Linan Song, NTNU NRM

Wind Farms and their Perceived Impact on Local Landscapes

A comparative Study between China and Norway

Master's Thesis in Natural Resources Management

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Supervisor 2: Professor Gard Hopsdal Hansen

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Trondheim, May 2014

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Abstract

It is widely recognized that developing of renewable energy is a good way to reduce carbon emissions. China has set ambitious goals to increase the use of wind power. Developing wind power in rural areas is also one of the most important strategies. But the rural areas are always viewed as real nature that have special landscapes and should be protected priority. This thesis mainly describes the different perspectives among Chinese and Norwegian university students towards the issue that how they think about the wind farms impact on local landscapes. The study is based on the data collected from survey of Chinese and Norwegian university students. The results show that there are some different views among them about the construction of wind farms in mountain areas determined by different attitudes, different aesthetic and different views on its impacts due to their very different cultural and education background. In addition, this study is also related to wind farms in Inner Mongolia, province in China and conflicts that have been caused by constructing a wind farm there.

Key Words: Wind power, Wind farms, Environment, Landscapes, Aesthetic, NIMBY, China, Norway, University Students.

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Abbreviations and glossary

CCICED	China Council for International Cooperation on Environment and Development
CCS	Carbon capture and storage
CMA	China Meteorological Administration
DTRP	Da Tang International Power Generation Co., LTD
DTWP	Da Tang Wind Power Corporation
ECM	Energy Conservation Measures
EEC	European Economic Community
EES	Energy, Environment and Society
EPI	Environmental Performance Index
EU	European Union
GWEA	German Wind Energy Association
GWEC	Global Wind Energy Council
HDI	Human Development Index
IMDRC	Inner Mongolia Development and Reform Commission
IMDTWP	Inner Mongolia Da Tang International Wind Power Development Co., LTD.
IMETT	Inner Mongolia Electricity Transmission and Transformation Corporation
JNU	Jilin Normal University
NDLU	Northeast Dian Li University
NDRC	National Development and Reform Commission
NEU	Northeastern University
NGO	Non-Governmental Organization
NIMBY	Not In My Back Yard
NTNU	Norwegian University of Science and Technology
NWRED	Norwegian Water Resources and Energy Directorate

PPA	Power Purchasing Agreements
PPP	Purchasing Power Parity
PRC	The People's Republic of China
RES Directive	Directive on Electricity Production from Renewable Energy Sources
STJU	Shanghai Jiao Tong University
SWPA	Spanish Wind Power Association
UNDP	United Nations Development Program
YSN	Yanshan University

1. Introduction

1.1 Background

1.1.1 Overview of wind power

With increasing concern among scientists and policy-makers about the potentially hazard of climate change and the challenge of carbon cycle of the earth system there has been a drive across many countries to increase the amount of energy generated from renewable resources (Houghton 2003). Wind is inexhaustible and clean energy resource. So it is one of the renewable energy that has most promising future. But it is widely recognized that public acceptability often poses a barrier towards renewable energy development (Devine 2005). So does wind power. In some cases, development of wind power has been marked by social controversy (Walker 1995), due to it causes a lot of controversial issues especially onshore wind farms.

Onshore wind farm occupies huge areas and it is often constructed in rural areas or mountain areas (sometimes inside national parks or untouched areas). And some conflicts may appear as regard wind farms impact on local landscapes.

The existing literature on public perceptions of a wide variety of renewable energy resources, including wind energy, has presented a striking divergence (Elliott 1997). At a general level, there is strong public support for developing renewable energy, as evidenced by extensive international opinion polling since the 1970s (Alternative Energy Sources 1998). However, at the local level, there has been frequent controversy and public opposition across different technologies and social, economic and cultural contexts (Devine 2005).

1.1.2 General introduction of China and Norway

Geographical location

China

China, officially the People's Republic of China (PRC), is a sovereign state located in East Asia with land acreage of about 9.6 million square kilometers, which is only second to Russia and Canada and there is a population of 1.3billion in China. The territory of China lies between latitudes 18° and 54°N, and longitudes 73° and 135° E. China's landscapes vary significantly across its vast width. In the east, along the shores of the Yellow Sea and the East China Sea, there are extensive and densely populated alluvial plains, while on the edges of the Inner Mongolian plateau in the north, broad grasslands predominate. Southern China is dominated by hills and low mountain ranges, while the central-east hosts the deltas of China's two major rivers, the Yellow River and the Yangtze River, which are, the sixth- and third-longest in the world, run from the Tibetan Plateau to the densely populated eastern seaboard. China's coastline along the Pacific Ocean is 14,500 kilometers (9,000 mi) long, and is bounded by the Bohai, Yellow, East and South China Seas.

Norway

Norway, officially the Kingdom of Norway, it lies between latitudes 57° and 81°N, and longitudes 4° and 32E°, and comprises the western part of Scandinavia in Northern Europe. The rugged coastline, broken by huge fjords and thousands of islands, stretches 25,000 kilometers (16,000 mi) and 83,000 kilometers (52,000 mi) and include fjords and islands.

Norway has a total area of 385,252 square kilometers (148,747 sq. mi) and a population of a little above 5 million. It is the 2nd least densely populated country in Europe. The country shares a long eastern border with Sweden (1,619 km or 1,006 mi long), which is the longest uninterrupted border within both Scandinavia and Europe at large. Norway is bordered by Finland and Russia to the northeast, and the Skagerrak Strait to the south, with Denmark on the other side. It shares maritime borders with Russia by the Barents Sea; Greenland, the

Faroe Islands, and Iceland by the Norwegian Sea; and Sweden, Denmark, and the United Kingdom by the North Sea. Norway's extensive coastline, facing the North Atlantic Ocean and the Barents Sea, is laced with fjords, a renowned part of its landscape. The capital Oslo is the largest city in the nation, with a population of 630,000. Norway has extensive reserves of petroleum, natural gas, minerals, limber, seafood, fresh water and hydropower (Wikipedia 2014a).

Climate

China

China's climate is mainly dominated by dry seasons and wet monsoons, which lead to pronounced temperature differences between winter and summer. In winter, northern winds coming from high-latitude areas are cold and dry; in summer, southern winds from coastal areas at lower latitudes are warm and moist (Fu 2008). The climate in China differs from regions to regions because of the country's highly complex topography.

Norway

The climate in Norway is very special. The southern and western parts of Norway experience more precipitation and have milder winters than the southeastern part. The lowlands around Oslo have the warmest and sunniest summers but also cold weather and snow in wintertime (especially inland).

Because of Norway's high latitude, there are large seasonal variations in daylight. From late May to late July, the sun never completely descends beneath the horizon in areas north of the Arctic Circle, and the rest of the country experiences up to 20 hours of daylight per day. Conversely, from late November to late January, the sun never rises above the horizon in the north, and daylight hours are very short in the rest of the country. Due to that large latitudinal range of the country and the varied topography and climate, Norway has a larger number of different habitats than almost any other European country. And the Norwegian Shelf large marine ecosystem is considered highly productive (McGinley 2008).

Economy

China

China is one of the world's most populous countries, with a population of over 1.35 billion. The PRC is a single-party state governed by the Communist Party, with its seat of government in the capital city of Beijing. It exercises jurisdiction over 22 provinces, five autonomous regions, and four direct-controlled municipalities. Since the introduction of economic reforms in 1978, China has become one of the world's fastest-growing major economies. As of 2013, it is the world's second-largest economy by both nominal total GDP and Purchasing Power Parity (PPP), and is also the world's largest exporter and importer of goods (White 2013).

Norway

Norwegians enjoy the second-highest GDP per-capita (after Luxembourg) and fourth-highest PPP per-capita in the world. Today, Norway ranks as the second-wealthiest country in the world in monetary value, with the largest capital reserve per capita of any nation (Statkraft 2008). According to the CIA World Fact book, Norway is a net external creditor of debt (World Fact Book 2013). Norway maintained first place in the world in the UNDP (United Nations Development Program) Human Development Index (HDI) for six consecutive years (2001–2006) (Human Development Report 2013), and then reclaimed this position in 2009 (Human Development Report 2009) and 2010. The standard of living in Norway is among the highest in the world. Foreign Policy Magazine ranks Norway last in its Failed States Index for 2009, judging Norway to be the world most well-functioning and stable country. Based on continued oil and gas exports, coupled with a healthy economy and substantial accumulated wealth, Norway is expected to continue as among the richest countries in the world in the foreseeable future.

Education system

China

As the world economy becomes more and more integrated, education becomes internationalized at a greatly accelerated pace (Wang 2003). China runs the largest education system in the world. Since 1986, compulsory education in China comprises primary and junior secondary school, which together last for nine years (Education 2014). In 2010, about 82.5 percent of students continued their education at a three-year senior secondary school (Huang 2009). The Gaokao, China's national university entrance exam, is a prerequisite for entrance into most higher education institutions. In 2010, 27 percent of secondary school graduates are enrolled in higher education (Chen 2011). Vocational education is available to students at the secondary and tertiary level.

In February 2006, the government pledged to provide completely free nine-year education, including textbooks and fees (Xinhua 2006). Annual education investment went from less than US$50 billion in 2003 to more than US$250 billion in 2011 (Chen 2011). However, there remains an inequality in education spending. In 2010, the annual education expenditure per secondary school student in Beijing totaled ¥ 20,023, while in Guizhou, one of the poorest provinces in China, only totaled ¥ 3,204 (Roberts 2013). By 2007, there were 396,567 primary schools, 94,116 secondary schools, and 2,236 higher education institutions in China (Roberts 2013). As of 2010, 94% of the population over age 15 is literate, compared to only 20% in 1950.

Norway

Education in Norway is mandatory for all children aged 6–16. The Norwegian school system can be divided into three parts: Elementary school (age 6-13), lower secondary school (age 13-16), and upper secondary school (age 16-19).

Elementary and lower secondary school is mandatory for all children aged 6–16. Students

almost always have to change school when they enter lower secondary school and upper secondary school, as most schools only offer one of the levels. Higher education is anything beyond upper secondary school, and normally lasts 3 years or more. To be accepted to most higher education schools you must have attained a general university admissions certificate. This can be achieved by taking general studies while in upper secondary school or through the law of 23/5 where a person must be above 23 years of age, have 5 years of combined schooling and work experience and have passed exams in Norwegian, mathematics, natural sciences, English and social studies. Some degrees also require special electives in second and third grade (e.g. math and physics for engineering studies.)

Higher education in Norway may be divided into the university and non-university sectors (Naess 1992). The university sector comprises four universities and seven university colleges or specialized institutions in fields such as business administration, agriculture, veterinary medicine, architecture, music, etc. Courses last for four to seven years. The non-university sector comprises 26 state colleges and several minor private colleges (some of which receive public funding). They mainly offer short-term courses of two or three years' duration, but also some four- and five-year courses, for instance in teacher training and graduate engineering (Arnesen 2000).

The gross enrollment ratio of education in colleges and universities is 19% in China according to the world education report in 1995 under the United Nations Educational, Scientific and Cultural Organization. While in 1994, the gross enrollment ratio of education in colleges and universities in the west have been more than 30%, including France, Canada, the United States, Australia, Finland, New Zealand, Norway, which countries have already over 50%. Most astonishingly, Norway in 1998 comprehensive enrollment rate reached almost100%; adult literacy rate reached 99%.

From the statement above, we can see that nowadays, the mandatory education in China is 9 years and in Norway is 10 years. China starts to offer free education for primary and middle

school students form 2006 and Norway's education is always free includes higher education in university. While its Nordic neighbors Sweden and Denmark continue to provide free tuition for domestic and EU students only, Norway stands alone in offering free higher education to students regardless of citizenship.

1.2 Motivation

My study program is Natural Resources Management, so when I was thinking about the topic of my thesis, the first idea, which came into my mind was clean energy that comes from nature. I was born and grow up in China, a very big country that is still very thirsty of energy for further developing. Studying in Norway for these two years, country rich of petroleum and hydropower, driving me curious about what is the difference between these two countries' energy system and what are the youth views on renewable energy. It is also an opportunity for me to know Norway's culture, economy and politics better through comparison with China during the process of researching my subject. Therefore, I think the topic is very interesting and meaningful.

Norway is not a very familiar country for Chinese people compared with United States, England and other Western countries in Europe. Therefore, I hope through my research, I could transfer more information between these two countries and let people know each other better. Meanwhile, we might learn some successful cases in field of wind power from Norway.

To sum up, the main reason I choose this topic is to compare the perspectives among Chinese and Norwegian university students. Few have done this before, thus I hope to contribute to a better understanding among these young people.

1.3 Objectives

A general objective of this thesis is to understand how people assess the influences on local landscapes caused by wind farms. The study focuses on different views among Chinese and Norwegian university students towards renewable energy and wind power. The youth is the hope of the future and often have a fresh view and creative ideas. Therefore their opinions could have a great influence on further development of wind power. The objectives of this research include two parts.

A) To assess the wind farms conflicts in terms of:
   - Impact on local people
   - Impact on local landscapes

B) To assess university students view on the impacts caused by wind farms.
   - Access to the different living and education background among the respondents.
   - Access to the attitudes of these respondents on the conflicts that wind farms caused.

1.4 Research question

In line with research objectives, I am aiming to answer following questions:

- What is the current situation of wind power globally?
- What environmental issues wind farms has caused?
- How different perspectives are on these issues among Chinese and Norwegian university students?

1.5 Summary

In conclusion, with the increasing development of renewable energy globally, wind as a clean energy source attracted more attention by both China and Norway. China is viewed as the biggest developing country in Asia and Norway is a developed country in Europe.

Obviously, China and Norway have many different conditions on geographic location,

climate, economic conditions and education system as I described above. So does the situation of renewable energy development. How do young people in these two countries view on some issues about renewable energy would be a very interesting topic?

In my thesis, I focused conflicts on the regards to impact on local landscapes and explain the different views on these issues among Chinese and Norwegian university students. In addition, I will discuss conflicts between wind farm and local people in China. This is based on a short field study in Inner Mongolia.

2. Literature study

2.1 Literature review

The views of public on renewable energy resources, including wind energy, has appears sharply divided based on existing literature. At a general level, there is strong public support for the developing renewable energy. However, at the local level, there has been frequent controversy and public opposition. Because different technologies and social, economic and cultural contexts, the controversial is different. For instance, there are some studies that have identified conflict arising from geothermal energy development in Hawaii, tidal energy development in the UK, hydroelectric development in Australia, waste incineration projects in France and biomass development in the UK (Devine 2005). While conflicts occurred during the process of renewable energy development is in a different way with that in other energy resources such as fossil fuels and nuclear energy. It is the juxtaposition of high and stable levels of general public support with frequent local opposition to actual development, a phenomenon that has become known as the NIMBYism (not in my back yard) attitude (Gipe 1995).

Public attitudes' research on wind energy has been undertaken in developed countries like the USA, Canada, the UK, Denmark, Germany, Sweden and the Netherlands chiefly (Devine 2005). Most of this research is empirical in nature, and set out to identify specific reasons for negative public attitudes with items focusing upon landscape, acoustic, socio-economic, environmental and technical aspects. Reviewing the literature as a whole, apparently, the majority of empirical research studies have been guided by several key research questions as the followings:

1. What support exists amongst the public for a switch to wind energy from conventional resources?

2. What physical or environmental characteristics are linked to negative perceptions of wind farms?
3. Do those living closest to a wind farm have the most negative attitudes?

2.1.1 Historical background

Global warming and climate changes are discussed all over the world. Using of conventional fuels is viewed as one of the main contributors to the effect of global warming (Dennis 2012). In the meantime, demand of energy is still increasing, particularly in developing countries. So renewable energy sources have been developing for many years to meet the increasing energy demand. Wind energy is one of the most promising ones among the renewable energy sources. Utilization of wind energy can reduce the consumption of conventional fuels and speed up to meet the planned target of emission reduction in electricity generation (NINA 2013).

Wind power has a history of more than 3000 years. For example, people began to use windmills to pump water about 3000 years ago and to generate electrical power about 120 years ago in Egypt (Leung 2012). Actually they have used wind power for much longer than the coal and refined petroleum. Moreover, Chinese farmers started to use wind wheels with a vertical axis of rotation to drain rice fields, centuries before Europeans did so. However, the horizontal axis windmill was probably invented in Europe that was first found in the year of 1180 in the Duchy of Normandy (Hau 2000). Prof. James Blyth built a windmill to generate electricity in 1887 firstly in Scotland (Price 2005). Meanwhile, in the year 1888, the wind machine developed by Bruch and his colleagues was put into effect on the Atlantic coast successfully. From this moment forward, wind power technology start to develop step by step (Anon 1890).

In 1920, Kurt Bilau used an aircraft airfoil in a modern windmill design (Hau 2000). America widely developed small wind machines (<1 kW) and windmills without electrical systems in its rural places during the 1920s and 1930s. During this period of time the popularity of

windmills used reached its highest levels in the US, with about 600,000 units installed (Hepbasli 2004; Deng 2008).

In 1941, a prototype of the modern horizontal axis wind turbine was built in the US, and it was widely used to provide electricity to farms to which electric power lines could not reach (Hepbasli 2004; Wikipedia 2011a). However, in the beginning of 1950s, with the fast development of electric power lines, the market of wind power was gradually diminished (Hepbasli 2004). It is clear that the popularity of wind energy has always fluctuated with the price of fossil fuels when checking the development history of wind energy. Since the oil crisis in the early 1970s, the price of oil skyrocketed that led to a focus back on wind power development, and a boom took place in 1995 (Wikipedia 2011b). In the last decade, wind power experienced a leap in usage since the beginning of the 21st century. The world wind electricity generation capacity has doubled approximately every three and a half years (Wikipedia 2011b; Ackermann 2000).

During the period of last ten years, due to the concessionary policy towards the wind power industry adopted by many countries, wind market has developed rapidly and the technology of wind turbine has also experienced an important evolution over time (Leung 2012). Beyond the original pioneering countries, such as Germany, the USA, Denmark and Spain, countries like China and Turkey have made substantial efforts to develop their own wind power industry and developed very fast during these years (Hepbasli et al. 2004). It is estimated that wind power will provide 5% of the world's energy in 2020 (Herbert 2007). However, the wind power, which being used today mostly comes from onshore wind power. Meanwhile, there is a growing interested in offshore wind power as well. Because of wind at sea is normally stronger and more uniform than that on land. European countries are act as leaders in development of offshore wind power. Denmark has been applying offshore wind to supply electricity for more than 20 years (Sawyer 2010). In countries like the US, where coastal wind sources are abundant, offshore wind power also has the potential to become a major energy source to meet domestic energy demand (Musial 2006). Norway has abundant coastal wind resource as well and has been continuing making efforts on offshore wind power these years.

Although wind power has performed very well in recent years, it also brings about some strong environmental impacts, like noise, environmental, visual and climatic impacts. Even though these impacts seem minor when compared with fossil fuels, its effect on humans should not be ignored, due to its potential great development in usage afterwards. It is necessary to figure these potential drawbacks out, especially their potential long-term effects, and to find solutions of them in order to keep the long-term sustainability development of wind power (Leung 2012).

2.1.2 Key items

Before reviewing the literature I will generally discuss some key concepts.

Landscape

Landscape comprise the visible feature of an area of land, including the physical elements of landforms like (ice-capped) mountains, hills, water bodies like rivers, lakes, ponds, and the sea; human elements including different forms of land use, buildings and structures; living elements of land covering including indigenous vegetation and transitory elements such as lighting and weather conditions (Tilley 1994). Combining both their physical origins and the cultural overlay of human presence, often created over millennia, landscapes reflect the living synthesis of people and place vital to local and national identity. Landscapes, their character and quality, help define the self-image of a region, its sense of place that differentiates it from other regions. It is the dynamic backdrop to people's lives (Olwig 1996).

The earth has a vast range of landscapes including the icy landscapes of polar regions, mountainous landscapes, vast arid desert landscapes, islands and coastal landscapes, densely forested or wooded landscapes including past boreal forests and tropical rainforests and agricultural landscapes of temperate and tropical regions. Landscape may be further reviewed under the following specific categories: landscape art, cultural landscape, landscape

ecology, landscape planning, landscape assessment and landscape design. The activity that modifies the visible features of an area of land is named landscaping (Olwig 1996).

Aesthetics

Aesthetics is a branch of philosophy dealing with the nature of art, beauty and taste, with the creation and appreciation of beauty (Shimamura 2012). It is more scientifically defined as the study of sensory or sensory-emotional values, sometimes called judgments of sentiment. More broadly, scholars in this field define aesthetics as "critical reflection on art, culture and nature". More specific aesthetic theory, often with practical implications, relating to a particular branch of the arts is divided into areas of aesthetics such as art theory, literary theory, film theory and music theory (Shimamura 2012).

However, there is not permanent definition of aesthetics. Different people may have their own definitions on it. Like, For Alexander Gottlieb Baumgarten aesthetics is defined like that "the science of the sense experiences, a younger sister of logic, and beauty is thus the most perfect kind of knowledge that sense experience can have". For Ludwig Wittgenstein aesthetics consisted in the description of a whole culture which is a linguistic impossibility. For Friedrich Schiller aesthetic appreciation of beauty is the most perfect reconciliation of the sensual and rational parts of human nature (Shimamura 2012). But the core of aesthetics is "beauty "that we can tell form all these definitions.

NIMBYism

NIMBYism is an acronym for the phrase "Not In My Back Yard". Nimby is a pejorative characterization of opposition by residents to a proposal for a new development because it is close to them. It means that such residents believe that some developments are needed in society but should be further away from their land (Marcotte 2013). Opposing residents themselves are sometimes called Nimbies. Examples of projects likely to be opposed are homeless shelters, oil wells, chemical plants, industrial parks, military bases,

wind turbines, desalination plants, landfills, incinerators, power plants, prisons, pubs, adult entertainment establishments, mobile telephones network masts, abortion clinics, toxic waste dumps, group homes, youth hostels, sports stadiums, strip malls, housing developments, freight railway, highways, airports, seaports, and medical cannabis, dispensaries along with recreational cannabis shops (Gerdner 2003). The NIMBY concept may also apply more generally to people who advocate some proposal (for example, austerity measures like budget cuts, tax increases, or layoffs), but oppose implementing it in a way that would require sacrifice on their part (Marcotte 2013).

As for NIMBY perceptions of wind farms, which have been used as a means of describing the tension between general support for wind energy and local opposition to specific developments—that is a negative relation between general and local support for wind farms. The validity of NIMBYism as a negative relation between general and local perceptions of wind energy would be demonstrated by studies indicating support for wind farms at regional or national level, but not locally in close proximity to respondents' place of residence. In contrast, most empirical studies have identified a positive relation, at least in terms of support—with those in favor locally also in favor of wind farm development nationally (Simon 1996).

2.2 Current status of world wind energy

2.2.1 International case study

There are many researches attempting to identify possible reasons for public opposition to wind farms. Public attitudes anywhere in Europe show support moderately to strongly for the implementation of renewable energy. Nevertheless, planning the site of wind plant appears to be a complicated matter in most countries as I mentioned above. The visual impacts and noise are viewed as the most frequently reported problems (Simon 1996). Visual impact problems refer to the negative evaluation of the impact of a wind farm in a specific landscape context, whereas noise problems relate to negative evaluations of the noise made by rotating turbine

blades. Other reported complaints include perceived unreliability, high cost, dangerous impact upon birds and wildlife perceived inefficiencies compare to coal-fired power stations, suspicion of the motives of development organizations and annoyance at idle turbines (Devine 2005).

With respect to size, there are consistent results showing that smaller wind farms are more positively perceived compared with larger ones (Devine 2005). Research in Denmark reported that clusters of two to eight turbines received more public support than both scattered single turbines and larger arrays (AIM Research 1993). In the Netherlands, Wolsink (1989) reported that wind farm developments were less highly supported than stand-alone turbines in a review of 11 empirical studies. In Ireland, research indicated a preference for smaller, smaller numbers of large turbines were considered preferable to larger numbers of smaller turbines (Ireland 2003).

Visual impacts have consistently emerged as an issue of objection to wind farms. But few research studies have examined visual perceptions by systematically comparing how turbines of different color, shape or size are perceived. As a consequence of controversy, visual impacts are routinely carried out in wind farm planning applications as part of a wider environmental impact. That wind farms can be perceived to have a negative visual influence upon the landscape. Sometimes it is reflected in language, which used to describe visual representations, such as ‘zones of visual intrusion’, ‘visual burden’ and ‘visual impact’ (Berry 1998). The negativity is also reflected in the research priorities of government agencies, for example the UK had investigated the role of color in reducing the visual impact of turbines (Berry 1998). In Ireland (2003) that used photomontages to study comparative perceptions of the visual impact of different forms of development and differently sized wind farms in different landscape contexts. There was a survey among 1200 Irish people, which results showed that wind farms were more positively perceived than mobile phone masts, electricity pylons and fossil fuel power stations, but less positively than wooden poles carrying local electricity wires (Ireland 2003).

The controversy that occurred when making decision on the siting of wind turbines is usually referred to as mere 'communication problems'. However, public attitudes towards wind power are fundamentally different from attitudes towards wind farms (Wolsink 1989). This 'gap' causes misunderstandings about the nature of public support for renewable energy source. In particular where planners easily assume support for renewables can be generated by information campaigns emphasizing the environmental benefits, whereas opposition to renewable energy schemes can be explained by a selfish 'not in my backyard' attitude. Actually, majority people hold the view like that, being accustomed to such spatial distance, faced a moral difficulty in accepting renewable energy development closer to their back yards rather than the conventional low-awareness, 'out of sight, out of mind' experience (Morality 2000).

Perceptions of a wind farm lessen over time

A small number of studies conducted in different countries have used longitudinal designs to track self-reported perceptions of wind farms across time, chiefly prior to development and for some period afterwards (Gipe 1995). These have generally indicated that negative perceptions decline over time. The authors concluded that 'the results show, decisively, that any change of attitude from 1990 to 1992 is toward thinking that wind power is better'. In the Netherlands, Wolsink (1989) concluded similarly that approval increases following construction. This led to the conclusion that the level of acceptance of wind energy in a local area declines with construction and rises afterwards as the Figure 1 shows below.

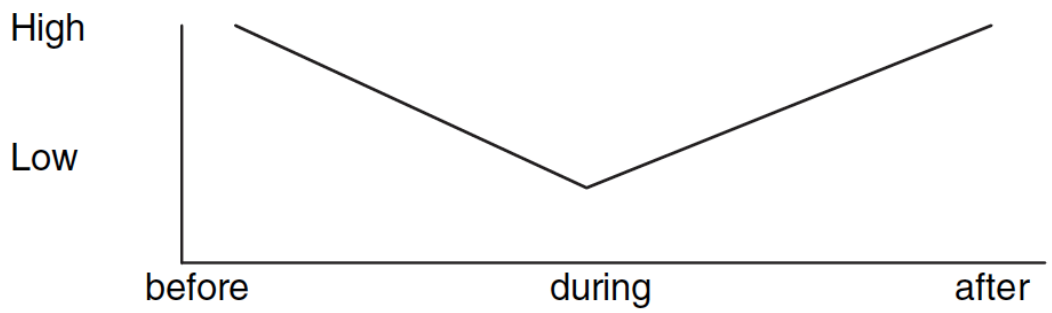

Figure 1 Level of acceptance of wind energy in a local area before, during and after construction of wind power plants (Gipe 1995)

Does NIMBYism explain opposition to wind farms?

Empirical researching on wind farm is often poorly grounded in existing social science theory. The most frequently cited explanatory concept that has been used is the NIMBY concept. It has been used to refer to both public perceptions generally and more negative perceptions of wind farms specifically (Wolsink 1996). Wolsink (1996) pointed out that NIMBYism actually represented a constellation of different attitudinal positions to both wind energy policy and development and he was critical of NIMBY assumptions such as:

• *Decision-making on facility siting is laborious;*
• *The project represents 'higher' interests than those of the local 'population';*
• *Everyone is agreed on the usefulness of those facilities;*
• *Everyone prefers not to have the facilities in their back yard;*
• *Everyone prefers to have the facilities sited in someone else's back yard;*
• *The attitudes and opinions that go to make up the NIMBY phenomenon are static.*

In a later empirical survey of three Dutch wind farm sites, Wolsink (2000) reported similar conclusions to those previously identified. Only 24% of respondents agreed that wind farms should be sited in other sites away from the locality. Wolsink (2000) contend that attitudes to a local wind farm were mainly explained by visual perceptions. He concluded that resistance behaviors were directly explained by local factors rather than more general arguments in favor of wind energy (e.g. that wind energy is a 'clean' energy source). Wolsink (2000) concluded that the data did not support the NIMBY hypothesis and to a great degree, that those opposed to wind energy locally were not in favor of wind farms anywhere.

Study about the impact of landscape/visual aspect

The visual evaluation of the wind power impacts on the values of the landscape is one of main factors in explaining why some people are opposed to wind farm implementation and why others support it. Moreover, on the basis of other research on how people judge aesthetic

value, it is the type of landscape in which the turbine is sited that is the most significant factor (Wolsink 1989).

The dominance of characteristics of landscape on attitudes can easily be illustrated on the huge differences in acceptability of wind turbines in different types of landscapes. There is a national environmental organization -Wadden Vereniging- that is an organization whose aim is to protect the Wadden Sea in Netherlands (Wolsink 2000). About half of the economically feasible wind energy potential in the Netherlands is located in the North and northwestern part of the country. The largest part is situated around the Wadden Sea wetland, an ecologically important area of shallows and small islands extending along the coast of Germany and Denmark. The assessment of the degree to which wind turbines would spoil the landscape in the Wadden region was also the strongest reason to oppose further wind turbine developments. Although the shallows are very important to large numbers of birds, it is still being considered secondly. This indicates that the choice between sustainable energy and ecological values is not really a dilemma for the members. They simply assess the applicability and acceptability of wind turbines in terms of visual intrusion, landscape quality and the consequences for the chosen location. Even from that point of view, most members think there will still be suitable wind turbines sites, even in a sensitive area like the Wadden Sea. Investigating the most important question for members, which sites are acceptable, the respondents were presented with a list of 19 characteristic landscapes. The variety in acceptability of wind turbines is enormous. Moreover, the judgments do not simply follow one pattern, according to the attitude towards wind power in the Wadden region (Wolsink 2005). About half of these options were rejected by a majority, some due to their location in nature reserves. Other examples of poor siting were recreational areas and locations near dwelling mounds, which are important cultural relics. However, some other locations were considered suitable places for wind turbines by about half the members and some by a clear majority.

Obviously, industrial areas and military training grounds, both harshly criticized by the environmentalists, were generally found acceptable for wind turbines. As regards the other locations, the majority of members that do not oppose turbines in the Wadden region tend to

view these as suitable sites. They offer many opportunities to generate large quantities of wind-power capacity. Generally considered fairly acceptable were turbines alongside the 32 km dike separating the Wadden Sea from the Ijsselmeer (Afsluitdijk). In 2001, the largest wind power scheme ever in The Netherlands (278MW) failed, because the government refused to negotiate, primarily with the Wadden Vereniging, and tried to implement the wind farm top–down. Actually, there were good options for a wind farm alongside the Afsluitdijk; however, the government did not communicate about the acceptability of different options, and it proposed a wind farm that for a small part was located in the northern part of the Ijsselmeer, whereas the larger part was located in the Wadden Sea. Particularly, the latter part is hardly acceptable for anyone, and the Wadden Vereniging succeeded to generate national political support for its resistance (Wolsink 2002).

2.2.2 Onshore wind farms across the world

Wind farm is used to collect wind turbines for generating electricity by capturing wind power. A large wind farm could contain several hundred-wind turbines and cover hundreds of square miles land as well. Most of the large onshore wind farms in operation are located in the US, the biggest of which is the Roscoe Wind Farm that installed capacity of 781.5 MW in total with 627 wind turbines. This project was finished in 2009, and covers an area of nearly 400 km^2 in Roscoe, Texas. The Dabancheng Wind Farm in China is the only one in Asia in the top 10-wind farms list; it is also the largest operational wind farm in China, which located in Xinjiang Province with the installed capacity of 500 MW. However, the Gansu Wind Farm under construction now in Gansu Province, China, the installed capacity of which is planned to grow to 20 GW by 2020 (Zhang et al. 2010). It will be the largest onshore wind farm in both China and the whole world in the future. Europe also has large numbers of wind farms, while the amount of wind farms in Germany stays in second place after the United States (Leung 2012). Nevertheless, with the rapid construction of large onshore wind farms around the world, the list of the top 10 largest onshore wind farms will soon be changed.

2.2.3 Installed wind power capacity in selected countries

The updated top five market contributors of global installed wind energy capacity are China, the US, Germany, Spain and India, respectively. The following section will give a brief overview of wind power installed capacity and outlook in these five leading countries, as well as some representative countries in European. Table 1 and Figure 2 show the cumulative installed capacity data of the 10 leading wind power countries until 2013 (GWEC 2013). While, Figure 3 clearly demonstrates global wind power development trends and speeds over the past decade.

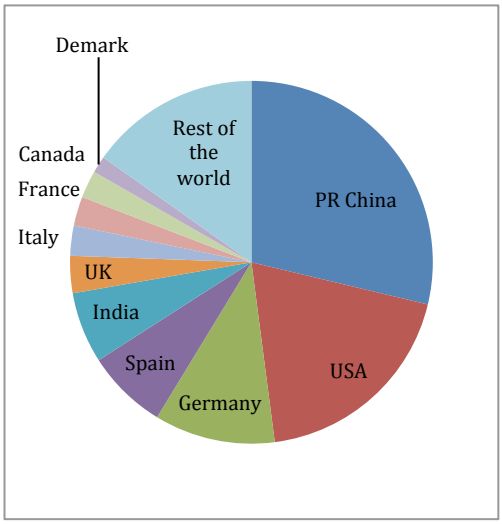

Figure 2 TOP 10 Countries Cumulative Capacities Dec 2013

Table 1 TOP 10 Countries Cumulative Capacities Dec 2013

Country	MW	% Share
PR China	91,412	28.7
USA	61,091	19.2
Germany	34,250	10.8
Spain	22,959	7.2
India	20,150	6.3
UK	10,531	3.3
Italy	8,552	2.7
France	8,254	2.6
Canada	7,803	2.5
Demark	4,772	1.5
Rest of the world	48,332	15.2
Total TOP 10	**269,773**	**84.8**
World Total	**318,105**	**100**

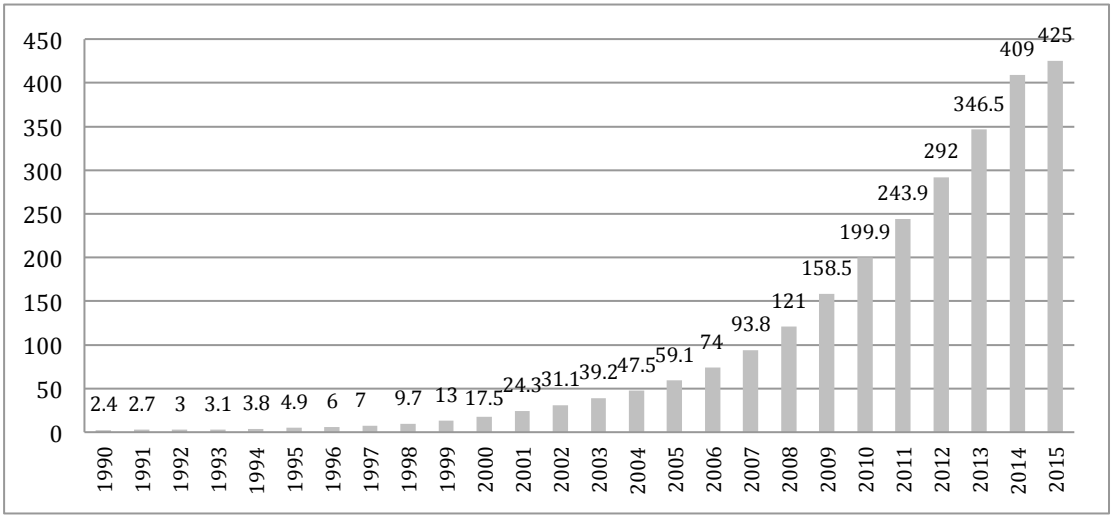

Figure 3 Global wind power installed capacity, GW, 1990-2015

Source: Wind power report 2010

China

In 2010, China overtook the place of the US as the leading producer of wind power with hitting a total of 42.3 GW (Global Wind Energy Council 2013). It is not surprising that China now as the biggest wind energy market replaced the United States, because China's total installed capacity has doubled every year from 2006 until today. Furthermore, the wind energy source is abundant in China, especially in the north part. The total exploitable capacity of China for both onshore and offshore wind energy is around 700–1200 GW, based on the third National Wind Energy Resources Census (Xu 2010). China started to utilize wind power in the 1970s. However, its utilization of wind power developed slowly until "The Renewable Energy Law of China" was issued in 2006 (Liu 2010). Then China's wind power market experienced a breakthrough, and its installed capacity reached 12 GW at the end of 2008 in total, an increase of 8.6 times over its capacity in 2005. With its rapid and seemingly unhampered expansion, the next goal of the Chinese wind power market is to reach 90 GW by 2015 and 200 GW by 2020, in which year China also plans to build an independent technical system (Global Wind Energy Council 2013). It is expected that wind power will also play an important role in China's energy structure in the middle of this century (Xu 2010).

The United States

Although the United States' wind energy capacity was surpassed by that of China in 2010, at the end of 2013 there was more wind farms under construction than ever before: over12, 000 MW of new generating capacity was under construction, with a record breaking 10,900 MW starting construction during the fourth quarter (Global Wind Energy Council 2013). The more than 61.1 GW of total installed wind power played an important role of the US power supply last year. The current operating fleet of wind capacity in the US can power the equivalent of more than 15 million average American homes (Global Wind Energy Council 2013). It is estimated that by 2030, wind energy will generate 20% of the US electricity if there are proper US policies, while at present it provides around 2% of the nation's electricity. The future of wind power in the US seems uncertain, but the manufacturers are appearing to treat the slowdown in 2010 as a short-term phenomenon (Global Wind Energy Council 2013).

Germany and Spain

Germany and Spain are as the main contributors of wind power producers in Europe and Germany maintained its position as the European leader in wind energy in 2013, ending the year with a total of 34,250 MW installed capacity spread over 23,761 operating wind turbines (Hot 2011). Renewable energy accounted for 23.5% of electricity generation in Germany, with wind energy being the single largest contributor, supplying about 8% of Germany's net electricity consumption (Global Wind Energy Council 2013). Additionally, the new installed capacity includes 108 MW of offshore wind power. The development of offshore wind power technology is paid more attention by Europe countries nowadays. On the other hand, the rapid development of wind power has also created 5000 jobs for around 100,000 people in Germany (Hot 2011). It is predicted by the German Wind Energy Association (GWEA) that the country would hit 45 GW of onshore and 10 GW of offshore wind by 2020 (Global Wind Energy Council 2013).

As for Spain, despite experiencing a financial crisis in 2010, Spain still retained its second place in Europe, after Germany. By adding more 1.5 GW wind energy, Spain brought the total installations up to 20.7 GW in the end of 2013 (Global Wind Energy 2013). On windy days, wind power can be the largest energy source in the country. It is estimated by the Spanish Wind Power Association (AWPA) and the Renewable Association that Spain should reach a capacity of 45 GW (40 GW on-shore and 5 GW offshore) by 2020 (Global Wind Energy 2013).

India

By renewable energy policies being issued in 2003, India achieved great energy returns in 2013 with adding new wind energy installations of 1.7 GW, reaching over 20 GW at the end of 2013. Now India is put in the fifth place among global producers of wind power (Global Wind Energy Council 2013).

Other potential European wind producers

Across Europe, 12,030 MW of wind power was installed during 2013, with European Union countries accounting for 11,159 MW of the total. Germany remains the largest installed capacity of the EU countries, followed by Spain, the UK, Italy and France. Eleven other EU countries have over 1 GW of installed capacity, which are Austria, Belgium, Denmark, France, Greece, Ireland, the Netherlands, Poland, Portugal, Romania and Sweden. There are eight countries (Denmark, France, Germany, Italy, Portugal, Spain, Sweden, United Kingdom) have more than 4 GW of installed wind energy capacity in Europe. Annual wind power installations in the EU have increased steadily over the past 13 years from 3.2 GW in 2000 to 11 GW in 2013, representing an average annual growth rate of over 10% (Global Wind Energy Council 2013).

In late March 2014, the Heads of State of the EU's 28 Member States will meet and discuss the Commission's proposal for a 2030 climate and energy framework. The advanced

countries in the field of wind power, like Germany, need to show leadership and demand more ambition that including a renewables target of over 30% with national targets for all Member States (Global Wind Energy Council 2013).

In order to produce more wind power and reduce the cost of renewable energy generation, more powerful and larger-scale wind turbines are needed. Therefore, the sizes of the wind turbines, including both blade length and generation capacity, are becoming larger and larger. At the meantime, it means that the size of wind farm also has to be expanded. In a large modern wind turbine, the generator can be 100 times of the size of a similar turbine in 1980, and the blade length has increased almost 8 times (Leung 2012). Typically, the rotor diameter in modern wind turbines ranges from 40 to 90 m, and is rated between 500 kW and 2 MW. Until now, the maximum onshore wind turbine size in operation is 6.5 MW, which doubled the size of the largest turbine in 2005 (Global Wind Energy Council 2013). Along with the bigger size of wind turbine, the more negative impacts it will have especially as on birds.

2.3 Wind power in China

2.3.1 Environment situation

In recent decades, China has suffered from severe environmental deterioration and pollution (Ortolano 2000). While regulations such as the 1979 Environmental Protection Law are fairly stringent, they are poorly enforced, as they are frequently disregarded by local communities and government officials in favor of rapid economic development. Urban air pollution is a severe health issue in the country, like the smog in many cities such as Beijing, Nanjing, Shanghai etc. in China recently; the World Bank estimated in 2013 that 16 of the world's 20 most-polluted cities are located in China (NINA 2013). China is the world's largest carbon dioxide emitter as well (NINA 2013). In addition, the country still has some water problems. Roughly 298 million Chinese in rural areas do not have access to safe drinking water (Hui 2012), and 40% of China's rivers had been polluted by industrial and agricultural waste by

late 2011 (Jain 2011). This crisis is compounded by increasingly severe water shortages, particularly in the northeast of the country.

And yet for all that, China is the world's leading investor in renewable energy commercialization, with $52 billion invested in 2011 alone (Friedman 2010); it is a major manufacturer of renewable energy technologies and invests heavily in local-scale renewable energy projects (Biello 2008). In the beginning of 2013, China began a five-year plan, US$277-billion effort to reduce air pollution, particularly in the north of the country (Upton 2013).

2.3.2 Current energy situation

In the past several decades, especially after the reform and opening up in 1978, the energy industry in China has experienced great growth. It is reported that the energy consumption in 2009 amounted to 3.1 billion (Zhao 2010). The domestic energy supply reliance is over 90% (Zhao 2010), as the Chinese government holds firmly to the principle that its energy supply must rely mainly on domestic resources, and coal-dominance in the primary energy mix remains unchanged (Wang 2002). China has by now established a comprehensive energy industry system including the entire chain from energy exploration, transportation, storage, processing and conversion, research and development, design, equipment manufacturing, construction and engineering services. The current energy situation in China can be described as that of multiform energy resources with low per capita possession quantities; rapid growth of energy consumption with relatively low energy efficiency and heavy environmental impacts with coal as the main primary energy source (Zhang 2011).

China's Renewable Energy Law issued on February 28, 2005, and having taken effect on 1st January 2006. It has identified the key role of the renewable energy as "increasing energy supply, improving energy structure, guaranteeing energy safety, protecting environment and realizing the sustainable development of economy and society" (Zhang 2009). In the year of its implementation, the proportion of the installed capacity of renewable energy from the total

installed capacity stopped descending and began to climb. In 2009, the cumulative installed capacity of renewable energy reached 212.9 GW (Zhao 2010), and accounted for 24.4% of the total installed capacity for electricity generation (Zhao 2010).

China has abundant renewable energy resources, and is especially rich in hydropower potential. The hydropower resources are 676 GW (China energy Statistics Yearbook 2008), which ranking as the largest in the world. Electricity generation from hydropower reached 554.5 TWh, that is 15% of the total electricity generation in 2009 (Information of electricity industry 2010). The country's annual solar energy flux ranges from 3360 to 8400 MJ/m2, and two thirds of China's surface receives a solar radiation flux that is above 5020 MJ/m2 with annual sunshine for more than 2000 h (Zhang 2010). Potential for biomass energy in China includes mostly crop stalks, firewood, animal and human wastes, domestic garbage, industrial organic wastes and waste water (Ma 2009). It is estimated that the total exploitable biomass energy in China is around 700 million, more than half of which are crop stalks (Zhang 2009). But China still face a lot of challenges during the process of developing renewable energy like technical problems，environmental problems, energy efficiency，markets，and problem of investment and income (Zhang 2009).

China has abundant wind energy resource as well. The development potential of onshore wind resource is estimated to be as much as 253 GW at a 10 m height with an annual electricity generation of more than 50 billion kWh (Zhang 2009). Developable offshore wind resources are about 3-fold larger than those on land, i.e. around 750 GW (Zhang 2009). Up to the year 2013, a total of 500 wind power plants have been completed, with a total installed capacity of 16.1 GW. Currently the wind fields are mainly located in the North (Inner Mongolia), Northeast (Liaoning, Jilin, Heilongjiang), East (Hebei, Jiangsu), West (Gansu), and Northwest (Xinjiang). Several more wind power bases would be constructed in Xinjiang, Gansu, coast area of Jiangsu and Shanghai, Inner Mongolia, Hebei and Jilin provinces.

China pays more attention on developing renewable energy, especially wind energy during these years. And the development of wind power grows fast, which total installed capacity in

the list of top 10 countries in the world. Before 1970s, wind power was unknown to most people of China, and was insignificant in comparison with the cutting-edge countries such as Denmark, the U.S. and Germany (Korsnes 2012). However, China has rich resource of wind especially in north, which gives high potential for wind power development. Wind power market has developed fast but the utilization of wind power in China started relatively late compared with other countries such as German, United State, Spain etc. after the first Chinese wind farm was constructed in 1986 in Shandong province (Korsnes 2012).

2.3.3 Some case studies in China

Development of renewable energy resources is being promoted as a promising method of solving rural energy issues and improving life condition of rural dwellers (Liu 2012). As planned in the mid and long term development plan of renewable energies in China, up to 70% of rural households should have adopted renewable energy in their daily lives by 2020 (CCICED 2009). Although governments and research institutes worldwide express a generally positive attitude towards renewable energy, these years have witnessed that some renewable energy projects faced resistance from the local population (Liu 2012). Some studies also demonstrated the contradiction between an ambitious high-level target and weak local acceptance (Batley 2001). It is especially common in China that a target is set via top-down approaches, but in terms of public preferences less are concerned with. Rural dwellers are major consumers of energy for rural residential use. However, their preferences are easily overlooked given their little involvement in decision-making of public projects. Actually rural households could be easily involved in the production of (renewable) energy. The production of renewable energy by Chinese rural households plays a key role in the formation or transformation of rural domestic energy uses. So far rural renewable energy utilization is mainly in the field of residential use (CCICED 2009). Learning the attitudes of rural residents towards renewable energy, we are better able to understand how to expand renewable energy in rural areas as a way of reducing carbon emission and improving rural living conditions.

Willingness to pay for renewable energy was usually evaluated as a reflection of residents' attitudes or preferences, followed by some examinations on determinants or influencing factors of social acceptance (Nomura 2004). Site-specific or personal factors are pointed out to be with major influences which may refer to socio-economic characteristics, living conditions, family income, residence size, individual age, education, social status and personal experience and so on. For instance, villagers were unwilling to change cooking routines and refused to pay for the installation of green electricity. Obviously, there are various obstacles to renewable energy deployment especially in rural areas in light of poor economic condition, low educational level and others. It needs to explore pathways suitable for rural China focusing on participation mechanism or policy systems including price management and subsidy system (Liu 2012). Different from many developed countries, where households need to pay more if they choose and consume green electricity rather than traditional thermal power, so far in China the higher cost of electricity production from renewable energy is to a large extent balanced by governmental subsidies. Judging from experiences of countries with remarkable renewable energy development, high price of green electricity is bound to be spread upon end-use consumers and a diffusion of green electricity surely needs to rely on consumers' choices and behaviors. That may also be a future in China (Liu 2012).

2.4 Wind power in Norway

Norway is a big producer of renewable energy, and its power supply system is highly rely on hydropower, accounting for as much as 97% of the total production and making Norway as one of the world leaders in renewable energy production (Gebremedhin 2012). In Norway, there is also a large potential in the development of onshore and offshore wind power, wave power as well as production of bio-energy from wood. Although Norway has limited resources in solar energy, it is one of the world's largest producers of solar grade silicon and silicon solar cells.

However, the dependence on hydropower in Norway is nor always positive for producers or customers, particularly, during periods of low precipitation and high demand (cold winters). It is not known how much of the imported power is based on fossil fuels. Consumers are also advised through the media to reduce their consumption in order to slow down the utilization of stored water in the reservoirs. Other renewable energy sources such as wind power, biomass and ocean energy may contribute to a more sustainable energy system not only on a national level but also in broader system perspectives. The ambitious goal set by the Norwegian government will definitely require action in this direction.

2.4.1 Environment situation

While in Norway, because of most of the electricity comes from hydropower that is very clean energy source, the whole country has a very good environment condition. As for people in Norway that have higher-level awareness of environmental compare with Chinese, so they don’t face serious environmental problems. And, stunning and dramatic scenery and landscape is found throughout Norway. The west coast of southern Norway and the coast of northern Norway present some of the most visually impressive coastal sceneries in the world. National Geographic has listed the Norwegian fjords as the world's top tourist attraction (Hamashige 2009). The 2012 Environmental Performance Index (EPI) put Norway in third place, based on the environmental performance of the country's policies.

2.4.2 The Energy Certificate Market

Due to the growing awareness of climate change and energy dependence, many countries in Europe have begun to discuss whether the governments should encourage the renewable energy development. Electricity Production from Renewable Energy Sources (RES Directive) is regarded as one of many ways to encourage the development of renewable energy (Council European Parliament 2009). The RES Directive comes in force in Norway through the European Economic Community (EEC) (Kullmann 2012).

Norway has been part of a Norwegian-Swedish electricity certificate market since 1st January 2012, which encouraging increased development of renewable energy. This bilateral certificate market is a support scheme for renewable energy, estimated to introduce 26.4 TWh of renewable production by 2020 (Kullmann 2012). The Norwegian government is obligated to further develop renewable energy as a result of the Kyoto protocol and directive 2001/77/EC1 (the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market) of the European Parliament (Kullmann 2012). One of actions taken by the government in order to increase the level of renewable energy was the introduction of the Swedish-Norwegian Renewable Energy Certificate System. The certificate system will generate an extra revenue-stream to develop the new and renewable electricity production.

2.4.3 Current energy situation

Since the discovery of North Sea oil in Norwegian waters during the late 1960s, exports of oil and gas have become very important elements of the economy of Norway. In 2011, Norway was the eighth largest crude oil exporter in the world (at 78Mt), and the 9th largest exporter of refined oil (at 86Mt). It was also the world's third largest natural gas exporter (at 99bcm), having significant gas reserves in the North Sea (Encyclopedia 2014; Statistics 2011). Norway also possesses some of the world's largest potentially exploitable coal reserves (located under the Norwegian continental shelf) on earth (Wideroe 2005).

With North Sea oil production having peaked, disagreements over exploration for oil in the Barents Sea, the prospect of exploration in the Arctic, as well as growing international concern over global warming, energy in Norway is currently receiving close attention. Three million barrels of oil adds 1.3 Mt of CO2 per day to the atmosphere as it is consumed, 474 Mt/year. Thus the global CO_2 impact of Norway's activities is significant. Much of the CO_2 creation happens outside of Norway's borders, from Norwegian fossil fuels.

The alteration to a more environmental friendly energy production and use in Norway is since 2002 managed by Enova SF. Enova is a public enterprise for promoting energy savings, new renewables and environmentally friendly natural gas solutions. Enova is owned by the Government of Norway, represented by the Ministry of Petroleum and Energy. Its main mission is to contribute to environmentally sound and rational use and production of energy, relying on financial instruments and incentives to stimulate market actors and mechanisms to achieve national energy policy goals (Rosenberg 2006).

And Norway was the first country that to operate an industrial-scale carbon capture and storage project at the Sleipner oilfield, dating from 1996 and operated by Statoil. Carbon dioxide is stripped from natural gas with amine solvents and is deposited in a saline formation. Electricity generation in Norway is almost entirely from hydroelectric power plants. Of the total production in 2005 of 137.8 TWh , 136 TWh was from hydroelectric plants, 0.86 TWh was from thermal power, and 0.5 TWh was wind generated (Statistics 2011). Based on the statistics, Norway is in shortage of electrical power production. The consumption of electrical power will exceed the domestic generation in a normal electrical power production year. Hence, in a year with average hydrological conditions, Norway will import electricity from its neighbors. This is one of the reasons why the Norwegian government has announced that more wind power will be installed in Norway by 2015 (Rosenberg 2006).

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The use of wind power is not new in Norway. Historically, wind power was already used in pumping of water, and later, to produce electricity in remote areas in the 19th century in Norway (Müller 2011). Norway has a lot of potential with respect to develop wind power and this can be used in the production of more electricity in a clean way. By the end of 2009, there was installed 420 MW of wind power in Norway, producing slightly more than 1 TWh a year, or slightly less of 1 percent of the total electricity production in Norway. In the development plan for the central grid 2010, Statnett are using one common forecast towards 2015, called Expectation 2015. In this plan, three scenarios are analyzed towards 2025 (IFE 2013):

- Low end use demand
- Wind power and growth
- Electricity export and exchange

Obviously, it shows that Norway has paid more attention on wind power during the periods from 2010 to 2015. Now, state-of-the-art wind power plants can generate electricity at a price that is becoming competitive with conventional energy sources. It is the main challenge to make the new wind turbines compete head to head on a cost of energy basis with conventional energy sources. The following Figure 4 and Table 2 show the increasing of wind energy capacity of Norway form 1997 to 2013, we can see from the Figure 4 that Norway has experienced a great leap development during the last decade.

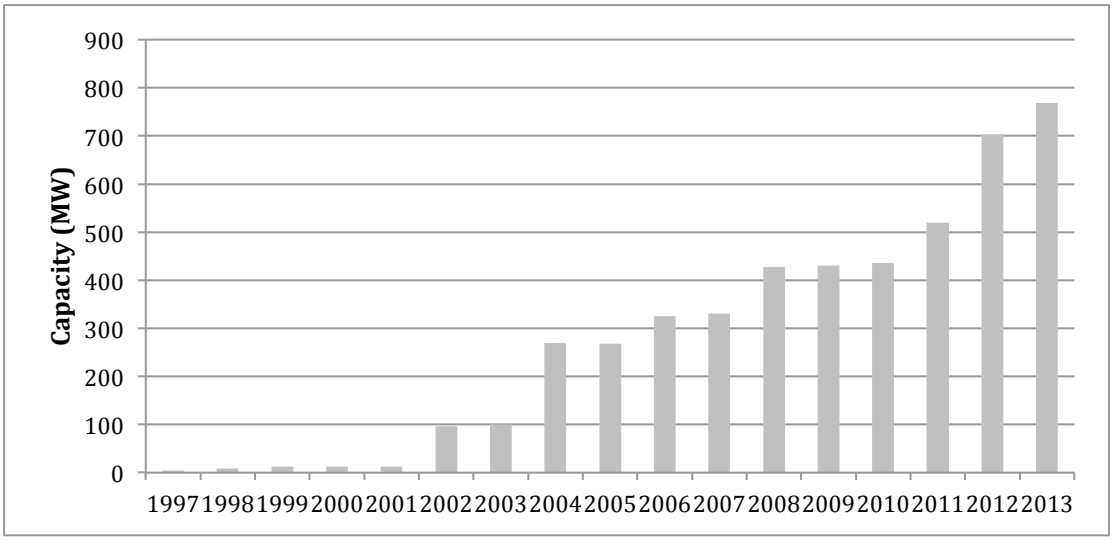


Figure 4 Wind energy capacity of Norway from 1997 to 2013
Source: http://www.gwec.net/

Table 2 Wind energy capacity and increased percentage of Norway from 1997 to 2013

- End 1997: 4 MW
- End 1998: 9 MW (+125 %)
- End 1999: 13 MW (+44.5 %)
- End 2000: 13 MW (- %)
- End 2001: 13 MW (- %)
- End 2002: 97 MW (+646.2 %)
- End 2003: 100 MW (+3.1 %)
- End 2004: 270 MW (+170 %)
- End 2005: 268 MW (-0.7 %)
- End 2006: 325 MW (+21.3 %)
- End 2007: 331 MW (+1.9 %)
- End 2008: 428 MW (+29.4 %)
- End 2009: 431 MW (+0.8 %)
- End 2010: 436 MW (+1.2 %)
- End 2011: 520 MW (+19.3 %)
- End 2012: 703 MW (+35.2 %)
- End 2013: 768 MW (+9.3 %)

Source: http://www.gwec.net/

According to the Norwegian Water Resources and Energy Directorate (NWRED) Norway had a wind-power capacity of 811 MW and a production of 1898 GWh (Table 3) in 2012. Wind power represented 1.1 percent of the country's total power production. Norway has awarded concessions to build eight new onshore wind farms for about 20 billion kroner ($3.3 billion) in a bid to triple the country's capacity to more than 2 GW by 2020.

Today, wind farms in Norway could produce electricity for 50,000 households in total. The largest wind farm is in Smøla, Nord-Møre that has the largest number of wind turbines (68 wind turbines) in Norway and the smaller ones are in Finnmark, Nordland and Trøndelag (Table 3) (Müller 2011). The Smøla wind park was built in two steps that opened in September 2002 and September 2005, respectively. It is also the largest land-based wind generating facility in Europe. It produces energy corresponding to the combined average electricity consumption of 22,500 Norwegian households (Müller 2011).

Table 3 Wind farms in Norway 2013

Vindkraftverk	Eier	I drift år	Antall turbiner	Installert ytelse [MW]	Rapportert produksjon [GWh]
Andøya	Andøya Energi AS	1991	1	0,4	0,59
Hovden	Vesterålskraft Produksjon AS	1991	1	0,4	0,60
Vikna	Nord-Trøndelag Elektrisitetsverk	1991	2	0,9	1,48
Fjeldskår	Norsk Miljø Energi AS	1998	5	3,75	7,34
Harøy, Sandøy	Sandøy Energi AS	1999	5	3,75	8,26
Mehuken I&II	Kvalheim Kraft	2001	13	22,65	67,91
Smøla I&II	Smøla Vind AS (Statkraft)	2002	68	150,4	305,7
Havøygavlen	Arctic Wind AS	2002	16	40,5	88,49
Utsira I&II	Solvind Prosjekt AS	2004	2	1,2	3,51
Hitra	Hitra Vind AS (Statkraft)	2004	24	55,2	132,5
Nygårdsfjellet I&II	Nordkraft Vind AS	2005	14	32,2	86,52
Kjøllefjord	Kjøllefjord Vind AS (Statkraft)	2006	17	39,1	119,2
Valsneset	TrønderEnergi Kraft AS	2006	5	11,5	29,66
Bessakerfjellet	TrønderEnergi Kraft AS	2008	25	57,5	160,71
Hywind	Statoil ASA	2009	1	2,3	8,28
Høg-Jæren I&II	Jæren Energi	2011	32	73,6	224,64
Åsen II	Solvind Åsen AS	2012	2	1,6	3,89
Fakken	Troms Kraft AS	2012	18	54	128,4
Ytre Vikna	Sarepta Energi AS	2012	17	39,1	103,85
Lista	Lista Vindkraftverk AS	2012	31	71,3	208,25
Annen vindkraft*			57	149,5	208,27
sum			356	811	1 898

*Vindkraftverk som ikke var under normal drift i 2013 (Hundhammerfjellet, Valsneset testsenter, Midtfjellet)

Source: https://www.ssb.no/en/forside

2.5 Summary

Based on the literature study, renewable energy sources have been developing for many years to meet the increasing energy demand around the world for slowing the step of global warming. Wind power has been regarded as the most promising renewable energy source and has been used for a long time as well. During this decade, it develops very fast, especially in Germany, the USA, Denmark and Spain, developing countries like China and Turkey have also made substantial efforts to develop their own wind power industry and growth very fast.

With the fast development of wind power, in order to generate more electricity, the size of wind turbines become bigger and bigger as well as the wind farms. So construction of wind

farms bring about some strong arguments, even though wind power has performed very well in recent years. Public reaction to the wind power appears sharply divided during its development. On one hand, public support for the development of wind power, but on the other hand, there are many arguments about it due to some negative impacts (noise, landscapes, birds, land occupation etc.) caused by wind farms at local level. And the attitude towards wind power among local people called NIMBYism. However, the perception of a wind farm is changing over time. The level of acceptance of wind energy in a local area declines with construction and rises afterwards

China now is the biggest wind energy market replaced the United States with the abundant wind energy source and fast technology development. It is expected that wind power will also play an important role in China's energy structure in the middle of this century. Wind power market has developed fast but the utilization of wind power in China started relatively late compared with other countries such as German, United State, Spain etc. Furthermore, especially, in China the target of wind power development is set via top-down approaches, but in terms of public preferences less are concerned with.

Norway has a substantial renewable energy potential that which is of great importance both on the national level and on the continental level. This is particularly important in Europe, where the need for lower dependence on fossil fuels increasing. It is therefore essential that a broader perspective be applied and cooperation in the energy sector increased when developing the potential renewable energy sources in Norway.

Generally, China and Norway have very different energy resources conditions and energy system. But both of them are now struggling to cope with the development of cleaning energy due to the global issue of climate change and pollution. China still has a long way to go on the development of renewable energy, so it will be possible to learn some good models from Norway.

3. Methodology

3.1 Introduction

I have used both qualitative and quantitative research methods in my thesis. Qualitative research is a method of inquiry employed in many different academic disciplines, traditionally in the social sciences (Norman & Lincoln 2005). It is the method that investigates why and how of decision making, not just what, where, when. Hence, smaller but focused samples are more often used than large samples. The most common method is the qualitative research interview, but forms of the data collected can also include group discussions, observation and reflection field notes, various texts, pictures, and other materials (Baden 2013). Qualitative researchers aim to gather an in-depth understanding of human behavior and the reasons that govern such behavior.

Quantitative research is often contrasted with qualitative research, which is the examination, analysis and interpretation of observations for the purpose of discovering underlying meanings and patterns of relationships, including classifications of types of phenomena and entities, in a manner that does not involve mathematical models. Qualitative research is often used to gain a general sense of phenomena and to form theories that can be tested using further quantitative research (Moghaddam 2008).

In sociology, quantitative research refers to the systematic empirical investigation of social phenomena via statistical, mathematical or numerical data or computational techniques (Given 2008). The objective of quantitative research is to develop and employ mathematical models to test, theories and/or hypotheses pertaining to phenomena. The process of measurement is central to quantitative research because it provides the fundamental connection between empirical observation and mathematical expression of quantitative relationships. Quantitative data is any data that is in numerical form such as statistics, percentages, etc. (Given 2008).

Using the qualitative method in social science researches involves doing fieldwork or collecting primary information, which is centrally important part of this study. This study is based on the primary information but secondary information is also used when required.

3.2 Primary data collection

I got my primary data by both qualitative and quantitative methods. I did surveys among university students in China and Norway. These are the most important data for this study. In addition, during fieldwork in a new wind farm in Inner Mongolia in China, I collected data by interviews and observations mainly. I also took photos and kept record of field notes as my original data.

3.2.1 Data from fieldwork in Inner Mongolia

Though studying in Norway, I found that Norway pays high attention to develop renewable energy, especially hydropower and wind power. Compare to China, in which country, wind power developed very fast these years, there are exit many situations could be compared. As for me, I am very interested in the research topic of the influence of wind farms. So I decided to do my fieldwork in a wind farm in Inner Mongolia in China and to see what is happening on earth in a Chinese wind farms.

Interview

Interview is the most common and widely employed method in qualitative research, which seeks to describe the meaning of central themes. It is a technique used to understand the experiences of others (Seidman 1998). The semi-structured standardized interview allows the respondents to contribute as much information as they desire. It is the most popular form of interviewing in qualitative research because of the format of questions is open and respondents are free to express their opinions related on topics or questions.

During my fieldwork in Inner Mongolia used semi-structured interview system to

communicate with respondents. I interviewed four people who worked in Han Wu La Wind Farm with different backgrounds. It is important to reflect on how the interviews will be analyzed before the interviews are conducted (Kvale 1996). Therefore the interview guide, a sample of which is attached in appendix, was shaped with a view to the problem at heart for this study, and line with the theoretical framework. The use of following up questions during the interviews was meant to clarify the position of the informant, or to confirm or reject my own hypotheses about the wind farm impacts. The interview guide was revised several times, and adapted to the individuals I interviewed. Also, as I learned more about the topic, some questions were added or removed.

Each interview lasts about 30 min, and I asked for their permission to take records. All the transcriptions were performed by the same person, and after each transcription were was done, I read the transcription and listened to the audio material simultaneously in order to verify and correct the transcription. Most of the informants had received a copy of the interview guide before interview.

Observation and participation

Observation is one type of data collection method typically done in the qualitative research paradigm. It is a widely used methodology in many disciplines, like sociology, communication studies, human geography and social psychology. Its aim is to gain a close and intimate familiarity with a given group of individuals (such as a religious, occupational, sub cultural group, or a particular community) and their practices through an intensive involvement with people in their cultural environment, usually over an extended period of time (Malinowski 1929).

Since the March 2013, I have attempted to immerse myself in the Chinese wind power development, signing up to various e-mail lists, such as the Beijing Energy Network, and participating in online groups; for instance, on LinkedIn, a professional networking website. In the summer holiday in 2013, I got an opportunity to participate a summer course in Shanghai Jiao Tong University (STJU) for two weeks (24 June to 12 July 2013). The theme

of the course was: Energy, Environment & Society. The overall objective of the course was to explain the political, economic, environmental and social aspects of energy production and consumption. Better understanding of these issues is important with regards to participate in technological, political and business development of the energy domain. Before that course, I visited the Wind Power Expo that was held in Shanghai and helped professor Gard Hopsdal Hansen doing a survey about this Expo.

After the summer course, I got another opportunity to do my fieldwork in Han Wu La Wind Farm in Inner Mongolia, but only for one week. It was not easy to get access to do it longer. But during that time I stayed with the people who work in Han Wu La Wind Farm almost everyday. Even though it is not a long time for me to observe the whole situation in Han Wu La Wind Farm, I tried my best to observe the workers, residents and events as more as possible.

Field photos and notes

Excepting talking with people, I also took many photos and notes in the construction site as my original data. The photos could reflect some conflicts that Han Wu La Wind Farm caused directly. The notes were good reminder that helpful for me to analysis the data when I came back to Norway. I put some typical photos in appendix, which showed some negative impacts that Han Wu La Wind Farm caused, such as the new roads inside wind farms, the sheep was grazed under wind turbines, burned garbage at random and conflicts with local people. These photos can be vivid evidences of my research.

3.2.2 Data from survey

From doing this fieldwork, I gained a better knowledge of current situation of wind power in China. But considering about wind power is an emerging renewable energy, I really wanted to know what young people think about it. Will they see it from the overall viewpoint? In order to work this hypothesis out, I designed a questionnaire for undergraduate university students in China and Norway. The questionnaire is posted in appendix. So the data from the

questionnaire is the main source of my study.

In this study, non-probability was sampling techniques were adopted. The survey was devoted to Chinese and Norwegian university students. As I am living in Norway, I asked my friend to help me do this survey in two classes in Chinese universities -- Northeastern University (NEU) and Yanshan University (YSU), the first is a biomedical engineering class in NEU, and the other is a economic management class in YSU. There were 200 hundred students in these two class and 186 students of them answered my questionnaires.

In Norway, I got opportunities to administer the survey it in two classes from Geography department. One was a class of Climate Change and effects led by professor Päivi Lujala. The other is class of Population Resources and Environment led by professor Jorund Aasetre. I also did this questionnaire in petroleum department and marine technology department in NTNU. Lastly, I got 130 answered questionnaires form Norwegian students.

To sum up, I received 316 questionnaires from both China and Norway, 186 from Chinese students and 130 from Norwegian students.

3.3 Secondary data

After receiving the questionnaires from Chinese and Norwegian university students, I used SPSS and Excel to deal with the original data. SPSS is a widely used soft program for statistical analysis in social science. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners, and others. The original SPSS manual (Nie, Bent & Hull, 1970) has been described as one of "sociology's most influential books" for allowing ordinary researchers to do their own statistical analysis. In addition to statistical analysis, data management (case selection, file reshaping, creating derived data) and data documentation (a metadata dictionary is stored in the data file) are features of the base software.

I classified the participants by several main factors as nationality, study background and gender and then calculate the answers separately by SPSS. The results I got from the calculation as my main secondary data. In addition, before I started my survey, I collected a lot of relevant information and database from Internet, books and newspaper.

3.4 Barriers and ethical dilemmas

In China, it is not easy to get access to information and relevant informants, especially some kinds of sensitive research topics. Heimer and Thøgersen claim that political sensitivity in China "become a question of timing as well as the audience and the use of the information" (Heimer.M 2006). Having talked with some experienced researchers in the field of energy in universities in China before I did my survey, it was established that renewable energy is not at all sensitive; rather, it seems to be a field China is proud of (Korsnes 2012). Rather than the sensitivity of the topic, what proved to be a barrier to access was the chance to do fieldwork or even go and have a look at in a real wind farm. I sent a lot emails to wind power companies and tried to get a chance to do my fieldwork, but I didn't get any replies. Fortunately, I knew an engineer named Kaiyu Liu who is working for Da Tang Wind Power Corporation though my brother in law, and I got an opportunity to do my fieldwork in the wind farm, which he is working on finally. The connection is very important in China. Kaiyu liu worked as a gatekeeper in my fieldwork.

In addition, in the area of Inner Mongolia, most of local people, especially the people that live in very rural area can only speak their local dialect—Mongolian, which I don't understand. So that is another barrier for both my fieldwork and the written information accessed. And the wind farm is in a very remote area with small population. It was particularly difficult for me to find an interpreter there; everyone who worked in the wind farm seems very busy and not interested in my study. Due to there were only several families who live in the surrounding areas, which were close to the Han Wu La Wind Farm, and most of them are old people who can only speak Mongolian, I had to quit my idea to do questionnaire and interviews among them. Luckily, though Kaiyu Liu, I got some opportunities to interview some project

managers and workers.

3.5 Summary

The samples I focused in my thesis are the university students in China and Norway and the local people who live around wind farms, the workers in wind power companies. Both qualitative and quantitative mythologies were used in this thesis. The main qualitative method in my project includes semi—structure interviews, observation, field notes, pictures and the way of designing questions in my survey of questionnaire. After data collecting from questionnaire, fieldwork, literature study and online database, I used quantitative method to deal with and test my data. The main quantitative method is the survey of questionnaire. After receiving the data, I analyzed them by soft programs -- SPSS and EXCEL.

4 Development of wind farm in Inner Mongolia

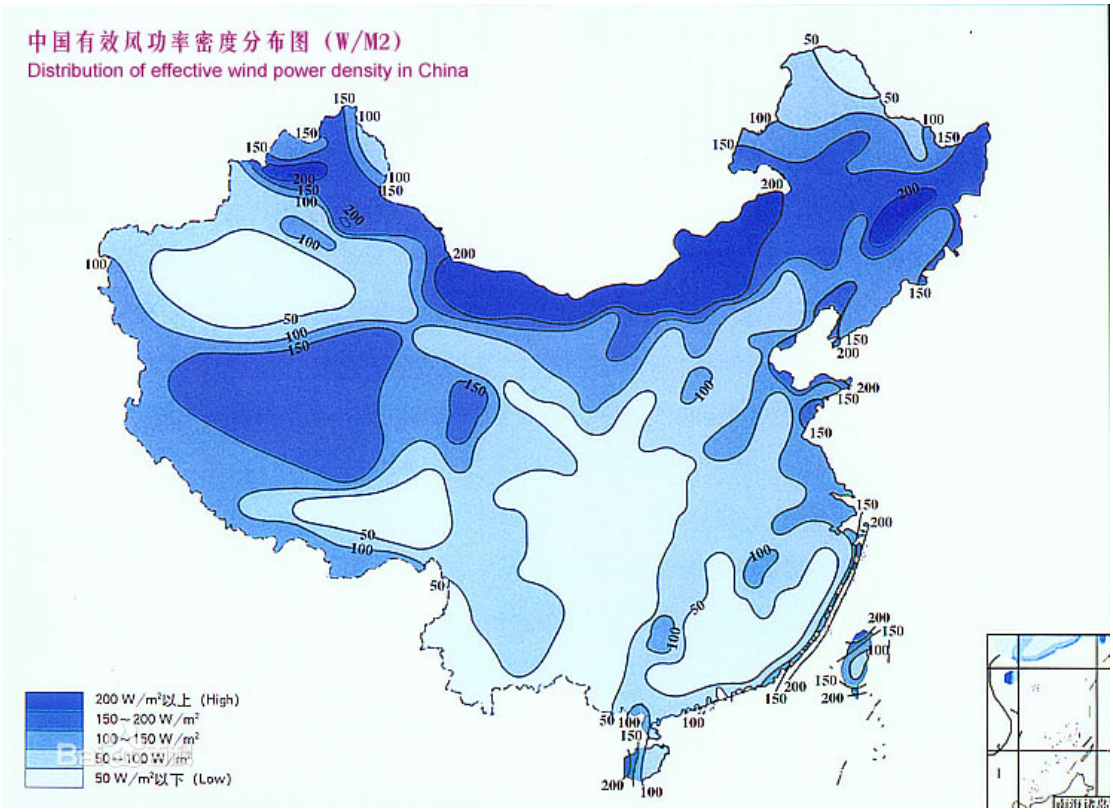
4.1 Introduction

4.1.1 Inner Mongolia

Map 1 Location of Inner Mongolia
Source: Wikipedia Commons
http://en.wikipedia.org/wiki/File:Inner_Mongolia_in_China_(%2Ball_claims_hatched).svg

Inner Mongolia, officially Inner Mongolia Autonomous Region or Nei Mongol Autonomous Region, is an autonomous region an of the People's Republic of China, located in the north of the country, bordering Mongolia and Russia as the Map 1 shows. Its province capital is Hohhot. The Autonomous Region was established in 1947, it is the third largest subdivision of China, spanning about 1,200,000 km^2 (463,000 sq. mi) or 12% of China's total land area. It has a population of 24,706,321 as of the 2010 census, accounting for 1.84% of Mainland's total population. It is mainly characterized by temperate zone continental monsoon climate with yearly average temperatures of 0–8 ℃ and yearly temperature differences of 35–36℃.

Spring is warm and windy; summer is short and hot with many rainy days; autumn usually sees early frost and dropping temperatures; winter is long and bitter cold (Han 2008). Inner Mongolia is the country's 23rd most populous province-level division (Tabulation on the 2010 population census of the people's republic of China 2010). The majority of the population in this region is Han Chinese, with a substantial Mongol minority.



Map 2 Distribution of effective wind power density in China

Source: baike 2014 – a Chinese knowledge website

http://baike.baidu.com/view/3815423.htm

Inner Mongolia is abundant in wind energy resources due to its special geographic characteristics such as relative high altitude, open terrain, low vegetation, few buildings, and speed increasing effect when north-south air flows through the raised landform, and small ground friction. According to estimations by China Meteorological Administration (CMA), Inner Mongolia has 101 GW of exploitable onshore wind energy resources, 40% of the nation's total amount. Furthermore, wind energy resource in Inner Mongolia is distributed

evenly both at spatial and temporal scales. Four-fifths of its vast territory is suitable for developing wind power, with minimally 4400 and maximally 7800h of effective wind speed (5–25m/s) accumulation (Table 4). In one word, Inner Mongolia is a perfect place for developing wind energy in China (Han 2008).

Table 4 Wind energy resource in Inner Mongolia (Zang 1998)

	Area (10^3km^2)	Wind power Density (W/m^2)	Wind energy density (kWh/m^2)	Effective wind speed accumulation (h)
Greatly abundant	83	240-400	1500-3600	6100-7800
Abundant	200	180-220	1000-1500	5300-6780
Exploitable	660	100-200	400-1000	4400-6000

Wind power develops rapidly in Inner Mongolia. Nevertheless, increase in scale alone does not necessarily mean successful wind power development. Inner Mongolia still falls short in wind power production compared to a number of western countries (Han 2008). During these years, there are still many new wind farms being built in Inner Mongolia, and it is continue being a very popular place for developing wind power compare to other places in China.

4.1.2 Da Tang Wind Power International Corporation and Hanwula wind farm

Wind farms that in operation are run by wind power companies. The wind power companies take the responsibility of constructing wind farms as well. All wind power companies in Inner Mongolia are directly managed by IMDRC (Inner Mongolia Development and Reform Commission). Purchase of wind power is strictly controlled by the national government. Prices of wind electricity are decided in Power Purchasing Agreements (PPA) signed between NDRC (National Development and Reform Commission) (or IMDRC) and wind power companies by calculating generation cost and reasonable profit rate. There are two power gird companies in China, the State Power Grid Corporation and the Southern Power Grid

Corporation, they are obliged to purchase all wind electricity, which is subsequently sold to ender users from these two grid companies. If the purchasing price of wind power is higher than the price of power generated from other sources, the price difference will be apportioned with in the whole power grid. This project management mechanism has two advantages. First, there exist a legal separation between electricity generation and electricity transport and distribution. Second, the authority of IMDRC to decide on wind power projects smaller than 50MW significantly increases efficiency of wind farm establishment. This new project approval procedure gives impetus to the rapid development of wind farms in Inner Mongolia (Han 2008).

I did my fieldwork in a new wind farm called Han Wu La Wind Farm, which is still under construction by a wind power company named Da Tang International Power Generation Corporation.

Da Tang Wind Power Corporation (DTWP) is a branch under Da Tang International Power Generation Co., LTD., which was established in December 1994 and officially registered in Beijing. It is one of the largest independent power generation companies in China. Its main business scope is: the construction and operation of power plant, sales of electric power, heat; for the maintenance of power equipment debugging; electric power technology services. By the end of 2010, the whole capacity of this company is 36300.3 MW. Its business scope covers the following fields: thermal power, hydropower, wind power, nuclear power, solar energy, coal chemical, coal, transportation, railways, shipping, ports, metallurgy etc. It has been developed from a single power company to a comprehensive energy company.

Inner Mongolia Da Tang International Wind Power Development Co., LTD. (IMDTWP) is a branch company of the Da Tang Wind Power Corporation in Inner Mongolia. It was officially registered in September 7, 2009, in Hohhot, the main business scopes are: wind power electric power production and sales, technical advice and technical services, wind power equipment maintenance, installation, maintenance, new energy development and utilization. Inner Mongolia wind Power Company viewed the sustainable development as the goal and expands

itself in the field of new energy actively, increasing project resources reserves. Currently the wind resources reserve is close to 10 million kW and there are 8 projects sites distribution in the area of Inner Mongolia, ensuring the company's future development effectively.

Map 3 Location of Han Wu La Wind Farm

Source: Wikipedia Commons 2014

Inner Mongolia Da Tang International Wind Power Development Co., LTD (IMDTWP) is taking the responsibility of constructing Han Wu La Wind Farm. And this project is untaken by Inner Mongolia Electricity Transmission and Transformation Co., LTD. (IMETT) Han Wu La wind farm locates inside the city of Wu Lan Cha Bu in the middle of Inner Mongolia as the Map 3 shows. This wind farm is designed to install 49.5 MW capacity to 33 turbines with 1500 kW.

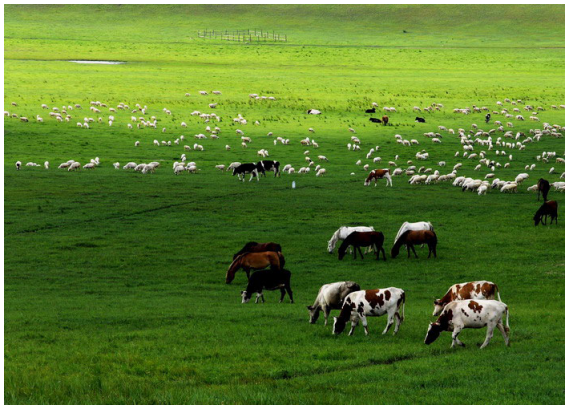
4.2 Conflicts about Hanwula wind farm

Although there is a small population and more homogenous ecological environment in Inner Mongolia, some conflicts among wind farms, local people and environment still occurred when constructing wind farms. Firstly, conflicts between local people and wind power

companies are intense sometimes. Like the local people tried to stop construction by protesting in construction sites. The main reason of the conflict is that the wind farms have occupied some local people's farmland or pastures and they were not satisfied with the monetary compensation. Due to Inner Mongolia is a scarcely populated area and rich of wind resource; its potential of developing wind power attracts many companies investing money to construct wind farms there. Until now, all three quarters of this area of Inner Mongolia was full of wind farms. Such a huge density of wind turbines in Inner Mongolia is sure to have significant effects and on local landscapes and surrounding environment. The pictures below show the different scenery of Inner Mongolia with and without wind turbines.

Picture 1 landscapes of Inner Mongolia with wind turbines

Source: I took it in Han Wu La wind farm during my fieldwork



Picture 2 landscapes of Inner Mongolia without wind turbines

Source: down load online

http://www.wabuw.com/info/7948

Interviews

I have interviewed four people during my fieldwork in Hanwula (meaning the highest mountain) Wind Farm in Inner Mongolia as I mentioned in the chapter of methodology. The interviewees include two project managers, Changqing Li and Liwen Su who work for the Inner Mongolia Da Tang International Wind Power Development Co., LTD. (IMDTWP) and the Inner Mongolia Electric Power Transmission and Transformation Co., LTD. (IMEPTT) respectively, an engineer named Kaiyu Liu who works for the Inner Mongolia Da Tang

International Wind Power Development Co., LTD. (IMDTWP) and a temporary manual labor named Chao Fang (Table 5).

Table 5 Basic information about the interviewees

	Name	Position	Time	Company/Organization
Interview 1	Changqing Li	Project manager	23/07/2014	IMDTWP
Interview 2	Liwen Su	Project manager	23/07/2014	IMEPTT
Interview 3	Kaiyu Liu	Engineer	24/07/2014	IMDTWP
Interview 4	Chao Fang	Builder	24/07/2014	Temporary worker

I take some chocolates from Norway and gave them as a gift in order to build a good relationship with them and have a quick start of the conversations. After introducing myself and explaining the purposes of my research, they are glad to help me. Then the interviews started.

The two middle-aged project managers have worked in the Hanwula Wind Farm for two years since the opening of the wind farm. They are both Masters. And they both hold the idea that the wind power is a positive way to produce energy and with no doubt, it is also an effective way. They are very proud of the works they are engaged in.

Question: *Do you think it is necessary to build more wind farms here in Inner Mongolia with so many existing ones?* Their answers were quite similar. With the richest wind resources and excellent geological conditions, Inner Mongolia is the ideal place for the development of wind power. Besides, there is a vast area for exploitation. The more wind power people tend to use, the less people rely on the traditional energy such as the fossil fuels, and the less pollution there will be. Moreover, it is also good for their companies in that the construction of wind farms may bring about more projects and more profits for them. In conclusion, the more wind farms, the better.

When I mention the impacts on the local environment and conflicts with the local people that the wind farms may cause, Liwen Su, the second interviewee, tries to avoid answering this question directly. He says that these issues are out of his reach and he suggests me talk them with the manager Changqing Li who worked for the IMDTWP, because his job is only to build this wind farm. It seems that he never pays attention to these issues and cares little about them. As for the roads inside the wind farms, he says that the roads were already there before they started to build this wind farm, and they just widened the roads to let the trucks and machines pass. He never bothers to think the probable damage to the local landscape made by the roads and paths. In his opinion, building roads is just a part of the wind farm construction. When I show him the photo of piles of burning garbage in this wind farm, he replies that it won't produce hazardous substances. Lastly, I ask him whether he thinks the wind turbines make the Inner Mongolia more beautiful or not. He thinks the wind turbines look harmonious and integrated with the grasslands in Inner Mongolia.

When Changqing Li, the project manager of the IMDTWP is asked the question of the wind farm's impacts on the local environment and the conflicts with the local people, he replies that there is a certain department to deal with these problems. He admits that to some degree the wind farms have negative impacts on the local environment, which can be ignored compared to the negative impacts caused by the traditional energies. The key to the conflicts between the local people and Da Tang Wind Power Company is the land issue, he says. The local people are always unsatisfied with the compensation for the occupation of the farmlands and grasslands rather than the damages to the landscape caused by the wind farms. As he describes, most of the local people in this remote place are farmers or herdsmen with low education, so they are not able to aware the potential damages the wind farms may bring about to the scenery or landscapes. In fact, after living a relative poor life for generations, the local people care more about money and a more prosperous life. Li also says, when there are conflicts, the company first talks to the local government to reach an agreement on the issue of compensation, and then the government would negotiate with the local people. But

sometimes the negotiations are not smooth, and the local people blame it on the wind power company.

As for the roads inside the wind farms, Li says that, the roads are necessary and unavoidable. But the company is trying to make a better design of the location and length of these roads in order to minimize the damage to the local landscapes. As for the problem of burning garbage at random, he says he didn't know about it, for it is beyond his responsibility. And he has similar views with Mr. Su that the wind turbines look nice especially with the natural scenery in Inner Mongolia.

Then I talk with the engineer Kaiyu Liu who has worked in the IMDTWP for a longer time than the previous two interviewees. As I mentioned before he is my gatekeeper of my fieldwork. With his help, I obtain this opportunity. So we have a very open interview and talk a lot about the wind power in China. He has worked on this wind farm since he graduated from the Northeast Dian Li University (NDLU) in 2011. The main reason he chose this job is that wind power has better prospects of development and a promising future in China. So in his opinion, wind power is a one hundred percent great way to produce energy. He also mentions Beijing for it is frequently shrouded by haze and fog at present. So in his point of view, it is very urgent to develop the renewable energies. And these years he has been busy doing the technical work and also focusing on the other aspects of wind power.

After I show him the interview questions, he says, the more wind farms there stand in the Inner Mongolia, the better it is for the development, for there are abundant wind resources. However, there still exist some defects of the wind power development in Inner Mongolia, namely, the side effects on the power grid safety—the peak load regulation capacity appears insufficient, wind power penetration seems inadequate and the equivalent full load involving most of the projects have proved far fewer than designed, due to the limits resulting from the imbalanced makeup of installed capacity and others factors. "So now to solve these problems is more important than to build more wind farms," he said. "Compared to the current situation of pollution in China, the impacts on environment that wind farms may cause can be ignored."

The conflicts between the local people and the Wind Power Company are not a big issue, and it can be solved through negotiations anyway. He regards the technical problems are the most important issues that need paying more attention. I understand it is reasonable for an engineer to focus on technology first. As for the way of handling garbage that produced during the process of construction of wind farm, he says they have the specialized department and the specialized equipment to deal with it. In regard to the roads and landscapes in Inner Mongolia, he says he had no idea about these issues. It is hard for him to recognize the differences of landscapes with or without roads. Due to the long period he has worked for the wind farm, he is used to the scenery with the wind turbines. For him, the wind turbines have already become a part of the landscape in Inner Mongolia.

Lastly, I interview the manual laborer, Chao Fang, who just does simple and routine works in the wind farm. He grew up in Inner Mongolia and his family lives very close to the wind farm. He didn't receive a higher education. After graduating from the middle school he went to a big city to earn his life. So sometimes he can't understand my questions. I have to explain with simple words and tell him what I want to know. He knows little about renewable energies, and what he knows is that wind power is better than fuel energy. In fact, he never thought about the things I have been concern. He only cares about finding more work to do and earning more money for his family. So in his opinion, the more wind farms in Inner Mongolia the better, because he doesn't need to go to some faraway cities from home for more job opportunities. And to my surprise, when I ask him "how do you think of the wind turbines' impacts on the local scenery", his answer is totally different from those of the other interviewees. He says he doesn't like the wind turbines. They look like huge lifeless ironworks. He missed the scenery of Inner Mongolia when he was a child. But on the other hand, he also thanks the wind farms, because of which he can get a job and earn money.

Observation

During the fieldwork I live with the secretary named Chenxi Wang who works for the IMEPTT. Sometimes she shows me some documents of this project. There are two kinds of

contracts on the compensation for the local people. One is Contract A (Appendix): “Side agreement of temporary land acquisition and expropriation in the Hanwula Wind Farm project under the Da Tang Wind Power Company”. It says that due to the postponement of this project, there will be a secondary damage to the crops, but after the negotiation, the two sides including the company and the local government come to consensus that the company should pay the local people the compensations with the help of the government.

The other one is Contract B (Appendix): “Compensation for the temporarily expropriated lands”. The main content in this contract is about the items of compensation that includes permanent land occupied and temporary land occupied. If the people concerned signed this contract, they couldn’t stop the project with any excuses. But I still see some people trying to stop the big truck in the middle of the roads to hold back the construction team. The scans of the two contracts are in the appendix.

4.3 Summary

Inner Mongolia is regarded as the best region to develop wind power in China due to its special geographic location and rich source of wind. It attracts a lot of investment from wind companies to develop wind power and improves the local tax increase as well. But during the process of wind farm construction in Inner Mongolia, many conflicts occurred among local people and wind power companies as well as some arguments about the negative impacts on local landscape and surrounding environment. Based on my study during my fieldwork in Hanwula wind farm, I found that, the main conflict between local people and wind power companies is the issue of compensations for the land occupation. In regards to the landscapes impact, it seems that both local people and Wind Power Company pay little attention on it. According to the information from interviews, workers of Wind Power Company think that the wind turbines have a positive effect on landscape. Due to the local people living a poor life in that area and with lower level of education, they always focus on earning more money rather than the issue of visual and landscape impacts.

People in different levels of education, economic conditions and positions may have very different opinions. So the views of the interviewees towards the wind farms are different due to their different backgrounds. After all, the people with higher education backgrounds or decent living conditions are still the minority in China. And nowadays China is thirty of energy to develop further, so government paid more attention to develop wind power seems make sense in principle. To sum up, it is reasonable that the government pays so much attention to the development of the wind power, nowadays China is thirsty of energy to develop further, so government attach great importance to develop wind power seems make sense in principle.

5. Students view of wind farms in China and Norway

5.1 Background

The main purpose of this thesis is to analyze how wind farms impact on landscapes and compare views about this topic between university students in China and Norway by making a survey. The questionnaire was distributed to students of three Universities, two in China (Northeastern University, Yanshan University) and one in Norway (Norwegian University of Science and Technology). There were 316 participants in this survey, from which 186 are Chinese and 130 are Norwegian as I mentioned above.

Among Chinese students, the number of female and male is equal, 55 of Norwegian students are female and 75 of them are male. The reason why I separated the gender is to see how different is the view on renewable energy between females and males. I will discuss this in more detail in the next section.

All the Chinese students are during their bachelor program whereas 64 Norwegian students are during bachelor and 66 making master degree as the Table 6 shows below.

Table 6 Overview of the informants

Nationality	Degree	Frequency	Percent
Chinese	Bachelor	186	100%
Norwegian	Bachelor	64	49.2%
	Master	66	50.8%

(Source from Question 2 in questionnaire)

Academic background may be an important factor that may have an impact on informants views. It would be appropriate to choose students who study in Geography department, but unfortunately, that was impossible for me to do in China. I didn't get any access to geography

class in both two universities in China. I divided all the informants study background into two groups that are non-engineering and engineering. As shown in Figure 5, 120 Chinese students study engineering (65.50%) and 66 of them study non-engineering programs (34.50%). The number of Norwegian informants who study engineering is 58 (44.70%) and 72 (55.30%) study non-engineering program.

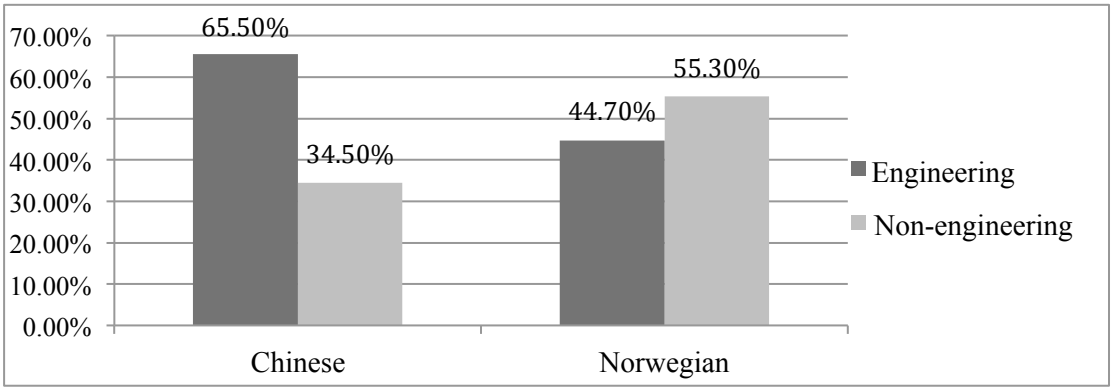


Figure 5 Percentages of students' study background
(Source from Question 3 in questionnaire)

In my questionnaire I asked if students were member of an environmental organizations. By environmental organizations I mean small groups of students or teachers organized in universities as well as some ones organized by NGO (Non-Governmental Organization) outside universities. If some students have been or are being members of this kind of groups, they may have more information about renewable energy, than those who are not. According to the data, only 17% of students in total have been or are being members of this kind of organizations from among all the students.

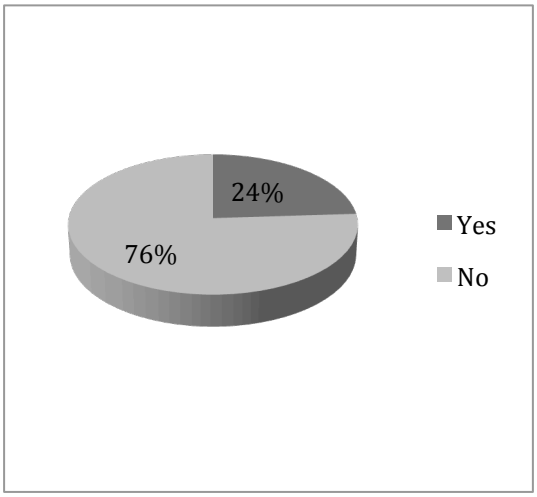


Figure 6 Percentage of the Chinese participants who take part in some environmental organization
(Source from Question 5 in questionnaire)

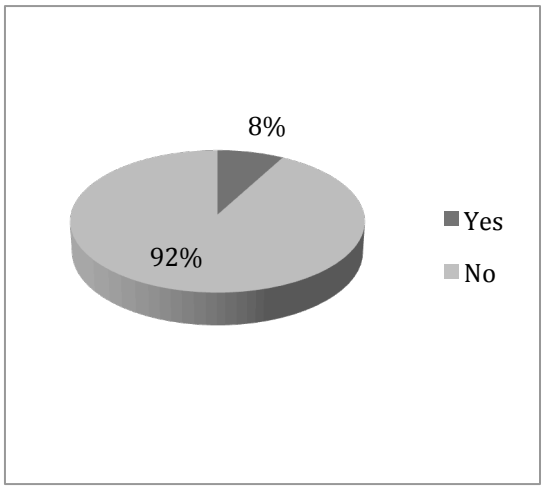


Figure 7 Percentage of the Norwegian participants who take part in some environmental organization

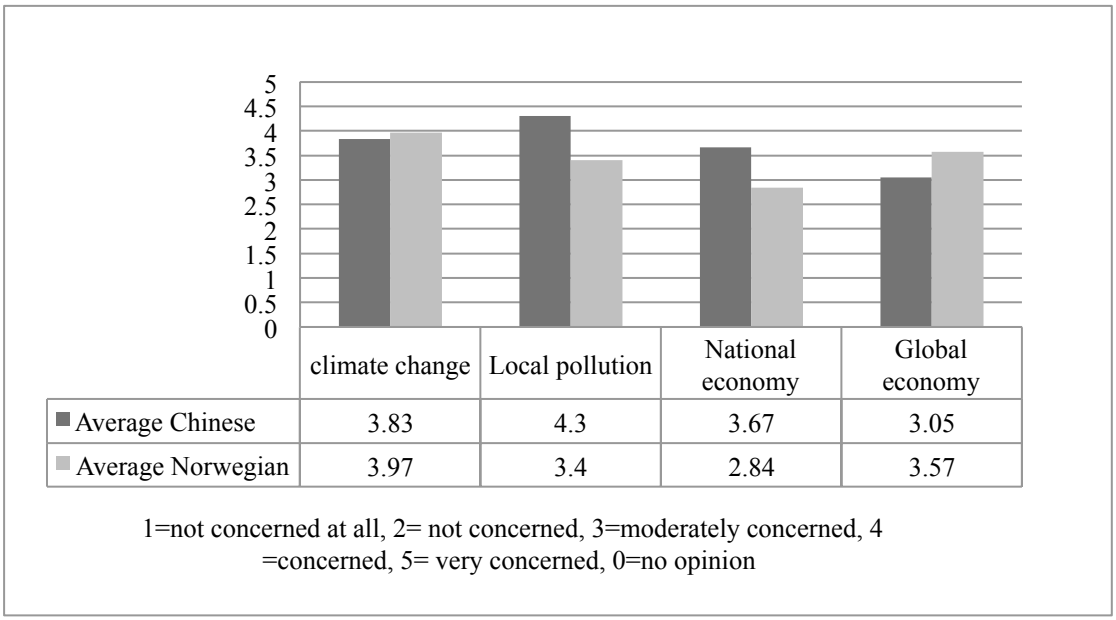
While in China, the percentage of students who have been or are being in some environmental organizations is 24% (Figure 6) and in Norway is 8% (Figure 7). So Chinese university students are increasing the awareness of environmental protection and they are interested in gaining some more knowledge about the environment.

5.2 Findings and discussion

In the following sections, some key findings from this survey will be presented, analyzed and discussed.

5.2.1 Concerned-rating of the basic issues

The participants of this study were asked whether and to what degree, are they concerned about the following issues: climate change, local pollution, the national economy and the global economy (Q 4). They were asked to rate their level of concern about these issues in scale from 0 to 5, where 5 was defined as very concerned, 4 as concerned, 3 as moderately concerned, 2 as not concerned, 1 as not concerned at all and 0 as no opinion. The resulting distribution for each issue is given in Figure 9, Figure 10 and Figure 11.

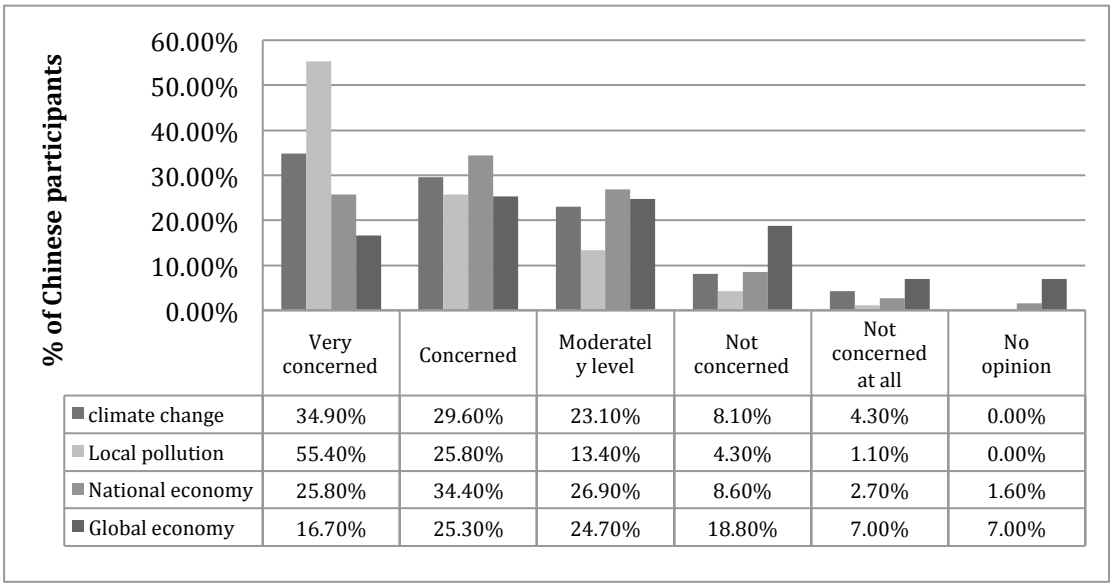


	climate change	Local pollution	National economy	Global economy
Average Chinese	3.83	4.3	3.67	3.05
Average Norwegian	3.97	3.4	2.84	3.57

1=not concerned at all, 2= not concerned, 3=moderately concerned, 4 =concerned, 5= very concerned, 0=no opinion

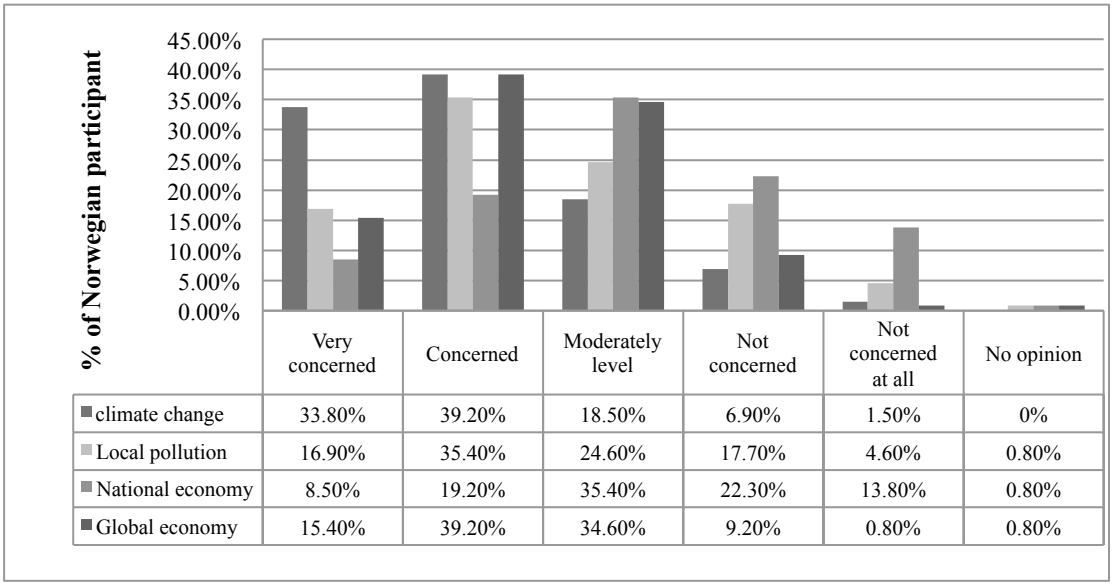
Figure 8 Concerned-rating of the four issues; average scores
(Source from Question 4 in questionnaire)

Figure 8 illustrates average scores of concerned-ratings of the four basic issues between Chinese and Norwegian students. From this figure one can see that “climate change” and “local pollution” are the issues that are rated the most with average scores of 3.83 and 4.30 among Chinese students separately. Although Norwegian students rated “climate change” and “global economy” the most with average scores of 3.97 and 3.57. It can also be seen that the Chinese students pay more attention on the issue of national economy with the average score of 3.67, while the average score of this issue is only 2.84 among students in Norway. About the global economy, the average scores among Chinese are 3.05 and 3.57 among Norwegian students. Therefore we can see that from these comparisons, Chinese students are more concerned about domestic environmental issues and economic events when, Norwegian students are concerned more about global issues.



	Very concerned	Concerned	Moderately level	Not concerned	Not concerned at all	No opinion
climate change	34.90%	29.60%	23.10%	8.10%	4.30%	0.00%
Local pollution	55.40%	25.80%	13.40%	4.30%	1.10%	0.00%
National economy	25.80%	34.40%	26.90%	8.60%	2.70%	1.60%
Global economy	16.70%	25.30%	24.70%	18.80%	7.00%	7.00%

Figure 9 Concerned-rating of the four issues among Chinese students
(Source from Question 4 in questionnaire)



	Very concerned	Concerned	Moderately level	Not concerned	Not concerned at all	No opinion
climate change	33.80%	39.20%	18.50%	6.90%	1.50%	0%
Local pollution	16.90%	35.40%	24.60%	17.70%	4.60%	0.80%
National economy	8.50%	19.20%	35.40%	22.30%	13.80%	0.80%
Global economy	15.40%	39.20%	34.60%	9.20%	0.80%	0.80%

Figure 10 Concerned-rating of the four issues among Norwegian students
(Source from Question 4 in questionnaire)

As the data shown in Figure 9 and Figure 10, concerns about "climate change" and "local pollution" are rated the highest among all students. Chinese students have been very concerned about local pollution (55.4%), and some of them were very concerned about climate change (34.9%). On the whole, China, 64.5% and 81.2% of informants were very concerned and concerned about climate change and local pollution—the environmental

problems; and the total percentages of them who are “very concerned” + “concerned” about national and global economy are 60.20% and 42% respectively.

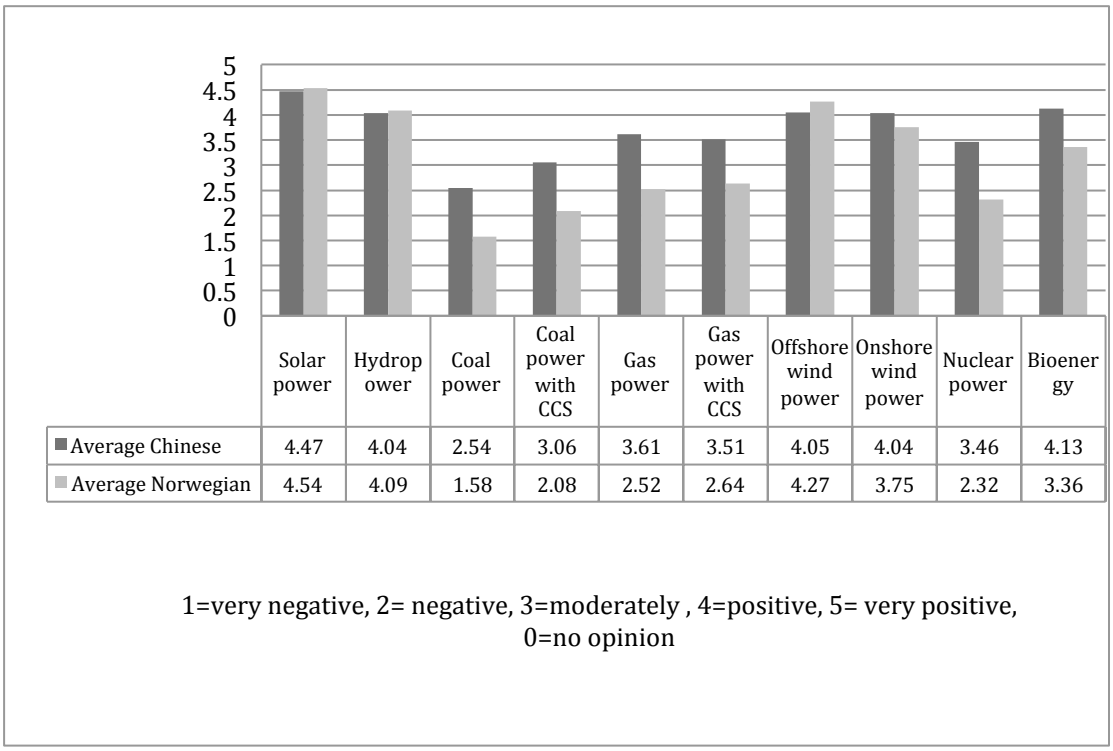
In Norway, most of the students are most concerned about climate change (33.80%). Whereas the share of them concerned about “local pollution” and “global economy” were 16.90% and 15.40%. The issue of national economy is rated as the lowest by Norwegian students (8.50%). The percentage of the students who are “very concerned” + “concerned” about climate change is 73.00% and 52.3% of students are “very concerned” + “concerned” about the issue of local pollution. While, the percent of students who was “very concerned” + “concerned” about national and global economy was 27.7% and 54.6% respectively.

The data shows that the students in China and Norway are more concerned about environmental problems than the economic events. So I think the youth nowadays, know clearly that the environment cannot be sacrificed in order to pursue the development of economy. It is clear even more for Chinese students, because they are aware of that China has suffered a lot due to that mistake. It is also very interesting to find out that most of Norwegian students focus more on global issues while Chinese students are focused more on national issues.

5.2.2 Attitude towards ten different energy technologies

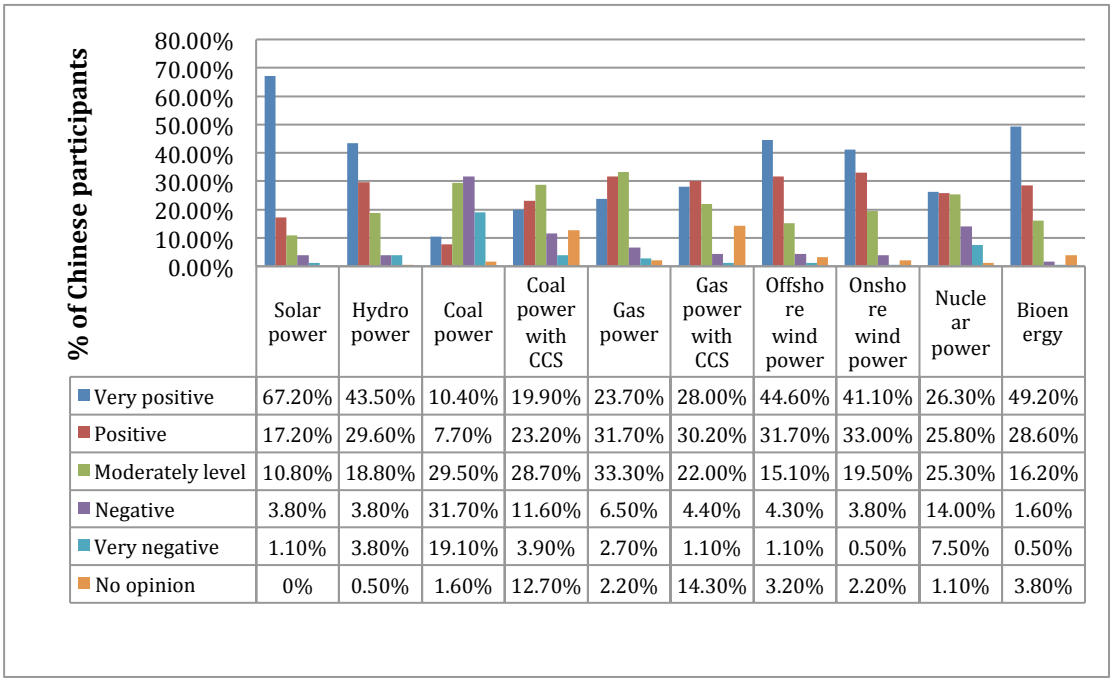
One question in the survey was related to the student view of different technology. I listed the following ten energy technologies in my questionnaire: solar power, hydropower, coal power, coal power with CCS[1]， gas power, gas power with CCS, onshore wind power, offshore wind power, nuclear power and bioenergy. The question was “What is your attitude towards the following energy technologies? (Q 6)” and informants rated their attitudes from 0 - no opinion to 5 - very positive. The result is shown in Figure 11.

[1] CCS= Carbon capture and storage, is the process of capturing waste carbon dioxide from large point sources, such as fossil fuel power plants, transporting it to a storage site, and depositing it where it will not enter the atmosphere.



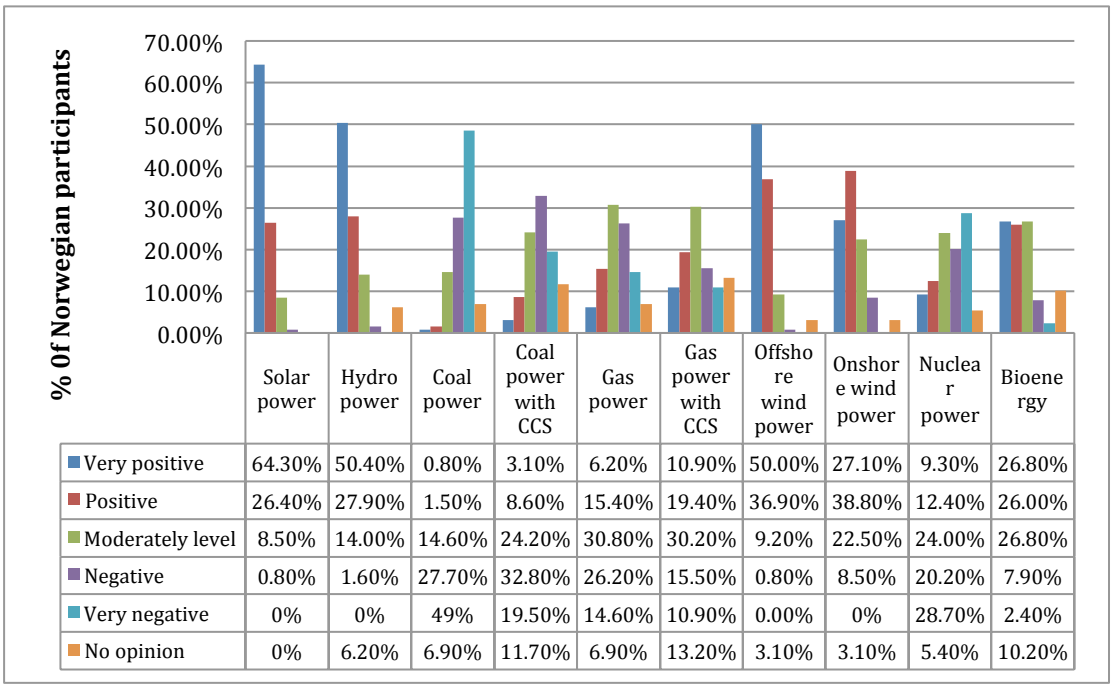
	Solar power	Hydropower	Coal power	Coal power with CCS	Gas power	Gas power with CCS	Offshore wind power	Onshore wind power	Nuclear power	Bioenergy
Average Chinese	4.47	4.04	2.54	3.06	3.61	3.51	4.05	4.04	3.46	4.13
Average Norwegian	4.54	4.09	1.58	2.08	2.52	2.64	4.27	3.75	2.32	3.36

Figure 11 Attitude-rating of the ten energy technologies; average scores
(Source from Question 6 in questionnaire)



	Solar power	Hydro power	Coal power	Coal power with CCS	Gas power	Gas power with CCS	Offshore wind power	Onshore wind power	Nuclear power	Bioenergy
Very positive	67.20%	43.50%	10.40%	19.90%	23.70%	28.00%	44.60%	41.10%	26.30%	49.20%
Positive	17.20%	29.60%	7.70%	23.20%	31.70%	30.20%	31.70%	33.00%	25.80%	28.60%
Moderately level	10.80%	18.80%	29.50%	28.70%	33.30%	22.00%	15.10%	19.50%	25.30%	16.20%
Negative	3.80%	3.80%	31.70%	11.60%	6.50%	4.40%	4.30%	3.80%	14.00%	1.60%
Very negative	1.10%	3.80%	19.10%	3.90%	2.70%	1.10%	1.10%	0.50%	7.50%	0.50%
No opinion	0%	0.50%	1.60%	12.70%	2.20%	14.30%	3.20%	2.20%	1.10%	3.80%

Figure 12 Attitude-rating of the ten energy technologies among Chinese students
(Source from Question 6 in questionnaire



	Solar power	Hydro power	Coal power	Coal power with CCS	Gas power	Gas power with CCS	Offshore wind power	Onshore wind power	Nuclear power	Bioenergy
Very positive	64.30%	50.40%	0.80%	3.10%	6.20%	10.90%	50.00%	27.10%	9.30%	26.80%
Positive	26.40%	27.90%	1.50%	8.60%	15.40%	19.40%	36.90%	38.80%	12.40%	26.00%
Moderately level	8.50%	14.00%	14.60%	24.20%	30.80%	30.20%	9.20%	22.50%	24.00%	26.80%
Negative	0.80%	1.60%	27.70%	32.80%	26.20%	15.50%	0.80%	8.50%	20.20%	7.90%
Very negative	0%	0%	49%	19.50%	14.60%	10.90%	0.00%	0%	28.70%	2.40%
No opinion	0%	6.20%	6.90%	11.70%	6.90%	13.20%	3.10%	3.10%	5.40%	10.20%

Figure 13 Attitude-rating of the ten energy technologies among Norwegian students (Source from Question 6 in questionnaire)

Based on the Figure 11, solar power is the most popular energy technology among all the youth in China and Norway with the average score 4.47 and 4.54 separately. In China, bioenergy is rated second with the average score 4.13 and then is the offshore wind power with the average score 4.05. While in Norway, offshore wind power is the second popular energy and hydropower is the third one with the average score 4.27 and 4.09.

During these years, renewable energy has become very popular in China. Especially solar power, which is well advertised in China. Compared with solar power, wind power is rather new of this kind of renewable energy, which has developed very fast during these ten years.

According to Figure 12 and 13, coal power is rated as the lowest in China and in Norway as well. It indicates that most of students have recognized the negative effects caused by coal power. Although the technology of Carbon capture and storage can probably handle the negative effect of coal power, it is still rated very low, especially in Norway. Although in China, coal power was treated as the main energy all long, so maybe it is a reason why students in China rate the coal power with CCS (Carbon capture and storage) higher.

About gas power, both gas power and gas power with CCS are rated similar in China and Norway. Chinese students rated them with average scores of 3.61 and 3.51 separately. It shows that in the opinion of Chinese students gas power is relatively positive. While in Norway, the average scores of gas power and gas power with CCS are 2.52 and 2.64 that indicates the Norwegian students think gas power is a negative with CCS or without. The similar average scores of gas power and gas power with CCS also show that, till some degree, neither Chinese nor Norwegian students could tell the differences between gas power and gas power with CCS. This indicates that the technology of CCS is really unfamiliar for most of the youth.

Nuclear power is a controversial source of energy all over the world. It has some advantages such as no impact on air with pollutants or no emission of CO_2. But the disadvantages are also very obvious; it will produce a lot of radioactive waste that might harm people's health and environmental surroundings also expenses are high. It is a sensitive topic that might easy cause some political conflicts. Therefore I think both, Chinese and Norwegian students have recognized this kind of problems and nuclear power is marked lower, with average scores 3.46 and 2.32 and ranked as eighth in China and Norway the same. But Norwegian students have more negative attitude than Chinese.

Next source of power is the bioenergy, which means renewable energy made available from materials derived from biological sources (Fischer 2000). Figure 13 and 14 tells that the bioenergy is more popular among Chinese students than Norwegian. Chinese students marked it with 4.13 while Norwegian only marked it as 3.36. Norway is rich in petroleum and hydropower, and there may be a reason why people paying there less attention to other sources of energy.

Now finally let's focus on wind power. It includes onshore wind power, which means building wind farms on land. Moreover offshore wind power is also included and that means building wind farms on sea. Offshore wind power has more supporters both in China and Norway from Figure 13 and 14, and their average scores are 4.05 and 4.27. Main advantages may be that, they are located in long distance from populated areas, which might avoid

conflicts. Unfortunately some technical problems exist. Thus most of wind farms in China are located onshore. When the wind farms are constructed on land in populated areas, disagreements are highly probable. It is very interesting to see that attitudes rated onshore wind power on forth position by both Chinese and Norwegian students with the average scores of 4.04 and 3.75 separately. According to that, students in these two countries treat the onshore wind power as a positive source of energy, but not that much if compared with solar power and hydropower. The following questions are to see further views on onshore wind farms.

5.2.3 Willingness to pay more for renewable electricity

The participants of this survey were asked: "Would you be willing to pay more for electricity if it was guaranteed renewable; if yes, how much more would you be willing to pay? (Q 7)" The participants were then given a set of possible answers that are 20% more, 40% more, 80% more and 100% more. Figure 14 is presenting the distribution of these answers.

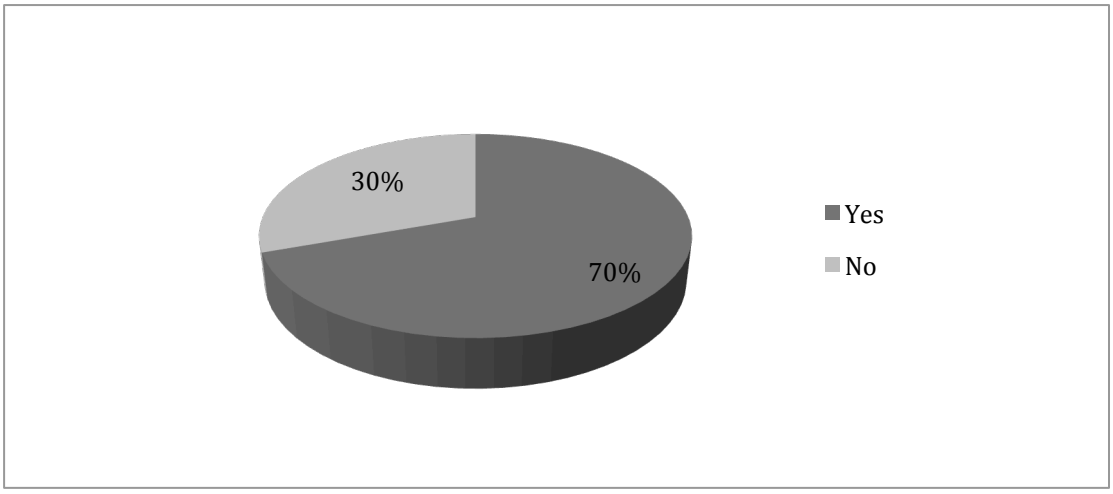


Figure 14 Percentage of all the participants who would like to pay more for electricity from renewable energy
(Source from Question 7 in questionnaire)

Almost 70% of respondents till some point were willing to pay more for renewable electricity, and only about 30 % were not; so one can conclude that both Chinese and Norwegian students are in general willing to pay more for electricity if it was guaranteed renewable.

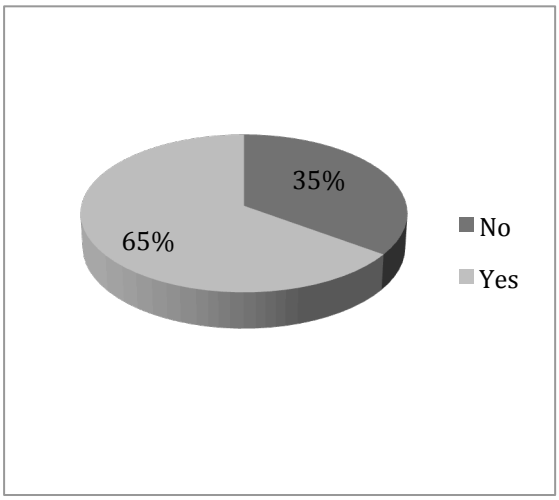


Figure 15 Percentage of the Chinese participants who would like to pay more for electricity from renewable energy
(Source from Question 7 in questionnaire)

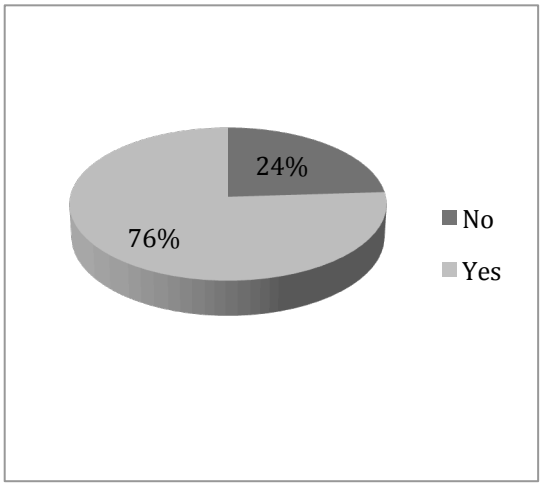


Figure 16 Percentage of the Norwegian participants who would like to pay more for electricity from renewable energy
(Source from Question 7 in questionnaire)

From Chinese students, 65% (Figure 15) of them are willing to pay more and 76% (Figure 16) of the Norwegian students would do the same. Considering that, to some extent, the Chinese society in the last 20 years has developed its economy in part by harming environment, it is reasonable, that majority of aware Chinese students are willing to pay more for electricity from renewable energy.

One reason behind this difference could lie in the economic conditions. Comparing with Chinese, Norwegian has higher quality of life and welfare. Most people in Norway earn higher salaries and live without bigger financial problems. However, in China, most of people have to focus more on their financial condition first. Informants are students from families with different economic preferences. It is reasonable that Norwegian students would pay extra for cleaner energy.

Here I want to show a result of a survey, which my friend Anne Jarmot Hvatum and her partners did in Shanghai Jiao Tong University (SJTU) in China summer 2013. In this survey, they classified students by different family incomings. One group was made by students who come from families with more than 6000 Yuan income per month, the other group was made of students who come from families with income between 3000-6000 Yuan per month. The

last group was consisting of students that come from families with income less than 3000 Yuan per month.

Based on her data, students from wealthy families having more than 6000 Yuan in monthly income, have a tendency to be more willing to pay for renewable electricity. One can see that from students who are willing to pay more, 50% comes from families with a monthly income higher than 6000 Yuan. Compared with that, over 70% of students who are not willing to pay more are from families with income lower than 6000. That is to say, people views are influenced by their economic situation. The better their family income is, the more they will focus on environmental issues than economic situation (Hvatum 2013).

In Norway most of the electricity production is already renewable hydropower, while most of the electricity in China is produced by coal power. Considering the Chinese students senses of urgency for environmental problems such as urban air pollution, and coal power as a pollution-intensive energy supply, it is therefore not unreasonable that more than half percent of Chinese students are willing to pay for cleaner electricity: when you pay for something you usually want to get something back.

Table 7 Different views on willing to pay more among the Chinese students who are members of environment organization and who are not.

Nationality	Member or not	Answered	Frequency	Valid Percent
Chinese	Yes	Yes	35	81.40%
		No	8	18.60%
	No	Yes	78	58.60%
		No	55	41.40%

(Source from Question 5 and 7 in questionnaire)

Table 8 Different views on willing to pay more among the Norwegian students who are members of environment organization and who are not.

Nationality	Member or not	Answered	Frequency	Valid Percent
Norwegian	Yes	Yes	9	90%
		No	1	10%
	No	Yes	87	74.40%
		No	30	25.60%

(Source from Question 5 and 7 in questionnaire)

As Table 7 and 8 shows, 81.4% of Chinese students who are members of environmental organizations are willing to pay more for the electricity from renewable energy compare with 58.6% among those who are no member of any environmental organizations. Similarly, in Norway, there 90% of students who are members of some environmental groups are willing to pay more while 74.40% of them who are not members willing to do the same. From this result, it is easy to find that students who have been or are being members of environmental organizations are more willing to pay more money for getting environment-friendly electricity than the students who are not. That indicates universities and society should create more this king of environmental organizations or groups, in which students could participate and improve their awareness of environmental protection and energy saving.

It seems that in accordance with the Figure17, almost half students who are willing to pay more would rather pay 20% more, no matter what nationality they are. All the respondents are students and they don't have regular income, so this could probably be a reason why most of them are willing to pay up to 20% more. However there are still quite few students who are willing to pay 40% more, in China, the percentage is 17.20% and in Norway 22.30%. More Norwegian students will pay 40% more of regular price than Chinese students.

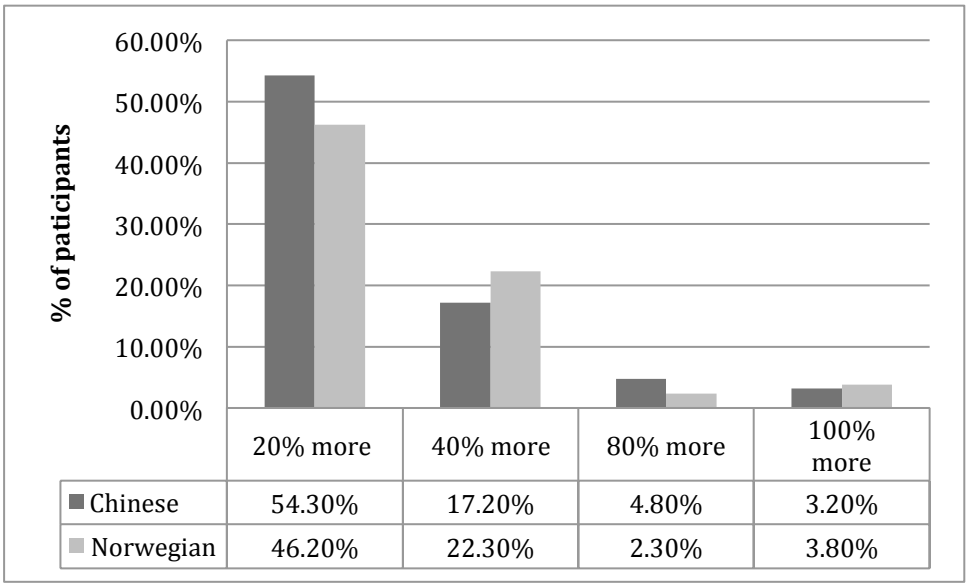


Figure 17 The rate of how much more money would the students want to pay (Source from Question 7 in questionnaire)

In addition, many various factors will have an influence on the options of these students, such as their country economic condition, family incomings (as mentioned above), different opinions of values and so on.

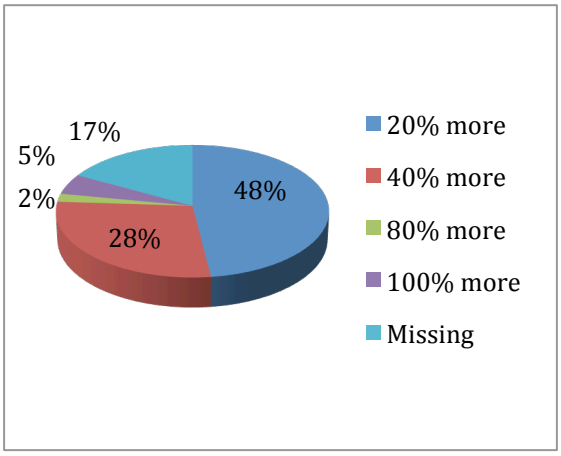


Figure 18 Percentage of bachelor Norwegian students ' choices (Source from Question 2 and 7 in questionnaire

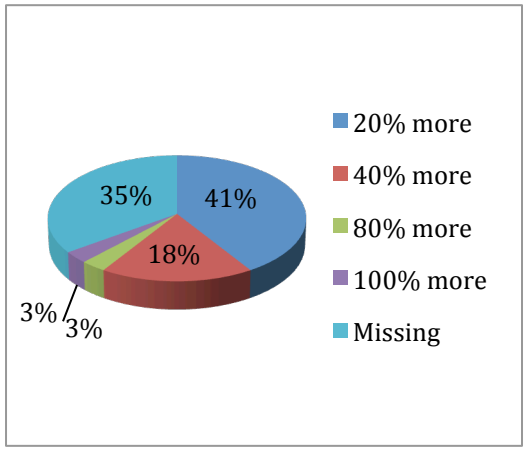


Figure 19 Percentage of master Norwegian students ' choices (Source from Question 2 and 7 in questionnaire)

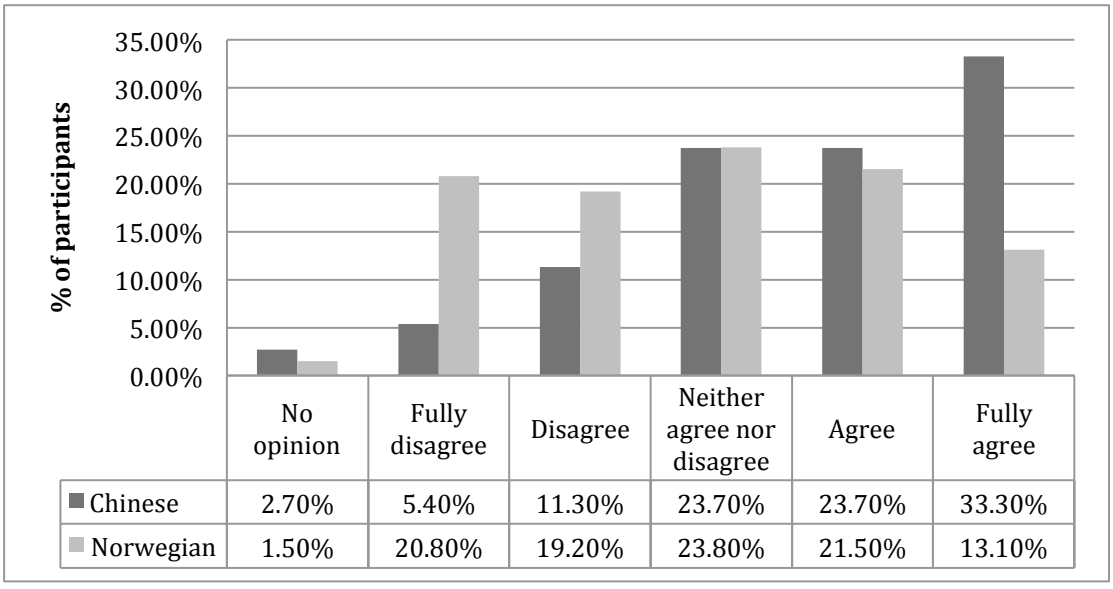
By 18 and 19, compared with the master students, to some degree, the undergraduate students would rather pay more in all levels in Norway. It is surprised that with the higher level of education of Norwegian students, the less proportion of extra money for renewable electricity they would like to pay.

5.2.4 Experience wind farms and perspectives

Considering the students may have different perspectives, depending on their experience with wind turbines in real nature, I classified the participated students in two groups. One group was the made of by the students who have ever been in some real wind farms, another one was made of those who have never been.

In China, only 10% of students have ever been in a wind farm, while in Norway, the percentage of that fact is 26%. The main reason of this difference could be that, most of Norwegian respondents are studying geography, and because of that they have opportunities to go inside some wind farms within one of their special courses.

The next question is: Do you agree with that the wind turbines may look good in nature and wind farms may improve access to nature (Q 10). There were shown two pictures of wind farms in Norway and China in this survey. Answer was rated from 0-5, 1 fully disagree, 2 disagree, 3 neither agree nor disagree, 4 agree and 5 fully agree.



	No opinion	Fully disagree	Disagree	Neither agree nor disagree	Agree	Fully agree
Chinese	2.70%	5.40%	11.30%	23.70%	23.70%	33.30%
Norwegian	1.50%	20.80%	19.20%	23.80%	21.50%	13.10%

Figure 20 Percentage of participants views on whether wind turbines looks good in nature (Source from Question 10 in questionnaire)

The results are shown in Figure 20. Here is a big difference between opinions of Chinese and Norwegian students; there is almost one-third of Chinese students that fully agree about the

wind farms look good in nature. Although in Norway, only 13.1% of students choose that option.

In general, 57% of students in China “agree “+ “very agree” with that the wind turbines look good in nature and 34.6% of students in Norway think the same. There is similar percent (24%) of students who have no particular views. Only 15.7% of Chinese students are “fully disagree” + “disagree” in comparison with 40% of Norwegian students. In China, the percentage of students who “fully disagree” with that idea is 5.40% whereas the percentage is 20.80% among Norwegian students.

Actually, it is always a very controversial question and has been discussed and argued a lot these years. The different views among students may come from their different personal aesthetic preferences.

In order to see whether there were some differences of views on this issue exit among female and male informants, I divided the informants by gender and made a comparison, which results showed in Figure 21 and 22. As we can see from Figure 21 and 22 below, there is small dispersion of different views between female and male towards the question whether the wind turbines may look good in nature. Based on Figure 22, in Norway, more males than females have a negative view on that issue.

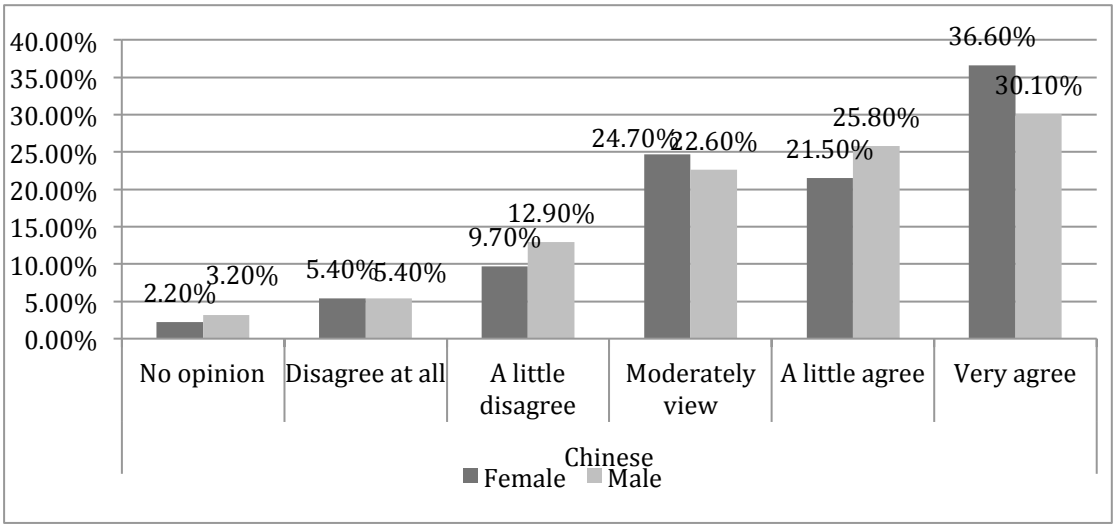


Figure 21 Percentage of different gender of Chinese participants views on whether wind turbines looks good in nature

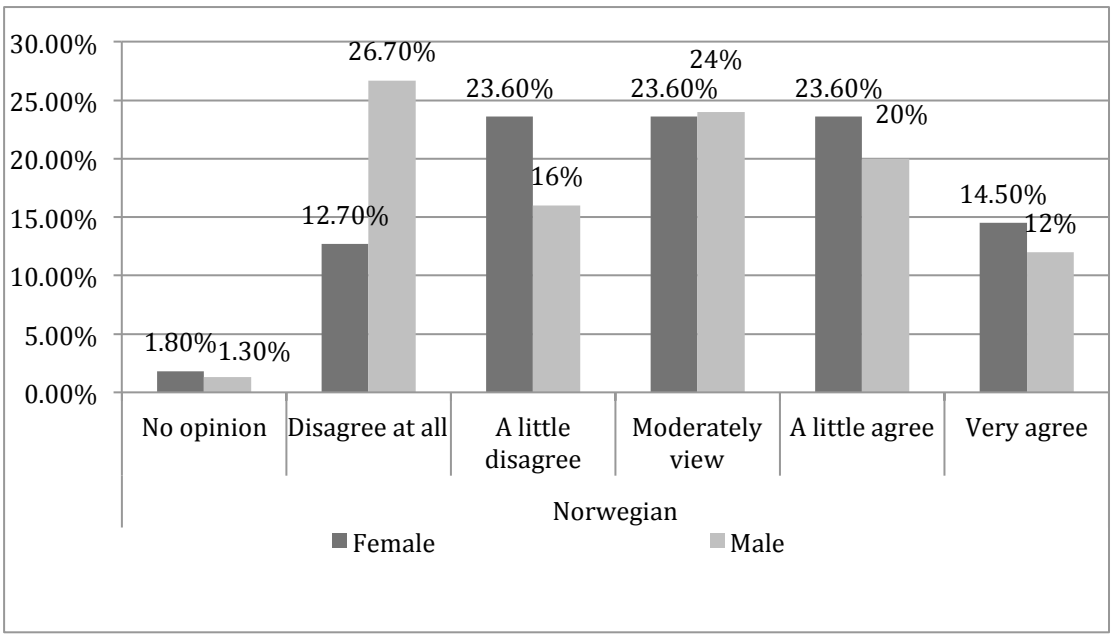
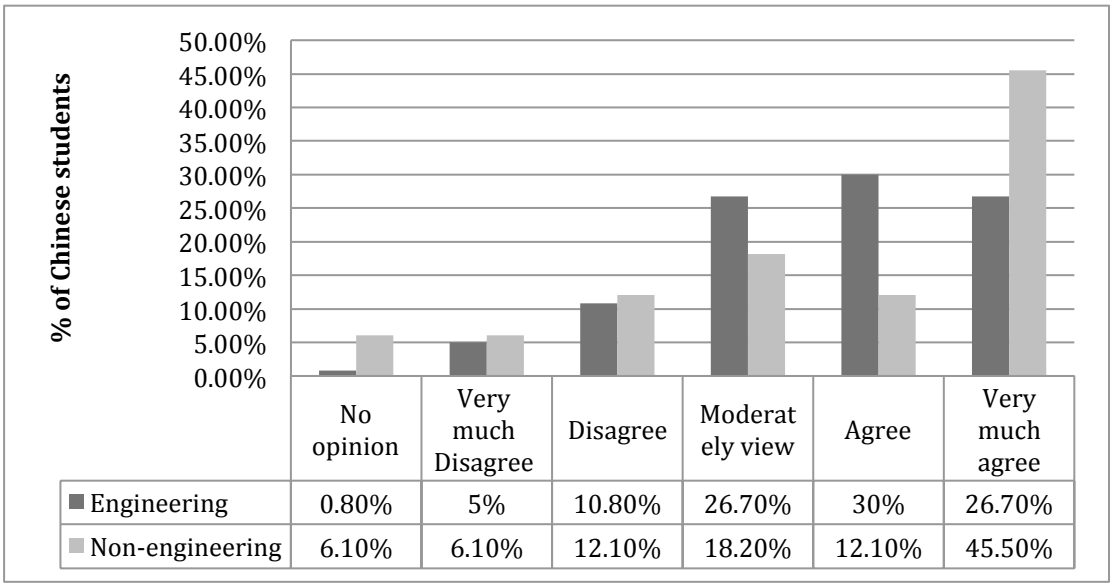


Figure 22 Percentage of different gender of Norwegian participants views on whether wind turbines looks good in nature

The participants are divided into two different kinds of groups by their study background: engineering and non-engineering.



	No opinion	Very much Disagree	Disagree	Moderately view	Agree	Very much agree
Engineering	0.80%	5%	10.80%	26.70%	30%	26.70%
Non-engineering	6.10%	6.10%	12.10%	18.20%	12.10%	45.50%

Figure 23 Percentage of different background Chinese studensts are regard a statement that wind turbines look in nature
(Source from Question 10 in questionnaire)

From Figure 23, the percentages of Chinese students who agreed with this idea between engineering and non-engineering are 30% and 12.10% respectively. It shows that as for engineering students both in China and Norway are more support this view. In general, there are 56.70% of engineering students and 57.60% non-engineering students who chose “agree” and “very much agree” with this idea. So points of their view on this subject are similar in total. The percentages of disagreeing are also similar which is 15.8% and 18.2% between engineering and non-engineering students.

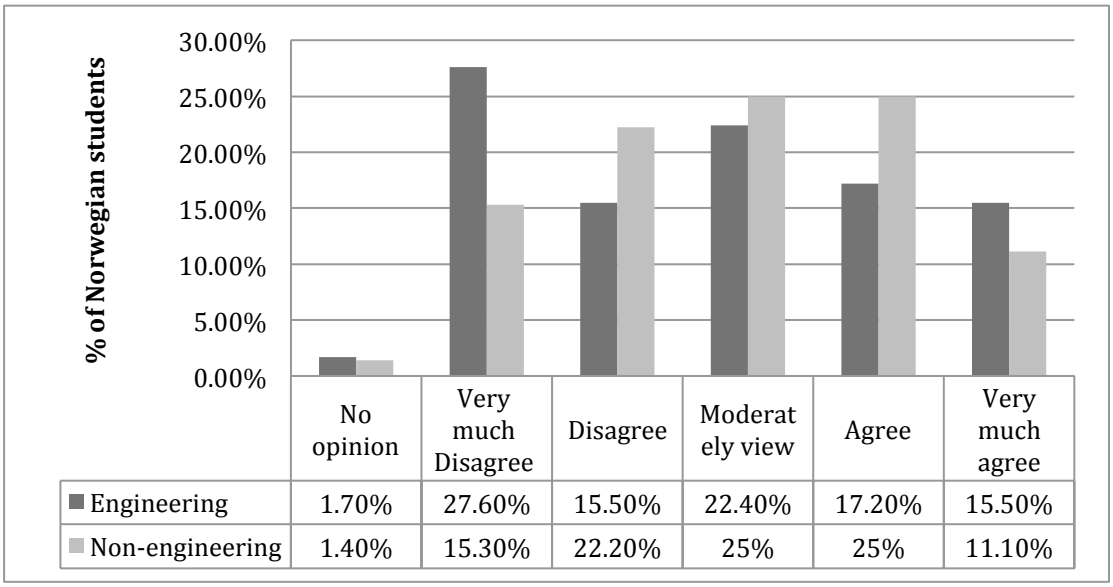
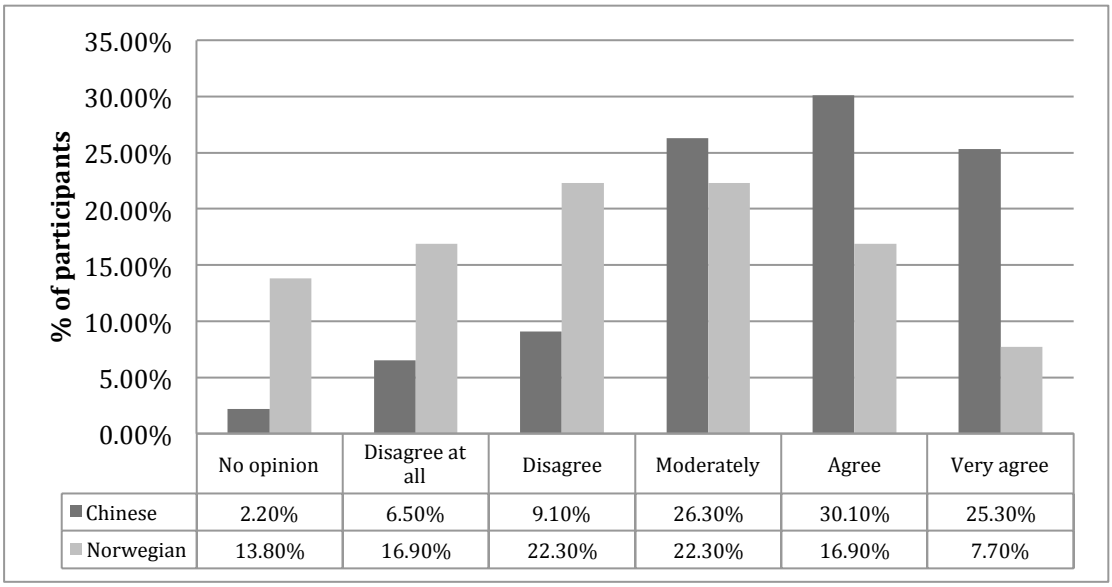


Figure 24 Percentage of different background Norwegian studensts are regard a statement that wind turbines look in nature
(Source from Question 10 in questionnaire)

There are 27.6% of engineering students who "very much disagree" and only 15.3% of non-engineering students "very much disagree" in Norway (Figure 24), which means that the view of "wind turbines may look good in nature" is opposed more by engineering students. Moreover, the percentages of them who "disagree" are 15.50% and 22.20% between engineering and non-engineering students. The percentage in total of the engineering students who "disagree" is 43.1% and the non-engineering students take 37.5%. The number of students who study engineering and non-engineering that "agree" with this view is 17.2% and 25%. It also indicates that students in engineering background do not think the wind turbines make the scenery better.

About the second statement in Question NO. 10; Whether wind farms may improve access to nature, in general, 55.40% of Chinese participants "very much agree" + "agree" with that, while among Norwegian students the number is 24.6% (Figure 25). In Norway there are 16.9% of students who totally disagree with that statement where in China the percent is only 6.5%. The result shows a very big difference between Chinese and Norwegian students' views on this issue. Chinese students think wind farms make nature more accessible whereas Norwegian students do not support this view.



	No opinion	Disagree at all	Disagree	Moderately	Agree	Very agree
Chinese	2.20%	6.50%	9.10%	26.30%	30.10%	25.30%
Norwegian	13.80%	16.90%	22.30%	22.30%	16.90%	7.70%

Figure 25 Percentage of participants views on whether wind farms improve access to nature (Source from Question 10 in questionnaire)

5.2.5 Priority between national park and wind farm

In Question NO. 11 asked: If a wind farm was in conflict with a national park or protected area in Norway/in China (for Chinese students), which one do you think should be given priority? The reason why I design this question is that in China some of national parks or nature reserves are in conflict with wind farms.

The result shows (Figure 26) that most of students think that national parks should have priority in case of such a conflict with wind farms. In terms of this result, the views of Chinese and Norwegian are very consistent.

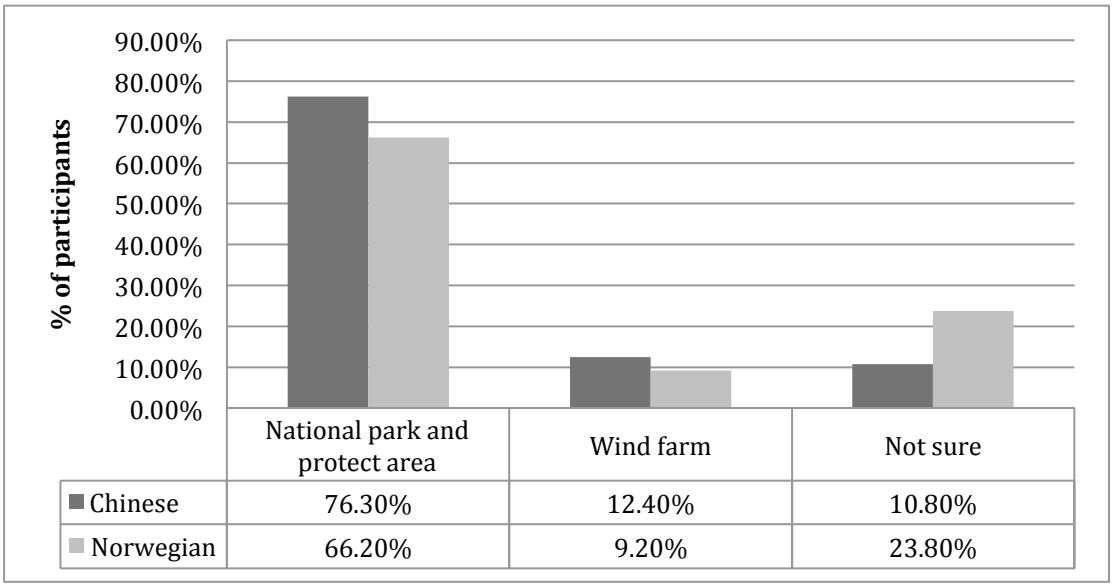
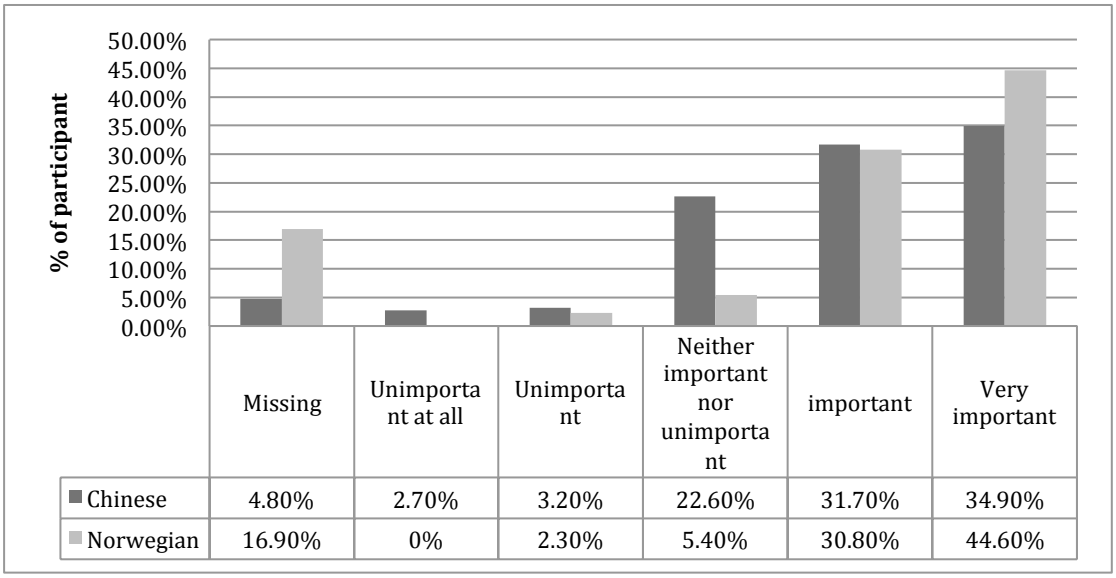


Figure 26 Rating of which one should be given priority when they meet conficts
(Source from Question 11 in questionnaire)

This result illustrates that when speaking of producing energy even if it is renewable energy, to some degree, most of youth choose to protect nature scenery first.

5.2.6 More wind farms in China/Norway?

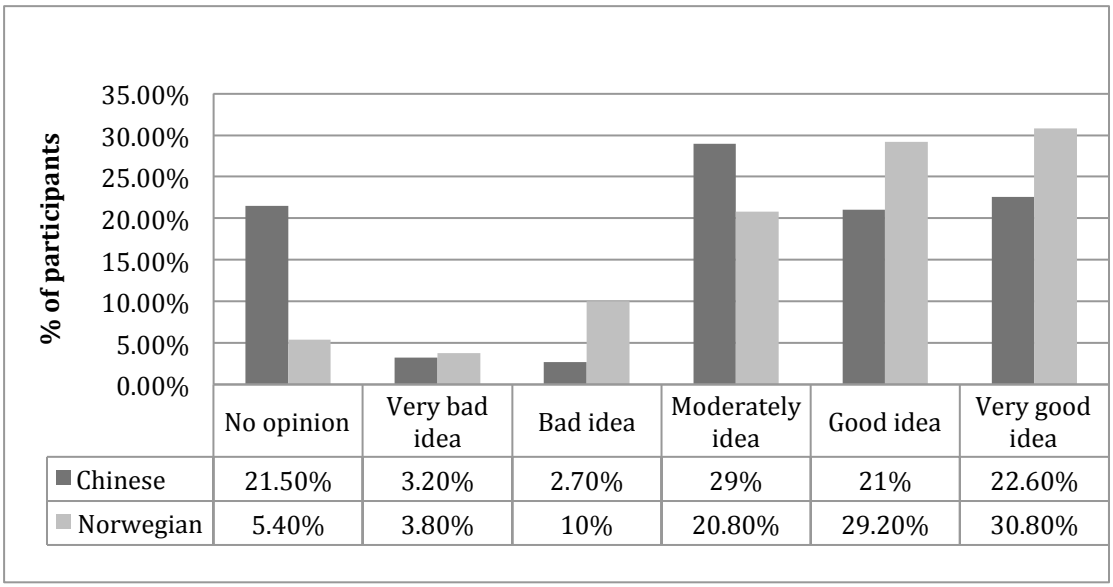
Next Question NO.11 is: Do you think it is more important for China to have more wind power? 0 is defined as on opinion, 1 as not important at all, 2 as not important, 3 as moderately view, 4 as important and 5 as very important.



	Missing	Unimportant at all	Unimportant	Neither important nor unimportant	important	Very important
Chinese	4.80%	2.70%	3.20%	22.60%	31.70%	34.90%
Norwegian	16.90%	0%	2.30%	5.40%	30.80%	44.60%

Figure 27 Perspectives-rating for importance of China to have more wind power
(Source from Question 12 in questionnaire)

From Figure 27 we can see that almost 2/3 of Chinese students think it is important to have more wind power in China, and almost 3/4 of Norwegian students think that as well. China as a resiliently developing country has a strong need for energy. Therefore, most of respondents have recognized this situation in China.



	No opinion	Very bad idea	Bad idea	Moderately idea	Good idea	Very good idea
Chinese	21.50%	3.20%	2.70%	29%	21%	22.60%
Norwegian	5.40%	3.80%	10%	20.80%	29.20%	30.80%

Figure 28 Perspectives-rating for Norway having more wind farms
(Source from Question 8 in questionnaire)

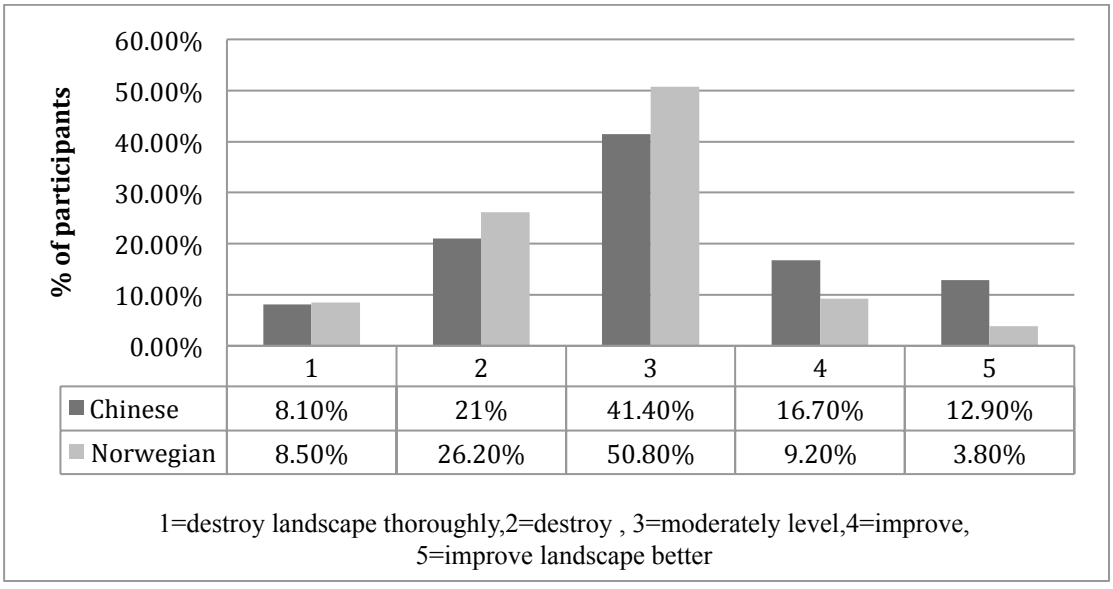
Likewise, based on Figure 28, 60% of Norwegian students think it is a good idea for their country to have more wind farms, only 13.8% of them thinks the opposite. Perhaps for

Chinese students, Norway is an unknown country, which they know a little, so 21.5% of them have no opinion about that questions. There are 43.6% of Chinese students seeing it as a good idea or very good idea.

5.2.7 Roads in wind farms impact on landscape

Onshore wind farms as a big projects, occupies large areas of land. When new wind farm is built, it will have an influence no local landscape to some extent. What are the students' attitudes towards this topic?

In order to see their opinions, I designed the question: A lot of new roads needs to be built if a new wind farm is constructing, so how do you think these new roads impact the local scenery. 1 means destroy landscape thoroughly, 5 means improve landscape better.



	1	2	3	4	5
Chinese	8.10%	21%	41.40%	16.70%	12.90%
Norwegian	8.50%	26.20%	50.80%	9.20%	3.80%

Figure 29 Percentage of students views on how the road in wind farms impact landscape (Source from Question 13 in questionnaire)

From the Figure 29 we can see that the answer of this question is similar between Chinese and Norwegian students, almost half of students determine to choose moderately perspective on this question. There are 29.1% of Chinese students think the roads inside wind farms will destroy the scenery, and 29.6% of them think the scenery will be improves by these roads. In Norway, 34.7% of students think the roads will destroy the local scenery and 13% of them

think the scenery will be improved by them. In a word, the Chinese students consider roads as more positive than and Norwegians

5.2.8 Open questions

As follows are the last two questions which are open questions:

Q 14. In your opinion, is it good or bad to build lots of roads in the mountain area connected to wind farms? Please Explain why?

Q 15.What other negative/positive impacts do wind farms bring to the surrounding environment?

80% of the participants answer Q 14 and 75% answer Q 15.

Analysis of Q 14

About Q 14, data results between Chinese and Norwegian students are quite opposite. About 57% of the Chinese students think it is good to build roads in the mountain areas but 42.10% of the Norwegian students think the same. So the majority of the Norwegians think the roads are negative wherever they are constructed, in the wind farms or in the mountain areas. According to the reasons they put, I divide the answers into several categories. Firstly, I will discuss the reasons why the Chinese students think it is good to build roads in the mountain areas that are connected to the wind farms.

Analysis of the Chinese students who vote "good" on the Q14

81% of the Chinese students answer the Q 14, more than 1/2 of who think it is good to build roads in the mountain areas, which are connected with the wind farms. 50 students, taking 47% approximately, mention that the roads inside the wind farms in the mountain areas are good for the local economic development. Because of these roads will improve the local transportation system and help the mountain areas communicate with the outside. Then there will be more opportunities for these rural areas to develop their economy, and the local people's living standard will be improved as well.

Among these students who think it is good to build roads, 10% considers that the roads can improve accessibility for people to get into the mountain areas and to see the wind turbines. And the scenery will be better with these wind turbines and roads if they are designed very well. In addition, with these roads, the mountain areas might attract more visitors, so that the local government can develop tourism to get more tax revenue and the local people can also benefit from that.

A saying went popular in China twenty years ago, that is "Building the road is the first step to become rich." Now, this thought is still ingrained in many Chinese people's minds. Many Chinese people who live in the mountain areas or the rural areas are living a hard life and very yearning for money, so what come to their mind first is to become prosperous. It seems impossible for them to care more about how to protect the environment or how to protect their "untouched" home if they haven't solve the problem of food and clothing. Moreover, some students say that, the construction of these roads inside the mountain areas may bring the local people more job opportunities, and help them have a better life. And 7% of the students mention that, many new roads in the mountain areas may also be helpful to improve the construction of the infrastructures, upgrade the energy structure and expand the energy supply.

Several students think that, the mountain areas is not that crowed like the cities, so it should be very easy to construct some big projects there like wind farms. And the construction of roads will be helpful to maintain and manage the wind farms.

Moreover, about 20% of the students consider about the environmental issues. in their opinions, the aim of building roads is to develop wind power, and the wind power as a very cleaning energy is very worth for developing in China. So for that reason, they think the roads inside the mountain areas are meaningful and valuable. Because the final goal of developing wind power is to protect environment and reduce pollution from traditional fuel energy, they treat that as a good use of resources.

Analysis of the Chinese students who vote "bad" on the Q14

About 43% of the Chinese students think it is bad to construct many roads inside the mountain areas. The reasons they give towards this issue are categorized as follows:

Many students, taking 70% or so, think that the roads inside the mountain areas will impact on the local ecosystem, biodiversity and landscape. The construction of the roads may destroy the local scenery and break the balance of the local ecosystem. They have recognized that the environment should not be destroyed again to pursue the economic development. Especially in the mountain areas that hold the national parks, roads should be moved away rather than to be built.

Some other students, about 20%, think that the construction of many roads may need more investment to and cost of the whole project, which is not necessary. Yet they still think that the energy will be wasted during the transportation if wind farms are too far away. What is more, some think that the mountain areas do not need so much energy as the developed areas do. So to build wind farms is a kind of waste of resources. To sum up, in their opinions, there is no need to build wind farms in remote mountain areas as well as the roads inside, due to the high cost and low utilization.

In addition, about ten students mention that the roads in the mountain areas not only destroy the local environment but also disturb the life of the local people, because these roads and wind farms may occupy a large area of the farmlands and bring more visitors. And they don't think the wind farms have a high value for travelling.

However, there still exist some students who consider this issue from a dialectical way. They accept that the roads are necessary if we want to build wind farms to get wind power. But meanwhile, they also recognize the roads may have a negative influence on the local environment and the people. So no matter which they choose, good or bad, they say that the roads should as less as possible and the environment should be protected as much as possible.

Analysis of the Norwegian students who vote "good" towards the Q14

42.10% of all the Norwegian students think it is good to build more roads in the mountain areas. Even though they choose "good", there are almost 1/2 of them explaining that the roads should be built in an environmental-friendly way and be designed so well that they are not intrusive.

The reasons that the Norwegian students give are: firstly, about 12% of Norwegian students think that it is more convenient and easier to access to the nature and then people could have more knowledge about the nature.

Secondly, another 12% students think that the final aim of building roads is to develop the wind power which is a renewable and cleaning power; and the renewable energy is more important than the view of the mountain areas. There is a student saying that "it is better to build roads in the mountain areas for more renewable energies than to use carbon and other non-renewable resources".

A few Norwegian students think the roads are good in the mountain areas only in Norway because they think the roads in Norway need to be improved. And they have no ideas about other countries. There are five students mentioning that the roads are needed because it is very useful for maintaining and installing the wind turbines and it is very helpful for constructing more infrastructures in the mountain areas. So it is good for the further development of this region.

Last, some students say that it is a necessary evil to build wind farms and roads in the mountain areas. It will probably not look that great, but they think it is the only option, and less is better that the roads don't necessarily have to be intrusive.

Analysis of Norwegian students who vote "bad" towards Q 14

The reasons why it is bad to build roads inside the mountain areas among Norwegian students are: firstly, the majority of the students say the roads in the mountain areas may impact on the local environment and ecosystem. For example, they may destroy the forest system, the habitat of the local species and wildlife, and make these areas more vulnerable. In addition, it may also disturb the local people's daily life. The peaceful and tranquil atmosphere will be broken by the new visitors or workers.

Secondly, some students (about 10%) mention that these new roads may destroy the aesthetic landscape and scenery. They think the roads inside the mountain areas look bad. Some students say that the mountain areas are "untouched areas" which should be protected and kept as it is. People should not go inside by building roads. The tourism is also not good for these areas, it may ruin these "untouched areas".

Furthermore, a few students think the roads will cost much money and it is very uneconomical. If it is only for getting access to wind farms, the benefit is not obvious either.

Based on the answers that Norwegian students give, I find that there are 20 students' answers are very dialectical. No matter they choose "good" or "bad", they have known that the roads have negative impact on the local environment and ecosystem. But some of them still support the construction of roads only if the mountain areas don't hold national parks and the roads should be built as few as possible. Others disagree on building roads in the mountain areas because of the negative impact it has on the environment, they recognize the importance of developing wind power for further sustainable development. And they also think the roads give more opportunities for people to know the nature better. So it is very hard for them to make a choice.

Analysis of Q15

Q15. What other negative/positive impacts do wind farms bring to the surrounding environment?

Chinese students' views towards this question

There are 143 Chinese students and 81 Norwegian students who answer the Q15, which take up about 77% and 62% respectively of total number of the participants. Most of them answer this question from a dialectical way—positive and negative. But what is the biggest difference is that most of the Chinese students think that building wind farms is more positive than protecting surrounding environment and what the Norwegian students think is just opposite.

For the Chinese students, they consider the economic development more important. What they think the most positive impact that wind farms bring is to help the surrounding areas to develop their local economy. For example, the construction of the wind farms can bring more job opportunities for the local people. In China, there exists a very severe problem about the left-behind children in the rural areas. It means the children left behind by their parents who go to the cities for job opportunities are lacking in cares. Proper solution of this issue is of great significance in terms of the collaborative growth of rural and urban areas, families' stability, social harmony and the overall progress of the nation. Maybe burying this issue in mind, most Chinese students think that more job opportunities are so important for the local people in the rural areas that they don't need to leave for the bigger cities to earn their lives. They mention some other positive impacts on economy—the wind farms can attract tourists and develop the local tourism.

Except for the positive impacts on economy, some Chinese students also think that the wind turbines make the local scenery more beautiful, improve the aesthetic landscape and make a distinctively beautiful scene, while the Norwegian students have an opposite view towards this issue. As the majority of them don't think the wind turbines make the landscape look

better, I will discuss this later.

In addition, some Chinese students think that, the wind farms are very useful and should be built because they will reduce the pollution in the long run for producing renewable energy instead of the traditional fuel energy in China. Meanwhile, they are a full use of the natural resources with electricity delivering to the local families and bringing more convenience. The modern technology are developed, more people know the wind power and more people become aware of the importance of the environmental protection and energy saving.

However, some negative impacts are taken into consideration among the most of the Chinese students. Wind farms may make noises, disturbing the local people, and the construction will ruin the local environment, ecosystem and landscape and cost a lot of money with low profit in return. This will have a bad impact on the local agriculture and development, and it is also a waste of land resources.

Norwegian students' view towards the impact of the wind farms

As I mentioned above, most of the Norwegian students think the wind farms have more negative impacts than the positive ones, which is quite the contrary compared to Chinese students.

As to the positive views, some students answer that the construction of the wind farms is a positive way to produce clean energy, reduce CO_2 emission and solve the air pollution. Development of the wind power is the full use of the nature resources, which can supply more energy for human beings. At the same time it is also a good way to protect the environment in a long run and maintain a sustainable development of the world. A few Norwegian students say that the construction of the wind farms brings economic benefits such as job opportunities from maintenance; decreases the number of hydropower stations in Norway; and brings about better road conditions for the local people. These positive views are very similar to the Chinese students'. Particularly, some Norwegian students also mention the offshore wind

power is a better option, but none of the Chinese students mention that. So the Norwegian students have a better knowledge of the wind power than Chinese students do.

Nevertheless，the reasons for negative views are quite different between the Chinese students and the Norwegian students. The wind farms may destroy or reduce the local environment. For example, it may break the balance of the ecosystem, disturb the habitats of wildlife, destroy the forest system, and endanger the local biodiversity. Besides, the construction of the wind farms may change and devaluate the landscape and ruin some "untouched areas" like the national parks or natural reserve area. Few Norwegian students think the wind turbines look good in nature; most of them view it as an eyesore. However, many Chinese students think the wind turbines make the scenery better and look very harmonious with the surrounding environment. So I think there is a large gap between the perceptions of landscape of the Chinese and Norwegian students. Noises from the wind farms also have an influence on the local people's daily life. And some ones mention the land occupation problem, which will bring about a fierce debate within the local community and the wind power companies. Another negative impact is the high constructing cost of the wind farms. The Norwegian students think that it is a high-cost-but-low-efficiency project to build the wind farms, so it is not necessary.

In addition, many Norwegian students mention that the wind turbines may kill or hurt birds, particularly the rare bird species, but no Chinese students bare it in mind. The Norwegian students mention the white-tailed eagle frequently. Because of Norway is a great habitat of the white-tailed eagle with about 40% of the European population (Gilbert 2002). Research on the impacts of the wind farms on birds has so far mainly focused on the mortality from bird collisions with turbines and with collision risk assessment, as it is thought to be the most severe problem from wind power generation (Hunt et al. 2000) Other possible negative impacts are loss of, or reduced, habitat quality and disturbance leading to displacement (Dahl 2010), which is not that serious compared to the death of birds.

Picture 3 White-tailed eagles

From October 2005 to December 2009, 28 dead white-tailed eagles (Haliaeetus albicilla) were recorded as collision victims within Norway's first large-scale wind farm on Smøla island, which in the central of Norway (Bevanger 2009). The archipelago supports white-tailed eagle population breeding at a very high density (Follestad 1999), an important reason for the island's status as an Important Bird Area (Heath 2000). In 2002, the largest Norwegian energy company (Statkraft) began construction of a large-scale wind power plant on Smøla, which had a lot of argument at that time actually. This power plant consists of 68 turbines covering a formerly undisturbed area of 18.1 km^2. In addition to the turbines themselves, the power plant holds an extensive infrastructure with a power station, 14.7 km of power lines and 28 km of roads connecting the turbines (Statkraft 2008). Smøla holds a large and dense breeding population of white-tailed eagles, estimated at more than 50 breeding pairs (Bevanger 2009). Bird species that mature late, lay few eggs and have a long life span have demographic characteristics making their population growth rate especially sensitive to changes in adult mortality (Sæther 2000). Eagles fall into this category, and are therefore vulnerable to increased adult mortality caused by wind farms.

So this phenomenon emphasize the importance of thorough preconstruction studies identifying important breeding areas for sensitive species. The cumulative impacts from several wind-power plants along the Norwegian coast and elsewhere could potentially have a substantial negative effect on the white-tailed eagle breeding population if they are located in important breeding areas, turning them from sources to sinks. Moreover, the results underline the need for more studies to properly assess the impact of wind-power plants on bird populations. Increased knowledge and understanding of the impacts of wind-farms on birds and other wildlife is essential for sustainable future wind-energy development in Norway and elsewhere (Dahl 2010).

As indicated in my previous description, Norwegian students listed a lot of negative impacts of constructing wind farms, while Chinese students listed quite many positive impacts of it. Although the negative impacts seem similar but the birds, it shows that less Chinese students recognize the negative parts of wind farms compare to Norwegian students. So I think the young people should be given freedom to participate in discussion of developing wind power in China or let them know what is really happened during the process of developing wind power.

5.3 summary

To sum up, university students in China pay more attention on domestic environment and economy whereas students in Norway are concerned more about global environment (climate change) and economy. Both Chinese and Norwegian university students view renewable energy in a positive light. Especially, solar power, hydropower and offshore wind power obtain a higher support level. Meanwhile, almost all the youth are not familiar with the technology of CCS. So the support level of coal power with CCS and gas power with CCS are lower both in China and Norway. Compared to China, Norway seems not that interested in other kind of renewable energy sources but hydropower.

As regards to the renewable electricity, the result shows that majority of the informants are willing to pay more money for renewable electricity. But on the whole, Norwegian students prefer to do this more. And the level of willingness paying more for renewable electricity among Chinese students based on their family income. The students who have taken part in environmental organizations are more willing to pay more than those who have not.

The attitude of visual impact by wind turbines is different among Chinese and Norwegian students. As for Chinese students, the wind turbines look good in nature whereas the Norwegian students think opposite. Furthermore, the views on this issue among female and male students on China are similar while in Norway males view it worse than females. Engineering and non-engineering students have the view on this issue in China as well. But in

Norway, most of engineering students think the wind turbines making the scenery worse than non-engineering students.

The opinions about the roads inside wind farms are different as well among Chinese end Norwegian students. Most of Chinese students think the roads give more opportunities for people to get close to nature. But in the view of Norwegian students, they think the roads in wind farms destroy the original landscapes. Almost all the students think the national park should be given priority when conflicts occurs between wind farms and national parks.

For the further development of wind power, nearly all the informants think China should have more wind farms. As for Norway, half of them support Norway to have more wind farms.

6. Conclusions

In the introduction I listed 2 main objectives of this study, these were

C) To assess the wind farms conflicts in terms of:
   - Impact on local people
   - Impact on local landscapes

D) To assess university students views on the impacts caused by wind farms.
   - Access to the different living and education background among the respondents.
   - Access to the attitudes of these respondents on the conflicts that wind farms caused.

According to the literature review and fieldwork in Inner Mongolia, I found that wind farms have some influences on the life of local people, which cannot be ignored. Although majority of public admit that wind power is a sustainable energy resource and they prefer to use the electricity generated form wind power rather that from fossil fuels, the wind turbines probably better not in their back yard (NIMBYism). Constructing of a wind farm will occupy a lot of land, which always as the main factor of conflicts among Wind Power Company and local people. It is also the most immediate impact on the life of local people. Furthermore, a long with the construction of wind farm, some other supporting facilities be built or improved in which aspect will bring both positive and negative impacts on local people. As for the positive aspect, it is good for developing local economy, increasing job opportunities, facilitating the lives of people and improving the local energy structure. Negative parts include the noise impact; degrade soil quality (impact on local farmers directly), visual and landscape impact. In short, the living environment of local people would be changed a lot by wind farms that closed to them.

In regards to the landscape impacts caused by wind farm, it has been argued for a long time and is still very controversial issue today. For environmentalists, increasing number of wind turbines has a big impact on landscape which with no doubt, especially on some “untouched areas”, mountain areas, rural areas and national parks. As time goes on, the attitude of wind

power changed a lot among public. Majority of people viewed wind power as a great energy source in the beginning. But with the fast development of wind power and more and more wind farms being constructed, fierce arguments about landscape impacts occurred around the world. For some areas, the density of wind turbines is very high which have changed the landscapes to a great extent. With the quality of life improving, the aesthetic consciousness of people has also been progressed and improved. In the light of some informants, no matter how wind turbine is designed to match the landscape, nature should always be kept as it is. As regards to some local people, although they are living conditions are not good, they still prefer to keep their original living environment without any modern lifeless machines.

China and Norway are very different countries with many aspects like geographical location, nature environment, economy condition, national situation, cultural background, and education structure and energy system. Although with so many differences, both of them pay more attention on wind power and still continue working on it. Based on the results of my survey of the views on wind farms impacts among Chinese and Norwegian university students, I found they have some different opinions indeed due to variable growth background. However, to some issues, they have similar perspectives.

Common views

Majority of the university students no matter in China and Norway have recognize the positive of renewable energy and accept wind power as a very clean energy source. So their attitudes towards wind power are all support but in different agree. Also, they concerned about some environmental problems at both local and global level like climate change and air pollution (concern more among Chinese students).

Referred to the construction of wind farm, they still have some same attitudes on that. More than half of them could assess this issue from positive and negative sides. Even though Chinese students generally tended to the positive sides and Norwegian students are opposite. Generally, the similar views about the positive impacts that caused by wind farms among Chinese and Norwegian university students are:

- Positive way to produce clean energy
- Economic benefit
- Reducing pollution in the long run
- Make full use of nature resource
- Improving awareness of environmental protection and energy saving.
- Improving the life quality for people live in rural areas

The general negative perspectives on wind farm among Chinese and Norwegian students are:

- Noise
- Destroying local environment
- Breaking balance of ecosystem
- Disturbing local people
- Disturbing wildlife habitat
- Land occupation problem
- High cost

Different views

The main picture is almost the same in both Chinese and Norwegian university students as I explained above, while, something in detail are very different. Referred to the positive sides, Chinese students stress more about economic develops for rural areas bring about by wind plants and then is the environmental advantages it caused. As for Norwegian students, there are more of emphases on the accessible improvement of nature that wind farm caused. In addition, for Chinese students, wind turbines impact on local landscape is positive. They think wind turbines improve the aesthetic landscape and make a distinctively beautiful scene whereas the Norwegian students have an opposite view, which means Chinese students and Norwegian students might have different standards of aesthetic sense.

For the negative part, the Norwegian university mentioned an aspect that none of Chinese students referred to, which is the killing or hurt of birds by wind turbines, especially the white tailed eagle in Norway. So this phenomenon indicates that the structures of knowledge are different between Chinese and Norwegian university students.

The attitudes about renewable energy are different as a whole due to the different development national situation. China is struggling to produce more energy to meet the demand of people need whereas Norway has already rich of petroleum and hydropower. Due to hydropower is a very good cleaning energy, some Norwegian students don't see the point of developing wind power in Norway.

Above all, according to this research, we can see that the attitudes on wind power development among youth are different based on their different backgrounds. So the further development of wind power should be have new diversifications

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Appendices

Appendices A: Questionnaire

I am a master student in NTNU. My program is Natural Resource Management and the purpose of this questionnaire is to collect data for my master thesis. My subject is to find out how different of views on wind power between Chinese and Norwegian students and compare them. Thank you all for filling in it with your precious time firstly.

1. Gender: □ Female □ Male

2. □ Bachelor □ Master

3. which program do you study? □ Geography □ other:_____

4. Are you concerned about the following issues?

	not concerned				very concerned	No opinion
Climate change	1	2	3	4	5	0
Local air pollution	1	2	3	4	5	0
The national economy	1	2	3	4	5	0
The global economy	1	2	3	4	5	0

5. Are you a member of some environmental organizations? □ Yes □ No

6. What is your attitude towards the following energy technologies? (CCS= Carbon Capture and Storage)

	Very negative				Very positive	No opinion
Solar power	1	2	3	4	5	0
Hydropower	1	2	3	4	5	0
Coal power	1	2	3	4	5	0
Coal power with CCS	1	2	3	4	5	0
Onshore wind power	1	2	3	4	5	0
Gas power	1	2	3	4	5	0
Gas power with CCS	1	2	3	4	5	0
Offshore wind power	1	2	3	4	5	0
Nuclear power	1	2	3	4	5	0
Bioenergy	1	2	3	4	5	0

7. Woud you be willing to pay more for electricity if it was guaranteed renewable?

□ Yes □ No

If yes, how much more would you be willing to pay?

Yes, I would be willing to pay up to

□ 20% more □ 40% more □ 80% more □ 100% more

8. Do you think it is a good idea to build more wind farms in Norway? (1=bad idea; 5=very good idea, 0= no opinion) 1 2 3 4 5 0
9. Have you ever been inside a wind farm? □ Yes □ No

The followings are two pictures of wind farms in Norway and China.

10.

	Disagree				Agree	No opinion
Wind turbines may look good in nature	1	2	3	4	5	0
Wind farms may improve access to nature	1	2	3	4	5	0

11. If a wind farm has conflict with a national park or protect area in Norway/in China(for Chinese students), which one do you think should be given priority?
□ National park and protect area □ Wind farm □ Not sure

12. Do you think it is more important for China to have more wind power? (1= not important at all, 5=very important, 0= no opinion) 1 2 3 4 5 0

13. A lot of new roads need to be built if construct a new wind farm, so how do you think these new roads impact the local scenery. (1=destroy landscape thoroughly; 5= improve landscape better) 1 2 3 4 5

14. In your opinion, is it good or bad to build lots of roads in mountain area that connection with wind farms? Please Explain why? □ Good □ Bad
Explian:_____
_____
_____

15. What other negative/positive impacts do you think wind farms bring to the surrounding environment? Explain:_____

Appendices B: Interview guide (sample)

Interview guide (sample)

Wind farms and their perceived impact on local landscapes

This is a very loose guide as to how the interview will be structured and what questions will be most important. However, as the interviews are meant to be of a more qualitative nature, new questions might arise throughout the process and jumps back and forth between topics might be made. Especially closed questions in this guide will most likely be followed up by one or more open questions of the same subject, although not specifically stated below. Length of interviews is estimated at approximately half hour, not necessarily all question will be asked.

1. Introduction

- Information on Master Thesis project
- Assurance of confidentiality of personal details/information given during the Interview
- Explanation of Interview structure

2. Main research question

- What effect has wind power had on landscape and people during its development in China?
- Sub-question for data gathering:

How does Han Wu La Wind Farm impact on local environment and residents during its construction?

3. Background

- For which company do you work currently?
- What is your position?
- How long have you worked in Han Wu La Wind Farm?

The goal of these questions is to be sure which positions do these participants work in Han Wu La wind farm. And the following questions are meant to find out how participants that from different positions view on the main research question: How does wind farm impact landscapes and local people?

- To what degree do you think wind power is a good way to produce energy in China?
- There has been already had many wind farms in Inner Mongolia. Do you think it is necessary to build more here?
- What is your opinion about the impacts that Han Wu La Wind Farm caused on local environment and residents?
- What do you think of the roads that inside wind farms impact on landscape?
- How do you deal with the garbage that produced during the construction?
- How do you think of the scenery with wind turbines in Inner Mongolia, make the scenery more beautiful or worse?

4. Conclusion

- Further comments and suggestions?
- Other questions you would have liked me to ask/ focus more on?
- Do you have any questions that you want ask me?
- Other people/groups you think I should talk to?

- How would you evaluate the quality of the interview?

Thank you for your help and participation.

Appendices C: Contract a

Contract A: Land Acquisition and Expropriation Temporarily Side Agreements of Han Wu La Wind Farm Project that under Da Tang Wind Power Company

大唐新能源察右后旗韩勿拉 49.5MW 风电项目 220KV 送出线路工程 征地及临时用地补充协议

甲方：

乙方：

大唐新能源察右后旗韩勿拉风电项目 220kV 送出线路工程，因工期延后跨年度施工，致使放线施工必然发生临时用地耕地青苗的二次碾压，经与乡政府协商，乡政府同意放线施工期间青苗损坏的二次赔偿由施工单位自行对受损失村民给以补偿，乡政府派专人配合施工单位做好对村民的补偿兑现工作，使工程得以顺利完成

甲方签字：　　日期：

乙方签字：　　日期：

Appendices D: Contract b

Contract B: Compensation for Land Temporary Expropriated

临时占地补偿协议

工程名称：大唐新能源察右后旗风电项目 220kV 送出工程

施工单位：内蒙古送变电有限责任公司送电第四工程处

被征地方：察右中旗土城乡、塔步村委会

为了保证大唐新能源（察右后旗）有限公司韩勿拉风电项目 220kv 送出线路工程顺利施工，维护好农牧民的切身利益，依照《中华人民共和国》和察右中《旗中政办发【2012】6》文件，及其他有关法律，行政法规，遵循平等，自愿，公平和诚实信用的原则。

一、施工单位因施工需要临时占用、使用被征地方土地，征地方不得乱走乱压草地，经共同协商后决定占地协议如下：

二、施工方在被征地方土地施工车辆运输砂石和材料堆放造成临时碾压一次补偿_____元。图纸编号为_____铁塔到_____铁塔。此款包含铁塔永久性征地款和铁塔周围线路施工基础浇制、铁塔组立、放线材料用地青苗补偿费（包括临时用地和道路碾压等），此款包干使用，被征地方领取征地款后应允许征地方进行施工，被征地方不得以任何理由阻碍征地方施工。如征地方因被征地方阻碍不能正常施工造成一切损失由被征地方负责。

二，农牧民须向建设单位提供本人身份证复印件，签字并按手印；并附各种补偿明细表，由乡政府村委会开据补偿无遗留问题证明。

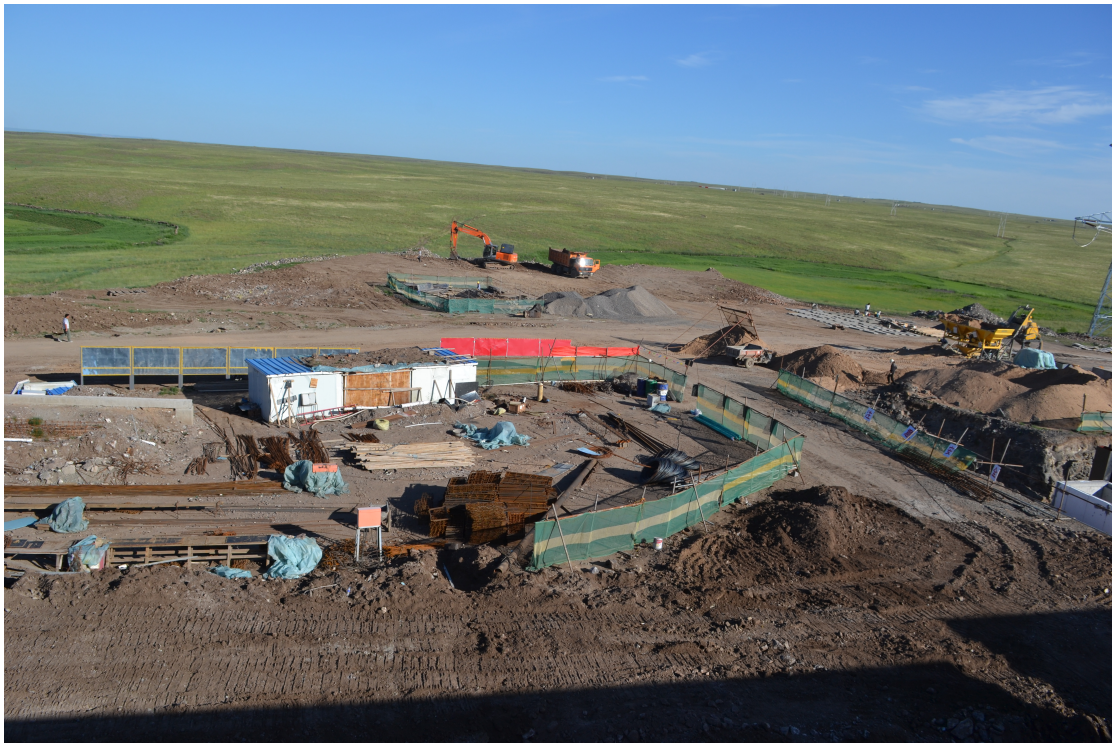
Appendices E: Photos

Picture 4 Air pollution caused by a truck in Han Wu La Wind Farm

Picture 5 Local people who are preventing the constructing of wind farm

Picture 6 Randomly burning garbage in wind farm 1

Picture 7 Randomly burning garbage in wind farm 2



Picture 8 Construction site of Han Wu La Wind Farm

Picture 9 Han Wu La Wind Farm and flock of sheep

Picture 10 Houses of local people who live close to Han Wu La Wind Farm