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TRENDS AND BUSINESS OPPORTUNITIES OF SOLAR ENERGY IN CHINA

Business Economics and Tourism

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FOREWORDS

Today the most important topic is climate. Every country is active in developing renewable energy because renewable energy can solve the problem of conventional energy shortage and protect the environment. Solar energy as one kind of the renewable energy is becoming more and more popular. It is clean, safe and free to use. Chinese solar market is at a beginning stage especially in application sector, so this topic is interesting and challenging for me.

When conducting this study, I read a lot of materials from the internet in order to familiarize myself with solar energy, especially the downstream value chain of solar energy. The good thing is when I contacted the Chinese solar energy association and governmental sector I got a strong support from them and was able to gather a lot of information.

I hope the thesis provides new insights and helps to make further decisions in companies who want to enter into the Chinese markets. I should thank Mr. Jukka Kasi for providing this topic and his strong assistance. I would like to thank my supervisor Ms. Satu Lautamäki for her great help, careful checking and recommendations on my thesis. I would like also thank Mr. Wang Linzhi, the manager of Nanjing solar energy association for his support of information on solar energy and Ms. Chen Min, head of the department of Nanjing Investment Promotion Centre for the information she provided.

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ABSTRACT

Author	Yuan Zhang
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The objective for the thesis was to study the trends and business opportunities of solar energy in China. The thesis was completed by doing a desk research based on literature, reports, industrial magazines on solar energy and conducting interviews of experts and case companies.

The theoretical part focused on analyzing market potential with PESTEL analysis and describing key elements of market analysis, value chain analysis and competitive strategy. In the empirical part of the thesis, the main policies, a series of projects in China and three company studies are presented. The research approach for this thesis is qualitative research.

The challenge of Photovoltaic (PV) industry in China is the imbalance between production and consumption-most PV companies in China are solar cell manufacturer and most of the PV products are exported overseas. PV industry depends on foreign market a lot which is not good for long-term development. Therefore, in order to change this situation the trend for PV industry turns to domestic market development. Incentive policy plays an important role in developing domestic PV market. Advertising and attending industrial fair are main marketing tools to be used when entering the Chinese PV market. In order to participate in the Chinese PV projects, it is better for Finnish companies to cooperate with local PV companies and government. Advanced technology and service quality are the competitive advantages to get the collaborated opportunities.

Keywords**:** Photovoltaic, Market Opportunities and Trends, Value Chain Analysis

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Degree Programme of International Business

TIIVISTELMÄ

Tekijä	Yuan Zhang
Opinnäytetyön nimi	Aurinkoenergiaan liittyvät trendit ja business-mahdollisuudet Kiinassa
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Työn tavoite oli tutkia aurinkoenergian trendejä ja business-mahdollisuuksia Kiinassa. Työ toteutettiin tekemällä kirjoituspöytätutkimusta, joka perustui kirjallisuuteen, raportteihin ja teollisuusaikakauslehtiin sekä asiantuntijoiden ja case-yritysten haastatteluihin. Teoreettinen osuus keskittyi analysoimaan markkinapotentiaalia PESTEL-analyysin avulla, markkina-analyysin keskeisiä osatekijöitä, arvoketjuanalyysiä ja kilpailukykyisiä strategioita. Tutkimuksen empiirisessä osassa selvitetään poliittisia päätöksiä, erilaisia projekteja Kiinassa ja kolme case-yritystä. Työn tutkimusote on kvalitatiivinen.

Haasteena Kiinan aurinkoenergiateollisuudessa on epätasapaino tuotannon ja kulutuksen välillä. Suurin osa Kiinan aurinkoenergiayrityksistä on aurinkokennovalmistajia ja suurin osa teollisuuden tuotteista viedään ulkomaille. Aurinkoenergiateollisuus on riippuvainen ulkomaan markkinoista, mikä ei ole hyvä pitkän aikavälin kehityksessä.

Kannustavalla politiikalla on tärkeä rooli aurinkoenergiamarkkinoiden kehityksessä. Mainonta ja teollisuusnäyttelyihin osallistuminen ovat markkinoinnin tärkeimpiä työkaluja, kun astutaan Kiinan aurinkoenergiamarkkinoille. Jotta suomalainen yritys voi osallistua Kiinan aurinkoenergiaprojekteihin, paras tapa on toimia yhteistyössä paikallisten aurinkoenergiayritysten ja julkisyhteisöjen kanssa. Yhteistyön käynnistämisessä suomalaisten yritysten kilpailuetuna on kehittynyt teknologia ja palvelun laatu.

Asiasanat: Aurinkoenergia, markkinoiden mahdollisuudet ja kehitys, arvoketjuanalyysi

1 INTRODUCTION

The sun is a huge power entity, because it provides clean, safe and renewable energy and its use can last 60 billion years. Solar energy exists anywhere such as on land, in the ocean, and on desert and it is free to use. The radiation that earth receives is 10,000 times more than the energy demand. If 4% of the desert area on earth was installed with solar photovoltaic (PV) system it could satisfy the world's primary energy demand. With the United Nations Climate Change Conference held in Copenhagen, more and more attention is focused on low-carbon economy and sustainable development. With a combination of the price of electricity, available solar energy and governments' incentives, investments on grid-connected photovoltaic (PV) are attractive and promising. This thesis concentrates on investigating how solar energy business can develop in China, because it is a country with a growing demand for energy. (China Solar PV Report 2007, 2)

Solar electricity originates from the l950s. In the 1960s solar power was used for earth-orbiting satellites. In the 1970s, PV was applied in recharging batteries for navigation, signal and telecommunication equipment. In the 1980s, PV was used in small appliances such as calculators, watches, lanterns. Today, PV power systems are built and developed fast in Europe, US and Japan. The production of PV modules is increased by 30% annually. (Uni-Solar 2010)

Solar photovoltaic (PV) is a kind of technology that can make solar energy into electricity. PV constitutes arrays of cells containing a material that converts solar radiation into direct current (DC) electricity. In order to get the maximum energy, the cell units need to be connected into modules. These modules constitute the basic part of a PV system. There are two basic operation modes for a PV system: on-grid

PV system and off-grid PV system. Off-grid power generation is mostly installed for countryside buildings, boats, roadside lightings and so on. It is a stand-alone grid and it can provide electricity for remote and under developed areas where the electricity is instable. On-grid photovoltaic modules are mostly used in large on-grid power generation system today. In this case, an inverter is needed for converting direct current (DC) to alternating current (AC) and into grid in the end. In the daytime, the electricity generated from the system is used instantly or sold to a power supply company. At nights, the system cannot generate electricity so the electricity from a power supply company will be brought back. (Solartechnologies 2010)

Solar energy will be the most promising source of energy in the future. China is an emerging market for components manufacturing and system installations of PV. In May 2009, Chinese government proposed a $440 billion stimulus package on improving renewable energy. The proposal indicates that solar power is one of the key green resources to be developed in the near future. There is a large quantity of solar power projects under construction. The estimated installation of solar power system will be ten times larger than the target of 1.8 GW in 2020. In the following 15 years, Chinese government will invest 20 billion Euros on solar power industry. In 2010, China will introduce the preferential tariff in order to promote the solar power generation. In 2010, the main use of solar power is in stand-alone solar power system while during 2011-2020, grid-connected solar power system will be dominant. (China Solar Energy 2009, 2-3)

1.1 Research purpose and objectives

The main research question is how to enter into solar energy markets in China. The research is done for a Finnish PV solar inverter manufacturing company, which is

interested in knowing how to approach and enter the solar markets in China.

There are three main research objectives. The first objective is to theoretically describe the main concepts and tools that help to analyze new markets: PESTEL analysis, market analysis, value chain analysis and strategic planning. The second objective is to give an overview about business-to-business marketing in China. The third objective is to empirically study the Chinese solar markets.

1.2 Structure of the thesis

Chapter 1 is an introduction for the thesis including research purpose and objectives as well as the structure of the thesis.

Chapter 2 is a theoretical chapter which provides theoretical background about PESTEL factors, key elements of market analysis, value chain analysis and strategic planning.

Chapter 3 presents an empirical study of the Chinese solar markets. First, research methodology is described and explained. Second, the history and development of the solar markets of the world and China are introduced. Third, the present industry situation in China is presented which includes issues like solar power's market share in renewable energy markets, electricity price, Chinese government plans in solar, and value chain structure in PV solar in China. Fourth, an empirical study of the leading Chinese solar case companies is presented. Finally, solar market trends are analyzed, and conclusions made on the basis of the empirical study are presented.

Chapter 4 is a conclusive chapter which includes a summary of the thesis and recommendations for entering the Chinese solar markets.

2 TECHNIQUES FOR ANALYZING MARKET POTENTIAL

In this chapter, the main theoretical tools for analyzing market potential are introduced and evaluated. Markets not only consist of customers but also competitors, suppliers, distributors, shareholders and other stakeholders which can be described as microenvironment. In addition to the microenvironment, there is the macro environment which is a more general market environment than the microenvironment. In the macro environment there are technological factors, social-cultural factors political factors and legal factors. So, all these factors should be analyzed in order to estimate the market potential. Next, these factors will be described based on PESTEL analysis. (Kent 2007, 4)

2.1 PESTEL analysis

PESTEL stands for Political, Economic, Social, Technical, Environment and Legislative factors. PESTEL analysis is an analysis of the external macro environment which business operates in. PESTEL is a useful tool for companies to learn about the risks related to market potential and direction. There are many factors influencing business decisions, such as changes in taxation, new laws and changes in policy. Next, each of these factors will be examined, especially by giving examples of each PESTEL factor in the Chinese markets.

2.1.1 Political factors

Political factors represent the government’s will and interest. In order to reduce the risks a company should know the political issues of the country before entering the market. A company should create and maintain a good relationship with political officials for the following reasons. Firstly, if an industry is important for a nation, it

will benefit from favorable policies. Governments will not enforce any unfavorable laws or regulations toward those industries or companies, which can create big profit for them. Secondly, governments are big buyers and the government officials have the power to decide how much to purchase for public constructions and certain projects. Thirdly, governments play an important role in securing and helping companies go abroad. (Dibb, Simkin, Pride and Ferrell 2006, 72-73)

Government has an emphasis on public policy, regulatory agencies, government incentives and penalties, and investment in government enterprises. Government sometimes works with an industry towards a common national industrial policy. The taxation system, tariffs and product safety rules and special rules on foreign multinationals are determined by the government. Government is also an important member in the distribution channel. (Malhotra&Birks 2003, 668)

A major political factor in China is the party which is in power. The present objective for the Central Committee of the Communist Party (CPC) is to build a harmonious socialist society. The CPC has both central and local organizations. The National Party Congress has the supreme power which is held every five years by Central Committee. Central Committee is elected in the National Party Congress. It leads all the work representing CPC when there is no session. Political Bureau and its Standing Committee are elected by the plenary session of Central Committee. They can excise the power when there is no session. (Chinese Government Official's Web Portal 2009)

Another political factor is the National Energy Committee which was established in January 2010. The obligation of national energy committee is to draw up the strategy for national energy development, discuss issues about energy safe and development, and coordinate the domestic energy development and international

energy cooperation. Premier Wen is the leader of National Energy Committee. (Chinanews 2010)

2.1.2 Economic conditions

Economic conditions include economic size, economic growth, interest rate, exchange rate and inflation rate. These factors reveal what is happening within the economy. Each factor can have an impact on the business operation, for instance, high interest rates may deter the investment because it costs more to borrow; a strong currency is not good for export because the price is increased; inflation can leads to an increase in employee's salary and high national income growth can call for more products. (Gillespine, 2007) A country's stage of economic development determines the size, the degree of modernization and standardization of its markets. Consumer, industrial and commercial markets become more standardized and consumers' habits of work, relaxation and lifestyles become more homogenized. (Malhotra&Birks 2003, 668)

Since 1979 China has reformed its economy and implemented the so-called open-door policy. The economy has transferred from a central-planned economy to a market-oriented economy. During the past two decades, the economy has maintained an average growth of 9.5%. In 2006, the economy was one fifth of the US economy. (U.S. Department of State 2009) By 2010, a complete socialist market economic system will be relatively established. Resources are allocated by the market with a macro-control system. By 2020, China will set up a more mature socialist market economic system. (Invest in China, 2009) Even when facing the economic crisis in 2008-2009, China's economy still has increased with a growth of 8.7% in 2009, and the gross domestic product (GDP) reached 33.54 trillion yuan (4.91 trillion dollars) according to the National Bureau Statistics (NBS). There are eight features of the

economy of the past year which can be closely examined: the growth of agricultural industry, the growth of industrial production, the growth of investment, decline in consumer price and producer price while an increase in the end of the year, drop of the overall value of import and export, steady increase of urban and rural residents' income and the rapid growth of money supply.

The agricultural industry has developed steadily with an increase of consecutive six years. Industrial production has increased quarter by quarter, profit has changed from a sharp decline to an increase, and about 11% increase for the whole year. The growth in the first quarter was 5.1%, in the second quarter 9.1%, in the third quarter 12.4% and in the fourth quarter 18%. Different types of enterprises also have different growth rates: state-owned and stated-holding enterprises have grown 6.9%, collective enterprises up by 10.2%, share-holding enterprises up by 13.3%, and foreign funded enterprises by 6.2%. The growth of the heavy industry was 11.5% while the light industry grew with 9.7%. The growth of the eastern, central and western regions was 9.7%, 12.1% and 15.5% respectively. In the first eleven years the industrial enterprises made a profit of 2,581.1 billion yuan, 2.9% higher than the same period of 2008. 30 out of 39 industrial divisions have reached year-on-year profit growth. (Ministry of Commerce, 2010)

Investment keeps on growing, especially investment on livelihood is growing fast. The total investment in fixed assets has reached 22,484.6 billion yuan with an increase of 4.6% of 2008. The investment in eastern, central and western region grew by 23.9%, 36% and 35%. The market sales grew fast and steadily. In 2009, the total sales of consumer goods reached 12,534.3 billion yuan with a growth of 15.5%. (Ministry of Commerce, 2010)

There has been a decline in consumer and producer price but an increase in the end

of 2009. Consumer price index (CPI) has dropped by 0.7% including 0.9% drop in cities and 0.3% in rural areas. Prices of four categories of goods, which are tobacco, liquor, medical care and household appliance, have increased. The prices of houses went down by 3.6%, transportation and communication by 2.4%, clothing by 2.0% and education, cultural articles and services by 0.7%. The CPI grew by 0.6 percent in November 2009 and 1.9% in December 2009. Throughout 2009, the producers' prices for manufactured goods went down by 5.4% while in December 2009 it was up with 1.7%. The purchasers' prices for raw material, fuel and power decreased by 7.9% for the whole year 2009 and the retail prices for commodities decreased by 1.2%. The overall value of imports and exports dropped in 2009 but in November 2009 it recovered. The total value of export was 1,201.7 billion US dollars dropped by 16% and the value of import was 1,005.6 billion US dollars which was down by 11.2%. (Ministry of Commerce, 2010)

The urban and rural residents' income has increased steadily with a good employment situation. The last feature of the economy in 2009 is that money supply grew rapidly and new credit increased by a large margin. Compared to the end of 2008, the broad money was 60.6 trillion yuan at the end of 2009 which was an increase of 27.7%. The narrow money was 22 trillion yuan, increasing by 32.4%. The cash in circulation was 3,824.6 billion yuan, up by 11.8%. The total outstanding loans of all the financial institutes was 40 trillion yuan, increased by 9.6 trillion more than that in the beginnning of 2009 or 4.7 trillion more than that at the end of 2008. (Ministry of Commerce, 2010)

China's demand for energy is also growing rapidly with the development of economy. China has been the second largest consumer of the primary energy while China is also the third-largest energy producer in the world. Electricity consumption

will increase by over 4% a year until 2030, which means there is a demand for more electricity infrastructure investments worth more than $2 trillion. It is estimated that China has to add 15,000 megawatts capacity of generation a year, of which 20% are generated by foreign suppliers. (U.S. Department of State 2009)

The 11th Five-Year program held in 2005 indicates the importance of renewable energy development and environmental protection. China has abundant resources besides coal, thus moving from coal to cleaner energy is a necessary developmental trend. China's renewable energy law went into force in 2006, and it states that 10% of the energy must come from renewable resources by 2020. (U.S. Department of State 2009)

2.1.3 Societal-cultural issues

Social-cultural issues are demographic aspects of the external macro environment. Culture includes concepts, values, and tangible items such as buildings or foods which together constitute the society. Culture is passed generation to generation. When foreign products are introduced to a country, acceptance is mostly dependent on whether the two nations have similarities in their cultures. For multinational companies, cultural differences are important to understand in terms of product development, personal selling, advertising, packaging and pricing. In industrial marketing, culture may also affect marketing negotiations and decision/making behavior. (Dibb, Simkin, Pride and Ferrell 2006, 743-744)

China is a large country with a long history, so the culture has many dimensions. The most traditional and dominant values of Chinese culture are modesty, conservatism and respect. The business culture in China also has its own character, for example, answering "no" directly is seen as impolite in the Chinese culture. The

Chinese way of expression is not as direct as in the western countries. Chinese people are afraid of “losing face” so in case someone asks an intrusive question it is not good to express the irritation, but instead try another way to express it. Chinese call each other with titles added after the family name in business occasions or office. Giving a business gift to a company is acceptable but the gift should not be an expensive one. (Globaledge 2009)

Hofstede’s cultural dimensions analyze cultural differences among countries. The five cultural dimensions are low vs. high power distance, individualism vs. collectivism, masculinity vs. femininity, low vs. high uncertainty avoidance, and long vs. short term orientation. (Itim International 2010)

Power distance means the extent to which less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally. The country with a low power distance is decentralized. There is a smaller portion of supervisory people. The country with a high power distance is centralized. There is inequality between people. Regarding China, the power distance index reached 80, which is higher than the average level of the world, including even the other Asian countries. This means there is a high level of inequality existing in China, and this condition is mostly caused by the cultural heritage. In a high power distance country, superiors and subordinates consider each other as unequal, because a high hierarchical system exists in the workplace. Also, there is a lot of supervisory personnel and a wide salary gap exists between supervisors and subordinates. (Hofstede and Hofstede2005, 55)

Individualism is the tendency that people only care about themselves or their family. On the other hand, collectivism means people belong to a group and look after each other for loyalty. China is lower in terms of individualism than the world’s and

Asia's average. China as a collectivism society fosters a strong relationship where everyone takes responsibility for fellow members in the group. (Itim International 2010)

Masculinity and femininity refers to the distribution of roles between genders in a society. According to the study of Hofstede (2005) that women's values differ less than men's values and men's values differ a lot among different countries. The values in a feminine society are modest and caring while values in a masculine society are comparably assertive and competitive. Therefore there is a big difference between masculine and feminine country. In terms of masculinity, China is lower than Asia's average but higher than the world's average.

Uncertainty avoidance index indicates the tolerance that a society has in dealing with uncertainty and ambiguity. Uncertainty avoiding countries try to minimize the possibility of unstructured situations by strict laws, rules and security measures. On philosophical and religious level they have one absolute belief. The opposite of uncertainty avoiding countries is uncertainty accepting countries. They are more tolerant to accept things and opinions that different from what they are used to. Regarding uncertainty avoiding China is lower than the world's and Asia's average which means China is more tolerant to accept things and opinions that are different from what they are used. (Itim International 2010)

Values with long-term orientation are thrift and perseverance and values associated with short-term orientation are respect of tradition, caring about social responsibilities and protecting one's "face". The long-term orientation index for China is 100, which is the highest compared to Asia and the world's average. Asian index is also higher than world's average. So it shows that China represents short-term orientation. (Itim International 2010)

2.1.4 Technological changes

Technological changes can cut down costs, improve quality and lead to innovation. New technology creates new products and creates new markets. Technological factors can overcome the barriers of entry and improve the manufacturing efficiency (Gillespie 2007)

China's solar PV industry is developing quickly. The world's huge demand, especially in the European countries and the U.S. encourages the development of solar PV in China. Since 1958 China has been studying solar cell and solar cell production in China has increased from less than 100 MW in 2005 to 1,088 MW in 2007. The production will exceed 5 GW by 2010, and reach 10 GW by 2015. Major markets for the Chinese solar cell are Europe and the United States, so China is becoming the world's largest solar cell manufacturing country. (Liu 2008, 10)

China is building a world-class PV industry in all parts of the solar value chain, with the support of favorable tax policies, aggressive government procurement and national target. Meanwhile, the use of solar energy at home is also developing quickly. (Shi 2009, 7)

2.1.5 Environment

Environmental factors relate to weather and climate change. With the climate change and environmental awareness, government and companies are thinking about green and environmental-friendly ways to development. For example, renewable energy industry is growing fast and any product which is environmental-friendly and energy-saving will be encouraged to be produced. PV industry is an environmental-friendly industry which generates power in a clean and non-polluted way. Developing PV industry can change the energy structure of China in the future.

China has promised to the world that the emission of CO_2 in 2020 will be cut down by 40%-45% compared to 2005. (Invest in China, 2009)

China is one of the largest countries in the world, which has abundant natural resources. The land area of mountains, hills and tableland is larger than plain and high plains. The grassland takes up 37.4% of the total area of China, farmland accounts for 10.4%, woodland accounts for 12.7%，desert, Gobi, tor, mountain glaciers and permanent snow areas account for 20.5%. (Invest in China, 2009)

China also has full range of conventional energy resources. The country is especially rich in coal and oil resources. Waterpower resources rank first in the world and the reserves are 6.76 million kilowatts. In addition, China is also one of the few countries in the world, which has many species of mineral. The proved mineral species has reached 148. As for PV industry, silicon reserve as the raw material for solar cell is also large accounting for 25% of the world's reserve. China is rich in solar energy: the annual solar energy reserve is equal to the reserve of 1700 billion tons of coal, and China has the second largest reserve of solar energy in the world. (Invest in China, 2009)

2.1.6 Legal and regulatory forces

Legal factors are often connected with political factors. Legal factors include all kinds of laws and legislations which can have a great impact on the operation of a company. One of the major trends in political environment is the increase in business legislation. Business legislation is mainly to protect companies from unfair competition, to protect consumer from unfair business practices and to protect the interests of society. (Kotler and Keller 2009, 126)

Chinese government is making a big effort on promoting laws and regulations.

China's legislative power is carried out by two or more power organs, which means the country has multi-legislative powers, including a national level for administrative laws and local laws. The current legislation system has both centralization and decentralization to some extent. The most important legislative power is national legislation, the constitutional and state law, guided by central authorities and takes a leading position in the whole legislation structure. (China Internet Information Center, 2009)

Chinese government has enacted many laws and regulations regarding, for instance, foreign investment and patent protection. Local governments have their own policies regarding businesses and all kinds of industries. Law of the People Republic of China on foreign-capital enterprises was approved on 12 April 1986 and revised on October 31, 2000. The law indicates that "the benefits obtained and other lawful rights and interests of foreign investors are protected by Chinese laws. Foreign capital enterprises must pay taxes and enjoy preferential treatment such as tax reduction or exemption in accordance with relevant regulations. If a foreign capital enterprise invests its after-tax profits in China, it may apply, according to state regulations, for an income tax refund of a part of the income tax already paid on the reinvestment amount" (China Internet Information Center, 2009)

The Chinese government will extend the investment field for foreign investors encouraging the investment in hi-tech manufacturing industry. Premier Wen has said on 30 December, 2009 that China will expand the opening area for foreign investment. The encouraged area includes advanced manufacturing, hi-tech and new technology industry, modern service industry, new energy and energy-saving environment protective industry. Foreign enterprises are one of the most important components constituting the Chinese economy. In order to stem the financial crisis

and keep the stale development of the economy, China will create a more open and optimized investment environment. (Chinanews 2009)

China has taken measures to develop clean energy. The Renewable Energy Law was passed in 2005 and came into effect at the beginning of 2006. It is the most decisive policy tool. The Renewable Energy Law supports and promotes the technological development. The target is increasing the use of renewable energy to 10% by 2010 and 16% by 2020. (Zheng 2007, 5-6)

The New Energy Law states that the Chinese government will establish a renewable energy development fund to support the research and development of new energy. Energy authorities of the state council are responsible for implementing and managing renewable energy development. Grid-connected renewable energy power generation will be supported by the government. As to grid companies, they will make the renewable energy to be connected to the on-grid system and purchase electricity generated by renewable sources. Renewable energy price levels will be set by the government based on the principle of "reasonable costs plus reasonable profits". The tariffs will be funded by a small levy on the price of electricity for domestic customers. (Zheng 2007, 5-6)

In addition to the law, Chinese government has also established many policies and goals on renewable energy. A Stimulus Package of $180 billion dedicated for renewable energy by 2020 will be offered. The goal is to save five times as much in CO_2 as that which needs to cut energy intensity 20% between 2005 and 2010 and cut major pollutant by 10% by 2010. In this case, targets of energy efficiency and carbon savings are imposed for the top 1,000 relevant companies. In addition, thousands of older, smaller and dirtier power plants will be closed by 2010 and building energy codes in all regions and extensive efficiency standards for

appliances will be established. New buildings in major cities like Beijing, Shanghai and Chongqing are targeted to achieve 65 per cent greater energy efficiency than local codes require. Regarding PV industry, the target market projections for the installations of PV will reach 300 MW by 2010 and 1.8 GW by 2020. (Shi 2009, 7)

2.2 Key elements of market analysis

Foreign markets offer potential opportunities to increase sales and profits which drive domestic companies to go international. In order to enter into foreign markets, companies have to conduct market analysis: "Client-based marketing research is a process of construction, analysis and interpretation of data both on organizations and their environments so that information can be provided for organizations in diagnosing, deciding and delivering marketing strategies and tactics." (Kent 2007, 5.)

The goal of a market analysis is to determine the attractiveness of a market and to understand its opportunities and threats because these are related to a firm's strengths and weaknesses. A market analysis should contain a series of factors such as market size, market growth rate, market profitability, distribution channels, market trends and key success factors. Growth rate helps to analyze the future trends of goods based on a historical data. Market profitability estimates the profit can be gained in the potential market and how hard to reach this profit. In order to get the distribution channel in a market, it is necessary to know the existing distributional channels, emerging channels and channel power structure. Market trends means the changes in the market, and the changes can bring new opportunities to a company. The key success factors are the elements of achieving the marketing objectives including access to the resources, channels and technological progress. (NetMBA 2010)

As an example, we can analyze the growth rate of the Chinese solar energy markets by examining the Chinese PV installation capacity from 2005 forward (see Table 1).

Table 1. 2005-2008 National PV installation capacity and future estimate (MW) (Global PV industry development report 2009).

Year	2005	2006	2007	2008	2009-2020E
Cumulative installation capacity	68	80	100	145	20,000
Increased installation capacity	5	12	20	45	19,855
Compound increased rate		140%	66.7%	125%	53%

Compared to Europe and the United States, Chinese PV market lags, especially in field of system application. Statistics show that the increase rate of installation capacity from 2006 to 2008 is high but the base number is low, so the increased installation only takes up 0.8% while production accounts for 32% world-wide.

From table 1, we can see that the installation capacity of PV began to increase in

2006 and it has reached a high increase rate. From 2006, the PV installation capacity has kept growing, which shows a great concern of nation on PV development. Based on the awareness and notion of environmental protection more and more, PV systems will be installed, so we can see that the future of the PV markets is quite bright. As it is estimated, nearly 20,000 MW PVs will be installed by 2020.

2.3 Value chain analysis

The concept of value chain has a close relationship with supply chain analysis. The supply chain is a channel stretching from raw materials to components to final products offered to final buyers. Every company in the supply chain gets a certain percentage of the value generated in the supply chain. In order to get more value companies often expand their business to upstream or downstream or acquire competitors. (Kotler&Keller 2009, 54) So, a value chain can be described as a set of activities within the supply chain. Together these activities add value into products passing through the supply chain.

Value chain analysis categorizes the value-adding activities in order to develop low-cost differentiation strategies. Value-chain analysis implies a linear process. Firms make inputs into the process at every stage. As a result value chain becomes a value network, which includes a group of companies or organizations. Those companies and organizations have interrelated and complex relationships with each other making contributions to the final value.

2.3.1 Collaboration versus competition

According to Bronder and Pritzl (1992), the benefits for collaboration are time advantages, know-how advantages, access to market, cost advantages and system competence. Time advantages mean faster responses to changes of the environment.

Cooperation with R&D programmes can largely reduce the development times. Regarding know-how advantages, strategic alliance can help companies learn from each other in order to overcome the knowledge deficits. The third advantage is access to market, which is very important due to increased global protectionism. Cost advantages from external synergy can arise through combing value chain activities. Through strategic alliances, companies can achieve system competence in the market even though their own core competencies are focused on special areas. (Baker 2007, 216-218) A company operating in the international market needs to know how to deal with the supply chain in the target country. Companies should know when to compete and when to collaborate, for example, forming alliance with local companies to implement projects. Strategic alliance is a modern business concept compared to the traditional concept. In the traditional way, business and management interest has focused on the concept of competition but nowadays this concept has begun to shift to the collaboration and its potential benefits. With development of globalization, firms that collaborate with suppliers, customers and even competitors will have a competitive position. There are mainly two ways for cooperation between companies. Companies can pool their resources to achieve mutual objectives and exchange resources in order to acquire complementary strength.

In order to make the final “compete or collaborate” decision, companies have to define their competences and the main competitive strategy. The concept of “distinctive competence” firstly came out in Harvard Business School in the business policy course by Selznick (1957) who defined it as “any factor at which a firm was uniquely good by comparison with its main competitors”. The concept was further developed as that core competencies are a combination of a number of distinctive competencies in terms of product/market, production, finance,

technology and management style and succession which are difficult to replicate by other competitors.

According to Porter (1985) there are basically three strategies to gain competitive advantage: cost leadership, differentiation, and focus (see Figure 1). Cost leadership strategy aims at minimizing the cost of production, distribution and focus on intensive supervision of labors, etc. It means all the resources for the production should be the cheapest resources. In reality, companies move production to developing countries in order to cut costs and approach to the markets. Differentiation means products and services provided by the company different from competitors. It is necessary for a company to equip itself with creative flair, strong ability to research and a reputation for quality and technology. The third strategy is focus, which stresses market segmentation in a small-defined group with either low cost strategy or differentiation strategy. The products and services for these markets are often expensive and highly technical. (Blythe&Zimmerman 2005, 38-39)

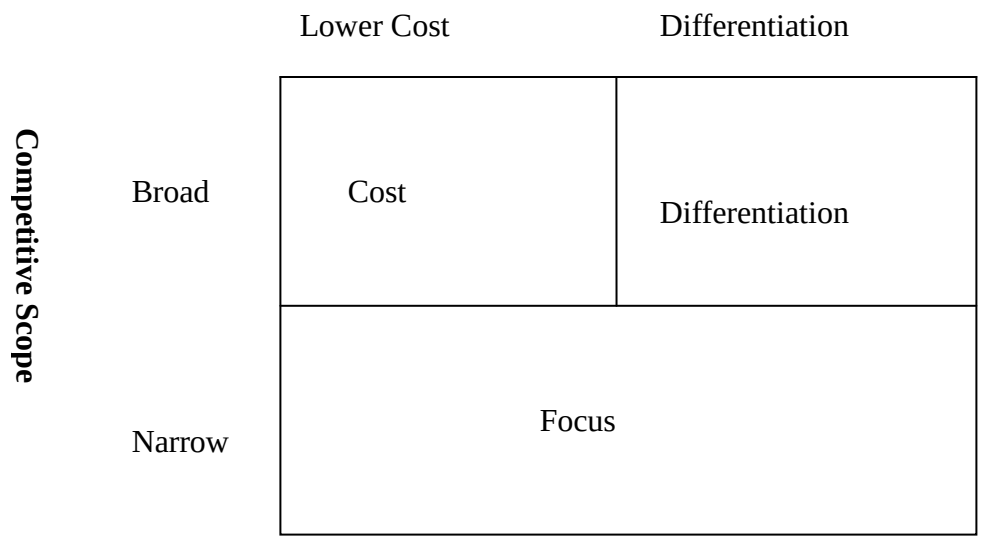

Figure 1. Basic competitive strategies (Michael Porter 1985).

Cost leadership and differentiation have a broad target compared with focus strategy. In the industrial market, companies have to segment the market so that they can concentrate on a specific group. In order to reach a niche segment, companies can use either cost leadership strategy to reduce the costs or differentiation strategy to update the technology.

2.3.2 Photovoltaic value chain in China

It is important to understand the whole value chain so that companies can build a holistic picture of this industry. Every actor in the value chain has a close relationship with each other. With a deep understanding and relationship with suppliers and customers, a company can ensure the supply of materials and market of the products.

Photovoltaic (PV) value chain in China can be divided into five parts, which are

silicon, ingot and wafer, cell, module, and system. Upstream activities include silicon and ingot&wafer production while middle stream activities include the production of cell and module. System belongs to downstream activities in the value chain. At a global level, the number of companies within the value chain increases when going from the upstream to downstream industry.

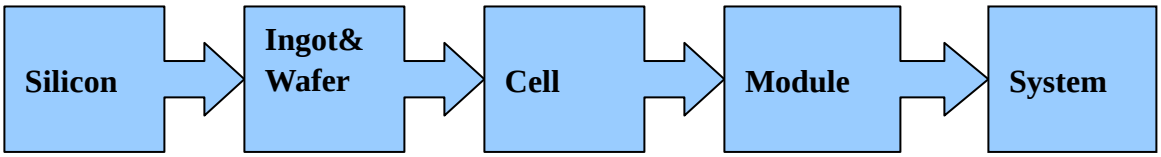

Figure 2. Value china of PV industry in China.

In PV industry's value chain, cell is the most important element. At present, 90% of the PV cells are made of monocrystalline silicon and polycrystalline silicon. During 2006 and 2007, there were almost ten Chinese PV companies operating in the export markets of which eight companies have reached 20 billion U.S. dollars and have listed in the United State's stock market. In 2007, there were already 500 PV companies which are focused in the middle and downstream of value chain. (People, 2008)

Since 2003 China's solar cell producing sector has increased rapidly and the annual increase rate has been even 100%-300%. In 2007, the annual production of PV cells in China was 700MW followed by Japan and Europe. Because of the high price of cells, most of them are made for export. In 2008, the solar cell capacity reached 2.6 GWp. (Global PV industry development report 2009, 17) Although China had gained a success in PV cell's manufacturing area the core technology is still from

abroad, which is not good for long-term development.

In the whole PV value chain, module manufacturer sector is one of the fastest developing areas since it needs less investment and technology as well as rapid construction period and approach to the market. It is estimated that China has more than 180 module manufacturing companies. In 2008, China was the biggest module manufacturing country with a global share of 32.9% followed by Germany (19%), Japan (16.5%), Taiwan (11.4%), the United States (5.5%) and others (14.8%). Because the end market is not mature, 98% of modules are exported. The production quantity of PV is large but the application standard is low. PV product manufacturing is mainly focused in Fujian, Zhujiang river delta and Zhejiang. With the limitation of price and market opportunities, domestic PV application is not popular. (Global PV industry development report 2009, 17)

Within the internal industrial value chain of China, there is an uneven technology development and a gap between demand and supply. The whole PV technology is at a low level and the core technology is dependent on foreign countries. The Chinese solar energy industry is mainly focused on the middle industry chain. (LRN, 2010) Since China is a large country with a large amount of labor force, it is cheap for manufacturing companies to produce goods. Chinese government also offers some favorable policies for foreign companies which also cut the costs for investment. So, most companies come to China in order to benefit from the cost leadership strategy. Today, as the whole nation is starting on renewable energy development there will be more and more PV projects and systems need to be built. In this case, companies will have to implement the focus strategy to have a clear customer segment. For example, inverter manufacturing companies' customers will be the PV system and turnkey projects as well as the Chinese government. To conclude, investment in

China is quite necessary, which means both approaching the market and the customers as well as cutting down the manufacturing costs.

2.4 Benchmarking

Once a company has identified the structure of the value chain, the next step is to benchmark firms which have competitive advantage. Benchmarking is the process of continually comparing and measuring the leading organizations anywhere in the world to gain information which will help the organization to take action to improve performance.

There are four kinds of benchmarking types which are identified as internal benchmarking, competitive benchmarking, functional benchmarking and generic benchmarking. Internal benchmarking means comparing successful practices within the organization. Competitive benchmarking is used when comparing successful companies with which one is competing. Functional benchmarking means to evaluate firms in a particular sector. Generic benchmarking is a comparison of firms in any industry in order to try and understand how they have become successful. (Baker 2007, 213-214)

Benchmarking helps companies to identify critical success factors. According to Rockart (1979), the concept of critical success factor was inspired by the issue of optimum match between environmental conditions and business characteristics. There are five factors to be noticed which are the industry, competitive strategy and industry position, environmental factors, temporal factors and managerial position. Based on a series of considerations, Grunert and Ellegaard (1993) conclude a key success factor as “a skill or resource that a company can invest in, which, on the market the company is operating in explains a major part of the observable

differences in perceived value and/or costs.”

According to previous studies, there are several factors which can affect companies’ success. Firstly, a key factor is a causal relationship. It means a relationship between the competitive advantage a company has in a market in terms of perceived value, relative costs and the causes of the competitive advantages in terms of certain skills and resources. Secondly, the skills and resources are the key factors for a company to win. Thirdly, being market-specific which means they have better advantages to access the market or more shares in the market. (Baker 2007, 210-212)

In China, the solar market is not mature and it is at a beginning stage, so the regulations and policies are not the same in different areas. It is important for the Chinese government to learn from the successful experience from the developed countries such as Germany and the United States. There are many companies in each sector of the supply chain. Some of them are doing well and expanding the markets to foreign countries but some of them have failed due to different reasons. It is important for companies to learn about the management and operation of companies which have gained a success in this industry.

3 EMPIRICAL STUDY OF THE CHINESE SOLAR ENERGY MARKET

The empirical part of the study is based on the facts and policies related to the Chinese solar energy market. The research aim is to analyze and evaluate the present situations of the Chinese solar energy market and find the trends and business opportunities in solar energy market. The research is conducted as an exploratory research. Qualitative research methods like observation, interviews of experts, and secondary data provided by different reports on solar energy market have been used.

3.1 Research methodology

Research methodology is divided into two kinds, one is qualitative research method and the other one is quantitative research method. Qualitative research refers to an unstructured, primarily exploratory research design based on small samples, intended to provide insight and understanding. Quantitative research is using techniques to seek to quantify data and typically, apply some form of statistical analysis. (Malhotra & Birks 2003, 132)

In this study, the qualitative approach was chosen because the research problem is explorative in nature. This means to find new possibilities of entering into the Chinese PV industry. Qualitative research encompasses a series of methods that can be applied in a flexible manner to enable respondents to reflect upon and express their views or to observe their behavior in their own terms and context. Qualitative research does not rely on measurement or the establishment of “fact”. Qualitative research method can be used to develop an understanding of the nature of a research problem, and to develop and pilot questionnaires. (Kent 2007, 118)

The empirical study is conducted by using multiple-case studies. Three companies were chosen as case study companies. These companies are located or founded in China and they are participating in different sectors of PV value chain or can be vertically integrated companies. Face-to-face interviews were made to the president of Nanjing solar energy academy, head of department of Nanjing investment promotion centre and secretary of president of Nanjing First Second Power Equipment Company. In addition, a company visit to China Sunergy was made in February 2010.

3.1.1 Data collection

Data is the systematic records made by individuals. Data can be divided into two kinds: primary data and secondary data. Primary data have been constructed by the researcher specifically for the project at hand. Primary data can be collected by one or a combination of four methods-observation, experimentation, sample survey and simulation. The major source of primary data is the sample survey. The survey methods include mails, telephone, personal, drop and collect and panel. (Baker 2003, 152) The primary data for this thesis is gathered by interviews and a company visit.

Secondary data means data which are already constructed by other researchers for other purposes. The process of accessing secondary data is called desk research or secondary research. Secondary data are easily assessable, relatively inexpensive and quickly obtainable. It can help to diagnose the research problem and develop an approach to the problem. The sources of secondary data can be published sources, commercial sources and internal sources. (Kent 2007, 70-71)

Published sources include all the sources which are available in the public domain. The information can be accessed through a website of national government,

government departments, local authorities, associations, newspapers, periodicals. Basically there are three main ways to accessing data from the internet, firstly using the organization's website, the second is using searching engine, and the third way is using a specialist host site that lists catalogues, directories, guides and databases. (Kent 2007, 72)

Commercial sources are usually referring to data that larger market research agencies collect and sell to serve a number of clients. Commercial companies sell data online which includes a wide range of information in organizations, industry sector and countries. (Kent 2007, 74)

Internal data is captured, stored, and analyzed by a company itself. There are three main sources which are operating data and company accounts, previous research and data contained in information systems. Operating data relate to daily activities and transactions such as sales, profits, and costs. Company accounts will supply information on overall performance of an organization such as turnover, costs, revenue, profits, a balance sheet and profit and loss statement. Previous research may have been conducted on company and market to which the product sells. The previous research can help the company know the background of the current situation and guide the on-going research to be undertaken. Previous research can be viewed as a benchmark to study. (Kent 2007, 75-76)

The data used for the thesis are from various sources. Secondary sources were used, such as the policies published in the industrial magazines and the Internet. In the following subchapters, analysis of the data will be presented.

3.1.2 Validity and reliability

Validity is defined as the extent to which measurement represents characteristics that

exist in the phenomenon under investigation. Reliability is the extent to which a measurement reproduces consistent results if the process of measurement were to be repeated. Validity refers to the degree to which a study accurately reflects or assesses the specific concept that the researcher is trying to measure. Reliability is focused on the accuracy of the measuring methods or procedure. (Colorado State University 2010)

The empirical study is completed with a combination of secondary resources and in-depth interviews. The secondary data is authorized by solar energy associations. The related policies are made up by the local government. The respondents have done the research on solar energy for many years and they are specialized in this field. Depth interview is adopted as my research method since it is more direct and effective. Questions were designed before conducting interviews. Questions are mainly open-end questions. The interviews took place in February of 2010 in the office of Nanjing Solar Energy Association. The questions were based on the problems of this thesis. Questions I asked included what are Chinese government's plans in solar energy; what kind of stimulus package is offered by central and local government; what does the value chain structure of PV solar industry constitute in China, especially the downstream value chain; which regions or districts do PV inverter mainly sell in China; what are the sales channel in China for PV inverter; how should PV inverter manufacturer approach to the Chinese market. The answers of these questions are concluded in the empirical study part.

The results are explorative, which means they cannot be generalized but they can be used to understand and evaluate the different possibilities to enter the Chinese PV markets. The generalizability of the results remains to be studied in future research. In order to make the results more reliable many secondary sources were also

checked. So, the results are concluded based on the interviews and secondary sources like industrial reports, magazines and internet. The meanings of results are almost the same as the secondary resources. Therefore, the validity and reliability of the thesis can be guaranteed.

3.2 PV industry outlook

PV industry is becoming more and more popular in China these years. An outlook of PV industry in China as well as the world is revealed based on plans, policies and development of PV industry.

3.2.1 Development of the Chinese PV industry

In the past 15 years, developed countries have developed the global PV industry into an advanced level. Today, Germany, Japan and America take up 70% of the world's PV capacity. China's PV industry started in the 1970's. Seven production lines were imported from the U.S. and Canada in 1983 -1987, which made the annual production of PV cell increase from 200 KW by 1984 to 4.5MW in 1988. Then the PV industry had a stable development during the 1990's. During 30 years the Chinese PV industry has been developing at a very fast pace.

China has huge solar energy reserves (see also Table 2). The daily radiation quantity in most areas of China is more than four kwh per square meters every year. The reserve of solar energy is equal to 1.7 trillion ton of coal. Rich solar energy resources are scattered in Tibet, Northwestern area, Northeastern part of China, Yunnan, Guangdong, Hainan and some other low latitude regions. In 2008, the production of PV components reached 2000MW, ranking No. 1 in the world. However, most of these components are exported to foreign countries, so that only 50MW of these components are used in China domestic market. In 2008, the

revenue of PV industry in China had been over 100 billion yuan. Among the strongest PV companies in the world, half of these companies are in China but the PV power generation only accounts for 1% of the world's market. (Global PV industrial development report, 2009)

Table 2. China's renewable energy development plan (MW) (National renewable energy mid&long-term development plan 2009).

Year	Hydro	Biomass	Wind	Photovoltaic	Solar heat	Percentage on whole energy
2010	190,000	5,500	5,000	300	0.15 billion m^2	10%
2020	300,000	30,000	30,000	1,800	0.3 billion m^2	15%

The table 2 shows that renewable energy will take up 10% of the whole energy. PV energy takes a small part of the renewable energy market. However, it has a great potential. In 2020, the capacity of PV will be six times more than the present one. Renewable energy will account for 15% of the total energy by 2020.

Today, the majority of the Chinese PV industry consists of the upstream industrial value chain which focuses on producing components and solar cells. 95% of the

production is for export, which means that it is easily influenced by the financial situations of foreign market and the reduction of orders can have a great impact on domestic PV industry. Germany has been the biggest buyer. However, from the second half of 2006, Germany has changed from buyer's market into seller's market. With the reduction of 5% of subsidy on renewable energy as well as the restriction on PV products' import, the demand in Germany has reduced which had somewhat negative effect on China's exported market. Therefore, China's present PV industry relies on the fast development of PV cells but the resources (silicon) rely on import and PV system market is waiting to be developed. (Global PV industrial development report, 2009)

From 2009, China began to develop its domestic PV market and change the focus from upstream value chain to downstream value chain since downstream value chain offers the high profits in PV industry. The plan is to build an over 1000MW PV power plant in the area which has rich solar energy. With the decrease of overseas orders and cost reduction as well as the surplus of components production in the PV industry, the Chinese government and leading companies have begun to turn into the domestic markets. (Global PV industrial development report, 2009)

3.2.2 Global PV market

PV market is quite dependent on the political framework of the country. According to the study of European Photovoltaic Industry Association (EPIA), in 2010 the global PV market will grow about 10.7 GW under policy-driven scenario which is based on the assumption support-mechanisms and feed-in tariff in large countries. Under moderate scenario, the global PV market will increase to around 5.1 GW which is based on the assumption of a "business as usual" scenario without any assumption of any laws and support mechanisms. Until 2013, the global PV market

is expected to reach 22GW under policy-driven scenario and 12 GW under moderate scenario (Global market outlook for PV until 2013, 5-6)

The United States is estimated to be the one of the largest PV markets by 2013 because of the extension of the investment Tax Credit, and the continuation of the state-level support programme and the emergence of local support such as feed-in tariff. The performance of the U.S. PV market depends on the possibility to finance the PV projects. (Global market outlook for PV until 2013, 7)

Germany will be the most mature market with the feed-in tariff scheme, good financing opportunities, high potential for future development, good availability of skilled PV companies and good awareness of PV technology. (Global market outlook for PV until 2013, 7)

China has a high potential of renewable, domestic energy challenge and many important companies in the PV sector. These years the government has been initiating a policy to support the PV industry. In a policy-driven scenario China is considered as one of the important markets alongside Europe and the U.S. by 2013. (Global market outlook for PV until 2013, 10)

3.2.3 Feed-in Tariff

In feed-in tariff schemes, a price for each kWh that is produced is fixed. Producers of solar electricity have the right to feed PV electricity into the public grid. The producers will receive a tariff per generated kWh reflecting the benefits of solar electricity compared to electricity generated from conventional power. The PV electricity producer will receive the tariff over a fixed period of time. Feed-in tariff is a temporary method to develop the PV market. The whole project can be paid for about 20 years from the day the system is connected to the grid. When the

investment costs become low, there will be no need to support the system with feed-in tariff. Feed-in tariff needs to adapt to the national conditions. In Germany, the largest global PV market, utilities need to pay a tariff of €0.38/kWh to €0.54/kWh depending on the size and type of system for a newly-installed PV system. This extra cost is passed to consumers through their regular electricity bill. The monthly extra cost per person due to the feed-in tariff for solar energy was only over €0.20 per person in 2006. So, it is not a burden for consumers and every consumer can participate in the national PV. Compared to the old ways that are financed by government budget feed-in tariff can reduce the event of running out of money. (European Photovoltaic Industry Association 2008, 6)

Premium feed-in tariff is similar to the regular feed-in tariff schemes. Premium feed-in tariff is mainly used to support wind electricity installations other than PVs. Investor can also receive a certain price or tariff for each kWh produced. However, premium feed-in tariff has two separate payments. First the produced electricity is sold to the electricity market at regular market prices and the shortfall or difference will be paid to the investor in the form of a premium tariff. The investor can receive a pre-determined fixed rate. (European Photovoltaic Industry Association 2008, 8)

At present, the production of PV industry is growing rapidly and PV technology is also developed but the cost of PV power plant is a barrier for the expansion of PV market in China. The country is badly in need of PV policies to support domestic PV market. One of the most important policies is to promulgate grid-connected pricing law or build the feed-in tariff system. By the end of 2009, there have been many incentive policies and subsidies regarding the PV systems given by Chinese government, which shows a positive attitude of the Chinese government to support PV system construction. But, unfortunately, there is still not a clear policy concern

on-grid price for PV. There are several reasons for this. According to Mr. Zhu Xiaodong (2010) the director of national PV R&D centre, firstly, there is not any exact data on national solar energy resources. Although there are many versions of solar resources used for research purposes, they are different from the real available quantity. Therefore, it is necessary to have a long-term track on the PV industry in order to make the conclusion. The second reason is that present PV projects are at demonstration stage so there is not enough statistics and estimation on operation and management costs.

Based on the experiences from Europe, Japan and the United States, feed-in tariff is the most effective way to encourage the development of PV application. Japan and the U.S set the policies for PV earlier than Germany. Japanese subsidy for PV has been 70% of the whole cost of PV installation. Germany promulgated fee-in tariff in 2004, and the PV market surpassed America and Japan quickly. (China news, 2010)

With the pressure of financial crisis and the cost reduction of polisilicon makes the price law possible to be released in the near future. The present polisilicon price is decreased from $400/Kg to $60/Kg. The price of PV demonstration projects gives some reference for setting the standard of on-grid electricity price in the future. (China news, 2010)

Dinghuan (2010) has given some recommendations on the price setting. It is suggested that 1.3yuan/kwh in Western China where there are rich resources, and 1.5 yuan/kwh on average for the whole country. In the Eastern part of China the cost might be higher. However, with the cost reduction on polysilicon, which takes up 50% of the total cost, it can be estimated that the electricity price will go down with 1yuan/kwh. (China news, 2010)

According to the estimation of national development and reform commission, from 2015 to 2020, the cost of PV power generation can be in balance with the cost of conventional energy due to the capacity increase of PV inverter and cost reduction of silicon chip. (Newenergy, 2010)

Some experts have analyzed that in the process of setting the price there are some rules that should be considered: first, the price should neither be too low nor too high. Too low is bad for the export of PV products while too high a price will cause high subsidy and then make the company lose the driving force for technology update. Second, the price should be differentiated according to the geographical difference and adapted to the technological development level. The third is that domestic PV industry is depending on private enterprises and international capital. Nowadays many state-owned enterprises enter the solar market. If they set a low price for PV industry, this will cause a great loss for private enterprises but there is little loss for state-owned enterprises. In the long run, it will drive private enterprises out of the market, which is harmful for PV industry. (Newenergy, 2010)

3.3 Location specification for solar energy

In China, in more than 2/3 land area, the annual radiation quantity is more than $5.02*10^8 kJ/m^2$ and sunshine time is more than 2000 hours, especially in west part of China where the sunshine time is more than 3000 hours. China can be divided into 4 districts according to radiation quantity. District I is the richest area of solar energy which includes most part of Tibet, Southern part of Xinjiang, Qinghai, Gansu and Western part of Inner Mongolia. It accounts for 17.4% of the national area with annual radiation of over 1750 KWH/m^2. District II includes North of Xinjiang, Northeastern area, East part of Inner Mongolia, north of Jiangsu, which takes up 42.7% of land area. The annual radiation quantity is between 1400 and 1750

KWH/m^2. District III has less radiation quantity than district I and II. The annual radiation quantity in this district is between1050-1400 KWH/m^2. It accounts for 36.3% of national land area. District IV has the least radiation quantity which takes up 3.6% of land area. This district contains Sichuan and Guizhou provinces. The location advantage and rich resources are best for developing solar energy. (China Solar PV Report 2007, 24-25)

Generally speaking, the Chinese PV industry base is located in Bohai district, Yangtze River delta district and middle and south of China which consists of seven provinces: Jiangsu, Hebei, Shandong, Guangdong, Hubei, Sichuan and Hunan. (Shanghai Information Service Platform, 2009)

Jiangsu province has taken a lead in the Chinese PV industry because they have a well-developed industry base. The representative enterprises are Suntech in Wuxi and China Sunergy in Nanjing. Followed by Suntech and China Sunergy there are many companies of PV industry in the nearby cities. There are several advantages for Jiangsu Province to develop solar energy. Firstly, the production capacity is one of the largest in China. Secondly, they have the technology and ability to research and develop. Thirdly, they have rich experience in production of PV products. From governmental point of view, it is suggested that Nanjing and Wuxi will become the PV industry base. In March 2006, 25 PV enterprises formed an alliance with the aim to develop the technology and expand the market. (Shanghai information platform, 2006)

The representative city in **Hebei province** is Baoding. Baoding technology development zone is positioned as new energy and energy equipment manufacturing base. By the end of 2003, there were 50 companies related to energy within the economic development zone. (Shanghai information platform, 2006)

In **Shangdong province**, Dezhou has been a relatively mature solar energy base. Solar energy heater production in Dezhou account for 70% of Shandong province. Until the beginning of 2005, there were approximately 100 companies doing business in solar energy. (Shanghai information platform, 2006)

The representative city of **Guangdong province** is Shenzhen, where the PV industrial base started at the end of 2005. Shenzhen Photovoltaic energy Ltd cooperates with Hefei industry University. Shenzhen is good at producing solar lightening products. According to the market share of 2006, 72% of the world's solar energy lightening products were made in Shenzhen and nearby areas and most of them were exported. (Shanghai information platform, 2006)

Hubei province PV industry developed later than the mentioned provinces. Guanggu Wuhan is the research and development centre for the downstream sector of the industrial value chain. Cities such as Yichang and Jingmen are focused on the upstream value chain of PV. (Shanghai information platform, 2006)

The representative cities of **Sichuan province** are Leshan and Chongqing. They have abundant resources for producing PV components. **Hunan province** is the same as Sichuan province, their advantage is rich in resources, and the representative city is Yiyang. (Shanghai information platform, 2006)

3.4 Industrial policies and subsidy

China has made considerable progress in solar PV generation technology but compared with other kind of renewable energy grid-connected PV technology, is at an early stage. Therefore policy incentives will play an important role to attract more investment.

At present Chinese PV incentive policies are drawn up by central government and local government respectively which gives stimulation for the domestic PV market. Considering the local policies, Jiangsu and Jiangxi and Shanghai have already enacted related incentive policies. The incentives focus mostly on the east part of China, which is ready for developed PV markets and provinces with solar advantages. In 2009, central government implemented positive financial policies in order to promote technology innovation, energy-saving, emission-reduction. From 2009 to 2011, central finance is focusing on financial subsidy and electricity price favorable for PV system construction in the domestic market. (PV industry research report 2008)

With the increase of conventional energy price and awareness of environmental protection, the renewable energy law was ratified on January in 2006. The law clearly defined the responsibility and obligation of the government in developing renewable energy. It established a series of regulations and measures and it includes the long-term target and development plan. The law encourages the development of renewable energy technology and promotes renewable energy to connect to grid. It indicates the preferential price for grid-connected power generation and set up special fund for renewable energy. (PV industry research report 2008)

With the 11^{th} five-year national economy plan implementing in China, the renewable energy consumption will take up 10% of the total energy consumption quantity in 2010 and reach 15% in 2020. By 2010 the application of solar energy will be 300MW, which includes grid-connected PV system (100,000kw), stand-alone power generation in remote areas (150,000kw), and solar heat (50,000kw). Grid-connected PV system is divided into two parts which are BIPV (50,000kw) and PV power plant (50,000kw). The focus regions of grid-connected PV systems are western areas such

as Tibet, Gansu, Inner Mongolia, Ningxia and Xinjiang. BIPV will be developed in Beijing, Shanghai, Guangdong, Jiangsu and Shandong. PV power plant will be built in Lasa, Dunhuang and Erdos. Regarding to stand-alone power generation projects, the focus areas are Tibet, Qinghai, Gansu, Xinjiang, Yunnan and Sichuan. The Inner Mongolia will develop solar heat. All the demonstration projects are subsidized by central government and the part over the benchmark price of coal-fired power generation will be calculated in accordance with renewable energy cost-sharing mechanisms. (Kuang 2009, 64-65)

From 2009, China began to develop its domestic PV market. There are seven policies regarding photovoltaic industry: five out of these seven policies are ratified by the central government. After the breakout of financial crisis, every country is rethinking the economic development modules. Under pressure of the energy saving and carbon emission reduction, Chinese PV industry has developed quickly in these years. China is making great effort to subsidize the application market of PV, and at the same time China is also cautious about the over-development of PV industry.

3.4.1 Policy on building integrated photovoltaic (BIPV)

The Ministry of Finance enacted “implementation suggestions on speeding up the application of BIPV” (no.128 document) and “temporary methods on management financial subsidy of BIPV” (no. 129 document) in order to improve BIPV applied in buildings of cities and countries. The standard of subsidy was also settled. Firstly, the installed capacity of one project should not be less than 50kWp; secondly, the generation efficiency of applied PV products must reach advanced level, of which single crystal silicon efficiency should be more than 16% and polycrystalline silicon’s efficiency should be over 14%. Products made out of amorphous silicon should make the efficiency more than 6%. PV components and buildings integration

projects are to be developed and schools, hospitals, government and some other public buildings are to be supported in priority. The subsidy standard of 2009 is 20 yuan/Wp, the concrete standard will be settled according to the integration degree with buildings and the technology of PV product. The future annual subsidy standard will be adjusted according to the industry development situation. (Solar Energy 2009, 35)

3.4.2 Jiangsu province's promotion advice

The land resource in Jiangsu province is not as large as in other provinces so there is a high potential to develop BIPV. The yearly radiation time is between 1400 and 3000 hours. In the north part and coastline area of Jiangsu province there are certain areas which cannot grow vegetables and trees. These areas can be used to develop PV systems. At present the number of undergoing PV power plant is 12 and the capacity is 2.856 MW. There are also five demonstration power plants with a total capacity of 4 MW. Jiangsu province developed PV system quite early and there are some enterprises that are doing well in solar energy business such as Suntech, Trina, and Jiangsu New energy. These companies have participated in many PV system construction projects. (Solar Energy2009, 35)

Still, at present there are some problems in the development process. The cost for cells, system integration, and installation techniques is high so as a result it is expensive to generate power. It is calculated that the cost for on-grid power generation will be 2.15 yuan/kwh which restricts PV markets and promotion. The energy structure for Jiangsu province is mainly constituted with coal. There is a lack of activity in developing large PV power plant in some areas. There is some technological difficulties in building a PV power plant and connecting it to the grid. In addition, there is not a clear regulation on grid-connected electricity price of PV.

After the document NO.128 and document NO.129, development and reform commission of Jiangsu province published the promotion advice on PV power generation on 19 June, 2009. This policy sets a new target that the installation capacity of grid-connected PV power generation will reach 400MW in three years. The target grid-connected electricity price is 1 yuan/k Wh including tax. In 2011, the production of cell and other PV components will reach 10000MW and the output will be 350 billion yuan. The policy indicates that “roof grid-connected power generation project”, “building integrated photovoltaic grid-connected power generation projects”, and “grid-connected power generation project” are the focus for Jiangsu PV industry, and three kinds of projects will reach 260MW, 10MW and 130MW respectively. Jiangsu will build the fund for PV power generation, and the main use of this fund is to subsidize the electricity price, which is the price difference between coal power generation and PV power generation. The local government will support key enterprises in PV industry and improve the standard. Jiangsu, as the strongest province in PV industry, is not only satisfied with the production, but based on this policy, Jiangsu is intended to upgrade the strategy from production to application. The aim is to make the whole PV industry develop by building power plants, so as to improve PV industry in terms of production, technology standard, and terminal market. This policy is meaningful for the sustainable development of Jiangsu PV industry.

In order to achieve the target of 1 yuan/kwh (incl.tax), the costs must be cut and competitive advantage must be improved. The target electricity price for 2009 to 2011 is presented in the Table 3.

Table 3. Target electricity price for 2009 to 2011 (yuan) (Jiangsu PV promotion Advice 2009).

Year	Ground	Roof	BIPV
2009	2.15	3.7	4.3
2010	1.7	3	3.5
2011	1.4	2.4	2.9

Jiangsu province plans to foster a series of PV companies with competitive advantages. By 2011, the capacity of cells and modules will be 10000MW and the production of PV industry will be 350 billion yuan.

3.4.3 "Golden Sun" demonstration projects

On 16 July 2009, Ministry of Finance, Ministry of Science and Technology and Bureau of Energy published the notice of "Golden Sun" demonstration projects, and worked out the temporary method on managing the subsidy from "Golden Sun" demonstration projects. China decided to take comprehensive actions through financial subsidy, technology support and market-drive to speed up the PV power generation development. It is also stated that China supports PV power generation demonstration projects which are not less than 500MW within 2 to 3 years. The notice definitely indicates that the focus is supporting user grid-connected power generation, stand-alone PV power generation and large grid-connected PV power generation and some other demonstration projects. In addition, Chinese government

will support the technology of extract silicon and core technology of grid-connected PV power generation as well as infrastructure construction. Based on the technology and market development situation, government will set up the maximum of subsidy for companies which invest in projects. (Solar Energy 2009, 35)

Regarding grid-connected PV power generation projects, government will subsidize 50% of the whole investment including the power generation system and complemented electricity transfer projects. In remote areas, the subsidy will account for 70% of the stand-alone PV power generation system. The grid-connected power generated by the users is used for themselves, the rest power generated by large PV power plant are purchased at the electricity price of coal power. The size of demonstration projects should not be more than 20MW for each province. (Solar Energy 2009, 35)

The main subsidy areas of “Golden Sun” demonstration project cover user on-grid PV power generation projects, PV power generation in remote areas and large grid-connected PV generation projects. This policy and supportive policy on BIPV supplement each other and cover the main downstream application areas of PV industry. (Solar Energy 2009, 35)

There are 294 demonstration projects. The total installation capacity is 642MW and annual power generation is about 1billion kWh. The amount of industrial and commercial on-grid power generation projects are 232, the installation capacity is 290MW. The number of stand-alone power generation in remote areas is 27, and the installation capacity is 46MW, which can satisfy daily usage of 0.3 million families. The amount of large grid-connected PV power generation is 35. The installation capacity is 306MW and the power generated will connect to the grid. The investment is about 20 billion yuan and will be finished in two to three years. (Solar

Energy 2009, 35)

3.4.4 PV industry plan of Huhhot

In order to implement new energy strategy, Huhhot, the capital city of Inner Mongolia, published Hurhot PV industry development planning compendium and some other regulations. Inner Mongolia has the advantage of rich resources and industrial infrastructure. The planning time is from 2010 to 2020. The strategy is divided into two phases. For the first five years, the focus in on upstream value chain, meanwhile, developing downstream value chain. The total installation capacity will be 500MW. The last five years is to achieve large scale application of grid-connected power system. At the same time, preferential policies are offered in terms of administrative service, land, tax and administrative institution fee. (Solar Energy 2009, 36)

3.4.5 Policy on importing polysilicon

In September 2009, Development and Reform Commission, and Ministry of Finance together made some changes of the “content of encouraging imported technology and products”. Terms of “wind power technology of more than 2MW" and “encouraging importing polysilicon” were deleted from the content. It means the Chinese government doesn’t encourage importing polysilicon. In the first half of 2009, there were 50 companies in 20 provinces which were building and expanding polysilicon product line. The total production is 170,000 ton and the total investment is 100 billion yuan. The production is more than twice the demand of the world. In addition, the production of cell and cell components has already been surplus. There is no necessity to import more silicon. It is better to focus more on research and development. These changes of content reflect that government is worried about the

surplus of production. The repeated construction and production are barriers for PV industry. (Solar Energy 2009, 36)

3.5 PV demonstration projects in 2009

In 2009, with the technology development, accumulation of funds, pressure of energy saving and emission reduction as well as support of policies, Chinese PV demonstration projects spring up like mushrooms.

On 6 December 2008, the largest PV demonstration project of China-Shilin large on-grid PV power station began construction in Shilin, Yunnan province. The total installation capacity of this power station is 166 MW and the investment is 9.1billion yuan. It is divided into an experience demonstration area and science popularization area with installation capacity of 100MW and 66MW each. The 66MW's project is cooperated by Suntech and Yunnan provincial power investment Ltd. As the contractor of science popularization area, Suntech invested 3.58 billion yuan with an annual power generation of 77,038,900 kWh. The duration of the project is 18 months. After finishing of the project, there will be a scientific demonstrate center with the land area of 1862 square metres. This project will provide a scientific research platform for PV appliance industry and PV research institutes. (Solar Energy 2009, 37)

In Dunhuang, a 10MW grid-connected PV power plant is under construction and it takes space of 1 million square meters in the area. The annual electricity generation is 16,37 million kWh and the target is 100MW. The total investment is 0.5 billion yuan. It will be the largest PV power plant in a desert. (Solar Energy 2009, 37)

This project is developed by Jiangsu Baishide solar technology company and Zhongguang nuclear development Ltd as well as Enfinity of Belgium. The whole

project was prepared for 4 years and 9 months. Since it is national PV power plant demonstration project, the invitation of bidder is organized by development and reform commission with the help of local government. There were 50 companies participating in the bidding including foreign and national PV enterprises as well as the Chinese 5 power groups. Some company even offered 0.69 yuan/kWh, but finally the price of 1.09yuan/kW was successful by the contractors. The electricity price of PV demonstration projects will be the referenced standard for setting the on-grid electricity price. (Solar Energy 2009, 37)

3.5.1 Large-scale PV power plant projects

On 19 May 2009, the first MW-level PV project was permitted by development and reform commission. The capacity is 1.5MW which is installed by Suntech. They will lay the PV module on the roof of Jiangsu guoan biomass power generation Ltd. The used area reaches 19,000 square meters. (Solar Energy 2009, 37) This project plays a leading role in making Jiangsu province from PV manufacturing province to PV application province.

On 24 June of 2009, another PV project was started by State Development and Investment Corporation (SDIC) in Dunhuang, Gansu province. The on-grid electricity price is set as 1.09yuan/Kwh. The investment is 0.167 billion yuan, which is one of the biggest PV power projects. The installation capacity is 15.3697 million kWh. (Solar Energy 2009, 37)

At the end of September 2009, there were two large PV power plants formally having the celebration for connecting to the grid and these two projects are separately located in Zhejiang province and Ningxia province. On 28 September 2009, the first PV roof power plant formally connected to the grid. This project is

developed by two local companies in Zhejiang with the total investment of 64million yuan. The capacity is 2MW. It is a combination of new energy and building and the annual production of power will be more than 2million kWh. On 30 September 2009, China first 10MW PV projects connected to the grid in Ningxia province. The project is cooperated by China Energy Conservation Investment Corperation and Suntech as well as the support from central and local government. The whole project will be finished by 2011. (Solar Energy 2009, 38)

These two projects are meaningful especially the second one, because it is installed in desert area, which indicates that China has reached in the stage of implementation of PV power generation.

3.5.2 China-US PV power plant in Inner Mongolia

First Solar, the biggest thin-film solar cell producer in the world, signed an agreement with Chinese government on 8th September 2009. The plan is to build a PV power plant in Inner Mongolia in the future 10 years with an investment of 5-6billion US dollars. The capacity of the project is 2000MW. The project takes up 65 square kilometers in area. At the same time, there will be a factory to provide the solar energy modules and solar cells. The whole project is estimated to be finished by the end of 2019. It is the first time that US solar cell producer enter China PV field. (Solar Energy 2009, 38)

Still, there are worries about this project. Firstly, China has not published the standard price for grid-connected PV electricity, which has great impact on the future cost of power generation. Secondly, the electricity transfer problem will be another barrier as for instance, there is not enough transferring circuit. Thirdly, pollution is a big problem. First Solar is famous for producing CdTe thin-film solar

cell which is poisonous and result in deciding how to deal with CdTe is a question. (Solar Energy 2009, 38)

At the end of 2009, China Energy Conservation Corporation signed a cooperation intention with Inner Mongolia demonstration area for 100MW PV power plant project with a total investment of 2.2billion yuan. The construction period will be 6 months and the construction content includes PV power generation system, grid-connected inverter, step-up system, information control system as well as relevant infrastructure construction such as roads, buildings and so on. In the capital city - Baotou of Inner Monglia, it is planned to build three PV power plants and the total capacity is 600,000 kW. Zhongguang Nuclear and Suntech plan to install 200,000 kW respectively, China Huadian and Huaneng are responsible for 100,000 kW respectively. These two projects means that the PV power generation is under development in the North of China. (Solar Energy 2009, 38)

According to these on-going projects, we can find the trend that there will be more and larger-scale PV projects planned by central and local government in the near future. From these PV projects, we can see that most of these projects are developed through the cooperation with leading enterprises in PV industry (e.g. Suntech) and large state-owned enterprises or these enterprises united with local government. As the other energy industry it is also monopolistic to some extent. Therefore, it is difficult for small-medium sized companies to participate in the projects.

3.6 Preferential policy of local government

As to foreign invested manufacturing companies, the corporate income tax rate is 15%. Companies which have operated more than ten years, the first and second year of profit earning, is free from corporate income tax and from the third to the fifth

year the corporate income tax is levied on the basis of half of the corporate income tax. Export-oriented companies which are invested by foreign companies have a preferential tax rate of 10% after the tax-fee and tax-reduction period as mentioned above and they must export 70% of turnover. If a foreign-invested company is advanced or high technological and after the tax-free and tax-reduction period, it is still advanced and high technological it can enjoy a 10% tax rate for three years.

Corporate income tax rate for high-technology companies located in the economic development zone is 15%. For the new established high tech companies the income tax is free for the first two years of operations. For export processing companies it is free to charge value-added tax and consumption tax. Raw material, components, modules they are imposed with a protective tariff.

There is an exemption for administrative sector fee from Nanjing municipal government and economical development zones in Nanjing as they do not charge any fee for foreign companies. There are fourteen kinds of service fee by administrative organization and the fee is charged on 2/3 of the charge standard that government has set. For foreign-invested companies the water and electricity capacity fee is free. For any company with registered assets of more than 10 million dollars, there is a refund of income tax and value added tax and a large preferential policy. If the company invests a project registered capital over 10 million U.S. dollars, the company will be granted a big refund in terms of income tax and value-added tax. (Nanjing government, 2009)

3.7 Case company studies

Three companies which have different kinds of businesses in the solar energy value chain will be introduced. These companies are all located in China in Jiangsu

province. The operations, networks and sales channels of these companies will be presented.

3.7.1 ET Solar Group

ET Solar group is a vertically integrated solar energy equipment manufacturer and turnkey solutions provider. The focus areas for ET Solar group are ingot, wafer, module and system which cover almost the whole value chain. Their local sales and marketing subsidiaries and offices are located in Asia, Europe, and North America. The manufacturing base is built in Taizhou, north part of Jiangsu province. The marketing subsidiary is in Nanjing, the capital city of Jiangsu province. The other subsidiaries are located in Munich, California, Rome, Soul and Hongkong China. Their marketing network has already covered the main PV markets in the world. They provide PV modules, solar tracking system, and turnkey solutions in more than 50 countries and areas. (Etsolar 2010)

ET solutions provide turnkey projects for large scale power plants with a whole procedure of access, engineering, sourcing, financing, installation and maintenance. In Taizhou, China, there are two manufacturing factories of ET Solar. They have an integrated value chain including ingot and wafer, solar module and tracking system design and producing with a high quality according to global standard. (Etsolar 2010)

ET has built a global network with offices in Europe, the United States and Asia which can ensure marketing and customer services. They have created partnerships with distributors in more than 20 countries, local sales, and marketing offices and subsidiaries. Regarding the logistics, there is 48 hour-response with a local technical and logistics team. (Etsolar 2010)

In terms of project planning, ET analyzes weather, terrain and layout conditions, does on-site inspection; investigates legal issues, investment return and risks. They provide services regarding to engineering, procurement and construction. Engineering and project design is conducted by engineers. Material procurement is conducted by the subsidiaries or partners. Construction is done with the local partners and installation companies. The system is customized for the customers and the quality of the system is in compliance with the industry standard. The chosen partners have to have experiences within the industry. (Etsolar 2010)

Before conducting a project, ET makes a financial assessment for this project. They recommend the configuration and layout of the PV module transformers, invertors and other components of the system which will be applied in the system. At the next stage, ET will procure equipment which includes modules, invertors, transformers etc. ET has knowledge about incentives for PV investment globally and they can offer financing instruments to the customers, for instance, ET can provide short-term financing for equipment procurement. The installation work is conducted with local partners. They also provide system maintenance services to the customers. ET's supply chain provides access to mono and poly-crystalline and they claim to guarantee an in-time delivery. They aim to build a partnership with inverter manufacturers. (Etsolar 2010)

3.7.2 China Sunergy

China Sunergy is a specialized manufacturer of solar cell product founded in 2004 in China. They sell solar cell products to Chinese and overseas module manufactures and system integrators. Their manufacturing capacity is 160 MW in 2006 and reaches 320 MW in the third quarter of 2008. (ChinaSunergy, 2010)

China Sunergy takes direct sale as the measure to sell their product. Their marketing programmes include industrial conference, trade fairs, sales training, and advertising and public relation events. Their sales and marketing group works closely with the R&D group in order to coordinate with the R&D activities, product launches and ongoing demand and supply planning. They plan to expand the sales and marketing networks in China, Japan, and Germany in the short-term. For the long-term, they want to develop and keep a good relationship with the key customers who are the niche players or market leaders. Their customers are module producers. Their target is to obtain a large amount of revenue through the strategic customers. Since China Sunergy is only a producer of cells, it can avoid the conflict with modules producer and it is easier for them to build a long-term partnership with their customers. There are more and more module manufactures in China. The China Sunergy has a competitive advantage of proximity to these module manufactures, which means that they can provide an in-time delivery and good post-sale service. At this moment, their main customers are module manufactures and they also want to expand the market to applications such as traffic lights and solar power street lights. (ChinaSunergy, 2010)

The competition is fierce in solar cell market since there are more and more market players participating. The main competitive factors are composed of manufacturing efficiency, conversion efficiency, price, strength of supplier relationship, and reputation. Their competitors include large conglomerates like Sanyo and Sharp and specialized manufactures of solar cells such as Q-cells AG, Suntech and Solar fun and some other vertical integrated companies. In addition, the whole PV industry has to compete with conventional energy. (China Sunergy Prospectus 2007)

Most of their competitors are developing the low-cost thin-film technology in order

to cut the producing cost. The existing and potential competitors also have great financial, technical, manufacturing and other resources which can reduce the manufacturing cost. Many competitors have established more distributional networks and large customer base. (China Sunergy Prospectus 2007)

With the existing competitive advantage and competitor analysis, China Sunergy's strategy is to focus on solar cell manufacturing, achieve technological updates, expand the production capacity, further optimize raw material supply source, achieve a diversified customer base and to establish a global sale networks. (China Sunergy Prospectus 2007)

3.7.3 Nanjing Fist Second Power Equipment

Nanjing First Second Power Equipment was founded in Nanjing, China. They are specialized in developing solar/wind power on-grid and off-grid inverter, controller, and wind generators. The company has established a wide technical cooperative partnership with specialists and professors with institutions and universities which help them update the technology. Their main market is domestic but in the future they will expand to foreign countries. The company uses not less than 5% of the sales as research and development fund. (Nanjing First and Second, 2010)

The inverter manufacturer in China has different kinds of sales channels. Basically, there are three types of sales channel strategies which are agent strategy, sales localization and brand united strategy. According to the company statement, in China most of solar inverter manufacturers take localization strategy as sales channel. First and Second Power Equipment company has already established partnership with Nanjing University of Aeronautic and Astronautics, Nanjing University of Technology, Shenyang University of Technology, Hefei University of

Technology and Anhui University of Technology and Science. The company has offices in Beijing, Shenzhen, Lasa, Urumqi, Hefei and Jinan. With the close partnership with local institutes their products are applied in renewable energy field and they have a high market share in China. (Nanjing First and Second, 2010)

3.7.4 Comparison of the case companies

Policies and projects developed in China indicate that the Chinese government and companies are quite positive in developing the Chinese PV market. There are also foreign companies participating in the projects. It shows that the PV market is also open to foreign companies. The Chinese government also offers various favorable policies as instruments to attract foreign PV companies because PV is clean and environmental-friendly and foreign multinational companies usually have the core and advanced PV energy technology. The electricity price for the demonstration projects can have a deep influence on the future of real PV electricity price and can promote feed-in tariff system in China. In the future more and more PV power plants will be built and the trend of PV installation will keep on growing. Due to the positive policies and a positive investment environment in China, there are a number of opportunities for cooperation or investment for companies in the PV field. The three case companies are representatives of solar cell and module manufacturer, inverter manufacture, and a system integrator. Since China began to develop domestic solar market, more and more companies expand businesses to downstream value chain like system installation in order to achieve much more profit.

ET Solar group is focused on the system construction. Forming an alliance or building a partnership with the local market players makes it quite important when entering the market, for example, for creating a good relationship with suppliers or customers. For an inverter manufacturer the customers can be a system integrator,

turnkey projects or the government. System integrator is responsible for the system installation and can decide which inverter could be purchased and used in the system. In order to approach the customer it is necessary to establish an office in the area. ET Solar Group has a marketing office in Nanjing - the capital city of Jiangsu provice, so it is easier for the Finnish case company to get contact with them and establish partnership because they also have manufacturing base in Jiangsu province.

Compared to ET Solar Group, China Sunergy and Nanjing First and Second Power Equipment Company are more specific in component producing. China Sunergy is focused on upstream and middle value chain but in the future they want to expand business to the downstream value chain. Nanjing First and Second Power Equipment Company are focused on the downstream value chain and their products have a price advantage and they own experience in Chinese market. So it is also good to build a partnership with these two companies and make some collaboration in the future, which is helpful to explore the Chinese markets.

4 CONCLUSIONS

Through previous research, a conclusive statement will be presented. The conclusions are made based on the policy, demonstration projects, location specification and PV value chain in China. A recommendation for entering the PV market is presented from the viewpoint of the marketing and relationship strategy.

4.1 Summary

China is a large country for manufacturing PV products. China's PV industry has relied on the foreign market a lot, which is not good for long-term development. At present the foreign market shrinks, so developing domestic market could prevent the bankruptcy of many domestic companies. Solar energy costs more than other forms of energy. It is difficult to sustainable develop without governmental support. Policy and technological updates play an important role in long-term development. Large PV systems should be built in order to accelerate the development of the whole industry. The fundamental instrument for developing the PV market is national policy. The renewable energy law ratified by the government has a great effect on promoting the development of PV industry. The BIPV support policy offers a subsidy of 20 yuan/watt. The "Golden Sun" policy subsidizes grid-connected projects with 50% and stand-alone projects with 70%. By 2020, the target of installation of a PV system will be 20,000,000kw. Local governments' supportive policies are also very important in stimulating PV development. Jiangsu, Zhejiang and Jiangxi provinces are trying to develop PV industry as the key industry and they are drawing up preferential policies on PV industry. Companies in these regions are trying to form a cluster of PV industry, which can make them more competitive.

Subsidy and demonstration projects are effective methods for the PV system development but they are not enough because they do not have long-term effects. Following the success experienced in Germany, a feed-in tariff mechanism is the best for long-term development of PV industry. The whole society can share the price pressure generated by PV.

PV development should be adapted to the local conditions. The east part of China is suitable for developing building integrated projects while the west part and the north part of China are large and they have the conditions for developing large grid-connected PV power plants.

Companies in upstream value chain and downstream value chain should make efforts to research and develop the products forward and not only be satisfied with the present market share. Instead, they should focus on improving the efficiency and reducing the cost. International cooperation is necessary for PV application. PV industry in China focuses a lot on solar cell manufacturing and there is not enough attention paid on the system, so it is important for PV companies to cooperate with power supply or electricity supply companies.

4.2 Recommendations

In order to enter the Chinese PV market, an inverter manufacture should learn about the local policies and main projects. A governmental network could help a company to reach potential customers and projects. Jiangsu province has offered a series of policies on developing PV installation. There are also many PV companies doing business in PV installation. Therefore, Jiangsu province is the best one for foreign country to enter the Chinese market.

Next step is to search for projects. It is better to investigate the present projects and make contacts with the PV companies to seek the collaboration opportunity. In addition, establishing partnerships with institutes, universities, suppliers and customers are also key tools in getting involved in the Chinese market. Since most of the projects are controlled by the government, it is important to make contacts with central or local government. In order to make contacts with Chinese government foreign companies can ask a middleman to express the intention of entering Chinese market to the government. The middle man can be an agent or someone who is familiar with Chinese government. Normally, Chinese government welcomes the foreign companies to enter the Chinese market. The company can visit and meet the related governmental members to have a further and detailed conversation. Government has much information so they can provide some related projects and companies which are doing business in PV industry. Government can also help to contact these companies. It is good to visit these companies in order to search the possibilities to cooperate or build partnership. The second way is to consult the solar institutes and universities by email or phone call to look for the collaborative possibilities.

Since there are more and more inverter manufactures in Chinese market, the company entering the markets should take advantages of technology and service quality to compete with other inverter manufactures instead of competing on price. The technology of inverter should meet with international and Chinese national standards. Beside, the technology should be at advanced level over the world. The type of inverter should also meet the needs of projects. As for the service quality, the company must have an outstanding service quality from selling to installation, and to after sale. The most important factors are the safety, reliability and sustainability of the inverter.

Marketing strategies can also be used to improve the reputation of the company, for instance, by advertising and participating in industrial fairs. The sales strategy product in China can be based on an agent and direct sales. No matter what kind of sales methods are to be taken, keeping a good business-to-business relationship and business-to-government relationship is very important. Cooperating with the local companies can help to form an industry alliance or a cluster, which certainly helps to develop long-term operations in China. In order to enter into the cluster that companies already formed there, the company can contact with these companies directly and find the cooperation opportunities.

Another way is to apply for the membership of solar association. Jiangsu PV Industry Association as an example states that their main services are to provide suggestions to government on plan of PV industry, participate in standard setting, organize industrial fairs in order to promote the market exploration, and organize member companies to participate in different PV projects. Jiangsu PV Industry Association is an industry cluster in Jiangsu province and it helps company reduce risk and expand the markets. The company with registered capital over 500,000 yuan can register in this association and pay an annual fee about 2000-5000 yuan. Then company can get a lot of information on PV projects in China. (Jiangsu PV Industry Association 2010)

To summarize, network is quite important in Chinese business-to-business marketing. A large network can help the company find more opportunities and expand business.

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