pro M W22-S-R-0	6AGC070483	EVLunic_Pro_M_W22-S-R-0	wallbox type 2 AC, socket with shutter 22kW,	142,000.00
EVLuni	EVLunic Pro M W22-S-0-C	6AGC070484	EVLunic_Pro_M_W22-S-0-C	wallbox type 2 AC, socket with shutter 22kW,	139,000.00
EVLuni	EVLunic Pro M W22-S-R-C	6AGC070485	EVLunic_Pro_M_W22-S-R-C	wallbox type 2 AC, socket with shutter 22kW,	156,000.00
EVLuni	EVLunic Pro M W11-G4-0-0	6AGC070486	EVLunic_Pro_M_W11-G4-0-0	wallbox type 2 AC, cable (4m) 11kW	128,000.00
EVLuni	EVLunic Pro M W11-G4-0-C	6AGC070487	EVLunic_Pro_M_W11-G4-0-C	wallbox type 2 AC, cable (4m) 11kW, UMTS/3G	142,000.00
EVLuni	EVLunic Pro M W22-G4-0-0	6AGC070488	EVLunic_Pro_M_W22-G4-0-0	wallbox type 2 AC, cable (4m) 22kW	130,000.00
EVLuni	EVLunic Pro M W22-G4-R-0	6AGC070489	EVLunic_Pro_M_W22-G4-R-0	wallbox type 2 AC, cable (4m) 22kW, RFID	146,000.00
EVLuni	EVLunic Pro M W22-G4-0-C	6AGC070490	EVLunic_Pro_M_W22-G4-0-C	wallbox type 2 AC, cable (4m) 22kW, UMTS/3G	144,000.00
EVLuni	EVLunic Pro M W22-G4-R-C	6AGC070491	EVLunic_Pro_M_W22-G4-R-C	wallbox type 2 AC, cable (4m) 22kW, RFID,	160,000.00
EVLuni	EVLunic Pro M W22-G6-0-0	6AGC070492	EVLunic_Pro_M_W22-G6-0-0	wallbox type 2 AC, cable (6m) 22kW	134,000.00
EVLuni	EVLunic Pro M W22-G6-R-0	6AGC070493	EVLunic_Pro_M_W22-G6-R-0	wallbox type 2 AC, cable (6m) 22kW, RFID	151,000.00
EVLuni	EVLunic Pro M W22-G6-0-C	6AGC070494	EVLunic_Pro_M_W22-G6-0-C	wallbox type 2 AC, cable (6m) 22kW, UMTS/3G	148,000.00
EVLuni	EVLunic Pro M W22-G6-R-C	6AGC070495	EVLunic_Pro_M_W22-G6-R-C	wallbox type 2 AC, cable (6m) 22kW, RFID,	165,000.00
EVLuni	EVLunic Pro M W4.6-P4-0-0	6AGC070496	EVLunic_Pro_M_W4.6-P4-0-0	wallbox type 1 AC, cable (4m) 4.6kW	128,000.00
EVLuni	EVLunic Pro M W4.6-P4-R-0	6AGC070497	EVLunic_Pro_M_W4.6-P4-R-0	wallbox type 1 AC, cable (4m) 4.6kW, RFID	144,000.00
EVLuni	EVLunic Pro M W4.6-P4-0-C	6AGC070498	EVLunic_Pro_M_W4.6-P4-0-C	wallbox type 1 AC, cable (4m) 4.6kW, UMTS/3G	142,000.00
EVLuni	EVLunic Pro M W4.6-P4-R-C	6AGC070499	EVLunic_Pro_M_W4.6-P4-R-C	wallbox type 1 AC, cable (4m) 4.6kW, RFID,	158,000.00

http://new.abb.com/ev-charging

Source [https://www.pmk.co.th/shop/ev-charger]



Source

[https://www.alibaba.com//trade/search?fsb=y&IndexArea=product_en&CatId=&SearchText=SC+charger+station+50kw]

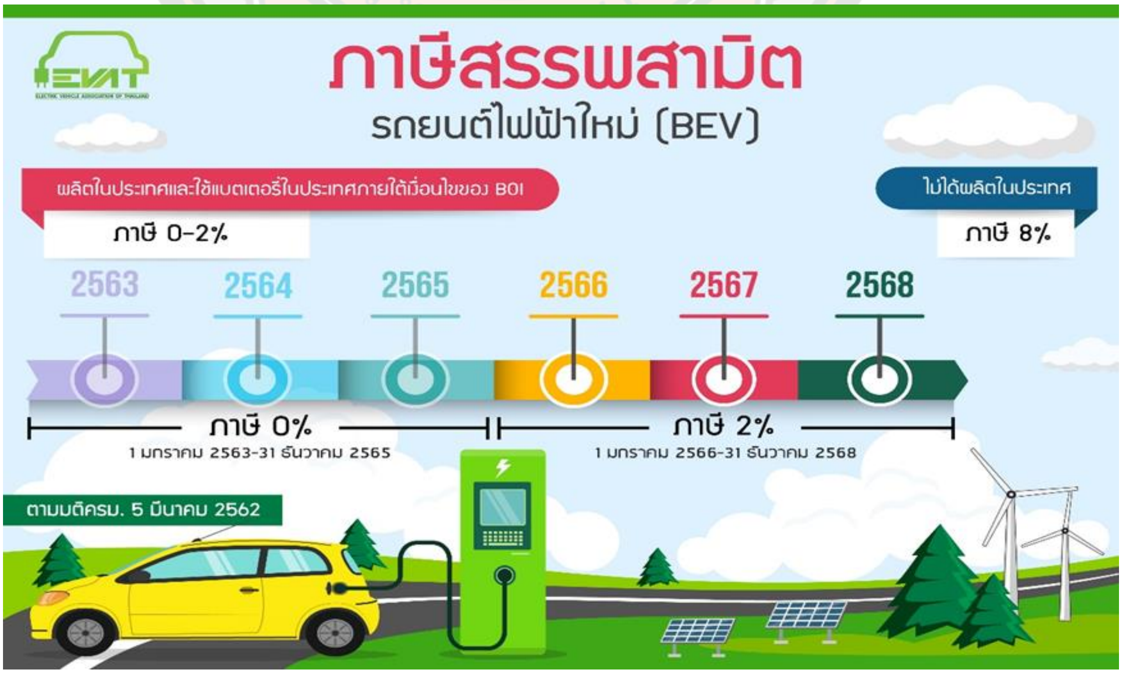
ราคา ล่าสุด ยืนยันราคา ถึงสิ้นเดือน มิถุนายนนี้ เท่านั้น

ระบบ 22,000 -400/230 Volt

ที่	kVA.	phase	ราคาเดิม	ราคาพิเศษ	ขนส่ง	รวม	vat	รวม
1	30	1	56,450	54,150	4,000	58,150	4,070.50	62,220.50
2	50	3	85,150	81,640	4,000	85,640	5,994.80	91,634.80
3	100	3	121,550	115,150	4,000	119,150	8,340.50	127,490.50
4	160	3	167,550	156,100	4,000	160,100	11,207.00	171,307.00
5	250	3	213,800	197,300	4,000	201,300	14,091.00	215,391.00
6	315	3	222,350	209,000	4,000	213,000	14,910.00	227,910.00
7	400	3	273,300	255,700	4,000	259,700	18,179.00	277,879.00
8	500	3	306,450	288,150	4,000	292,150	20450.50	312,600.50
9	630	3	347,300	326,900	4,000	330,900	23,163.00	354,063.00
10	800	3	402,200	377,300	4,000	381,300	26,691.00	407,991.00
11	1000	3	450,000	421,800	4,000	425,800	29,806.00	455,606.00
12	1250	3	558,000	520,950	4,000	524,950	36746.50	561,696.50
13	1500	3	658,250	621,000	4,000	625,000	43,750.00	668,750.00
14	2000	3	842,750	796,000	4,000	800,000	56,000.00	856,000.00
15	2500	3	1,053,500	1,000,200	4,000	1,004,200	70,294.00	1,074,494.00
16	3000	3	1,262,000	1,202,500	4,000	1,206,500	84,455.00	1,290,955.00
17	3500	3	1,471,000	1,404,800	4,000	1,408,800	98,616.00	1,507,416.00
18	4000	3	1,628,000	1,554,900	4,000	1,558,900	109,123.00	1,668,023.00
19	5000	3	2,169,500	2,092,000	4,000	2,096,000	146,720.00	2,242,720.00

สอบถาม / ต้องการข้อมูล / หรือ อยากรู้ ราคาหม้อแปลงไฟฟ้าแรงสูง / สนใจ / ติดต่อ

Source [https://transformae.wordpress.com/อยากรู้-ราคาหม้อแปลงไฟฟ้า]



Source [http://www.evat.or.th/]

Source [https://www.prachachat.net/motoring/news-840761]

New Number of xEV Registration 2021-2020

BEV	Battery Size kWh	Year 2021	Year 2020
MG	44.5	1066	824
Tasla	62	222	86
Porsche	79	194	15
MINI Cooper	32.6	83	11
NISSAN	40	61	54

Source [Department of Land Transport]

CO2 distance Phisanulok to Khao Kho

distance	วังทอง-เข็กน้อย	75 km								Year 2564
distance	เข็กน้อย-อาเซียน	30 km	105km							
CO2 = g/km	100	150	200	200	200	200	200	200	200	200
	รถ์นั่ง(ไม่เกิน 7 คน)	รถ์นั่ง(เกิน 7 คน)	รถขนาดเล็ก	รถขนาดกลาง	รถขนาดใหญ่	รถ(4 ล้อ)	รถ (6 ล้อ)	รถ (10 ล้อ)	รถพ่วง	รถกึ่งพ่วง
วังทอง-เข็กน้อย	2599	2912	6	4	72	918	197	99	67	47
เข็กน้อย-อาเซียน	1899	196	9	11	5	3429	172	34	44	15
	4498	3108	15	15	77	4347	369	133	111	62
Total vehicle	12,735									
วังทอง-เข็กน้อย	19,492,500	32,760,000	90,000	60,000	1,080,000	13,770,000	2,955,000	1,485,000	1,005,000	705,000
เข็กน้อย-อาเซียน	5,697,000	882,000	54,000	66,000	30,000	20,574,000	1,032,000	204,000	264,000	90,000
CO2	25,189,500	33,642,000	144,000	126,000	1,110,000	34,344,000	3,987,000	1,689,000	1,269,000	795,000
CO2=g/105km	102,295,500		EV 5%		2.88 %		28,083.57	ppm	381	vehicle
g/m	974.24		EV10%		5.77 %		56,167.14	ppm	762	vehicle
1 g=1000ppm	974,242.86	ppm=g/m								

[https://data.go.th/en/dataset/vk2564]

BIOGRAPHY

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Date of Birth

Address

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Current Position Assistant Director

Work Experience Senior Credit Analysis Specialist at Kasikornbank Uttaradit Thailand experience working in Financial Management.

Education Background 2001 M.B.A.(Master of Business Administration) Naresuan University, Thailand.
1994 B.Sc (Computer Science) Uttaradit Rajabhat, University, Thailand..