The Feasibility of Smart Green Gas Stations with Electronic Vehicle Infrastructure in Taiwan: Case Study of Key Stakeholders

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ABSTRACT

With the reduction of oil reserves and awareness of environmental protection rising, global governments are developing renewable energy actively. At the same time, global auto industries increased their investment and developed electric vehicles (EV). However, the gas station industry are trying to promotes its transformation. Nowadays, Taiwan's Chinese Petroleum Corporation (CPC) has begun its transformation plan and launched the smart green gas stations. This is a major reform of the future energy transformation. CPC's chairman said that as long as the introduction of smart green gas station is successful, the model will soon be implemented to other gas stations and expected to enter the international market. This study to analyze smart green gas station’s utility and risks to collect data through in-depth interview. I will interview the owners of gas stations and smart green gas station’s technicians were conducted. This interview determined the opinions of these key stakeholders and the profit models of the transformation plan. Then organize the main factors which effect the smart green gas station to evaluate its feasibility, and investigate the operation status of Chiayi and Tainan smart green gas stations was determined. The use of EVs in Taiwan has increased significantly in recent years, however, the related policy and government’s

decision are in the initial stage. I hope that through my research, I can analyze the possibility of Taiwan's energy station and find out the impact of relevant policies on transformation.

Keywords: Transformation, Smart Green Gas Station, Energy Policy, Electronic vehicle, Charging Station

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INTRODUCTION

Background

Nowadays, with the rapid increase in greenhouse gas emissions that decrease air quality and arise the odds of illness. Therefore, the awareness of renewable energy has risen and people started to reduce energy use in daily life.[1] The greenhouse emission became the main reason to make electric vehicles (EV) and electric motorcycle (VM) begun to flourish[2], because public transportation cannot afford such many commuters each day. Taiwan is a small island, which is highly populated. Hence, the road systems are strictly restricted and complicated. Consequently riding a motorcycle is a very common way of transportation, especially for the student population. It resulted in the factories produce various kinds of motorcycle to meet the rising need. Moreover, Taiwan's government was announced the act to ban fuel vehicles in the future[3] and use strict policy to examine fuel car's exhaust emissions.

These developments have prompted gas station operators and executives of China Petroleum Corporation (CPC) start to value the oil industry's transformation in Taiwan.[4] As a response to changing circumstances, CPC promoted energy transformation in 2019, launched the first phase of the "Smart Green Energy Gas Station" with the Chiayi demonstration station[5], which combined with charging stations(CS) and renewable energy. Creating, storing and utilizing energy are the

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[1] Sarah Darby, "The Effectiveness of Feedback on Energy Consumption," *A Review for DEFRA of the Literature on Metering, Billing and direct Displays* 486, no. 2006 (2006).10-24

[2] Marc Dijk, Renato J Orsato, and René Kemp, "The Emergence of an Electric Mobility Trajectory," *Energy Policy* 52 (2013).1-11

[3] 周宜德, 曾振南, and 陳中邦, "台灣電動車產業政策與推廣措施之探討," *石油季刊* 54, no. 3 (2018).23-36

[4] 整合傳播部企劃製作, "台灣中油董事長戴謙：智慧綠能加油站打造產能、儲能、用能自給自足生活圈," (2018).

[5] 郭家宏, "中油開設全台第一家綠能加油站！24 小時都能靠綠電營運，秘密在模組化貨櫃儲能系統," (2019).

driving targets. [6]However, gas station operators are aiming to supply oil and joint EV manufacturers as a short-term goal, and plan to use CS as their main business to develop diversified operations, combining shops and the restaurant industry in the future.

Complementing the government's energy policy, CPC has completed two smart green demonstration stations in Chiayi and Tainan. At present, the two demonstration stations are designed and planned by the Refining Research Institute and Green Energy Research Institute, so they are located near each institute. However, the design of the two stations is different: Chiayi's station is powered by a rooftop solar power system. Through the lithium-ion battery[7] energy storage system, providing in a self-sufficient manner. Conversely, the Tainan Qianfeng demonstration station uses multiple power supply and energy storage systems to provide gas stations and CS demand. CPC also said that it has completed two demonstration stations, and will continue to build smart green station in the western and eastern regions. Then combine the community green energy equipment to become a smart grid. The demonstration points for regenerative energy storage in the whole station are expected to increase.

The transformation of gas stations toward renewables is in the embryonic phase. However, each country has different practices for the development of EV in the state-owned and private petrol industry. For instance, the world's second-largest oil company, Royal Dutch Shell Plc., signed a cooperation contract with Dutch EV supplier Allego in 2017. It later added CS in various Shell gas stations in Europe where gas stations are mostly privately; South Korea's gas station transformation

[6] 台灣中油, "綠色 智能 共生 「台灣中油智慧綠能加油站—嘉義示範站」啟動," (2019).
[7] 黃任賢, 黃瑞雄, and 李秋萍, "中油鈦酸鋰儲能材料研發與試量產探討," *石油季刊* 54, no. 4 (2018).95-109

mode is similar to Taiwan. In 2019, GS and LG cooperation launched a charging system which combines the existing GS gas station with the EV charging system. They plan to expand from Seoul to other major counties and cities this year; However, Japan's gas station is also private, its oil industry is not combined with EV. Nissan said that there are more efficiency and availability to public and the number of car CS in Japan is already more than that of traditional gas stations.[8] With tens of thousands of charging locations for public use which far from the number of traditional gas stations, such achievements can be attributed to the influence of the Japanese government's subsidy program.[9]In short, the different practices between these countries are the Netherlands' oil industry through the joint with EV supplier to expand the established CS. Then, Korea's gas station trying to combine with the CS brand. Whereas in Japan, EV brands are expanding by itself, they don't cooperate with other industries. That lead to the numbers of CS surpassed gas stations.

> 2018 was a pivotal year in Taiwan's EM industry, which can be divided into Gogoro's power exchange and KYMCO's charge and replacement. There are currently more than 520 GoStation battery exchange stations in western Taiwan. [10]In addition to changing the power, the owner can also charge at home, but currently only supports Gogoro 2. "With the world's first two Ionex scooters launched today, consumers can embrace electric without compromise," stated Allen Ko. "This is a worldwide invitation to an open movement that celebrates one of the important social missions of our time." [11]

Also, Kymco emphasized their exclusive feature is to provide the power supply and ensure that users can still ride when charging batteries. Then the different between Kymco iONEX and existing EV is Kymco's car can be charged and rented.

[8] Justin McCurry, "Japan Now Has More Electric Car Charge Points Than Petrol Stations," (2016).
[9] Max Å hman, "Government Policy and the Development of Electric Vehicles in Japan," *Energy Policy* 34, no. 4 (2006).440-443
[10] Lisa Wang, "Gogoro Introduces Mobile Battery Charging Solution," (2018).
[11] Kymco, "Kymco Launches World's First Ionex Scooters," news release, Jun 13, 2018, https://www.kymco.com/news/kymco-first-ionex.

While, Sanyang previously running a little behind in the EV development[12]. During the Milan Auto Show, Sanyang announced that it will build a self-contained charging and replacement system with the CPC at the petrol station. Wu Qingyuan, chairman of Sanyang, said that the EV is a world trend and a national policy direction. Considering the four major aspects of "recharge and exchange convenience, continuous operation possibility, research and development autonomy, and overseas expansion possibilities", Sanyang is considered that to be the alliance with CPC is the best choice for integrating market resources with government resources. In the future, this cooperation model will not be ruled out to jointly develop the international market with CPC.

Different countries have different development methods for gas stations and EV. Some EV brands have set up their CS in various regions, while some have cooperated with state-owned enterprises and merged with gas stations. Although media has emphasized that EV could be spread to the whole world quickly, the implementation and usage have lagged behind those expectations. Limits to the spread of EV implementation in Taiwan can be explained by several factors. One of the reasons is because of the difficulty in promoting adequate CS. In 2015, some CS were damaged or there was no electricity provided. In 2016, Taiwan promoted EV actively, but it has not yet been popularized. Owing to EV are a relatively new type of product, that cause lower acceptance rate. Therefore, some car manufacturers regard EV as a by-product and do not invest too many resources to develop it. Besides, the development of EV requires a lot of cost. Yet, the scale of the companies that invested in EV is limited, because well-known car manufacturers in Taiwan have chosen to go

[12] Bryan Lawrence Morrissey, "The Design and Construction of Electronic Motor Control and Network Interface Hardware for Advance Concept Urban Mobility Vehicles" (Massachusetts Institute of Technology, 2008).9-28

to other countries to produce and expand the international market. This is also the difficulty of EM's development.

Inadequate establishment of CS might lead long distance driver cannot charge their car. Alongside this, CS is harder to build in less urbanized regions, that would reduce purchase intentions of EV.

> According to the research, the distance traveled by EV、the cost of battery replacement, and the weight of the battery would cause the "mileage anxiety" that can't be counted when they're out of power, making consumers reluctant to try.[13]

Therefore, CPC develops a transformation plan for gas stations that would be equipped with CS, in conjunction with the government's energy policy to combine wind and solar energy. These actions would counter consumers' mileage anxiety; therefore, providing incentives to service providers can increase the development of EV.

I found that the main reason why Taiwan has not widely applied EV is owing to the government policy. In Norway, they had strong public backers such as no VAT and reduced road tax when buying an EV, free city parking and charging, free toll road passing and permission to drive in public-transport lanes.[14] However, our government didn't have such complete incentives for EV users. That leads to the EV cannot be deployed quickly in Taiwan. In recent years, as more and more EV brands are releasing around the world, the government in Taiwan also offers some subsidy for the purchase of EV[15].

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[13] Chun-mei CHEN et al., "Analysis on the Influencing Factors of Driving Mileage of Electric Vehicles: A Case Study of Taxis in Beijing," *DEStech Transactions on Engineering and Technology Research*, no. ameme (2017).7-7

[14] Harald N Rnstvik, "Norway's Electric Vehicle Deployment Success. A Historical Review Including Plans for Fast Charging Stations Covering All of the Country—by 2015" (paper presented at the 2013 World Electric Vehicle Symposium and Exhibition (EVS27), 2013).2-10

[15] Jenn Jiang Hwang, "Sustainable Transport Strategy for Promoting Zero-Emission Electric Scooters in Taiwan," *Renewable and Sustainable Energy Reviews* 14, no. 5 (2010).1-13

According to the sources of the Ministry of Economic Affairs, all counties and cities have subsidies for the elimination of fuel car to encourage the purchase of EV. Among them, the subsidies for EV in Taoyuan County are highest as $28,500, second is Yunlin and Chiayi.[16] This boosts the use of EV and makes the public start to aware of the advantages of EV. When more people willing to buy EV, the problem of the CS insufficient also arises.

Motivation

In Taiwan, gas station density is widespread throughout the island. Previously, there didn't have cooperation between Taiwan's oil industry and EV, this year's cooperation between CPC and Sanyang could meet with problems and risks such as the increase of different EV brands and low public acceptance in the future. This research proposes to analyze and record the petrol station's transformation with renewable energy. By comparing Taiwan's EV brands, it will determine which party is most suitable for CPC to cooperate with for optimal development. According to the statistics of the Energy Bureau of the Ministry of Economic Affairs, there are 2,476 petrol stations in Taiwan, of which more than 1,800 are private petrol stations. Therefore, the gas station industry is a source of income for many families. Gas station owners are worried that the rise of EV will have a detrimental impact on the industry.

For the development of energy and technology, those engaging in the industry would hope to both maintain the basic supply of oil and cooperate with the development of the EV industry. Their long-term goals are to combine green energy and EV to create sustainable development. However, unlike other countries, Taiwan's petrol stations are densely populated in various regions, even in the rural areas, so it is

[16] Furch, "新購電動車看這篇：怎麼買最便宜？2019 電動車政府補助款項總整理," (2019).

very suitable to set up CS there. While Taiwan has many petrol stations, but adopting the CS could be difficult at first because the petrol station has to redeploy personnel scheduling, achieve consensus and balance with EV manufacturers. Moreover, the CS setting needs funding and time for widespread to each petrol station. Therefore, I want to through the interview to combine each problem and make evolution. I hope that through this research, I will participate in the whole process of transformation initiation, assess the difficulties and crises that will be encountered in the future transition, and compare the technology and development process of similar cases oversea.

Research Purpose

The purpose of my study is to access the feasibility of the gas station's transformation in Taiwan. Because Taiwan’s EV have not been popularized in the past, it has just begun to consider the development of gas station transformation in recent years. Startup stage is the hardest and most risky in the entire transformation plan. To follow the government's renewable policy, CPC target to set 1000 charging station for three years. Yet, each area has a different situation; so it quite difficult to broadly apply and earn profit from the CS in a short period. Therefore, I plan to access whether they are developing as the public expected after I visit two demonstration station in Chiayi and Tainan. Then analyze the possibilities of utilizing the same transformation model in other gas stations and calculate it's practical time. Also through an interview with owners of the gas station and executor of CPC to sort out their transformation plan. And then integrate both ideas and opinions to make a further assessment.

Research Questions

1. What is the main problem which obstructs gas station transformation?

2. How to overcome the difficulties of transformation?

3. What is the future direction of transformation on gas station?

4. What the feasibility of smart green gas station widespread applied?

Contribution

The findings of this research compiled domestic legislation on EV and summarized the views and attitudes of key stakeholders. Taiwan began planning smart green energy stations in 2018, and it is expected to set up 1,000 CS in three years.[17]However, the transformation will affect both the government standing and the automotive industry's profit. Ministry of Transportation and Communications, Lin Chia-Lung, said 'Ban fuel car by 2035 is a policy goal, but it might base on preserve those existing industries, also let them have time to adjust and develop towards green transportation.' When government policy is changeable, public and related industries would also shift their ground. As the government doesn't promote the transformation of gas station actively, CPC might have second thoughts on the transformation plan. Therefore, I will according to the support of the government and the public to evaluate the transformation plan and find out the reasons and solutions for its risks.

[17] 台灣中油股份有限公司, "綠能永續、智能共生、創新轉型 台灣中油集結產官學研辦論壇 啟動智慧綠能加油站," news release, May 9, 2018, https://www.cpc.com.tw/News_Content.aspx?n=30&s=780.

Limit

It may be hard to compare the overseas transformation plan with Taiwan's because different countries have different conditions and policies. Lots countries' EV brand establish the CS by themselves rather than combine with the gas stations. Owing to Taiwan is a small island, the distance of the gas station in Taiwan is very close. Therefore, it's convenient for the CS to set in the gas station. Most developed countries are starting to focus on the use of EV, but we use different methods in application and promotion. We can reference their way but it's hard to compare each of them.

Delimits

My research scope is limited to CPC's transformation plan for Taiwan. Then my research target is for gas station operators in mid-south part of Taiwan and demonstration station operators in Chiayi and Tainan. The more difficult areas for the transformation of Taiwan's gas stations are in the mid-south region, especially in the rural areas of Yunlin. People in rural areas have more elderly people have lower acceptance of EV and are less willing to use newer operations such as self-service refueling. Therefore, I hope to learn about the owner's views through interviews and evaluate the possibility of transformation.

LITERATURE REVIEW

Owing to the greenhouse emission, the globe started to enact renewable energy policy. However, the renewable energy policy would according to government intention and condition to be formulated. I use Europe debt as an example to explain the surrounding could make the renewable energy policy to move up and down and find out some recourses about renewable energy development in Taiwan. Then collected the data of globe EV circulation and market share. This chapter also includes the government incentives, government's policy and action can arise public interest. I found that there are many differences between the Netherlands (with the second-highest EV market share) and Brazil (with the second-lowest EV market share). Therefore, I list their different in the part of government subsidies. There also have researchers mentioned the EV development is related to drivers behavior and charging station's establish. When the government offering more concessions, its EV are more likely to be widely purchased and used.

Renewable Energy Policy

Because of technology progress and economic growth, people started to address the energy crisis through boost energy transformation. However, there have many ways can accelerate renewable research. In World Economic and Social Survey 2013, the researcher had responded to the influence and methods of global energy transformation. Also mentioned that the energy transformation is not hard to achieve, the difficult part is how to implement it. In this regard, the world needs more government and public investment to provide enough renewable energy systems. According to Adib 2015, global installed capacity and production from all renewable

technologies have increased substantially[18]; nevertheless, the fund was still far from the transformation. In many countries, the financial problem is the main reason to slow down invest in the renewable energy industry, which has enhanced the difficulties of related industries development. Such as the European debt crisis has led countries to continue to reduce their subsidies on renewable energy; Germany, Spain, France, Italy, and the United Kingdom have also begun to reduce their respective renewable energy incentives in 2012.

European Solution for Renewable Energy

Because of the occurrence of European debt, European countries began to develop solutions. They planned to increase the use of renewable energy to turn the crisis into a turning point. It is expected that by 2020, 27 member states will cooperate to establish a 2/3 power network powered by renewable energy[19]. Yet it's still just planning and needs to do lots of work to accomplish. In general, global investment in renewable energy wasn't developed steadily. Most countries are over-optimistic about the development of renewable energy, lacking engineering feasibility consideration.

The world's transition needs to follow the global trend. If some larger countries started to keep rolling the development of EV, the other countries would follow their steps to do it. As Christoph Frei, World Energy Council's Secretary General said that 'If China enacts policy to transition to electric vehicles in 2018 as many predict, the world's most populous nation could change the global picture.'

[18] Rana Adib et al., "Renewables 2015 Global Status Report," *Paris: REN21 Secretariat* (2015).
[19] 張福昌，"歐債危機對歐洲統合的影響," (2012).

Greenhouse Gas Emission in Taiwan

The Europe debt would influence the growth of renewable energy, however, there also have many reasons might affect energy policy for EV charging. Hwang referred to the influence of greenhouse gas emission and the status of renewable energy development in Taiwan. The author describes the main difficult on renewable energy's development is the lack of government subsidy. Owing to Taiwan didn't have enough skills and industries to make renewable energy factories, it's expensive to entrust a foreign factory to produce and ship it back to Taiwan. Therefore, the use of renewable energy needs substantial government's subsidy.

EV Circulation Number

Renewable energy policy would affect the EV circulation number. Then according to the survey, EV circulation number keeps arising during these years. In 2017, China owns 1.23 million EV circulation, become more than half of sales around the world. Numbers are gathered from the international energy agency. This is great news for the globe because the great state can influence the whole countries to follow the trend on EV. The reason for this outcome is because their government is activity carry out incentive and install CS in recent years. To promote the market acceptance of New Electric vehicles (NEVs), the Chinese government has launched NEV demonstration projects and issued numerous policies since 2009, which promoted NEV sales, but also resulted in a subsidies-oriented NEV market.[20] Therefore, China government decided to remove the most incentive in the following years. That one of the reason caused the public refused to use EV because the policy is changeable. We

[20] Ning Wang, Huizhong Pan, and Wenhui Zheng, "Assessment of the Incentives on Electric Vehicle Promotion in China," *Transportation Research Part A: Policy and Practice* 101 (2017).

can find China own highest EV circulation in fig.1, but they didn't have an as high market share as Norway. One of the reason is that they have more than 13.86 million population so they are easier to reach the highest EV circulation.

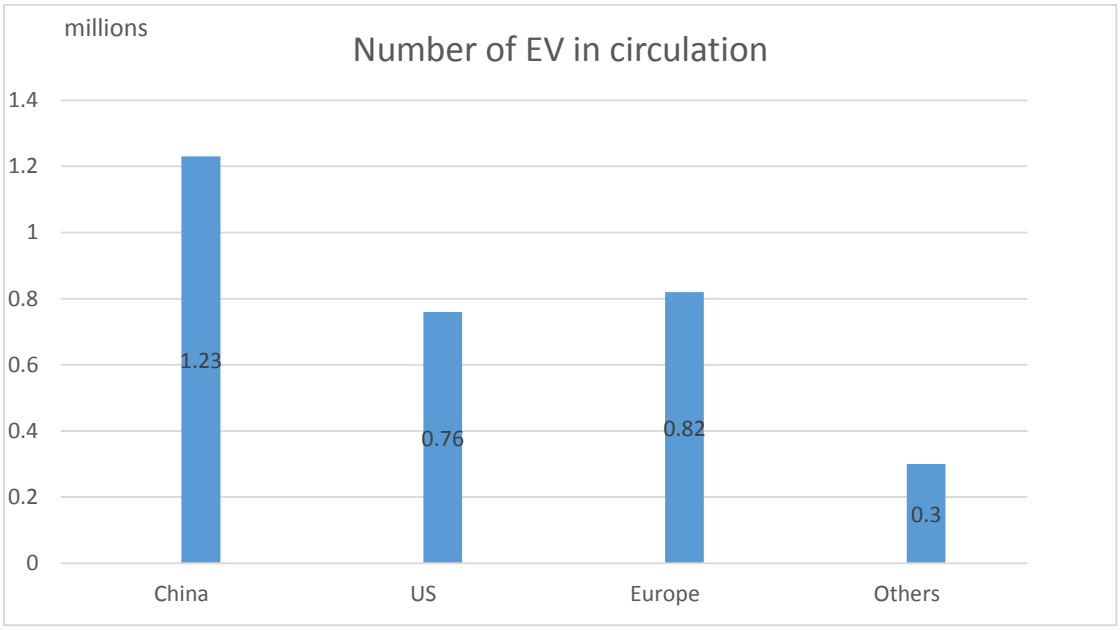


Figure. 1 EVs see record sales again in 2017
Source: The IEA Global Electric Vehicle Outlook 2018

Market Share of EV

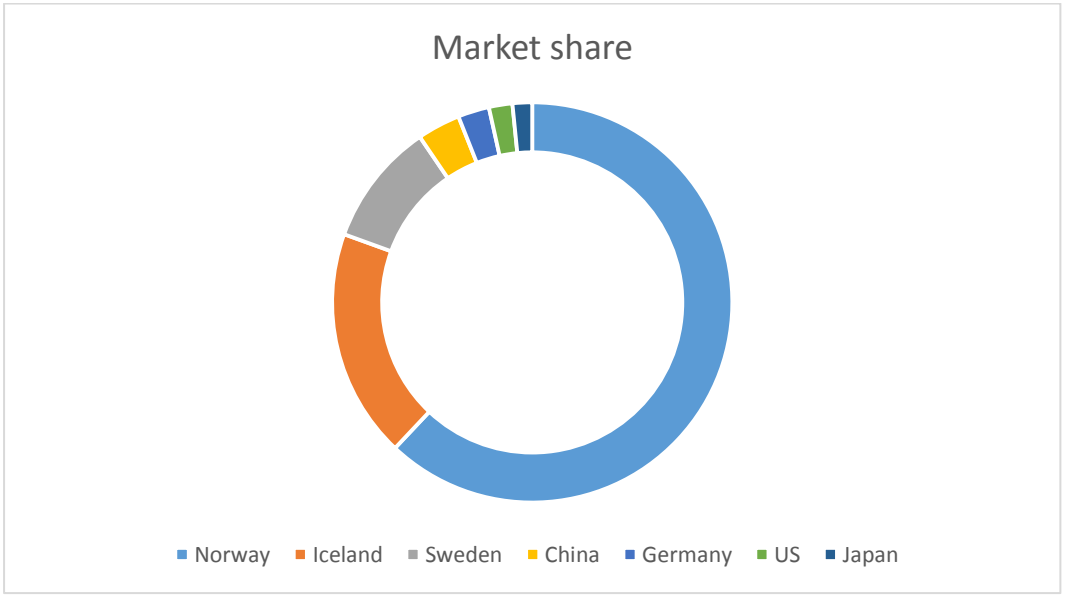


Figure. 2 EV market share in 2017
Source: The IEA Global Electric Vehicle Outlook 2018

As figure 2, we can find that Norway remains the highest market share in the globe.

Then its government practices many policies on EV development. Their EV are exempt from non-recurring vehicle fees, sales tax and annual road tax (Bakker et al. 2012). Besides their government provide grants for individual and companies who purchase EV. Also give EV driver privilege on road usage: free access to public areas, free parking/toll road and can use bus/ taxi lanes. Their policy on EV is overall and aimed to public need, that make their EV widespread. However, the Norway government needs to enact long-term policy to face the growth of EV market share. Modifying the extensive Norwegian EV-incentives as E-mobility enters the market expansion phase will be a major challenge.[21]

Government's subsidies

The government's monetary incentives are the main inducement for consumers' purchase and increase EV market share. When the gas station wants to transform and combine with CS, they need consumers. According to Rietmann and Lieven, compared the policy measures promoting EV in 20 countries including Taiwan. The authors found that there are lots of differences between the Netherlands (with the second-highest EV market share) and Brazil (with the second-lowest EV market share). They found out the main reason for the Netherlands success in EV sales is its high monetary incentive. After that, their government collaborates with the market to develop the charging station. Moreover, an association for EV driver also made a linkage platform to assist EV driver access the important information.

[21] Erik Figenbaum and Marika Kolbenstvedt, *Electromobility in Norway-Experiences and Opportunities with Electric Vehicles* (2013).

Financial Incentive and Market Share

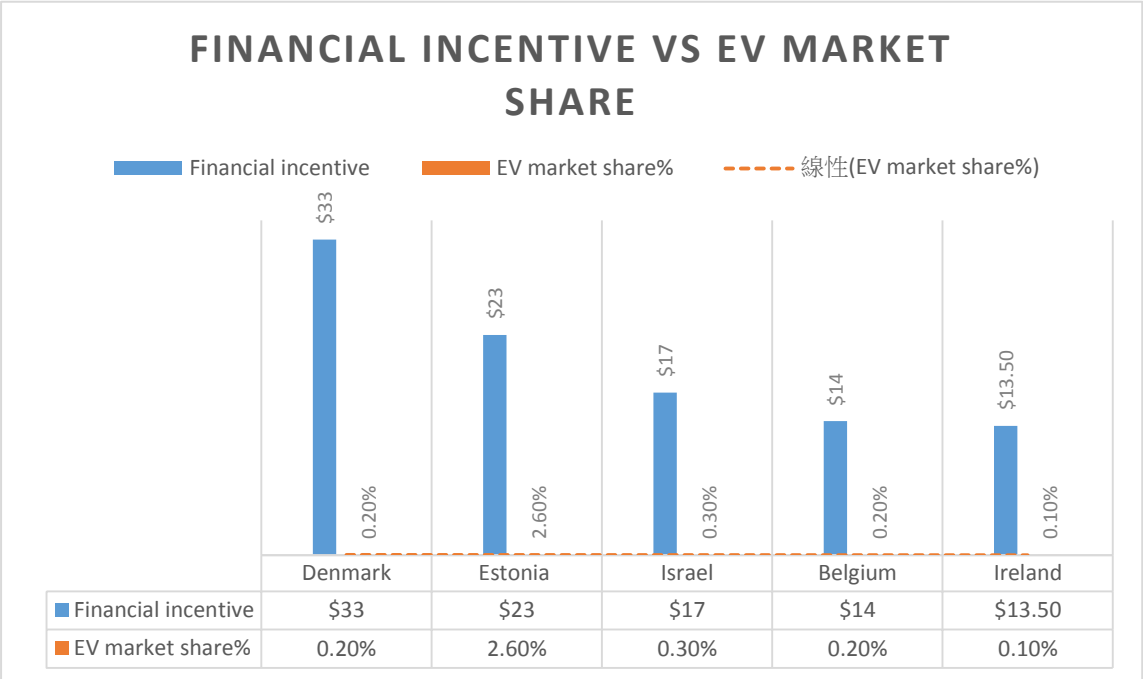


Figure. 3 Countries which have high financial incentive with law market share
Source: Energy Policy 68(2014)

Sierzchula mentioned that there are many countries implement financial instruments, but there have contrast consequences on their market share: Demark, Israel, Belgium, and Ireland. They are the top six countries which promote most financial instrument on EV but make relative low market share. The result proves the financial incentive cannot be the only reason to make EV success. According to the report, Danish sales of EV have fallen dramatically -- from nearly 5,000 in 2015 to around 700 in 2017 -- since Rasmussen's center-right government phased out subsidies such as those offered in Norway and Germany.[22] So it arose it EV market share as first but decrease quickly. "We have tax incentives for electric cars, and you could discuss if they should be bigger. I will not exclude that," Rasmussen said in an interview in Copenhagen. For another instance, consumers in Estonia adopted 55 EVs

[22] Nick Rigillo and Peter Levring, "Denmark May Reintroduce Ev Subsidies," (2018).

in 2011 (Mnt.ee, 2013), but the federal government decided to purchase approximately 500 MiEVs in 2012 (Estonia, 2011).[23] This government action strongly influences the high rate of market share in 2012. On the contrary, the Norway government establish more CS and provide subsidies for individuals and companies to purchase. They increase the market by the customer rather than purchase by the government itself. Also, Sierzchula said 'Belgium's financial incentives were directed specifically toward households, so they may have largely missed engaging the fleet market, hurting the country's adoption figures.' Most of this country is owing to its government policy or action to make the consequence. In 2018, Israel has just 700 EVs (not including hybrids). The number includes buses, leftovers from the abortive Better Place EV initiative a decade ago and a small fleet of vehicles operated by the Car2Go short-term rental program in Haifa. [24]If a country only has the government to contribute to EV development, which would just own a short-term influence. That means the fluctuation easily exists in the market share of EV; therefore, the research of EV develop should consider various kinds of factors.

Charging Station (CS) Infrastructure

Except for the effort on subsidy for EV drivers, the government and industry also could add the EV CS infrastructure. Sung and Changhyun mentioned that one of the most critical barriers to the widespread adoption of EV is the lack of charging station infrastructure.[25] The CS has to be built before EV widespread. Because consumers must first consider whether they use EV can be more convenient. If not, they would

[23] William Sierzchula et al., "The Influence of Financial Incentives and Other Socio-Economic Factors on Electric Vehicle Adoption," *Energy Policy* 68 (2014).6-12
[24] Ora Coren, "As the World Adopts Electric Vehicles, Israel Finds Itself in the Slow Lane," (2018).
[25] Sung Hoon Chung and Changhyun Kwon, "Multi-Period Planning for Electric Car Charging Station Locations: A Case of Korean Expressways," *European Journal of Operational Research* 242, no. 2 (2015).1-30

fall out of change. However, the set of charging infrastructure need put into a large amount of fund and vacant land. That the reason why most of the undeveloped countries are hard to develop EV.

> Jing's paper used a case study using the GPS-based travel survey data collected in the greater Seattle metropolitan area shows that electric miles and trips could be significantly increased by installing public chargers at popular destinations, with reasonable infrastructure investment.[26]

In the early days, there were not many EV drivers on the road. Therefore, there had few settings for CS, there is no problem with CS causing queuing and traffic congestion. However, the author mentioned that the number of EV in Seattle is gradually increasing, so in the future, the city has to add enough CS, we should also consider the application of smart grid technology to enhance the charging function, which is the challenge and risk we are facing now. In conclusion, setting more public charger can efficiently decrease range constraint for BEV drivers. When there has enough CS, optimization objectives would need to be used to solve the cost and time problem.

Optimization Method

When the government started to enhance the CS, researchers mentioned to utilize the optimization method to develop and analysis EV's used. The authors referred that one optimization method is considered the charging behavior (Bi, Xiao, Viswanathan, Knoll 2016). They assess the consequence of different charging behavior in the case study of Singapore. The authors divided the charging behavior into three models: Zero Estimation Model (ZEM), Semi Estimation Model (SEM) and Full Estimation Model (FEM). 'Results suggest that especially the FEM differs from the other two behavior

[26] Jing Dong, Changzheng Liu, and Zhenhong Lin, "Charging Infrastructure Planning for Promoting Battery Electric Vehicles: An Activity-Based Approach Using Multiday Travel Data," *Transportation Research Part C: Emerging Technologies* 38 (2014).2-24

models due to the lack of a *SOCThreshold* or *safetyMargin*.'[27] While taking the charging behavior into account, can benefit the placement of CS and appeal to more people to purchase the EV. Because we consider the drivers' needs and make the whole charging infrastructure more efficiently.

Develop the EV need lots of costs, and hard to get public acceptance. However, the authors mentioned that the plug-in hybrid electric vehicles (PHEVs) are the better option for people to use (Fang, Di, Yafeng and Yongpei 2013). Because it separates the car into two parts, one is for charging and another is for gasoline. Its cost is relatively low and extend the route for drivers to eliminate their range anxiety. Also, most customers would think PHEVs are more credible because they don't need to worry about when their cars may need to charge. There are lots of ways to promote the use of EV, yet PHEVs are the most easily and smoothly way for customers. It can reduce public concern and let people try the EV step by step. Therefore, many countries start to pay attention to this business opportunity and try to promote it. Like the Obama administration is taking responsibility to cooperate with the industry to increase EV's R&D. Although the US still not the most active country to develop EV, the future of its development is still expected.

Beyond Government Policy

When the government and market reach a consensus to preserve the tradition market rather than develop the new sector, EV would hard to widespread. EV's development needs the government's infrastructure and practical action to provide a subsidy, optimization methods. Moreover, it needs stakeholder and related industries'

[27] Ran Bi et al., "Influence of Charging Behaviour Given Charging Station Placement at Existing Petrol Stations and Residential Car Park Locations in Singapore," *Procedia Computer Science* 80 (2016).7-10

assistance. Netherlands well development on EV is not only because of government policy but assisted by market, stakeholders and non-governmental support. Compare with Netherland, Brazil is less developed. Because there are various actors and economic factors still hinder growth of Brazilian EV penetration such as alcohol lobbying group[28], automobile and oil industry. Besides, as Brazil's recession, the government cannot afford the subsidy for EV drivers; even hard to pay for charging infrastructure.

The stakeholders and relevant industries intervene are one of the reasons made Taiwan's EV cannot well-develop. When the government started to focus on air pollution and announced that they would reach the target of banned fuel motorcycle in 2035, however, this policy has triggered related industry protests. After the Ministry of Transportation and Communications and the eight major motor industry met in 2019, this policy announced to be suspended. The government stated that they are still optimistic about the prospects of EV, but should not be compressed into the development and survival of traditional industries for new industries. But there still have some motor industry believe that they may earn more profit to develop the EV industry.

Comparing EV Policies

There were many countries already use different ways to develop the EV. In (Martijn 2015), the author used *Interreg e-mobility North Sea Region (E-Mobility NSR) project*, which is co-funded by the EU and participating countries/ regions/ organizations to analysis their policy strategy towards E-Mobility. Because EV is a

[28] Nele Rietmann and Theo Lieven, "A Comparison of Policy Measures Promoting Electric Vehicles in 20 Countries," in *The Governance of Smart Transportation Systems* (Springer, 2019). 125-145

new technology, and still not widespread like conventional cars, its design is more complex and customers would think it is an unpredictable product. Also, compare with traditional fuel cars, EV is more expensive owing to its battery packs price are higher. Therefore, government policy is the most efficient way to gain a significant market share in the sector. In this paper, the author divided the government's tools into four-part: legal, financial, communication and organization. Legal is means the government provides legal parking/charging admission and access others legal need. Financial is give EV users tax benefit and subsidy. Communication is used in education or some campaigns to provide information for the public. The organization is government efforts on CS installment. However, the following countries are an effort on organizational instruments. In Denmark, they establish an information centre to share different ideas. Another is Copenhagen Electric, which plans to provide objective information of EV to municipalities, companies and private individuals to strengthening the capital regions. (Copenhagen Electric 2014) in Germany, the government aims to make a change in public transportation first. They try to use diesel hybrid buses and new energy storage systems on rail vehicles. In Norway, (Rnstvik 2013) the author said ‘Transnova, the national governing body that promotes the fund's such developments are supporting the deployment of charging stations, both slow-, semi- and fast- and it is happening systematically and quickly.’

The research consequence shows that most countries are a focus on more financial support on EV rather than establish more CS. They believe that governmental financial instruments can appeal to more customers to purchase; therefore, they consider more about the downstream part- customer sector. Examples are free or preferential parking, access to toll lanes, free charging, and free access to

ferries for EVs. [29]Like Belgium, Denmark, Germany, The Netherlands, Norway, Sweden, and the UK are a focus on tax incentives and subsidies. On the other hand, many countries are also effort on the upstream side- R&D and production focused. The government spends money on the skill side, willing to launch a better EV for the market need. They provide research funding and production funding in Germany, Sweden, and California. Then few countries provide financial incentives on the CS: Belgium, Netherlands, Norway, UK, and California.

Synthesize summaries

The commonality of the indicators is they are all following the development of EV. The greenhouse emission leads the public to pay attention to the renewable, and then the government made the law to accelerate its growth. Therefore, a country's EV develop base on its economic foundation, for instance, the undeveloped country is difficult to provide as many incentives as other developed countries. Because they may need to spend money on national infrastructure. That the reason why Europe EV decrease in the period of the Europe debt crisis. EV circulation number and market share would evidence the relationship between EV drivers and government policy. Then there are many researchers mentioned that EV well-developed countries such as Norway and the Netherland government provide more subsidy for EV drivers. However, there also have some researchers proposed that some countries give many incentives but lead to low EV market share. After read both side of research, I found that government subsidy can raise the consumers' aspiration on EV but it still needs other policy and related stakeholders cooperation.

[29] Martijn van der Steen et al., "Ev Policy Compared: An International Comparison of Governments' Policy Strategy Towards E-Mobility," in *E-Mobility in Europe* (Springer, 2015).27-53

Kristin’s research use content analysis to investigate whether incentives would promote battery electronic vehicle widespread in Norway. Then the author found that purchase tax plays an important role in affect EV purchasing power. Then the author also through the existing paper about incentive in Europe, US and worldwide to classify their different action of incentives, which make me get the resources clearly and quickly. Besides, Martijn used a case study to looking for different countries' renewable energy policy on EV and make tables to introduce the policies they found. Also, the authors used content analysis to gather related research and analysis them. They discovered the value chain of EV, infrastructure, and network to list each instrument focus on which point. Then summaries both organizational and financial instruments influence on EV development.

These research data can make to clarify the government policy and tactics on EV and assist me to find out which factors would help the rise of EV development. Both of the researchers use content analysis to categorize the EV policy between different countries. However, in my research, the content analysis of EV policy already enough. Therefore, I think my paper is more suitable to use in-depth interviews to realize the transformation plan (smart green gas station) in Taiwan. Because Taiwan's transformation plan for the gas station is announced in 2019, there still changeable and didn't have enough articles and research about it, it better to use the interview way to ask the key stakeholders directly.

METHODOLOGY

This paper is aimed to examine the comprehensive transformation plan of the gas station, find out the problem and risky point for the whole circumstances. Because there have different situations in Taiwan's petrol industry, I need to in light of the changeable policy to follow the transformation plan, knowing the notion of different stakeholders. Therefore, in this section of my research methodology, I choose to use an in-depth interview to complete my paper.

The in-depth interview not only can let me gather the newest information about the transformation step but give me a chance to talk with key stakeholders. Because each people have a different point of view and own interests. That's the reason why I plan to interview three different part of interviewer: the owner of the gas station, executive of the transformation plan and representatives of CPC. Also, I hope I can through the interview to see their real reaction to the transformation. There has fewer article revealed risks of the transformation plan, that make we still don't know whether those plans can be achieved or not. So the interview could directly explain my doubts on those reports.

Research Design

In this paper, I have two research question, the first one is, what’s the main problem obstructs gas station transformation? Another is, how to overcome the risks of transformation? Then the interviewee's responds can point out the correct way of my research question. Because the transformation plan in Taiwan is related to government policy, CPC, and owner of the gas station, it changeable because the policy would affect the relevant industry.

Also, some plans and decisions are still undetermined, which hardily to get literature resources of my paper. Therefore, an in-depth interview can give me the way to solve the transformation problem and risks.

Because my respondents are from different fields, they will have different reactions and perspectives in the transformation plan. I will design different interview content according to various respondents so that each respondent can aim at their professional field and content to answer my questions. Besides, the problems and results are diversified. I don't want to use the one-by-one question to restrict respondents' opinions. Then in-depth interviews can let the respondents open their hearts and lead them to say more relevant responses. Therefore, I design my interviews as an in-depth interview, according to the collection of energy, EV and gas station transformation to talk with interviewees. Moreover, I would create an easy interview space to give respondents more valuable advice.

Research Subjects

First, the transformation plan is based on the government intend on new energy. Therefore, I would interview the pre-president of CPC, who vigorously promote the green energy gas station and accelerate the transformation of the gas station during his tenure. Because he is the one in response to the government's policy of banned fuel vehicles to focus on this field and finished the charging station infrastructure in a gas station. I want to through his response to find out the relationship between government and CPC.

Then, my next interviewees are owners of gas stations. When the policy ensures to ban the fuel vehicle in recent years, gas station and car repair shop would be the first industry to be affected. These industries might stop policy to carry forward

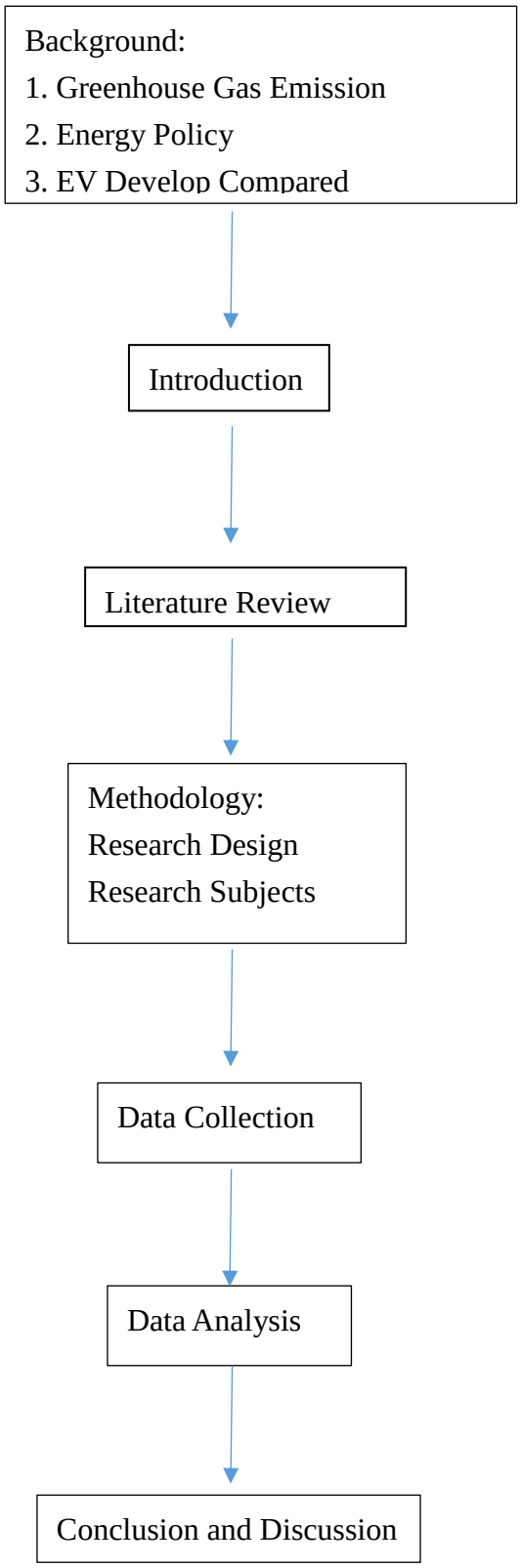
because the government is responsible for the exits of the traditional industry. From a government standpoint, they don't willing to see the existing industry been completely replaced by new industries. Therefore, their point would play an important role in the transformation plan.

Third, CPC established two green energy gas station demonstration in 2019, one is in Chiayi and another is in Tainan. Therefore, I plan to visit these two gas stations and interview smart green gas station’s technicians and observe how energy storage facilities be applied. As my literature review, there exist several problems and difficulties in the development of new energy. So I think it's hard to make full use of the wind turbines and solar panels in the gas station to store energy. Even the CPC announced that they would establish nearly 1,000 green energy gas station combine with CS in three years. There must have lots of dilemmas that need to break through.

Principles of Selecting my Study Population

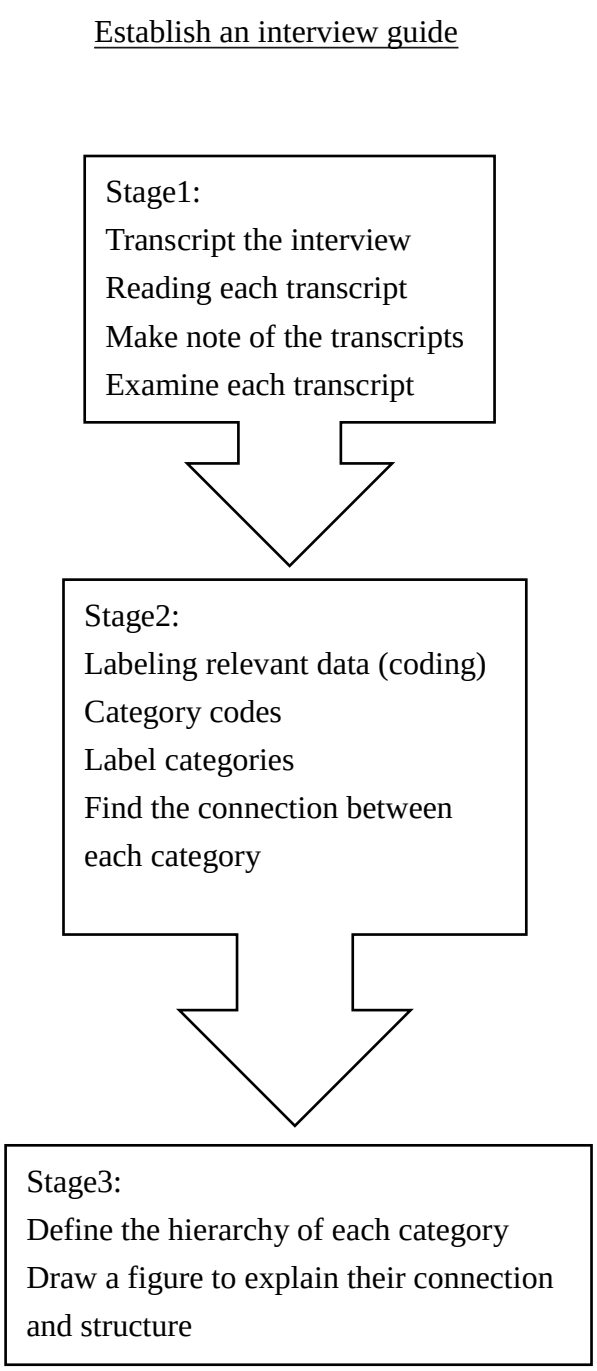
The interviewee must have the ability to answer my research question and clearly understand the transformation of the gas station and government policy. Also, the transformation plan might affect their interest in work or industry, which makes them insist on their standpoint and have their own opinion on the policy. Then they have to follow the following principles: (1.) My study population must work in the related field for at least three years. (2.) Respondents have experiences and knowledgeable about the transformation plan. (3.) The owners of the gas station have to participate in the green energy meeting and activities. Table 1 shows that the responsibility and industry of my respondents.

Research Process



Ways of Data Analysis

The method that I used to analyze my data is an expert interview, to get their feelings, responses, reactions, and opinions which benefit my research question. Then, the following are the steps I use to evaluate the findings:



DATA ANALYSIS

The main purpose of this chapter is organize the response of interviewers and analyze them. I found the respondents tends to look forward to the success of the gas station transformation and try to provide some advice to make it easier to achieve. Therefore I divided data analysis into five parts, which follow the schedule of the transformation plan and my interview order. In the first part, I would introduce the start of the transformation and why these key stakeholders want to involve in the development of transformation. In this part, respondents referred to the transformation plan is related to the global trend and government policy, also contained what they expected to do on the transformation plan. The second part discusses the development of electronic vehicle (EV), and discussing what kinds of actions these key stakeholders does in the field of EV. In the third part, I will introduce the characters of renewable energy in the smart green gas station and gather technical related response of the researchers in CPC. Four, I will talk about the key factor of the whole transformation plan- government. Most of respondents indicated that the success of the transformation must related to government's degree of support. No matter CPC, gas station owners, or EV industry, they all need government support. In the last part, respondents advise is important to analysis the feasibility of the transformation plan. Because they are involved in gas station transformation and some of them will carry forward in the develop of smart green gas station.

Section One: The motivation of transformation- smart green gas station

An industry needing transformation faces threat, but also is an opportunity to improve business direction, enhance competitive advantage and social value. The transformation of gas stations in recent years is derived from the trend of global

energy development. When the global time limit for the ban on fuel trucks came out, the Taiwan government and related state-owned businesses began to think about the impact of mobile pollution sources. Major related industries have also followed the footsteps of the government to change their business policies. What surprised me was that the advent of new energy did not defeat the industry that depended on oil, but motivated them to transform into new business opportunities. However, the attitude of the government in the transition process has been vacillating. The relevant bills proposed for new energy sources are being replaced from time to time. However, it is indelible that the government has indeed done some positive transformation programs and added many new energy-related projects. But to get a new energy to start, it still requires long-term and stable support from the government.

According to this interviewee, he referred to the reason of the gas station transformation is because it because oil marketing accounts for nearly half of CPC's turnover.

CPC itself is a state-owned enterprise, so CPC has several tasks. I should. improve the national economy, abide by national policies and foster industrial development. Now, 49% of our oil production value comes from oil sales. Today, CPC leads all gas stations to make a refueling alliance, but there is no need to use oil in the future, we have to think of a way for you.

CHEIN TAI,Chairman, CPC Corporation, Taiwan

From his point of view, he must fulfill his responsibilities to seek another business opportunity for the state-owned business to solve the problem of energy shortage. In addition, in the face of the problem of mobile pollution sources, he must also try to solve the problem of eliminating people’s complaints and improving people’s quality of life. Owing to these issues, smart green gas station’s plan emerged and technicians

gave impetus to transformation proactive.

The respondent indicated that there already have few cases to do the gas station transformation plan overseas.

At the beginning, our Green Energy Research Institute began to consider how to do this if we want to store energy. After we looked at some foreign cases, we are considering whether it is suitable to put this energy storage system at the gas station.

- Ph.D. of CPC Green Energy Research Institute

Because CPC plans to continue building smart green energy stations in Taiwan, the developers of CPC demonstration stations must ensure that the application and setup of energy storage systems are safe, and that different demonstration stations need to be differentiated. Use effective resource allocation to achieve maximum results.

The R&D personnel also referred to the case of foreign energy storage systems, and confirmed that the energy storage system can be combined with the gas station to assist the supply of future electric vehicle charging needs. Not only CPC staff are pay attention on the transformation but the owners of gas station have active engagement in transformation.

If the gas station is still not transformed after the next ten years, it may face bankruptcy after ten years. In order to protect the environment, we have to reduce our carbon emissions. The future trend is to be an energy station, which in line with mass transportation, fueling, electricity, charging, and hydrogenation.

- LI,JIE-XUN,Chairman of the National Federation of R.O.C Gas Station Association

Since the respondent is the owner of the gas station, he believes that the gas station transformation is to continue the development of the gas station industry. Because of

the increase in electric vehicles and the reduction in energy, it is necessary to find alternatives to maintain the industry. He also plans his fourteenth gas station as an energy station, combining a hydrogen refueling station with a charging station as a pioneer in the energy station. Some gas station operators believe that the transition is for sustainable operation and in response to environment changes. However, some owners see transformation as a business opportunity.

Respondents believe that transformation can create more business opportunities, and he also sees transformation as an opportunity.

> *This is the business opportunity. Because of the current diversified operation of the gas station, we are now very competitive in the market of oil. We should find more diversified business operations at gas stations in response to the government's policy.*
>
> *- FU-HONG,WANG ,Green Energy Committee of the Gas Station Association*

Because the transformation can increase the diversity of the industry and as the advancement of technology can develop more business opportunities such as unmanned shops. However, he also mentioned that the transformation must respond to the government's policies and cooperate with the development of the government to create greater output value.

Section two: the development of EV invoked the CPC's transformation plan

Energy policy began to be released in various countries with the increase of electric motor vehicles. The global EV trend has prompted many related industries to continue to invest in the research and development of EV. However, in the initial stage, there was no suitable unified plan for government policies, state-owned enterprises, and private-related industries. As a result of many related industries actively

developed electric vehicles and batteries by themselves. Then, the government is also watching the trend in the general direction, so the owners and the government are taking a positive attitude towards the development of electric vehicle-related transformation programs. However, at this stage, most related industries are in the development period, without sufficient resources and the government has no clear intention to cooperate. As the development of the related industry has gradually matured, the government began to combine with the gas station and the EV industry, and the transformation plan of CPC has gradually formed and matured.

Private enterprises started to make the transformation plan by themselves

Most of the gas station owners are expect to the development of the transformation plan. They are businessman, therefore, they have to seek more business opportunity in the process of the transformation.

We found some battery and EV manufacturers, they willing to form an alliance to develop gas stations combined with EV. At that tome, the software and equipment were all done quite well. After that, with the policy changed, it generally suspended.

-CHIN-CHIH,HSU, Chairman of the Yunlin County Gas Station Association

When those gas station owners trying to cooperate to develop the EV market, CPC found their transformation plan and invest is attractive. So CPC invite those gas station owners to make the cooperation and devoted to the green energy together.

I originally cooperated with a domestic trading company, which sell cars on their own platforms. Our association is only an auxiliary role, we wanted to use their company's plan to cooperate with CPC and CPC was very interested in our cooperation. After the policy changed, we stopped after CPC stopped.

-FU-HONG,WANG ,Green Energy Committee of the Gas Station Association

This gas station owner already constructed 13 gas stations in Taiwan. Therefore, I'm curious why he willing to open the 14th gas station in the future. Then he responded that he wants to build a energy station. To see how the hydrogenation system applied to the gas station.

The 14th station, I plan to buy electricity, fuel and hydrogenation equipment. It is necessary to let the Energy Bureau and relevant government units use this station as a demonstration station to develop a set of laws that are suitable for Taiwan.

- LI,JIE-XUN, Chairman of the National Federation of R.O.C Gas Station Association

At the beginning of the transformation, key stakeholders are all actively developed the transformation plan. Because the government just announced the policy of ban the sale of petrol and diesel powered vehicles, several related industries were started to value the development of EV.

These respondent as an owner of gas station, he must come up with a better way out for the gas station before the gas station is replaced. Plus, the gas stations are composed of guilds. They are industries that stand on the same line, so they will unite and combine with other industries. Therefore, they have a strong incentive to transform the gas station, so that the energy crisis is not the end of the gas station, but provides another market and business opportunities. Yet, the success of transformation must need CPC and government assistant. When the policy changed, these plan would difficult to forward. Therefore, owners of gas station are all care about CPC's perception.

The position and perception of CPC

When CPC started to make the smart green gas station, they found that safety is its limitation. Because gas station itself belongs to public area and oil combine with electricity would enhance the dangerous of gas station.

The problem of transformation is the location of some gas stations or the land area is not suitable for adding equipment for charging. The transformation of the gas station is to set up for the green energy gas station. Two green energy demonstration stations have been set up, and then the CS are replaced. What I know now is that our company will continue to promote the implementation of CS.

-MING-FA,XU, Management Professional of Chiayi Oil Marketing Department

CPC staff mentioned the limitation of the smart green gas station also referred to the CPC's construction in the process of transformation system.

In the position of the internal staff of CPC, he focused on finding suitable venues for transformation, because the transformation of gas stations will face many difficulties, such as whether the use and setting of renewable energy is in compliance with regulations, and the land area of the gas station itself is enough or not. So they will be more cautious in the planning period and spend more time to evaluate.

The current situation of the smart green gas station

Recently, the Industry Bureau announced to the public that they will start to support the usage of EV and build more CS. However, when the government suspended the policy of ban the petrol and diesel vehicle, people were afraid the construction of CS would also be postpone. Then the CPC technician indicated that they would keep building the CS and battery.

The Industry Bureau asked us to build a thousand stations in three years, so we will accomplish them. The transformation of the gas station is do EV service, so we started planning two smart green gas stations. We will use the battery to make a practical match with the EV, and see that its actual performance is incompatible with its safety. So do batteries, we must make sure it under safe and secure conditions will be further assessed that the commercialization of this possibility, the transition is currently on this stage.

-Ph.D. and Project Manager of CPC Refining Institute

The CPC technician also focus on the battery's safety, they spend several years to develop the EV battery to ensure it can be launched to public. Then Sanyang is trust CPC's battery and willing to cooperate with them.

We are now cooperating with Sanyang. They are willing to use our batteries. The battery materials to be used are the soft carbons that our Chiayi Research Institute puts forward. We want to unify the future batteries into the same specification, but this requires all car manufacturers to cooperate.

- Ph.D. of CPC Green Energy Research Institute

For those motorcycle industries, is hard for them to develop the battery by they own. Because the development of battery need to spend lots of time and money. In addition, CPC plan to make their battery widespread. Therefore, the cooperation between CPC and related industries is benefits to each of them.

CPC also has some related proposals and constructions in the transformation of gas stations, such as undertaking the business of the Industrial Bureau to add charging stations, and preparing for the Smart Green Energy Demonstration Station. The things they verify at the demonstration station will be different, otherwise it will become a duplication of investment. According to the respondent's answer, CPC will continue to

increase the demonstration station and charging station. They also have combined with the car factory to develop batteries and electric vehicles, and plan to achieve a win-win and mutual benefit effect. In addition, as a technology research and development staff, respondent are more focused on the safety of batteries and charging stations. They hope that after repeated tests and evaluations, they will reach the safest state and then launch them for public use.

Section three: smart green gas station

This section elucidates the purpose of demonstration station and clarifies the differences and utility of technologies used in different demonstration stations. With the growth of renewable energy, CPC's transformation plan tries to make it combine with gas station, and hence the rationale behind the smart green gas station. CPC made two smart demonstration stations in 2019, one is in Tainan and another is in Chiayi. Both of them used different renewable energy because that help researchers to test which one is more effective. In this part, respondents refer to their perspectives of demonstration stations. Some of them put emphasis on technical skills of green energy, and some of them are hesitate to the effect of it. Then CPC already done many research on it and introduce some energy storage systems from Japan. I think the smart green station is the most influential construction of the state-owned enterprise in the transformation of gas stations. That help owners of gas station and public received the information of transformation.

The purpose of demonstration stations

The construction of the smart gene gas station need to spend billions of money. Yet, the CPC still willing to build them is owing to the purpose of the demonstration

stations are significant. The CPC is state-owned enterprise, they have responsibility to encourage the green energy and provide the public need.

The purpose of the demonstration station is to show the implementation of the national policy to the public, and to let the people feel at ease that the future riding of the electronic motor car does not have to worry about the problem of not having a CS. On the one hand, it is also encourage industry to proceed in this direction in the future.

-CHIN-CHIH,HSU, Chairman of the Yunlin County Gas Station Association

Respondents believe that the transformation is not for profit at present, but to achieve technical testing for the future use of gas station transformation.

CPC must to support the development of the industry and maintain the revenue of the overall oil company of CPC. Therefore, he cannot be satisfied with the status quo. He must provide a transformational way for the state-owned enterprises and franchisees in the spirit of experimentation.

During the development of demonstration station, our chairman always said that the franchisees are our important partners, so he has been helping the franchisees to think about how to go in the future. This is also a purpose of the demonstration station. It is said that CPC should build a factory, make battery, control cost and performance by ourselves, and then we can further expand it.

-Ph.D. and Project Manager of CPC Refining Institute

From the standpoint of CPC technicians, he hopes to take the chairman's idea to do the demonstration station, find out the technology which suitable for the demonstration station and evaluate its effectiveness. However, he also mentioned that the cost of developing batteries is quite high.

If the future transformation need to be applied to various gas stations, it is

necessary to think of ways to reduce manufacturing costs and improve production quality. Apart from the cost, there also exist some pros and cons in the smart green gas stations.

The usage and limits of demonstration stations

Although there exists some dangerous factors in the gas station, the CPC still decided to build the CS in the gas station and even make the smart green gas station. The reason is because the location of gas station is so convenient.

The advantage of green energy combined with gas stations is the location of CPC is dense. It is not necessary to worry that you have to go far to get to the next stop. CPC is originally a supplier of energy. Now it is oil, so it is oil supply and we can also supply electricity. We still stick to our own business. This is a goal and advantage that it wants to promote.

-Ph.D. and Project Manager of CPC Refining Institute

Responses indicated that gas station area is not only convenient for EV charging but also have more space for CS and renewable energy system setting.

CPC might think that the gas station had a large land, and then there have large space on the top to set solar energy, so the solar energy part could be stored. Then the stored electricity can be provided to our charging station.

-CHIN-CHIH,HSU, Chairman of the Yunlin County Gas Station Association

Respondents generally said that gas stations are very suitable for building charging stations and green energy facilities, both in terms of location and land area.

The advantage should be used to develop charging stations and improve the convenience of people when using electric vehicles. Then achieve the mission of the gas station, providing the energy that the people need most. However, the smart green

gas stations still need long-term to achieve it benefit.

If the CS problem is solved, the doubts will be reduced and the number of purchases will be relatively increased. To be honest, because CPC is a state-owned enterprise, it is necessary to finish the infrastructure first. The limitation is there have lot of oil and gas just mentioned. The equipment should far away from the oil and gas areas. And the fast-filling EM need to be developed and applied widely.

-Ph.D. and Project Manager of CPC Refining Institute

Respondents pointed out that there is no fast-filling EM in the market that is suitable for the CPC demonstration station. Therefore, it is necessary to wait until CMC launches a new fast-filling EM next year, which may increase the utilization rate. He believes that CPC should first build these charging facilities before encouraging people buy electric cars and prevent future charging stations from being caught off guard when they face a lot of people.

In addition, he also mentioned that the lithium battery used in the demonstration station is dangerous, so CPC has a pay attention to discuss its safety and solutions in this part.

There are regulations in the gas station management rules, that is, how far away from the fueling island, this distance and height have certain specifications. They have to obey these current regulations.

-CHIN-CHIH,HSU, Chairman of the Yunlin County Gas Station Association

The combination of oil and electricity arise public awareness and some people started to oppose the development of the smart green gas station. That the reason why

they spent more time on setting the regulation of those energy systems.

The biggest limitation of the gas station combined with the green energy is the public hesitate. For example, we need energy storage equipment, these involve electricity. However, the electricity and the gas are basically not able to coexist. Therefore gas station setting management rules have to specify the distance and voltage.

- Ph.D. of CPC Green Energy Research Institute

When talking about the biggest limitation of gas stations combined with green energy, the respondent's general answer is to point to its security. Because the gas station itself belongs to the public area, and it is more dangerous than other business places.

When setting up green energy with electricity, the public showed their worry and fear. So, CPC must be more cautious in this aspect of research and development. When setting up different energy storage equipment, it must be tested repeatedly to ensure that it is safe. Then the most difficult part is to attain both save the cost and ensure it security.

The cost and effectiveness of demonstration station

The cost of energy storage system is quiet high. That cause the transformation plan hard to develop widely.

The biggest cost comes from the energy storage system. However there is no benefit in Taiwan because Taiwan's electricity is too cheap. Therefore, we will evaluate the feasibility of building the entire station from non-economic benefits perspective.

-Ph.D. and Project Manager of CPC Refining Institute

The CPC technician are focus on the value of both smart green gas stations rather than onside its cost. However, they still account the cost of each smart green gas station and evaluate their usage. That would analysis both energy systems and select the better to set in other gas stations.

If you consider the investment cost, Chiayi may be better. Because it storage tank is bigger, that can reduce the cost. At such a cost, make the small system relatively expensive. Of course, it is also said that there have some restrictions on the solar energy setting at the gas station.

- Ph.D. of CPC Green Energy Research Institute

According to the respondent's answer, the cost of the energy storage system is quite high. But the R&D staff is evaluating the applicability of the value and benefits that the energy storage system can produce, rather than considering its cost. However, in the process of evaluation, it is possible to calculate which system can achieve the maximum utility and reduce the cost.

The R&D personnel of the Green Energy Research Institute have proposed that the large system amortization cost will be lower than that of the small system. To reduce costs, it is necessary to increase the service life of the system, and to evaluate the use and value of the energy storage system when the number of visitors to the demonstration station is gradually increasing. I think that during the development period, the cost is bound to be the highest, because it using the latest technology and resources, the market is full of uncertainty, so many companies are not willing to put too many resources on it, the process of acquiring these new technologies will be more difficult. Having said this, I think they can through the achievement of smart green demonstration to encourage related industries invest.

Systems in different demonstration stations

The chairman of CPC referred to the different system of both smart green gas station. Tainan smart green gas station is applied vanadium liquid flow which is a new technology can store a large amount of electricity. Them Chiayi demonstration developed soft carbon, also cooperate with technology of Delta Electronic.

The different places in the Tainan demonstration station is vanadium liquid flow system in the basement, where LGO is used to store the energy of the battery, Chiayi station used soft carbon, and Delta is doing energy storage. So the two materials are different, we have two institutes, one Green Energy Institute is specialized in LGO, and another Chiayi Refining Institute is doing soft carbon.

- CHEIN TAI,Chairman, CPC Corporation, Taiwan

The main purpose of both smart green gas station is different. Chiayi demonstration station os plan to utilize its larger land area to reach the effectiveness of self-sufficient. Then Tainan demonstration station plan to used multi-power system to store more electricity in it small area.

The Chiayi Xinyi station is designed to be self-sufficient, because it has a large piece of solar panel system, it produces abundant electricity, Then the station in Tainan is called the multi-power system because it has different power sources, one is solar energy and another is a fuel cell, it also has different energy storage systems. Then, based on the operation of this demonstration station to know that which mode the CPC should copy.

-Ph.D. and Project Manager of CPC Refining Institute

In the setting of the demonstration station technology, the internal management of CPC and the technical staff's response tend to be consistent.

They all think that the three research institutes will allocate different research projects to avoid duplication of investment.

The study of the green energy system is mainly based in the Refining Research Institute in Chiayi and the Green Energy Research Institute in Kaohsiung. Chiayi uses the vast land of the demonstration station to develop soft carbon for a long time, combined with the technology of Delta Electronics to make green energy container houses to electricity. Self-produced and sold as a target to make large-scale energy storage system equipment. However, the Tainan demonstration station uses the all-vanadium liquid flow developed by the Green Energy Research Institute. This is a new technology that can store a considerable amount of electricity, but the volume is relatively large, so a special basement is needed for storage. The current demonstration time has not yet been able to assess the benefits of the two demonstration stations, but I look forward to the CPC plan in the eastern and western construction demonstration stations this year, they plan to use different renewable energy systems. So that when the future gas stations need to face major reforms, they can be screened and applied.

Section four: government policy

After interview these seven key stakeholders, I found that the main factor effect the transformation plan is government policy. According to the respondents, because the government's stance on energy policy is wavering, there is a lower investment willingness of the owners. In addition to the rotation of political parties, after the change of the governors, the people who make government policy decisions are different from those who execute them. Therefore, energy politics cannot be implemented. Since the policies related to renewable energy have only begun to be formulated in recent years, many laws and regulations on new energy have not yet

been revised. For example, the bill for the addition of renewable energy to special land has not yet passed, and the plan for private gas station produce and sell electricity did not pass the electricity industry law. The hydrogen-related laws are also in the drafting stage. These will delay the transformation of the gas station, because the development of the industry must be based on legal policies. With the stable and long-term support of government units, the major industries can follow the footsteps of the government.

The government's policy is inconsistent

Respondents mentioned that our government policy is constantly changing. That would make related industries afraid to make the investment of EV and CS.

If the government is ambiguous, the businessman wouldn't willing to invest because the purpose of the business owner is to make money. Therefore, I think that the most important factor affecting the transformation is the unclear attitude of the government, and the policy as to make a model rather than actually implemented.

-CHIN-CHIH,HSU, Chairman of the Yunlin County Gas Station Association

Then the changeable policy is owing to the government's attitude of EV development is unclear. Because they have to take care of all the industries' development. That make them hard to make each industry satisfy.

Now the government has suspended the policy of prohibiting the sale of fuel vehicles in 2035. This will cause our gas station operators to have an influence on the mood of setting up green energy equipment. Now CPC only working on a project, working with Gogoro to set up the exchange of charging.

-FU-HONG,WANG ,Green Energy Committee of the Gas Station Association

Respondents' attitudes toward government-related policies are disappointing, because policies are constantly changing. Compare to my discussion of other countries policy in my literature review, our policy still has a lot of room for improvement.

Norway uses a large number of electric vehicle subsidies to provide many discounts for electric vehicle users on the tax and the use of road rights. It also clearly shows that the country is targeting EV development, so that many people buy EV, and related private enterprises have also actively to invest in the EV industry.

Policy and impact: prohibition of fuel car

The development of EV would impact on various related industries. So when the government decided to ban the sale of fuel vehicles, most industries began to protest, but this directly affected the decision of the government.

> *EV may affect the livelihood of thousands families. So the first reason for those motor manufacturers protested the policy is because they have not found a countermeasure. The second is that their industry are originally profitable. The third point is if it is not the national units do it, they will have a big burden on them.*
>
> *-Ph.D. and Project Manager of CPC Refining Institute*

Then the respondents were also very distressed by the traditional industries that protested. Because the government did not provide any subsidy program for the transformation, or assisted the relevant traditional industries to make the transformation of electric vehicles. So once the fuel vehicles were banned, most of the profits of traditional car manufacturers will be greatly affected.

These operators have come to the government to suspend this policy. These operators are helpless and that government policies have not been implemented. The government didn't do anything to protect these transitional industries.

- CHEIN TAI, Chairman, CPC Corporation, Taiwan

Respondents mentioned here that the traditional factory protested the policy of prohibiting the sale of fuel vehicles in order to maintain the original profit. However, I think the government should solve this problem by providing other supplementary policies instead of directly canceling the original announcement.

The timetable for countries to ban the sale of fuel vehicles has been set. Even some developing countries have earlier schedules than ours. This is an international trend and must be done in the next few years. Therefore, the government is necessary to provide assistance in the transformation of traditional industries. Suspension of policies can only resolve protest disputes in the short term, and it is not a long-term solution. Then again, if government haven't enacted complete laws on gas station transformation, how can they value the protection of transitional industries?

Part of the bill is not complete for transformation

1. Taiwan's Electricity Liberalization Act

Respondents mentioned that some of the relevant regulations in Taiwan have not made any changes in the transition. Because the changes in policies and regulations are very complicated, it will be time consuming to update. However, part of the electricity industry law has affected the transformation plan because government stipulates that the relevant industries cannot sell electricity privately. This will make the power created by the smart green gas station no way to be used as a profit for the gas station itself, to provide electric vehicle charging.

CPC wants to achieve the community micro-grid, but the government's electricity liberalization law has not yet passed, that is to say, our private enterprises cannot sale electricity. We are different from the condition of CPC, we must take commercial interests into consideration.

-FU-HONG, WANG, Green Energy Committee of the Gas Station Association

2. Hydrogen Vehicle Act

The hydrogen vehicles are the most pollution-free renewable energy vehicles. Therefore, some gas station operators are very keen to promote this transformation. Then Japan has successfully developed hydrogen stations and hydrogen energy community. Also, they has formulated relevant regulations in the management of the cleaners. So we can follow the footsteps of Japan and learn about their system of energy policy.

The hydrogen electric car that Japan used is hydrogen with power. Japan now has 43 hydrogen refueling stations, so I hope our governments can focus on the direction of the energy in the future, to set a clear goal, go to the front of the world.

- LI,JIE-XUN, Chairman of the National Federation of R.O.C Gas Station Association

Respondents also mentioned that there is no way to implement the hydrogen-related laws in Taiwan because hydrogen is different from the management of gas stations, and people are generally worried about hydrogen vehicles and related systems.

In Taiwan, hydrogen is now managed by the fire station, and the gas station is managed by the energy bureau, so it is two different authorities. It is actually more difficult to coordinate this cross-unit. Therefore, Taiwan's current energy policy has always encountered bottlenecks. It involves the construction of the transport of hydrogen to the hydrogen refueling station and the safety of the

hydrogen tank. We does not have such a specification.

- Ph.D. of CPC Green Energy Research Institute

Besides, the hydrogen vehicle act also impact on the development of the transformation plan. Because, we cannot import and install hydrogen systems in the gas station. However, hydrogen still exist some risks, that need the technicians to verify its safety.

In the case of fuel cells, it uses natural gas, but it will have an intermediate of hydrogen in the middle process, but the renting unit of the gas station is the energy bureau, hydrogen isn't their responsibility. They would said that don't put it at the gas station before you have yet to clarify the powers and responsibilities. We are now facing the national policy forbid to build, so we need to verify that there is no problem with these security implementations.

- Ph.D. of CPC Green Energy Research Institute

3. EV plug specification

The lack of standardization of EV plugs will cause most EV manufacturers have no way to do more production. Then there didn't have diversity charging station settings. So we need the government to provide a unified plug specification, to give the major EV manufacturers the convenience of future EV development.

The main reason that no one to be interested in EV is government does not stipulate a unify plug. Because the government does not have a unified charging plug, so the charging plug of each of our brands is different.

-FU-HONG, WANG ,Green Energy Committee of the Gas Station Association

4. Pollution problems

Respondents mentioned that he raised the issue of air pollution to the government, but did not get results. Therefore, he suggested that we can promote Japan's renewable energy hydrogen to create a zero-pollution environment.

I asked the Energy Bureau about the pollution problem. He said that there are no relevant laws and regulations. We have to learn from Japan and some European countries because hydrogen is completely zero-pollution.

- LI,JIE-XUN, Chairman of the National Federation of R.O.C Gas Station Association

Because the battery of the EV will also cause the environment pollution. Although it emits less exhaust gas than ordinary fuel vehicles, its waste battery has become a burden on the earth if it has accumulated a lot.

The above four kinds of bills are based on the respondents' response to the policy, then I think these policies are currently eager to revise and upgrade. With the development of renewable energy, many methods for building new energy sources are still unclear. This will hinder the transformation. Of course, a policy to change or increase requires a lot of complicated processes and discussions, so the gas station transformation is a necessary path, but it has to takes a long time to complete. However, renewable energy regulations is necessary to clarify the management units and construction specifications for new energy sources, and to uniformly use the same charging joints. These all would affect whether the renewable energy-related industries can achieve mass production.

Section five: respondents' advise

Transformation is a trend. It is aimed at effectively combining green energy and guiding the development of the industry. Under the reports of many media, some CPC plans have been over-beautified. Some governments and CPC policies still make the

outside world unable to understand their future plan. The trend has led to the traditional industry becoming flustered. The gas station industry don't know which direction to go. However, during the interview, I learned that CPC is implementing some construction for the transformation, but the franchise owners did not know, I think this is a big problem. Because the information is not equal, the relevant industries do not have an accurate development goal, and the government has not expressed its position, resulting in the result of the current transformation staying in place. Therefore, the following summarizes the suggestions and views of respondents in different fields for the transformation, gives a unified direction for transformation, and discusses how the transformation should be improved at present.

Governmental support

The respondent cannot get equivalent information in the process the transformation plan. Sone of the gas station's owners were hesitated to the stages of the transformation because they didn't get the current development conditions of the transformation plan.

> *I hope the information should be transparent. Then we have a specific goal to cooperate with them. If their attitude is unclear, we do not have enough financial resources to develop green energy. Unless there is a lot of enthusiasm on EV in the market, but the Executive Yuan itself said that there is no need to stop selling fuel cars, and many manufacturers will suspend the transformation.*

-CHIN-CHIH, HSU, Chairman of the Yunlin County Gas Station Association

Then CPC's action of the transformation plan are inconsistent. Moreover, the changeable policy make those responses don't want to invest in the EV industries and build the CS.

In fact, the government has to support it. If the private sector willing invest, the government should provide some loose funds and time. At that time, we wanted to say that when CPC was doing, we could also do some education cooperation together. As a result, the whole case of CPC stopped.

-FU-HONG, WANG ,Green Energy Committee of the Gas Station Association

The government not only make the policy changed but also changed the chairman of CPC, who played an very important role in the transformation plan. However, the suddenly substitution would made most of CPC employees as a loss.

I hope that the government's energy policy should be consistent in the future, changed a chairman, and changed a policy, the confidence of employees is also decrease. When the policy be announced, everyone worked hard, so we said that our gas station also hopes that the chairman of CPC can implement the CPC company's policy.

- LI,JIE-XUN, Chairman of the National Federation of R.O.C Gas Station Association

Except for the government policy, the cost of renewable energy systems is also a problem. The blueprint of CPC is plan to transformation into the micro-grid community. Then that construction need to spend lots of money. Even the transformation plan need to make the EV usage widely, the cost and land area for setting the energy systems is still need to be solved.

It is recommended that the government reduce the construction cost because the energy storage battery of renewable energy is very expensive. Each station is not really suitable for putting those batteries. Because the land is not big, there is still a long way to go.

-Ph.D. and Project Manager of CPC Refining Institute

During the interview, the operators of the gas station mentioned the changes in the attitude between the government and CPC. With the change of government policies, the relevant measures for the transformation of CPC also changed.

> *At the beginning, it seems that CPC will build a thousand CS. However, it is not known whether it changed because the policy of prohibiting the sale of fuel vehicles in 2035 is suddenly suspended. The instructions were very enthusiastic in the first half of the year. They were also investigating with our industry and willing to install the CS.*

-*CHIN-CHIH, HSU, Chairman of the Yunlin County Gas Station Association*

Gas station operators have limited financial resources. In the huge plan of gas station transformation, the owners have no way to complete the project independently, thus highlighting the importance of the government. However, the current policy swing may affect the investment and development of many related industries, because the people cannot predict the direction of future policies. Therefore, government units should transparently provide subsidies and resources to owners, so that operators can have the right to know.

They can keep pace with the government and accelerate the transformation. In addition, the chairman of the CPC was replaced in the government's initial stage of transformation, the demonstration station has just been established. This is also a big problem. The chairman is the most important role and implementer in the transformation plan. In the absence of warning, the substitution will make the gas station franchisees and CPC employees completely as a loss what to do. That's what we need key stakeholders' advice on the transformation plan.

Green energy group normalization

Chairman of the CPC mentioned the Green Energy Group during his tenure. He said that it was a temporary group set up for the construction of a smart green gas station. However, after he left, he found that the group should be changed to the normal group. Then go to make more constructive research on the green energy program.

Before I went to CPC, there was no green energy layout. I was the first one, so I thought the green energy group that I founded is a temporary group, that is, the task needs to be compiled, so I hope I can make it normal. In addition, two research institutes doing this battery should be able to deepen the research talents in this area.

- CHEIN TAI, Chairman, CPC Corporation, Taiwan

In addition to the adjustment of the Green Energy Group, respondents also mentioned the importance of new energy. Because energy development needs to keep pace with the times, and CPC itself is an energy company, it needs to continue to develop new energy sources.

Develop new energy

Respondents mentioned that CPC has not had a significant construction in the past seventy years of green energy transformation, so he suggested that CPC make more progress and changes in energy transformation.

CPC is not only selling oil, but selling natural gas, they are an energy company and should develop some new energy. They can sell oil for seventy-three years, but what can they sell in the next seventy-three years? So you must find new energy.

- LI,JIE-XUN, Chairman of the National Federation of R.O.C Gas Station Association

Because of the comparison with Japan's energy development, many companies are hoping to move toward Japan, hoping that the government can actively explore new energy sources and improve Taiwan's living quality and environment.

CPC has not undergone a major transformation in its business for the past seventy-three years. This will leave no room for improvement in the entire industry. Therefore, as a part of CPC, gas station franchisees hope to make progress and the development of the industry can be extended.

CONCLUSION AND DISCUSSION

My data analysis shows different aspects of transformation and all of the data can divided into five part: motivation and development of transformation, smart green gas station, and government policy and respondents suggestions. These five part can be integrated to response to my research questions. Then I can through the responses to access the feasibility of the smart green gas station. All the petrol stations related to CPC, has 621 stations, and there are more than 1,300 stations in the franchise station. Therefore, CPC is an important sector for providing energy and gas in Taiwan. The gas station transformation need gas stations owner, CPC and government make the alliance to move on together.

Discussion issue one: Main problems that obstructs gas station transformation

The respondents all mentioned that government policy is the main problem to accomplish the transformation. For instance, our government previously announced that they would follow some developed countries like Europe and the United States to ban petrol and diesel cars in the interval from 2035 to 2040. However, the target was suddenly suspended. One reason could be pressure to delay transformation from industries that depend on the status quo. The changeable policy cause related industries unwilling to invest in. In addition, the infrastructure and basic regulations haven't enacted, that made the smart green gas station cannot implement completely. Policies change when different political parties are elected into office. Policy visions may also change with different heads of government. These are the main problems when facing the transformation.

Discussion issue two: Overcoming challenges to transformation

Respondents indicated that Japan's energy policy and transformation plan is worth observing. They already made some regulations like put the hydrogen station at the gas station should build the middle wall, and far from the road. There are actually several regulations and technical applications that we can refer to. Therefore, we can follow the step of Japan when we making the transformation. Moreover, batteries are expensive, and the traditional motor shop didn't familiar with the battery, that make the whole price of EV higher. Therefore, CPC indicated a plan to separate the car and battery. Then, CPC and gas station owners all expect to accelerate the transformation because it's the future trend. So when they positive negotiate with the government and settle this problems, these difficulties might be overcome.

Discussion issue three: future direction of transformation

CPC placed different renewable energy in the two smart green gas stations because the purpose of each demonstration is different. Then it is said that they will test how stable this is, the ultimate goal is make all the electricity become their own supply. Then CPC announced that it will continue to build demonstration stations in 2019 and 2020, indicating that the construction of the smart green gas station will be permanent. In addition, with the trend of electric vehicles in the global market, charging stations and infrastructure will gradually increase, and the government and traditional industries must also adapt to the development of the market. When the government is willing to actively invest in the development of transformation, the transformation will be half successful. Gas station owners are currently actively coordinating with government units because they have to take into account their main benefits. The blueprint for CPC's future is to plan the community micro-grid, plans to

transform the gas station into an energy station, and use green energy to supply the public's needs. However, gas stations need oil and electricity to coexist for a long time. After eliminating all petrol and diesel vehicles, they can completely use green energy and electricity as their main business products.

I think the two smart green gas station pay an important role in the whole transformation plan. The research topics of the two research institutes of CPC are completely different, because the refining research institute is in Chiayi, they doing the material of the lithium battery, therefore, the Chiayi Xinyi stations system are related to lithium batteries. Then Tainan is used the project developed by the Green Energy Technology Research Institute, such as fuel cells, solar energy and vanadium flow batteries, because the two institutes go individually design and planning. After all demonstrations are accomplished, CPC and researchers can find out the suitable one to employ on future gas station.

Discussion four: the feasibility of widespread adoption of smart green gas stations

The government is also considering where the CS is going to be put in for public to charge, so the Industrial Bureau has to do a thousand charging station within three years. In order to make the people more convenient to use, CPC received this case and promised to accomplish as soon as possible. When CS installed extensive, the feasibility of smart green gas station would increase. That would be the first step of the transformation. Then the transformation need to be implemented, that need the government’s support. After I interviewed the interviewees, I found that there was a big problem with the communication between the gas station owner ,CPC and the government. Some of the owners mentioned in the interview that CPC stopped almost

all transformational actions after the government's intention changed. However, the technicians of CPC stated that they are continuing to design and develop the demonstration station technology and will launch the battery of the CPC brand next year. In addition, CPC itself has signed a cooperation agreement with the part of motor factory, and plans to launch EM together. In the process of transformation, the owners did not get the equivalent information. Therefore, they are disappointed with the transition and have chosen to give up their investment.

However, CPC's actions for transformation are also inconsistent, and the company's internal information is not clear enough. This will cause most people to have a guess of the transformation and feel powerless. I think the feasibility of the transition is high because Taiwan has excellent technology and has been successfully developed in terms of batteries. Now there is market acceptance and public acceptance, but these will gradually improve with economic growth and technological progress. Therefore, I believe that what we have as citizens is capable of transforming gas stations is to support the development of EV. And urge the government to actively implement the policy of commitment to the public. Consider green energy as an important part of the country then make the contribution to improve the global environment and improve people's living quality.

APPENDIX 1

Table 1. Interview Agenda

DURATION in MINUTE	TASK
2	**CANDIDATE INFORMATION COLLECTION**
1	Informed Consent Form
8	**INTRODUCE INTERVIEW PURPOSE**
2	Research Subject-Gas Station Transformation with EV
2	Interview purpose
4	Asking if there have any questions before the interview
20	**BACKGROUND QUESTIONS**
5	Interviewers Background
5	Work Period
10	Standpoint of the transformation
30	**TRANSFORMATION DEFINITION AND EXPERIENCE**
10	**Explain/Clarify for Transformation and Ask for Solution**
10	**Government Policy**
10	**Propose Method**
30	**DEMONSTRATION STATION QUESTIONS**
15	Different Renewable Techniques
15	Related Reports and News Release
20	**FUTURE DEVELOPMENT**
5	**Advantages and Disadvantages of using renewable energy**
10	**Feasibility of Transformation**
10	**Outside Circumstance**

APPENDIX 2 Semi-structured Interview Protocol

Background Questions

·Tell me a little about your background.

1. How long have you work at CPC/gas station?
2. What is your position? Why did you decide on that position?

Transformation Definitions and Experiences

My research subject is about key stakeholders' opinion on the transformation plan, because the CPC's transformation plan was launched during 2018 to 2019, its still new and in the development stage. I'm wondering whether it can be achieved and how about its risks? I think this transformation plan has different meanings to different people. Can you describe for me, in your own words, what is to you and how do you think about this issue?

1. Where did you learned the transformation plan?
2. What do you plan to do when the transformation develop?
3. What's the relationship between you and new energy develop?
4. What kinds of field you involved in so far?

·How would you describe your role in the process?

·Tell me a little about your standpoint. Whether you stand by the transformation plan? Why? What about the benefit /loss if the gas station transformation successfully?

·Do you have any concerns/worries about electronic vehicle used in the future? What are they?

1. Describe which stage the transformation plan developed now.
2. What kinds of way to make the transformation work out?

·Do you think the government policy would affect the transformation plan?

1. If yes, can you describe what kind of policy?
2. Do you feel most government policy would make the positive or negative affect on the transformation plan? Why?

·If one of your work is to propose the method in the transformation plan, what do you think you might propose?

·What do you think are the advantages and disadvantages of using EV?

·Are there any limitations to combine gas station with EV charging station? If so, what are they?

·Why do you think the gas station can setting renewable energy? (What kind of renewable energy can be established in gas station? What was their goal in using these infrastructures? What are the results of using them?)

・There are a lot of different renewable techniques that CPC use in Chiayi and Tainan demonstration station. In light of new release, these two demonstration stations' electricity is made up of three sources: solar, natural gas and Taipower. As CPC's R&D team is continuing to introduce the following energy sources. I'm going to list some of these, and I would like you to tell me if you would consider these techniques to be useful techniques and why (and/or what would have to change in these utilize situations to make them profitable).

1. Solar power generation
2. Wind power
3. Lithium-ion battery energy storage system
4. Smart EMS Energy Management System
5. Natural gas power generation
6. Energy storage battery
7. Lithium battery
8. vanadium liquid flow battery

・I read some new reports describing energy transformation as….. What do you think? I want you to tell me if what you saw is feasibility or not and why you think it is or isn't (and/or what would have to change in these situations).

Future Development

・In general, how do you think the transformation plan's feasibility? Is there exist any risks or not? (What will be your goals in using it? What will motivate you to use it? Keep you from using it?)

1. Can you describe other outside circumstance that might influence the plan?
2. What do you think are potential problems of the transformation plan in the future?
2. Can you give me some actions or advices for CPC to utilize in the plan?

・For the next few questions, I would like you to think as a transformation developer.

・From a developers' perspective, what do you think the advantages are of using renewable energy in gas station? Disadvantages?

・How can you make the charging station widespread base on a profitable method ?

1. Are there any methods in your field that you could carry out? What are they and what makes them hard to be achieved?
2. Are there times or circumstances in which you would prefer the gas station combine with charging station? In which you don't want?

APPENDIX 3 Interview Consent

參與研究訪談同意書

_____先生/小姐：

您好，首先非常感謝您同意我的訪問，在訪問之前，有關於此研究的詳細內容以及您的權益必須先與您說明。

我是文藻外語大學國際事務系三年級的學生—許珈愷，我的畢業論文題目為：「加油站結合電動車充電站轉型的可行性分析—與關鍵利益關係人之深度訪談」。本研究的目的是要探討加油站在政府政策以及中油決議下最終會產生的轉型計劃為何？以及中油和業者本身對其轉型的看法。

本研究採用深度訪談法，訪談時間約為一小時。同時，為了避免資料遺漏以及方面資料統整分析，希望您能同意訪談過程中全程錄音。但您可放心，錄音內容僅作為研究者分析資料、編輯與編碼使用，不會將訪談內容對外公開或是透露至第三人。此外，基於保護受訪者之義務，您的姓名及個人資料將一律隱匿不公開，改以代號或暱稱稱之，以確保您的資料不會外洩。因此，希望您能提供真實的意見，以增加研究資料的正確性。

訪談期間，您隨時有權利要求或選擇退出，且沒有義務告知原因。訪談過程中您有權利決定回答問題的深度，面對不想回答的問題也能拒絕回答，亦有權利隨時終止錄音及訪談。若您對本研究有任何意見，歡迎隨時提供。

論文完成後，研究者將會寄送一份研究摘要及訪談後資料整理給您，若您同意以上內容，請您於下方簽名。在此誠摯歡迎與感謝您參與此次研究。

文藻外語大學國際事務系三年級學生 許珈愷
E-mail: azsx9079449983@gmail.com

☐ 以詳閱過上述的說明，也了解相關的細節與受訪者權益，因此同意受訪參與本研究。

受訪者：_____（請簽名） 日期： 年 月 日

☐ 同意研究者使用訪談過程中的所有內容

受訪者：_____（請簽名） 日期： 年 月 日

研究者：_____（請簽名） 日期： 年 月 日

Questionnaire for the Interview

您好，我是就讀於文藻外語大學國際事務系三年級的學生許珈愷，目前正在撰寫畢業論文，我的題目為—加油站結合電動車充電站轉型可行性分析，在文獻的彙整中，我發現各國針對加油站結合充電站及綠能轉型的案例較少，大多數充電站皆是各國各大廠牌自立門戶發展，然而台灣因為地緣關係，加油站數非常多，因此很適合結合充電站建設，再加上政府近期推動的能源政策，促使中油積極推出綠能示範站。但加油站轉型為 2018 年才開始有大幅動作，且政府立場不定與需要投資大筆金額，因此我開始好奇轉型的可行性，希望能透過幾位關鍵利益關係人去清楚得知轉型方案的細節，以及轉型會遇到的機會與風險，並且根據不同角度及立場的相關從業人員，去進行轉型的深入評估。此外，收集到的訪談內容僅會採納進本研究著之畢業論文研究中，請您安心，並且感謝您的參與。

以下訪談提醒：

1. 訪談時間約為 45-70 分鐘
2. 以便後續資料編碼及分析，此訪談將全程錄音。

一、受訪者背景：

1. 能否訴說一下您的工作職稱及背景？
2. 請問您從事相關領域工作多長時間？
3. 請問您目前從事的領域種類為何？

二、轉型定義及經驗：

· 我的研究主題是關鍵利益關係人對轉型計劃的看法，因為台灣中油公司的轉型計劃是在 2018 年至 2019 年期間啟動的，它是一個新的計劃，並且正處於發展階段。我想知道它是否可以實現以及它的風險如何？我認為這個轉型計劃對從事不同領域工作的人有不同的含義。我希望您能以您的立場訴說，您怎麼看待這個問題？

1. 您是從哪裡得知到轉型計劃的？
2. 請描述轉型計劃現在發展的階段。
3. 使轉型運作的方式有哪些？

· 您認為政府政策會影響轉型計劃嗎？

1. 如果是的話，您能說出什麼樣的政策嗎？
2. 您認為大多數政府政策會對轉型計劃產生積極或消極影響嗎？為什麼？

· 您認為使用電動車的優缺點是什麼？

· 將加油站與電動汽車充電站相結合是否有任何限制？如果是，他們是什麼？

· 為什麼你認為加油站可以設置可再生能源？（加油站可以建立什麼樣的可再生能源？他們使用這些基礎設施的目標是什麼？使用它們的結果是什麼？）
· 中油在嘉義和台南示範站使用了許多不同的可再生技術。根據新發布的消息，這兩個示範站的電力由三個來源組成：太陽能，天然氣和台電。由於中油的研發團隊正在繼續推出以下能源。我將列出其中的一些內容，我希望您告訴我您是否會將這些技術視為有用的技術以及為什麼（和/或在這些利用情況下必須改變哪些以使其有利可圖）。

1. 太陽能發電
2. 風力發電
3. 鋰離子電池儲能係統
4. 智能 EMS 能源管理系統
5. 天然氣發電
6. 儲能電池
7. 鈦酸鋰電池
8. 所有釩液流電池

· 我看了一些加油站轉型的報導，新聞媒體在相關報導中提出：

1. 台灣中油戴謙董事長表示:「中油要扮演落實電動車政策的領頭羊，未來加油站也會變身為商業平台，為此中油已組成專案辦公室，包含 3 年內在加油站及公共場域完成設置 1000 座電動機車充/換電柱，並導入大數據、智慧化、物聯網等新興應用，建立微電網，轉型綠能加油站，成為社區多元能源補給站。台達除了在本案中提供儲能系統，更擁有適合用於智慧電網的能源基礎設施解決方案，未來應會是中油重要的策略夥伴之一。」
2. 透過現階段兩座綠能加油站的開幕，除了大力展示中油的電池研發技術，以及加油站轉型的企圖，更重要的是以國營企業之力，扶植產業發展，攜手國內業者友量科技生產電池，也協助車廠作轉型。雖然中油清楚勾勒綠能加油站的藍圖，仍有待實際運作，透過逐步修正問題，降低消費者使用摩擦。

我想讓你告訴我報導內所提出的是否具可行性以及原因（和/或在這些情況下必須改變什麼）。

三、轉型立場：

<u>針對加油站業主</u>

1. 針對今年中油提出轉型計劃的看法。告訴我一些您的立場。您是否支持轉型計劃？為什麼？加油站轉型成功後的利益/損失為何？
2. 您對電動車的逐漸成長有任何疑慮/擔憂嗎？是什麼？
3. 轉型目前正在進行中，但隨著近期政府政策意向的改變，會對轉型產生怎麼樣的影響？然而轉型計劃的起伏，會不會改變你對轉型的看法與支持度？

4. 目前中油陸續於嘉義、台南增設綠能示範站，以示範站的規模及雛形，是否有辦法真的發揮綠能發電的功效。
4. 以你的角度以及立場，轉型是機會還是風險？若是風險，那以你的角度以及立場，你會為了延續石油的產業及多元發展去承擔風險，還是會選擇維持不變？為什麼？

針對中油公司

1. 針對今年中油提出轉型計劃的看法。告訴我一些您的立場。您是否支持轉型計劃？為什麼？加油站轉型成功後的利益/損失怎麼樣？
2. 轉型目前正在進行中，但隨著近期政府政策意向的改變，會對轉型產生怎麼樣的影響？然而轉型計劃的起伏，會不會改變你對轉型的看法與支持度？
3. 以你的角度以及立場，轉型是機會還是風險？若是風險，你會為了延續石油的產業及多元發展去承擔風險，還是會選擇維持不變？為什麼？
4. 示範站跟充電站是會持續增設的嗎？
5. 中油本身有在研發電動車電池的部分（鈦酸鋰（LTO）電池），它本身使用到量產階段有存在多少風險跟可行？
6. 中油聲明會建置一千座綠能加油站，做到電力自產自用，但是加油站本身用電加上提供電動車充電的用電是有辦法用綠能來完全取代台電的嗎？加上綠能（風力、太陽能等）發電機成本有沒有辦法達到目標效益？
7. 目前中油積極推動綠能轉型，從發展至今您對它實際運作情況的看法是什麼？

四、營運及獲利：

針對加油站業者

1. 轉型會影響到營業及獲利模式，若未來成功轉型，預估你的站加上環境影響，獲利會提升還是下降。
2. 轉型後許多加油站會陸續延伸出副業（如：咖啡廳、無人便利商店等），也會增設充電站與自助加油，相信這對營收是有所上升的，那相對的成本也會提高，營業模式已經動線規劃也需要重新規劃，那對你來說這是你會想嘗試的嗎？
3. 會不會想在近期嘗試充電站的設置？搭配電動車品牌會有什麼行銷策略及方案？
4. 與電動車廠牌的接洽及篩選

針對中油

1. 轉型會影響到營業及獲利模式，若未來成功轉型，若預估你的站加上環境影響，獲利會提升還是下降。

2. 中油目前正在進行天然氣的天然氣重組系統，把天然氣轉換成氫氣作為燃料電池，過程中產生的熱能則可產製熱水，提供加油站宿舍自用。目前仍在驗證階段，若未來能成功推廣應用，將可拓展中油天然氣業務，那現在中油天然氣的應用是發展到哪個階段，未來拓展天然氣業務的獲利有多少？
3. 一旦中油綠能加油站轉型成功，會給中油公司本身帶來什麼樣的經濟效益？與電動車廠牌的接洽及篩選基準是什麼？(您對未來使用的電動汽車有任何疑慮/擔憂嗎？是什麼？)

五、轉型未來發展前景：
· 大體來看，您如何看待轉型計劃的可行性？是否存在風險？
· 你能描述一下可能影響計劃的其他外部環境嗎？
· 您認為未來轉型計劃的潛在問題是什麼？
· 從您的的角度來看，您認為在加油站使用可再生能源的優勢是什麼？缺點是什麼？
· 如何以充足利潤的方式使充電站普及？
1. 您的領域是否有任何方法可以執行？它們是什麼以及它們難以實現的原因是什麼？
2. 您針對加油站轉型有什麼建議可以提供給中油？

以上訪談內容結束，謝謝您的參與及討論。

Written Documents of Interviewees

訪談對象: 台灣中油公司前任董事長(至 2019 年 3 月)-戴謙
訪談日期: 2019/07/17
訪談時間: 13:00-15:00
訪談地點: 台南裕農路加油站
受訪者願不願意在論文當中使用真名: 願意
受訪者的 diversity:

1. 國立成功大學生物科技研究所教授兼所長（1998 年 8 月－2000 年 1 月）
2. 國立成功大學生物科技研究所教授（2001 年 1 月－2006 年 7 月）
3. 南科籌備處主任（2000 年 1 月－2003 年 1 月）
4. 南科管理局局長（2003 年 1 月－2006 年 7 月）
5. 行政院國家科學委員會副主任委員（2006 年 7 月－2007 年 8 月）
6. 南台科技大學校長（2007 年 8 月－2017 年 11 月）
7. 台灣中油公司董事長（2017 年 11 月－2019 年 3 月）

三、轉型定義及經驗：

· 我的研究主題是關鍵利益關係人對轉型計劃的看法,因為台灣中油公司的轉型計劃是在 2018 年至 2019 年期間啟動的,它是一個新的計劃,並且正處於發展階段。我想知道它是否可以實現以及它的風險如何？我認為這個轉型計劃對從事不同領域工作的人有不同的含義。我希望您能以您的立場訴說,您怎麼看待這個問題？

Q1. 您當初怎麼會想要用綠能科技結合轉型計劃的？

中油本身是國營事業,所以中油有幾個任務,第一個任務就是照顧國民生機,就是說不能切油,大家每天要加油,所以每天都要有油的供應,這是第一個,那第二個就是配合國家政策,妳剛才看的這個影片中,國家的政策是怎麼樣?2030 年加油的 bus 就不能賣了,2035 禁售燃油機車,可以開就是不能賣了,那 2040 汽車不能賣了,這是國家政策,中油第一個要照顧國民生計,來加油不能沒有油、油價不能太高、要國際佈局等等,這些都是中油國營事業的任務,那第三個就是要扶植產業、幫忙產業發展,以台灣的產業來看的話,台灣的汽車在國際沒有競爭力,但以移動性的車輛,台灣在世界裡面最有競爭力的是摩托車,台灣的摩托車從生產到銷售是獨立的,不用靠別人,我車做出來我銷越南、銷印尼、銷歐洲等等,都做得到,這個產業他是不必依賴任何一個國家的,而且台灣在這個產業發展的非常亮眼,東南亞國家摩托車都是我們的市場,光是我們台灣就有一千三百萬台摩托車,這些摩托車從頭到尾都是我們台灣自己的摩托車公司做的,我們的加油車在好幾十年前就已經為國家為事業賺很多錢了,但是現在整個世界在都

在說移動性汙染源，全世界罪大惡極的汙染就是移動汙染源，就是車子，再往前面追朔就是化石能源，煤炭、石油等，中油所賣的東西就是製造污染的原料，所以對於我們的環境品質一直下降，中油不是最大的貢獻者大概也是前幾名!所以在這樣配合國家政策，還有中油的三大任務裡面，站在前三規劃，full side 的這個規劃裡面，我們中油的這個政策應該做甚麼樣的事情呢?這是一個中油的領導人要去想的事情,站在一個中油國營事業的領導人,我要有前瞻的想法跟規劃,所以一方面是三大任務，民生所需，不可以斷也不可以貴，再來就是扶植產業發展，現在扶植產業發展就像 Gogoro，他們本來就不是做車的，是在做電腦的，他們老闆跳出來說要做電動車，直接做電動車沒有問題，但是 KIMCO、三陽、宏佳藤、Yamaha 他們都是傳統的，他們做的東西要賣出去還是在國內生產，主要是要有中油的這支加油槍插下去就可以走了，但是以後這就不能賣了，他們以前做的好好的，他們本來在國際上是有競爭力的，那你現在國家有沒有照顧他們?國家有沒有協助他們?這是總統要去想的,不是我站在中油董事長要去想的事情,我是替蔡英文在想，到最後的時候她說戴謙下台，中油的工會就說董事長不務正業，要做電動要做電池，我是替總統在看前瞻的事情，整個世界你看中國大陸，人家專制國家是一聲令下，說改就改了，我們還在那邊 2040，我們是一個民主，我們是漸進，這個都可以接受，但是你如果現在不準備的話，現在 Gogoro 所有的電池都是 Panasonic 供應的，KIMCO 跟光陽是 LG 供應的，剩下的都還沒做，本來這個產業是獨立自主的，是可以跟國際競爭的，現在開始變成別人附屬的產業，Gogoro 如果沒有 Panasonic 的電池它的車會跑得比我們慢，台灣如果所有的產業都被別人控制住的話,台灣的競爭力在哪裡?所以我們跟三陽合作的時候，我就說我們來做中油牌的電池，你現在不做，要等到 2035 年才做嗎?如果現在就已經有中油牌電池,我們何必去煩惱呢?何必去研究呢?所以為甚麼我會提能源轉型，智慧綠能加油站，現在不管你家電池家裡充也好，要開出來外面要換電、充電也好，大家都習慣，我要能源要去加油站找!而且加油站第一是大家熟悉的地方，第二，它本來就可以在供應能源上去做轉型，全部跟中油有關的加油站，中油自己有六百二十一站，加盟站有一千三百多站，全國有百分之八十的加油站是跟中油有關，百分之二十是跟台塑有關，現在我們中油的產值，百分之四十九是來自於油品銷售，以後都變成電動車，沒有油品你要賣甚麼?所以現在大家想說 2035 還要很久，還要十六年，你現在都沒有準備，我們現在有電池公司，但是你去跟他分析都是虧錢，都在燒錢，不然就是跟外國合作，供應它們材料，我在中油裡面特別成立的那個綠能小組，歐嘉瑞來當董事長以後馬上把綠能小組解散。

Q2. 要往新南向發展的部分要怎麼去做?

新南向是一個好的發展，是一個可以去布局的一個方向，我覺得新南向是台灣現在唯一可以選擇的一個路，但是政府現在沒有一個做法，所以新南向要像中油，組一個石化聯盟，然後跟印尼的國營事業合作，我們已經講到他們印尼的國營公司跟中油，他們 49%我們也 49%，我們已經找了一個國際公司，他是台灣人然後

註冊在新加坡，然後我們已經講好了 2%是國際公司，他要靠哪一邊就哪一邊擁有經營權，我們就是規劃這 2%給國際公司去投資，那現在發展到怎樣我就不知道了，因為現在董事長換歐嘉瑞，我們當初去見他們統籌事業部的部長，他們有行政院，他們有五個部，裡面最大的部就是統籌的部長，聽說現任歐董事長跟代表處有去談，這當然董事長要做，因為這是大的合作，但是現在就是國情、人力這些都是問題，所以新南向是一個好的政策，但是要正確的政策作法，國家的力量整個投注進去，但是要用到國家的力量集注的時候又會觸及到國家 WTO 的補助條款，他們講的是要大家公平競爭，不能後面的成本是國家來幫忙付，這是不行的，但是回歸本身，我們不要認為我們是海島國家，我們要認為我們是海洋國家，海洋國家沒有一個地方是我們不能去發展的。

Q3. 將加油站與電動汽車充電站相結合是否有任何限制？

如果講加油站的模式，我在台南前鋒站還有嘉義的信義站，信義站就是一個模式，我們用台電的電，產生電浪費最多的是尖峰的時候，所謂浪費就是說你的電發電卻在沒有用的地方上損失掉，怎麼樣損失掉就是南電北送，電送越遠，損失的電越多，今天的電在這裡產生然後在這裡用，電的效用就最大，所以現在所有的國家都在推動社區微電網，就是說我們這個社區要先產電，我們社區自己在用，不用送，甲社區、乙社區要怎麼做社區微電網?大家屋頂上都做太陽能，太陽能就是綠色能源，台灣要講綠能就是說田地或是山區可以拿來種電，做太陽能，或是做風能，台灣有黑潮、潮汐這都可以用，氫能源把它燃燒產生氫能就變水跑出來了，水就不會汙染，電池通電則要廢電池回收，最沒有廢氣汙染的能量就是氫，所以像這個加油站要把他做智慧綠能的話就是產能、儲能、用能，像是台南的前鋒站就是我用的，像太陽能板產能下來，儲能你如果沒有要用就可以賣給台電，像信義站產生 315 千瓦的太陽能電，它那間需要三百就夠了，所以其實他那間產出來的電如果像今天一樣有太陽的話，它根本不需要用台電的電，那現在是自己用，如果是社區微電網每天要自己用那就沒關係，但是加油站每天在賣油要賺錢啊，那以後要賺甚麼錢?中油百分之四十九的收入都是來自賣油，現在油不能賣就要賣電，賣電就是靠充電，不然就是換電池，這就可以靠離峰尖峰，離峰的時候去充你的電池，尖峰的時候就用換電，這就是經營模式，所以有產能、儲能跟用能，用能就是充電，現在說 5C，就是說我現在充電的是 5C 的設備，就是十二分鐘可以把這顆電池充到飽，這個 C 就是 60 分鐘，這個 5C 就是 60 除以 5，就是現在車來，可以去喝一杯咖啡，現在我們加油站就有一個貨櫃咖啡廳，比較大的站就可以開一個比較漂亮的咖啡廳，如果不夠大的就可以做一個貨櫃咖啡廳，就可以在充電的時候去喝一杯咖啡，差不多 12 分鐘車子就可以騎走了，這就是充電，那如果像 Gogoro 換電，現在儲能的部分就可以用電池去儲能，這就是技術，所有的規劃都是按部就班的，所以你要講綠能加油站的這個事情，第一我要講的就是說今天中油帶領著所有的加油站來做一個加油聯盟，但是未來沒有要用油了，我們中油要替你們想一條路，像信義站它有太陽能有儲能，它儲能的設備是台達電的，我說中油的電池要發展，智慧綠能加油站要海納百川，大家有願意

要來跟中油合作的我們都歡迎，我們中油是國營事業，要幫忙所有要跟中油合作的公司做起來，我們要保護加油站，因為加油站是跟著我們在吃穿的，是幫忙我們把油賣出去的，中油會有今天是靠這些加油站的幫忙，才會有這百分之四十九的收入，所以我當董事長我是有感恩的心，就要去想說要把他們帶往哪裡，而不是說二十年後大家都沒有油可以賣了，我卻都沒有一個做法，很奇怪的是中油有三個研究所，都在做負極材料，我來的時候就說沒關係，你們前面都在做人家的工作而已都沒有在想，沒關係我們海納百川，所有正極材料的電池公司我們都歡迎來合作，所以就有來跟我們合作，我們電池就有做出來，我們有兩種負極材料，一個是軟碳、一個是 LGO，我們這兩種，現在電池就是要正極材料、負極材料、隔離膜、電解液，然後做成電芯，然後電芯堆疊以後就變成一個電池，這樣一個電池以後就可以開始做你的品牌，開始去推，中油是國家的國營事業，所以有責任義務去幫忙電池也好、摩托車也好、加油站也好，這些都是我們的兄弟，這樣聚集起來中油在會做大，現在面對問題中油都沒有去想，只會去工會這些，他要拔賴，所以跟賴有關的全部都要拔掉，我是賴清德叫去的，所以當初賴清德下台我就跟他講現在是要同進退嗎?他們說不用，你董事會裡面有任期到六月十一日，結果他到三月初四就叫我走了，然後你後面來的人怎麼樣?把綠能小組給解散，這個我能表示意見嗎?而且昨天還前天，陳其邁才在講說我們台灣要發展電池的研究跟生產，那些我早就做在前面了，那你經濟部長都不知道，我就覺得很奇怪。

· 我看了一些加油站轉型的報導，新聞媒體在相關報導中提出：

新聞一、台灣中油前任戴謙董事長表示:「中油要扮演落實電動車政策的領頭羊，未來加油站也會變身為商業平台，為此中油已組成專案辦公室，包含 3 年內在加油站及公共場域完成設置 1000 座電動機車充/換電柱，並導入大數據、智慧化、物聯網等新興應用，建立微電網，轉型綠能加油站，成為社區多元能源補給站。」

Q4. 您認為以上敘述發展目前還需要突破那些困境?

因為我的計畫是我們中油牌的電池明年(2020)元月就可以上市，就是明年就可以開始賣了，但是現在我離開之後綠能小組就被取消了，所以現在變怎樣我就不知道了，如果是我的規劃裡面就是明年中油牌電池就開始上市了。

新聞二、透過現階段兩座綠能加油站的開幕，除了大力展示中油的電池研發技術，以及加油站轉型的企圖，更重要的是以國營企業之力，扶植產業發展，攜手國內業者友量科技生產電池，也協助車廠作轉型。

Q5. 若您還在任，您面對行政院禁售燃油機車政策大轉彎，還會積極推動綠能的發展嗎?

因為我離開了，我看了那個新聞就是人走政完的意思，現在就是業者開始要求慢一點，那當初在選總統的時候說的那些 2030、2035、2040 這些是在騙老百姓的選票嗎?你要說空氣乾淨、要好的環境所以要用電動車，現在要做對的事情嘛!

朝令可以夕改所以現在業者一去抗議政策就軟掉了，我對這個我是沒有意見，但是我很同情業主的狀況，因為政府沒有做事情，他們沒有解決問題當然業主只能這樣要求，此時此刻我要講的就是說，本來我們摩托車業者是可以獨立自主可以在世界上稱霸的，當世界要乾淨，移動汙染源要減少的時候，我們的摩托車產業變成人家的附屬產業，LG 的附屬產業、Panasonic 的附屬產業，你沒有中油牌的電池變成台灣的產業的時候，你的摩托車產業還能在世界上稱霸嗎?所以我才說國家要認真、國家要把產業做出去，像我剛才所說的三大任務，我當董事長要去做國民經濟，遵守國家政策跟扶植產業發展，摩托車就是產業發展，加油站就是產業發展啊，像是前鋒站它不同的地方就是有液態瓦斯在地下室，還有太陽能板充換那些都不同，那邊是用 LGO 在做電池的儲能，信義站是用軟碳，是台達電在做儲能，所以兩個的材料不同，我們有兩個研究所，一個綠能研究所是專門研究 LGO，另外一個嘉義的煉製研究所是在做軟碳，所以你說這些業者來跟政府做這個要求，當然我前面有做這一些，政府自己不知道，反而我現在會覺得業者無助跟無辜，你政府政策沒有執行，當然要去趕快解決這個問題，我自己的看法是這樣，我如果是業者我也會這樣去跟政府要求，因為政府都沒有做法，我也要養妻小啊，我有多少員工要養，那政府政策定這樣，然後又按兵不動，時間快要到了政府都沒有說甚麼。

新聞三、戴謙任內大力推動綠能加油站，加速加油站轉型，目前除了台南、嘉義綠能加油示範站相繼開幕，據悉中油高層明日將到東部尋找第三座綠能加油示範站，地點選在台東或花蓮，與加油站附近居民合作，打造社區微電網，讓再生能源發揮最大效益。

Q6. 您當初大力推動綠能加油站的主因為何?

我到中油去，中油是一個七十二年的老公司，有的東西不用我做因為別人做七十年了，所以明天要的我董事長才要去做，我也可以不用去做啊，我做這麼多做甚麼?2035 我早就死掉了!但是做一個負責任的公司領導人，當一個國家領導的總統、行政院長、經濟部長這個難道不用去想嗎?這個是整個國家產業，這個是國家很有競爭力的產業，而且是在世界上排名非常高的摩托車產業，你不用幫忙他們嗎?我去的時候他們就已經組了一個石化產業，要去印尼跟印度投資的小組，這是新南向的計畫，那我是把它擴大就是說組台灣隊去參加國際賽，像韓國，他們現在幾乎所有的產業都是國家在後面支持，都是財團，台灣是台商、單打獨鬥啊!現在我們又沒有跟人家定經濟合作契約，現在叫台商回流，甚麼五缺，那個都不重要了，我以前在科學園區我是管理局局長，你要大用水、大用電、大用地，有甚麼問題!我都做過了啊，你去南科看有沒有電線?沒有，因為全部的電線都下地，電線下地一公尺要一百萬，電的品質要好，不能有意外，你稍微閃爍一下馬上就當機，所有的材料都要清出來重新再做一遍，這樣誰要付?台電要賠嗎?台電從來沒有在跟人家賠錢的!所以你的問題是說為甚麼要做這個綠能，我大概這樣你做解釋。

Q7. 現在技術已經做出來了，為甚麼沒有辦法普遍被使用?

一個技術成功不表示能變成產業,縱然變成產業也不一定表示變成一個成功的產業，像我在南科當管理局局長，有一個小兒科的醫生他是做基因轉殖的，把小孩子的過敏原轉到乳酸菌的菌株裡面，去發酵培養乳酸菌，然後拿去做優酪乳，這個乳酸菌裡面因為那一段有小孩子過敏原的 DNA，所以會產生出蛋白質，這個蛋白質就產生出抗氧，小孩喝了這個優酪乳之後身體就會產生抗氧，這個技術當然是很好,但是做不起來,他才跟我說他的產品賣不出去,但是他的功夫是一流的，我就叫他去找統一公司，他們有在賣優酪乳，他現在統一有 AB 優酪乳，所以就可以做一個不同名稱的產品，現在他去講完之後現在就有一個 HP 優酪乳，你去 7-11 看，他賣得比較貴，因為它裡面有小孩子的過敏抗原，所以你現在問說技術都成熟了，技術者跟管理者和經營者是不同的，所以技術都博士在做，做成功也要會銷售，也要有市場，也要有商業上的布局，事業成功或是一件事情的成功是一個 integration，不是 single fact，所以說要團隊，要異業組合，技術成功不表示真正的成熟，真正能解決的問題就是社區微電網，我們的先試先行，為甚麼我只有選前峰站、只有選信義站?我也可以做更多，我當時當董事長，我也可以說中油六百二十一間都給我用下去，我也可以這樣說，但是我們當前電動車還沒有到 critical mass，就是有沒有到商業的那個量，你沒有到那個商業的量你做那些做甚麼?像我們示範站一樣餵蚊子嗎?電池放在那邊電是會慢慢的消失掉的，所以不是說技術成熟就可以了，我是一個很務實的人，先試先行，因為我會去中油就是賴清德叫我去的，所以我第一個試範站就是在台南的前鋒站，他們前鋒站也非常的配合，再來就是信義站，因為他們地方很寬闊 ，他們用太陽能的量剛好不用再用台電的量，當然還是要看太陽大不大，所以技術當然是成功裡面重要因素的一部份，但是要成功要有很多其他的產業配合。

Q8. 現在目前已經有很多廠商投入進去做電動車,政府突然改變政策他們將如何是好?

今天要講到電動車就要講到 speck，任何一個產品都有它的 speck，今天我跟你說的 5C，5C 說充電 12 分鐘充到飽，10C 就是 6 分鐘充到飽，這個 C 是分鐘，所以 20C 就是 3 分鐘，這就是競爭力，另外一個是安全性，你騎摩托車遇到會跳動的時候，裡面的電解液、隔離膜如果不夠安全的話要怎麼辦?就是說你現在電池用三個月它的電量跟儲存量就剩 40%，另外一顆電池是用三年電量剩 40%，那你當然是要用三年這個，你說公司甚麼時候要生產它還有很多因素，這個都還在技術層面的因素，現在一年台灣差不多有二十萬台電動車銷售出去，二十萬台不可能只跟一個人買，所以他們都不敢做，那他們怎麼做?就是跟外國合作代工，和大公司配合,這就叫商業模式,每一件事情都有商模,現在政府規定都還不明確，誰要去買那些電動車?沒有人要買電動車的話幹嘛要研發那些電池，走在前面的就會先死，所以最主要還是政策。

四、轉型未來發展前景：

Q1. 如果政府將來沒有意願做轉型，中油有辦法自己推這一段嗎?

光是現在明明政策就是訂在那邊，我來到中油就去做了，結果我才做一個前鋒站信義站，他們就覺得我做太多了，怎麼會反而過來講這種話，像是工會他說我不務正業，那甚麼才叫正業?

Q2. 大體來看，您認為轉型是可以成功的嗎? 潛在問題有哪些？

轉型我當然是確信可以成功的。

Q3. 您在卸任中油董事長之後有在從事綠能相關的研究或是發展嗎?

綠能是整個世界的方向，也是國家的方向，因為我參與這個事情，所以現在教育部有一些循環經濟的計畫，有一些政策我都是執行委員，現在我是食安人文的理事長，也是台灣生計人文的理事長，像這一些都要跟綠能去連結，像食安，一定是要安全的，沒有汙染的，所有在這一方面的研究人員也好，產業人員也好都要全力以赴，實際上都有政策，但是政策有沒有落實這都要去檢驗的，所以我離開之後你看這些資料我都沒有丟掉，我現在在學校開的課也是高科技產業經營與管理，要有世界前瞻的東西像 AI 等等都是課程裡面的重點。

Q4. 您針對加油站轉型有什麼建議可以提供給中油？

我離開之前就有佈局，只要那個布局繼續的推動下去就可以了，因為我去之前中油沒有綠能的布局，我是第一個，所以我是覺得就是說我當初成立的綠能小組是一個臨編小組，就是任務需要才編的，希望能把它常態化，然後兩個在做這個電池的研究所要能夠深化去召集這方面的研究人才，另外很重要的就是要海納百川，所有願意跟中油合作的都歡迎，另外就是一定要有台灣品牌的電池，然後結合全台灣的力量，不管國家還是私人，現在私人也有很多像是台達電，你上去查綠能的公司很多，在高鐵台南站那邊也有一個綠能中心，所以大概中油這邊強化加油站當做社區微電網，把加油站的產能、儲能、用能發展起來，然後跟社區結合，社區現在也在推動屋頂型的太陽能，我的構想是以加油站當核心，然後加油站來統籌，這樣才會有一個管理系統，讓這個 Energy Management System(EMS)，也要有 Battery Management System(BMS)，那這些系統要有一個核心，如果以這個社區，就是以加油站當做微電網的核心，然後去產能、儲能、用能，因為以後如果都是電動車，加油站要做甚麼?所以這個短期是非做不可的。

以上訪談內容結束，謝謝您的參與及討論。

Written Documents of Interviewees

訪談對象: 中油管理師-徐明發
訪談日期: 2019/07/11
訪談時間: 9:30-10:00
訪談地點: 油品行銷部嘉義營業處
受訪者願不願意在論文當中使用真名: 願意
受訪者的 diversity:
1. 油品行銷部嘉義營業處的訪談代表
2. 前任研售中心的主任
3. 在中油的資歷 33 年
4. 目前專做加油站太陽能發電板提供技術人員接電

四、受訪者背景：
Q1.能否訴說一下您的工作職稱及背景？
A: 我是加盟服務中心的管理師，那以前上一個工作就是在研售中心的主任。
Q2.請問您從事相關領域工作多長時間？
A: 在中油的時間已經 33 年了。

五、轉型定義及經驗：
· 我的研究主題是關鍵利益關係人對轉型計劃的看法,因為台灣中油公司的轉型計劃是在 2018 年至 2019 年期間啟動的，它是一個新的計劃，並且正處於發展階段。我想知道它是否可以實現以及它的風險如何？我認為這個轉型計劃對從事不同領域工作的人有不同的含義。我希望您能以您的立場訴說，您怎麼看待這個問題？
Q1. 您是從哪裡得知到轉型計劃的？
A: 我們是配合政策，從我們事業部門，從總公司政策下來，我們是執行者，我們就是要配合政府去推動這個政策。

Q2. 轉型計劃現在發展的階為何？
A: 轉型加油站部分就是朝著綠能加油站去做，這個部分已經開始慢慢推行了，有兩個示範站，綠能示範站已經設置了，然後再來就是充電站、換電站，這部分目前佔最多。
Q3. 為甚麼台南的示範站跟嘉義的示範站要使用兩個不同的營運模式?
A: 要兩個去比較嘛，兩種不同的模式可以比較，台南那邊是用天然氣，那嘉義信義路這邊是用太陽能
Q4. 以目前來看，政府現今的意向會對轉型產生積極還是消極的影響?

A: 應該是要看政府的決策者,看他對這一塊的琢磨和用心,他做的程度到哪裡，像上次的董事長(戴謙)，他對綠能示範站就非常的重視，當然就推的很積極，但是現在的董事長在兩個示範站已經完成後,仍有在搭配充電站以及換電站的設置，還是有，還是有在做。

Q5. 您認為使用電動車的優缺點是什麼？

A: 優點當然是至少不會產生一些對環境有害的汙染，像是使用汽油所排放的廢氣，這都是對環保與環境不好的，那至於說缺點，目前機車方面應該是說它短程在市區跑還是比較 OK 的，那電動汽車的話，可能在蓄電的能力還有限制，那對車主來說使用上還是有限制，至於它充電的地點，可能還沒辦法及時提供，車主如果開到一半突然沒有電的話，它要想辦法去充電，這目前還是有問題的。

Q6. 為什麼加油站可以設置可再生能源？

A: 加油站來設置再生能源會比較方便，因為加油站的地點都比較適合，比如說每一個鄉鎮至少都會有一個加油站，加油站空間又可以用來做再生能源，比如說它可以利用它的屋頂可以來設置太陽能,那還有其他的空間可以用來做充電站或換電站。

Q7. 您認為未來加油站還可以增設哪些可再生能源？

A: 再生能源的部分目前還是以太陽能為主，目前因為加油站的屋頂上面是可以利用的，其他的部分就是要看它的面積大小，加油站腹地較大的話，它所能使用的面積又會更多，可增設的再生能源也更多。

Q8. 將加油站與再生能源相結合是否有任何限制或缺點？

A: 缺點的話，依我們現在設置用太陽能當再生能源結合加油站的缺點目前應該是沒有,因為它現在綠能發電工加油站使用以及賣給台電都算是多角化的收益，目前還沒有甚麼缺點。

Q8. 那與再生能源相結合的成本會很高嗎？

A: 成本主要是看它建置的 KW 數，如果它 KW 數較高，那當然成本會很高。

Q8. 目前嘉義信義站的充電站來客數高嗎？

A: 充電站目前只有信義站，其他的部分是 Gogoro 的換電站，但是充電站目前廠商好像沒有產生出公規充電，所以目前充電站還沒有使用到，目前都使用到 Gogoro 的換電站比較多。

· 我看了一些加油站轉型的報導，新聞媒體在相關報導中提出：

報導一、台灣中油前任戴謙董事長表示:「 3 年內在加油站及公共場域完成設置 1000 座電動機車充/換電柱，並導入大數據、智慧化、物聯網等新興應用，建立微電網，轉型綠能加油站，成為社區多元能源補給站。」

Q9. 報導內所提出的 3 年內在加油站及公共場域完成設置 1000 座電動機車充/換電柱可行性以及原因（或在這些情況下必須改變什麼）？

A: 可行性目前換電站應該是可以達成，換電站的比例較高，充電站的比例相對來說會較低一點，依今年來看，換電站的比例也是高於充電站，因為目前還是因為機車廠生產的電動車充電的部分可能還沒辦法去跟上進度。

Q10. 導入大數據、智慧化、物聯網等新興應用目前有在執行這一個部份嗎?

A: 這個就要去統合他們換電及充電的數據,像是 Gogoro 就說這是他們的,中油先前要跟Gogoro拿充換電的數據就有困難,但不知道後來有沒有解決這個問題,這些數據要等到他們提供給我們之後再去做一些後續的分析。

報導二、透過現階段兩座綠能加油站的開幕,除了大力展示中油的電池研發技術,以及加油站轉型的企圖,更重要的是以國營企業之力,扶植產業發展,攜手國內業者生產電池,也協助車廠作轉型。

六、轉型立場:

Q1. 您是否支持轉型計劃?為什麼?

A: 支持,因為配合政策,目前電動車有在持續增加,很多加油站都有一些回應及反映出來了,所以還是要去支持,當然電動車越多,去加油站加油的機車就會減少,這個都是必然會有影響的,所以還是要朝這個方面去改變。

Q2. 加油站轉型成功後對中油本身有什麼助益?

A: 幫助就是加油站會變成一個多元化能源的提供者,它可以加油又可以充電、換電。

Q3. 轉型目前正在進行中,但隨著近期政府政策意向的改變,會對轉型產生怎麼樣的影響?它會因此變的消極或政策消失嗎?

A: 以目前我所知道的是公司還是會陸續推動這個充換電站的執行,這是不會改變的,像今年 108 年到明年 109 年他有說大概要設置兩千站的充換電站,這應該是沒有問題的,我所知道的到明年為止都還是有在持續推動充換電站的政策。

Q4. 以你的角度以及立場,轉型是機會較多還是風險較多?

A: 都有,但我認為機會比較多,但要看科技跟技術方面成熟了,假設技術都成熟了,成熟度夠且困難突破當然是機會較大。

五、轉型未來發展前景:

Q2. 您認為未來轉型計劃的潛在問題是什麼?

A: 轉型的問題是有些加油站的地點或是它的土地面積會比較不適合再增設一些其他的充換電的設備,這是他的現實面。

Q3.您的領域是否有任何方法促進轉型的執行或運作?

A: 我們都只是配合政策的推行,上面甚麼政策交待下來我們就盡力去執行。

Q4. 您針對加油站轉型有什麼建議可以提供給中油?

A: 可能加油站的部分目前轉型是一定要做的,勢必要往轉型的方面去走、去改變,但目前像是太陽能的設置不是每個站都適合做太陽能,或者是不是個站都有足夠的空間去做充換電站的設置,這是我認為較大的問題。

以上訪談內容結束,感謝您的參與及討論。

Written Documents of Interviewees

訪談對象: 中華民國加油站公會全國聯合會理事長-李杰迅
訪談日期: 2019/07/17
訪談時間: 15:30-16:15
訪談地點: 台南裕農路加油站
受訪者願不願意在論文當中使用真名: 願意
受訪者的 diversity:
1. 中華民國加油站同業公會理事長
2. 經營十三家加油站(第十三家加油站於 2019 年開幕)
3. 到台南投資其個人第 13 座加油站，支持投資台南

一、轉型定義及經驗：
· 我的研究主題是關鍵利益關係人對轉型計劃的看法,因為台灣中油公司的轉型計劃是在 2018 年至 2019 年期間啟動的，它是一個新的計劃，並且正處於發展階段。我想知道它是否可以實現以及它的風險如何？我認為這個轉型計劃對從事不同領域工作的人有不同的含義。我希望您能以您的立場訴說，您怎麼看待這個問題？
Q1. 請問轉型企劃是如何開始萌芽的？
未來十年後如果加油站再不轉型，可能會面臨再一波的倒閉，去年戴董事長在中油推動非常成功的案例就像台南前鋒站，信義站跟前鋒站是使用不同的系統，希望加油站未來也能夠朝這個方向轉型，還有能源的問題，能源是未來大家要面對的，石油的部分會越來越少，這次我去日本看的氫電車，就是氫氣加電，就像我們台灣的油電車一樣，日本它現在氫的加氫站已經有四十三家了，所以會希望說我們國內一些相關政府不管是誰執政，都應該要去重視以後車的能源的方向，要訂定一個明確的目標出來，要走在世界的前端，不要走在世界的後面，就像日本它氫的氫氣站已經很完整了，像台灣我問能源局，他說沒有相關法規，也不曉得要怎麼改，這就是我們要跟日本以及歐洲一些國家借鏡的，因為氫它是完全零汙染的，以後像是油電車，特斯拉也是用電池，那以後這些電池是要搬到哪裡去?跟核廢料一樣搬到蘭嶼去嗎?現在加油站轉型一定要趕快做，如果台灣再晚個五年再去規劃的話，就不免十年後台灣又會面臨一波倒閉潮，一定的，因為車子越來越節能，加油站都不轉型，希望加油站能做到換電站、充電站、加氫站及加油站，把加油站的型態完全改變，然後再做到多角化，可以開便利商店，多角化的經營，所以說在此我也呼籲我們政府相關的單位，真的要去國外例如日本借鏡一下，Toyota 車商還有 Honda 本田車商還有現代也都在做氫氣了，還有他們 7-11 的運送車、貨車也是用氫氣，他加氫的時間跟加油的時間是一樣的，氫對我們的土地又零汙染，車子跑一公里排放六公升的清水出來，我之前去問這個排出來的

水是可以喝的嗎?他說只要這個管路是乾淨的就可以把它拿來喝，這對我們的地球是完全零汙染的。

三、轉型立場：

Q1. 針對今年中油提出轉型計劃的看法。

其實加油站業者他們都很關心加油站的未來，我們看不到以後的願景。

Q1-1. 那你怎麼還會在今年再開第十三加油站?

因為現在還能再撐個十年，我希望我在當理事長的時候能去改變政府，叫政府去設一套法令出來，然後車商那邊我們也會異業結盟很多工作團隊進來，讓政府看到說氫氣是真的可行的，不是不可行的，針對氫汽車政府也是要有補助，以前是瓦斯車政府有補助，現在氫氣日本也有補助好像 30%，比如說一台車子一百萬，政府就補助三十萬還是四十萬,這樣政府在做才是對的,政府現在說柴油車老舊，二期、三期、四期柴油車汰舊換新會有補助，政府也可以推動這個補助，就像現在這個油電車進來政府好像也是免關稅的樣子,所以說油電車會比較便宜的原因也是因為這樣子，政府有相關的補助，所以下一個站，第十四個站，我要做到加電、加油、加氫，加氫的設備我都要買，車子我也要想辦法引進一台進來，不管能不能掛牌，我就要讓能源局、政府相關單位來把我這個站當成是示範站，來研擬一套適合台灣的法令出來，因為氫氣它是一個高壓的環境，它不是像我們油槽是放在地下,它是放在一個倉庫裡面,而且它的管線都非常的安全,它都很清楚，管線都看的到，所以那是最安全的，而且氫就是綠能的一部份，綠能的部分我也希望可以做到像我們去日本看的那個綠能社區，那個社區真的是非常不錯，如果真的發生大災難了，停電的話，車子大家都是共享的，它車子可以回充到社區，讓社區又有電可以用，所以說車子以後跟能源站直接結合在一起。

Q2. 第十四個站怎麼沒也有想要單純設置充電站,而是將加油站與電動汽車充電站相結合？

因為未來的趨勢就是這樣,就是要做能源站,我符合大眾運輸,所有的公共運輸，要加油也有、換電、充電、加氫也有,所以他們日本有加氫的站就統稱叫能源站，他們加氫的車是多到要排隊的。

Q2-1. 加油站結合再生能源的部分會有那些限制？

就是政府要來推動，因為氫的來源也是要從中油來，它煉解石油一定會有氫的成分在，也是需要中油，所以說政府現在目前沒有一套相關的法令出來，說實在現在還談不上甚麼有利有弊,都還談不上,去看到日本真的環境到整個排放都很好，弊的話應該是說大家會怕危險,就是說那個氫氣筒會不會像以前的瓦斯桶一樣那麼危險。

Q2. 轉型目前正在進行中，但隨著近期政府政策意向的改變，會對轉型產生怎麼樣的影響？

禁售燃油車的政策,這個要推動困難,那麼多大廠的公司你說一下子要把它禁售,是不可能的,只是說替代能源是甚麼,要趕快去尋找新的替代能源出來,就像我跟你講的氫氣,是一個很不錯、很正確的選擇,因為是零汙染的。

四、轉型未來發展前景：

Q1. 以您全國加油站理事長的身分，有甚麼是您可以替轉型方面做到的?

這就是我現在在做的,我這次去日本就是要找相關部分,要談這個事情,要讓我們台灣加油站有知道的權力,讓他們知道說新時代加油站要走向新的能源,不能再墨守成規了,因為我們要考慮到城鄉差距,像麥寮那邊比較偏僻,跟都市的加油站不能有差距,要一同慢慢往上提升,為了環保,為了這個地球,說實在我們的碳排放量真的是太高了,去日本真的會覺得空氣很好,連在東京空氣都這麼好,我去那邊待四到五天都覺得空氣比台灣還好,尤其是到去到他們的微電網社區,真的是連一點噪音也沒有,空氣非常好,而且搬進去那個社區的不是都老人喔,還有很多年輕人,他們做到整個社區有育幼院,還有老人院,他們整個社區的微電網,你這一戶用多少電、那一戶用多少電,都在我們手機就能看的到,共享的車子還有多少電大家都看的到,所以說台灣真的是要朝向這個目標來發展。

Q1-1. 所以您一直有跟政府那邊做接洽嗎?

能源局會阿,我們主管機關能源局會跟他做接洽,還有跟經濟部部長,也會請他來辦一個加油站未來轉型的論壇,要讓能源局他們去說,他們才要去做而已。

Q2. 您針對加油站轉型有什麼建議可以提供給中油？

中油關於到國家能源政策就關於到我們中華民國未來的總統,換了每一個總統,他們的思想、腦袋裡想的能源政策都不一樣,我也希望說以後政府他們的能源政策要一致,經濟部能源局以及中油他們才能夠有一條正確的道路出來,就像說戴董事長他以前在推動的這個能源政策,當時的行政院長是賴清德,他推動這個能源政策,然後現在換一個院長,他又換一個中油董事長,說實在的我現在還搞不清楚中油會帶我們到哪裡去,台灣如果有第三油商的話,有競爭的話會更好,中油要改變,不改變的話五年後就會走下坡,就不是一家正確的能源公司了,中油不是只有買油、賣油還有賣天然氣,你是一家能源公司,應該去開發一些新的能源,這樣才是正確的一條路,不能一成不變,就像戴董事長當初做的,他在新能源、電池以及充電,要去開拓其他新的能源,一家能源公司不是單純的賣油,賣油你可以賣七十三年,你下一個七十三年要賣甚麼?中油有辦法在撐個七十三周年嗎?我看是不行、做不到,一定要找新能源,如果你沒有辦法找新的替代能源,台灣的法規如果有第三油商進來,就像我這次去日本看的,日本跟他們當地的豐田、Toyota 跟一些車子進來,加氫站又設下去,中油會被淘汰掉,包括台塑也會被淘汰掉,不要在一昧的原地踏步了,要往前走,我也期許說中油新的歐董事長你對這新的能源有甚麼期許?不然我們這些加油站看不到未來啊!也希望政府不要朝夕令改,換了一個董事長,又換了一個政策,底下有千千萬萬的員工,也不曉得說我們這次換了這個董事長,政策又是甚麼?到頭來大家又白忙了一場,

就像戴董他設立了很多能源政策，現在又沒辦法去推動，到頭來大家對員工的信心也是一種打擊，當初在做的時候大家是埋頭苦幹，這麼用心去收集資料，現在我不曉得歐董事長有沒有在執行，所以說我們加油站也希望說，以後中油的董事長能夠秉持著公司的政策，而不是他個人的意志在行事。

以上訪談內容結束，謝謝您的參與及討論。

Written Documents of Interviewees

訪談對象: 雲林縣加油站公會理事長-許欽智
訪談日期: 2019/07/09
訪談時間: 19:30-21:00
訪談地點: 品強加油站
受訪者願不願意在論文當中使用真名: 願意
受訪者的 diversity:
1. 品強加油站董事長
2. 擔任雲林縣加油站公會理事長
3. 經營加油站時間:16 年

七、受訪者背景：

Q1. 當轉型持續進行，您的工作或是你對加油站的規劃會不會有所改變？

因為每一個時期，每一個時代都不一樣，所以當初在六輕初期進場的時候，它的油品、柴油的部分需求量很大，然後慢慢隨著一些外包廠商的進駐，在我們雲林縣麥寮鄉這個區域加油站這個行業是非常的蓬勃，光是麥寮鄉就有九到十家左右的加油站，代表說我們麥寮鄉雖然是一個小鄉鎮，但是它油品的消耗量是非常大的，面對以後加油站的油品也會慢慢的枯竭，現在政府也都在推動一些綠能的作業，所以這一方面當然就是我們加油站也不得不去做一些轉型的改變，所以我也會利用一些相關附屬的設備去開闢一些新的財源進來，預期未來油品這個部分會慢慢的消失掉，但也不可能一下子油全部都不見，所以這個是一個過渡期，油品慢慢地減少，但是綠能等等替代能源會逐漸做起來，因為油要完全取消掉也不是那麼簡單，有一些器具、有一些設備目前還是非得用油去提供它的動力，所以我們要轉型的部分一定是慢慢地去發展，就是說油電到時候一定是併行一陣子，然後當油品開始漸漸少了之後每個加油站的企業主就會去觀察哪個部分有錢賺，最後當然每個加油站的油品會慢慢地去減少，然後電能的部分會慢慢地去增加，之後就會開始朝這個部分去處理了，譬如說早期的汽油還有一種是有鉛汽油，然後慢慢地政府開始注意到環保的時候他們把有鉛汽油慢慢地取消掉，變成有鉛汽油，然後除了有鉛汽油以外還有一種東西叫做二行程，我們早期有一種摩托車都會需要二行程，然後慢慢的二行程被政府慢慢淘汰掉了以後，有鉛的汽油也淘汰掉了，所以在這個早期轉型的過程我們就會賣代鉛劑，就是早期有一些較為老舊的機車還會需要加入鉛它才可以啟動，那種古老的機車，慢慢的政府在補助淘汰二行程的機車，所以我們就發售了一種叫二行程的機油，去跟現在的汽油去混和，可以讓機車去用，所以這都是一個轉型的過渡期，我們一定都會找一個替代的東西先進來讓民眾代替使用，就是慢慢讓這些老舊的車輛淘汰完了以後，我們就可以開始全面使用無鉛汽油，所以現在我們賣的都是無鉛汽油了，像我們現在的柴油，早期它的含油量很高，現在中油就把它改良變成超級柴油，前一陣子又配合東京

議定書，就是現在目前有很多轎車都是使用柴油，為了讓柴油更加精緻化所以這個柴油的部分也是做了很多的改變，使它府和含油量更低，然後很多高級的轎車開始也是會用柴油去帶動它，這個就是慢慢的一個轉型，就是符合現在的環保法規，環保的第幾期還要加尿素，那個尿素也是目前針對柴油車要用的一個東西，也就是說它所排放出來的東西是完全沒有污染的，讓那個油加進去沒有汙染，然後這個部分也是一個階段，每一個時期有每一個時期油品的階段，逐漸地走向精緻與環保，所以你看早期很多卡車它都是會冒很多黑煙等等，現在政府都會慢慢淘汰掉，然後用使用這種超級柴油，符合環保法規又要再加入一些尿素，尿素也成為我們加油站可以賣的一個商品，那以後電動車的發展又到了一個階段的時候，柴油車也會慢慢地去淘汰掉，也是會有一段時程去慢慢淘汰他們，而且像貨卡車那些完全用動力的部分，它的技術可不可行還是處於一個發展的階段，因為大貨車它可能要拖很重的東西，不是像一般的轎車載人而已，所以那個部分是不是那麼容易就完全用電動車去取代，也是一個問題，所以一定是油電會慢慢併行，在慢慢地去做一個淘汰，舊的車輛去淘汰，等電的電池、和一些相關的設備研發的越來越多、越來越進步之後才有可能會逐漸發展，然而這一、二十年內油不可能會一下子的不見，但是我們也會朝著這個目標，然後看政府的政策怎麼去配合。

Q2. 所以早期中油也是有在做轉型的部分，只是是針對油品的轉型，那注重綠能轉型是從甚麼時候開始？

之前政府他們為了配合他們的環保政策，配合很多世界上的一些潮流去發展，像是現在很多國家都開始在推綠能發展以及電動車的部分，例如挪威他們禁售燃油車所訂的時程就定的蠻快的，他們規定大約在 2025 就全面發展電動車，但畢竟像他們國家都有所謂的配套措施，所以相對來講就能發展得比較快，那像我們台灣之前所講的是 2035 年就先禁售燃油車，汽車的部分可能就要等到 2040 年，大概是這個時間點，但是目前也不知道政府針對這方面的政策會不會去做改變或者是調整，因為有時候換個政黨，可能很多東西又會改變，或是說換個行政院長，可能一上台政策又不明朗了，但之前是宣示要比照歐美國家等興星國家的時程，但是每個國家它所訂出來的時間都有些不一樣，不過大多數都是在 2035 年到 2040 年這個區間開始禁售燃油車，但是它的禁售是那個時候才開始停止賣，所以至少我們油品的部分還是可以賣到 2035 年之後，因為還是有一些老舊的車輛需要使用，所以政府目前的目標可能是先朝電動機車的部分去做處理，因為汽車的電池部分還是一個很大的問題，你要抽換電池還是幹嘛汽車肯定是還不太可行，因為汽車太大了，但機車相對汽車來說就方便許多，所以政府正在朝著這個方向前進。

八、轉型定義及經驗：

· 我的研究主題是關鍵利益關係人對轉型計劃的看法，因為台灣中油公司的轉型計劃是在 2018 年至 2019 年期間啟動的，它是一個新的計劃，並且正處於發展階段。我想知道它是否可以實現以及它的風險如何？我認為這個轉型計劃對從事不

同領域工作的人有不同的含義。我希望您能以您的立場訴說，您怎麼看待這個問題？

Q1. 請問您是從哪裡得知轉型企劃開始萌芽的？

剛開始是因為國家很多政策訂出來的時候，新聞都陸陸續續有一些相關的報導，加上當初因為我們是中油的加盟站，中油又屬於國營事業，所以中油主要也是配合國家政策去發展，因此在之前賴清德當行政院長的時候他就是找戴謙去當中油董事長，然而國營事業需要去配合國家政策，所以這一個部分他就請中油去做一個綠能的示範站去處理這一段。

Q2. 請描述轉型計劃現在發展的階段。

轉型目前據我們所知，我們有去智慧綠能加油站參訪，所以目前現在示範站大概就是有兩個地方一個是嘉義信義路站，另一個則是台南的前鋒站。

Q3.使轉型成功運行的方式有哪些？

這部分最主要還是在政府的著力點，比如說政府初期的建設，還是他有沒有補助加油站去增設一些綠能或者是充電站相關的設備，或者提供一些綠能技術上的支援，那我們才有辦法去做，所以他目前有兩個示範站的用意就是說要給我們去參考，告訴我們說以後可能就會慢慢朝這個方向走，但是依目前來看他們兩個站實際上到站的客人也不多，代表說這個示範站只是一個示範，但是目前因為電動機車還不是很普遍的情形之下，大家還在觀望所以不可能就是說一次投入太多，技術方面還不夠成熟，成本又相當的高，因為之前政府有說三年內要建置一千站的充電換站，但是現在看起來感覺好像雷聲大雨點小，好像講一講然後可能做個幾站又沒消息了，可能換了一個行政院長蘇貞昌院長上來以後，政策不曉得又做了哪些調整，所以這個部分除非是政府繼續把這一千站推下去，才有辦法說每個站都可以充電與換電，再加上一些購買電動機車的補助，所以要先把這一方面先炒熱起來才有辦法提升大家建構的意願。

Q3-1.那當初所提撥的一千站有包含你們的加油站嗎？

有的，當初好像是中油的直營站在加上民營的加盟站總共會有一千站，這是屬於中油體系的部分，但不是包含全部的加盟站，可能一開始是先挑幾個加盟站，然後他們直營站可能會挑大約六百個，然後四百個加盟站，不過目前不曉得是 2035 禁售燃油車這個政策突然喊卡，還是怎麼樣，所以這個部分可能要問中油它們後續所推得是怎樣，是要暫停了還是還要再看政府下一個階段的指示，不過現在感覺上好像沒有太大的聲響，但是在前半年的時候他們是推動的蠻熱絡的，就是還有跟我們業者做調查，要裝充換電站的意願，然後在新聞媒體上面也報導的非常活耀，甚麼階段要推動甚麼，這些都是他們新聞稿出來的，所以我們的資訊來源也是看他們報導上的意向，目前是有叫我們去參訪示範站等綠能設施，不過是否會繼續朝這個目標去走，或是一樣三年內會建構一千家充換電站，這些我們其實還是不太清楚。

Q4. 您認為現在政府政策會如何影響到轉型計劃？

政府如果態度很曖昧的時候，當然業主不可能把錢丟下去投資，因為企業主的目的是要賺錢，雖然兼顧環保，但是若只顧到環保卻沒有利潤的話，在一般民營加油站的企業主眼裡一定不可行，中油他們國營事業需要背負國家的政策，國家要求做他們就必須要做，所以他們就是扮演著領頭羊的腳色，如果連他們六百個直營站他們三年內都做不起來的時候，那民營站哪有可能去做。

Q5. 您認為使用電動車的優缺點是什麼？

電動車當然最主要是環保，但講到環保其實我們台灣的電力來源真的是蠻短缺的，所以表面上是環保，現實面需要製造更多的電去提供電動車使用，但如果是說能夠做出一些替代能源，能有一些新的技術去自行發電等，對我們國家的電力方面會有很大的幫助，又可以賣，電動機車缺點就是它比較適合短程，而且當加油站中的充電站不是很多的時候，就比較不方便，騎到較遠的地方要換個電池就會找不到地方供應，當充電站非常普遍的時候，大家就會很方便，也不會造成這麼多的空氣汙染，減少像 PM2.5 的問題。

Q6. 將加油站與電動汽車充電站相結合對加油站而言是否有任何限制？

依據我們之前去跟經濟部討論，目前是沒有特別說加油站不能裝充電換站，因為本身在加油站管理規則裡面有規定，離加油島大概要有多遠的距離，這個距離跟高度等都有一定的規範，只要不離加油島太近的區域去設置充換電站，依目前的法規來看應該都沒有甚麼問題。

Q7. 以雲林縣麥寮鄉來講，裝設充換電站廠牌是如何篩選的?

據我所知目前我們雲林縣麥寮鄉已經有一個充電站，應該是 Gogoro 的部分，好像有在橋頭設一個點，但不曉得這個訊息是不是正確的我還不太清楚，到時候我們加油站要設置充換電電站時，我們可能不會侷限在同一個品牌，若是 Gogoro 有興趣的話我們也有可能跟他們裝，三陽要做我們也可以跟他們合作，然後以後可能會有一些共用模組的東西，可以不限廠牌的充換電，就有點像我們的手機有 Android 也有 IOS 系統的，那 Gogoro 你就把他當成是 IOS 系統，其他廠牌就可以當成是 Android 系統，現在好像是有 motor 動力跟 pgo 還是 Yamaha 的樣子，好像有幾家已經有結合 Gogoro 的電池，現在好像有分派，就是有幾個適用 Gogoro 的電池，那另一方面就是用中油所研發出來的公版電池；加油站因為它腹地比較大所以可以選擇設置較多廠牌的充電換椿，但有一些其他小廠牌他們一定會用一個公版，頂多就兩台不同的充換電系統，因為本來是三陽跟 Gogoro 這兩個部分在角力，之前 Gogoro 是搶著要當老大，它想要所有電動機車都用他們的系統，但是可能就是有圖利廠商的嫌疑所以最後又被擋下來，所以它自己就是結合一些其他廠牌的部分去做一些結合。

Q8. 為什麼加油站適合設置可再生能源？

因為當初中油在接這一段的時候他們可能認為加油站的腹地較大，加油島上面又有一個油亭，油亭的部分面積也很大就能來做太陽能，所以太陽能的部分就可以儲電，然後儲存的電又可以提供給我們的充電站去用。

Q9. 根據新發布的消息，這兩個示範站的電力由三個來源組成：太陽能，天然氣和台電，請問光是利用這三種電力來源供加油站及充電站使用是足夠的嗎?

以目前的情況來講應該是夠的，因為目前電動機車跑去示範站充電的數量還不是很多，一天可能沒幾台，而且它示範站的地點在嘉義跟台南，據我們所知嘉義示範站那邊一天好像也收不到多少錢，所以代表說電力的部分應該是夠用的，只是到時候量多就不一定了，至於說它可以發多少電供給充換電樁去使用這個部分，可能就是要由中油技術人員才有辦法提供出準確的數據。

Q10. 裝設充換電樁的營收要怎麼去跟電動車行分配?

依目前市面上 Gogoro 的是用月租的方式去做換電站的處理，那 Gogoro 它本身已經有做很多不同的付費方式了，例如像 199 跑幾公里或是 299 跑幾公里這樣，電池的部分則是客人都不用保固，Gogoro 公司都會自己負責電池受損的部分，像是早期我們電信的吃到飽方式，每個方案都有，那它們則是用那種租賃的方式，還有一種就是用充電樁計費，所謂充電樁就是本身機車有一個充電孔，這種充電方式就是利用充電孔充電，充電樁上面就會顯示充幾分鐘多少錢，這個部分妳如果有機會去示範站就會看到，那邊有一個好像是悠遊卡或是其他功能扣款的機制，可能充五分鐘就是多少錢這樣，如果妳趕時間的話就可以充個五分鐘就走，那邊也有換電池的換電樁，大概有這兩種模式。

· 我看了一些加油站轉型的報導，新聞媒體在相關報導中提出：

新聞一、台灣中油前任戴謙董事長表示:「中油要扮演落實電動車政策的領頭羊，未來加油站也會變身為商業平台，為此中油已組成專案辦公室，包含 3 年內在加油站及公共場域完成設置 1000 座電動機車充/換電柱，並導入大數據、智慧化、物聯網等新興應用，建立微電網，轉型綠能加油站，成為社區多元能源補給站。」

Q11. 您認為以上敘述發展的可能性有多大?

這當然是未來發展的一個藍圖，因為這個部分也是要民眾有一些再教育的環保相關觀念，它這個部分可能也是說妳每個家庭家家戶戶它都有一個綠能的概念，那他們在建構房子的時候就可以設置一個太陽能發電板，先是自給自足，在把多餘的電回饋出去，那加油站就可以收集那些電，多的電我們就可以賣給台電，只不過這個目標應該是比我們加油站裝設充換電樁還要後續的事情，因為這些還要結合社區，社區除非是那種都會型的社區或是發展較快速的地區，他們都有這方面的概念才有辦法這樣子做，在鄉下地區很難發展這一段。

新聞二、透過現階段兩座綠能加油站的開幕，除了大力展示中油的電池研發技術，以及加油站轉型的企圖，更重要的是以國營企業之力，扶植產業發展，也協助車廠作轉型。

Q12. 既然中油有意去扶植傳統車廠做轉型，為甚麼他們還是要去抗議 2035 年禁售燃油機車的政策?

因為他們抗議的部分是屬於機車修復的業者,妳應該很常看到現在到有很多傳統各大品牌的機車店,他們賣的是燃油機車,他們主要都是靠修理燃油機車去賺錢,換機油或是換個甚麼零件或修理引擎等,現在有這麼多的摩托車修理廠,一旦電動機車出來的話,大量的電動機車會導致他們沒有錢可以賺,這些都會互相去影響到對方,所以我想這次政府政策的轉彎也有很多的原因是因為這一些機車的經銷商,就是機車修復的公司聯署去抗議,才會讓這個政策又稍微改變,因為總統大選將近,然而我們國家又是很常遇到政策接近選舉而大轉彎,選舉之後我就不知道會不會又開始推電動車,政府現在就是需要對那些機車業者交代說,並沒有要在2035年去實施禁售燃油機車的政策,但是他們話術都是隨便他們去怎麼講,搞不好到時候又會強調這是一個需要去貫徹的落日條款,畢竟這是一個趨勢,他們擋也會擋不住,只是機車業者會如此抗議也是因為電動機車它修理的方法非常的簡單,就是一個馬達加上兩個輪胎和電池而已,就是這三樣比較重要的東西而已,它不像燃油機車還有燃油的引擎這些需要定期的保養與維修,所以電動車沒有甚麼需要修理的支出,但他們慢慢以要去接受這一個現實,它們可以採用一半去修理燃油機車,一半去兼賣電動機車這種方式去處理,然後電動機車這個部分可能就要去附加一些價值,就是像Gogoro它就是把摩托車弄得非常漂亮,然後加裝甚麼就加多少錢這樣,用那個去賺錢才是一個賣點,因為一味地去阻擋也沒有用,畢竟這是一個趨勢,所以倒不如像油跟電的部分,我們油可能也是慢慢的會減少,電的部分可能也是慢慢的會增加,那我們怎麼去做這方面的收入,電動機車可能慢慢起來,我們就要去思考電動機車要賣甚麼品牌,然後電動機車要賣的時候要有甚麼附加價值下去,廠商開發出的一些可以DIY的配備或裝置,因為它裡面沒有甚麼可以修理的,所以利潤一定使已配備為主,所以可以朝那個方面去做精品化的銷售。

三、轉型立場：

Q1. 針對今年中油提出轉型計劃的看法為何?

當然要轉型我的立場是要看現實面,例如說政府目前針對轉型的力道有多少,電動機車有沒有去補助,中油對我們加油站轉型有沒有提供一些較為優惠的方案,至少要提供多一點的補助我們才會有動員的力量跟考量。

Q1-1. 目前有提供一些相關補助嗎?

目前是有做一個意見調查,好像本來想做不過之後又感覺有要喊卡,所以這一段我是不太清楚。

Q2. 轉型目前正在進行中,但隨著近期政府政策意向的改變,會不會改變你對轉型的看法與支持度？

因為目前政策還不是特別的明朗,再加上現在新聞有說2035年禁售燃油機車的政策要喊卡,那我們業主當然對轉型會沒有太多的意願。

Q3. 如果未來加油站沒有轉型成功,電動車比例又不斷的成長,您對此會有任何擔憂嗎？

電動車這個東西不可能會走回頭路，它數量一定會慢慢的提升，影響較大的地方一定是從都會區開始，所以都會區的加油站會比較早去做這一段的動作，因為據我所知有很多外縣市的加油站已經在裝設充換電樁的部分了，也是要看那個都會區電動車發展得如何，像桃園市、台北市以及新北市這一段它們應該有很多加油站已經完成充換電樁的動作了，因為他們車輛很多，那像我們雲林縣這個地方電動車的數量很少，所以這個投資報酬率目前來講還不太划算，而且沒有那個量設備裝了也是白裝，再加上地方政府它對電動機車這一方面的補助，桃園它就是全國補助得最多的，所以桃園那邊的電動機車就賣得不錯。

Q3-1. 只是雲林縣針對電動車的補助也相當多，那為甚麼電動車比例會遲遲提升不起來？

因為我們雲林縣有存在的很大的城鄉差距，可能在斗六市就是全雲林縣電動機車賣得最好的地方，再來就可能是虎尾鎮，人口數多當然電動機車就會越來越多，越鄉下的地方要推廣的話民眾的接受度可能就較低，而且鄉下買的電動車又不會傾像於充換電的方式，他們家裡面腹地大所以通常都是買可以在家裡充電的電動機車為主，他們可能只是需要去買個菜，需要小馬力的那種電動機車，因為他們不是在都會區，所以他們較不會住在公寓，因此家家戶戶都有庭院，它們把車牽來家裡自己充電就很方便，門口就可以直接插進去充電了，他們的生活方式是這樣子，那都會區的話，大家一般都住公寓，所以不太可能會把機車牽進家裡充電，一般都會去加油站找充換電樁充電為主，所以一定是都會區的轉型會比我們雲林縣等偏鄉地區較快。

Q3-2. 因為電動車是在幾年前就開始有在研發，不過中油是在 2018 年才開始有些轉型相關的動作，這之前加油站業主是否有針對電動車發展合作?

有的，在中油還沒有開始在做綠能這一段的時候，就有部分加油站業主開始嗅覺到這一部份的商機，因為 Gogoro 出來了，全國的加油站理事長聚在一起的時候我們都會開始討論這些事情，所以我們在全國聯合會的時候就有推出一個綠能主委，就是我們台南市的理事長，他當初涉略這一段比較深，因為當初中油都不動，所以我們逼不得已只好找一些電池跟機車廠商還有抽換電站的廠商，他們有意願來結盟一起發展加油站結合電動車的動作，當初包含軟體跟設備等都做得蠻好的，只是後來可能是政策不明朗，所以目前計畫到哪一部份我就不清楚了，後來中油得知業主自己在做這一段的時候就開始加緊腳步的介入，才有這兩個示範站的產生。

Q4. 目前中油陸續於嘉義、台南增設綠能示範站，以示範站的規模及雛形，是否有辦法真的發揮綠能發電的功效?

目前以企業經營的角度去看，當然不是賺錢的行業，但如果是單看他們以這一個系列綠能系統的供應成效是足夠的，如果看它投入的成本一直到它回收的價錢應該是不太可能賺錢，但技術上是可行的。

Q4-1. 目前中油還沒有一個能符合成本效益的技術來源嗎?

他們的目的只是示範站要做綠能可以用這些方式(如:風力、太陽能及全釩液流等)去發電，成本部分要等發展一段時間後才能去做精算，要符合成本只能等未來技術可行再加上民眾購買意願的增加，才可能可以符合成本效益，若是未來充電站大排長龍，就會有越來越多充換電椿的設置，大家都投入之後成本自然會較低。

Q4-2. 示範站的用意是主要是為了吸引加油站業主投資還是為了告知民眾中油開始有在規劃綠能的發展?

示範站的用意也是要給民眾看國家政策的實施,也讓民眾安心說未來騎電動機車不用擔心沒有充電站的問題，可以從北到南、從南到北的放心行走，因為電動機車令人詬病的地方是跑不遠且續航力不佳，如果充電站問題解決之後，疑慮就減低了,從麥寮騎到斗六騎到台中都可以一站站接續下去,購買人數就會相對提升,一方面也是鼓勵業者以後可以朝這個方向去進行。

Q5. 以你的角度及立場，轉型是機會還是風險？

轉型當然是一個機會,因為時代在進步,若干年後一定會慢慢進入到那一個狀態,只是說時間的快跟慢而已，那妳就可以預期說每一個時代的變化，當然那是未來的一個趨勢，所以也是要去吸收一些新的知識，就像是說我們老祖先發明算盤一樣,當然這些都會被慢慢淘汰及更替,如果一直堅持舊的東西,遲遲不願做改變，那這個行業最終還是會被取代的。

Q6. 您會積極去做轉型還是會靜觀其變?

我不會很積極的去做，但我可能換先去吸收一些相關知識，知道未來轉型可以怎麼去做怎麼去經營，但是我不會當第一個，衝太快通常都會死在沙灘上，因為一開始成本太貴了，再來就是我沒有那麼多的時間成本來去跟它耗，靜觀其變的話當然就可以慢慢去觀察說哪一條路是對的，等技術差不多時再出手。

四、營運及獲利：

Q1. 轉型會影響到營業及獲利模式,若未來成功轉型,預估你的站加上環境影響,獲利會提升還是下降。

這個部分應該很難去評估,但是站在加油站業者的立場當然是看到時候油品減少，能源的管銷也會慢慢地減少，就像是現在有兩個加油島，之後可能來客數減少之後就會縮減成一個加油島，而充電的人會變多，充電椿操作上比加油這個部分還要簡單又安全，我們就可以把人力給減少，因為加油站最主要的成本就是人力，那妳看我們油減少，就需要增加一些附加設備，像咖啡廳或是零售商店，店也能監管外面的充電設備，我們就能著重在門市這一段，門市也可以賣東西也可以賣機車，到一個趨勢之後，來加油的人變少就可以採用全面自助加油的方式，就沒有甚麼人力成本了，因為未來會面臨更多人力短缺的問題，再加上現在手機支付設備都做得非常先進，所以就很適合搭配無人商店去做發展，營運上就會更省時省力，當油慢慢減少直到最後沒有油的時候，安全這一段可能就剩下保全這一部份而已，根本就不需要投注大量的人力在那邊了，這是未來，但可能還是要好久以後的趨勢了。

Q3. 會不會想在近期嘗試充電站的設置？

近期的話目前是暫不考慮，因為之前可能政府禁售燃油車的時程是制定好了，但現在又開始不明確，所以這一段我還在觀望，只是說可能要等到政府幾年幾月開始確立，我這邊才會考慮設置充電站的部分。

Q4. 與電動車廠牌的接洽及篩選

依加盟業者去做的話，中油都會有配合的廠商，但至於要配合甚麼廠牌去做的話，這個部分還是由我們加盟業者依當時電動車發展情形去做篩選，但勢必是我們是中油的一部份，所以中油如果有跟一些大廠簽約的話，我們就可以比照，所以機車也可以賣它們的。

五、轉型未來發展前景：

Q1. 大體來看，您如何看待轉型計劃的可行性？是否存在風險？

轉型它存在的風險就是，一開始是國營事業開始去投入，妳看現有的兩大油商中油跟台塑，那台塑在轉型的部分就比較沒有太多的動靜，因為中油是國營，台塑是私人企業，私人企業在評估這一個部分的時候就會以賺錢為前提去考量，那中油是國營事業所以主要會依據國家的政策去設置，一般妳如果看到台塑開始有在動作的時候，就代表市場上好像可以開始動到這一塊了，所以依目前來看，以現在電動車的使用量，機器可能就會放在那邊生鏽而已，你看台塑連在規劃這一方面的東西都還沒有出來，就表示依目前車子的數量應該還是不成氣候，而我們民營業者也是跟台塑一樣的立場，就是停、看、聽，等到電動車都賣得很好的話，我們業者也就會紛紛投入去做充電站的設施，那轉型自然就發展的起來了。

Q2. 你能描述一下可能影響計劃的其他外部環境嗎？

我認為最主要的外在因素是政府態度的不明確，且政策的制定比實際上執行的還要少，感覺好像只是做一個樣板，沒有真正要推動的感覺，他們現在已經做了兩個示範站，若是之後開始建設三個、四個、五個示範站且綠能相關設施都有持續在增設的時候，就表示說中油的上級長官還是有朝著這個方向去做，當初在戴謙董事長任內的時候他們是蠻積極的，現在不曉得現任的董事長在政策的走向方面是否有所改變，再加上現任的行政院長政策的調整，所以對一些有在積極想朝加油站轉型的業主可能就不太敢繼續投注太多。

Q4.您有沒有想在加油站增設可再生能源？

目前加油站最可行去做的就只是太陽能板而已，因為風力不是每個地方都適合，加上又有噪音，所以以目前的技術跟方式加油站還是最適合使用太陽能板，至於中油有一些新的發電方式是否適合，可能還要再評估，它們的價位如何?產電出來的效益是不是值得投資?這個就有待商榷，目前電動車這一段的政策近期還是不明朗的話，我可能就不會打算增設太陽能板等再生能源，但我之前有考量過要裝，因為要搭配充電站的使用，而其實現在很多中油的直營站幾乎都有裝太陽能板了，甚至連民營的都已經有做了，但現在政府在回收這一段的價格又降低了，

所以有時候不見得投資會划算,可能現在目前要大概十年才能回收設備的成本，早期大概六年就可以回收，因為早期台電跟我們收購的電價比較高，早期甚至一度可以到八、九塊，之後慢慢降到六、七塊，現在搞不好降到四、五塊，當然這就會影響我們投資，然而現在有一些太陽能廠商會跟加油站合作，就可能它出設備，加油站就是提供地點，這樣設備的費用就省下來，但是賣給台電的錢就要跟它分，所以如果資金充裕的話，這一段就可以自己來做，之前經濟部能源局好像有補助，我們業者可以去申請，但是不曉得民營加油站可不可以去申請。

Q5. 您任職雲林縣加油站公會理事長，是否有任何方法增進轉型的運行？

早期我會去收集這一部份的資料也是為了要告知所有的加油站目前政府的政策是這樣子，未來加油站面臨轉型的時候我們會開一些教育訓練，去集結部分電池跟電動車的廠商，然後發公文給所有的會員來開會，去讓業主知道說現在有哪些廠商在做這些東西，我們可以怎麼樣去做，之前我們都有做成一套計畫。

Q6. 您針對加油站轉型有什麼建議可以提供給中油？

政策要更明確一點，希望上面新的領導人資訊能夠更透明一點，我們才有一個目標可以跟他們配合，當然他們態度不明確的話，我們沒有那麼多的財源去做綠能的發展，除非是現在市場上有很熱絡，因為如果市場上很熱絡的話，中油不去做也沒關係,但是問題是行政院自己說沒有要停售燃油車了,那很多廠商就會收手，廠商收手我們業主當然也會收手，我們不可能說人家場收都收了，我們業主還搶在前面繼續去做，如果國營事業有心在做，政府又積極在做，當然這種東西就能推得很快，像妳要做一條公路之類的建設，妳只是宣示只是去講，卻沒有真的去做的話，當然無論在等多少年都還是很難成形。

以上訪談內容結束，謝謝您的參與及討論。

Written Documents of Interviewees

訪談對象: 綠能主委-王富宏
訪談日期: 2019/07/18
訪談時間: 16:00-17:00
訪談地點: 台南太子路加油站
受訪者願不願意在論文當中使用真名: 願意
受訪者的 diversity:
1. 加油站公會的綠能主委
2. 三家加油站
3. 經營加油站 28 年

一、轉型定義及經驗：
· 我的研究主題是關鍵利益關係人對轉型計劃的看法,因為台灣中油公司的轉型計劃是在 2018 年至 2019 年期間啟動的，它是一個新的計劃，並且正處於發展階段。我想知道它是否可以實現以及它的風險如何？我認為這個轉型計劃對從事不同領域工作的人有不同的含義。我希望您能以您的立場訴說，您怎麼看待這個問題？
Q1. 促使您積極推動加油站轉型且擔任綠能主委的原因為何？
A: 就是有這個商機，就是因為目前加油站的多角化經營上，我們現在靠油這個市場在賣的話目前很競爭，就想說因應政府的政策，在加油站多找一份多角化經營的事業，以增加加油站的盈餘。
Q2. 請描述轉型計劃現在發展的階段。
A: 中油之前有自己研發充電樁，在台南前鋒站，但是到目前為止沒有使用，因為它是針對三陽機車的開發來做的一個充電裝置，全省都設置好了，卻不能用，因為三陽沒有推廣市場,沒有車,所以前鋒站設置的那些充電樁根本沒辦法使用，我們現在政府其實也是有很大的缺失,會造成沒有人對電動機車有興趣主要原因是因為，政府沒有規定一個公規的插頭，像我們台灣有三大電動車廠牌，三陽、光陽跟 Gogoro，這三家充電方式的口徑都不一樣，今天沒辦法推行就是政府沒有強迫實施一個統一的充電口徑，所以每個廠牌的充電接口不同，像電動機車就是有分單電池跟雙電池，它們的區別就是雙電池的速度比較快以外，它走的距離也比較遠，像中華汽車跟光陽它們都是單電池而已，Gogoro 則是採用雙電池，那針對這一點中油一直有去反映給政府，應該召集國內全省的機車行，要講好到底充電口要用哪一個?然而它輸出的功率也不一樣，我們之前有一個公司就有推出一些解決計畫,這邊有我們的計畫書可以給妳,本來我們民營站是想做綠能屋,綠能屋投入的成本比較高。
Q3. 將加油站與電動汽車充電站相結合是否有任何限制？
A: 沒有限制，我只是在等市場充裕才會增設。

· 我看了一些加油站轉型的報導，新聞媒體在相關報導中提出：
新聞一、台灣中油前任戴謙董事長表示:「中油要扮演落實電動車政策的領頭羊，未來加油站也會變身為商業平台，為此中油已組成專案辦公室，包含 3 年內在加油站及公共場域完成設置 1000 座電動機車充/換電柱，並導入大數據、智慧化、物聯網等新興應用，建立微電網，轉型綠能加油站，成為社區多元能源補給站。」
Q4. 您認為以上敘述發展目前還需要突破那些困境?
A: 我認為他講的那是夢想，不太可能發生，他講的那個微電網在我們台灣不可能實施，畢竟政府做事情扯經濟扯很大，一個政府改朝換代，甚麼東西都停下來了，為甚麼戴董事長會下來?就是因為換院長嘛!然後這個歐董事長也不是賴清德的人，是蘇貞昌的人，所以這個董事長說不定到明年就又換下來了，一個政策沒有辦法永續執行就是因為部門改朝換代，韓國瑜講的沒有錯我們台灣是政治一百分，經濟零分，真的是這樣子，你看我們現在很多不管是甚麼部門，很多政府政策要執行的時候就換人執政了，換人的時候有時候他要報仇阿，就把它推翻掉，像明年如果換國明黨執政很多政策也都要改掉，像核四就好了，現在就停掉。

新聞二、透過現階段兩座綠能加油站的開幕，除了大力展示中油的電池研發技術，以及加油站轉型的企圖，更重要的是以國營企業之力，扶植產業發展，攜手國內業者友量科技生產電池，也協助車廠作轉型。
Q5. 您面對行政院禁售燃油機車政策大轉彎，還會積極推動綠能的發展嗎?
A: 現在交部已經暫緩 2035 年禁售燃油車，這會造成我們加油站業者對設置綠能設備的心情有所影響，導致我們興致缺缺、不想設置，一位原本說 2035 是內燃機車禁止銷售，2040 是汽車，然後據我知道說中油有沒有在接洽這個部分，我說知道的是中油這部分都停下來了，因為改朝換代，現在是歐嘉瑞董事長在帶領中油，因為我都有陸續跟中油在做聯繫，那現在目前他們只有在做一個項目而已，跟 Gogoro 合作去設置充電的交換，目前只有這樣子而已，中油有兩個事業體，對我們國內電動機車比較有幫助，一個叫綠能所，一個叫煉研所，這兩個單位都是開發電池的壽命，電動車有分三種電池，第一個鋰電池，這是目前最好的，充電速度快，壽命也最長，就是現在 Gogoro 跟三陽的電池，第二個叫做鋁三元，鋁三元大概是鋰電池一半的壽命，那現在目前為止鋰電池的話 Gogoro 的充換差不多可以到 500 至 600 次，差不多到 600 次那顆電池就報廢，鋁三元差不多可以充 200 至 300 次，第三種就是目前我們看到的外勞車，叫做鉛酸電池，這個電池的壽命大概充到 100 至 150 次而已，那電池的壽命一直到充換電次數到之後，它的電池就要重新去做淘汰，就是換新的啦，我剛剛講的中油他們的綠能所跟煉研所很厲害，他們現在所研發的鋰電池可以達到大概 1000 至 1200，但是工作都停下來了，電動機車裡面的成本來講，電池大概佔成本百分之七十，其他都是輪子、車體然後就是馬達，然後還有無線裝置，就是一個用手機的 APP 可以跟我們的資料整合等等；我現在推動綠能的那些動作也都停下來了，現在我們的民營站目前

就是在等一個合作案看有沒有把握、有沒有興趣去做，就是三陽機車跟中油公司有做一個雙向合作，然後目前這個計畫好像是說今年年底要去做，可是都沒有聽到中油有講什麼，我有問中油說:「阿你們跟三陽合作都怎麼樣了?」他們就說因為上面沒有說要做所以就停下來了，所以應該從三月份一直到戴董事長卸任後我都沒有在做了，三陽機車目前全省加盟摩托車目前大概有一萬家，現在就是說想利用我們加油站這個場地來展示、換電和充電，那這個計畫現在可能要看現任中油董事長那邊，有沒有一個明確的指示，這是目前的一個發展，那現在政府補助的部分又延長到年底，原本到今年的七月就沒有了，然後從七月到十一月政府就有撥錢下來，就是補助電動機車的部分，有一個東西妳可能要先知道一下，我今天一樣買電動機車，為甚麼有的車不能補助，有的車可以補助?一般我們正統的機車妳要受到政府的補助，一般車商他一定要到我們台灣的工研院，整組電池要到工研院去做一個檢定合格才可以，電動機車從一萬六一直到八萬塊都有，我講的一萬六就是外勞車，妳看市面上就有 Gogoro、三陽、光陽跟中華汽車，他們可以掛牌，他們的電池時速超過五十以上是屬於輕型汽車，時速從九十到一百三是屬於重型機車，然後一般目前我們講的那些雜牌車其實不是電動機車，我們應該較他電動代步車，這個是比較簡單的去區別，電動機車跟電動代步車不一樣，電動代步車其實只能騎低於時速大概五十公里以下，然後他充一次電池大概要充約七個至八小時，充飽之後大概只能騎七十至八十公里的距離而已，那鋁三元它在家自充大概充電時間在兩個至三個小時之間，Gogoro 它現在沒有做這樣的服務就是想去賺這個會員費，跟我們打手機一樣，它不想要我們自己在家裡充電，妳要就到全聯或是家樂福，或是到中油各大直營站及民營站去換電池，Gogoro 的會費好像有從 599 到 799 這樣子去算，譬如說 599 我就讓妳一天騎幾公里這樣子，這是屬於 Gogoro 這個類型的，那三陽跟光陽當然就比較籠統，光陽機車它有一個叫做 iONEX，它是妳回到家之後可以充，在外面也可以充電。

三、轉型立場：

Q1. 因為電動車是在幾年前就開始有在研發，不過中油是在 2018 年才開始有一些轉型相關的動作，在這之前加油站業主是否有針對電動車自行發展合作?

A: 有，我們當初有發展一個叫多角化經營，除了充換電以外我們還有做一個 AI 的無人商店的部分，那時候我有去跟統一協商，但是 7-11 也不敢去做無人商店，因為技術門檻太多了，因為它是取自於大陸的 AI 人工智慧，他們在統一便利商店也有做無人商店，所以我們當初也是想做那樣的無人商店，就是無人看管的商店，那統一它們有想說這樣的話他們可能沒有辦法做，投入成本太大了，光是那個攝影機一間店就要很多成本了，我們當初就是想要做出綠能屋，就是說外面是充換電，裡面就可以做多角化經營，因為目前這一塊中油對無人超商這個部分做的很失敗，幾乎每一間店都虧錢，它是把整個加油站的這個房子把它切為兩半，一半營業一半去賣東西，那妳消費者走不進來嘛，應該在路邊就來做啊，就是說

可以把充換電跟超商去結合在一起，但我想它們的能力應該沒辦法做出來，畢竟中油的直營站太多了。

Q1-1. 在你還沒跟中油合作之前有跟電動車廠牌做接洽過了嗎?

A: 現在目前中油跟 TPK 也好跟三陽也好，他們只是簽一個備忘錄而已，備忘錄就是說雙向協議合作，沒有正式簽約，中油現在也是有這些單位，只是中油這些人，政府有錢嘛，開發費都花了結果沒有執行，因為它花了好幾億在這上面，像我現在我的站上面也有100K的太陽能,想利用太陽能引進來跟電動機車做結合，就是上面是太陽能，那電傳下來，上面的太陽能可以去發電，然後電就放在兩個地方，一個充電池，一個就是可以充機車，因為我們的方式有兩種，充跟換，目前這個理想好像也還沒實施，目前唯一一家就是台南市的前鋒加油站，它是全省第一家太陽能電動機車的示範站，它也是利用上面的太陽能發電，它地下室還有全釩液流的機器，他們的機器都設計好的，有充電跟換電，這一部份他們還想做到社區微電網，可是這有一個問題就是政府的電業法還沒有通過，電業法通過就是說我們民營的企業不可以來做電能的買賣;那我們當初做的部分就是我們團隊有設計出一個我們的能源屋，這是在中油做之前我們自己組的一個團隊，最後沒有做成就是因為中油的商業組合沒有做好，因為這個部分的商業結合非常困難，因為我們跟中油的性質不一樣，我們都是中油的加盟站，我們要以商業利益為考量，我們沒有這麼多的資源，主要是政府沒有支持，因為政府都是做那種半吊子的工作,他們今天針對買電動車的人有補助,因該也要對機車廠去做一個雙結合，像是 Gogoro 已經虧損十幾億了,它成立了好幾年,平均每年都會虧損將近兩億，所以它目前已經增資四次了，Gogoro 它是看以後不是看現在，目前排行第一的是 Gogoro，第二就是光陽跟三陽；我當初合作是找一家我們國內的貿易公司，他們有做網路平台的開發，他們網路平台本身也是有在賣車，他們也有一個團隊在開發那個東西，而我們全聯會只是輔助的角色而已，我們當初想用他們公司做的這份企劃書去跟中油合作，而中油當時對我們的合作是非常感興趣的，之後問題就出在中油腳步停了之後我們也停了，因為我們不是主導，我們只是一個媒介而已，我們全聯會本身不是專業，專業的話在中油跟機車行。

Q2. 針對今年中油提出轉型計劃的看法。

A: 針對加油站轉型他們目前有做一個案子很失敗，中油現在在全國有做好像三十幾個站，跟中華汽車的合作，他做一個平台，把車放在裡面，現在消費者如果要買一個車，那站長就把車商的資料拿給他寫，他寫完之後就替他傳真到公司去訂機車，加油站在這方面所能做的就只有充換電的服務而已，賣機車的專項還是機車行,但是或許中油他們有一個計劃也是想說讓加油站有一個舞台可以來賣機車,他們有規畫過,現在這個案子有沒有在推我是不知道,要等三陽的車子出來。

四、營運及獲利：

Q1. 會不會想在近期嘗試充電站的設置？

A: 台南最近有選出16個站來建設充電站,我這邊也有入選,其實業者興趣缺缺，它一個月租金才收個3500,3500你要裝嗎?然後電不是我們的電是用他們的電，所以很少人想要做這方面的轉型，一定要中油公司、機車廠、跟我們政府這三方面要連在一起，這個才有辦法實施，還有最重要的問題就是政策，沒辦法結合的關係就是綠能政策沒有很明確，然後中油又踩煞車，應該去定一個計畫，譬如說五年你要做甚麼，十年你要做甚麼工作，因為機車目前全世界還沒有甚麼龍頭，全世界的人對電動機車市場最大好像就是中國大陸,因為有的國家是禁止騎機車，目前汽車的部分則是全世界都在推，像很多國家例如荷蘭，荷蘭到了2025年就全面實施電動機車,那我們台灣目前來講沒有這個政策,你說要能把這個電動機車的市場打開的話一定要有政策。

Q1-1. 轉型這麼困難為甚麼您當初還會投入這麼多心力去做？

A: 當初是政府委託中油去推動電動機車，然後中油公司有找我們加盟站來去談這個事情，我是從那邊開始我才去找廠商，是這麼來的。

Q1-2. 與電動車廠商是怎麼做接洽及篩選的?

A: 那時我在找的時候剛好我有一個同學在彰化，他剛好跟李董是好朋友，那時候我介入的時候李董剛好也在賣電動機車，它已經賣了大概兩年了吧，他是從104年就在賣了，然後我們是106年開始談這個case，談了大概兩年，106年到107年都還有在進行，我剛才說的李董就是在賣外勞車，他不是在賣光陽、三陽還是Gogoro,他是在賣一台一萬多塊的車子起來的,他有引進大陸的品牌進來，叫愛瑪，賣得也不好，因為最近電動車的市場太小，所以除了Gogoro以外好像其他的廠都沒在動，三陽、光陽或中華汽車都賣得很差，Gogoro的市佔率大概就佔百分之八十以上，然後三陽好像大概百分之五而已。

Q2. 如果未來加油站沒有轉型成功，電動車比例又不斷的成長，您對此會有任何疑慮/擔憂嗎？是什麼？

A: 主要是政府的工業局，政府方面在推廣的力道，加油站目前可以做的部分就是換電而已，其他就是賣機車，因為我們那時候也有構想就是說加油站賣機車一定輸給那些傳統的車行，因為我們加油站不是專業的，你現在看一般的那些傳統的機車行，他們本身專業度就很夠，他們有推銷、維修還有各方面的保證，可能加油站就比較沒有那方面的專業性，因為加油站的專業性還是在賣油，然後現在傳統機車行本身的服務性，從事四、五十年的很多，賣機車的很多都賣超過四十年了，還有最重要的一點就是民眾的消費意願，我們有做過調查，十個裡面有八個消費者希望在機車行買機車，他們不想從加油站這邊去買，因為他們很注重售後的服務跟品質，如果今天加油站來賣機車，加油員有辦法去做一個專業上的解釋嗎?問他車子的性能、車子的耗電量或者是車子的優缺點，政府把禁售燃油機車的政策停掉，就是因為那些機車業者有去跟政府陳情，萬一政府真的實施電動機車的話，據說有十幾萬的家庭會失業。

五、轉型未來發展前景：

Q1. 總體來看，您認為轉型的可行性為何?

A: 短期來看除非中油可以跟機車廠和政府三方面去做結合，因為現在是三方面都沒有辦法結合，現在有一點可能的合作就是三陽跟中油，你要機車廠還有中油和政府的補助，不然一定沒辦法可行。

Q2. 您針對加油站轉型有什麼建議可以提供給中油？

A: 其實很簡單，就是政府還要再支持，我是涉入很深但是我對政府很失望，政府花了很多錢喔，它光是煉研所就有一百多個人在負責，這些人都已經閒閒沒事做了，但他們是國營企業人員，它現在已經沒有在從事綠能，而且都停下來了，我當初涉入的原因是因為商業利益，做到已經可以在我們加油站裡面去招商了，那招商就遇到中油打退堂鼓，你中油不支持我們怎麼做?我們那時候是想說，中油做的時候我們也可以一起做一些建教合作，結果中油整個案子停下來我要怎麼做?我不像 Gogoro 那麼有錢，像 Gogoro 它可以一年花個幾億去虧，我們沒有辦法去做這些，因為他們後面有民間集團在支持，光是一組電池、一組車型要鑑定一個電池的時間大概要兩年，費用要兩百多萬，光是鑑定費就要兩百多萬了，這也是政府部門本身的問題，所謂民間業者投資就要給民間業者一些寬松的資金跟時間，政府部門的時間太慢，你說你的電池去做一個檢定和證明為甚麼要到兩年?但我知道現在已經有縮短到一年，我一個機車我發展車來了放在那邊，我電池拿去做檢定，我車還不能賣喔，Gogoro 機車你去看它沒有新款，因為它一個新款又它要去鑑定一次兩百萬，然後它又要花一年的時間，等到電池出了之後才能在市面上去做銷售，所以這方面是政府沒有執行力。

以上訪談內容結束，謝謝您的參與及討論。

Written Documents of Interviewees

訪談對象: 中油煉製研究所博士
訪談日期: 2019/07/11
訪談時間: 10:30-11:30
訪談地點: 中油煉製研究所(嘉義)
受訪者願不願意在論文當中使用真名: 不願意
受訪者的 diversity:
1. 煉製研究所技術服務組-專案經理
2. 從民國 100 年開始從事中油材料開發
3. 參與部分中油電池負極材料的開發及綠能加油站開發

一、受訪者背景：

Q1. 能否訴說一下您的工作職稱及背景？

A: 我目前是專案經理，從民國 100 年開始就陸續在做材料開發，只是這個綠能加油站的事務是因為去年開始公司政策跟政府下定的一些政策才開始有在從事這個方面的研究，所以智慧綠能相關的事是去年(2018)才開始，所以在去年之前都是在做電池材料的開發。

二、轉型定義及經驗：

· 我的研究主題是關鍵利益關係人對轉型計劃的看法，因為台灣中油公司的轉型計劃是在 2018 年至 2019 年期間啟動的，它是一個新的計劃，並且正處於發展階段。我想知道它是否可以實現以及它的風險如何？我認為這個轉型計劃對從事不同領域工作的人有不同的含義。我希望您能以您的立場訴說，您怎麼看待這個問題？

Q1. 您是從哪裡得知到轉型計劃的？

A: 我們是公司的幕僚單位，所以轉型就是我們去建議的，應該說市政府先給我們一些大方向，然後我們這些幕僚單位就要去擬定針對這些大方向去執行，在這些大方向下面我們應該可以去做甚麼事情，然後定期的去跟領導階層回報再做下一步策略的制定。

Q2. 請描述轉型計劃現在發展的階段。

A: 本來政府有規定燃油車的一些發展時程，例如本來 2035 年不能再販售燃油機車，然後 2040 年還是 2045 年燃油的汽車也不能賣了，因為有這樣的前提我們開始思考說，第一個，加油站要怎麼轉型?第二個就是我們的產品線要怎麼去轉型?這兩個層面的問題，那加油站的轉型就是以後如果有電動車的服務的時候我們要怎麼做，所以我們基於這樣的一個理念跟目標，我們去年就開始規劃兩個所謂的智慧綠能加油站，一個在嘉義，一個在台南，然後根據兩個研究所不同的研究項目去規劃，還有搭配那個站體的一個特性去設計，兩個示範站的設計目的跟它搭

配的東西都完全不一樣，所以就是採取有點像先試先行，看這樣的架構之下可不可以去運轉，這是加油站的轉型；那產業轉型的話我們現在還是持續，之前都是主要著落在材料的研發，可是理論上如果因應這種綠能轉型的話其實你要思考的是產品的開發，產品的開發有一個微笑曲線，材料、製造跟產品，這兩道是最有經濟價值，中間這個是最低的，所以我們現在開始去思考怎麼去設計這個材料，之前戴董事長還在的時候，那時候宣示說中油要做電池，就是一個產品，那這個產品目前還是研發的問題，就是我們會跟機車廠把這個電池去跟機車廠的機車做實際的搭配之後，看它實際的性能表現跟它的安全合不合我們的期望，重點是安全，因為電跟油本來就是一個相剋的東西，你在加油站，油氣那麼多的地方要放一些電的東西會有一些安全上的疑慮，尤其電池也是，所以我們必須確保它安全無慮的情況下，才會進一步評估這個商業化的可能性，從產品面來講的話，所以轉型目前差不多是到這樣的一個階段。

Q3.為甚麼中油在嘉義信義路站及台南前鋒站的綠能示範站使用不同的技術？

不同技術是因為中油有三個研究所，一個是碳採研究所，就是去找哪裡有油氣，哪裡有油礦的地方，它在苗栗，那另外兩個研究所是煉製研究所在嘉義市，它是中油最老的一個研究所，也是最大的研究所，主要是在做一些製程的改善跟一些新產品的開發，那有一個在高雄的叫做綠能科技研究所，它顧名思義就是一些跟再生能源有關係的太陽能、風能之類的都是在他們那邊進行，所以兩個研究所研究的課題就完全不一樣，因為煉製研究所在嘉義，所以我們就會把我們研發的東西加在裡面，例如說我剛剛講說我們在開發中油的電池，在做負極材料，我們做的就是鋰電池的材料，所以在嘉義信義站全部放的都是跟鋰電池有關的東西，然後台南是用綠能科技研究所他們研發的項目，例如說有燃料電池、有太陽能、鋰太陽電池、還有釩液流電池，因為是兩個研究所個別去設計規劃，所以才會放不同的東西，這樣也有一個區隔性，因為目的不一樣，再來就是說，嘉義信義站的設計目的就是所謂的自給自足，因為嘉義信義站本身有一個很大片的太陽能板系統，其實它產生的電是非常充沛的，所以當初設計的理念就是要把所有太陽能的電，全部供給一天的加油站所有電的使用，才叫自給自足，也就是說當初設計的目標是在晴天的情況之下，我們的綠電使用率可以達到 95%，加油站跟充換電所有的電，95%的電都來自於太陽能，然後台南那一個站叫做多元電力系統，因為它有不同的電力來源，一個是太陽能，一個是燃料電池，它也有不同的儲能系統，一個叫釩液流，一個叫鈦酸鋰，它是比我們的複雜一點，所以是兩個不同的設計取向。

Q4. 嘉義信義路站是以電力自給自足為目標，台南前鋒站則是以多元電力與儲能用用為主，你們有評估過兩者之間哪一種方式較能產生最大的效用？

A: 目前來講應該是說，這個東西要長時間的去收集 data 才知道，所以我們才叫示範站嘛，這兩年是我們的一個示範、觀察的一個期間，之後才會做一個效益評估。

Q5. 那研發示範站所投入的成本呢?

A: 一般來說從創能、儲能跟用能這三個層面來看的話,創能一般都是用太陽能,它已經是蠻成熟的一個產業,那其實最大的成本是來自於儲能系統,儲能系統都很貴,貴的話在台灣推動其實是沒有甚麼效益,因為台灣的電太便宜了,但如果你在日本、美國甚至歐洲的話儲能系統相較來講是非常有效益的,因為他們電費是有一個時間差價,尖峰的時候電價特別貴,反正就是供需的原則去設計這個電費,我們這兩個示範站的儲能系統成本其實都不低,所以我們這兩個示範站比較不會去從經濟的效益去評量它,我們會從非經濟效益去評估它整個建這個站的一個可行性,跟它可帶來怎樣的好處。

Q6. 目前針對中油的綠能示範站來看,儲能系統有辦法做到普及嗎?

這個是有辦法的,因為電池每年甚至是每一個月都在日益精進,無論是在技術或成本,儲能系統最大的成本就是來自於電池,那電池如果你要評估成本達到一定的範圍的話,經濟規模要夠大,可是台灣現在沒有,所以有點像雞生蛋蛋生雞的問題,市場夠大它就可以帶動市場產業,就會便宜,或者是說電子產業夠大,出來的產品也會較便宜,就是這樣子,就是要取捨,不過我相信這個下降的速度跟半導體有點類似,所以再過幾年應該是可以預期,儲能系統可以下降到差不多具有商業的競爭力。

Q7. 目前鋰電池的使用率高嗎?

鋰電池的使用率很高,大家用的手機都是使用鋰電池,鋰電池使用的範圍跟應用很廣,電池有很多不同種類,就要看你應用的範圍在哪裡,就是適才適所,像是手機體積這麼小,它在乎的是你一顆電池能帶多少能量,越高越好嘛,機車也是,機車空間不大,所以當然要帶有一定的電量,不然我騎到一半很快又沒電,但是這個東西如果越大的話,它反而不在乎那些所謂的單位體積帶的容量密度,比如說巴士好了,它很大所以空間也蠻大的,它一顆電池能夠帶的電量不用像機車要求的這麼高,所以在機車上鋰電池的設計是屬於比較嚴苛的,因為你想想看你騎摩托車,每天都在震動,對電池來講就是一個外力,然後再加上天氣又熱,鋰電池最怕熱,再來就是說,你又要快速充電,帶的電壓又多,所以所有鋰電池的應用裡面,電動摩托車最嚴苛。

Q7-1. 它的危險性是不是也很高?

對,你看 G 牌(Gogoro),前陣子不是在很多地方放了很多電池櫃,然後天氣太熱,也有看到多新聞是電池噴出來等等,所以現在董事長才會想說一些安全事情都要確定不能有任何閃失,他才願意推出這個電池。

Q7-2. 所以目前鋰電池機車還沒有正式推出嗎?

還沒有,但是我們私底下都還在跟車廠密切的合作,因為老實說,它弄上去會怎樣沒有人知道,除非做實驗。

Q8. 將加油站與電動汽車充電站相結合是否有任何限制?

限制就是剛才所提到的油氣很多,鋰又電池是很特殊的,它不像一般的電器,其實加油站本來對電器的使用就有一些辦法,只是那是普通的家電,但鋰電池比較不一樣,鋰電池是一個化學的東西,它的燃燒行為跟電器不太一樣,所以盡可能

把這些充換電設備遠離油氣區域，當然我們公司針對這個議題也開了五、六次的檢討會，邀請國內外專家去給一些意見，應該不久的將來會有些辦法出來，就是如何將這些特殊的電的東西放在加油站裡面。

Q8-2. 將加油站與電動汽車充電站相結合的優勢在哪裡?

你想想看在加油的時段，大家要加油一定先想到中油，中油的點又很綿密，騎一騎不用擔心要走很遠才會到下一站，就是要結合便利的優勢繼續去推廣，中油本來就是能源的供應者，現在是油所以是供應油，電的話我們也可以去供應電，所以還是堅守在自己的本業，這是它要推廣的目標跟優勢。

Q9.為什麼加油站適合設置可再生能源？

現在傳統的電廠都是像台電這樣的大電廠,那你就會發現當一些地震的時候整個大區會停電,所以現在電網有一個很重要的發展趨勢叫做分散型電廠的一個概念，例如我這個嘉義 C 區，就有一個負責發電的區域，甚至不要擴這麼大，例如說甚麼里，這附近應該有個電廠可以供應這個里去發電，那這些就是分散性，例如說小電腦，這些小電腦電壓從哪裡來，總是要有個產生電的方式，就是用太陽能還有風能，這些就很適合再生能源去做分散式的電，那加油站適合做這個東西是因為它剛好都是在一些樞紐上，所以它很適合做一個能源的中繼站，社區可以圍繞這個加油站去供給它的電，做一個再生能源的供應站。

Q10.中油之後還會再推出綠能示範站嗎？

董事長說今年還要做兩個站，一個在東部花蓮，另外一個西部要再挑一個點做。

Q11. 他們使用的技術會和以往的示範站不同嗎？

對，因為示範站基本上每個都要有不同的賣點，才叫示範站，然後基於這個示範站的運轉才知道，以後中油加油站要複製哪一個模式。

Q12. 中油在嘉義和台南示範站使用了許多不同的可再生技術，由於中油的研發團隊正在繼續推出再生能源，請問哪一項是效用最大的技術以及為什麼?

A: 電池其實適才適所，假如說電廠的程級越大，好幾個 Gega 那種，我覺得釩液流是很適合的,釩液流是適合非常大的電廠,因為每個電池的特性也不太一樣，釩液流就很適合那種大電流瞬間輸出輸入，鋰電池就沒辦法，但是如果比較小的廠像信義站或是家用的話鋰電池就很適合,但現在全釩液流跟電池成本都很高。

Q12-1. 成本很高的話，未來會不會也較難做到普及?

未來的事誰都說不定，如果未來市場夠大的話，它的價格或是它的製造成本就會下降。

· 我看了一些加油站轉型的報導，新聞媒體在相關報導中提出：

3. 台灣中油前任戴謙董事長表示：「要在 3 年內在加油站及公共場域完成設置 1000 座電動機車充/換電柱，並導入大數據、智慧化、物聯網等新興應用，建立微電網，成為社區多元能源補給站。」

Q13. 報導內所提出的是否具可行性以及原因?

那個是政府的政策，工業局要求我們配合，所以可行性的部分我們一定要把它達成，因為這是政府下的命令，工業局要求我們三年內要蓋完就是要蓋完，沒有甚麼可不可行，就是要做完。

Q13-1. 那中油對轉型採取的態度為何?

我覺得戴謙董事長之前的一個概念是蠻好的，本來就是要及早布局，現在中油還有時間可以去及早布局，把所有的可能性都去研究先做起來，等到那一天到來的時候，我們才不會驚慌失措，然後花大錢買一些莫名其妙的技術。

Q13-2. 中油聲明未來將導入大數據、智慧化、物聯網等新興應用，目前有做到這個階段嗎?

有，大數據跟 AI 的部分其實在信義站有將大數據及物聯網融合在裡面，所以這是同步在進行的，就能源的調度的話其實簡單來講，我們綠能加油站就是創能、儲能及用能，但其實台灣的資源很有限，大數據大家都會講，我們以前都在做大數據，可是重點是數據是死的，目的是如何把這些能源做最有效率的應用，比如我們在信義站屋頂有一個很大片的太陽能板，其實它就固定在那邊，我們的研究課題就是說怎麼讓它產電最大化，因為太陽能板會髒，然後下雨或是說落塵有的沒的，就會導致它的發電效率降低，甚至哪條線走火也不知道，所以這都會影響所有的發電效益，所謂的大數據跟物聯網就會在這邊發揮作用，所謂物聯網就是說，每個太陽能板上面可能就會有一個感測器，你就可以知道說它每個設備當場的狀況，然後回報給中央的控制中心，然後你可以通知維運人員哪個部分壞了，這是很基本的，再來更進階的就是說，我們甚至可以根據下個禮拜氣象局的天氣預報可能告訴我說，下禮拜可能會下雨，那到時候是不是要先把太陽能板關掉，然後晚上的時候這個儲能的電池要多充一點電，因為你隔天太陽能沒有產電的話，你要用最便宜的電費，用離峰時間去充電，然後白天的時候是尖峰，尖峰就用電池來放電，但是你要先預知這個事情，這在現在的能源科學裡面有一個學科叫智慧排程系統，我們現在就在開發這個系統，這就是一種 AI 跟大數據的結合還有跟物聯網的結合。

Q13-3. 那有辦法供應社區的能源使用嗎?

有阿，現在是做到甚麼程度，你如果有機會你可以去日本看一個 Panasonic 他們做的一個智慧綠能社區，他們住宅、社區都有智慧電表，沒人的時候它感測沒有人它就會關電，然後它後面裝燃料電池、天然氣產電之後產生熱水還可以泡澡，等於所有能源都不會浪費，他們現在是做到這個程度了。

Q13-4. 加油站目前發展的目標為?

加油站目前要做這樣一個中繼站，因為每一個住宅一定都會有多的電，但多的電要有地方存下來，可以存到中油這邊來，中油有一個大的儲能電池，然後等到你跟我簽約之後你這個住宅有一天需要用電的時候，我可以用便宜的電賣給你，這就是互相互惠，大家都不會浪費，然後你需要用電的時候我可以用比台電更便宜的電賣給你，因為當初的電是你賣給我的，這是一個共生的模式。

Q14. 現在政府政策的轉彎主要是因為傳統車廠的抗議，那目前有沒有辦法協助他們做轉型?

其實摩托車他們要面臨的問題很多，第一個電動車跟燃油車完全不一樣，燃油機車你看一些火星塞或是說引擎那些，其實都需要人的功夫，有經驗才有辦法去處理這些問題，可是電動的不是，整組壞掉就換一個較好了，不是說要像以前燃油車那樣師傅的功夫決定一切，這樣會影響一個生計，如果全面換電動機車的時候，全台灣有一兩萬家機車行要怎麼辦?他們最大的獲利來源就是修理摩托車，那電動機車做起來之後，這些人都沒有可以著力的地方了，這是第一個他們要輔導的問題，可能影響一二十萬家庭的生計，這是第一個很嚴重的問題，所以那些機車廠商會極力去阻擋，是因為他們還沒有找到對策，第二個就是說機車很好賺，賺得開開心心的為甚麼要去淌這個渾水，這是第二點，第三點如果不是中油這樣的國家單位來做的話，其實他們去做這樣的電動機車對他們來講負擔會很大，因為電池很貴，他們又不懂電池，導致車的整個價格會高很多，所以那時候戴董才會提出一個車電分離，我覺得這個概念其實很好，也應該要這樣子做，因為其實中油在做電池不是只有摩托車做一做就算了，因為一顆新的電池電流量是百分之百，用到一個程度譬如說百分之八十的時候它會衰退，兩年之後它可能充飽只能充到百分之八十，這顆電池就不能繼續在電動機車上使用了，它就要退休了，退休後不是代表這顆電池沒用了，它只是不適合運用在這麼激烈的環境，可以繼續把這顆電池拿去做儲能，等於像信義站的儲能系統，你可以把這顆電池裝進去裡面做儲能，因為儲能很緩慢，所以它很適合這樣的情境，等到剩下繼續用到百分之四十的時候，它就整個要報廢了，要回收，要用一些化學溶劑把裡面的一些重金屬洗出來，其實還可以再重新利用，這所有的課題我們都有對應的研究題目正在進行，等於說中油來做這個生意就非常的適合，因為它整個循環經濟的產業我們都有思考進去。

九、轉型立場：

Q1. 當初中油怎麼會想要與台達電合作去做貨櫃型儲能系統？

選擇台達電第一個就是說台達電在國內甚至全世界，算數一數二的跟電的設備有關的公司，因為你要做儲能系統你要有一個觀念就是說，它電池的品質的一致性要很好，等於說它出廠每一顆的差異性能不能很大，否則這樣對儲能應用很傷，這取決於說有一個公司要全自動化生產，等於說你要開一間電子公司它做的電池一致性好不好就是看它自動化的程度有多少，台達電基本上現在是幾乎百分之百，因為它是跟日本三菱買整個廠的輸出，整廠輸出全部全自動，所以至少可以確保這個電池在儲能應用上不會有任何的閃失，再來他們的經驗也蠻夠的，所以我們那時候才會決定使用他們的系統，重點是很安全。

Q1-1. 貨櫃型儲能系統有存在任何缺點或風險嗎？

缺點就是鋰電池很怕熱，凡事都有風險，就是因為我們知道鋰電池的風險在哪裡，鋰電池它是一個活的東西，因為它的電化學反應時時刻刻都在產生，所以你一顆

電池如果很久放在旁邊沒有用的話也是很恐怖的，像 Gogoro 如果兩、三個禮拜都沒有動它的話它會發簡訊來通知你去換電池，因為它電池會一直放電，自己放電出來，放到一個程度那個電池就死了，那一顆電池就爛掉了，所以我們也會很怕這種事情發生，我剛才講那麼多就是說鋰電池本身是一個隨時都在動態且產生反應的一個東西，所以你很怕它裡面產生甚麼短路造成它溫度上升，然後一發不可收拾，對於溫度的監控跟它電流、電壓及電阻的監控其實都要很在意，它是有風險在的，並不是說絕對安全，我們這邊強調安全就是說把預防跟後續危害的處理做到最好，我們現在是可以擔保這件事情，但是不會擔保說這個電池絕對安全。

Q1-2. 所以以儲能來看全釩液流跟貨櫃型儲能系統哪一個較好？

這要看在哪一個應用，全釩液流如果拿來像信義站或是其他更小的電廠其實是很不划算，因為太貴了，它適合大電廠，如果台電要蓋一個大電廠那它就很適合做全釩液流，全釩液流號稱有危險，它的電解液是酸的，它還是有腐蝕的危險，它造成的危害跟鋰電池所造成的危害是兩個不一樣的層面，鋰電池可能會有爆炸燃燒，它那個是可能會有另外一種公安的危險，例如說腐蝕，它裡面都是酸的融液，碰到皮膚可能會爛掉之類的，有不一樣的公安危害。

Q2. 中油蓋示範站的主要目的為何?

這其實我們戴董事長之前一直在講說加盟業者是我們的命脈、兄弟，是重要的夥伴們，所以他一直也在幫助加盟業者思考這個未來的路該怎麼走，這也是示範站的一個目的，可是示範站最貴的就是電池，所以怎麼去降低這個成本，這是我們現在研究的課題，我們現在正在做研發電池，這個電池安全之後，我們就會提案一個報告說，中油是不是應該要蓋一個廠做電池，成本跟性能我們可以自己掌控，然後可以進一步拓往，如果我們之後要轉型的時候可以用，我們會做這個事情。

Q3. 充電樁跟換電樁哪一個比較好?

這個不知道，因為老實說各有各的好，中油電池的設計本來就是說你要充電還是換電都可以，看車廠的設計還有消費者的選擇，假如說你今天比較沒有錢，卻有很多時間，就可以選月租費比較便宜的，但是我今天時間太寶貴，我可能就會選擇較高的月租費，一分就能換電，在這方面就是讓消費者去選擇最適合自己的方案，我們主要是以這樣子的理念去設計，老實說充換電哪一個比較好其實也沒有答案，那像中華它是想要做快充機車，三陽就想要做換電，但是日本三葉它就是給一個答案說，當你要遠程，就是騎乘時速要到每小時八十公里以上，這種高性能的車應該就要用充電的比較好，那換電就是適合用都會區短距離的，他們有這樣一個策略的一個制定，所以就看你的車型。

Q4. 你們當初規劃示範站的藍圖與現在的成效有落差嗎？

因為那些外觀跟場域都是我們自己去主導的，所以它的樣子是我們要的樣子，但是可能還有要修的部分只是因為時程很短，不然其實還可以做得更好。

五、轉型未來發展前景：

Q1. 中油目前除了再增設兩站綠能示範站還有沒有要做其他綠能的轉型設施？

因為剛才有講說工業局請我們三年內要推一千站，所以明年還會繼續蓋充電站跟換電站，然後明年的話會有加入新的換電系統，就是光陽他們也有一個新的換電系統，它有加入所以明年會有一些站會有光陽的系統在裡面，綠能加油站預計今年會蓋兩座，但是明年會蓋幾座還不知道。

Q2. 中油政策還是會在持續下去做嗎?

董事長換了之後可能政策會換，所以我不曉得，我覺得還是這樣子啦，因為他們還是在乎到底安不安全，我們示範站的作用也是這樣子，要實際運作過後才知道，我們是希望這些運行成果之後，跟剛才講的那些開發成果，跟他們報告之後他們才會去決定下一步該怎麼走，現在還沒有辦法去下一個定論說該怎麼辦，但是大方向當然還是一定會走，但是要多快多慢現在還沒辦法保證。

Q3. 中油前段時間正在進行天然氣的天然氣重組系統，把天然氣轉換成氫氣作為燃料電池，過程中產生的熱能則可產製熱水，提供加油站宿舍自用，目前運行的情況為何？

那是燃料電池的其中一塊，其實那個東西是一個很成熟的技術了，燃料電池是一個很成熟的系統，當然我們綠能研究所在做的是，這個燃料電池裡面有一個叫重組系統，重組系統就是要先把天然氣轉化成氫氣之類的，這是其中一個小塊的附件而已，你說燃料電池現在全世界沒有一間做的贏 Panasonic，Panasonic 太強了，我們現在有跟他簽 MOU 就是希望他們可以教給我們一些知識，他們可以連續運轉 22 個小時，然後效率都保持在很高。

Q4. 嘉義前鋒站目前的來客數有沒有辦法勝過綠能的投資成本？

沒有辦法，來客數零，現在還沒有充電機車，但是換電的機車很多，老實說因為中油是國營事業，本來就是要先把基礎建設做完，所以現在要先看市面上有沒有快充的機車，那我們上半年是沒有，因為我們市面上也沒有一台機車是可以做快充的處理，除了我們示範站有四台我們自己的快充機車之外，就沒有了，而今年中華六月發表一台快充機車，就可以使用我們的快充樁，所以中華才跟中油合作在桃園市加強蓋了很多快充的充電樁，因為中華機車他想要先在桃園市強力去推廣他的快充機車，相信下半年那邊的來客數跟使用量會很大。

Q6. 針對加油站轉型有什麼建議可以提供給中油？

建設成本降低，因為儲能電池非常貴，每一站也不是說真的適合放那些電池，因為地沒有那麼大，所以還有很長的一段路要走。

以上訪談內容結束，謝謝您的參與與討論。

Written Documents of Interviewees

訪談對象: 中油綠能研究所博士
訪談日期: 2019/08/01
訪談時間: 10:30-12:00
訪談地點: 台南智慧綠能加油站(前鋒站)
受訪者願不願意在論文當中使用真名: 不願意
受訪者的 diversity:
1. 綠能科技研究所 企劃行政組
2. 代理組長
3. 接觸綠能相關研究及開發近十年
4. 負責台南前鋒站智慧綠能加油站開發

一、受訪者背景：
Q1. 能否訴說一下您的工作職稱及背景？
我是中油公司綠能科技研究組企劃行政組的組長,我們的工作其實就是做一些綠能的相關研究，那現在在企劃行政組就是做一些企劃的推廣，還又一些行政工作。

二、轉型定義及經驗：
· 我的研究主題是關鍵利益關係人對轉型計劃的看法,因為台灣中油公司的轉型計劃是在 2018 年至 2019 年期間啟動的，它是一個新的計劃，並且正處於發展階段。我想知道它是否可以實現以及它的風險如何？我認為這個轉型計劃對從事不同領域工作的人有不同的含義。我希望您能以您的立場訴說，您怎麼看待這個問題？
Q1. 嘉義市煉製研究所，而台南是綠能研究所，為甚麼要分成這兩種不同的研究中心?
煉製研究所主要是服務我們公司的煉製系統,它最主要就是開發一些電池的事務或者是幫公司做一些製程改善，當然後來綠能開始有一些發展，未來的政策也會走向綠能，因為這是環保問題，所以我們公司就有規劃說要走這個綠色能源的部分，一開始其實我們跟煉研所是在一起的，我們綠能科技研究所是從新能源組合裡面再獨立出來的，當然那時候人比較少所以就以分組來成立，我們做這個綠能研究所主要是因為遇到高層要觀察這個議題，高廠在高雄其實面積蠻大的，未來我們要怎麼樣保存高廠的土地，因為你沒有用就會被收回去，所以我們那時候就想說要在高廠成立一個研究所，在那邊做一個比較綠能的研究，因為高廠那邊的居民長期認為煉油廠是一個嚴重的汙染問題,所以說我們公司也有想法就是說把那邊變成一個綠能的基地，也是改變居民對我們中油的印象，所以才在 100 年開

始成立綠能中心到現在大概 8 年,這兩年像去年開始其實經濟部有想要把那邊變成一個綠能技術跟循環經濟的研發中心,所以說在高雄市有這樣子的背景才會成立。

Q2. 現在示範站成形之後，你們還有在從事綠能相關的研究發展嗎?

其實我們做的綠能的題目是蠻多的，我們從所謂的因應環保議題，未來石油可能不再開採，石油不再開採之後一些石化原料就沒有了，我們沒有石化原料的話我們就有想一些方法就是說從一些動植物生質的來源來做這一些原料,所以我們其實有在開發一些生質原料，來做不管是油品，或者是石化的材料，來當替代，這些都有在做，投入太陽能也是有在做，因為國家跟我們公司都有新能源的政策，我們就要配合，所以我們在九十幾年開始就有協助油銷部在做太陽能，其實我們已經有大概兩百多個站了，我們有去做一些管理系統，讓這些太陽能的發電變比較好，基礎研究也有在做，另外就是氫能，像日本就覺得氫能是未來能源的終極使用目標，因為它最乾淨，但是因為它離要實現還有點距離，不過日本其實已經做的很多了，我們也有在關注，也有做一些核心技術，剛好藉由這次綠能站要去做規劃，我們就把它找進來，所以氫能也是有在做，另外在材料部份我們也是有在做，像是剛剛有提到的負極材料，算是為了電池，因為電池在台灣的最大問題就是成本太高，另外就是電池材料會燃燒所以會有點危險，再來就是在商業上這種電芯廠它遇到的問題是,它都是做幫人家代工的電池,它遇到的是國外的廠商,量都很大，成本很低，所以他們營業就會比較困難，因此我們就有發展較新的材料，想要做比較不同的應用，或改善安全性與提高產品的性能，以後商業化就可以幫助台灣的廠商去做比較高規格的電池，看能不能有比較好的銷售，這都是在我們之前戴董事長的時候他有的雄心，我們研究所就配合，除了這個材料以外我們也有做蠻多其他材料的，剛剛說的生質材料，另外我們還有做塗料，塗料在我們的煉油廠是很重要的，如果看到很多煉油廠有燃燒爆炸，它最後原因都會有一些是因為腐蝕，或是管線哪裡破了，使油量露出來而燃燒，造成大爆炸或是工廠起火，這有很多原因就是因為塗料沒有用好，或者是塗料的品質不佳，導致腐蝕以後沒有發現，所以說我們中油公司很早以前就有遇到這個問題，就開始去研發塗料,所以說我們現在公司大部分塗料是由研究所去開發配方出來以後去自己生產，這個塗料也是從煉研所就開始做了，我們綠能所進來以後我們就會往環保塗料走，比如說裡面的溶劑要用一些比較沒有揮發性溶劑，甚至是裡面沒有溶劑，或者是裡面的顏色，有些顏色是重金屬，我們就會改成有機的燃料，去做一些環保的塗料，這些塗料可能不是一個高技術，但其實它是一個蠻能夠獲利的產業，塗料在台灣是一個蠻大的產業，除了材料以外我們還有做一些生技，因為我們有生技組，我們會做一些生技產品的應用，或者是做一些藻類的開發。

Q3.當初怎麼為想到要把加油站結合綠能去做發展?

當初我們研究所一開始是考慮如果要做儲能、產能應該要到哪裡做?所以我們看了國外的一些案例之後我們就想說,如果我們把這個儲能系統放在加油站適不適合?那時候想到說像是一些偏遠地區或者是山區，它們供電比較困難，比如說小

琉球好了，它是一個比較小的島，如果颱風來的話，我們的供電電纜斷掉，他們就沒有電了，那現在如果我們有一套儲能系統在那邊，我們是不是可以先存一些電，如果真的遇到這樣子的一個台電沒有辦法供電的時候，我們就可以把這個電拿來做緊急使用，可能沒有辦法維持跟平常一樣的用電，但是至少可以提供緊急使用的功能，不用再靠發電機，比如柴油發電機都會有一些空氣的污染，所以我們在三、四年前就有這樣子的想法出來，剛好在去年我們戴董事長來了以後，就有在想說電動機車每年汰換的數量越來越多，是不是會危及到我們加油站的領域業務，因為賣汽柴油佔了我們公司很大的營收，如果我們公司所有的營業載具都變成充電的話，我們的營收勢必會受到影響，剛好國家也有在考慮說這種充電樁未來是要放在哪裡讓民眾來充，因為當充電需求多，基礎建設相對也要起來，所以工業局就有做一個三年內蓋一千站充電站，讓民眾在使用上能夠更方便，剛好中油就承接到這樣子的業務，所以要幫工業局來建設這個站，所以當時的董事長就像說是不是可以把這些站結合所謂的充電業務，再結合我們未來的複合商店營運，變成一個加油站的加值，希望產生一個獲利能夠去彌補加油站加油業務的減少，維持加油站的永續經營，未來就會變成加油站業務越來越少，充電業務會越來越多，慢慢的把加油站變成全加電站，那時候的想法是這樣，才會想說那先做哪個站來試看看，那會做這兩個站是因為這樣的營運模式對我們來講都很陌生，到底未來要怎麼做才會獲利?所以我們的研究所就有根據我們自己投入的一些技術跟想法來建置，因此嘉義那邊就是利用他們比較大的環境來建置它們自給自足的系統，我們這邊則是小系統，然後先來測試這樣子的穩定性如何，當然最後的終極目標就是希望，當有一天我們可以把所有的電都變成是我們自己來供應，我們這邊採取的是部分自產電，到最後是全自產電，嘉義那邊是因為它環境的關係，它有這個條件可以一次就做到自產電，那它就比較單純，它是單一的自產電然後單一的儲能，我們這邊就是比較複雜，我們的設備比較豐富一點，我們就是把一些現在的可能性都放進來。

Q4. 全釩液流使用上會有甚麼樣的危險性?

全釩液流的原理很像我們以前國高中在做的這種理化反應最原始的電池，以前的實驗它就是兩邊放鹽的水溶液，中間弄一個鹽橋，然後它就可以發電，其實它的原理就是類似這樣，只是說它裡面兩邊的鹽變成釩，用釩是因為它是五個帶電，所以它有很多鋰子的變化，它這樣鋰子變化下都還是液體，所以它不會因為得到電荷或者失去電荷它就變成固體，變成固體就會比較麻煩，所以它兩邊都是液體，這樣有一個好處就是說這些水溶液其實就會很安全，它在運用上就很像我們一般的鉛酸電池，就是這些硫酸水溶液，所以它在安全上是沒有顧慮的，但是它有一個缺點，就是它跟現在所謂的鋰電池來比它的電容量比較少，它的體積也比較大，所以說它必須要有空間才可以放，另外就是說在一開始的建置上它的成本會比較高，因為是用這種釩的溶液，設備又大，但它的壽命很長，因為它很簡單，像日本它們也有做很多文獻研究，它可以做一萬到兩萬次充換電的壽命，換算整個操作的年限在二十年的使用上其實是沒有問題的，那一般的電池會遇到問題就是說

它可能用不到七、八年，它裡面的電池就壞掉了，或是已經不能用了，但是釩的建置成本就較高，所以建置的時候就要考慮你初期的投入成本，跟有沒有空間來放，那我們會建置這樣的設備除了安全性以外我們也是有參考，像台電它們也是有在它們研究所內放置這一整套從小到大的設備，感覺它們的研究員也是認為這樣的設備很適合用在電力系統上面，所以我們就把它導入在加油站系統上面，它在安全風險上其實是蠻安全的，也不會有甚麼較多的公安問題，但是中科院它們其實有在做這樣子的研究，他們有說他們會有液體，因為它是液體在跑，所以他們有說管線爆開來、液體噴出來的問題，這個就可能跟液體洩漏的安全性上有關係，但這個我覺得是設備上的問題，跟本身釩液流的特性是沒有太大的關聯，可能是設備的材質沒有選好，或者是它老化，他們沒有復育，或者是接頭沒有接好，這個其實都是在工程上要克服的，倒不是釩液流本身的特性造成的。

Q5. 將加油站與電動汽車充電站相結合是否有任何限制？

現在我覺得比較大的限制就是現在大眾會認為這些綠能設備有一些風險，比如說我們在裡面需要一些產能跟儲能設備，應用的話就是一些充電樁及充電設備，這些東西因為它牽扯到電，但電跟加油站的油，基本上油跟電不太能夠並存的，大家會覺得電如果產生火花會造成油的燃燒爆炸，會很危險，其實這個從我們開始在做太陽能建置的時候就有稍微研究，因為太陽能它也是電器設備，所以那時候在建置的時候我們也有在討論說是不是不能建置在加油站的屋頂上?那時候我們就有做一些評估，最後是認為說還算 ok，其實電器安全它是用電，怕這些原件可能會走火或產生火花導致油氣燃燒，但其實我們加油站設置管理規則都有規定要距離多遠，電壓要多少，所以其實是還好，但是現在綠能設備會遇到一個問題就是說我們用電的功率是不是要大?或者是說我們的儲能系統要不要大?還有我們的燃料電池是不適合放在加油站?這個我們其實都有在討論，以燃料電池來講它是用天然氣，天然氣是沒有問題，但是它在中間的過程會有一個氫的中間產物，但加油站的租管單位是能源局，它又不管氫氣，它就會覺得是不是在還沒有釐清權責之前先不要放在加油站，所以像我們燃料電池就是放在我們的宿舍區，那就不是屬於加油站的土地裡面，我們現在遇到的是國家政策予不予許建置，所以說我們會把這裡當成是示範站就是說我們也想要來驗證一下，這些安全性執行上有沒有問題?那像儲能就是怕燃燒，所以我們這裡就是放較安全性的儲能系統，嘉義它們就是做這種距離上的差別，還有就是它們將儲能系統放在牆後面，它如果燃燒的話有牆擋著，這個其實都會有參考到國外在做這個安全區隔上的一些建議，所以說目前以我們兩個示範站來講，這些是沒有問題，但是國家政策上還有一些需要突破的地方，未來才有可能再廣設這些充電站，比如說像燃料電池，不可能以後要建置就是做在旁邊的土地，這樣就很麻煩，其實燃料電池在日本是一個很安全的設備，在日本已經發展到有點像是我們家用的瓦斯跟熱水器，就是擺一台放在家庭的後院，它又可以提供熱水又可以提供電，所以聽說日本去年總銷售量已經賣了二十幾萬台，民眾接受度也是蠻高的，熱跟水使用的需求都符合，但像

我們台灣做的是需要電比較多熱比較少，不太一樣，但它是還蠻適合這種分散式用電的運用。

Q6. 嘉義信義路站是以電力自給自足為目標，台南前鋒站則是以多元電力與儲能用用為主，你們有評估過兩者之間哪一種方式較能產生最大的效用？

如果以真正投資成本來看的話，可能嘉義會比較好，因為儲能貨櫃第一個它比較大，那它是商業化的東西，只要是商業化的東西成本都會比較低一點，像這種儲能設備也有一種特性，就是儲能設備做的越大相對攤提的成本就會越低，即使像我們的釩液流或是碳酸鋰也是這樣，我們的釩液流或是碳酸鋰是外面比較新的材料，外面真正有在商品化的公司也少，像是釩液流在日本有一家公司算是做的最好，那碳酸鋰也是日本的公司有在做，但現在你也買不到它的東西，所以說這種比較新的材料第一個它的成本較貴，在這樣的成本下，你要做比較大的系統跟做比較小的系統，攤提起來小的系統就是貴，所以說我們這邊的成本在攤提上就會貴很多，那我們以另外一個角度來看，我們比使用壽命的時候，有可能我們的使用壽命會多，我們就可以把成本再拉回來一點，當然這個就是見仁見智，有的人會說搞不好二十年以後就會有新的技術，這個就不會再使用了，那我們是以材料的性質來看，我們這個材料確實是有二十年以上的使用壽命，商業化的鋰電池可能到七、八年就不行了，不過以成本的效益來看應該是嘉義那邊未來要推會比較有可能做成，當然它也是遇到說它放這麼大的儲能貨櫃，要怎麼放到加油站?因為加油站的空間沒有那麼多，剛好是嘉義那個地方有空間放，另外加油站的太陽能未來要怎麼設置當然都會有一些限制。

Q7. 中油聲明未來將導入大數據、智慧化、物聯網等新興應用，目前要做到這個階段需要突破怎麼樣的困境?

大數據中心是未來的趨勢，我們公司也有成立一個大數據中心，現在也是在探討說我們需要去做怎麼樣的一個資訊收集跟分析，以我們自己研究所來講，我們在做每一項項目都會有自己的一些監控軟體，比如說太陽能，我們就把所有的太陽能都拉起來，我們有寫一套軟體監控、數據分析，這個未來都可以提供給總公司的大數據中心做收集，就可以多方面去探討，我會認為這個其實都是後台，真正要做的其實都是在前台的一些困難，比如說未來我們營運一定是要跟交通載具做連結，我們現在做綠能站其實都是在做背後的服務而已，真正要營運的是前面的充電服務，或者是我們去年有一些新聞你可以看到我們賣電池給這些廠商，這些才會賺錢，然後做一些營運的管理，這些就要去做一些數據的開發，然後到時候怎麼去分潤，這些營運模式是我覺得現在我們公司應該要去做，但是較難去推廣的，這個做出來到時候是不是會遇到人家說與民爭利、跟外面的公司來做競爭等等。

Q8. 中油目前有在做再生能源的量產了嗎？

現在我們公司投入的再生能源就是太陽能，太陽能其實國家有它的政策，到 2025 年大概要到多少建置的容量，其實我們公司配合的一開始就是在加油站的各個屋頂去做，但是加油站的屋頂其實沒有辦法做太多的容量，比如說一個加油站的棒

島這邊最多做 20kw 就很大了，20kw 就是說一小時能有 20 度的電產生，一天就是乘以 3.4，其實就已經差不多了，那時候我們配合國家政策這樣子推，其實我們有很多點，但是我們加起來的量能沒有那麼大，所以說我們就有在評估我們是不是要把一些閒置土地或空間，拿來做大型的太陽能，它的產電才會多，才可以給台電用電的應用，否則像我剛剛講的這種屋頂型很多都是投入到台電的電網之後就分配掉了，反而會造成台電的電網不平衡，如果真的有大電廠的話，台電就可以把它視為是一個電力來源，當然我們還是會遇到台灣現在很多中油公司的土地還是特殊用途，所以說要拿來蓋太陽能也不行，所以這些都會遇到政策上使用變更的問題，但是我們還是有在做，最近應該會更積極的原因是再生能源的條例更改了，它更改的話有一個我們必須要面對的問題是，它裡面有提到說用電大戶必須要有 10%的再生能源，像我們中油一定是用電大戶，因我們有加油站、有電廠，所以說我們有在盤比說各個單位的用電多少，建置的綠電符不符合，現在看起來只有油銷部比較符合，其他地方反而都不夠，不夠的話就要建置不然就要去買，去買人家生產的綠電，這樣我們不如自己建置，多的我們還可以賣，我們公司現在也是有在評估，所以說未來在再生能源的擴增上面其實是有這個想法的。

Q9. 目前我們台灣充電機車還沒有做到量產，為甚麼你們要先做充電樁的設置?

其實這個關於國家政策，因為電動機車的電力來源就是電池，電池有兩種情況，一種是用換的，像 Gogoro，那另外一種就是用充的，所以說當初國家在做這種公共的基礎建設的時候，就有在評估要做全部都是換電的還是充電的，後來他們的默契是因為現在換電的比較多，充的比較少，不是沒有充的，是沒有快充，最早開始其實電動機車是用充電的，只是它需要充很久，可能它整個充飽電要四小時，所謂的快充是兩小時，後來 Gogoro 這個模式就比較受歡迎，因為它用換的，6 秒鐘就換走了就可以騎走了，所以感覺是比較好的營運模式，所以後來工業局在做這個工業計劃的時候也是有跟中油去討論說要蓋多少，所以後來現在每年概的比例換電是 9 成，充電是 1 成，現在的充電中沒辦法有車子來充是因為充電接頭不一樣，一般我們的充電接頭就是用 110 的充電接頭，來接這個變壓器再把它充進去，因為去年七月的時候，工業局發表了一個共同的規格，它充電的接頭已經變了，是一個比較大的接頭，現在就是說從它規定以後新的車子如果要採充電模式必須要用那樣的規格，導致之前出的車都不能來這邊充，其實我們也有發生過在嘉義有人看到充電站開幕就來充，結果他找不到充電的頭，他才說:「你們是騙人的嗎?」，其實不是騙人的，是因為我們配合政府就把這樣子的接頭預先做上去，未來如果有車就可以來充，只是我們現在還沒做好的一點就是未來要怎麼收費、怎麼充，這個現在我們其實還沒有討論出來，但是它充電功能是正常的。

Q10. 目前中油牌的電池已經開始發售了嗎?

我們現在跟三陽有合作，他們很願意用我們的電池，當然我們的電池材料其實不錯，要用的電池材料不是我剛剛說得鈦酸鋰，因為鈦酸鋰需要的空間比較大，所以說如果放在現在的電動機車，本來可以有兩度電，就可能變一度電，這跟剛剛提到使用者用電的焦慮就有關係，所以我們現在跟三陽合作是嘉義煉研所他們提

出來的軟碳，這個軟碳它也是碳，它可以改善電池在工作時的溫度，所以電池不會這麼容易燃燒爆炸，它其實也會改善它充電的速度，所以說以往充電需要 2 到 4 小時，現在只需要 10 分鐘就可以充飽電，所以你看我們的影片以前是寫台灣中油為你加油，現在我們把它變成是台灣中油十分來電，講十分來電就是說我們十分鐘就可以幫你充飽電，所謂十分鐘不是說真的剛好十分鐘，從沒有電到有電要十五分鐘，可是你不可能完全沒電才來，所以說你可能剩下 20%來充到 100%是十分鐘，所以我們叫十分來電，我們這樣子的一個軟碳就很適合放在電池來改善它的效能，而且他們煉研所是比較早在做這個軟碳，我以前在煉研所也是比較早就開始做，當然遇到的問題時接近做出來的時候要做驗證，驗證就是需要一些時間，放到車上也還需要驗證，但是其實我們在基本性能上都是沒有問題，剩下就是跟廠商模組的配合這些，我們是有想法說，是不是把未來的電池都統一成同一個規格，就好像汽車電池的充電器一樣，大家都是用這樣的規格，但這個需要各個車廠都願意配合，我們現在是先跟三陽來做結合，希望最晚明年看能不能有一個真正的上市，但是上市也有可能未來是我們提供材料然後讓他們做成電池，這個未來的營運模式是不確定的，但是確定的是我們的材料配這樣子的車子是還不錯的。

三、轉型未來發展前景：

Q1. 未來示範站會嘗試做成加氫站嗎?

這個方面我們也一直在想，加氫站它有一個特色就是它都是使用氫，那它的氫怎麼來?如果以現在我們台灣比較有可能就是用天然氣重組轉成氫，所以說如果要做加氫站就可能要做一個大型的天然氣重組系統，或者是必須要從有氫的來源去用氫汽車再來這邊放到儲槽裡面讓人家做加氫，台灣現在牽涉到台灣氫氣的管理是消防局，而加油站管理是能源局，所以它是兩個不同的主管機構，現在跨單位的協調上其實比較困難，所以說台灣現在的能源政策一直遇到瓶頸，遇到瓶頸就比較沒辦法突破，在國外的話像是日本它這兩個主管機構都是消防單位，因為都是他們負責所以他們就要想出一個好的方式，去想如果要一起的話要怎麼辦，它們就有限制說如果要放加氫站在加油站，中間要隔牆，或者是加氫站跟路要隔多遠，如果不夠遠也要隔起來，現在其實都有這些可以讓我們來參考的規定，我們未來如果真的要做的話就可以來做，但是我們在研發就會認為加氫站本身現在在台灣需要一段時間才有可能來裝，我們台灣其實有很多小公司都是在做燃料電池的配件，然後供給國外的燃料電池公司，所以說我們也有一個燃料電池聯盟，希望把這個國產化，另外就是有一家叫做亞太燃料公司，它就是做燃料電池的機車，它就主打說用氫能才是未來的趨勢，它就有在跟國家和我們中油公司討論說是不是有做加氫站的可能，但是它牽涉到要建置這些設備，所以還是需要比較長的一段時間才有可能實現，因為光是牽涉到氫要怎麼運到加氫站還有氫氣槽的安全，國家其實都還沒有這樣子的一個規範出來。

Q2. 因為之前戴董事長有說它離開中油之後綠能小組就解散了,所以我想知道綠能小組解散之後中油還有沒有在做智慧綠能加油站的發展及推廣?

我在這邊釐清一下,其實綠能小組還沒有解散,綠能小組現在在公司還有持續的運作,大概也是兩三天會開一次會,現任的副總也是接替我們離職的副總來領導這個小組,這個小組的工作是接下來我們還有綠能站要做,我們新的歐董事長也在公開場合說我們今年要再做兩個站,東部一個站、西部一個站,現在我們東部的站其實也都規劃好了,就是等當地的立委等等他們覺得這樣子的規劃是可以接受的就會開始進行,因為我們示範站有一個默契就是我們驗證的東西會不一樣,否則就會變成重複投資,我們一直有在討論這些,包括西部示範站在來會做在哪裡,當然我們公司現在新的董事長是比較著重在設備安全性,他認為如果設備不安全再強力的去推,未來會有風險,畢竟加油站是一個高風險的地方,所以油銷部這邊陸續也開了好幾十個會在討論這種安全性,其實也不是說沒有在做,只是說會比較傾向安全性的探討。

Q3. 現在行政院長蘇貞昌根八大機車行會面之後,2035 年禁售燃油機車的政策暫停,這樣會不會影響中油正在做的這些充電站建置?

關於這點你說的是賴前院長說的 2035、2040 的政策,現在好像沒有硬性規定了,但是說實在的因為從去年電動機車這麼的火熱來看,其實民眾對使用電動機車的經驗好像是不錯,所以在汰換電動機車的速度來看沒有減緩,沒有因為政府決定讓它自由發展而減緩,反而使感覺銷售量有一直在提高,另外一點就是說政府它其實有規定,現在的機車業者要賣油車必須要有一定比例是賣電動車,這一點其實沒有改變,業者能夠鬆一口氣的是說他被規定的時間不見了,但是壓力還是在的,因為他每年要賣油車還是要達到賣電動車的比例,這個也是迫使宏家騰、三陽會跟 Gogoro 快速結盟,他必須要有電動機車的銷售,油車才可以賣,所以他們當然會先找目前最大的電動機車廠商來做結盟,我覺得電動機車現在已經變成一個由民眾來驅動的一個力量,現在有一個可能會停緩的因素,就是接下來如果沒有補助可能就會導致它接下來減緩,因為電動機車像 Gogoro,它在怎樣出新的一代,它少了政府的補助的話價格其實還是蠻高的,至少六萬、七萬,再搭配月租費跟油車來比,就沒有這麼多的好處了,但是當民眾使用久了,它們覺得電動機車是一個比較環保的移動工具的話就另當別論了,不過如果真的要以經濟來看的話其實少了補助以後,它在推動上可能就會有一點困難,因為這個會去牽扯到整個營運模式,像是 Gogoro 的電池就是用租的,它現在在用的電池壽命其實兩、三年就要汰換,換新的一批,所以說它在電池上面的投資是要一直重複的,這樣它要賺夠錢才能去彌補它電池的汰換,相對而言它隨著銷售量越來越多,這些都需要再次的投入,所以這些對未來他們在營運上都會有影響,另外就是說雖然我們民眾是六秒就來換,換完插上去了它也是要充個四小時才會飽,那換完以後比如說像我們現在前鋒路站就只有 24 顆可以讓 12 台車來換,如果你早上 8 點出來,你比較晚出來,電池都被換完了以後你就沒有了,要等四小時你才會有電池,所以說現在 Gogoro 這邊他們也是有遇到問題就是說常常不到充滿電,他

就會顯示說這顆電池是 80%你能接受嗎?接受才拿走這樣子，不然就要去預約，民眾在這方面他其實是會有焦慮的，你現在給我 80%我就會覺得怪怪的，其實我夠用，但是我就會覺得為甚麼不能給我 100%的呢?這就是為甚麼電動機車在推行上面會有困難，我們油車可能到油見底了就附近找一間加油站就可以加滿了，但是電動機車到最後一格就會開始擔心會不會馬上就沒電，就像你在使用手機時剩下 10%你就會開始焦慮，因為可能會從 10%突然變 2%，電池會有這樣的狀況發生，所以說大家對電動機車在電的使用上面會有焦慮感，現在的電池還不太能夠克服這樣的狀況發生，所以大家拿到沒有滿電的電池多少在心理上會有這樣子的顧慮，這個都是在營運上會有的困難。

Q4. 您認為中油加油站轉型的企劃大約需要多長的時間才可以達成?

時間會比較不好講，因為這個要看國家推動，但加油站除了電動機車還有汽車，汽車充電是要更大的電流，我們現在做不出來，如果以單純把現在電動機車的業務變成可以實現，我覺得搞不好四、五年是有機會的，因為我們之前國家訂的 2035 禁售燃油機車，我覺得只會快不會慢，因為以現在電動機車的淘汰它是非常快的，所以當它起來之後一定有配套措施，我覺得如果真的要做，加油站轉型結合充電站業務的整合是會蠻快的，因為聽他們講說加油站業務也是有漸漸在下滑，因為充電機車變多了，現在差不多佔了十分之一，一年平均國內大概七十萬到八十萬輛機車的汰換，去年電動機車銷售量就八萬輛了，所以已經取代十分之一了，我覺得轉型只會快不會慢，因為它有點像檔不太下來的趨勢，像現在年輕人買 Gogoro 是一個趨勢，它的背板又可以貼一些漂亮的造型，可見大家騎起來感覺是良好的，不像以前的電動機車一上來，大家就發現怎麼電池這麼快就壞掉，車子怎麼這麼醜等等，現在 Gogoro 它就是用手機的概念來做車，感覺就是一個新潮流，所以說像我們之前在跟車廠接洽的時候，宏佳騰車廠那邊就有說現在年輕人買電動機車都不會考慮去買中華汽車，而是會考慮去買 Gogoro 的哪一個型號，當然後面的經濟行為是不一樣的。

Q5. 針對加油站轉型有什麼建議可以提供給中油？

加油站轉型，充電站大家有在質疑一個重要的問題就是安全性，安全性是一個比較重要的問題，我到覺得中油不妨真的找一個地方來做充電站的驗證，就先不要跟油一起，就把這裡變成一個充電站，我們有甚麼複合式的想法就可以把它放在裡面，這個也是一些專家建議我們的，做一些商店街在裡面，然後把充電業務放進來，讓大家邊充電邊吃個飯或者是買個東西，我們的充電又快，十分鐘就好，這樣就把安全性屏除掉了，如果不跟油放在一起大家可能就比較安心，所以我會覺得中油是不是可以來先做一個這樣子的站，大膽一點的想法可能就可以跟電影院結合在一起，弄一個智慧綠能電影院，外面做一個充電站讓人家充電，這樣做起來大家也不會這麼擔心跟油放在一起的問題，像很久之前加油站剛開始的時候大家也是會害怕危險，但後來宣導夠多之後大家對加油站的疑慮也是漸漸消除，其實像氫能也是這樣，日本很願意用就是因為他們在宣導以後大家去買，

買多了設備就便宜了，但是像台灣光是講到氫能大家都怕了，所以說在使用上它是需要去被說服的。

以上訪談內容結束，謝謝您的參與與討論。

Table 2. Interviewee's Information

Information: **-Name** **-Position**	**Where the interview took place?**	**Interview date**	**Years of experience**	**Code**
-戴謙 -Chairman, CPC Corporation, Taiwan(2019/3) (前任中油公司董事長)	Yunong Rd., East Dist., Tainan City, Taiwan	2019/7/17	21 years	CP1
-徐明發 -Management Professional of Chiayi Oil Marketing Department (中油嘉義油品行銷部管理師)	Chiayi Oil Marketing Department	2019/7/11	33 years	C1
-李杰迅 -Chairman of the National Federation of the Republic of China Gas Station Association (中華民國加油站公會全國聯合會理事長)	Yunong Gas Station	2019/7/17	10 years	O1
-許欽智 -Chairman of the Yunlin County Gas Station Association(雲林縣加油站公會理事長)	Pinqiang Gas Station	2019/7/9	16 years	O2
-王富宏 -1. Green Energy Committee of the Gas Station Association(加油站公會綠能主委) 2. Chairman of the Tainan City Gas Station Association(台南市加油站公會理事長)	Gas Station	2019/7/17	28 years	O3
-不願意使用真名 -Doctor and Project Manager of CPC Refining Institute(煉製研究所博士兼專案經理)	CPC Refining Institute	2019/7/11	8 years	R1
-不願意使用真名 - Ph.D. of CPC Green Energy Research Institute (中油綠能研究所博士) -planner of Tainan Green Energy Station (台南前鋒站規劃人員)	Tainan Smart Green Energy Gas Station	2019/8/01	10 years	R2

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