SAVONIA

VALITSE KOHDE. - VALITSE KOHDE.
VALITSE KOHDE.

Status and Trends Of New Power Generation Technology

Author/s: Jianguo Zhou

SAVONIAUNIVERSITY OF APPLIED SCIENCES

THESIS
Abstract

Field of Study Technology			
Degree Programme Degree Programme in Industrial Management			
Author(s) Zhou Jianguo			
Title of Thesis The Status and Trends Of New Power Generation technology			
Date	28.04.2016	Pages/Appendices	23
Supervisor(s) Principal Lecturer Harri Heikura and Jarmo Pyysalo			
Client Organisation Savonia University of Applied Science			

Abstract

Science and technology development cannot leave energy, and our life is also inseparable from energy. Oil and coal in all energy is 80%. However, oil and coal are non-renewable. If precious energies would disappear, what should we do? Oil and coal combustion and release of energy we need, and it also releases harmful gases which lead to damage of our home planet. These problems forces us to develop clean and renewable new energy.

This report discusses mainly three new sources: solar energy, wind energy, geothermal Energy, and how they generate power. New energy co-generation system is also included.

The market of solar energy, wind energy and geothermal energy were analysed to know that New energy power generation technology has many disadvantages. We should have lots of Knowledge to solve these problems to use new energy efficienies. More and more countries start to invest and develop new energy technologies, because new energy is clean and renewable.

New energy will replace traditional energy in the future.

Keywords
Solar energy, wind energy, geothermal energy

CONTENTS

1 INTRODUCTION 4
1.1 Target of Thesis 4
2 NEW ENERGY TECHNOLOGY 6
2.1 Wind Power Generation Technology 6
2.1.1 Generation System and the Principle of Wind Power 7
2.1.2 How Does Wind Turbine Work 7
2.1.3 Wind Power System 8
2.1.4 Status and Development Trends of Wind Power 8
2.1.5 Major Market of Wind Power Shifts to Asia 9
2.1.6 Wind Power Will Continue Developing in The Future 9
2.2 Solar Power Generation Technology 10
2.2.1 Principle of Solar Power 10
2.2.2 Status and Development Trends of Solar Power 11
2.3 Geothermal Power Generation System 12
2.3.1 Principles of Geothermal Power 13
2.3.2 Status 14
2.3.3 Development and Utilization of Geothermal energy 16
3 NEW ENERGY CO-GENERATION SYSTEM 16
4 MARKET ANALYSIS OF PLANTS 17
4.1 Locations of plants 17
4.2 SWOT 18
5 RESULT OF THIS THESIS 21
6 CONCLUSION 21
REFERENCE 22

1 INTRODUCTION

Today's world, energy is an important material that affects human existence and development. Before the 18th century, human was limited to use directly of wind, water, animal, wood and other natural energy sources, especially wood. In 18th century, steam engine was invented, and it accelerated steps of industrial revolution. In 19th century, it was first time that energy conversion appeared in human history. In 1860, coal was accounted for 24% of world primary energy consumption. In 1920, coal percentages were rose to 62%. Since then, the world had entered the "Coal Age." In 1870s, electricity replaced steam engine, so electrical industry was developing rapidly, and the proportion of coal gradually declined in the world' energy consumption structure. In 1965, oil replaced coal for the first time and occupied the first place of energy. The world had entered the "oil era." In 1979, the proportion of international energy consumption structure was 54% oil and 18% natural gas. So oil replaced coal to finish second times conversion of energy. Therefore, oil is main energy source in the world today, and it has been facing depletion crisis. (New energy technology,06,12,2015)

Human needs more electricity and oil, but oil and electricity are in short supply, so new energy technology is required to research and develop. Currently some new energy can be used to generate electricity, and they are nuclear energy, geothermal energy, tidal energy, wind, biomass energy and so on. This thesis focuses on new energy generation technology and development in the future.

1.1 Target of Thesis

Traditional energy is coal, oil and gas. According to the current mining technology, human detected reserves of coal, oil and gas in 2015, and people predicted that coal can be used 113 years, oil can be used 53 years and gas can be used 55 years. If these traditional energies converted to standard coal (standard coal 7000kcal/kg) energy reserves, we just have 1.2 trillion ton of standard coal (standard coal: 7000kcal/kg).

Fossil energy discharges pollutants in the process of production and consumption.
In China, fog and haze are very serious. Coal plays a very important role for PM2.5 changed. In 2012, coal had a largest percentage of affecting the concentration of PM2.5, and the percentage is 56%. From1886 to 2012, global temperature had increased by 0.85 degrees after human started using much fossil energy. (Global proven coal resaves, 29,10,2015)

New energy is renewable energy and nuclear energy and so on. Compared with traditional energy sources, new energy sources generally have less pollution and large reserves. It is significant role for new energy to solve serious environmental pollution problems and resources (especially fossil energy) depletion issues in the world.

This article mainly discusses the status and trends of 3 types of new energy power generation technology. Fossil energy produces a lot of pollution, and it will be exhausted in the future. Humans expect that new energy can replace fossil energy and reduce pollution in the future. A lot of countries encourage companies to develop new energy power by capital and beneficial policy.

2 NEW ENERGY TECHNOLOGY

New energy technology is the backbone of high technology, including nuclear technology, solar technology, MHD power generation technology, geothermal energy technology and marine energy technology. Nuclear technology and solar technology are very essential branch in new energy technologies. Through the development and utilization of nuclear energy and solar energy, oil and coal dominated energy computation could be replaced by the newly eco-friendly energy source.

New energy generation technologies consist of solar power, hydropower, wind power, nuclear power generation, waste incineration power generation and geothermal power generation etc. The following chapters will discuss wind power, solar power and geothermal power generation.

2.1 Wind Power Generation Technology

Wind energy is an environmentally friendly and renewable energy source. With the continuous development of wind power technology, people pay more and more attention to research and development of wind energy. Wind energy will play an important role in the new energy power generation.

Wind energy is a very important new energy. Wind power generation technology has rapidly developed in nearly 20 years. There is wind energy about 2.74 × 10^9MW on earth, which can be using that there is 2 × 10^7MW. (Wind power, 27,05,2016)

Advantages of wind power:
(A) Using of natural renewable energy, clean, non-polluting and no fuel
(B)Operating costs, wind turbine design life is about 20-25 years, and costs of operating and maintenance are generally 3% -5% of total cost. (Hou Fuxu,5,5,2013)
(C) Short construction period, excluding wind direction and speed detection device for Wind Power Generate Electricity System. A wind power station need about a year to build. (Hou Fuxu,05,05,2013)

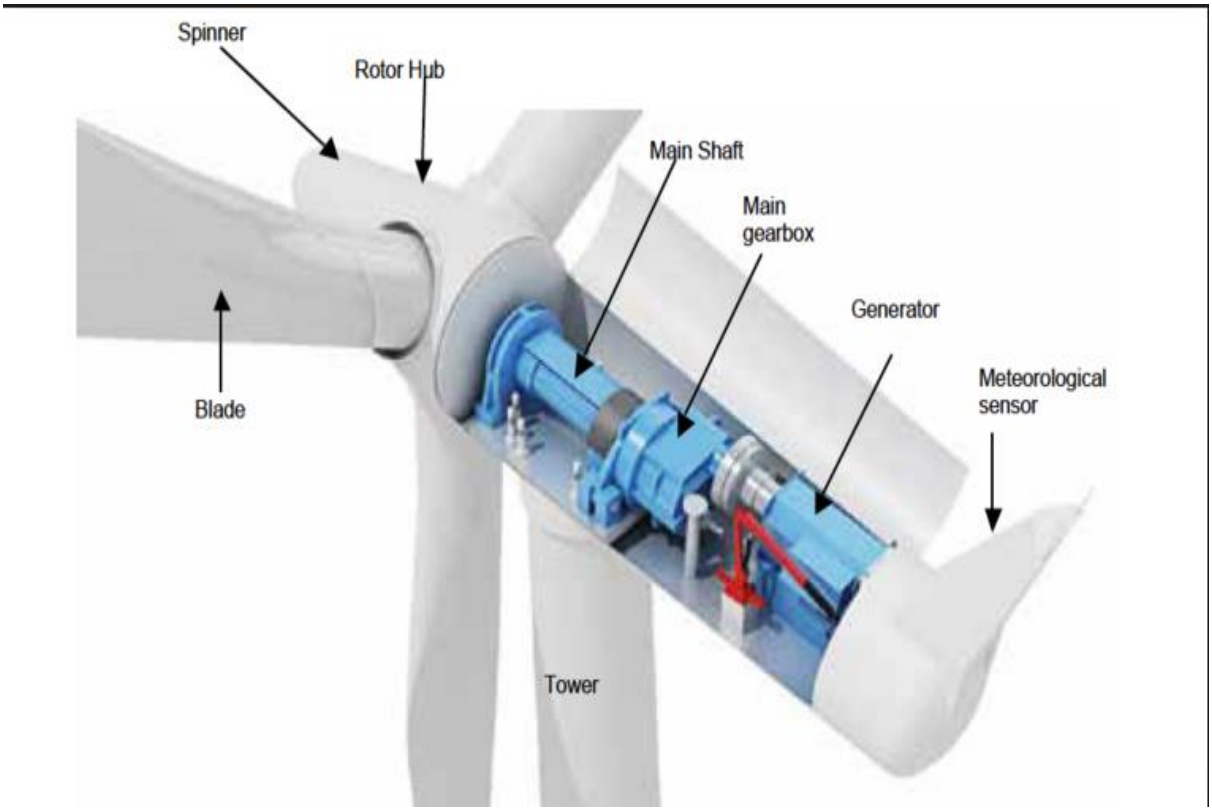

Figure1. The wind turbine (The wind turbine, 27,05,2016)

2.1.1 Generation System and the Principle of Wind Power

The principle is that wind rotors are used to convert wind energy into mechanical energy, and then wind rotors are driven generator to convert the mechanical energy into electrical energy. Large-scale wind turbine generator system generates power, which is sent directly to the power line, and fed to power grid. Small wind turbine generator system generates power, which is generally stored by energy storage device (usually with batteries), and then electric energy is supplied to loads from the storage devices when it is needed (supply to available DC power, it can also be converted by AC inverter and then supplied to the users). (Hou Fuxu,05,05,2013)

2.1.2 How Does Wind Turbine Work

Wind turbines can be divided into two types, one is wind rotors have the same direction as wind direction to get aerodynamic torque, and then the aerodynamic torque can drive generators to work, and the other is aerodynamic torque come from perpendicular to wind direction. The power coefficient of the former is small and energy conversion efficiency is low, so the farmer had been gradually eliminated. The latter has two kinds of axis, and they are horizontal axis wind turbine and vertical axis wind turbine. Vertical axis wind turbine main drawback is the large torque ripple in the face of strong wind, and it is difficult to control in strong wind. In the late 1980s, a lot of countries had stopped to research and develop vertical axis wind turbine, and now the main wind turbine is a horizontal axis propeller type.

Main parts of Horizontal axis wind turbine are rotor, gear box, generator, yaw system, control system, the tower and other parts. Wind rotor can convert wind energy into mechanical energy. Wind rotors are formed by high performance pneumatic blades (current commercial unit is generally 2-3 blades) mounted on the hub for wind turbine. Wind rotors mostly have 2 kinds, and they are fixed pitch and variable pitch. Low speed wind rotor is accelerated through the transmission system by gearbox, and then the wind rotors drive generator to work. These components are mounted on the nacelle, which is lifted by tall scaffoldings of support structure. People want to utilize wind energy more effectively, but human cannot control direction of wind, so wind turbine must have an orientation mechanism. This orientation mechanism can induct the signal of wind' direction by wind sensor, and then controllers control yaw motors to drive big gears moving, and let small gears move, which are meshing with big gears, so nacelle always toward wind. Big and small gears are mounted on support structure. Power generation devices have support structures and nacelles.

The horizontal axis wind turbines use a different number of wind turbine blades, because every wind turbine has a different use. Wind power main uses 2-3 wind turbine blades and 20 and more blades of wind turbine are driven by pumps and other mechanical devices. Windmill also includes many larger control devices, for example, manual brake mechanism can ensure safety when wind turbines work in different wind conditions, like typhoon. (Hou Fuxu,05,05,2013)

2.1.3 Wind Power System

Small wind turbines are mostly used in remote areas. Wind speed is always changing to lead to change of voltage and frequency, it is not easy to directly use by loads, so energy should be stored. Usually small wind turbine can use batteries for energy storages. It is first step that alternating current, which from electric generator, converted into direct current by rectifiers, and the direct current charges batteries. Second, direct current of batteries is converted into alternating current by using inverters, and the alternating current can supply to loads. Rectifiers and inverters can make into 2 devices, and they are also combined into one device. 1KW ~ 10KW wind turbines are mainly used in small wind systems. This kind of system is suitable used in some place which is away from main power grids. Grid-connected wind turbine consists of transmission system, yaw system, hydraulic system, braking system, generator, control and other security systems. Wind turbine generators convert the mechanical energy into electrical energy into electrical grid.

2.1.4 Status and Development Trends of Wind Power

Since 2005, global wind power has been growing rapidly. Newly- installed capacity reached 63,013MW in 2015, and the cumulative installed capacity from wind power amounted to 432,419MW, to achieve a 22% annual growth. ((The world's wind power industry development status, 16,03,2016)

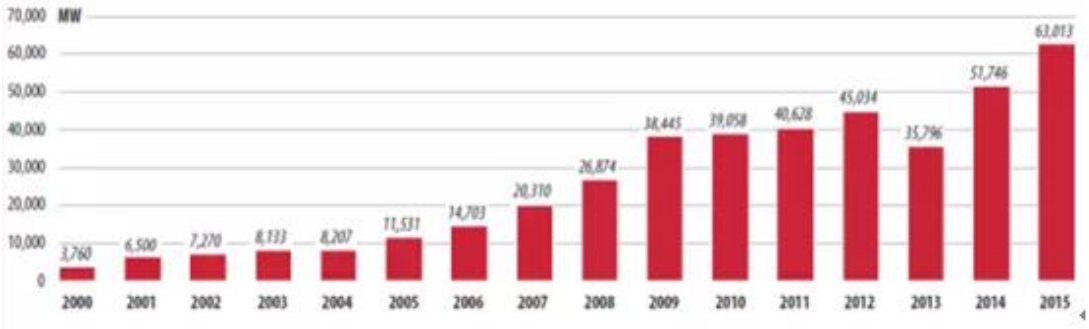

Figure2.2000--2015 global cumulative installed wind power capacity (The world's status of wind power industry development,16,03,2016)

2.1.5 Major Market of Wind Power Shifts to Asia

Because Europe and America have good technology and beneficial policies, they are earliest regions in development of global wind power. Since the 1990s, European wind power began to develop. Meanwhile, a lot of Asian countries started to focus on clean energy, and market of wind power would appear. In recent years, the world's wind power development center has turned away from Europe and the United States, and Asia will be center of wind power development. In Europe, newly-installed capacity reached 13805MW in 2015. In the same year, in Asia, newly-installed capacity reached 33606MW. (Status of the world's wind power industry, 16,03,2016)

2.1.6 Wind Power Will Continue Developing in The Future

A lot of countries want to promote production of wind power in the future, so they will invest more money to develop wind power. It is predicted that European renewable energy will account for 34% of total generating capacity by 2020, of which wind power will account for 16.90%. 23.5 billion Euros will be used to develop wind power in every year. In 23.5 billion Euros, people will invest 14.7 billion Euros in onshore wind power, and people will also invest 8.8 billion Euros in researching and developing for offshore wind power. Wind power cumulative installed capacity will reach 230 million kilowatts. (Status of the world's wind power industry, 16,03,2016)

With wind power technology promoted, the cost of wind power generation will be gradually reduced. In the future, wind power major markets in Asia, North America and Europe, and they will be a major force, which can promote global wind power development**.** Because a lot of countries encourage companies to develop clean energy by beneficial policies, and counties demand more clean energy to develop, global wind power market will continue to grow. It is predicted that new capacity will be 53.5GW by 2015 in the world. From 2015 to 2019, international new capacity will be growing 3%-7%. By 2019, global cumulative installed capacity will reach about 666.1GW. (Status of the world's wind power industry, 16,03,2016)

2.2 Solar Power Generation Technology

Solar power is produced by collecting solar sunlight and converting it into electricity. This is done by using solar panels, which are large flat panels made up of many individual solar cells. They are most often used in remote locations, although they are becoming more popular in urban areas as well.

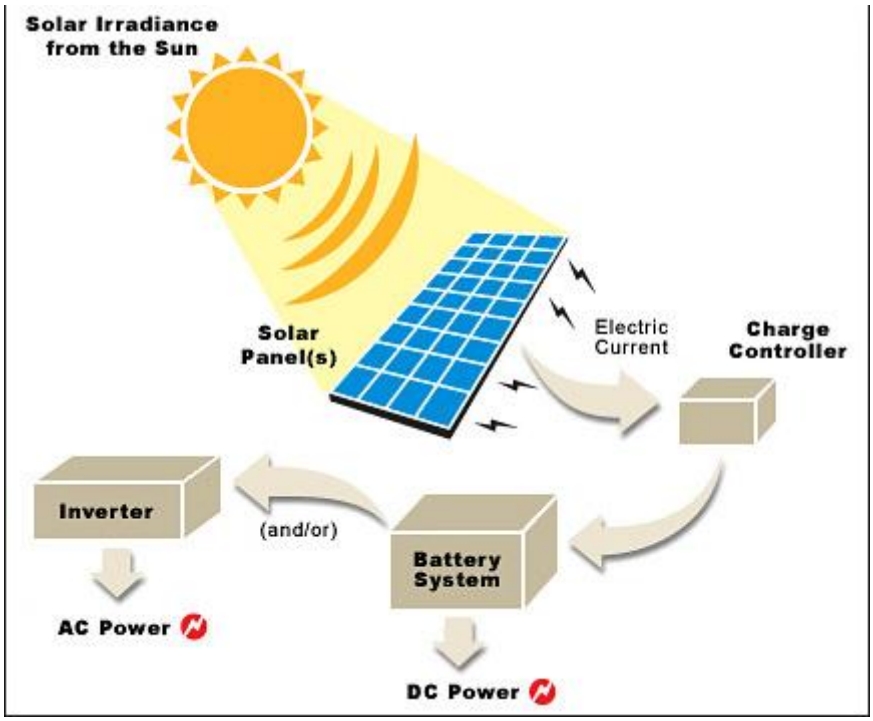

Figure3. Solar power (Solar power,27,05,2016)

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic (PV) effect, or indirectly using concentrated solar power (CSP). Concentrated solar power systems use lenses, mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaic systems convert light into electric current by using the photovoltaic effect.

The photoelectric effect is that light is shined onto a piece of metal, and then a small current flow through the metal. The light gives its energy to electrons in the atoms of the metal and allows them to move around and produces the current.

2.2.1 Principle of Solar Power

The sun shines on the semiconductor p-n junction, and then a new hole - electron pairs are formed, in the p-n junction electric field. Electron hole moves from n region to p region, and electrons flow from the p region to the n region, then it forms current after completing established connection. This is the photovoltaic solar cell's operation principle.

There are two ways produce electricity from solar energy, one is light - heat - electricity conversion mode, and the other is light - electric direct conversion method.

(A) Light - heat - electricity conversion mode is using thermals to generate power from solar radiation. Solar collectors absorb heat to make fluid convert into steam, and then steam drives steam turbine to work. The former process is light - thermal conversion, and the latter process is heat - electricity conversion. This ways and ordinary thermal power generation have same disadvantages. These disadvantages are that cost too much and inefficient. It is estimated that cost of this type of power plant is more than at least 5 times for an ordinary thermal power plant.(Solar power principle, 27,05,2016)

(B) Light - electric direct conversion approach is using by the photovoltaic effect principle, and let solar radiation directly convert into electrical energy. A semiconductor photodiode of a solar cell can convert solar energy into electrical energy by photovoltaic effect. When the sun shines on the photodiode, photodiode will convert solar energy into electrical energy, and current will be formed. A number of batteries connected through series and parallel in order to get a relatively large output power of the PV array. Solar cell is a very promising new energy, because it has 3 major advantages, and they are unexhausted, clean and flexible. Solar cells have a long life, as long as there is sun, the solar cell can be established and used in a long-term. Compared with thermal power generation, solar cells will not cause environmental pollution.(Solar power principle, 27,05,2016)

2.2.2 Status and Development Trends of Solar Power

Rich solar energy is an important source of energy, because it is inexhaustible, clean, cheap, and people have the freedom to use it. Every second solar radiation reaches the ground, and the ground can get 80 million KWH. If people could convert 0.1% of solar energy into electrical energy from Earth's surface, we can get the annual output up to 5. 6 x 1012 KWH and it is equivalent to 40 times of energy consumption in the world. (Yuanding, 28.12.2014)

In 1954, it was the first time that American scientists Charbin and Pirson made practical monocrystalline silicon solar cell in the bell LABS, and Practical technology of photovoltaic power generation was invented. After the 1970s, solar power technology has been gradually paid attention to by humans. After the 1980s, solar cell types continued to increase, and market size has gradually expanded. After the 1990s, photovoltaic power generation was rapidly developed. By 2006, photovoltaic power generation systems were built more than 10 megawatts, and 6-megawatt photovoltaic networking power plants in the world.

The United States was the first to plan to develop photovoltaic power generation. In 1997, American proposed a "million roofs" plan. In 1992, Japan started a new project of solar energy. By 2003, Japanese PV modules produce too many, which accounted for 50% of world' PV modules. In German, Renewable Energy Law provided photovoltaic electricity price, which greatly promoted the development of PV market and industry, and then German was fastest-growing of photovoltaic power generation except Japan in the world. Switzerland, France, Italy, Spain, Finland and other countries have also developed PV plan, and they invested much money in technology development to accelerate the industrialization process.

According to Prospects Net "2013-2017 China PV Industry Market Outlook and Investment Strategy Analysis Planning Report" survey data shows that global photovoltaic (PV) of new power capacity is about 27.5GW by 2011, compared with18. 1GW of last year, it raised 52%, global total installed capacity was more than 67 GW. Global total installed capacity was nearly 28GW, and in which Europe has 20GW of installed systems. In 2011, China, India and Japan, as the representative of the Asia Pacific, they market demand for PV industry were grown to 129%, and they had a different installed capacity, respectively 2.2GW, 1.1GW and 350MW. In addition, North American solar market has been improved, and newly installed capacity is about 2.1GW, so its growth rate is up to 84%.

China is the fastest growing in the world in PV installed capacity. In 2011, Chinese photovoltaic installations were more than 5 times compared with 2010 PV installed, and the number of solar cell production was 20GW, which is about 65% of the world's cell production. By the end of 2011, China had about 115 battery companies, and total capacity is about 36.5GW, in which 14 enterprises had beyond 1GW installed capacity, and accounted for 53% of total capacity, 63 enterprises are between 100MW and 1GW, accounting for 43%of total capacity, the rest of 38 companies' capacity is less than 100MW, and they have only 4% capacity in total of Chinese capacity. It is gradually clear that solar power will be joined in competition, which mainly reflected in 3 aspects that are scale, technology, and cost. The top ten Chinese component manufacturers' shipments accounted for 60% of the amount of battery in China. In the world, conventional energy sources are very limited, Chinese primary energy reserves are far below the world average, and it is only about 10% of the world's total reserves. Solar energy is inexhaustible, renewable source, cleanliness, really long-life and maintenance-free, resources etc., and it is playing an important role in long-term energy strategy. In the next ten years, China's PV market will turn to electric grid system from independent power systems, including power plants in desert and city rooftop power generation system. Chinese solar PV development has huge potential, because Chinese have positive and stable policies. In2030, PV installed capacity will reach 100 million kilowatts. The annual generating capacity can be up to 130 billion KWH. China will invest 20 billion to PV industries in next 3 years, so Chinese solar photovoltaic industry will have rapidly growth, and it will attract more investors into the industry. (Yuanding, 28,12,2014)

2.3 Geothermal Power Generation System

Geothermal energy is the energy stored in the form of heat beneath the earth's surface. Geothermal energy is a carbon free, renewable, sustainable form of energy that provides a continuous, uninterrupted supply of heat that can be used to heat homes and office buildings and to generate electricity.

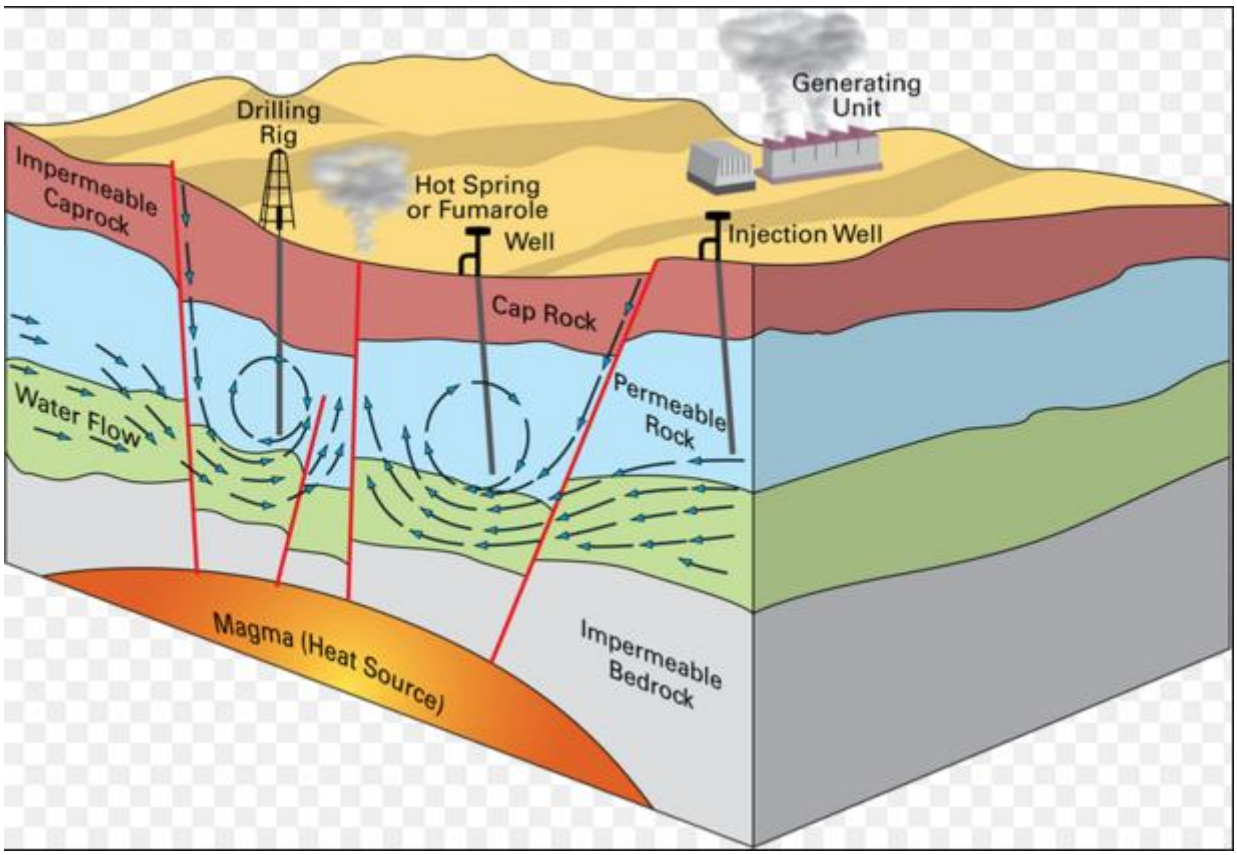

Figure4. Simplified diagram of a geothermal plant (Geothermal energy, 27,05,2016)

Geothermal power generation technology can convert geothermal energy into mechanical energy, and then convert the mechanical energy into electrical energy. In 1904, Italian started geothermal power projects. Geothermal power generation technology has matured into a commercial application stage. With its 2080MW of installed capacity, American Geysers became the largest geothermal power plant in the world. Philippine geothermal power installed capacity is up to 1050MW, which accounting for 15% of total installed capacity in the world. There are about 300 geothermal power plants around the world and plant' total installed capacity is close to 10000MW. These plants are distributed in more than 20 countries. China installed capacity is about 30MW, and China has 3 large-scale geothermal plants, They are Naqu, Langjiu and Yang Bajing(10thousand KW).(Geothermal power generation, 17,07,2011)

From the surface down to the Earth's interior, the temperature has gradually increased and an average increases is 20-30 ° C/km. In center of the Earth, the temperature is about 6000 degrees Celsius. Geothermal resources can be divided into four categories by different storage methods, and they are hot-water resources, earth press resources, dry-heat resources and lava resources. (Geothermal power generation, 17,07,2011)

2.3.1 Principles of Geothermal Power

A geothermal power plant converts geothermal energy into mechanical energy, and mechanical energy into electrical. Heat energy from deep underground can be transported to surface of the earth by heat carriers, and then humans use the heat energy to generate electricity. Heat carriers have

some different kinds of materials, such as Natural steam (dry steam and wet steam) and geothermal water.

Because hot water and steam have different temperature, as well as their water pressure and steam quality, geothermal power has also some different ways to generate electricity. Ways of conventional geothermal power:

(A) Direct steam method. High-temperature steam is taken from geothermal wells. At first, high-temperature steam comes to separator to purify and remove various impurities from deep underground. Steam turbines are driven to work by clean steam, and then generators start to generate electricity by steam turbines driven. Geothermal power generation equipments are almost same with conventional thermal power equipments.(Geothermal power generation, 17,07,2011)

(B)Duplex circulation power generation. When local geothermal water temperature is above 150 ℃, hot water can be used repeatedly to generate electric. When local geothermal water temperature is low, it is difficult for using this way to generate electricity. But this is appropriate to adopt duplex circulation power generation. Using lower-temperature geothermal water to heat a low boiling point fluids (such as isobutene, freon and so on), and then vapors of the low boiling point fluids drive generators to work. This way has a high efficiency in theory, but it is difficult in technology. At present, China imported two generating units of 1000 kilowatts and they have been put into operation. (Geothermal power generation, 17,07,2011)

(C)Total flow system for electric power production from geothermal energy. This way is that let all geothermal carriers come into total flow generating units. This way is very high efficiency, and it is up to 90% in theory, but the efficiency is lower than expected from actual results. (Geothermal power generation, 17,07,2011)

Principle of geothermal power is nearly the same with thermal power. Geothermal power does not consume fuel, so it does not require a huge fuel transport and storage facilities. Equipment systems of geothermal power plants are less than thermal power plants. Water is only reduced a little temperature after hot water discharged from geothermal power, the water can also be used for heating and so on. Geothermal power plant does not have pollution. (Geothermal power generation, 17,07,2011)

2.3.2 Status

(A) America

In 2014, geothermal power generation capacity is 88 MW in the America. By the end of 2014, total installed capacity reached 4.65GW. With the increasing amount of financing in 2014 in America, it is expected to add more geothermal power capacity in the future.

In America, the United States owns the biggest part of total installed capacity for geothermal power generation, and newly installed capacity is 38MW in 2014. By the end of 2014, total installed capacity reached 3.15GW.

In 2014, the United States started most important geothermal power project by Don Campbell Ormat Company, it had an installed capacity of 16MW. This company has been using duplex circulation power generation. Raser Technologies Company had a Lightning Dock project with the same technology, and it had installed capacity of 4MW. (Geothermal power generation capacity in 2015, 30,07,2015)

(B) Europe

In Europe, geothermal power newly installed capacity reached 108MW in 2014, and it had a sharp decline by comparing 2300MW in 2013. By the end of 2014, total installed capacity reached 2.39GW. In Europe, Italy owns the most advanced technology of geothermal. In 2014, a 40MW geothermal power plant, which is located in Mount Amiata area, was built. So far, Italian total installed capacity reached 916MW.

Turkish geothermal energy application achieved great development in 2014, there are three geothermal power plants were built and put into using, they are Dora power station, Degirmenci station and Alasheir station. By the end of 2014, Turkish total installed capacity reached 397MW.

(C) Asia

In 2014, geothermal power newly installed capacity reached 369MW in Asia-Pacific region. By the end of 2014, cumulative installed capacity reached 5.04GW. In the Asia-pacific region, Indonesia geothermal power is the largest countries of newly installed capacity in 2014, and geothermal power newly installed capacity reached 202MW. By the end of 2014, total installed capacity reached 1.45GW in Indonesia. However, Indonesia has rich geothermal resources, and their government also committed to remove obstacles, which stopped development of geothermal energy. So Indonesia geothermal power can increase rapidly.

In china, although there is no breakthrough about geothermal power newly installed capacity in 2014, government gave a plan is "Energy Development Strategy Action Plan (2014-2020 years)", which is clearly said that geothermal energy utilization will reach 50 million tons standard coal(standard coal:7000 kcal/kg) by 2020. It will greatly promote development of geothermal energy in China. (Geothermal power generation capacity in 2015, 30,07,2015).

(D) Africa

In 2014, Africa is also a hot area of geothermal development, its newly installed capacity reached 322MW, and all plants built in Kenya. By the end of 2014, African cumulative installed capacity reached 601MW. (Geothermal power generation capacity in 2015, 30,07,2015)

2.3.3 Development and Utilization of Geothermal energy

Geothermal water has a wider use in agriculture, it is mainly used to heat greenhouse, cultivate seeds, planting vegetables, flowers and hatching, etc. Hungary has devices of geothermal direct heat utilization, and its heat power is 638MW. Gardening and greenhouse heating system are relying on geothermal water. (Yinxing, 25,09,2013)

It is predicted that global geothermal energy capacity can reach 14.5 to 17.6GW in 2020. The World Bank and other organizations are supporting for geothermal energy development by investing. World Bank Energy Sector Management Assistance Program (ESMAP) gave $ 200 million to support geothermal energy development projects through the Clean Technology Fund. The World Bank predicted that 40 countries can meet most of the demand for electricity by using geothermal energy in the future. (Geothermal power generation, 22,04,2016)

People want to reduce carbon dioxide and other gasses emissions which can cause global warming, so governments around the world are supplying beneficial policies to encourage winder use of renewable energy power generation. Development and utilization of geothermal energy will become more and more popular in the world, and scientists predict that this trend will be maintained at least a decade. (Geothermal power generation, 22,04,2016)

In 2015, the United Nations announced that "Global Geothermal Union" was established, which want to reduce cost and risks associated with exploration drilling geothermal power investment. (Geothermal power generation, 22,04,2016)

Geothermal power is getting faster development in Latin America. El Salvador wants to achieve electricity supply 40% of geothermal power in 2020. Mexico made a plan, which said that geothermal power generation system will account for 35% of all energy power generation in the future. Nicaragua plans to continue to develop geothermal energy 100MW in the next 15 years.(geothermal power generation, 22,04,2016)

3 NEW ENERGY CO-GENERATION SYSTEM

Wind energy, solar energy and geothermal energy have different advantages and disadvantages. New energy is rich stores, but bad climatic and geographical conditions are also affected to get sources, and some energy is cheap and free, but they can convert to more expensive electric energy. The advantage of new energy co-generation system is making advantages and disadvantages complementary between different new energy, such as stable and unstable, and the shortage of rich, universal and regional, the price of expensive and inexpensive, and so on. For example, in the high-

er latitudes, solar radiation is weak and wind is strong in winter, but solar radiation strong and wind is weak in summer, so we can make wind and solar power input to same energy storage devices.

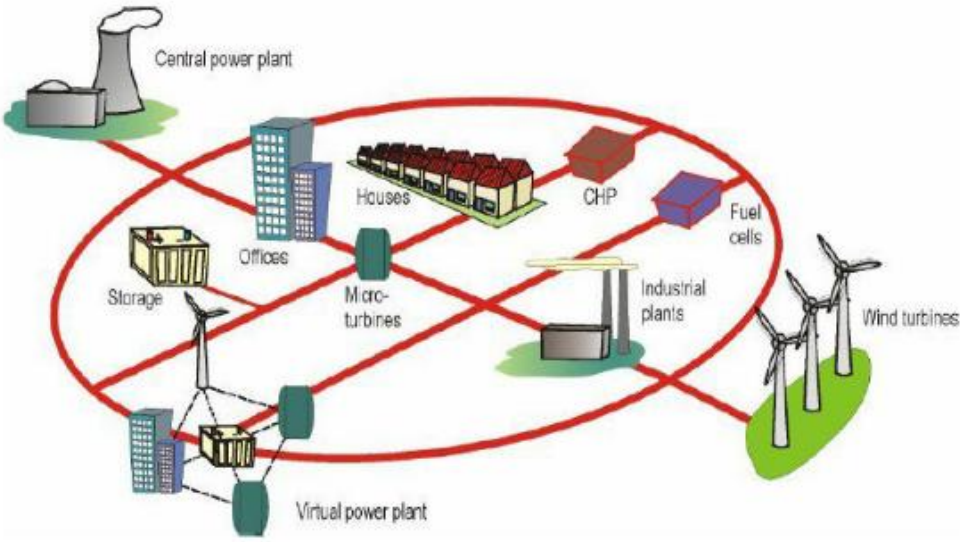

Figure5.New energy co-generation system (Yuanding,28,12,2014)

4 MARKET ANALYSIS OF PLANTS

From the development trend of new energy technologies, it shows that new energy has a very big market, so more and more countries invest lots of money in developing new energy.

4.1 Locations of plants

It is impossible that all places are suitable for building wind power plants. For example, you cannot build wind power plants in dense urban. It must meet the following conditions which is suitable for constructing wind power plants.

(A) Wind energy resource-rich areas, wind direction are relatively stable, it has a good average wind spend and wind power density is better place. Such as grasslands, cols, sea and valleys like these places which have bigger wind speed and fewer obstacles. Mountains, forests and too many buildings which are not good choice to build plants.

(B) Wind speed is small of daily variation and annual variation.

(C) It has less natural disasters, such as sandstorm, smog, hail and typhoon and so on.

(D) Wind plants should be adjacent main power grid, so less wind power investment in lines to reduce cost.

(E) Wind plants usually build in a relatively flat area, which is more convenient to transport wind turbines and install and so on. Plants are better built in radius 4KM to 6KM area, which height is less than 0.03 between ground and obstacles, for example Mountains and trees etc.

Of course, some places, which are constructing solar power plants, where need to meet several conditions.

First, we need plenty of sunshine, as shown below

Table 1 Sunshine time level (Chenjie, 22,04,2013)

Grade	Annual solar radiation	Peak sunshine hours every day	Generating appropriate degree
1	>6660MJ/(m².a) >1850kwh/(m².a)	>5.1h	Great
2	6300-6660MJ/(m².a) 1750-1850kwh/(m².a)	4.8-5.1h	Good
3	5040-6300MJ/(m².a) 1400-1750kwh/(m².a)	3.8-4.8h	General
4	<5040MJ/(m².a) <1400kwh/(m².a)	<3.8h	Bad

Second, Local wind direction, geological conditions and meteorology are the main factors which affect the PV systems' brackets strength, such as hail, sandstorms, snow and other weather disasters.

Third, Short-time maximum local precipitation, water depth, water level and flood drainage conditions affect the metal brackets and solar cells.

Fourth, Local government has certain subsidy.

Fifth, Reducing transportation cost.

Geothermal energy plants are normally located in regions where there is volcanic activity
Human should choose different new energy power generation plants to invest and build by analyzing different environment.

4.2 SWOT

Swot is an important way to do the analysis of marketing. It includes strengths, weaknesses, opportunities and threats.

Table 2 Swot analyse of wind power generation

Strengths:	Weakness:
1 Clean 2 Good environment benefit 3 Renewable and never exhausted 4 Short construction period 5 Flexible of installed size	1 Noise and visual pollution 2 Take up large areas of land 3 It is not stable and control 4 Too much cost 5 Affected birds
Opportunity: 1 Fossil energy will exhausted 2 Good policies to support 3 More and more experts like to research Wind power	Threats: 1 Lack of lots of relevant experts and high technology 2 Transportation is not convenient 3 Many large megawatt wind power generator components are in short supply 4 Market competition pressure

Strengths:

Wind energy is abundant and renewable energy. It doesn't pollute environment. Wind power plants have short construction period. For example, 50 MW wind plant need to take about half a year to finish building.

Weakness:

Wind power in the ecological problem is that may interfere with birds, such as the United States Kansas grouse has been faded away after windmill appeared. Wind power plants require a lot of land to build, which can produce more energy. Wind turbines make too much noise when they are working, so wind plants should find some places to build, which places have few persons to live.

Opportunity:

Fossil energy reserves will be less and less. A lot of governments give beneficial policies to support new energy development.

Threats:

Raw material prices, wages and cost of management are rising, and these things lead to increase pressure of market competition. Many large megawatt wind power generator components are in short supply.

Table 3 Swot analyse of solar power generation

Strength:	Weakness:

1 Clean and renewable energy 2 Easy to acquire 3 Conversion process is simple 4 No noise and no pollution 5 No mechanical transmission parts 6 Service life is long 7 Solar cells component has simple structure, small volume and light weight 8 Easy to transport and install	1 Low energy density 2 Cover a big area 3 Conversion efficiency is low 4 Intermittent work 5 Affected by the climate factors 6 High system cost 7The manufacturing process of crystalline silicon cells is high pollution and high energy consumption
Opportunity: 1 Good policy to support 2 The development of science and technology to reduce the cost 3 People pay more attention to protect environment	Threats: 1 Market competition pressure 2 Grit initiative

Strength:

Photovoltaic energy generation conversion process is simple, and light energy is directly converted into electrical energy, there is no middle course, for example thermal energy converted into mechanical energy. So photovoltaic power generation has a high efficiency in theory, which is up to 80%.

Photovoltaic power generation system is stable and reliable, and its service life is usually more than 30 years. Crystalline silicon solar battery life is up to 20-35 years.

Weakness:

Because sun exposure area is large, solar energy density is low, it makes photovoltaic systems will take up large areas, for example each 10KW photovoltaic power occupies about 100 square meters. Solar power generation has a low efficiency of conversion. Crystalline silicon solar cell conversion efficiency is 13% - 17%, and amorphous silicon photovoltaic cells only are 5% - 8%.

Table 4 Swot analyse of geothermal power generation

Strength: 1 clean and renewable 2 Never exhausted 3 High heat energy utilization 4 Geothermal energy can be directly use	Weakness: 1 Regional restriction 2 Geothermal energy can belong to a slower renewable resources 3 The development of high initial investment
Opportunity: 1 Good policy to support 2 Human pay more and more attention on new energy development 3 Environmental protection	Threats: 1 High cost 2 May bring radioactive elements to the ground 3 Improper drilling will lead to seismic activity

Weakness:

Geothermal energy power plants are limited to build by region, because geothermal steam and hot water cannot transmit over a long distance.

5 RESULT OF THIS THESIS

Human is gradually focused on new energy. The proportion of new energy power generation is increasing, human is more positive in researching and investing in new energy sources, so new energy technology development speed is improving. However, we also see new energy power generation which has many deficiencies. For example, solar power generation, photovoltaic power generation system only is used during the day, and it cannot generate electricity at night, but humans usually use electricity at night. In addition, photovoltaic power generation needs high cost and conversion rate is low. These problems have constrained the development of new energy. So human needs to do lot of things to help new energy to develop.

We should choose the right new energy to develop, according local conditions.
We should make many advertisements about new energy to let more persons to know new energy, and hope more persons add to research and develop new energy.
Improving science and technology in order to reduce difficulty of new energy power generation and reduce cost.

People should continue to support the development of new energy by providing favorable policy.
Some organizations can also teach many students to research and find new energy.

6 CONCLUSION

Through the introduction of 3 type's new energy power generation technology status and trends in the future, it is easy to know that new energy is main energy source in the future.

Traditional energy sources will be both exhausting, and they are discharging too many pollutants in using, so new energy sources could replace traditional energy in the future.

Through the analysis of new energy' market, we know that there are a lot of disadvantages for new energy. These disadvantages are direction of researching by scientists in the future.

It is important to choose new energy power plants' sites. We should take into account capital, science, technology, and environment and so on. We must optimize maximum efficiency in the use of new energy.

New energy co-generation systems will develop rapidly, so more and more countries are not only investing a kind of energy to develop. New energy co-generation systems will complement disadvantages of different new energy that promote economic development.

REFERENCE

Date from New energy technology, Posted on 06,12,2013, Available from http://wenku.baidu.com/link?url=NsjCQbeh9jQ9EENoVqfJwDripuClzeItYSSBo8D7dAsvDrKxv3r6LjAkFvjS2TuOsBt0mHcUkUyaD_symbSUpc86pUUIak6ZUoa48WWmsmK4

Date from Global proven coal reserves, Posted on 29,10,2015, Available from http://gold.hexun.com/2015-10-29/180214364.html

Date from Wind power, Posted on 27,05,2016, Available from http://baike.baidu.com/link?url=aBtoJeaYx_C59Mf3wnmdkfW1XaqKnpy7oq5qvHmEJeAenDAiymTPzHasw_mU8wMlkjHqTjFW7A2mbjDszST8oa

Date from Solar Power Technology, By Yuanding, Posted on 28,12,2014, Aavilable from http://www.doc88.com/p-9079397545617.html

Geothermal energy, Posted on 27,05,2016, Available from http://www.bgs.ac.uk/research/energy/geothermal/

Geothermal power generation, Posted on 17,07,2011, Available from http://wenku.baidu.com/link?url=vTViJTYfpzi8_elFe9mJcTU_JA9fINfQm5cjtvTYXk36caoqcDy3s5ZgaV62wXvqIWp8iLeybfaymYl-KttguZ1mnP9zXsmgFxulovTo_

Geothermal power generation capacity in 2015, Posted on 30,07,2015, Available from http://www.chyxx.com/industry/201507/332203.html

Geothermal power status, By Yinxing, Posted on 25,09,2013, Available from http://www.docin.com/p-704521846.html

Geothermal power generation, Posted on 22,04,2016, Available from http://www.chyxx.com/industry/201604/409046.html

Photovoltaic power station site selection, By Chenjie, Posted on 22,04,2013, Available from http://wenku.baidu.com/link?url=XiT4cDywlCoRtcGFEisqbYNOlj1_oEQV9rI611Q92VbM6G0dZl1KyLc361O82MKHuOQgGYkaZrtrcxkQZGVn2w6KyyC7duhti7KPjaSAcO

Solar energy, Posted on 27,05,2016, Available from http://www.alternative-energy-news.info/technology/solar-power/

Solar power principle, Posted on 27,05,2016, Available from http://baike.baidu.com/link?url=abohNPSOGcLlEM44NgWfEcIB_VjyZ44Jk9J2E_4Q7N5jO0QJwhDGxGYlYQLiCtYap37qQW2FR4wjBRG-6rK

Status of the world's wind power industry, Posted on 16,03,2016, Available from http://www.chyxx.com/industry/201603/395778.htm

The wind turbin, Posted on 27,06,2016, Available frome http://jeffreysbaywindfarm.co.za/about-wind-energy/the-wind-turbine/

Wind power technology research VSCF, By HouFuxu, Posted on 05,05,2013. Available fromhttp://wenku.baidu.com/link?url=NcJA95wgcDoP2rQoH33ULmyIdErW4xhN0LP6EQDDD2URw2SAN9oJQYMwk4BXBNoj3-xpD2kL25vp2Obc83fZllL7FvrL9KvzLtY3qfF