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**MARKET RESEARCH FOR DOMESTIC SOLAR PRODUCT IN
CHINA**

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ABSTRACT

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The thesis introduces the situation of solar energy and smart solar mobile power in China market. The report was completed by doing research based on relevant data and information from reports, academic books, internet, and interviews energy companies.

Chinese government has realized renewable energy is the one way to replace the traditional energy. The solar energy is an emerging industry in China. Solar technology and devices have become increasingly popular in China in recent years. The purpose of this report was to analysis the market potential, market needs in China. Analysis of the smart solar mobile power and Chinese market is the main task in the report. SWOT system and PESTEL method are used in the part.

China has a huge potential market in solar industry, but Chinese solar industry has a weak competition. Chinese government provide policy support and subsidy with the solar enterprises. Depends on the government is not good for a long-term development.

Keywords: Renewable energy, market research, solar battery, China.

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1 INTRODUCTION

During the past three decades, China's economy has made an amazing achievement. Especially in the past ten years, the world has witnessed the stable and strong growth of the China's economy. As China's economy grows, China has become one of the world's largest energy producers and consumers. As a basic industry, electric power industry has an increasing important role in modern society. However, the most of the traditional electric power industry is using fossil fuels as raw material in China. Although we have the world's third-largest coal reserves, but the scale it is not reasonable. Along with the decline in coal production, energy supply would directly influence the development of the economy. Meanwhile, traditional electric power industry would bring a huge pollution for the environment. Especially in recent years, air pollution has become the most important problem in Beijing which is the capital city of China. The Chinese government has realized that they should solve the problem and the best way is to adopt measures to develop clean energy and renewable energy to replace the traditional electric power structure.

In recent years, Chinese government has encouraged the private enterprises to invest in the renewable energy, such as wind power and solar power. However, they have met a series of technology and other problems in wind and nuclear power. They have to solve the ecological issues for the wind. The nuclear power is very dangerous to build in the southeast of China, because more than half of the Chinese inhabitants live in the area and there is also the China's economy center region. Because of the reasons described earlier, solar power will become the most feasible energy in the next stage. But the solar equipment is more expensive than the other traditional power sources, so most of private enterprises do not have enough money to build a solar power plant. Meanwhile, some companies invest in production of the small solar products for homes, for example solar batteries, smart solar mobile powers, solar LED lights and so on. In my thesis, I will apply the observation research to collect the basic data and

information about one of the solar products, smart solar mobile power, it is a kind of solar battery chargers.

As a new product, smart solar mobile power is in the process of gradual development and perfection. However, the solar industry is in the trial period in China this product is not a main business area for the most of solar industry companies. Since most of enterprises would refuse provide their information and data about their product, I will instead collect the relevant data and knowledge from the academic books and Internet.

This thesis is a report which analyses the Chinese renewable energy product. It has two aspects, one is the situation of the solar power industry in China at the moment and another one is how to upgrade and develop the domestic solar products in the future.

2 BACKGROUND OF ENERGY PRODUCTION

2.1 Global energy production

In recent years, the energy has gradually become one of the key factors of social and economic development, it is impossible to live without it. Especially in emerging economics, the energy supply has become the main factor in the economic development. In fact, emerging economies have accounted for about 80% of the energy consumption in the global increase.

According to the BP statistical Review of World Energy in 2014, the consumption and production of every type of fuel has reached the record levels and the world's usage of electricity grew by 2.5% in 2013. The last ten years trend has been about 3.3% (BP statistical review of world energy in 2014, cited 5.2.2015). Sources of energy are everywhere in the world and there are several energy resources which can be used to generate electricity. There are two kinds of energy resources: one is the non-renewable energy and another one is renewable energy. The non-renewable energy are the main sources of electricity. It includes fossil fuels and nuclear fuel. Worldwide, fossil fuels are the main sources for the electricity industry, such as coal, oil and nature gas. 20% of all electricity is renewable energy. The main type of renewable energy is hydropower. Hydro power has a large amount of potential energy, but the energy is controlled because of the climate and environment issues. Today, China relies mainly on coal, natural gas, hydro, nuclear and a small amount of wind and solar energy. (Ausgrid 2015, cited 8.2.2015.)

Thermal power plants, hydroelectric plants, nuclear power plants and renewable sources have their own pros and cons. What kind of electricity productions are offered is based on the market and technology demand and region environment. For example, coal is the main source of energy in China which is the largest energy consumer. Because China has the world's third-largest coal reserves and

it allows a large amount of electricity to be produced in one place. In the Middle-East, oil is the main source of electricity. In European Union, renewable energy has accounted for 30% of the electricity. Germany has been the world's top Photovoltaics installer, the solar power provides 7% of electricity in this country (Wikipedia 2015, Cited 6.2.2015). Wind power is the most popular renewable energy resource in Finland (Wikipedia 2015, Cited 6.2.2015). Wind power in Finland is based on the regional environment and technology. Figure 1 shows the world energy consumption by fuel type. According to the picture, the fossil fuels is still the most important energy type in the world.

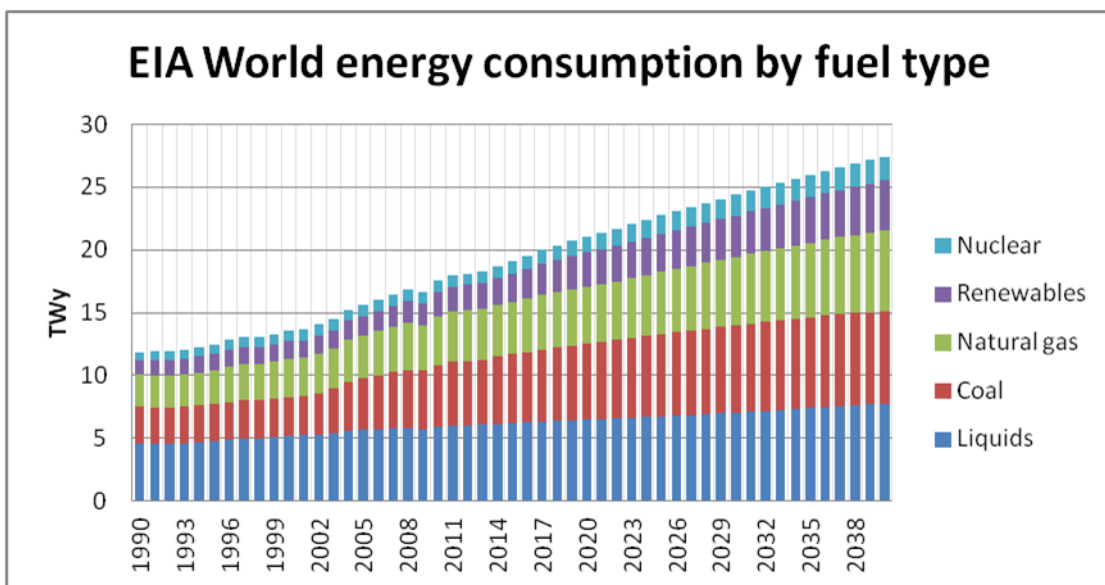


Figure 1, World energy consumption by fuel type (StratoSolar 2015, cited 18.5.2015)

Electricity is an integral part of people's life. It has influenced our lifestyle. However, non-renewable energy will not last forever. This is the main reason why we need renewable energy to replace the fossil fuels. Particularly after the oil crises of the 1970s, the world governments realized the significance of energy safety. After that, scientists from many fields including physics, biology, geology and chemistry have been working to develop technology of the renewable energy. In 1977, the US government embraced the use of solar energy by launching the solar energy research institute. After that, other governments across the world soon followed. In 1980, the world's first wind farm was built in New Hampshire.

The wind energy has transformed to official electricity in New Hampshire. Figure 2 shows the development of the nuclear, wind and solar energy.

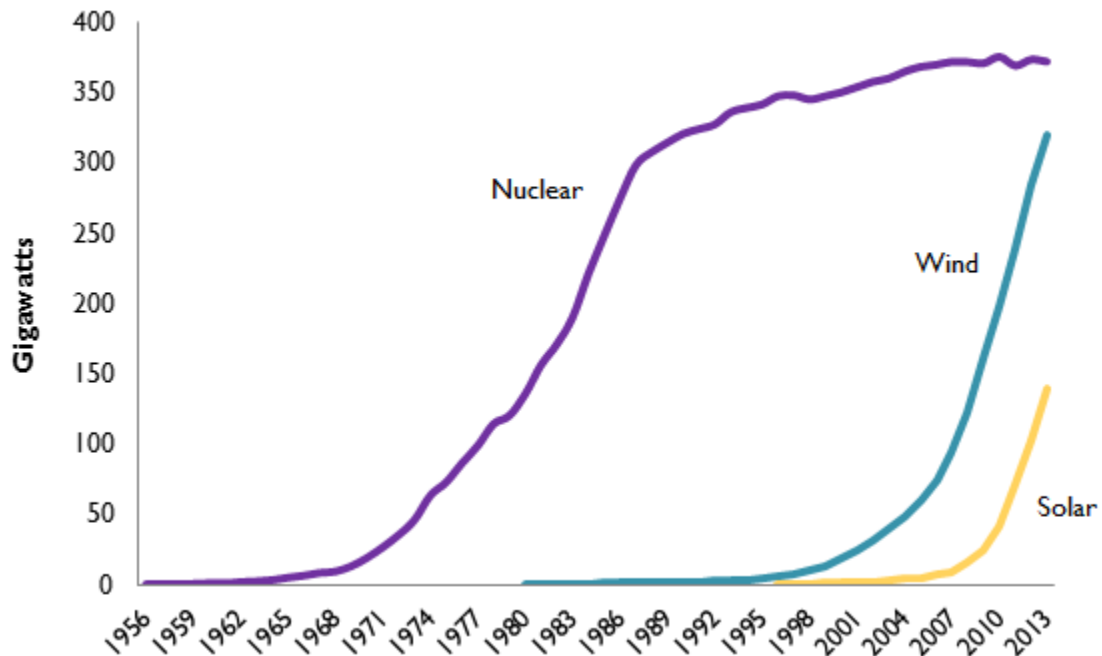


Figure 2, World Nuclear, Wind and Solar Generating Capacity, 1956-2013. (IAEA; Ochs and Ray; BP; Flavin 2014, cited 3.2.2015)

2.2 Traditional energy industry in China

China has become the world's top energy consumer, it has outstrip United States in 2011 (The wall street journal, cited 4.2.2015.) However, the government has focused on the environment problem it has influence on people's life.

When the private enterprises came into the electric power industry in the 1990's, the Chinese electric industry enter a fast growing period with the economic at the same time. At that time, electric power was mainly produced by the traditional primary energy sources. Especially China has massive hydroelectric resources, but most of electricity is produced from fossil fuels. In reality, from 2004 to 2010

about 79% of annual electricity was produced with coal in China (Wikipedia 2015, cited 4.2.2015).

Table 1, China electric power Research. (National Energy Administration, cited 5.2.2015)

Capacity/year(GW)	2012	2013	2014
Total installed capacity	1144	1247	1360
Hydro	249	280	301
Coal	819	862	915
Nuclear	12.57	14.61	19.88
Wind	60.83	75.48	95.81
Solar	3.49	14.79	26.52

The table 1 was published by the National Energy Administration. It shows the scale and proportion of the different kinds of energy in China.

However, the major problem is a geographical mismatch between the location of the natural resources and the fast growing industrial region. The fossil fuels are in the north and northeast, hydropower is in the southwest, but the main economic zone and inhabitant area is in the south and east. So, the government has a project which is to transmit electricity from west to east. The project is reasonably effective since hydropower generated in the western region is relieving the energy crisis in the eastern region. But it is not enough, the eastern region still needs more electric power. (Wikipedia 2015, cited 4.2.2015.)

Because of the reasons described earlier, Chinese government understands why renewable energy is needed and why the usage of traditional electric devices should be decreasing. In the last 10 years, Chinese government has encouraged the private enterprises to enter the renewable energy industry. They can get policy support and other favorable terms. During this period, an increasing number of electric power enterprises have built electric power-generating equipment in the southeast coast area which has the fastest increasing demand

for energy and electric power religion in China. These are not traditional power equipment, they mainly consists of wind power, solar power and tides power. These are three emerging renewably energy sources in China.

2.3 Renewably energy

Renewably energy is a kind of energy which comes from the sunlight, wind, tides, hydro and waves. The renewable energy is used in the electricity generation to replace the traditional electric power energy. In recent years, various countries have been increasing the investments in the renewably energy technology and devices. The amount of renewable energy has contributed to 22 percent of the electricity generation at the moment. It has decreased the amount of waste by the fossil fuels. (Renewable energy world, cited 7.2.2015.)

Renewable energy is available everywhere, unlike other energy which exists in a limited number of countries and areas. It has increased the energy safety for the world and it improves the climate. Increasing number of countries have realized the significance of renewable energy in the future and decided to improve the renewable energy contributed to the electricity generation and energy supply.

Wind and solar are emerging renewable energy in China. Based on the large amount of land and long coastline, China has identified that the wind power industry will become a key point in the economy. It is not only nationalized power companies that are increasing the investment in the wind power, but also the private enterprises are entering this industry. According to the report, the wind power has more electricity capacity than the nuclear power has in China (National Energy Administration, cited 5.2.2015). China has become the largest wind power producer in the world (BBC news, cited 7.2.2015). However, the wind power is unstable, the wind farm is not able to provide electric power for the grid all the time. It has restriction for the wind farm work. It means the wind power can't be the main renewable energy to replace the fossil fuels in the future. Figure 3 shows

the energy potential in the world. Based on the figure 3, we can understand the potential of all kinds of energy in the world.

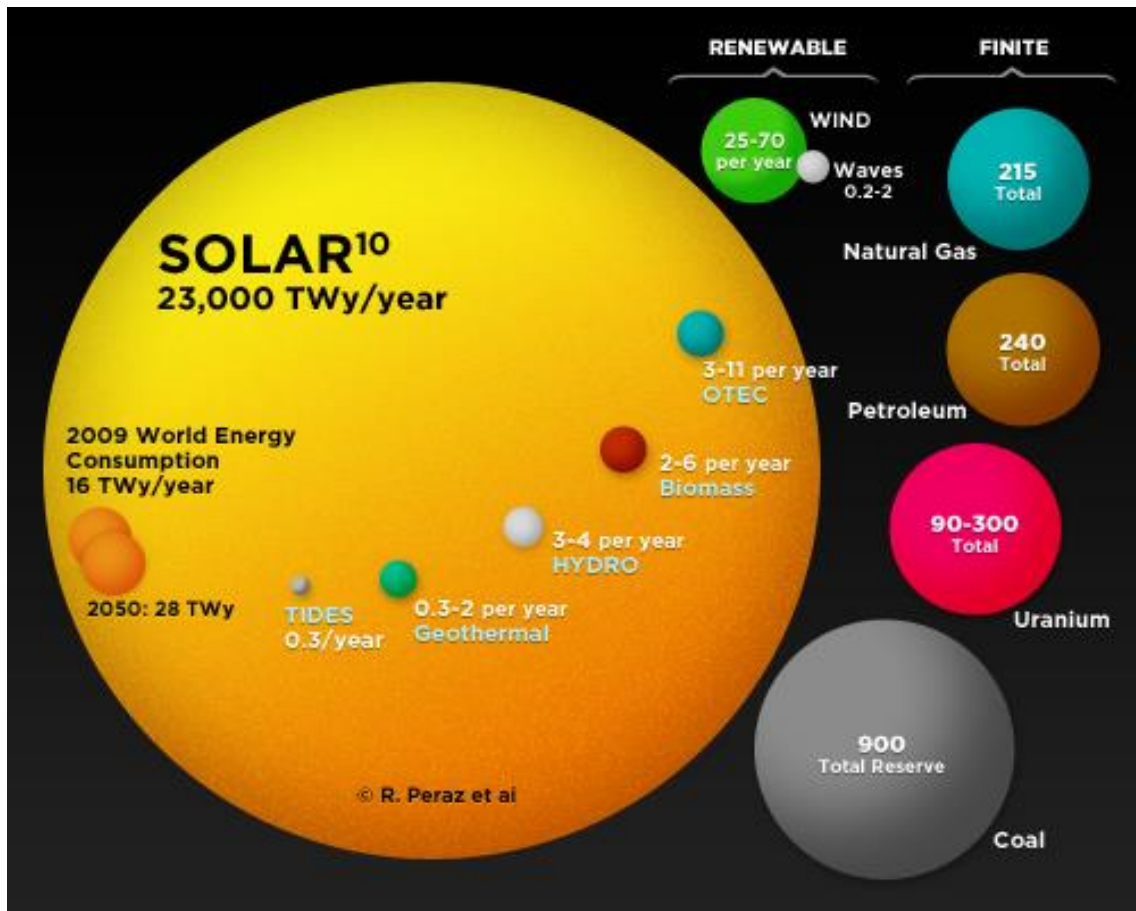


Figure 3, Global energy potential. (Peakoil 2011, cited 5.2.2015)

Solar energy is the other type of energy with exceptional resources in China. Although it is also a form of renewable energy, it does not attract the amount of companies to investment in. Solar energy is more expensive than the wind power. That is the reason why private enterprises do not use it so much. However, the solar industry is still a fast growing industry. Many small companies are manufacturing the solar panels. China has been the world's largest manufacturer of solar panels. It has ability to produce the majority of global photovoltaics for a years. (Energy informative 2014, cited 5.2.2015.)

According to the research of Lappeenranta University of Technology (Lappeenranta University of Technology, LUT), solar energy will become the

cheapest energy form in the next 5 to 10 years after the world's largest energy market in Asia (YLE news 2015, cited 7.2.2015). Solar is cheap energy, emission free, independent and quick profit. Most importantly, China has enough sunlight for solar energy in any area. Chinese enterprises need to transport coal and another fossil fuels to those areas where they need the sources for energy production.

2.4 Solar energy

Solar energy is becoming the most popular energy source because it does not consume any natural resources and sun is the most abundant and most cost effective energy on earth. This energy form is solar radiation and conversion of the sunlight to the electricity is the main purpose of the solar. It is a clean resource, because it does not produce any products or pollutants that will harm the environment and climate. (MOSAIC 2015, cited 3.2.2015.)

Photovoltaics (PV) and concentrated solar power (CSP) are the two main technologies used in the solar energy. The PV systems are used in devices that convert sunlight into electricity using the photoelectric effect. The CSP systems use lenses or mirrors and tracking systems to focus on a large area of sunshine into a small beam. The PV system has accounted for about 97.6% of capacity solar power and CSP system has only 2.4%. (Wikipedia 2015, cited 8.2.2015.)

Solar photovoltaics is the most common application in the Chinese solar power industry. The solar photovoltaics system is the most environmentally friendly technology available and it is very simple to install everywhere. System converts the sunlight to the electric power without any effect on the environment. It will improve the countries' energy security and sustainability, it will also reduce the air pollution. China does not have any restrictions of the fossil fuels and reduce global warming. The devices are built on the solar panels by a mount of solar cells to collect the solar and converted to the electric power. Silicon,

Polycrystalline Silicon, Amorphous Silicon and Cadmium telluride are the main materials for the solar panel. (Wikipedia 2015, cited 8.2.2015.)

During the last years, China has established more than 400 solar energy enterprises. China is the fastest growing market in the world. Because the solar panel systems are silent, many people have built the devices in their roofs, both in the city and countryside. Even though there has been a major increase in amount of solar devices, the total amount of the solar energy is still only 2% of Chinese energy production. One reason for that might be that solar energy is an intermittent source. The sunlight is available at the certain times. If it is rainy and cloudy weather it is unable to work. Compared to wind power, solar energy has fewer problems. The second reason is that solar devices require space. The power density depends on the used space. There are reasons why increasing the solar energy capacity in the electricity industry is difficult. Figure 4 shows the solar panels system need space to installed. (Triple pundit 2012, cited 5.2.2015.)



Figure 4, the solar panels in China. (Chinh's news 2013, cited 8.2.2015)

Because of the pros described earlier, Chinese government has decided that one of the best ways to clean up its polluted air is through solar power. Since China is one of the sunniest countries in the world there is a huge potential for solar PV to make a significant contribution to the electricity generation. Chinese companies have to get enough energy from the sun and organize the energy supply. But on the other hand, they should solve the problems mentioned.

Figures 5 and 6 show the solar radiation and capacity of solar power in China. In the western and northern there is huge number of solar radiation. However, in the South-East area, the main economic zone and inhabitant area does not have enough solar radiation.

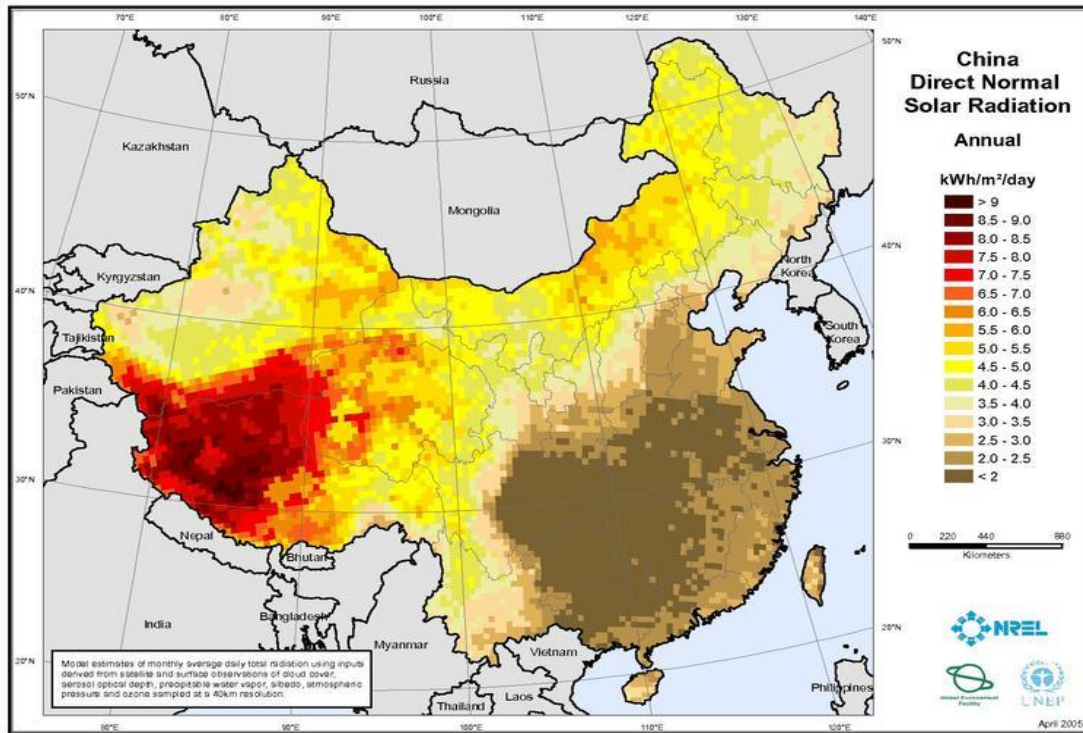


Figure 5, China Direct Normal Solar Radiation. (Open EI 2010, cited 8.2.1015)

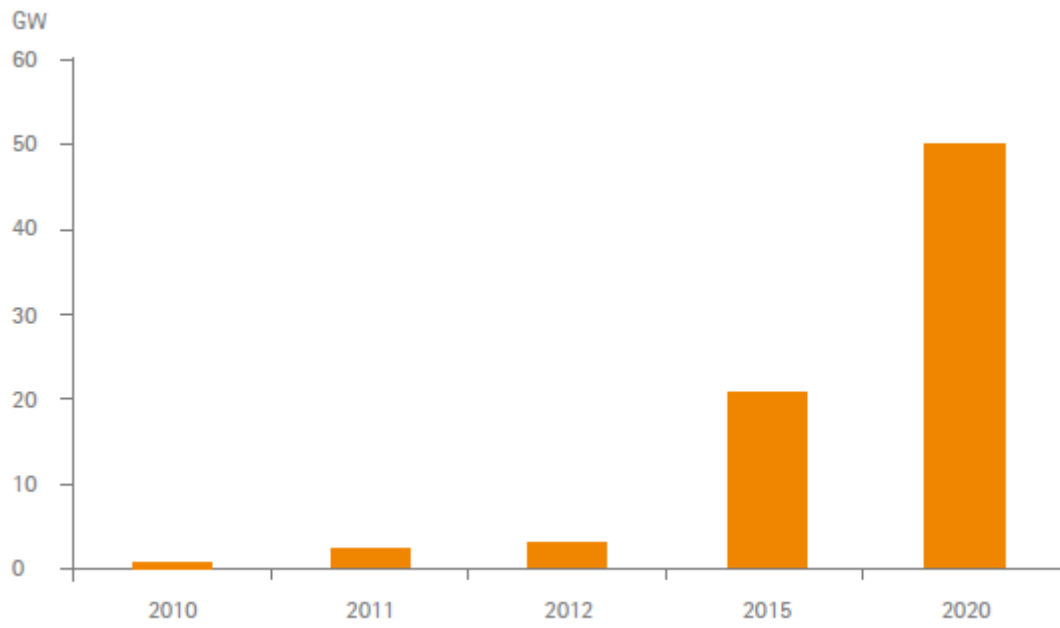


Figure 6, Capacity of solar power in China. (Accenture 2013, cited 8.2.2015)

3 INTRODUCTION OF THE PRODUCT

3.1 Definitions

Domestic solar product is a small device which transforms the sunlight to electricity device and it can always be used in the apartment. It gathers light from lamps and windows. These products can help in reducing people's influence on the environment and also save money on the electricity bills at the same time.

There are hundreds of different kinds of solar products for home use, for example: solar indoor products, solar outdoor products, solar garden products and solar pool products.

The domestic solar products are getting cheaper and they can help us solve a series of energy problems. For example a small power plant can provide the energy supply. The key point is that they can be used anywhere and electric outlet is not needed.

In this report, I will introduce a solar product, which can work anywhere and it is convenient to use. The device is called a smart solar mobile power it is a portable solar charger. Portable solar chargers are used to charge cell phones and another small electronic devices.

3.2 Smart Solar Mobile Power

The Smart Solar Mobile Power is a portable solar charger, a kind of solar battery. The device receives energy from the sun or home lights through solar panels. Solar cells are the main material of the device which is like a small solar photovoltaics system. The solar PV system just gathers the solar energy and transfers resource to the electricity power to the network. It does not have a

storage for the electric power. The Smart Solar Mobile Power is able to save electricity, it is a combination of a solar PV and a battery. The device can be used as a charger for a variety of cellphones and it can be used with many other electric devices, such as iPod, Mp3/4 and tablet. This is possible since it has multiple adapters. Figure 7 shows a smart solar mobile power and multiple adapters.



Figure 7, Smart Solar Mobile Power. (Direct industry 2015, cited 10.2.2015)

The types of solar batteries are often used by lead acid and nickel cadmium. The lead acid batteries are cheaper but they have some restrictions. The nickel cadmium batteries do not have restrictions but they are more expensive. In the

long term, from an economic point of view, the most of solar products like smart solar mobile power are using the nickel cadmium. (Enersac 2014, cited 10.2.2015.)

The device is usually fully charged after a four-hour-exposure to the sun or 8 hours to the home light resource. When the battery is full, the capacity of electricity is enough to charge four electric devices.

3.3 Advantage and disadvantage

In this part, I will analyse the features of smart solar mobile power using SWOT analysis as a method. SWOT is a method used to evaluate a business plan or project. This method includes strengths, weaknesses, opportunities and threats.

STRENGTHS

Cost: Solar energy is free, the users do not need to pay for the electric bill when the customers are using the device in our apartment. The device can help users save the electric power fee which pay for the cell phone, tablets and another electronic devices. The users don't pay for the extra bill. (Chris Rowling 2014, cited 15.2.2015.)

Convenience: The Smart Solar Mobile Power can easily be carried to the many different places. The device can provide the electric supply when the users are in the trips, especially if the users can't find a power. The device keeps cell phones working when the users are in an unfamiliar area, such as field, desert, ocean beaches and mountain region.

Lightness and smallness: The device is extremely light it has a small size just like a cell phone. Some of the portable solar chargers are integrated into backpacks. The users can put our electronic devices in the backpack and devices can be charged all the time.

Easy: The users do not necessary to study how to use it, there is only one brochure that explains what the meaning of the different color lights. It is very simple to use.

Clean and environmental: The device utilizes the renewable resource so the solar cell panels do not require maintenance. They are environmentally friendly which reduces the air pollution and global warming.

Adapter: Traveler usually has a travel plug adapter when going to another country. But now the portable solar charger has ability to replace the adapter duty. If the traveler lives in a place which has not outlet, the device can produce energy.

LED light: The device has a LED light. Although it is not a main function for the system, it can be replaced with the flashlight when the users are camping in field and mountain area.

WEAKNESSES

Reliability: The Smart Solar Mobile Power needs to collect the sunlight to keep it working. According to the Figure 5, China has enough solar energy, but if the sun doesn't shine you can't charge this device. The working time of the device depends on the weather and climate. When it is cloudy and rainy, and there is not enough light and the system is not able to produce energy.

Charging time: For a full charge the devices usually need a four hours exposure to the sun or eight hours to the home light, the traditional battery needs a shorter time. Especially during the trip, travelers can't afford for the devices to collect the sunlight for a long time.

Practicality: The device can be used as an emergency device during the trip. If users move, the USB plugin might fall off and device does not charge during the trip. Users don't know if it happens.

Price: The material is lead acid and nickel cadmium, it is expensive for the traditional materials so the device cost is more expensive than normal battery.

Kinds: A series of electric devices have a different outlet. This means the users should prepare a lot of USB outlets and carry them anywhere. It is inconvenient for the users.

Inefficient: The device is unable to charge larger electronic devices, such as laptops. The laptop consumes a lot of energy and the solar charger needs a higher wattage. It is only a technical problem and it can be solved by increasing a capacity of the device.

OPPORTUNITIES

Government factors: The solar energy is an emerging renewable energy in China which is why the Chinese government has carried out the support policies. The nationalized enterprises and private companies producing solar products will get allowance and subsidy from the government and banks. For example, the solar energy enterprise will get a higher electricity price than the traditional energy enterprise. A lot of companies which produce the solar cells panels will get a liberal policy and lower tax. That explains why China is the world's largest manufacturer of solar panels and why it has ability to produce the majority of global photovoltaics for years.

Social factors: In recent years, increasing number of Chinese people have realized the environment pollution has become the most important social problem. Decreasing the usage of fossil fuels is one of the best ways to clean up polluted environment. Based on a report, some of Chinese families have built solar cell panels on the roof of their home and more and more families will build

solar systems. It is a kind of domestic solar energy system which provides the clean energy for their home and it means more people have started to use solar energy (National Energy Administration 2013, cited 15.2.2015).

Market factor: The portable electronic devices have changed people's lives. Smartphones and tablets have replaced the traditional tools. Some occupational groups use smartphones and tablets in their work to collect and organize information. There are a large amount of potential customers using portable solar chargers because they need the electronic devices that are in use for a long time. The portable solar chargers have ability to provide electricity for them in anytime and anywhere. Smart Solar Mobile Power is becoming more common, it is as important as the smartphone.

THREATS

Technology: Today, the photovoltaics is the main application in the Chinese solar industry. The nickel cadmium batteries are the material for the solar batteries. However, they still have a problem because the nickel cadmium is expensive. If costs cannot be decreased it will affect the development of solar energy industry in China. Hence the best choice is developing new technologies and new materials.

Investment and profit: The nationalized enterprises and private companies are increasing investments in the solar energy industry but the profit is during a decreasing period. The point reason is the government policy. It has reduced most of the enterprises competitiveness. They don't have the ability to improve the function of the product and technology. The price is the main way to accounted the market share. Most product prices are lower than the costs. It is unsuited and will destroy the business market.

Product quality and service: As mentioned above, the nationalized enterprises and private enterprises have the policy and allowance from the government. The

product quality and service is not the point with them. It will decrease the market share and destroy the public relationship.

Hazardous material: According to a report, the material of the solar batteries and photovoltaics is dangerous for the workers because the devices are built using the toxic chemicals. These toxic chemical include arsenic, cadmium telluride, lead and polyvinyl fluoride. (Grist 2010, cited 15.2.2015.)

4 MARKET ENVIRONMENT

In this chapter I will analyze the market environment in China. Include target customer group, market potential and how to develop and upgrade the devices. I will use the PESTEL method to analysis the current Chinese market situation.

4.1 Customer group

This part analyses of target customer groups and potential customer groups. China's population is about 1.37 billion. China is the largest country in the world. According to the different customer needs, I have divided the target customer groups in two main parts. One group has life needs and the other one has occupational needs. (National Bureau of Statistics of the People's Republic of China, cited 18.3.2015).

In the life needs, the main target group are travelers, especially in the field trip. When the traveler is walking in unfamiliar area where electrical outlets are not available, such as camping, hiking and in some other district, the device allows the consumer to charge his or her electronics anywhere. That is the main use for these devices.

The main target group is **travelers**, but the customers can use the device also in the apartment. **Home use** possibility, with the huge population in China, increases the potential market area for the product. As electricity prices are continually rising, most of the people are looking for solutions to cut the costs. The device is a good choice, it can be used as a system to reduce the amount of monthly electricity bill.

The other customer group has occupational needs for the product. **The salesmen** are the first occupational needs group. For example, these people who are selling apartments and show they always have tablets to record customer information

and introduce product information. They have a meeting with all of the potential consumers to talk about their product materials, tablets and portable chargers are their necessity.

The second group is **media staff**, which includes for example reporters and photographers. They need recorders and cameras to record news and pictures. When they prepare for an activity, the battery is indispensable. It's important that their batteries will last long enough.

The third group is **service-workers**, such as **taxi drivers and civil launched servants**. For example, in recent years, a series of mobile apps have been published in China market. Some of those apps are helping customers to reserve taxi service and other services. These applications increase the convenience for customers and service-workers and save their time and money. So most of service-workers have one or two smart phones when they are working. The battery device keeps their mobile working for a long time.

Figure 8 shows the market potential in China. The total population is over 1.3 billion, 91% of people have mobile telephone. The internet users and active social media users both over 600 million. (We are social 2014, cited 9.4.2015). China has the largest amount of mobile users and internet users in the world. Especially in recent years, the smartphone and social media have increased the rate of network utilization. Increasing number of people access the internet from a smartphone device than a computer. Users can share pictures, video and spread news in anytime and anywhere. It has benefit to strengthen the relationship with each other.



Figure 8, China snapshot. (We are social 2014, cited 9.4.2015)

Social media has become the main way of communication among young people. Among the author's Chinese friends living in city, about 47% of young (20-35 ages) mobile users have one portable mobile charger at the moment. Based on the Chinese population, the market has more than 100 million mobile phone users. It is a massive customer base.

4.2 Market analysis

PESTEL method is used to analyse the target market. It includes political factors, economic factors, social factors, technology factors, environment factors and legal factors. (PESTLE analysis, cited 11.3.2015.)

4.2.1 Political factors

The political factors represent stand for the government's will and interest. The company should understand the government's policy and related laws before entering the market.

The official name of China is the People's Republic of China (PRC) located in the east of Asia. The population is over 1.3 billion and it is the world's most populous country. China is the world's second-largest country by land area, it is covering 9.6 million square kilometers. China is a single-party state which is governed by the Chinese Communist Party. PRC is a permanent member of the U.N. Security Council and China is also a member of numerous formal and informal organizations, such as WTO, APEC, IMF and G-20 developing nations. (CHINA.ORG.CN, cited 11.3.2015.)

China has the largest and most complex economy in the world. The socialist market economy is the world's second largest economy. Most of significant industry is directed by the government and state-owned enterprises, for example oil, electricity and transportation. (The World Bank 2015, cited 5.4.2015)

The energy industry is developed by the government policy and state-owned enterprise. However, the market mechanism is playing an increasingly important role in resource allocation. Investors in the energy industry are diversified, the amount of private investments keeps growing in this field.

The energy policy of China is decided by the relevant departments in the Chinese government. The National Energy Commission and National Energy Administration are the agencies to formulate the national energy policy, draft the new energy development strategy, evaluate the energy security and they are responsible for the investments in the energy industry. According to the 2012 China's energy policy by the National Energy Administration, China keeps strengthening its efforts in energy conservation and emission reduction and strives to raise the efficiency of energy utilization. Developing the renewable

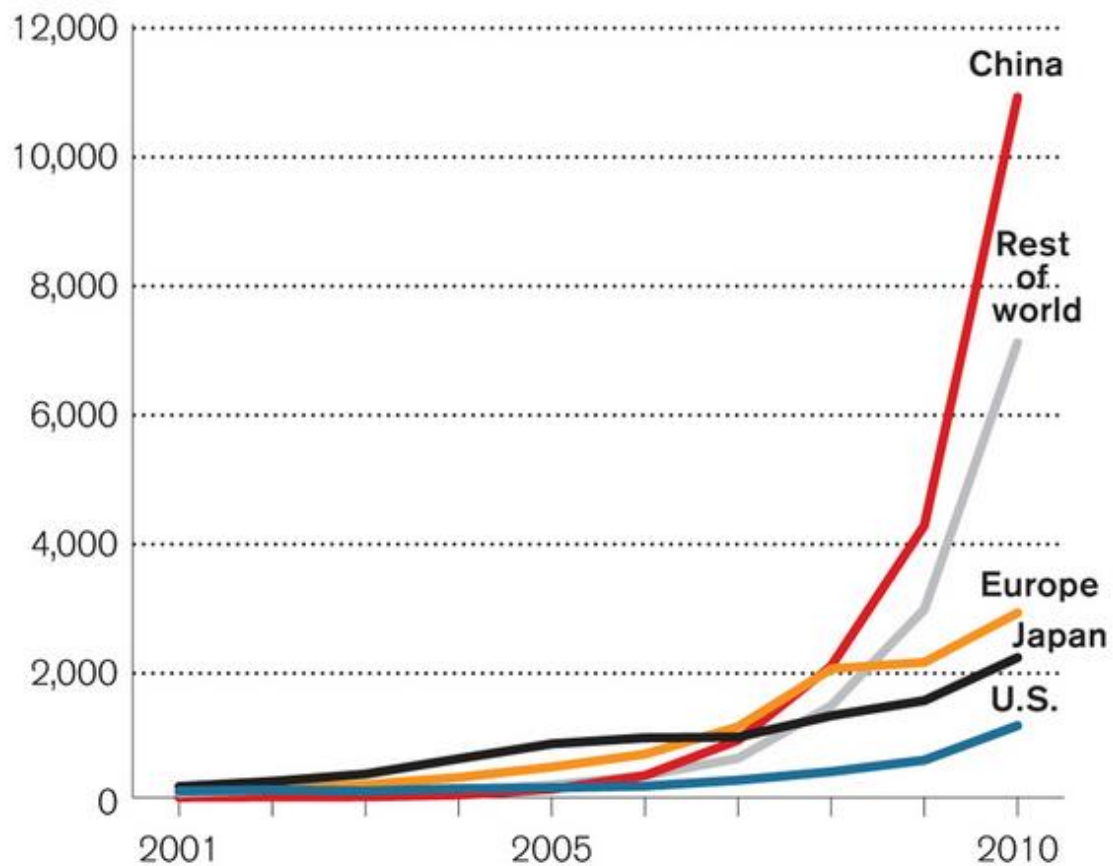
energy and active increased use solar energy are the key strategy measures in the next stage. In order to stimulate the development of the solar industry and encourage the private enterprise entering the market, Chinese government provides the subsidy and national policy support. (China daily 2012, cited 11.3.2015.)

4.2.2 Economic factors

According to the IMF research, China is the world's largest economy by purchasing power parity. The estimated Gross Domestic Product (GDP) is 10.355 trillion dollars in 2014 ranking 2nd in the world. GDP per capital (PPP) is 17.632 trillion dollars in 2014 ranking 1st in the world. Composition sectors of GDP are agriculture (10%), industry (43.9%) and service (46.1%). It is the world's fast-growing major economy and it is the largest manufacturing economy in the world. China is the largest exporter of goods and second largest importer of goods in the world. China is the largest trading nation and also the world's fastest growing consumer market. (Wikipedia 2015, cited 16.3.2015.)

China is a global center for manufacturing. In the southeast coastal areas, there are lower labor costs and more capital which are the main reasons why there China has become the largest solar panel manufacturer in the recent years. The solar photovoltaic industry has formed a complete manufacturing chain and the annual output of solar panels is increasing for more than 40 percent of the world's total. Based on the output, China has increased the solar photovoltaic export market share from 2% to 52%. It has decreased the price of the solar cell panel costs in the world. Figure 9 shows the production of solar-cell from 2001 to 2010.

Annual solar-cell production (megawatts)



Source: GTM Research

Figure 9, Production of solar-cell. (Energy collective 2012, cited 2.4.2015)

Manufacturing is an important part of the China's economy. Based on the GDP, the manufacturing accounted for about 43% in China's economy. The manufacturing leadership is the reason for China's rapid economy growth. (Central intelligence agency 2014, cited 15.3.2015.)

Figure 10 shows the price of solar panel from 2009 to 2012(PV tech 2013, cited 2.4.2015). Chinese manufacturers have increased output which lowers the costs of the solar products. This has some negative impacts. The most important affect is the output oversupply. The market potential is not enough. That means some smaller companies have to quit the solar market.

Chinese Manufacturer 3-Year Average Panel Price



Figure 10, the price of solar panel in China. (PV tech 2013, cited 2.4.2015)

According to the ENF research, by the industry overcapacity throughout the photovoltaic supply chain, about 350 small companies in China have stopped operating in 2012. (PV tech 2013, cited 2.4.2015.)

4.2.3 Social factors

Social factors are demographic aspects of the external macro environment. Social factors include culture, worldview, values and traditional etiquette. Different cultures represent different behaviors. In marketing, social and cultural practices also have an effect on marketing decision and behavior.

China is a vast country and it has a long history. Han group became the largest single ethnic group in China. This group account for about 91.5% of the total population. The other 8.5% of population is composed by the other 55 ethnic minorities. The 55 ethnic minorities have their own culture and tradition practices. Based on the Chinese government population statistical report, about 74.5% of the population from the age of the 15-59 and almost 55% of people living in the urban area (National Bureau of Statistics of the People's Republic of China, cited 18.3.2015). Since 1986, compulsory education comprises primary school and

junior secondary school in China. It means all citizens must study in school for 9 years. (World population statistics 2014, cited 18.3.2015.)

According to the administrative divisions, China has 22 provinces, 5 autonomous regions, 4 municipalities, 2 Special Administrative Regions (SARs) and Taiwan. China topography varies greatly. It is like a staircase descending from west to east. The Tibetan Plateau and the Himalayan Mountain located in the southwest of China. The largest desert in China, the Taklimakan is located in the northwest of China. Southern China is dominated by hills and low mountains. In the center and east, the plains of Yangtze River and the Yellow Sea are the country's most populated areas. Because of the complex topography and climate in China, many places have their own culture and practices. This directly affects the using of the new product and technology innovation. (Wikipedia 2015, cited 16.3.2015.)

4.2.4 Technology factors

Technological innovation can decrease the costs, improve the quality and performance. In recent decades, China has made rapid advances in science and technology areas.

In the last 30 years, China's policy has helped it access the foreign investment and technology support. Now China has established a complete industry system. More than half of China's technologies have an approach the advanced world level at the moment. (The guardian 2013, cited 4.4.2015.)

Figure 11 shows the expenditure of investments in research and development. More than 80% of expenditure was investment in development existing technologies in China. (Nature 2014, cited 4.4.2015.)

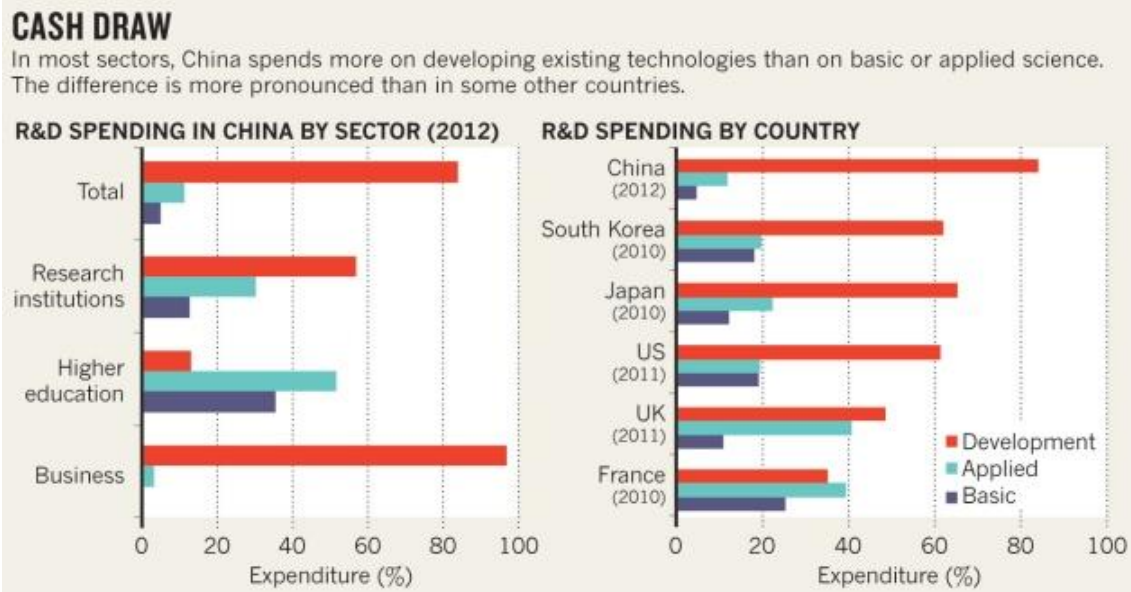


Figure 11, China spending in research and development. (Nature 2014, cited 4.4.2015)

China's solar PV industry is developing very quickly. In 2013, Chinese manufacturers have produced solar cells with a capacity of 23GW, it is 60% of global production. In the field of technology, mono-crystalline silicon and multi-crystalline silicon are the main solar panel technologies at the moment. China has approached the international advanced level in this field. (Earth policy institute 2014, cited 4.4.2015.)

As the basic research and technological innovation have made breakthroughs, it will provide the scientific and technological support for the development of resources and environment.

4.2.5 Environment factors

Environment factors consider environmental protection which includes waste pollution, weather and climate change. With increasing environmental pressure,

government and enterprises are thinking about environmental friendly development, especially in the energy industry.

According to the China's 12th Five-Year Plan (2011-2015) for National Economic and Social Development the usage of non-fossil energy should rise to 11.4% by 2015. China aims to cut the amount of energy and carbon dioxide emissions needed for every unit of economic output by 16% - 17%, during 2010 to 2015. The long-term plan is to cut carbon intensity by 40% - 45% by 2020, relative to 2005 levels (KPMG 2011, cited 23.3.2015.) Developing this system will benefit China's energy structure and finishing the national plan.

China has a full range of energy resources. China is one of the few countries which has many species of mineral in the world, including silicon, the raw material for the solar cells. According to the USGS research, China's silicon production was ranked to first in the world in 2011. It has been accounted for 67.5% of the total production. (U. S. Geological Survey, Mineral Commodity Summaries, Jan 2012, cited 23.3.2015.)

Solar panels may contain a number of hazardous materials, most of those materials are used to clean and purify the surface of panel. These hazardous materials could cause serious environmental and public health threats. However, a part of entrepreneurs and manufacturers have not realized the problem. (Union of concerned scientists 2013, cited 23.3.2015.)

4.2.6 Legal factors

Legal factors are usually connected with political factors. Legal factors often include all kinds of laws and relevant regulations published by the national government and local government. The aim of legislation is to build a fair market for national-owned companies, private companies and foreign enterprises.

Chinese government has taken measures to build a legal system of energy-related laws and regulations which protect the rights of enterprises, consumers and society. A series of laws and relevant regulations have been published in the last few years, including the Energy Conservation Law, Renewable Energy Law, Circular Economy Promotion Law, Law on the Protection of Oil and Natural gas Pipelines, Regulations on Energy Conservation in Civil Buildings, Regulations on Energy Conservation by public Institutions. In addition there are a number of laws and regulations which are encouraging the energy enterprises to explore and develop technology in renewable field. (Lawinfochina 2015, cited 24.3.2015.)

In addition to previously mentioned laws, there are laws which have been published by the Chinese government, United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol (Wikipedia 2015, cited 24.3.2015). They have established goals for the most of governments in the world.

4.3 Market strategy

A market strategy combines the business and market goals into one comprehensive plan. A good market strategy should be based on the market survey and focus on the product which open the market potential and sustain the business activity. The marketing strategy is the foundation of a marketing plan. (Business dictionary 2015, cited 27.3.2015.)

In this part the author is providing a market strategy which might increase number of customers for the smart solar mobile power. This market strategy is based on the information gathered from the SWOT analysis of the product and analysis of Chinese marketing environment by PESTEL method.

Strategy 1: Advertisement

Educating the target customers that the solar energy is green energy. The importance of renewable energy is that it does not consume any natural resources. Especially in recent years, government and people have realized the importance of saving resources and protecting of the environment. However, introducing the solar devices and solar technology is the key point in this strategy. Social media is the main tool in this strategy, for example Weibo and Weixin. These tools have ability to attract number of people and spread knowledge everywhere in a short period of time.

Strategy 2: Increasing product awareness through existing customers

In this product, travelers, salesmen and military are the main target customers. However, there can also be other potential customers. The customers have experience for this product, they understand the advantages and disadvantages of this device and they know what kind of people might need it. They have ability to share information of the good features to the potential customers. On the other hand, the enterprises should have ability to nurture the customer. To keep existing customers is more important than the getting new customers.

Strategy 3: Government support

In this strategy, government support does not mean policy support and subsidy but it means cooperation with the government. In Chinese market, government encourages the enterprises entering into the solar industry, these enterprises have policy support and subsidy. If these enterprises are able to cooperate with government, they will benefit of the corporate image and enterprise culture. For example investment in the utilities is a good choice.

Strategy 4: Public relations

Every organization, especially business organization, should build connections and have communication with public and media. The characteristics of business world is a fierce competition and increasing the market share. In Chinese business world, a successful corporation should understand how to build relations with public and media. Some of these are press releases, newsletters, public

appearances, social media and public works. For solar energy enterprises, the public work means investments in the public service equipment like solar devices, such as solar street lamps, solar charger stations.

Strategy 5: Service

Customer services provides the services for the customer before, during and after purchasing and using goods and services. The goal of customer services is to provide the perfect experience in this business activity and retain the existing customers. The good service is a key point of the brand to get new customers. So the customer services has the same importance as the product quality. (Business Case Studies 2014, cited 27.3.2015.)

Strategy 6: Upgrades the product

With the development of the technology, increasing number of customers are attracted by the new products. Upgrading the product has become an important method for the enterprises to retain the existing customers and to get the potential customers. Understanding the product and solar industry is the premise of upgrading the solar devices. The owner of enterprises have to understand how to satisfy their customers and they need to understand the development trend of the solar field. Before upgrade the devices, they have completed the customer survey.

4.4 Development plan

The development plan includes some recommends for the product and solar field, upgrade the solar devices and solar industry. These recommends are based on my research with my friends who have this devices.

Rollable Solar Charger:

The rollable solar charger is the first recommend for the solar device. Firstly, it can be decrease the volume and weight of the devices when the device is rolling.

Secondly, the thickness will reduce than the normal product at the same time. However, the key point is the rollable solar charger has lower limit for the size of the solar panel. Meanwhile, increasing the size of the solar panel has benefits for the devices which are using solar energy at the same time. Figure 12 shows the rollable solar charger. (Power film solar 2015, cited 5.4.2015.)

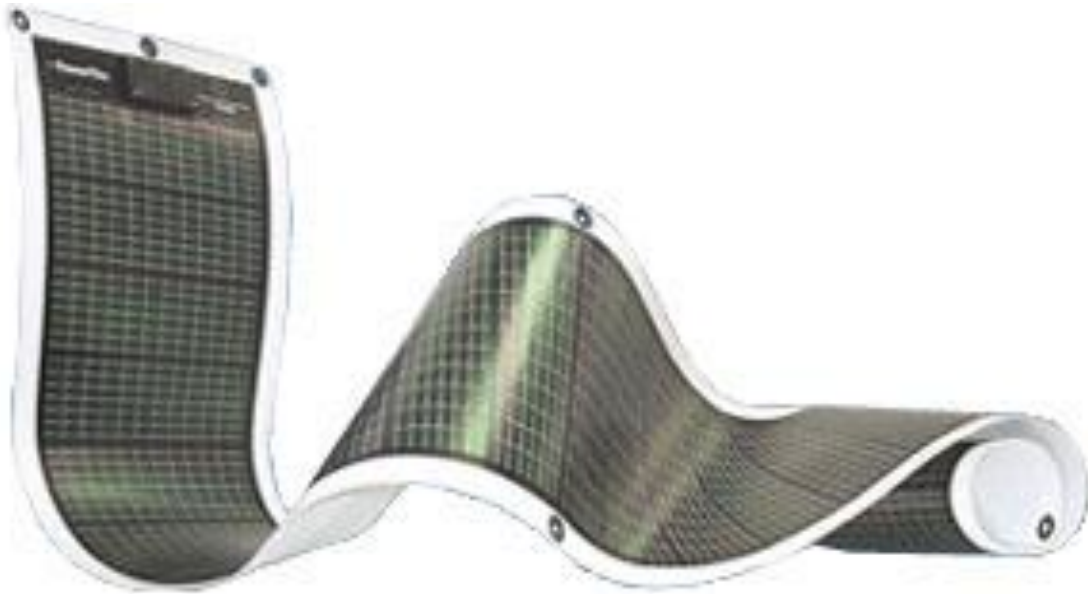


Figure 12, rollable solar charger. (Tactical Solar 2015, cited 20.4.2015)

Interface:

The traditional portable solar charger has a lot of interfaces. It can charge all kinds of electronic devices which have different interfaces. However, the next generation of solar devices should have ability to charge two or more devices at once. That means that one portable solar charger can charge two or more electronic devices at a same time.

Waterproof:

Waterproof is another feature for the next generation of solar devices. It can be used in the rainy weather and marine environment, for example, charging battery in boats and yachts. The new devices will fascinate more and more travelers. (Union of concerned scientists 2013, cited 23.3.2015.)

Customer Design:

Rollable, interface and waterproof are the main features in the next generation portable solar product. What customer needs is the key point in the business activity. In the solar device industry, solar companies should offer to customers design products and service. The project has ability to create a massive potential market. The customer has opportunity to decide the volume and size of the product, and number and type of interfaces he needs. The waterproof is only use in the boating and yachting, but according to the Chinese market situation, it is not necessary.

Military:

The military is a huge potential market for the solar devices. Figure 13 shows the military solar power. This customer group has a wide range of needs. In the future war, traditional power couldn't provide effective support. The solar devices can replace the traditional power system or they can be used as a spare power supply system. This system reduces the burden of fuel storage, transport and maintenance. Especially in complex environment and remote area, it relieves of the power pressure. (Power film solar 2015, cited 8.4.2015.)



Figure 13, military solar power. (Power film 2015, cited 8.4.2015)

Integrated into other devices:

The solar panels could be integrated into backpack, laptop cases, clothes or cover another electronic devices. That kind of integrated systems have ability to collect solar energy and charge electronic devices at a same time.

Large-scale:

Increasing the size of solar panel to replace the traditional power plant provides the energy for apartments. The equipment could be installed into a roof or a balcony to gather the solar energy. The large domestic solar panel have ability to provide power for the large electronic products. The extra power can be sold into grid.

5 CONCLUSION

By means of studying and researching China's solar product and energy field, there are some advantages and disadvantages I would like to summarize.

As an advantage, there are three points. Firstly, solar energy is a renewable energy. The solar energy does not consume any natural resources and it is the most abundant and most cost effective source we can use. It is clean energy, because it does not produce any product and pollutants that will harm the natural environment and climate. Secondly, it is an economical style to produce power. The technology of photovoltaics system is safe and efficient. The price of solar panels has decreased in recent years. Thirdly, the solar power station does not need so much solar panels, but the smart solar mobile power has a huge potential market. It has solved the problem of the solar panels oversupply.

On the other hand, there are three disadvantages. Firstly, there are some defects in this product. Manufacturers and research departments should upgrade this device as soon as possible. Secondly, the solar panel contains a lot of hazardous materials. Some of materials are used to clean and purify the surface of panel. These hazardous materials could cause serious environmental and public health threats. However, a part of entrepreneurs and manufacturers have not realized the problem. It is very dangerous for the environment and people's health. Thirdly, China's solar field has a weak competition. Chinese manufacturers has built the perfect manufacturing chain and Chinese energy enterprises has accounted more than 90% of the energy market. Chinese government provides support and protect in this field. But it is not good. Based on the ENF research, by the industry overcapacity throughout the photovoltaic supply chain, about 350 small companies in China have stopped operating in 2012. Chinese government is unable to protect all of the enterprises. Chinese people are very interested in emerging field, solar energy field is one of it and it is explanation the development problems of solar industry in China. China has the highest savings rates in the world. The Chinese banks have enough money for the borrowers. Entrepreneurs

have policy support and subsidy. It is very easy to come into this field. Chinese enterprises lack competition in foreign markets.

Solar energy industry has a huge market potential in China. The smart solar mobile power has some questions at the moment. However, this field is able to change our energy structure and our life style. The manufacturers and research department should upgrade the current product and develop a series of new products.

The solar energy is an emerging industry, the cost of devices is higher than the traditional electricity production devices. In order to encourage the private enterprises to come into the solar field, policy support and subsidy is necessary. Completed legal framework and providing more opportunities for local and foreign enterprises including large as well as medium and small enterprises to enter the Chinese market is the main task for the government.

6 DISCUSSION

This thesis process lasted for about four months, but the research started already last summer when I working as a training in a Chinese Anneng group company. Through the entire study and research process, I was able to gain valuable knowledge and experience.

I focused on the development of Chinese energy policy for a long time. The Chinese Anneng group company is an important energy company in my hometown, Wuhan. During the professional training, I understood the basic process and information for an energy company. Some of the managers working in that company discussed the energy situation with me. I learnt a lot of Chinese energy policy and market situation in the company.

This was my first time to write an academic report. I learned the method to control a study and research in an academic way. The report structure is important and difficult. I spent a long time collecting the relevant knowledge and information on the internet and reading academic books. The report structure helped me understand how to put all the information and data into my report. When the thesis structure was completed finishing the writing process was easier.

Through the research of the topic, I gained knowledge on Chinese energy market and solar industry. These experiences will help me gain more achievement in future. I am satisfied with the process and results of the thesis work. I realized the attitude is much more important than the way of working. I hope that whoever is interested in the renewable energy and markets in China is able to use this thesis.

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