Assessment of New Energy Use Policy in Land Use Planning

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Assessment of New Energy Use Policy in Land Use Planning

By

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A THESIS

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Master of Community and Regional Planning

Major: Community and Regional Planning

Under the Supervision of Professor Zhenghong Tang

Lincoln, Nebraska

May, 2012
In modern society, energy has long been a part of human life. However, traditional energy resources will be used up eventually, and they also cause environmental pollution. In contrast with traditional energy resources, new energy has three major advantages: it has high efficiency, renewable and environmentally friendly. Considering new energy’s efficiency, local government should adopt appropriate policies. New energy policies are the most effective and direct method to enable governments to achieve their goals.

This study mainly focuses on how energy policies can improve the efficiency of new energy use. More specifically, this research addresses three major questions: 1) To what extent does California local planning addresses the new energy policies? 2) Which policies have local jurisdictions adopted to directly improve new energy use, and which strategies have received the most and least attention? 3) What methods or models can other place learn from California? In the United States, California has established a successful new energy use system. This paper uses California as a study area. California has 58 counties. The study sample is 37 counties which have energy plans and have updated them at least once.

To systematically evaluate new energy use in these counties, the author examines six policies from energy plans and general plans: conservation easement, energy efficient buildings, low impact
development, clustering and mixed-use, greenhouse gas emission regulations and transit-oriented development. The research methodology uses these policies as indicators and uses the Geographic Information System (GIS) and statistical tables as evaluation methods. After describing these policies, the paper describes the characteristics of the six policies and suitability for adoption in other places of the world using the result tables and GIS graphics. The discussion and analysis may provide the state of California with some helpful suggestions. In addition, these six policies could be adopted in other places; the suggested location is Guangdong Province in China, which has similarities with California and is deficient in adoption of new energy plans and new energy use.

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Chapter 1: Introduction

Section 1: Problem statement:
In recent decades, energy resource is a hot topic. It is vital to every country, including the United States. Americans are overly dependent on petroleum and other fossil fuel resources. Some experts think that situation will harm the natural environment. In addition, citizens’ routine lives will also be threatened with environmental degradation and energy resource depletion. To address this issue, planners’ attitudes and practices in their communities have an impact on both energy demand and the type of energy resources available for use in the future. However, not only Americans face these problems, most countries do as well. In addition, natural disasters are happening more often than half a century ago, and there are some evidences that prove that these disasters have something to do with environmental pollution. As one example, climate change has already threatened human security. How does climate change happen? According to several scientific researches, climate change is mainly caused by greenhouse gas emissions. Ironically greenhouse gas emissions have become a problem since the industrial revolution which is a milestone in human history. Yet, the impact of greenhouse gas will eventually have adverse effects on humans, the environment and the economy. (Beck, et al, 2008)

In this situation, new energy is imperative. First of all, in contrast with traditional energy, new energy has three major advantages: it is highly efficient, renewable and environmentally friendly. More importantly, new energy can solve the global energy crisis and reduce the hazards which caused by traditional energy pollution. But new energy use is a kind of high-tech process, and most of them need a system progress. A reasonable way is to set up a “new energy plan”. In recent decades, some states or
local governments have made some energy plans but they were all isolated. To improve new energy use efficiency, the author proposes to include energy policies into local general plans. Theses policies can stimulate new energy use development and play a significant role when new energy use encounters barriers such as market barriers.

This study focuses on local land use plan policies and energy policies linked to new energy use plans. I chose California as a sample study area, identify some typical policies as indicators, and use the Geographical Information System (GIS) and quantitative statistics analysis as evaluating methods. Through this work, this research displays and illustrates how the relatively successful energy policy model works in representative locations. In this study, the major works are: 1) evaluates existing energy policies and suitability of land use planning policies for new energy use; 2) identify the differential of each policy to be adopted in different places through the results. Finally, based on the results, I discuss and conceptualize an ideal framework which can efficiently use new energy in land use planning.

Section 2: Definitions of key terms:

For better understanding this paper, it is necessary to define “new energy”. In common sense, new energy only means solar energy, nuclear energy, wind power, and so on. However, these energy sources are only part of the new energy family. In a professional definition, new energy is alternative energy, sustainable energy or renewable energy. According to several sources:

Alternative energy: (1). “Energy fuelled in ways that do not use up natural resources or harm the environment” (Oxford Dictionary, 2007). (2). “Energy derived from sources that do not use up natural
resources or harm the environment” (Princeton Word Net, 2006). Alternative energy can provide necessary resources to land use plans from natural sources that do not harm nature.

Sustainable energy: (1). “Dynamic harmony between equitable availability of energy-intensive goods and services to all people and the preservation of the earth for future generations” (Tester, et al, 2008). (2). “Any energy generation, efficiency & conservation source where: Resources are available to enable massive scaling to become a significant portion of energy generation, long term, preferably 100 years” (Natural Resources Defense Council, 2008). (3). “Effectively, the provision of energy such that it meets the needs of the future without compromising the ability of future generations to meet their own needs” (Renewable Energy and Efficiency Partnership, 2004). Sustainable energy will help long term land use planning since the energy can be used for a long time while it must be efficient.

Renewable energy: “Renewable energy resources are naturally replenishable, but flow-limit, and they are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time” (Webster dictionary, 2008). Renewable energy can be directly used in the land use plan or energy plan to increase energy use efficiency.

After the brief introduction of new energy, it is necessary to state why new energy so important. To answer this question, one must discuss traditional energy sources. After all, the fundamental situation is that our traditional energy sources are being used up and are also harmful to our environment. For instance, coal or fuel, which is the most popular energy source since the industrial revolution, is a low efficiency energy resource compared with any new energy resource. Firstly, it consumes the original
materials such as timber or petroleum, which is limited in the world; additionally, they emit gases like CO2 that can be harmful to human health and the environment. In short, traditional energy is not suitable for sustainable development anymore. Hence, we need other energy sources that can support our development. Fortunately, we have new energy. As we define it, new energy mostly comes from nature, like sun, wind and so on, so we can consider it as an unlimited resource. These resources will not be used up. What is more important, compared with traditional energy, is that new energy is friendly to the environment and to human beings. Just imagine that in a few years from now, we can use solar energy to replace coal or fuel so that we do not have to endure car exhaust. We can live in a clean new world.

Now that the importance of new energy resources has been stated, it is a good time to introduce what are the existing new energy resources.

**Wind power:** According to our geographical knowledge, the wind comes from the differences of temperature due to the fact that the Earth is unevenly heated by the sun. The wind energy stored in its movements, and it can be used to generate power. Wind power has much potential for development. Wind power have less effects on the environment compared with traditional energy sources, since wind power consumes no fuel and emits no air pollution, unlike fossil fuel power sources. Although a wind power plant consumes much materials and money, a scientist named Garrett Gross, from the University of Missouri at Kansas City, said that compared with the contribution of wind power, the negative impact of a wind power plant can be ignored (Gross, 2009). One more consideration is danger to birds in some locations. However, some studies show that the number of birds killed by wind turbines is very
low compared to the number that die by other means of generating electricity, especially the environmental impact of using non-clean power sources. The disadvantage of wind farms right now may be the area. Most wind farms are established in counties on agricultural farms’. However, wind farms are generally compatible with agricultural operations, occupy only a small area, and are compatible, with only small areas of turbine foundations and have minimal or no effects on agriculture. One more disadvantage of wind farms is noise. In the United States, there has been industry or housing loss due to their properties being close to wind turbines. Fortunately, using noise-reduction-modifications for the wind turbines could solve this problem.

However, wind power is also unpredictable. Environmental changes can affect wind power generation; a decline of wind speeds would reduce energy yield. A model reported in the November 2010 issue of the “Journal of Renewable and Sustainable Energy” claimed that wind speeds are influenced by several factors such as a huge forest area, climate change or even wind farms (Widder, 2010).

Hydropower: Hydropower comes from water movements. Like wind power, the movements can provide a lot of energy. Prior to the widespread availability of commercial electric power, hydropower was used for irrigation and operation of various machines, such as watermills, dams and domestic lifts. Hydropower sometimes can be particularly powerful such as in time of floods. Flooding is certainly a natural disaster, but the huge movement of powerful energy can be converted to generate electricity though appropriate methods.
Solar: Solar power involves concentrating sunlight and converting it to electric or heat energy via specific infrastructure. Solar energy mostly means the radiant light and heat from the sun, and according to solar physics, solar power has been utilized since a long time ago. We can say that solar energy has been humankind’s best friend for a long time. However, not all solar radiation can be converted to the energy we want, like wind and wave power or hydroelectricity. Only a minuscule fraction of the available solar energy can be used. Solar energy has great potential, but the transformation from solar power to useful energy is much more complicated, even though there are a number of solar applications such as solar lighting machines or heating machines. To briefly summarize, while solar energy has tremendous potential but humans have only developed a small part of it.

Compared to other new energy forms, solar energy is relatively harmless. However, solar energy is not suitable for every place of the world. Its effectiveness depends on a geographical location, like places closer to the equator have more "potential" for solar energy, and places further from the equator has less solar energy potential because they have less sunshine. Also, other natural energy sources have the same disadvantages, like wind and hydro; they all depend on the geographic location (Ramachandra, 2007).

Biomass source “is biological material from living, or recently living organisms, such as wood, waste, (hydrogen) gas, and alcohol fuels” (US Department of Energy, 2010). The biomass energy’s major functions are to generate electricity and produce heat though the plant grown. Plants can also generate electricity while they are still alive. This is a typical example of sustainable development. However, the
most conventional way to use biomass sources still relies on direct incineration. For example, humans often burn dead trees, branches wood chips and garbage. However, biomass also includes animal waste which can be burned as fuel or gas.

Biomass energy is derived from six distinct energy sources: forestry crops and residues, agricultural crops and residues, sewage, industrial residues, animal residues and municipal solid waste. The largest source of biomass energy is from forestry and agricultural wood sources like paper waste and harvest waste. Here the “waste” does not mean “wasted” energy. In general, it is still accounted for in the forestry and agricultural areas. Waste energy here means solid waste, architectural waste, and the waste gas. Actually, some states such as California conduct research on “hybrid vehicle” that use the solar energy and biomass energy to replace the fuel and gas as the power source.

**Geothermal** energy is from the earth’s core. The definition is “energy obtained by tapping the heat of the earth itself, both from kilometers deep into the Earth's crust in volcanically active locations of the globe or from shallow depths, as in geothermal heat pumps in most locations of the planet” (US Department of Energy, 2010). Just like wind and hydro power, the location is crucial to geothermal energy. In addition, it will be very expensive to build a power station even in a suitable location. To be frank, this is one of the large barriers to geothermal use. However, when a power station is already established, the operating costs are low and the energy is sustainable for a long time.

There are three major types of power plants or power stations that are used to generate power from geothermal energy: dry steam, flash, and binary. In short, the dry steam plants take hot steam from
underground and use it to generate power. California has the largest geothermal power plant. The flash plants take hot water out of the ground, and separate the hot water into steam and water by the facility when it is up to the surface. The flash plant is the most common technology among them. It was invented in New Zealand. The last one is the binary plant; the process here uses hot water which comes from underground and takes organic fluids to generate the energy source. In addition, scientists have also found that rocks are able to store geothermal energy artificially. They inject hot steam and geothermal fluid which process all three types of the plants into the rock to generate heat. (Wagner, 2007)

As stated above, the core of the Earth, the place from which hot underground steam or water can be excavated may be suitable to generate geothermal energy. The United States has abundant stored geothermal energy. In the United States, the most famous locations are the Yellowstone basin and northern California. There is also the potential to generate geothermal energy from hot and dry rocks. In addition, scientists have found some rocks that can also release geothermal energy. In the future, geothermal energy is predicted to be widely used.

**Tidal power** is “the only form of energy which derives directly from the relative motions of the Earth–Moon system, and to a lesser extent from the Earth–Sun system” (US Department of Energy, 2010). As stated above, tidal energy comes from the gravitation which is produced by the Moon and Sun. To be more specific, tidal energy is extracted from large bodies of water produced by the gravitational forces. To use this energy, one still has to consider a suitable location that has large bodies of water and is affected by the gravity of the Sun and Moon. The power of tidal energy is related to so many elements
such as the changing positions of the Moon and Sun, the Earth’s rotation, and the local geography of the sea floor and coastlines. Since tidal power is ultimately due to gravitational interaction with the Moon and Sun and the Earth's rotation, one big advantage of tidal power is that it is practically inexhaustible. Tidal power is utilized in many places in the United States. Maine has established the first tidal power station. To support this new energy use, California has explored tidal power in San Francisco Bay, which is also zero emission renewable electric power.

**Energy planning:** To date, “energy planning” does not have a professional definition. Energy planning is commonly referred to as a long term process to establish or strengthen local or national energy use systems. It is not a term in “fashion” in this century; many countries or cities have already been doing this plan. For example, California has its own Energy Plan Commission. Because environmental problems have become more serious over the years, energy plans tend to encompass sustainable development, energy efficiency and clean energy (which basically means new energy). Because new energy is becoming popular and considered by more people, the “new energy plan” has been developed. This new energy plan focuses on implementing new energy to substitute traditional energy in planning; it also relies on local or federal policy. In addition, unlike traditional energy use, new energy has its own characteristics such as techniques that still need to be developed or upgraded according to location. New energy plans not only focus on planning fields, but also pay attention to new energy itself. Broadly speaking, new energy plans have five steps: 1) find a suitable location (such as strong wind power); 2) organize the problems, and find barriers the planners may face and assess them; 3) if passed step two, then formulate a model to use the energy and establish the plant; 4) find support for the policy, and if there is not one, then make a proposal; and 5) take practical action.
**Energy policy:** In the United States, energy policy typically includes several elements. First of all, the major part of the policy is energy sources such as fuels (traditional) or solar (new energy), which have been described above. The target or goal of an energy policy is to achieve efficient energy use though energy planning. To implement a plan or a policy, government should consider the budget, initiatives and tax incentives. In the United States, the funding channel also includes public investment and loan guarantees. Energy policies will give varying definitions or meanings in different situations. In the new energy policy, “law access” means using legal methods to protect or utilize the new energy.

**Section 3: Literature review:**

To make this study more reliable, it is necessary to quote some experts opinions. Rolf Wüstenhagen, a Switzerland energy scientist has written an article named “*Strategic choices for renewable energy investment: Conceptual framework and opportunities for further research*”. (Wüstenhagen, 2011) His main point of this research is that in any energy policy, government should present the risks while they contribute some benefits, and the policy makers should be highlighted the risks rather than avoid them. Since the outcomes sometimes may vary it would overall dampen investors’ enthusiasms for new energy. Furthermore, he discussed investments in project finance, stating that the present investment for new energy instruments provides guidance for equipment which can be improved in a few years. Finally, he addressed the new energy market. Recently, the energy market is experiencing dynamic growth because of global awareness of energy issues. This situation would help policy makers deviate from the trend of traditional energy and move toward new energy resources.

In 2009, American energy policy researchers Elizabeth Doris, Joyce McLaren, Victoria Healey, and
Stephen Hockett co-authored a book named “Renewable Energy Development and the Role of Policy” (Doris, et al, 2009). According to their research and data analysis, they found that new energy policies on energy development were not well understood due to the limited time and extended evaluations which show lack of practical experience with new energy policies. Because of that, they proposed the “current best practices” for new energy policy. They suggest that best practices should mostly be based on policy design which is expected to result in further new energy development rather than simply extending their experiences everywhere. As they explained, the more policies are implemented on different levels; the more policy makers will pay attention to the interactions between the federal and state levels. To be more specific, they identified the best practices, which can be majorly categorized as “contractor licensing, interconnection standards, renewable energy access law, renewable portfolio standards (RPS), and mandatory utility green power consumer option” (Doris, et al, 2009). After they summarized the status of new energy development in the entire United States, they found that the policies have shown encouragement. Furthermore, through their “best practices”, they not only found the connection between policy and new energy development, but also refined other factors that affect the new energy policy. According to their research, the factors include: financial and economics, land use programs, environmental issues, social acceptance, resources protecting, advanced technology, institutional structure and transmission factors. (Doris, et al, 2009)

In 2004, an international association of local governments named ICLEI (Local Governments for sustainability) published an article named “Sustainable Urban Energy planning”. This article illustrates several cities’ experiences which developing an energy plan and summarizes 10 steps to develop a sustainable energy plan for a city. For example, ICLEI reports on the “5 milestones” to reduce
greenhouse gas emissions. This method provides a standard system to test, manage, reduce and forecast the greenhouse gas emissions in a city. According to this article, urban planning also has something to do with reducing greenhouse gas emissions. For instance, mixed-use community increases energy efficiency, transit oriented development reduces vehicle pollution while limiting sprawl, and planning high density communities also benefits energy plans. (ICLEI, 2004)

Boqiang Lin is a professor with the China Energy Economy Research Center of Xiamen University. He focused his analysis on the new energy use market between the United States and China, and the cooperation of both countries. He said that that new energy industry has grown so fast that many countries have had to face global threats such as climate change and energy insecurity. In addition, he also describes the new energy challenge and opportunity for China; China is in the rapid process of industrialization and urbanization, and over development is a danger to the scarcity of natural resources, energy costs and other concerns. Furthermore, the new energy in the United States will play an important role in the United States, because it has the potential to support their economy and maintain American influence on global energy issues. Coincidently, the Obama administration has also considered improving new energy technology and sustains its leadership in this field. On March 30, 2011, the administration enacted several energy policies. Specifically, these policies emphasized expanding new energy sources as an oil substitution and strengthening clean energy standards to increase new energy use efficiency.
Section 4: Summary

This chapter introduced why this study chose this topic and gave definition of some core words. Then, the literature review quoted some experts ideas to support this thesis. First of all, some experts emphasize the connection between an energy policy and an energy plan, which provides the basis of this thesis to use energy policy to support energy use plan. The ICLEI’s work provides several cities’ successful energy plans models and methods, which also provides valuable references for later policy selection and assessment. Finally, a Chinese professor’s idea explains why this thesis focuses on transferring a United States model to China.
Chapter 2: Research Framework

Section 1: The mission

As we understand the problem of new energy use, what can our planners do? Referring to some planning journals, planners can 1) set clear goals; 2) give guidance on efficient energy use and diversify our energy supply through their decisions; 3) collect energy information and data; and 4) choose the most benefit plan from several optional plans (Berke, 2002). Increasingly planners will be asked to help inform communities regarding the use of traditional energy sources. However, most planners lack of experience with energy-efficient community planning and are confused about the range of new energy options which are available.

First of all, for most states and cities to carry out new energy policies, planners must have an awareness of their influence, as well as the knowledge and methods to incorporate the new energy use and planning considerations in all aspects. Secondly, they also need to know how energy issues are connected to planning and what resources they can use to assist their task. Finally, they need to fully use local land use plans to assist with new energy use. Local land use plans can provide a fundamental factual basis for local land management, developing new energy plans, setting a long-term sustainable mission, making appropriate land use policies, coordinating cross-boundary planning issues, and implementing development decisions. In short, their mission is to utilize policies contained in local land use plans and energy plans to influence the use of new energy resources.
Section 2: The new energy plan current situation:

As mentioned before, state and local governments have adopted new energy use. To sum up their results, they are doing a good job in addressing climate change, including reducing greenhouse gas emissions. For instance, the California state government passed several assembly bills to support these policies, which are detailed in the next section of this paper. However, in my opinion; new energy plans should be more popular. In another words, it should be convenient and comfortable to most citizens. For example, in some communities there are one or two houses using solar heaters, so why can’t we convince the other residents to use them? Worldwide, new energy use is unbalanced. Developed countries have mature new energy systems, but developing countries still have a long way to go. Last but not least, new energy planning plays a relative isolated role in planning. No one extends it to local land use planning. Actually, it will be mutually beneficial if local planning would use it in the right way. How to use new energy in local land use planning is my purpose of this paper.

Section 3: Research objectives:

The objectives of this study are as follow: 1). through evaluation of the typical energy policies in California, this thesis attempts to make some improvements in new energy efficiency in local areas by implementing several energy policies. These policies are the most effective and direct method for government to achieve its goals. Policies derive from goals and objectives, but focus more directly on government action. For example, energy policies can set forth regulations for energy plan to ensure that progress is being made in a correct manner. Policies represent the heart of a plan because they actualize community goals and objectives. Strong policies draw heavily on environmental and land-use planning literature to identify tools that effectively protect ecological systems. In this paper, the author chose
several existing policies from counties in California to illustrate land use plan links to the new energy plan. California leads in new energy efforts across the country. 2). this thesis tries to suggest that California’s successful models can be replicated in other places such as fast growing cities or provinces in China.

Section 4: Research questions:

Although many previous studies have researched new energy plans, few have focused on the relationship with local planning and new energy policies. To date, there is still no empirical model to show how local planning policies related to new energy plans. In recognition of this gap in the current research, this paper may propose a change. In this regard, this study will focus on the questions below:

1) To what extent do California local plans address the new energy policies? 2) Which policies have received the most and the least attention from local jurisdiction? Why did the local governments show different levels in new energy plans? 3 Which of California’s energy policy development methods or models deserve to be replicated in other places?

Section 5: Factors influencing the new energy plan:

According to an energy policy experts’ article titled “Renewable energy policies and barriers” (Beck and Martinot, 2004), the major barriers that obstruct energy plan implementation are: 1) institutional; 2) financial; 3) capacity/skills; 4) time; and 5) locations. The institutional problem is a common planning issue (Sawin, 2004). The core barrier is management gaps. For example, local government discovered a farm which is perfect for using wind energy; however that farm is private property. Legally, the farm owner has the right to utilize the land as he/she wants. Government has to spend more time to negotiate
it. And then, the new energy plan needs public participation before adoption. Like solar energy panels installed by willing residents, some citizens do not realize the new energy’s benefits so they do not want to spend money on new energy facilities. Hypothesis solution: pass related laws or policies, encourage public participation, and popularize new energy use. Secondly, financial issue is a major problem for government. For instance, a solar project in California cost 3.35 billion dollars (California Energy Commission, 2010). In my opinion, this demonstrates that local governments can promote and adopt new energy use when they have enough fiscal support. Hypothesis solution: Government may cooperate with energy companies or provide new energy use investment bonus (Cory, 2008). Next is the capacity or skills issue. This is based on geographical location such as by a riverside. A few decades ago, building dams was a trend, but not every river is suitable. If these locations are not thoroughly evaluated by planners, there may be multiple hazards. Some places have delicate natural environments and they cannot afford too many new energy plans. Frankly speaking, this problem could be an easy one as long as planners have the awareness of protecting environment while setting up a plan. Hypothesis solution: Planners should set up protection policies such as conservation easement. The last one is a “stubborn” one: time. Just like land use plans, new energy planning also take a long time to go through the process. During the planning process, local governments should persist until the plan is finished. Hypothesis solution: they can separate the planning process into phases so that people can see some results in a short time (Beck and Martinot, 2004).

Section 6: The way to fill the gap:

The evaluation standard of this study will concentrate on three key points: 1) awareness, 2) analysis, 3) actions (Tang, et al, 2009). In order to focus on new energy, first of all local planners should have full
awareness of how to use new energy, and then make a thorough analysis of the advantages and disadvantages of new energy policies. Finally, they should convert their awareness and analysis result into concrete actions. By combining existing concepts of new energy plans and policies, this paper develops a framework using these three critical components to evaluate local planning that addresses new energy policies.

Awareness measures whether policy makers understand the concepts of new energy use. There is currently sufficient evidence to support the idea that new energy is and will continue to be beneficial. Local governments should have an awareness of the trends of global new energy use. Additionally, many cities have adequate resources but few of them have drafted policies. In reality, local plans significantly influence new energy plans. The American Planning Association (APA) did a survey on what percentage new energy occupies in planning issues, finding that new energy play an important role in planning issues.

According to their survey (APA, 2008), new energy takes 83% in transportation and sustainability planning, 79% in smart growth, and 76% in environmental protection, those data are mostly directly connected to new energy; however, it still take 60% in economic development, 55% in quality of life, 50% in affordable housing and 40% in public health. Although these four planning issues are not seen as strongly connected to new energy, they do show that new energy has a large influence on planning issues. For example, new energy has one policy named low impact development, which requires controlling storm water runoff and also protecting water quality. This is directly connected to public health.
Analysis means to identify and assess the advantages and disadvantages of the new energy policies in local planning. Analysis should involve using typical tools like GIS modeling graphics and statistical tables to identify the best and the worst places to use new energy policies. A good analysis should provide a scoring table to show the variation or differential of each policy in the same place or the same policy in different places.

Actions involves relative policies, tools and strategies to focus on new energy use policies in local planning, and how to use those policies to protect new energy resources and improve new energy use efficiency. Because new energy resources are important and complicated, successful local energy plans can not be isolated, they will require good communication and collaboration with land use planning. In addition, sometimes a good energy plan or policy should cross natural geographical and jurisdictional boundaries.

These three core components provide a framework to assess new energy policies in local planning. Under this frame work, a detailed policy will be developed for each place to explain the key points that incorporate new energy use policy concepts. When combined, these policies can be statistically measured to compare the plans across multiple jurisdictions.
Chapter 3: Research Methods

Section 1: Study area

Worldwide, many countries or cities have already developed policies for new energy planning. In this paper, the author would like to use California as a specific example for the following reasons: 1) California is the most populated state in the United States. In 2010, California has an estimated population of 37,253,956 (US Census bureau, 2010). 2) California is the most economically developed state; hence, California has enough fiscal support. 3) California is the most urgent state in which to develop new energy because of its fragile environmental situation. 4) Because California is the most populated state, the demand for energy is also the first in the United States. 5) Because of reason 4, California formulated a series of laws or acts for new energy plans, therefore establishing the state as a policy leader in the United States. 6) Because the California government pays a lot of attention to new energy, California has the most advanced new energy technologies.

Secondly, let’s look at the energy use in California: California, which has the most population in the United States, is also one of the largest energy consumers. Although California has abundant traditional resources like crude oil and natural gas deposits, it is necessary to develop new energy resources to address increased and unpredictable energy consumption. Fortunately, California has stored enough new energy resources. For example, the hydroelectric power potential is the second best in the United States. Moreover, substantial geothermal, solar power and wind power resources are found and put California in the top 5 in the United States (California Energy Commission, 2010).


Table 1: The percentage of California’s energy use:

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<thead>
<tr>
<th>Energy of source</th>
<th>% of total</th>
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<tbody>
<tr>
<td>Natural Gas</td>
<td>46.5</td>
</tr>
<tr>
<td>Nuclear</td>
<td>14.9</td>
</tr>
<tr>
<td>Large Hydro</td>
<td>9.6</td>
</tr>
<tr>
<td>Coal</td>
<td>15.5</td>
</tr>
<tr>
<td><strong>Renewable</strong></td>
<td><strong>13.5</strong></td>
</tr>
</tbody>
</table>

(California Energy Commission, 2008)

According to the chart, we can see that natural gas power is still the most popular energy source in California. “California is one of the largest hydroelectric power producers in the United States” (California Energy Commission, 2008); however it only produces 9.6% of the total. The reason why coal use is at 15.5% is due to the “strict emission laws” (California Energy Commission, 2008), so only a few small coal-fired power plants operate in California. Renewable energy seems only to produce a small part of total energy consumption, but California leads the nation in renewable energy generation such as wind power, geothermal power and solar power. The Solar Energy Generating Systems (SEGS) in California is the largest solar power installation in the world. The Geysers is the largest group of geothermal power plants in the world. The Alta-Oak Creek Mojave wind project is a high generation wind farm. (California Energy Commission, 2008)

Actually, California has used new energy for a long time. In 2009, 11.6 percent of all electricity came from renewable resources such as wind, solar, geothermal, biomass and small hydroelectric facilities.
Large hydro plants generated another 9.2 percent of electricity (California Energy Commission, 2010).

In 1970, the oil crisis made Americans concerned about over dependence on fossil fuels. At that time, federal and state governments helped establish a new energy industry. One example in California is the wind farm which was established near San Francisco. (US Department of Energy, 2009)

In addition, California is a pioneer in new energy use and climate change mitigation. The background and necessity for California to do this is high population density, land use demands, pressures from economic growth, environmental issues and local development. Furthermore, California is also highly vulnerable; “its ecosystems and socioeconomic environment are critically sensitive to climate change” (Tang, 2009). Then, the California Global Warning Solutions Act of 2006 has developed a standard framework which looks forward to sharply reduce California’s greenhouse gas emissions by 2020. This significant action lead the local general land use plan is playing a critical role in state climate change programs. (Tang, 2009)

Section 2: Data collection:
California has 58 counties; 37 of them have local energy plans (Table 2). Since the goal is to assess how the energy plan works in different places, counties were selected based on energy plans rather than population. The “energy plan” here means any county which has made a plan that directly mentions energy use or energy efficiency (such as energy efficient buildings), and the date must be dated before October, 31, 2011. In addition, the Climate Action Plan is the state wide plan; the core part is through improving energy efficiency use by reducing impact to the natural environment.
Table 2: Selected Counties in California

<table>
<thead>
<tr>
<th>County</th>
<th>Population</th>
<th>Energy plan</th>
<th>Planning Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alameda County</td>
<td>1,510,271</td>
<td>Climate Action Plan; Home energy efficiency retrofits</td>
<td>May 4, 2010</td>
</tr>
<tr>
<td>Butte County</td>
<td>220,000</td>
<td>Low-Income Energy program</td>
<td>August 30, 2011</td>
</tr>
<tr>
<td>Calaveras County</td>
<td>45,578</td>
<td>Conservation Element</td>
<td>December 9, 1996</td>
</tr>
<tr>
<td>Contra Costa County</td>
<td>1,049,025</td>
<td>Climate Action Plan</td>
<td>December 2008</td>
</tr>
<tr>
<td>El Dorado County</td>
<td>181,058</td>
<td>Final El Dorado County Hydroelectric Development Options Study</td>
<td>July 24, 2009</td>
</tr>
<tr>
<td>Fresno County</td>
<td>930,450</td>
<td>Large Solar Projects</td>
<td>December 15, 2010</td>
</tr>
<tr>
<td>Humboldt County</td>
<td>134,623</td>
<td>Green House program</td>
<td>June 17th, 2010</td>
</tr>
<tr>
<td>Imperial County</td>
<td>174,528</td>
<td>Geothermal/Alternative energy and transmission</td>
<td>October 17, 2006</td>
</tr>
<tr>
<td>Kern County</td>
<td>839,631</td>
<td>Large Solar Projects</td>
<td>December 15, 2010</td>
</tr>
<tr>
<td>Kings County</td>
<td>152,982</td>
<td>King County 2010 Energy plan</td>
<td>October, 2010</td>
</tr>
<tr>
<td>Lake County</td>
<td>64,665</td>
<td>Lake County Energy Action Plan</td>
<td>June, 2011</td>
</tr>
<tr>
<td>Los Angeles County</td>
<td>9,818,605</td>
<td>Los Angeles County Energy</td>
<td>February 22, 2010</td>
</tr>
<tr>
<td>County</td>
<td>Population</td>
<td>Program Title</td>
<td>Date</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------</td>
<td>----------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Marin County</td>
<td>252,409</td>
<td>Marin County Greenhouse Gas Reduction Plan</td>
<td>October, 2006</td>
</tr>
<tr>
<td>Mariposa County</td>
<td>18,251</td>
<td>Mariposa Energy Project</td>
<td>June 15, 2009</td>
</tr>
<tr>
<td>Merced County</td>
<td>255,793</td>
<td>Natural Resources Element</td>
<td>February, 2011</td>
</tr>
<tr>
<td>Monterey County</td>
<td>415,057</td>
<td>Energy Decent Plan</td>
<td>September, 2009</td>
</tr>
<tr>
<td>Napa County</td>
<td>136,484</td>
<td>Climate Action Plan</td>
<td>June 30, 2009</td>
</tr>
<tr>
<td>Nevada County</td>
<td>98,764</td>
<td>Nevada County Energy Plan</td>
<td>July 7, 2010</td>
</tr>
<tr>
<td>Orange County</td>
<td>3,010,232</td>
<td>Low-Income Home Energy Assistance Program</td>
<td>August 30, 2011</td>
</tr>
<tr>
<td>Placer County</td>
<td>348,432</td>
<td>Placer County Biomass Program</td>
<td>February 11, 2010</td>
</tr>
<tr>
<td>Riverside County</td>
<td>2,189,641</td>
<td>County of Riverside General Plan</td>
<td>Feb 8, 2011</td>
</tr>
<tr>
<td>Sacramento County</td>
<td>1,418,788</td>
<td>Climate Action Plan</td>
<td>May, 2009</td>
</tr>
<tr>
<td>San Bernardino County</td>
<td>2,035,210</td>
<td>Energy Conservation/Efficiency program</td>
<td>October, 2011</td>
</tr>
<tr>
<td>San Diego County</td>
<td>3,095,313</td>
<td>San Diego County GHG Inventory</td>
<td>September 4, 2008</td>
</tr>
<tr>
<td>San Francisco County</td>
<td>805,235</td>
<td>Climate Action Plan</td>
<td>September, 2004</td>
</tr>
<tr>
<td>County</td>
<td>Population</td>
<td>Action Plan Description</td>
<td>Date</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------</td>
<td>-----------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>San Joaquin County</td>
<td>685,306</td>
<td>Energy Action plan</td>
<td>June 9, 2008</td>
</tr>
<tr>
<td>San Luis Obispo County</td>
<td>269,637</td>
<td></td>
<td>November, 2010</td>
</tr>
<tr>
<td>Santa Clara County</td>
<td>1,781,642</td>
<td>Climate Action Plan</td>
<td>Dec 21, 2010</td>
</tr>
<tr>
<td>Santa Cruz County</td>
<td>262,382</td>
<td>Water Conservation</td>
<td>2003</td>
</tr>
<tr>
<td>Shasta County</td>
<td>177,223</td>
<td>Low-income Energy Program</td>
<td>August 30, 2011</td>
</tr>
<tr>
<td>Sierra County</td>
<td>3,240</td>
<td>Low-income Energy Program</td>
<td>August 30, 2011</td>
</tr>
<tr>
<td>Siskiyou County</td>
<td>44,900</td>
<td>Medicine Lake Geothermal Project</td>
<td>May, 2001</td>
</tr>
<tr>
<td>Solano County</td>
<td>413,344</td>
<td>Climate Action Plan</td>
<td>Feb 8, 2010</td>
</tr>
<tr>
<td>Sonoma County</td>
<td>483,878</td>
<td>Large Solar Program</td>
<td>December 15, 2010</td>
</tr>
<tr>
<td>Stanislaus County</td>
<td>514,453</td>
<td>Hazard Mitigation Plan</td>
<td>2010</td>
</tr>
<tr>
<td>Sutter County</td>
<td>94,737</td>
<td>Climate Action Plan</td>
<td>July, 2010</td>
</tr>
<tr>
<td>Tulare County</td>
<td>442,179</td>
<td>Climate Action Plan</td>
<td>July, 2010</td>
</tr>
<tr>
<td>Ventura County</td>
<td>823,318</td>
<td>Energy Action Plan 2010-2012</td>
<td>April, 2010</td>
</tr>
<tr>
<td>Yolo County</td>
<td>200,849</td>
<td>Climate Action Plan</td>
<td>November 9, 2011</td>
</tr>
</tbody>
</table>

(Data source from Census Bureau in 2010)
Figure 1: California energy plan map
Section 3: Sample scope

The scope of samples includes California county energy plans and local general plans. Since not all of the California counties have individual energy plans, some counties like Butte County’s low-income program are part of a local general plan. However, they are all counted as this thesis’s sample, as long as the local county has one official energy plan or program. California law requires each county to adopt a general plan that must contain the following seven elements: “housing, open space, land use, conservation, noise, safety and circulation” (California the governor’s office of planning and research, 2011). Since general plans include land use, the scope of the sample did not include the individual land use plan of each county. In addition, the target of this thesis is evaluating how energy policies improve energy planning, and this thesis assumes that land use planning plays an executive role. Some policies or strategies are developed from land use planning but they were found to be included in the energy plan, such as mixed-use and transit oriented development. This thesis categorizes them as an energy plan.

Section 4: Data analysis

The data includes Table 2 (Counties collection) and Figure 2 (Policies collection), and were analyzed in three phases. In phase 1, I examined all counties of California to find the presence or absence of an energy plan or policy; the results in this phase were exported by using descriptive statistics methods as shown in Table 2. In addition, I used the GIS mapping technique to display the results. It is obvious to identify the implementation of energy plans by the GIS graphics. Secondly, in phase two I researched the energy plans and policies, mainly in California but not limited to this area. Referring to the policies, I extracted six representative indicators from local energy plans or general plans: conservation
easement; energy efficient building; low impact development; clustering and mixed-use; greenhouse
gas emission fees and transit-oriented development. Because some of these policies can improve new
energy use efficiency such as energy efficient buildings; some could protect energy resources to
promote sustainable development like conservation easement. More detailed reasons are illustrated in
the next section. In the final phase, I tested the six policies in California counties by using statistical
tables and GIS technique mappings to display the different policies implemented in different counties.
This analysis examines the factors which influence the new energy application in local land use and
provides proposals for how to implement these policies in the future.

Section 5: Assessment policies

Through evaluating California’s new energy policy leads to a better understanding of the relative
strengths and weaknesses of the ability of local jurisdictions in California to achieve new energy use
efficiency. In this part, I extract some policies from both the land use plan and energy plan. In Table 3, I
use justifications to explain why I chose those plans. The measurements section details how these
policies are implemented, the components in that column are some examples cited from existing plans
in California, which is not the only standard to measure these policies. As stated, these six policies
come from both energy plans and land use plans, so I use a column to illustrate the relations between
them.
<table>
<thead>
<tr>
<th>Indicators</th>
<th>Justifications</th>
<th>Measurements</th>
<th>Link with new energy plan or land use plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>(California Energy Commission)</td>
<td>(Lantz and Doris, 2009)</td>
<td>(Lantz and Doris, 2009)</td>
<td></td>
</tr>
<tr>
<td>Conservation easement</td>
<td>Restrict the development to protect land value</td>
<td>Income tax deduction; income tax credits; estate tax reductions and exclusion</td>
<td>Protect natural resources so that provide it to new energy plan</td>
</tr>
<tr>
<td>Energy efficient building</td>
<td>Save energy, increase energy use efficient, provide clean energy emissions</td>
<td>LEED standard, benefit to environment, appliance standards with strict efficiency requirements</td>
<td>It’s part of new energy plan</td>
</tr>
<tr>
<td>Low impact development</td>
<td>Habitat protection, management resources such as water run-off</td>
<td>Storm water management practices,</td>
<td>Reduce the impact when implicate new energy plan</td>
</tr>
<tr>
<td>Clustering and mixed use</td>
<td>development density in a specific area to help contain growth within an urban core and protect critical</td>
<td></td>
<td>Make the new energy plan more efficient; provide instant way to use new energy. (Lantz and Doris,</td>
</tr>
<tr>
<td>GHG emission</td>
<td>Reduce GHG, protect air quality</td>
<td>Carbon tax, Non-CO2 tools</td>
<td>Promote new energy to substitute carbon</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Transit-oriented development</td>
<td>Make land use and energy use diverse and efficient.</td>
<td>Design a neighborhood that remain variety of new energy</td>
<td>Assistant new energy plan by traditional land use plan policy</td>
</tr>
</tbody>
</table>

**Conservation Easements**

The conservation easement official definition is “creates a legally enforceable land preservation agreement between a landowner and a government agency for the purposes of conservation” (US legal: Uniform conservation easement Act, 2008). This planning policy mainly emphasizes a series of restrictions on valuable place, while preventing future development in this critical place. If the critical place belongs to a certain landowner, this policy makes local governments purchase the landowners the development rights by tax reductions. This policy is also a mandatory document for land protection for contractors since it always conveyed by official or formal agency. This policy will be vital to new energy links to certain lands, because it protects places which have abundant natural resources or are appropriate to utilize new energy from over development or ruin caused by land sprawl. Accordingly, a lot of energy resources can be protected. For example, in California, the conservation easement includes prohibitions on excess road construction, over subdivision of the land and so on. Conservation easements can be a powerful method to restrict sprawl because they buffer or prevent growth from the
very beginning in ecologically sensitive areas or areas on the edge of urban centers. (Brody, 2006)

One of the measurements of this policy is income tax credits. According to market economy principles, this measurement will activate “conservation land” market, therefor, brokers often handle the contract and the right of protection, and they have the obligation and responsibility to report to the state government. The federal and state government is able to control those lands by increasing tax from the sale and using those tax credits to extend discussion and the conservation land issuance. (Brody, 2006)

**Energy - Efficient Buildings**

An energy-efficient building, also called a green building, is officially defined as “a building structure and using process that is environmentally responsible and resource-efficient throughout a building’s life-cycle” (US EPA: Green building information, 2006). According to the architecture theory, this kind of building would maintain the energy and recycle its use. To date, the American domestic construction industry is so maintenance that makes it difficult to find architects or engineers who are willing to design energy efficient buildings. However, the global building industry has grown inventive and is creating a growing gap between standard practices in the United States and global best practices. Meanwhile, American governmental regulatory building codes standards limited architects or engineers performance. In contrast, voluntary rating systems have helped work with best practices and make building codes understandable. Planners can assist both the regulatory and voluntary efforts to improve building energy efficiency by updating codes and encouraging adoption of energy efficient building ordinances in redevelopment plans.
In California, the Energy Code involves energy conservation standards applicable to all residential and nonresidential buildings in the state. It transformed architectural and engineering practices within a short period of time and made California's buildings become the most energy efficient in the nation. Along with high energy prices and mild climate, the Energy Code has helped California consume much less energy resources than the average American consume. The energy efficient building focuses on energy conversion nodes and it encourages energy storage and management with informed “building designers, owners, occupants, regulators, and equipment suppliers” (Andrews, 2008). Last but not least, California also has one more policy which implemented a "loading order" for new energy resources; this policy requires putting energy efficiency use as the most important priority. California government’s effort to build and maintain energy efficient buildings; has saved more than $900 million in utility bills and 4.7 million tons of carbon dioxide emissions in 2009. (California Energy Commission, 2010)

**Low impact development:**

Low impact development (LID) policy technically means “*an approach to land development (or re-development) that works with nature to manage storm water as close to its source as possible*” (US environmental protection agency, 2006). LID focuses on conservation and use of scenic natural features to protect natural resources; improve water quality and quantity management and reduce impervious surface and run-off. The LID design approach has received support from the U.S. Environmental Protection Agency (EPA). Many state or local programs have adopted LID techniques because it plays an important role in smart growth and green infrastructure land use planning, particularly in southern California. The key to effective LID is to catch the runoff and divert it for other uses such as irrigation.
This policy will benefit neighborhoods, communities, parks and other open spaces throughout the city.

Southern California is facing increased demands from urbanization, which can create adverse impacts to natural resources like water quality and quantity. Water pollution not only influences the quality of our water, but also reflects cities’ attitude to comply with strict state regulations and the federal Clean Water Act. However, water pollution has been managed through the strategies and principles of Low Impact Development, which designs an environment that maintains an operation part of an ecosystem rather than separates it. From my knowledge, LID could extend its function to the planning strategy such as decentralized planning, small-scale source control structural or management, to achieve certain requirements of government energy management regulations. (California Stormwater Quality Association, 2011)

**Clustering and mixed use**

Clustering and mixed-use development is a planning policy which can restrict urban sprawl at the jurisdictional level. According to the definition from the American Planning Association (APA), this policy means “*development that blends residential, commercial, cultural, institutional, and where appropriate, industrial uses*” (APA, 2010). At a regional level, clustered development can restrict growth within an urban core and also protect the environment. At the parcel level, clustering patterns helps high density development in a certain area of a parcel while keeping the rest of land unoccupied. To reduce the threat of sprawl, clustering patterns can increase the density in less sensitive place so that a more compact style of development will be created while the overall density is the same. A Mixed-use building means a building has multiple functions and has more than one ordinance in land use. Mixed-use community means planning the function buildings in the adjacent parcels or blocks so
that they can easily reached. For instance, planning shops, restaurant or service stores in the community lead residents to walk rather than drive. This policy will minimize the need for motor travel and create a more clean community. More importantly, mixed-use will maximize the district energy use efficiency. For example, in a mixed-use zoning the central plant can supply heating for a group of buildings no matter what time they need it. This policy may be the most effective tool for sprawl and protect natural resources since it shows easily recognizable benefits: creating more compact forms of development while protecting significant areas of natural resources without negatively impacting land values. This could be the basement policy for new energy use, since as long as natural resources are protected planners can have more alternatives to use new energy. (Brody, 2006)

This planning policy is widely used in California to maintain local growth and set aside sensitive areas such as wetlands. The typical example in California is Hercules city. In 2000, this city gave special permission for an “urban-design-based” land use planning effort. The target of this plan is preserving the undeveloped land from increased urban sprawl so that it maintains sufficient space for land use redevelopment. The result of this plan directly made Hercules a “transit-oriented, pedestrian-friendly, mixed-use town” (California Land Use Commission, 2010).

**GHG emission Regulations:**

Greenhouse gas (GHG) should be known to everybody; we all know it is pollution from gas emissions. To be more specific, greenhouse gas means “gases that trap heat in the atmosphere are often called greenhouse gases” (EPA, 2009), which includes carbon dioxide, methane, nitrous oxide and fluorinated gases. In addition, GHG is one of the major causes of the world climate change. GHG mostly comes
from transportation exhaust; inevitably, the air quality has been polluted by GHG. Since so far we understand the dangers of GHG, the next step should be how to control or even get rid of greenhouse gas. Lately, scientists have considered reducing GHG emissions by increasing energy efficiency, developing new energy and reducing fossil fuel consumption. And these considerations have been executive in the state of California. California is the second largest greenhouse gas emitter in the United States. To face this problem, California’s government and energy commission developed a series of solutions. The California Energy Commission research group has focused on non-CO2 GHGs and other sectors of the economy. During the research, the California energy Commission has found and organized the issues regarding reducing GHG emissions into one: methods to control GHG emissions and increase carbon sequestration. Generally speaking, this problem has led the research into two short-term projects: the increase cost of moderating non-CO2 gases and increasing carbon sequestration. Other research is aimed to develop new and better methods for reducing GHG emissions and increasing the substitution object effect.

From a policy perspective, California governments have successfully slowed down the growth rate of GHG emissions by a series of plans and acts such as Assembly Bill 32 which requires that “the statewide greenhouse gas emissions limit continue in existence and continue reductions in emissions of greenhouse gases beyond 2020” (California Environmental Protection Agency, 2008). In addition, to reduce the major part of GHG- CO2 emissions, California’s government passed the carbon tax act. California also considered the “Alternative Fuel Vehicle” and “Hybrid Vehicle”. California government regulates carbon emissions in the entire state by a carbon tax, so that they can handle or at least forecast GHG emissions in the future.
Transit-Oriented Development

The transit-oriented development’s core meaning refers to “residential and Commercial Centers designed to maximize access by Transit and Non-motorized transportation, and with other features to Encourage Transit Ridership” (Morris, 1996; Renne, 2009). For instance, housing units in dense downtowns consume less energy than the suburbs since they are smaller and often have shared walls. People who live in nice walkable neighborhoods with mass transit access do reduce gasoline consumption, but it only seems to happen with housing density within a short distance of the employment density or public transport stations. Just like clustering and mixed-use policy, transit-oriented development seems to be not directly to energy, but several successful transit oriented development experiences reveal their potential connection. Professor Clinton J, Andrews finds that transit oriented development will include: improving the alternative or function of mixed-use development, attracting investments in facilities and private development, and maintaining the attractiveness of their local transportation system and settlement patterns while making future plans or designs (Andrews, 2011). Traditional energy planning treats neighborhoods as sources of energy demand. Compared with that, the TOD gets people out of their cars, which particularly reduce energy use, as well as serving other longstanding planning objectives. One of the TOD successful examples is in San Francisco. In this city, local and regional governments use transit-oriented development policy planning to decrease traffic congestion, protect natural areas, promote public health and increase housing options.
Assessment Method:

This study uses six policy indicators to evaluate and measure the counties’ quality of a comprehensive plan. After this assessment, the counties will find their suitable method in a new energy plan; in addition, the counties which have a high score can be the model for other places. In turn, these 37 counties also play the indicators role to assessment the six policies. According to the 37 counties have their own conditions such as location, population and so on; this method can measure those six policies suitability and applicability. To better assessment those policies, the score measurement links awareness, analysis and action which illustrated in Chapter 2. Each item was measured on a 0–3 ordinal scale, where score 0 means the policy did not mentioned or considered in local general plan or energy plan (did not awareness), score 1 means the policy is not developed or adopted but some details or regulations of this policy have been mentioned in local general plans (have the awareness but did not analysis), score 2 indicates that the policy can be found in the local plans and will be adopted in the future or they have a timeline to complete it (have analysis but did not take action), and score 3 indicates that the policy can be found in the local plan or local county has a special plan like Climate Action plan, and according to the enact time assures that this policy has already been adopted (already taken actions). The typical example plans are in appendix.

Section 6 Linkage between land use plan and energy plan

Overall, some land use decisions are directly affecting energy use such as greenhouse gas. Because land use planning has a strong influence on our daily work and lives, housing, transportation and public facility plans are sometimes also considered as major factors in an energy use plan or policy. In fact, Land use plan and energy plan are mutually beneficial. In California, since the research of land use
impact on energy use has received significant attention, the California Energy Commission decided to support effective land use planning and develop long term energy plans based on land use planning (Appendix 1). This relationship of land use planning and energy planning is also significant to this thesis. For example, of the six policies, two of them are coming from land use planning. In addition, most of these policies need practical actions from land use such as conservation easement; it requires land use planning that buffers enough open space for natural resources. Finally, this thesis has found some examples of land use planning “cooperating” with energy plans and tries to transmit them to another place.
Chapter 4 Results

Section 1: Statistical distribution of six policies

Evaluating the sample of these counties can provide better understanding of the six policies advantages and weaknesses. In Table 4, the total score column of each county displays the “policy ability” of that county. For instance, Los Angeles County has a higher score than Butte County, and this only means that Los Angeles County pays more attention to energy policy. In addition, the column of each policy means the “applied ability”. For example, energy efficient building has a high score, which means this policy is easy to implement and is effective. To sum up, the result tables below illustrate which counties pay more attention to energy policy, and which policies have been widely implemented.

Table 4: Overall scores of six policies in 37 counties:

<table>
<thead>
<tr>
<th>Counties</th>
<th>CE</th>
<th>EEB</th>
<th>LID</th>
<th>C&amp;M</th>
<th>GHGE</th>
<th>TOD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alameda County</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Butte County</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Calaveras County</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Contra Costa County</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>El Dorado County</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Fresno County</td>
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Solano County | 0 | 1 | 1 | 2 | 3 | 1 | 8
Sonoma County | 2 | 3 | 1 | 0 | 3 | 0 | 9
Stanislaus County | 2 | 0 | 2 | 1 | 0 | 2 | 7
Sutter County | 0 | 1 | 1 | 2 | 3 | 1 | 8
Tulare County | 0 | 2 | 2 | 2 | 2 | 1 | 10
Ventura County | 0 | 3 | 2 | 2 | 0 | 2 | 9
Yolo County | 0 | 3 | 0 | 0 | 3 | 1 | 7
Total | 37 | 71 | 63 | 33 | 62 | 38

Table 5: Quality scores of six policies

<table>
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Obviously, according to Table 4, the overall statistics show the differences of new energy plans in these 37 counties. Since the goal is to discuss the successful California policy model of new energy, the counties which scored higher than 10 have good “applied abilities”, and are qualified to be chosen.
Section 2: Descriptive of variation

The common features of counties with high score are as follows: 1) They have higher populations than the others (Los Angeles County has 9,818,6052; Sacramento County has 1,418,788). 2) They all have developed economic power, especially Los Angeles, which has always been the top 5 cities in the United States. 3) These counties have a strong demand for using new energy because of the high consumption of traditional energy. For instance, Los Angeles is a symbol of a large metropolitan area, and it has high density, extensive transportation and large electrical consumption. 4) These counties’ governments have the responsibility of protecting the environment since they are also a large pollution producer. To sum up, these issues push local governments to implement new energy plans. In addition, the California state government has drawn up several policies to encourage new energy use. These counties are kind of representatives of California, so they should be good models for new energy use.

Los Angeles County: One important reason is that they set up an energy plan very early. Actually, in response to the California state energy plan, the Los Angeles County government drew up a series of energy policies and plans such as energy efficiency Assembly Bill 811 (AB 811). This bill aimed to encourage new energy use and control resource consumption. This bill approved county-wide loans for energy efficiency use and new energy use. As the lead county in California, Los Angeles implemented new energy plans fairly comprehensively. The evidence is in the table: Los Angeles County gets the full score in 5 indicators. Concerning energy efficient building policy, according to Environmental Protection Agency (EPA), Los Angeles has 293 energy efficiency buildings which ranked number one in the United States in 2009. Low Impact Development (LID) has just been implemented this year (2011) in Los Angeles. This policy in Los Angeles County not only can control the run-off water but
also can increase ground water supplies. The clustering and mixed-use policy was adopted many years ago, but Los Angeles connected it with energy use very well. One example of the mixed-use project in Los Angeles city is called “LUMA”. This project creates a model of sustainable design that was certified by LEED. This policy helps Los Angeles reduce carbon dioxide emission by upgrading public transportation and increasing bicycle lanes.

**Sacramento County:** Since the city of Sacramento is the capital of California, their behaviors will influence other counties of the state. In this case, this county has to be a leader in energy plan. Although the total score of Sacramento is lower than Los Angeles, their conservation easement policy implementation is better than Los Angeles. Their local conservation easement program was upgraded on August 18, 2009. This program’s main concern was protecting the existing wetlands around the county and it “protected over 30,000 acres of wetlands and associated upland habitat” (Sacramento National Wildlife Refuge Complex, 2010). The typical new energy policy is the GHG fees/credit in Sacramento County which is the “Climate Action Plan” enacted by the California state government. This Climate Action Plan established a good model to reduce GHG emissions. In Sacramento, local governments have implemented links to energy plans such as the Sustainability Master Plan 2007. Furthermore, this plan tries to protect the climate and reduce GHG emissions from transportation, land use, water, waste, and existing buildings. According to this plan, they will reduce greenhouse gas emissions 22% below 2005 levels in 2020 (Sacramento Climate Action Plan, 2008).

**San Francisco County:** The city of San Francisco is also a big modern city, just like Los Angeles and Sacramento. High energy consumption and pollution are the big issues. To respond to the California
state energy plan, local government did a good job with several policies such as conservation easement. In the city of San Francisco, the major goal is to protect the San Francisco Bay area. In 2009, the local government enacted a plan to protect the water, habitat and minerals from pollution and over use. However, the results are not shown obviously. The outstanding program in San Francisco is the energy efficient buildings policy. The method of implementing this policy in San Francisco was just like Los Angeles. San Francisco has 173 Energy Star labeled buildings, after Los Angeles and Washington D.C. Furthermore, San Francisco’s local energy commission pays much attention to green energy use. The famous one is the “San Francisco Solar Program”. This project was begun in 2001 and will be finished in 2020. When government finishes this project, they will save more than 200,000 dollars in electricity per year (California Energy Commission, 2010).

Other counties are emphasizing particular policies instead of fully implementing all of these six policies. Some counties are located in special areas, such as El Dorado County, which are adjacent to natural spaces so that their policies are deviated to preserving natural resources. In that case, their main focus is on conservation easement and low impact development. One particular example is San Diego County. The plan of this county mainly focuses on environment protection and energy efficiency. According to this plan, San Diego County will reduce their energy consumption by 20% and reduce 50% of greenhouse gas emissions by using solar energy by 2020 (California Energy Commission, 2010). In addition, the San Diego government wants to promote new construction with net zero consumption. However, this county is not like Los Angeles or Sacramento; the San Diego government did not use the land use plan such as transit-oriented development much. After briefly describing local county energy plans, I include a statement about each policy implementation situation in California.
Figure 2: Indicator performance scores for conservation easement:
Figure 2 displays the conservation easement distribution. This policy has been considered a lot but not implemented synthetically. One possible reason could be that this policy is a kind of “advice” policy rather than a mandatory method in some counties. In addition, the conservation easement mainly focuses on natural resources and protecting critical habitat. According to this, the high scores of conservation easement counties are adjacent to the coast line or large scale natural resource areas such as Calaveras County and El Dorado County. In Calaveras County, the conservation easement policy mainly focuses on protecting and managing the limited new energy and natural resources such as wetlands, organic soils, timber, minerals and water. Furthermore, this policy has legal authority which is Section 65302(d) of government code. This code also emphasizes the use of natural resources while protecting them as well. In addition, local government implemented conservation easement cooperation with other land use plans such as open space element issue. In this case, the conservation easement policy tried to enable the land use plan to preserve cultural, historic and scenic resources. In the energy field, conservation easement proposes a series of recommendations. For example, it should provide a smooth transition for the use of new energy resources, reducing the use of fossil fuels and encouraging the use of alternative resources through conservation easement efforts. In addition, conservation easement promotes the capability of solar energy use by future residential subdivisions, reducing the use of traditional energy in both transportation and stationary sectors, and provide for development of hydro, solar, wind, and biomass resources to serve local residents, businesses, and industry.
Figure 3 Indicator performance scores for energy efficient buildings
Figure 3 shows the energy efficiency building distribution in California’s counties. This policy wins the highest score among other five policies, and the distribution is quite wide. According to the content of energy efficiency building policy, this one does not have the location restriction, so it is easy to implement. Furthermore, energy efficient buildings rely more on government support; in other words, it requires exact actions. To respond to the California State energy plan, most local governments give priority to energy efficiency buildings because this policy is a kind of mandate. Additionally, this policy has a relatively short time cycle. However, Figure 3 shows that there are still some counties that have not adopted this policy or are only considering it. Although this policy does not depend on geographic location, it does rely on population density or strong economic power. Energy efficient buildings (also called green buildings) require high-technique and government fiscal support. Some counties like Los Angeles, San Francisco and Sacramento have the ability to execute this policy independently, but others need state government support. According to 2010 California Energy Commission’s data, the state government has already invested more than 10 billion dollars in energy efficient buildings, saving 56 billion dollars in electricity and gas costs since 1978 and a projected additional 23 billion dollars by 2013. This policy also has legal authority such as California building Section 24502 (California Energy Commission, 2010). According to the California Energy Commission’s survey in 2009, Los Angeles has 293 Energy Star labeled energy efficient buildings, which makes the county the leader in the United States. San Francisco has 173 energy efficient buildings, which makes the county is the third in the United States. The state of California has two cities in this rank, which also means that California is the leader in this field (California Energy Commission, 2009).
Figure 4 Indicator performance scores for low-impact development
Figure 4 is the low impact development policy distribution map. Just like conservation easement, low impact development policy also focuses on natural environment but it does not need a certain area to implement. This policy is mainly concerned with “common” resources such as water. For example, if any place uses hydro power to generate electricity, low impact development can promise a sufficient water supply and prevent any negative consequences. In California statewide, the California Environment Protection Agency (CEPA) has enacted several laws and regulations about low impact development, for instance, the “California Water Code” and “California Health and Safety Code”. Because low impact development focuses on water which is an essential factor of human life, this policy has a dual meaning: improving water energy efficiency and public health. On June 27, 2007, the California government approved the Sacramento, San Francisco and San Joaquin Water Quality Control Plans (California Environment Protection Agency, 2008). That is the reason why these counties have the highest score. This Water Quality Control Plan includes three major objectives: to improve industrial water use efficiency, to improve agricultural water use efficiency and to protect fish and wild life. The Low Impact Development policy is essential to both the natural environment and human health; however, it has only been adopted by five counties: Los Angeles, San Francisco, San Diego, Sacramento and San Joaquin. Other counties have adopted the plan but because a long cycle time and low results, few of them scored 3 points.
Figure 5 Indicator performance scores for clustering and mixed-use
Figure 5 is a graphic about clustering and mix-use distribution. This policy comes from the land use plan originally. In the new energy plan, it plays an assistive role. Here, the evaluation of the clustering and mixed-use focuses not only on land use, but also on the benefit to energy planning. For instance, in a place where there is a wealth of geothermal energy, this policy can change the original land use to better utilize the new energy. More importantly, the scores focus on whether or not the local government considered using mixed-use to reduce greenhouse gas emission, such as gathering commercial land use and residential land use together to reduce electric consumption and reduce the need for vehicles. One typical mixed-use building is in the city of Los Angeles named “Cherokee Lofts”. To be honest, while this policy has been widely implemented in most of the counties in California, just a few counties considered using this policy to assist energy use. Because this policy is coming from the land use plans, the legal authority such as zoning regulation has nothing to do with energy use. Recently, California energy, environmental, resource and land use lawyers decided to cooperate to develop several state wide projects. They all have awareness that land use policies will be helpful, and they point out that the practice of mixed-use is under the California Environmental Quality Act.
Figure 6 Indicator performance scores for GHG emission fees/credits
Figure 6 displays the GHG emission regulations policy distribution graphic. Since GHG emissions directly impact climate change, it is a hot research topic. In California, the state government has enacted a state-wide plan called the “Climate Action Plan”. This plan points out that every county has the obligation to join this action someday. This study will use the date of October 31, 2011 as a cutoff date; as of this date, I only found a few counties that had totally adopted, as displayed in Figure 6. This Climate Action Plan’s legal basis is the California Assembly Bill 32. It requires reducing the greenhouse gas emissions to the 1990 level in 2020. According to the California Energy Commission’s data, the major parts of greenhouse gases comprise transportation emissions, electricity consumption and industrial consumption. The methods to regulate greenhouse gas emissions will start in those three parts. Referring to AB 32 chapter 488, it dictates that the state board has the responsibility to adopt effective regulations to limit greenhouse gas emissions. More importantly, it requires improved new energy use in these three fields. To be more specific, the Climate Action Plan requires greenhouse gas to be updated more frequently so that experts are able to find the relative chain to absorb or decompose the CO2, and develop California state wide regulations for extra charge of CO2 emissions. This policy has received more attention from the state government than local governments. However, this policy is a kind of mandatory one. Local governments will all adopt it sooner or later. Before October 31, 2011, Los Angeles County, Sacramento County and San Francisco County adopted this policy and all of them got some results. For example, Los Angeles reduced 7% of CO2 emissions between 1990 and 2007 although the population still increased. (California Climate Action Plan, 2010)
Figure 7 Indicator performance scores for transit-oriented developments
Figure 7 shows the Transit-Orient Development (TOD) policy distribution. This policy also comes from land use planning, but just like clustering and mixed-use policy, this one also can plan an important role in energy planning. Frankly speaking, most counties in California have implemented it in land use planning for a while. In this study, only the benefits to energy planning will be counted. For instance, transit-oriented development can reduce the travel of vehicles. According to California government data, this policy has reduced vehicle travel every year by 20% to 40% by planning living, working and shopping adjacent to transit stations. This leads to another benefit, for instance the transit-oriented development also can reduce GHG emissions. The California government estimates that since implementing this policy, greenhouse gas emissions have been reduced 2.5 to 3.7 tons per year (California government, 2010). Furthermore, transit-oriented development is able to conserve sensitive land and provide more open space by developing high density communities which consume fewer land resources. Just as Figure 6 shows, the successful counties implementing this policy are San Diego, Sacramento, San Francisco and Los Angeles. The City of San Diego was one of the pioneers adopting this policy in 1992, and has been acknowledged as the “Transit-Oriented Development leader” in California. Why are these counties successful? According to their local land use plans or general plans, the common reason is that they all have well developed light rail transportation system. The light rail is fast and local government planned the living, working and shopping areas all near the light rail station, so that people were willing to take it rather than drive by themselves.
Chapter 5 Discussion

Section 1 Result summary

Through GIS and statistical analysis, the data indicate that the six policies vary in different locations, economic conditions and density. According to the GIS graphics, the variations did not show clear patterns. Each policy has independent characteristics. Identifying the variations of each policy’s characteristics will help other locations implement those policies. The statistical matrix describes which policy was widely adopted and which was not. (Brody, 2003)

Table 5 directly displays the minimum, maximum, mean value and standard deviation of each policy. According to this table, it is easy to find that each policy has the same minimum and maximum number which means each policy has at least one county that fully adopted or did not considered it. The mean value and standard deviation value reflect which policy was widely adopted and which was not. In this part, the discussion will use this statistics table and GIS map as reference.

To review the factors influence on energy planning, those five components (institutional, financial, skill, time and location) will be used to evaluate each policy’s value.

1. First of all, the overall scores of the six policies indicate that California has developed energy plans and energy policies very well. According to the results, every policy received the full score which means the California state government has the awareness and more importantly, they take actions. However, the result table also shows that each policy still has received zero score in some counties either. That means that the California state government did not pay specific attention to widespread
and complete implementation. For example, the GHG emission regulations policy is a kind of mandatory one and this policy has no location limit, but several counties received zero scores. Perhaps these counties have lighter GHG emissions than a metropolitan region such as Los Angeles, but the greenhouse gas issue will not be solved by just isolated local governments. In state wide, the California state government may be proud of implementing this policy in typical counties such as Sacramento, but they ignore the others. There is evidence to show that the counties which have higher scores are all the “big famous” counties (like Los Angeles, San Francisco and Sacramento). Other counties may have particular advantage in one policy but ignore the others. This is understandable for local regions because not each policy is suitable everywhere, but state government should give guidance and provide the skill and financial support to them (Wiser and Pickle, 1997). To sum up, the first suggestion is that California state government should provide more support to the “low scoring” counties.

2. GHG emission regulations: According to the results, the score of this policy shows a kind of “polarization”. Most counties got either full scores or zero scores; few of the counties got “middle” scores. This result may represent some characteristics of GHG emission regulations: This policy has no geographic limitations, meaning that, every local government is able to adopt it as long as it is necessary. This policy is highly dependent on institutional and financial backing. Just like the examples in California, the powerful local governments such as Sacramento all get full points for this policy. Although the GHG emission regulation is certainly a long time program, the detailed actions and results are not depended on time. In addition, this policy does not need relatively advanced technology. California government gives us some valuable examples such as the Climate
Action Plan. They invest a lot of money, enact the explicit assemble bill and take time to seriously supervise progress. However, this policy was not widely implemented or adopted. The suggestion for GHG emission regulations in California: continue the effective work in successful places, and use those counties as the model for other counties.

3. Energy efficient buildings: the results indicate that this policy received the highest score, and it increases the energy use efficiency in the places where they implemented this policy indeed. Referring to situations in those counties, the characteristics of energy efficient building policy are: This policy also has no location limitations, but considering the cost, this policy is better implemented in cities than in rural areas. Furthermore, this policy requires financial and skill support but requires the least time for results. To be honest, California implemented this policy very well, so it can be used as a successful model. The California methods to implement this policy are attracting market interest and explicit legal support. According to some specific methods in local areas, the government usually provides some benefits to use energy efficient buildings. (Madsen, et al, 2009)

4. Conservation easement and low impact development: These two policies have several common characteristics. They are all limited by location, especially conservation easement. They require institutional support and require a long time to process. As can be seen in California, their policies are suitable in the right place where natural resources and open space need to be protected. Apparently these policies are not attractive to all, but considering their function, it is necessary to make them as mandatory policies. Although the overall results of conservation easement and low
impact development policies are not as successful as the energy efficient building policy in
California, the methods of local counties, especially where they earned full points, still qualified to
be good models. California has several explicit and strict laws and regulations to conserve natural
resources. Some counties strengthen public participation and accept public supervision such as
Sacramento County. The scoring table shows that both of them mostly scored 2 or 1, meaning that,
local counties have the awareness but lack final actions or some programs need more time. The
advice here for California is to increase government investments in the program which links to
conservation easement or low impact development policies and continue their efforts while they
already have made the timeline.

5. Finally, the clustering, mixed-use and transit-oriented development policies: The results show that
both policies received low scores only because the functions or methods by which they can assist
energy plans have not been extracted for most counties since they come from land use plans.
According to the results, some of the five factors are not suitable to evaluate. In other words, these
policies are not influenced by the five factors most of the time. Because of that, the characteristics
of these policies are: they have no barriers to implement and they can be implemented in every
local place. However, the essential meaning of these policies here is whether they assist energy
planning or not. As the California example, most of the counties adopted and implemented those
policies for a long time but only few use them to help energy plans and get the scores. In this
situation, the limitation of these policies is government awareness. Frankly speaking, these policies
require the least financial and skill support but they are effective and efficient in both land use
planning and energy planning. Although the scores are not satisfactory, some typical places still
implemented them well and use them to assist energy planning such as Los Angeles County and San Francisco County. In those places, local governments did not isolate consider land use planning and energy planning. Actually when both plans are complementary, the benefits will be mutually. For example, in the city of Sacramento, high density development planning not only saved land resources but also saved electrical resources. Other places, especially where they have high populations and high energy consumption, should look at the California models. However, there is still some room for improvement, such as expanding the implemented range to make every county in California is able to use these policies to assist energy planning. In addition, local counties should pay attention to urban sprawl impact on energy planning, as the land resource is limited but the increase of population seems infinite, so the rationale and comprehensive plan seems more crucial. In those places, local government should frequently update energy planning and land use planning.

Section 2 reasons of policy variation

In general, suppose an energy policy is so effective that it should be widely adopted, but in fact, there are subjective and objective reasons that impact policy development. At an objective level, the most important reason is geographical location. For example, some counties do not need to develop the conservation easement policy because those counties don’t have the certain properties or land that needs to be conserved. Like Butte County and Kings County, they are inland counties and have relatively fewer land resources. Some typical land properties cross over the county boundaries, which mostly happened in counties along the coast; California government developed the policy to guide the related counties rather than those counties developing it by themselves. The examples are Orange
County and San Diego County. Subjectively, a clear direction for local government is vital. Energy efficient building and GHG emission regulations got a high score because local governments have the targeted group and program. Others like mixed-use and transit-oriented development did not have clear enough direction just in energy use. In fact, California counties developed both policies very well. For instance, some counties developed mixed-use in a community or a building, but because mixed-use governments or planners did not look for energy efficient use, energy consumption has maintained the same level compared to before. In that case, government should encourage sharing the energy in each mixed-use place. In Los Angeles County, for example, local government is using their successful example “LUMA” project as an advertisement to encourage mixed-use, and government give the bonus to this project. This example perfect explain the local government clear direction.
Section 1 Why transfer California results to China

As I stated in the first chapter, energy use is a global issue. If any place develops an energy system well, it should lead other places in this field. In this study, California is the leader and China is now a student. To better explain why it is desirable to transfer the results from California to China, we need to consider both locations. In California, the results and discussion section indicates that the state’s policy models are systematic and experimental. It is well qualified to be studied. As for China, they have enough reasons to learn from California models.

First of all, as the third largest country in the world (96 million Km2), China has the most population (1.3 billion), which comprise 20 percent of the total population of the world. To think about energy as a global issue, not only do developed countries have to take responsibility, but also the developing ones. China is a developing country; it represents the problems, disadvantages and potential of most developing countries. If the new energy plan is successful in China, then other developing countries will have a good model. In addition, China is also a big pollution producer. In 2008, China contributed 22 percent of global emissions, followed by US with 20 percent of emissions (World Resources Institute, 2010). According to this, China has an obligation to reduce pollution. Also, the Chinese government is urging the use of new energy. First of all, the natural environment in China can be dangerous. It has experienced several disasters such as the flood of the Yellow River and sandstorms. Some places in China do not have traditional energy; however, they have sufficient new energy resources. To date, the way to solve the lack of energy in China has been to bring it from other places.
no matter how far it is. Furthermore, China has enough economic power to support new energy use. For example, in recent years, China has invested $12 billion USD in the new energy field which is only second to Germany (Kinver, 2008).

Section 2 Why chooses China’s Guangdong Province:

After this brief introduction of energy use in China, the conclusion is that China has a firm new energy use basis and the attitude of the government is positive. That means that China is appropriate to learn from California’s energy plan model. However, not every place is suitable for California’s model. Throughout the whole country, Guangdong province is the best place because of the following reasons: 1) The facture base similarity: they all have sufficient new energy resources, such as being adjacent to the sea, owned large scale of timber area and have considerable solar energy from the sunshine. For example, Guangdong Province has more than 2000 hours of sunshine per year; the solar energy will save about 4,000,000,000 KWH per year when used by every family (Guangdong Province coast energy development plan, 2010). 2) Financial similarity: Guangdong Province has strong enough economic power to develop new energy plans just like California. 3) The skill and capacity similarity: Guangdong Province has the most advanced energy technology used in all of China. 4) It is imperative that Guangdong Province requires use new energy because of the highly increased population. In particular, Guangdong province has an amazing number of people (according to Chinese Census Bureau, Guangdong Province had 110,000,000 people in 2010). Last but not least, Guangdong Province has already adopted some policies or plans about new energy use. For example, the province government just approved an “offshore wind farm” in 2011. According to the official statement, this farm will generate 29 billion KWH per year. The Guangdong Province energy commission focused on
a new type of vehicle which uses electric power to substitute for fossil fuels. In addition, Guangdong Province made big progress in solar energy use. Thanks to their advanced techniques and sufficient sunshine, Guangdong Province has become the most successful place using solar energy. However, solar energy use in Guangdong is only 8 percent; this utilization cannot compare to California, even though Guangdong Province is a kind of new energy leader in China.

Section 3 New energy use situation in China Guangdong Province

China has a wealth of new energy resources. For instance, Xinjiang Province has strong wind and solar power; Tibet has one of the biggest geothermal energy resources in the world; along with the Yangtze River, there are several dams that use hydro power, including the famous “Three Gorges Dam”; Guizhou and Yunman Province has a wealth of biomass energy; Qiantang River has strong tidal energy. Since the central government realized the significance of new energy use, China has made great process indeed. For example, the “Three Gorges Dam” is the biggest hydro energy plant and the amount of the generated electricity was makes it a leader in the world.

Guangdong Province also has sufficient new energy resources such as wind, solar and hydro power, but the big contribution of this province is their advanced new energy use techniques. For example, China has the largest wind energy industry in the world, and because of that, China is also good at making wind turbines. China has the most advanced techniques in manufacturing solar panels, both wind turbines and solar panels are mostly made in Guangdong Province, Furthermore, Yingli is one of the famous new energy companies which also come from this province.
The Chinese government set up a technical department, the National Energy Commission, which is led by Prime Minister Wen. This department’s job is drafting energy plans responsible for energy security and gives special attention to new or clean energy development. However, China still has several barriers in new energy planning. The most important one is the huge demand that new energy improve efficiency. As stated before, China has the most population so it is also the number one energy consumer in the world. Secondly, new energy support is unstable. New energy is not easy to store or convey, so it will be very hard to use in some places. Despite these factors that new energy resources in China will likely not replace traditional ones for at least 20 years.

Section 4 California’s lessons for China’s Guangdong Province:

After briefly stating some of the energy plans and policies of Guangdong Province, we find that the government has a serious focus on the new energy field indeed, but they still have some problems and obstacles. First of all, they lack systematic supporting policies and explicit laws or regulations. The government still stays at the overall level, ignoring local practical situations. Furthermore, they also lack public participation. Because of that, the residents are not aware of the benefits of using new energy and the investors do not see the rewards of investing in such programs. In this situation, Guangdong Province can refer to California models. At the overall level, Guangdong Province should enact laws or regulations for each individual policy. For example, the “offshore wind farm” still does not have laws to support this plan. At the policy level, Guangdong Province only focused on new energy use planning, ignoring assistant and protection plans. More specifically, Guangdong Province has several wetlands, and hence they should adopt the “conservation easement” policy like California did. Guangdong Province is a high density province, especially the city of Guangzhou and city of
Shenzhen. If those places use energy efficient building policy they will reduce tremendous amount of energy consumption and greenhouse gas emissions. Guangdong Province has abundant water resources such as the Pearl River Delta; they can adopt low impact development policies to use water resources and improve water quality. Since Guangdong Province is one of the largest pollution producers in China, the government has a responsibility to protect the environment and reduce greenhouse gas emissions. The most effective way until now is to adopt GHG emission regulations, using the models of the City of Sacramento and City of San Francisco. Finally, the two high density cities of Guangzhou and Shenzhen should adopt transit-oriented development and clustering and mixed-use policies. Even though they were already high density cities, they need a rational and comprehensive plan to reduce vehicle emissions by improving public transportation, such as the “electric rail” like California did.
Chapter 5 Conclusion

While the majority of energy research focuses on the practical new energy plans, this study examines how the energy policies improve and support new energy plans. Through evaluating the six policies in California, this has enabled us to go back to answer the research questions.

1. To what extent do California local plans address the new energy policies? The most obvious influence here is the state’s mandatory policy. Such as GHG emission regulation policy is a mandate, most counties have to adopt it no matter if they have the awareness or not. In contrast, transit-oriented development policy is not mandatory, and some local government also did not have the awareness that this policy will assist new energy use.

2. Which policies have received the most and the least attention from local jurisdictions? Why did the local government show different levels in new energy plans? Energy efficient building policy has received the greatest attention, as they have been used to improve new energy use directly by local jurisdictions. The clustering and mixed-use policy has received the least attention. The reasons why they show different levels can be separated into subjective levels and objective levels. At a subjective level, some local governments did not have the awareness of the relationship between local land use planning and new energy use. At an object level, some policies have geographic location limitations, such as conservation easement policy. The “indirect” policies here include conservation easement, clustering and mixed-use and transit-oriented development. According to discussion analysis, those policies are absolutely necessary to new energy use. Conservation easement policy can protect natural
resources and provide biomass energy; the other two can reduce energy consumption and improve energy use efficiency.

3. What can other places learn from California? Frankly speaking, the California model is not perfect; the state still needs to improve and upgrade in several areas. However, California has established the most integral energy use system until now. Every plan has a supporting policy, and each policy has explicit laws or regulations. Furthermore, counties in California have gone through rational analysis to determine which policy is suitable for their condition and which is not. These two points deserve consideration in other places especially where there are energy issues to learn. For instance, Guangdong Province, China, has a similar situation to California; they have sufficient new energy resources and funding but they lack the energy use system.

To sum up, this study uses California as the sample to examine how the six policies relate to new energy use by GIS mapping techniques and statistical methods. The results tell that these policies show variations in different counties, and the discussion section explains why some policies are widely adopted or not. Through the GIS graphics and statistical analysis, this study recommends some policies that should be widely used, and makes some proposals for each policy. Finally, the discussion section provides some useful suggestions for those six policies. That might be the reference for places where to adopt those policies. However, this study provides only a starting point for this field; additional research is still needed in areas such as studying what practical results are there after implementing these six policies. For instance, in California, the energy efficient building and GHG emission regulations have already shown their results, but other policies still need more time to examine.
Acknowledgments

I spent one year to finish this thesis, and it was absolutely during a hard time. So I am really grateful to all the people who helped me. My family and my friends supported me when I was in trouble. My committee members Dr. Yunwoo Nam and Prof. Gordon Scholz were very helpful, explicitly pointing out my thesis’s shortcomings which make this paper more professional. I especially appreciate my advisor, Dr. Zhenghong Tang, who was impressively patient and gave me a lot of useful advices. Without his help I could hardly complete this paper. Finally, I really appreciate Professor Alan Rowch and Deborah Derrick who help me fix my grammar issues.
Appendix:

I: The Energy Commission supports the adoption of efficient and effective land use planning and recommends that the state:

- Adopt a unified statewide growth management plan, based on local and regional plans, aligning state planning, financing, infrastructure, and regulatory land use policies and programs.
- Require regional transportation planning and air quality agencies to adopt 25-year and 50-year regional growth plans that provide housing, transportation, and community services for projected population increases while reducing greenhouse gas emissions to state-determined climate change targets.
- Expand efforts to provide technical and financial assistance to regional agencies and local governments to facilitate climate-friendly and energy-efficient planning and development. Model climate-friendly and energy-efficient development patterns.
- Determine the extent to which state and local tax policies affect and guide land use practices and revise policies that encourage growth that is inconsistent with the state's growth management plan.
- Direct California's utilities to play an active role with regional and local governments to encourage climate-friendly and energy-efficient development in their service areas.
- Work with California's Congressional delegation to ensure that future federal highway and other transportation and land use-related legislation and programs include energy reduction and climate stabilization considerations.

Available at: [http://www.energy.ca.gov/landuse/index.html](http://www.energy.ca.gov/landuse/index.html).

II: California State laws:

Assembly Bill 32 for GHG limitation:

By January 1, 2008, the state board shall, after one or more public workshops, with public notice, and an opportunity for all interested parties to comment, determine what the statewide greenhouse gas emissions level was in 1990, and approve in a public hearing, a statewide greenhouse gas emissions limit that is equivalent to that level, to be achieved by 2020. In order to ensure the most accurate determination feasible, the state board shall evaluate the best available scientific, technological, and economic information on greenhouse gas emissions to determine the 1990 level of greenhouse gas emissions. 38551. (a) The statewide greenhouse gas emissions limit shall remain in effect unless otherwise amended or repealed. (b) It is the intent of the Legislature that the statewide greenhouse gas emissions limit continue in existence and be used to maintain and continue reductions in emissions of greenhouse gases beyond 2020. (c) The state board shall make recommendations to the Governor and the Legislature on how to continue reductions of greenhouse gas emissions beyond 2020.

Available at: [www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf)

California Assembly Bill 811

AB 811, Levine. Contractual assessments: energy efficiency improvements. Existing law authorizes the legislative body of any city, as defined, to determine that it would be convenient and advantageous to designate an area within which authorized city officials and free and willing property owners may enter into contractual assessments and make arrangements to finance public improvements to specified lots or parcels under certain circumstances. Existing law requires the legislative body to make these
determinations by adopting a resolution indicating its intention to do so and requires the resolution to include certain information, including, but not limited to, identification of the kinds of public works that may be financed a description of the boundaries of the area within which contractual assessments may be entered into, and a description of the proposed arrangements for financing the program. Existing law also directs an appropriate city official to prepare a report to include, among other things, the terms and conditions that would be agreed to by a property owner within the contractual assessment area and the city and identification of the types of facilities that may be financed through the use of contractual assessments. This bill would additionally authorize a legislative body of any city, as defined, to determine that it would be in the public interest to designate an area within which authorized city officials and free and willing property owners may enter into contractual assessments to finance the installation of distributed generation renewable energy sources or energy efficiency improvements that are permanently fixed to real property, as specified. The bill would require the resolution of intention to include, among other things, the kinds of distributed generation renewable energy sources or energy efficiency improvements that may be financed as well as a statement specifying that it is in the public interest to finance those distributed generation renewable energy sources or energy efficiency improvements. The bill would further require the report to include, among other things, the types of distributed generation renewable energy sources or energy efficiency improvements that may be financed through the use of contractual assessments. The bill would authorize a property owner, upon written consent of an authorized city official, to purchase directly the related equipment and materials for the installation of distributed generation renewable energy sources or energy efficiency improvements and to contract directly for the installation of those sources or improvements. The bill would make findings and a declaration in this regard. This bill would declare that it is to take effect immediately as an urgency statute.

Available at: http://www.energy.ca.gov/recovery/documents/ab_811_bill_20080721_chaptered.pdf

2005 California Government Code Sections 65350-65362 General Plan

65352. (a) Prior to action by a legislative body to adopt or substantially amend a general plan, the planning agency shall refer the proposed action to all of the following entities: (1) A city or county, within or abutting the area covered by the proposal, and any special district that may be significantly affected by the proposed action, as determined by the planning agency. (2) An elementary, high school, or unified school district within the area covered by the proposed action. (3) The local agency formation commission. (4) An area wide planning agency whose operations may be significantly affected by the proposed action, as determined by the planning agency. (5) A federal agency if its operations or lands within its jurisdiction may be significantly affected by the proposed action, as determined by the planning agency. (6) (A) The branches of the United States Armed Forces that have provided the Office of Planning and Research with a California mailing address pursuant to subdivision (d) of Section 65944 when the proposed action is within 1,000 feet of a military installation, or lies within special use airspace, or beneath a low-level flight path, as defined in Section 21098 of the Public Resources Code, provided that the United States Department of Defense provides electronic maps of low-level flight paths, special use airspace, and military installations at a scale and in an electronic format that is acceptable to the Office of Planning and Research. (B) Within 30 days of a determination by the Office of Planning and Research that the information provided by the Department of Defense is sufficient and in an acceptable scale and format, the office shall notify cities, counties, and
cities and counties of the availability of the information on the Internet. Cities, counties, and cities and counties shall comply with subparagraph (A) within 30 days of receiving this notice from the office. (7) A public water system, as defined in Section 116275 of the Health and Safety Code, with 3,000 or more service connections, that serves water to customers within the area covered by the proposal. The public water system shall have at least 45 days to comment on the proposed plan, in accordance with subdivision (b), and to provide the planning agency with the information set forth in Section 65352.5. (8) The Bay Area Air Quality Management District for a proposed action within the boundaries of the district. (9) On and after March 1, 2005, a California Native American tribe that is on the contact list maintained by the Native American Heritage Commission, with traditional lands located within the city or county's jurisdiction. (b) Each entity receiving a proposed general plan or amendment of a general plan pursuant to this section shall have 45 days from the date the referring agency mails it or delivers it in which to comment unless a longer period is specified by the planning agency. (c) (1) This section is directory, not mandatory, and the failure to refer a proposed action to the other entities specified in this section does not affect the validity of the action, if adopted. (2) To the extent that the requirements of this section conflict with the requirements of Chapter 4.4 (commencing with Section 65919), the requirements of Chapter 4.4 shall prevail. Available at: http://law.justia.com/codes/california/2005/gov/65350-65362.html.

III Example plans of scoring methods

0: Did not mentioned

1: Mentioned but did not make a plan or timeline. Example plan: County of Riverside General Plan: Policies: (for water conservation)
OS 2.1: Encourage the installation of water-conserving systems such as dry wells and gray water systems, where feasible, especially in new developments. The installation of cisterns or infiltrators shall also be encouraged to capture rainwater from roofs for irrigation in the dry season and flood control during heavy storms. (AI 57, 62)
OS 2.2: Where feasible, decrease stormwater runoff by reducing pavement in development areas, and by design practices such as permeable parking bays and porous parking lots with bermed storage areas for rainwater detention. (AI 57, 62)
OS 2.3 Encourage native, drought-resistant landscape planting. (AI 3, 57, 62)
OS 2.4 Support and engage in educational outreach programs with other agencies that promote water conservation and wide-spread use of water-saving technologies. (AI 58)
OS 2.5 Encourage continued agricultural water conservation and recommend the following practices where appropriate and feasible: lining canals, recovering tail water at the end of irrigated fields, and appropriate scheduling of water deliveries. (AI 57)
Available at: http://www.rctlma.org/genplan/content.

2: Did not complete but has a timeline. Example plan: Tulare County general plan General Plan 2030 Update
The Tulare County General Plan is a comprehensive, long-term general plan for the physical development of the unincorporated areas of Tulare County, excluding state and federal lands. The County's General Plan consists of development policies that set forth objectives, principles and standards that guide future land use decisions within the County of Tulare. The general plan and its
maps, diagrams, and development policies form the basis for the County’s zoning, subdivision, and public works actions. The proposed Tulare County General Plan 2030 Update (General Plan Update) amends the existing Tulare County General Plan and is made up of a Part I, Goals and Policies Report, and a Part II, Area Plans.

Proposed Final Environmental Impact Report

The Proposed FEIR for the General Plan 2030 Update (project) was prepared in compliance with the State California Environmental Quality Act (CEQA) Guidelines (California Code of Regulations, title 14, §§ 15000, et seq.). The County of Tulare (County) is the Lead Agency for the environmental review of the proposed project and has the principal responsibility for approving the General Plan 2030 Update. As described in the CEQA Guidelines §15121(a), an EIR is a public information document that assesses potential environmental effects of a proposed project, as well as identifies mitigation measures and alternatives to the project that could reduce or avoid adverse environmental impacts. CEQA requires that state and local government agencies consider the environmental consequences of plans and projects over which they have discretionary authority. The EIR is an informational document used in the planning and decision-making process. It is not the purpose of an EIR to recommend either approval or denial of a project.

Available at: http://generalplan.co.tulare.ca.us/.

3: Already adopted: example plan: Berkeley Climate Action Plan

New and existing Berkeley buildings achieve zero net energy consumption through increased energy efficiency and a shift to renewable energy sources such as solar and wind

Public transit, walking, cycling, and other sustainable mobility modes are the primary means of transportation for Berkeley residents and visitors

Personal vehicles run on electricity produced from renewable sources or other low-carbon fuels

Zero waste is sent to landfills

The majority of food consumed in Berkeley is produced locally

Our community is resilient and prepared for the impacts of global warming

The social and economic benefits of the climate protection effort are shared across the community

Available at:
References:
Brody SD (2003) A Longitudinal Analysis of Plan Quality Associated with Natural Hazards, pp 156-208
13-36