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Renewable Energy is Not Sustainable in the Current Economic Climate of South Mississippi: Examining the Feasibility of Electric Utilities Adopting Renewable Energy Production Mandates on the Mississippi Gulf Coast

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RENEWABLE ENERGY IS NOT SUSTAINABLE IN THE CURRENT ECONOMIC CLIMATE OF SOUTH MISSISSIPPI:

Examining the Feasibility of Electric Utilities Adopting Renewable Energy Production Mandates on the Mississippi Gulf Coast

By

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Table of Contents

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8 Dec 2011

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Abstract:

This study attempted to gauge the professional opinions of electric utility managers on their views of business risk regarding state and federal renewable energy generation mandates.

Part 1: Introduction

The purpose of this paper was to explore the treatment of carbon regulatory risk in the most recent resource plans of the largest electric utility in south Mississippi, Mississippi Power, which is a subsidiary of Southern Company, based in Atlanta, Georgia. This corporation's approach to assessing the risk of future carbon regulations was examined with special regard to understanding how utility managers account for variable costs involved in traditional and renewable energy production as well as the degree to which low-carbon resources and potential portfolios are evaluated.

The Issue

Since the Industrial Revolution, energy has been the main commodity in the global economy. The idea of renewable energy to promote a more sustainable environment has become a popular topic of debate in mainstream culture during recent years. From G.E. and Google's Ecomagination campaign for a smart energy grid to individual state energy portfolios mandating the use of renewable energy production, the notion of generating energy in a more sustainable way has become extremely popular on environmental and political platforms. There are many stakeholders actively promoting and discouraging the use of renewable energy production including law makers, special interest groups, environmental activists, grass-roots organizations, and the average American consumer to name a few. The so called, 'Green Revolution' has even triggered a new risk assessment control for corporations concerning the consumer population's opinions about the environment called corporate social responsibility.

The most widely accepted definition for sustainable development comes from the Brundtland Report created in 1987 by the World Commission on Environment and Development, "to meet the needs of the present without compromising the ability of future generations to meet their own needs." One of the most important tasks given to our generation will be to find the tools to reach a sustainable compromise between environment and industry. The argument for sustainable development is at the root of all renewable energy production initiatives. The issue of whether it is morally justifiable to pursue green energy initiatives begs the question, how would such expensive projects be financed? During these unstable economic times, one must wonder how companies and consumers would potentially be affected if federal energy mandates or GHG (green-

house gas) emissions caps were to become law. Most economists and politicians alike agree that the amount of capital handed down by each generation to the next should either increase or stay the same. Environmental activists argue that the production of electricity from fossil fuels is damaging to the environment to the extent that future generations will have to pay for the current population's abuse of natural resources in the form of climate change.

Some believe government intervention in the form of a cap-and-trade policy or a carbon tax will successfully reduce GHG emissions without hurting the economy. Others feel that interventionist policies are not the answer and that the markets should determine which type of electricity generation prevails. Still other groups feel that more sustainable electricity generation can be most efficiently achieved through very limited government intervention to encourage innovation and investment in renewable energy technologies.

History of the Energy Industry

The question of whether government should regulate energy production has been highly debated since the introduction of Roosevelt's New Deal programs. One of these programs created the Tennessee Valley Authority in 1933, a public power entity, to generate cheap power for consumers and to serve as a standard to protect against private utilities hiking up electricity rates (Wells 228). Through 1953, President Truman continued the expansion of public utilities and took 25 percent of the electricity market share away from private enterprise. Wells argues that because the upfront costs for capital in building and operating the transmission grid and generating facilities are so high, it is best for only one company to serve a specific geographical area (Wells 227). Economists

refer to this occurrence as a natural monopoly. Paul Joskow, an economist at The Massachusetts Institute of Technology, comments that, "the wrangling between pro- and anti-competition forces, jurisdictional disputes between federal and state policy makers, and plenty of ignorance have led our electric-power system to become stuck somewhere between the old system of regulated monopoly and a new system that relies more heavily on competitive markets" (Joskow 16). The complexity of the U.S. electric utility system, when dissected, reveals an inherent power struggle between both sides of the aisle, all of which are driven by carefully calculated agendas.

Deregulation

Historically, electric utilities have been characterized as regulated and territorially based monopolistic entities. They were allocated a certain population and charged with the task of delivering energy to those customers at the cheapest possible price. In recent years, many states have begun to deregulate their energy sector in order to ensure power supply reliability and to stabilize price volatility. The Energy Policy Act of 1992 required that the energy grid be opened up to all energy producers to encourage more competition (Turbeville 1). After intense resistance from electric utilities, the Federal Energy Regulatory Commission (FERC) issued a series of mandates in 1996 to ensure open access to the grid (Turbeville 1).

Another important recent change to the energy industry is disaggregation. This occurred when utilities were allowed to sell the power that their generating assets created to unregulated subsidiaries of utility holding companies. This allows independent power producers (IPP's) the potential to make more profit. The deregulation and disaggregation

of the electric energy sector in the United States offers an attractive financial opportunity to IPP's and has allowed the energy industry to act more like a free market rather than a regulated monopoly.

Job Creation/Loss

The resulting job creation/loss which stems from investment in renewable energy production as opposed to fossil fuels is an important factor to consider. Equally as important to distinguish would be the types of jobs to be created. Are they temporary or permanent; blue collar or white collar? One congressional study revealed that 40 percent more jobs per dollar of investment are created from renewable energy production than coal, although more jobs are in the manufacturing and construction trades and most are not permanent (Reid 5). However, Congressman Reid did not specify what type of job this 40 percent increase per dollar of investment would create.

In his book, *Strategies for the Green Economy*, Joel Makower sites an interesting concept, that of a fourth quadrant. Courtesy of Van Jones, the fourth quadrant idea represents the intersection of the lower-middle class Americans and the green economy and the that fact that, up to this point in time, no major marketing campaigns have been aimed at this demographic. For example, the majority of middle and working class Americans cannot afford to pay for organic foods. Since the majority of Americans fall into these categories, as Table 1 depicts, many assume that the American population cannot afford to pay for sustainable energy practices and the inherent spike in electricity rates.

Table 1: Academic Class Models

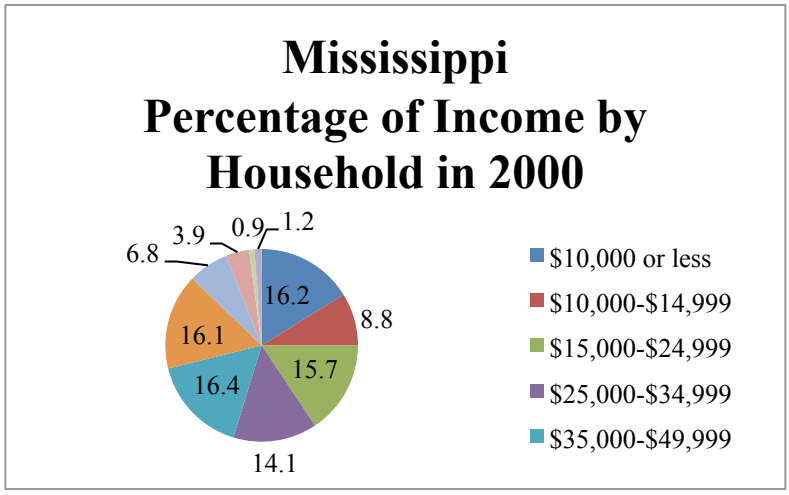
Upper Class	1%	Top-level executives, celebrities, heirs; income of $500,000+ common. Ivy league education common.
Upper Middle Class	15%	Highly educated (often with graduate degrees) professionals & managers with household incomes varying from the high 5-figure range to commonly above $100,000
Lower-Middle Class	32%	Semi-professionals and craftsman with some work autonomy; household incomes commonly range from $35,000 to $75,000. Typically, some college education.
Working Class	32%	Clerical, pink and blue collar workers with often low job security; common household incomes range from $16,000 to $30,000. High school education.
Lower Class	14-22%	Those who occupy poorly-paid positions or rely on government transfers. Some high school education

Source: William Thompson and Joseph Hickey, 2005

When one accounts for the fact that Mississippi is the poorest state in the nation according to the U.S. Census Bureau, one can better understand the predicament that electricity producers and law makers in Mississippi face. The lower classes in Mississippi simply cannot afford an increase in electricity rates resulting from the implementation of renewable energy generation practices. According to the U.S. Census Bureau, 49 percent

of the population of Mississippi lives in poverty. Figure 1 shows the income per household in Mississippi:

Figure 1: Mississippi Percentage of Income by Household 2000



Source: U.S. Census Bureau, 2000.

Critics like Robert Bryce, author of *Gusher of Lies: The Dangerous Delusions of Energy Independence*, argue that a carbon tax or government regulation on the release of carbon into the atmosphere would not only devastate the electric utility industry, but cause a chain reaction to begin which would eventually reach the American consumer, causing all products to be more expensive (Bryce 261). According to the Energy Information Administration, nearly half of America's electricity is produced from coal, which emits the most carbon dioxide compared to other sources of energy generation.

Global Concerns

In order for the effort of lowering net carbon dioxide emissions through taxation to be a success, all of the leading economic powers of the world would need to actively participate. In his famous paper, "The Challenge of Global Warming: Economic Models

and Environmental Policy," William Nordhaus concludes that in order for a carbon tax to effectively reduce global carbon emissions to an acceptable level by 2050, every country in the world would need to be involved. This conclusion begs the moral question of how one country or set of countries can justify depriving less developed countries of the opportunity to industrialize.

In 2006, China added the equivalent in kWh production of France to its electricity grid (Bryce 268). Nearly 90 percent of China's energy portfolio is made up of coal-fired power plants (Bryce 268). Since China and most countries in the Orient and Middle East have no intention of passing any kind of carbon tax, if America were to do so, the tax would only create an economic disadvantage for Americans and not an incentive for real change. Nordhaus also comments that his models predict in order to achieve a 90 percent reduction in carbon dioxide emissions by 2050, (the reduction depicted as preferable in An Inconvenient Truth), the U.S. would have to spend $1.2 trillion; not exactly a workable budget (Nordhaus 12).

Kyoto Protocol

More than ten years of climate policy negotiations led to the Kyoto Protocol negotiations in December of 1997. The Kyoto Protocol was the first agreement of its kind which limited the amount GHG emissions allowed to developed nations which was legally binding through the framework of the United Nations. The goal was for all participating countries to reduce and stabilize their GHG emissions to 1990 levels by 2010. The United States, however, never actually ratified this treaty. The issue of where and how to assign responsibility for GHG emissions has been the subject of much debate among various countries and non-profit organizations such as the United Nations over the

past few decades. Australia has also refused to ratify the treaty. One bizarre fact about the negotiations is that China is actually exempt from the emissions reductions standards. The major challenge for post-Kyoto climate policy negotiations is to better garner international support from the more economically powerful countries to recognize and implement emissions reductions standards. The Intergovernmental Panel on Climate Change (IPCC) was also established in 1988 by the United Nations and the World Meteorological Organization to act as an objective source of information on climate matters.

One recent international attempt to promote reduction in carbon emissions was the Copenhagen Agreement. The Copenhagen Conference was held in December of 2009 to try and better define and strengthen the United Nations Framework Convention on Climate Change (UNFCC). One-hundred and twenty government officials from 193 countries attended the conference (Wynn 1). Since then, 138 governments have expressed an intention to be associated with the Copenhagen Accord and 85 countries have pledged GHG emissions reductions by the year 2020. According to the European Environment Agency, in 2007 only 5 of the 15 countries that signed the agreement were on the right track to meeting their CO_2 reductions (Bryce 366).

In his presidential campaign, President Obama promoted the idea of federal renewable energy standards one of his key platforms. He has fought and failed thus far to garner sufficient legislative support to pass legislation mandating that all energy producers generate 10 percent of their electricity from renewable sources by 2012. There are a number of interest groups that are fighting for similar goals here in Mississippi. One such group is the national non-profit, 25x25. With a strong presence in Mississippi, their

mission is to achieve 25 percent of the energy produced in the U.S. to be classified as renewable energy by the year 2025. In order to do this, 25X25 states that Americans must promote renewable energy business ventures through federal and state tax incentives, as well as investment in infrastructure that is more geared towards biofuels.

Timeline of Emissions Reductions Policy Proposals

- *May 2010 -* American Power Act (APA), introduced as a discussion draft on May 12, 2010 by Senators Kerry and Lieberman.
- *Dec 2009 -* S. 2877, The Carbon Limits and Energy for America's Renewal Act (CLEARA), introduced by Senators Cantwell and Collins in December of 2009.
- *June 2009 -* H.R. 2454, the American Clean Energy and Security Act (ACESA) sponsored by Representatives Waxman and Markey, as passed by the House of Representatives on June 26, 2009.

Current Climate Change Legislation

There have been many energy policy changes since the 1990s all driven by a number of factors including sustainability of climate change, security, economic, and social concerns. These policies have had a significant impact on renewable energy production, both those designed to promote renewable energy and those designed to promote fossil fuel based generation. One article, "Renewable Energy Policies and Barriers," examined six different types of policies affecting renewable energy which were enacted in the late 1990s through the early 2000s including: renewable energy promotion policies, transport biofuel policies, emissions reduction policies, electric power

restructuring policies, distributed generation policies, and rural electrification policies (Beck 365). The article concluded that the policies which contributed the most to renewable energy development during that time were direct equipment subsidies and rebates, net metering laws, and technical interconnection standards in the case of solar photovoltaics (Beck 387). The following discussion breaks down the most recent federal legislative green energy bills which have been either passed or introduced:

Clean Air Act of 1977

- Originally established to address the acid rain being released due to of sulfur dioxide (SO2) pollution.
- Established a "command and control" approach to air pollution (Horn 8).
- Required a 50% reduction in SO2 emissions by fossil fuel-fired power plants
- Created emissions caps on the total amount of SO_2 allowed in the atmosphere, with the cap declining over time (Krupp 10).
- Established a new commodities trading market in the form of credits which rewarded plants that produced green energy. (Krupp 10).

In December 2009, the U.S. Environmental Protection Agency (EPA) signed the GHG Endangerment Finding that prepared to give the EPA the authority to establish federal emissions standards for GHG under the authority of the Clean Air Act. This was in response to the *Massachusetts v EPA* Supreme court case which ruled in April 2007 that the EPA has clear statutory authority to regulate greenhouse gases (M.J. Bradley & Associates 3).

Waxman-Markey Bill

According to a study conducted by the Heritage foundation on the potential economic costs of a cap-and-trade bill (Waxman-Markey) in the United States Congress, the energy costs for a household of four would increase $436 the first year the policy is introduced, with energy prices going up 90 percent by 2035 (Beach et al. 1). The study also estimates that if federal legislation similar to the Waxman-Markey bill is passed, it would cause the net job loss impact on average of 1,140,000 million jobs at any given time from 2012-2035, which includes green jobs created due to the theoretical passage of this legislation (Beach et al. 1). It also concluded that low-income houses would spend a larger proportionate amount on energy costs, which means that a federal renewable energy mandate would affect the poorest people in America the most.

Entergy, another large electric utility in Mississippi, supported the Waxman-Markey legislation and estimated that it would increase residential bills by less than 3 percent by 2020 according to the official Entergy website. Entergy does, however, disagree with the bill's promotion of solely renewable electricity and feels that the standard should be expanded to include energy efficiency efforts and nuclear generation.

American Power Act

- Introduced by Senators John Kerry and Joe Lieberman on May 12, 2010
- Took a sectorial approach by limiting the net emissions of electric utilities and later incorporating large industrial producers.
- Overall, this bill would have capped over 80 percent of GHG emissions productions in the United States by 2016, according to the Environmental Defense Fund.

American Clean Energy and Security Act of 2009

- The bill affects 85 percent of the entire U.S. economy, including: electricity utilities, oil refineries, natural gas suppliers and other large energy consuming industries such as iron, steel, cement, and paper manufacturers.
- The carbon permits would be used one per each ton of GHG emissions. Approximately 75 percent of these allowances would be given away free by the government at the beginning of the program, with the percentage of free allowances decreasing over time.
- The remaining 25 percent of the permits would be auctioned off in the first year to electric utilities.
- Regulated companies can also purchase credits from other companies to offset part of their required emissions reductions.
- The bill requires a renewable energy standard for large utilities such as Entergy, Southern Company, and Tennessee Valley Authority (TVA) to increase the portion of their generation portfolios made up of renewable energy generation over time.

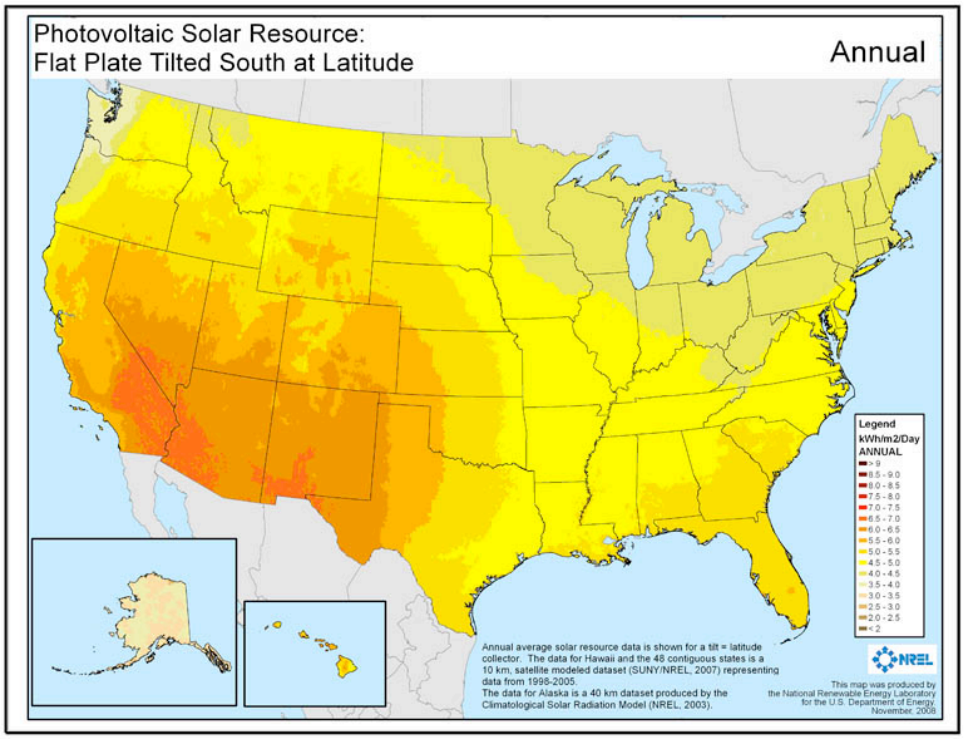
Renewable Energy Generation Concerns

It is estimated that just to build a smart energy grid to harness the intermittent nature of renewable energy production and transmission will cost at least $400 billion (Talbot). There has been significant debate on the plausibility of using an energy supply which is variable and susceptible to relatively unpredictable factors such as the amount of sun light for solar panels and wind speed for wind turbines. The problem with renewable energy such as wind, wave and tidal, hydroelectric, and solar is that these forms of power generation rely on variable resources of energy. Solar energy is harnessing the power of

sunlight through photovoltaic panels; therefore, this sort of generation is vulnerable to daily weather conditions. Since these sources are variable, they cannot be the sole generation of electricity for a population of consumers that demand energy at certain peak times. Some scientists have claimed that variable energy may not be able to keep up with consumer demand growth over time, especially in times of peak energy usage (Chandler 10). However, when variable energy is paired with controlled forms of generation like biomass, nuclear, and integrated coal gasification systems, the amount of electricity available in the grid should be balanced with consumer demand. Another controversial issue is the ability of electric utilities to transfer this energy to consumers using the current electric grid, which many experts say is incapable of distributing electricity evenly from renewable sources to the majority of consumers in high population areas (Talbot 45). This dilemma is another significantly complicating factor in the cost-benefit analysis of introducing federal renewable energy standards in the United States.

On average, each citizen in Mississippi has a carbon footprint of 22 tons each year (Bryce 261). According to the National Renewable Energy Laboratory's Solar Photovoltaics Resource Maps, Mississippi has the potential for between 4-5 kWh per square meter of sunlight energy per day; however the Energy Information Administration states that Mississippi received 6-9 kWh per square meter per day.

Figure 2: Annual KwH/m^2/day (Kilo-watt hours per square meter per day) of PV Solar Radiation (10 km)



Source: National Renewable Energy Laboratory

Electric utilities tend to view renewable energy production as an unprofitable investment because they have to invest in research and development, marketing, a new supply chain, as well as upgrade their infrastructure (the energy grid) in order to distribute the renewable power without being able to raise billing rates to pay for these upfront costs. Therefore, innovations tend to be more incremental than radical in nature within the electric utility industry. The upfront cost of building and operating a traditional coal-fired power plant is extremely high so in order to generate a profit, these business entities must maximize the use of the production systems already in place, rather than investing huge amounts of money into new, uncharted territory. For this reason, it has

been hypothesized that the government should intervene and mandate the production of renewable energy in order to stimulate the renewable resources business market.

Cap-and-Trade

For some electric utilities to act in compliance with the proposed standard, a cap-and-trade policy would need to be introduced to compensate for those companies which cannot produce renewable energy to buy credits from those companies that generate an excess of the required amount of renewable energy mandated by the government. These percentages would certainly carry negative effects on any electric utility that did not strategically plan for this risk. Given the public and political interest in the implementation of greener climate policies, how would the utilities in southern Mississippi react to a national adoption of such policies, and how has Mississippi Power (as a subsidiary of Southern Company) already anticipated this risk?

The typical U.S. household uses 10,000 kWh of electricity per year, resulting in around 11 tons of carbon dioxide emissions per household (Nordhaus 12). In 2006, the United States emitted roughly 5 billion tons of carbon dioxide emissions (UCS 1). However, China emitted 6 billion tons even though their per capita emissions were less than 25 percent of the United States' (UCS 1). Climate protection policies cannot be adopted by individual countries with the assumption that their efforts will succeed in reducing global emissions while other large polluting countries remain unchanged. The effort must be collective.

Much recent discussion concerns the need for an update of the traditional power system model. Power systems today are built around one large, mainframe power plant,

which supplies a specific amount of power to a specific population of consumers and is bound by a bilateral contract with the government. Hugo Chandler, of the International Energy Agency, notes that moving away from the conventional power plant business model and towards more geographically dispersed generation and distribution stations is an important step to fully incorporating renewables into energy production (Chandler 2). Other important steps include keeping the consumer price of energy low, ensuring the reliability of renewable energy power plants through adequate meteorological forecasting, and updating the current power grid to be able to control fluctuations of power and to be able to store a certain amount of energy to be dispersed during peak energy usage time (Chandler 2). Any change made to the traditional power system model would need to be fully explored before.

Smart Grid

A new energy smart-grid is being promoted from numerous sources, some of which include Fortune 500 companies, political action committees, special interest groups and grassroots movements. Although it has been asserted that the potential cost for updating the power grid is approximately between $338 billion and $476 over a 20 year period; for an industry that generates $300 billion a year in revenues annually, this investment does not seem unreasonably high (Fickling 1). There is an urgent need for new investment in electricity infrastructure in order to keep up with increasing demand.

International Examples of Successful Renewable Energy Initiatives

In other parts of the world, innovations in public policy have made great strides for the reduction of GHG emissions. One interesting positive example of international wholesale market for energy is the Nordic Power Market. This industry includes Denmark, Norway, Sweden, and Finland. This market trades energy in between countries in order to maximize the potential use of renewable energy in those countries.

Mississippi's Role

Currently the state of Mississippi is ranked number 44 in the United States for net renewable energy generation (EIA 1). Could this be due to insufficient venture capitalism in a traditionally conservative state? Maybe Mississippi simply does not possess the natural climate resources to sustain renewable forms of generation as previously suggested by the National Renewable Energy Laboratory's solar radiation map (Figure 2). The research question sets out to better understand these questions and find answers according to the experts; to understand how Mississippi Power managers perceive the risk and rewards of the proposed federal renewable energy mandates, and if they were passed as laws, how they would go about complying with them. This study seeks to understand the local 'climate' of renewable energy generation and the potential positive or negative impacts on the state and local economy in South Mississippi according to the local experts and will use the Delphi method to interview participants.

Enterprise Risk Management

A new form of assessing risk in corporations is enterprise risk management. Enterprise risk management is defined as a common approach for managing business risk

and reasonable ensuring successful achievement of business objectives (Randolph 25). Value for a corporation can be defined as a function of risk and return, and it is the goal of an Enterprise Risk Management Team to optimize the relationship between risk and return (Randolph 26). Enterprise Risk Management in one of the fastest growing business initiatives along with GRC (governance, risk management, and compliance) convergence (Randolph 42). Modeling systems have the potential to provide benefits in the practice of risk management (Santella, Steinberg, and Parks 410). By using the combined knowledge of field experts and data sets from multiple sources, models provide a large range of quantitative information and understanding of system connectivity which becomes an effective tool for persons trying to mitigate risk. The critical infrastructure and production methods of electric utilities are so important because they affect all sectors of the economy since consumers and businesses alike must both operate with the use of electricity. Therefore it is not only in the best interest of the electricity producer as a company, but also of the entire local population for the utility to create and employ a standard of risk management within their business entity. It is important to take note of this situation from a macroeconomic perspective when trying to assess the risks of extreme events, since this type of risk affects the entire economy and therefore every virtually industry. The passing of federal energy mandates would be considered an extreme political event due to the fact that the entire economy is affected by a surge in electricity bills. Enterprise risk management involves several key objectives, these include:

- The alignment of risk-appetite and strategy
- The enhancement of risk response decisions

- The reduction of operational surprises and losses
- The identification and management of multiple and cross-enterprise risks
- The seizing of opportunities
- The improvement in the deployment of capital

Of these objectives, the first one is the most significant. Every company or even investor must determine their risk appetite and from there create a strategy to approach risks such as natural disasters, terrorist attacks, and federal CO2 emissions reductions mandates. The enterprise risk management framework lays out four different categories of objectives for companies:

1. Strategic- High priority goals
2. Operations- Efficient use of resources
3. Reporting- Reliability of financial statements and raw data
4. Compliance- Compliance with laws and regulations, such as EPA regulations and Federal law.

Although compliance is the obvious choice for potential federal renewable energy mandates, this could also fall under the strategic and operations objectives. Strategic objectives do not always fall under the control of the business because they are subject to external events.

Enterprise Risk Management at Southern Company

The Enterprise Risk Management program at Southern Company is made up of executive and management committees such as a risk advisory and controls committee as well as a business assurance council and a functional risk oversight group (Randolph 28).

The Southern Company ROC establishes risk policies and principles as well as a risk appetite and integrates risk with strategy. When trying to come up with a risk mitigation strategy, significant business risks and related governance processes are established and aligned. In order for a company's risk management program to work effectively, that entity must recognize that value is a function of both risk and return and both must be actively managed. Certain risks themselves are identified by the Ethics and Compliance Council (ECC), Compliance Managers and Risk Area Teams (Randolph 34). Formal assessment meetings are conducted with each compliance officer and certain Risk Area Teams in order to maximize the knowledgeable input in developing the compliance risk inventory (Randolph 24). After many interactive working sessions, the compliance risk profile is presented to the ECC for approval (Randolph 34).

Given the long development and economic lifetime of most electricity production investments, it is necessary for utilities to evaluate the potential costs and risks of possible electricity portfolios in order to mitigate the risk of the uncertain cost of future carbon dioxide emissions (Barbose 3300). Electricity producers across the nation are currently evaluating their options for potential portfolios in order to limit their exposure to this highly uncertain but potentially serious risk. With a few exceptions, little effort has been made to assess exactly how utilities go about analyzing and managing these risks through resource planning and investment processes.

Emissions Trading as a Commodity

In 2003, the Chicago Climate Exchange (CCX) was established as an over-the-counter voluntary GHG reduction and offset trading program. As stated on the CCX

official website, the Carbon Financial Instrument (CFI) is traded on this exchange. A CFI represents 100 tons of CO_2. Offsets are created by certain projects which qualify as emissions reductions projects. The projects include over 15,000 farmers, ranchers, and other professionals who are currently conducting mitigation techniques on more than 25 million acres of land. Members of CCX have entered into legally binding contracts for reducing a specific amount of CO_2 which is verified at the end of each year. Since its inception, 700 million metric tons of CO_2 have been reduced, which is the equivalent of eliminating the emissions of 140 million cars for one year, according to CCX. Interestingly, in December of 2004, Entergy, one of the electric utilities evaluated in this study, made a one-million ton trade on the OTC (over-the-counter) bilaterally traded market (Fusaro and James 8). Although the CCX has been significantly scaled back since the energy legislation of the current administration has reached a stalemate, the European version of the CCX, the European Climate Exchange, continues to thrive under the EU ETS cap-and-trade program (Rudolf 1). In order for commodity markets such as the Chicago Climate Exchange futures market to thrive in the United States, federal mandates must be instituted. Would this approach be the most economically efficient path to creating realistic financial value for emissions reductions?

Generation Types

Biomass Energy Production

One option for the state of Mississippi to generate renewable energy is through the use of biomass. Biomass is a form of energy production which uses animal and plant materials as a feedstock for electricity generation. Mississippi has a large amount of natural resources such as lumber and animal wastes which could be used as feedstock for biomass power plants. This type of production is reserved more for municipality and city projects rather than individual homes. The generation and combustion process is similar to the one used in coal-fired power plants.

Biomass generation became very popular in the 1980s after the passage of the Public Utilities Regulatory Policies Act of 1978 (PURPA), which required utilities to buy electricity from co-generators at a price equal to the avoided costs of increased production on their own sites (Beck 389). When operated with extreme efficiency, these plants can release no net carbon emissions as long as they abstain from combusting fossilized fuel and use biofuels such as wood chips and switch grass (Sovacool 12). In some instances, co-firing is used in the process of energy which is when the feedstock is combusted with fossil fuels. It is estimated that two-thirds of biomass production feedstocks in 2050 will be produced on high-yield energy plantations that cover almost 400 million hectares. This is equal to 25 percent of the presently planted agricultural area on the planet.

Biomass fuels are a great option for a renewable resource for several reasons. First of all, biomass fuels can substitute almost directly for fossil fuels within the existing

production and distribution models and infrastructure of power plants (Beck 389). Second, the potential resource of feedstock availability is large. Finally, this alternative means of electricity generation could help stabilize demand in developing countries, where the demand for energy is rising at an exponential level due to population booms, urbanization, and the rising standard of living (Beck 389).

One important note, especially for Mississippi is that since the timber and paper products industry there are thriving, the price of raw materials (wood) in this region is relatively low compared to the global market. If a large percentage of the supply of timber and paper industry materials were to shift to feed-stocks for biomass, there is a chance that the price of timber and paper from that region would increase over time. According to the Mississippi Biomass and Renewable Energy Council, the following feed-stocks are the most viable resources of biomass production in the state of Mississippi: Wood harvest and residues, municipal solid waste, corn grain, poultry litter, soybeans, urban wastes, and used grease. It is important to note that there is a growing consensus among scientists that energy policies should be concerned with availability of supply and the use of biofuels while also finding ways to ensure the sustainability of the resources used to create the biomass feed stocks.

Biomass Production Technologies

Combustion

Combustion is the most established technology for biomass generation is the Steam-Rankine cycle; which is the same model used for coal-fired generation plants.

Gasification

Combustible gas can be produced from biomass during a high-temperature thermochemical process which is commonly referred to as gasification (Beck 390).

Biomass is estimated to cost on average around $0.07 per kWh which is still more expensive than coal that costs on average $0.05 per kWh (McMahon 1). One study by the World Resources Institute suggested that in the Southeast, Biomass resources can be used to meet base load electricity needs because it is a reliable source of power and the region has plentiful resources for feedstocks; while solar, wind, and hydropower can help even out peak energy use periods throughout the day (Creech 11)**.** It must also be notes that this type of hybrid between variable and fixed sources of energy production also requires a more highly advanced energy grid.

Biomass electricity generation carries special concern when one considers the land use impacts of the production process. Biomass feed-stocks are often co-fired with combustible fuels which can cause negative environmental impacts such as erosion, deforestation, and degradation of water and air quality (Creech 11). If the feed-stocks are co-fired with other fossil fuels, there must be a **carbon sequestration process** present in order for the process to be considered renewable. The extraction of raw materials in resource electricity production such as coal, natural gas, nuclear and the byproduct wastes associated with these production processes can also lead to the degradation of land and water resources (Creech 11). Solar, wind, and hydroelectricity generation land use concerns are mostly based around the surface area needed to capture the resources (sunlight, wind, and water flow).

Nuclear Power Generation

Many people believe that nuclear power is the most feasible option for clean energy production. According to the Economist, "a revival of nuclear power generation looks more likely than ever" (Economist 64). Nuclear power is a strong force in the southeastern United States. For example, it makes up sixteen percent of Southern Company's energy generation portfolio. Southern Company jointly owns and fully operates three nuclear plants; Plant Hatch in Baxely, Georgia, Plant Farley near Dothan, Alabama, and Plant Vogtle in Burke County, Georgia. The first approved construction of two nuclear reactors in the United States in thirty years at Plant Vogtle is currently underway. The plant is jointly owned by Georgia Power (45.7%), Oglethorpe Power Corporation (30%), Municipal Electric Authority of Georgia (22.7%), and Dalton Utilities (1.6%). On August 29, 2009, Georgia Power received an Early Site Permit for unit 3 and 4 which will be additions to the two nuclear reactors already in use at Plant Vogtle. The electricity generation capacity will be 1,100 MWH in 2017. President Obama and Secretary of Energy Steven Chu offered Georgia Power $8 billion in loan guarantees backed by the federal government in February of 2010 to stimulate the construction process to create clean energy jobs. The two new units are predicted to create 3,500 jobs during construction and 4,300 jobs once they are ready for commercial operation. After the fall of Fannie Mae and Freddie Mac's federally backed loan guarantees in 2008, Wall Street seems apprehensive about this business venture. Moody's Investors Service downgraded Southern Company's credit rating in August of 2009 due to the investment risk in building new coal and nuclear power plants (Thames 1).

Electricity producers first blocked the introduction of nuclear power because they were concerned about the initial sizable capital investment required to fund the cost of a nuclear power plant. Although nuclear power is an innovation compared to traditional fossil fuels, it has one element that other renewable energy technologies do not; it incorporates steam turbine technology and the entire grid system which is already in place. This factor makes nuclear technology much more affordable and feasible than more variable sources of renewable energy.

There are three significant drawbacks to nuclear power generation. First, the average nuclear power plant costs around $1.7 billion to build and around ten years to finish from paperwork planning to producing energy (Cohen 9). Second, many people do not want to live close to a nuclear power plant because of the horror stories that stemmed from nuclear plant accidents such as the Three Mile Island incident in 1979 and in Chernobyl, Russia in 1986. The construction of nuclear reactors would make the land close to any nuclear plant suddenly drop dramatically in real-estate value. This is an example of the Not in My Backyard (NIMBY) Theory. This effect would have significant negative effects on the local economy. Another complicating factor is the byproduct nuclear waste that is produced as a result of nuclear power production. The United States did have a plan to store tons of the waste in Yucca Mountain in Nevada; however, the Obama Administration has expressed its disinterest in pursuing the Yucca Project any further.

Solar Power Generation

Solar photovoltaics have become extremely popular for homes and businesses in recent years. For example, between 2001 and 2004, the number of solar panels in use around the world increased by more than half (Bryce 272). Although solar panels are more susceptible to weather conditions since they rely on solar energy, there are some distinct advantages to using them:

- They can be installed on roofs and therefore do not have to compete for land use availability within communities, although land based panels are very popular.
- They provide peak energy production during peak energy usage times (on hot summer days).
- They are more widely accepted by the majority of the population than visible wind turbines, biofuel plants, or nuclear plants which all are susceptible to the NIMBY Theory.

One disadvantage to the use solar energy is the cost. Fred Krupp and Miriam Horn state in their book, Earth: The Sequel, that the average cost per peak kilo-watt hour (or when the sun shines the brightest during the day), is $4.00 - $7.00 per kWh including hardware, mounting, installation, and engineering (Krupp and Horn 19). Although solar energy is one of the most expensive forms of renewable energy, economists expect the price of solar panels to decrease as research and innovations increase; similar to the way cell phones were initially too expensive for the average consumer, but are now relatively affordable for most Americans. One hundred square miles of land used efficiently for solar panels could power the entire United States during peak sunlight hours (Krupp and

Horn 18). At a cost of $7.00/ kWh, a 5-kW system (a solar panel system that produces 5 kilo-watt hours of energy per hour of direct sunlight) would cost around $35,000-$45,000, and an 8-kW system would be anywhere from $56,000-$72,000.

Wind Turbine Generation

It is a well-known fact that the wind does not always blow at the same speed all the time. Therefore, wind turbines are somewhat limited in their production capacity of electricity. They are, however, a viable source of electricity generation. According to a study conducted at Stanford University, the Mississippi Gulf Coast has a very high potential for wind energy. It is interesting to note that these findings contradict the potential wind energy production maps that are available to the public on the Department of Energy's website (Archer and Jacobson 1). An average large wind turbine (250 kW per hour) costs upwards of $700,000 to be built. These kinds of turbines can supply enough power to run a Wal-Mart. Smaller wind turbines (10 kW per hour) can be purchased and installed onto a residence for around $25,000 in Mississippi (Lofton 15).

Levelized Cost of Generating Technologies

One way to value different generation sources is to look at each source's levelized cost. The levelized cost of a process is defined as the present value of the cost of construction and operation over the financial life of a plant, converted into equal annual payments (EIA 1). The key costs evaluated include the cost of construction, the time required for construction, the non-fuel costs of operating the plant, fuel costs, the cost of financing, and the utilization of the plant (EIA 1). Table 2 on page 37 represents the

levelized costs for generating technologies as found in the Annual Energy Outlook 2010 reference case which used the National Energy Modeling System (NEMS).

Table 2: Estimated Levelized Cost of New Generation Resources

(2008 $/MGW hour) for plants entering service in 2016

	Levelized Capital Cost	**Fixed Generation Cost**	**Variable Generation Cost**	**Total System Levelized Cost**
Conventional Coal	$69.2	$3.8	$23.9	$100.4
Natural Gas				
Conventional Combined Cycle	$22.9	$1.7	$54.9	$83.1
Advanced Combined Cycle	$22.4	$1.6	$51.7	$79.3
Nuclear	$94.9	$11.7	$9.4	$119.0
Wind	$130.5	$10.4	$0.0	$149.3
Solar				
Solar PV	$376.8	$6.4	$0.0	$396.1
Solar Thermal	$224.4	$21.8	$0.0	$256.6
Geothermal	$88.0	$22.9	$0.0	$115.7
Biomass	$73.3	$9.1	$24.9	$111.0
Hydroelectric	$103.7	$3.5	$7.1	$119.9

Source: Energy Information Administration, Annual Energy Outlook 2010, Dec 2009

Part II: Literature Review

Utility Manager Study in Germany

The sustainability of the energy industry has been the subject of numerous recent studies. Popular topics have included analyzing climate change policy implications, documenting the opinions of consumers and producers of energy, and attempting to determine the factors influencing electric utility innovations in the field of renewable energy technologies. Since electric utilities are typically vertically integrated, any innovative activities should take into account the interests of all elements along the firm's supply chain (Markand and Truffer 619). Electricity producing firms are characterized by significant internal and external obstacles against the development and diffusion of so called "radical" innovations such as investing in renewable energy production technologies.

A recent study by Markand and Truffer interviewed 13 electric utility managers of eight firms in Germany to determine if a monopolistic market is a hindrance to innovative processes of the utilities and if the market were liberalized, would firms then move more quickly towards the development and diffusion of renewable energy technologies (Markand and Truffer 609). The interview questions used in Markand and Truffer's study were used as a rough guideline for the questionnaire used in this study. Markand and Truffer's study attempted to analyze the interplay between external drivers and internal structures in the case of the liberalization of electricity market as it pertains to renewable energy technologies. This study attempts to analyze the opposite; to understand how utility experts perceive government intervention will affect renewable energy

technologies in south Mississippi utilities. Markand and Truffer found that electric utilities do inhibit the development and diffusion of renewable energy technologies by lobbying and coordinating innovative processes based on incremental improvements of existing technologies (Markand and Truffer 623). Therefore, it is assumed based on the results of the study, renewable technology development and investment is dependent upon the implementation of government policies mandating such innovations.

Only when a market niche is established, will an electric utility have the incentive necessary to invest in a radical technology such as renewable energy. The establishment of a market niche is defined by Markand and Truffer as either the natural creation of the proper economic conditions in the market or a mandate issued by a government entity that calls for a specific technology to be introduced into that market, renewable energy generation in this instance (Markand and Truffer 612). Are electric utilities willing to actively engage in innovative renewable energy technologies under the current market conditions or is it necessary for the government to implement policies mandating this switch? This is one of the questions that this study will attempt to answer.

European Union Regulation of CO_2

The European Union (EU) has implemented policy initiatives in recent years mandating the reduction of CO_2 levels. In the EU, as the United States, the electric utilities' sizable share of the market is viewed as a hindrance to the jumpstart of commercially viable renewable energy technologies. One opinion of the literature stated that the only barriers to the adoption of renewable energy production systems are the traditionally conservative attitudes of policy makers and the electric utilities themselves

pushing their agenda through government at the state and federal level. Since its creation, the electricity industry's standard business model is soundly based in the theory of economies of scale. There is such a large upfront fixed cost for the mass production and distribution of energy that, in order to generate a profit, most often utilities use a traditional, centralized, coal-fired power plant which produces between 300-1300 mWh of electricity (Sovacool 102).

In recent years, the increasing levels of climate change awareness, coupled with rising prices, and the inefficiencies of the power grid are creating an unprecedented demand for a more diverse energy portfolio in the United States (Sovacool 102). It is argued in the literature that many countries are facing a new investment cycle in their energy industries, and that there is a tremendous opportunity for investment in renewable energy generation and distribution (Chandler 29).

Renewable energy does involve a high initial investment of capital; however some scholars argue that the lifetime costs are significantly lower than the cost of maintaining a coal power plant (Sovacool 109). For example, a solar thermal hot water system offers a return-on-investment in four to eight years according to the US DOE website (DOE).

The Wicked Problem

A recent study reviewed the progress of an energy bill in California which established an energy portfolio with an aggressive renewable energy generation target of 20 percent by 2017 (Horiuchi 432). The research investigates the results of the adoption of this act and examines the policy according to Rittel and Webber's wicked problem

model (Horiuchi 432). There are inherent conflicting interests of electric utilities and the agenda of those in favor of sustainability practices. This is a wicked problem. A wicked problem is defined to occur when each negotiating party attempts to create a solution to a problem creates one or more additional factors which further complicate the original problem (Horiuchi 442). In other words, the traditional method of problem solving in a linear fashion does not work in the case of a wicked problem. A large technical entity such as an electric utility has a high level of interdependency factors. If one component of the system is altered, then various other elements will also change relative to the initial modification; complicating the solution to the problem further and making the development and diffusion of renewable technologies a wicked problem for electric utilities. Markand and Truffer describe the supply chain of an electric utility as having six main objectives: the collection of energy producing resources, their transportation, their conversion into electricity, the transmission of electricity through the power grid, marketing, and the trading of electricity between utilities to handle peak usage times (Markand and Truffer 612). The elements of the electricity supply system are interrelated on several different planes.

They are interdependent in three ways:

- ***Technologically*** (the production process and the energy grid are adapted to each other)
- ***Contractually*** (contracts exist between firms and mandating delivery of a certain amount of energy to designated areas at certain times)

- ***Physically*** (due to the diversion of energy loads during peak energy usage times, all connecting transmission systems must operate properly and seamlessly) (Markand and Truffer 216).

To gauge the impact of the proposed energy plan on electric utilities in South Mississippi, research was conducted on how other scholars have measured similar impacts of energy policy upon electric utilities or similar entities in other countries and states. One study on an electricity producer in Canada used sustainable development indicators to track its own impact on the environment and to determine its level of social corporate responsibility to appease the preferences of its customer (Searcy, McCartney, and Karapetrovic135). Social corporate responsibility is an important factor when trying to understand what motivates the inner controls of an electric utility because it affects the reputation element. To remain in favor with their customers, all firms must maintain a certain level of corporate social responsibility in order to obtain public support and approval.

There is significant debate over how the United States should approach the task of updating the energy grid to keep up with ever increasing consumer demand. Some scholars believe government; more specifically FERC (the U.S. Federal Regulatory Commission) should oversee all energy grid infrastructure in order to eliminate the problems inherent in private ownership of the transmission system. One problem with federal management is that state regulatory commissions decide how much return on equity (ROE) a utility will make by setting the rate orders for consumers. If ROE is not sufficient to turn a profit, utilities simply will not build more transmission lines. Another issue involves all of the red tape is to even start an energy grid project. They must

complete rigorous state regulatory review processes, be approved by local governments, as well as in some cases federal and even tribal courts.

The various percentages of electricity that come from conventional and renewable means to make up the entire amount of generation is called an **energy portfolio**. Some studies have tried to assess the effects of state legislation mandating utilities to produce a certain percentage of electricity from renewable sources. In one such policy study, Pearson's coefficient was used to determine the correlation or relationship between independent variables such as renewable energy potential, the strength of electric utilities, public opinion liberalism, and the dependent variables of special interest environmental groups and the control variable the relative wealth of states or their Gross State Product (GSP) (Ciocirlan 548). The results reveal that Mississippi, along with four other southern states, is least likely to employ economic incentives in the area of climate change due to the state's low GSP. Not only is Mississippi slow to adopt climate change policies, but it is one of the five slowest states in the nation to introduce any kind of energy portfolio protocol.

One energy policy analysis of Swedish municipalities used in-depth interviews of managers of an energy utility as one of its primary independent variables. In Sweden, the energy industry is fully deregulated and all electric utilities are owned by the individual municipalities (Palm 448). In 1977, the Swedish government passed a law mandating all municipalities, "promote a reliable energy supply, stimulate energy conservation and develop an energy plan." (Palm 450). Even though it was the responsibility of the municipalities to accomplish these duties, the task was left up to the electric utilities. The cited reason for this transfer of power back into the hands of private enterprise is based

on the notion that their technical competence and ability to gather basic data not readily available to politicians or the general public. It was established that the power companies are subject to terms of the regulatory body of the municipality council, which could be compared to the Public Service Commission in Mississippi and that it was in the best interest of the company management to mobilize support from the municipal court (Palm 452). Therefore, it is reasonable to infer that utilities in Mississippi also mobilize support for their interests in the state legislature which governs the Public Service Commission which, in turn, reviews electricity rate orders and decides the terms and conditions of these service contracts.

Part III: Overview of Survey Participant Corporation

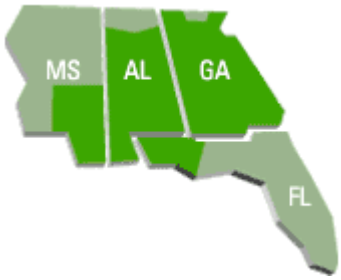
Mississippi Power

Mississippi Power is a subsidiary that is owned by a parent company, Southern Company, which has its corporate headquarters in Atlanta, Georgia. Unless otherwise noted, all statistical and informational data comes from either the Southern Company 2009 Annual Report, or the Southern Company Official Website. Southern Company is the second largest electric utility in the United States and the largest in the Sunbelt. The corporation serves over 4.4 million customers in the southeastern United States and has over 42,000 MGW of generating capacity. Southern Company and its subsidiaries are public utilities which generate and sell electricity on the retail and wholesale market and are responsible for generating and transmitting power to residential, commercial, and industrial customers in Mississippi, Alabama, Georgia, and Florida. Southern Company currently sells wholesale electricity through its subsidiary, Southern Power, in Alabama, Florida, Georgia, North Carolina, and Texas. Southern Company is subject to the Federal Power Act, which mandates that the Federal Energy Regulatory Commission (FERC) must regulate the rate and financing of projects undertaken by Southern Company and its affiliates. The FERC serves as a watchdog for consumers against electric utilities which have rate order contracts with the federal government. The FERC enforces reliability standards, addresses certain obstacles encountered in the construction of transmission lines, and restricts manipulative energy trading practices between utilities. However, since the deregulation of the electricity industry in the 1990s, some electric cooperatives can produce smaller amounts of electricity and distribute that electricity based on drawn out service territories.

Service Area in Mississippi

Mississippi Power serves the southern region of Mississippi. The following map in Figure 3 depicts the territory of Southern Company in Mississippi.

Figure 3: Southern Company Service Territory



Source: Southerncompany.com

Renewable Energy Technology Projects

Southern Company has a variety of pilot projects based on renewable energy technologies research including an offshore wind farm off the coast of Georgia and has been granted regulatory approval to convert a coal plant in Georgia to a biomass wood waste plant. Construction is currently underway for a clean-coal technology plant in Kemper County Mississippi. The facility will have an Integrated Gasification Combined Cycle (IGCC) 582-MGW power plant which uses TRIG technology developed by Southern Company and is sometimes referred to as coal gasification. This is a process which breaks down coal into a synthesis gas; the impurities are removed from the gas which is then heated to generate electricity with lower emissions than traditional coal-fired power plants. The Kemper County plant will also use carbon capture and sequestration (storage) which is a new process developed at the National Carbon Center

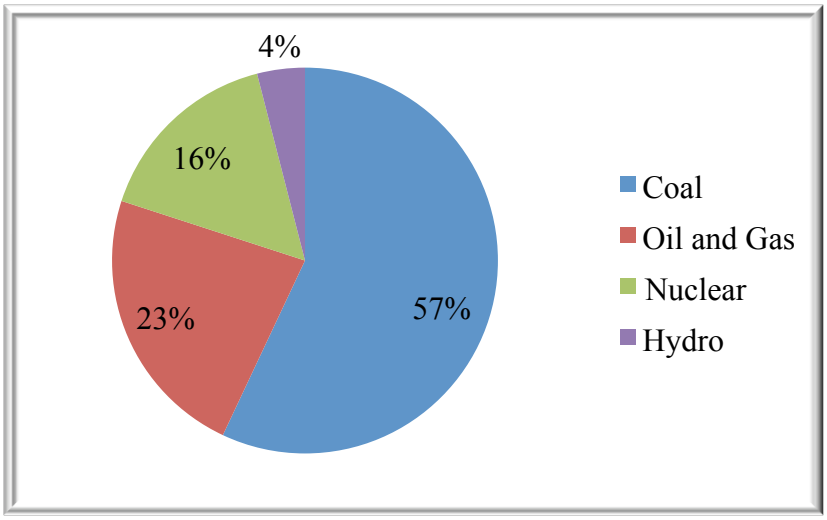
in collaboration with the Department of Energy. TRIG technology has been in the process of development for 15 years at the Power Systems Development Facility in Wilsonville, AL, which is another research center for the Department of Energy and Southern Company. The Kemper County power plant will capture 65 percent of the Carbon dioxide (CO2). The plant's fuel will be lignite, a natural resource which is very abundant in the state of Mississippi. Lignite is also much more affordable and less exposed to price variation than natural gas. To help offset the cost of capital for this project; Mississippi Power has received a $270 million grant from the DOE and $133 million in tax credits approved by the IRS. Mississippi Power has also petitioned the Mississippi Public Service Commission to authorize the Construction Work In Progress (CWIP) mechanism. CWIP will permit the collection of financing costs during the actual construction of the plant. If this petition is approved, customers will save $183 million in interest. This project also allows Mississippi Power the option to defer or possibly defer spending $1 billion at Plant Watson in Gulfport on environmental compliance with legislative mandates which would translate into substantial rate increase for customers. Mississippi Power has calculated that by 2014, it must secure a new energy source for its customers to accommodate predicted future demand for electricity.

Brian Henson, the executive director of the Kemper County Economic Development Authority stated, "It will have a huge impact, financially and job creation wise, not just for our county but for surrounding counties." Jeff Linder, a professor at Mississippi State University, notes that to reach a point when clean coal technology is successful and cost-effective, much research and development is still necessary, and that

the production cost of electricity itself can be affected by as much as 20 cents per kWh due to this need for additional investment.

In 2009, Southern Company sold 18 billion kWh of electricity. A kWh is the equivalent of burning a single 100-watt bulb for 10 hours. Eighty-two percent of this was retail power while the remaining eighteen percent was wholesale. A kWh is a measurement of energy which equals 1000 watt hours, it is most commonly known as a billing unit for customers. Southern Company's generation portfolio is mostly made up of coal, oil and gas, and nuclear generation technology as Figure 4 demonstrates:

Figure 4: Southern Company's Electricity Generation Portfolio



Source: SouthernCompany.com

Although Southern Company does have renewable energy initiatives and pilot programs, the current generation portfolio, as depicted in Figure 4, reveals Southern Company's lack of renewable energy production for its retail and wholesale operations.

Structure of Electricity Generation and Consumption

Consumer electricity rates are approved by the Public Service Commission which is in turn regulated by the Mississippi State Legislature. Mississippi's electric power production is relatively low and the state actually imports a significant amount of power from neighboring states to satisfy consumer demand (IEA 1). According to Southern Company CEO, Tom Fanning, Mississippi Power is currently exploring new options for diversifying its renewable portfolio including the adaptation of power plants with clean coal technology using state-of-the-art carbon sequestration methods developed by Southern Company and the DOE (Cuevas 1). It is most likely that Mississippi Power's management believes that carbon capture and storage has a very high potential in Mississippi. Plant Daniel in Escatawpa, Mississippi is currently experimenting with a Carbon-Capture Sequestration Technologies program (Cuevas 1). Coast Electric's CEO, Jim Compton, recently argued the same facts presented by the Energy Information Administration that Mississippi simply does not have the climate necessary to accommodate solar and wind power to keep up with consumer demand while keeping rates affordable (Compton 1).

Southern Company's Commitment to GHG Reductions

Energy Solutions

Energy Solutions is a program of Southern Company's which focuses on enhancing customer satisfaction by teaching consumers how to lower their utility bill by practicing energy efficiency measures. Smaller programs within this initiative include: Good Cents, which is an education-based energy efficiency program for customers;

Energy Services, which provides energy audits for industrial and commercial customers to make their facilities more efficient; and Heat Pump financing which assists residential customers in their purchasing of a high efficiency heat pumps.

Smart Grid

With an anticipated $165 million in federal stimulus funds to supplement their smart grid investments, Southern Company recently commenced their smart grid initiative in their four-state service area which includes deploying automated (smart) metering infrastructure and updating transmission lines.

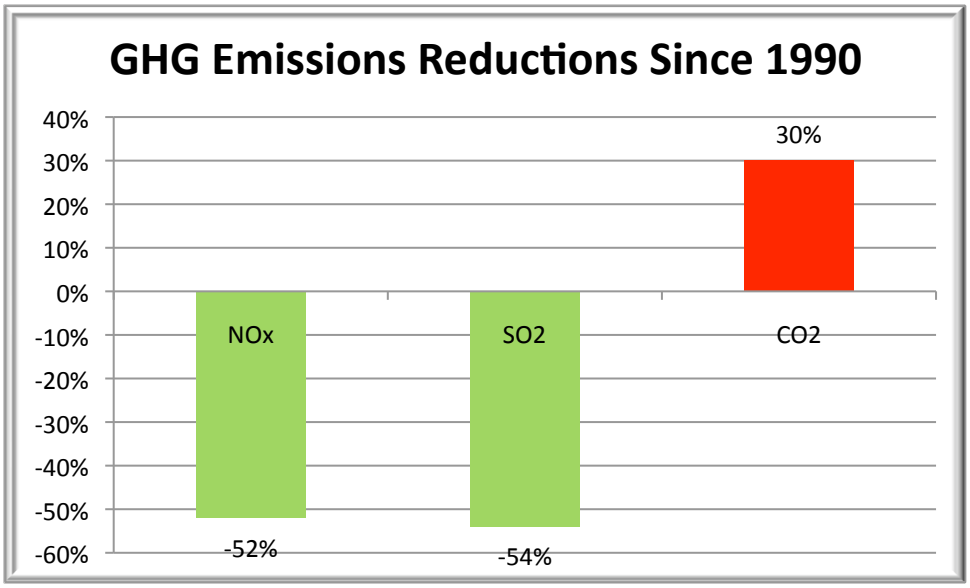
Solar Power Technology

In January of 2010, Southern Company entered into a strategic alliance with Ted Turner to pursue the development of cost effective solar power technologies. The partners will focus on investment and development of large-scale solar photovoltaic pilot projects in the Southwestern United States. Interestingly, Ted Turner owns the most property, over two million acres, of any individual land owner in North America.

Emissions Report Findings

According to a study conducted by Ceres in 2010, since 1990, power plant emissions of Sulfur-dioxide (SO_2) and Nitrogen-oxide (NOx) have decreased and CO_2 emissions have increased. SO_2 and NOx emissions from power plants have decreased since 1990 due in large part to emissions reductions programs instituted under the 1990 Clean Air Act Amendments. Figure 5 on the following page displays GHG emissions reductions as of 2008:

Figure 5: GHG Emissions Reductions Since 1990



Source: M. J. Bradley & Associates. (2010). *Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the United State*

Part IV: Methods

Research Question

Therefore, the research question is, "How do Mississippi Power utility experts assess the risk of climate change legislation and what is the feasibility of initiating renewable energy production in Mississippi?"

Survey Participants

It was determined that 10 experts would be an ideal number of participants. However, although 10 experts were targeted, only 5 responded to the survey. The survey participants specifically targeted were upper-level managers of the company, who had worked in the electricity industry for at least 10 years. The survey participants are also referred to as experts throughout this paper. Experts were interviewed from each of the following departments in an effort to reduce survey bias: Accounting, Legislative Affairs, Risk Management, Internal Auditing, and Compliance Management. Any more information about the survey respondents could be damaging to their anonymity. Since the survey included open-ended questions, survey participants were assured of their anonymity in order to ensure the most candid answers.

Administration of Questionnarie

The questionnaire was administered through email to each participant on April 25, 2011. Each survey respondent received the same questionnaire, which can be found in **Appendix A-1.1**. Participants were asked to return their answers to the researcher, by email, within two weeks (May 9, 2011). The survey used in this study was not intended

to contain leading questions in order to ensure the most thorough **qualitative** answers from survey respondents. The survey is also referred to as the "questionnaire" throughout this paper.

Purpose of Questionnaire

The questionnaire was written by the researcher under the guidance of the research advisor. The purpose the questionnaire was to assess the opinions of the experts on the driving forces that influence an electric utility to invest in renewable energy generation. The questionnaire was devised by examining the overall subject matter and the present industry concerns on a macro and micro-economic scale and organizing what the researcher considered to be the most relevant questions. The questionnaire aimed to identify the overall expert opinion on the perceived economic feasibility of compliance with federal renewable energy mandates. It also attempted to assess the opinions of respondents on the potential positive and or negative economic effects associated with investment in renewable energy generation. The questionnaire also attempted to assess how the experts perceive the overall market to react to federal electricity generation mandates.

Strengths and Weakness of Survey Method

Due to the emphasis placed on obtaining candid and objective responses regarding the questions included in the survey, an open-ended approach to forming the questions was selected. This approach was used in order to elicit the most relevant responses regarding the content of the answers to each question. An open-ended approach resulted in more detailed responses than closed-ended questions. Since the survey did not

ask only closed-ended question, the option for regression analysis is negated. This could be viewed as a weakness, however, given the fast-changing regulatory and industry environment of the issue examined; it was determined that qualitative information would be more relevant than quantitative information.

Part V: Results and Conclusion

All of the following information is either retrieved from respondent data or the previously cited body of this paper. Of the responses received, all respondents shall be kept confidential.

Question 1 Results: Addressing the Cost Competitivness of Clean Coal Technology

The first question reads, **"Does clean coal technology represent a cost effective means for generating the future energy needs of the Southeastern United States? Why or why not?"**

All of the survey respondents replied yes to this question. This is not surprising considering Southern Company has made a huge capital investment and research and development investment in clean coal technology. One example of this is the Kemper County plant in Mississippi. Responses cited the fact that the United States needs to develop clean coal technologies in order to best use our domestic resources to move our country closer to energy independence. Another interesting note stated that Southern Company has recently licensed its IGCC technology to a utility in China. The Kemper County IGCC Plant was also cited as Mississippi's and the Nation's key step towards this proposed energy independence.

Another carbon capture and storage facility was also cited, Plant Barry, in Bucks, Al, which is in the process of construction and became to be operational in June of 2011. This plant will be the largest carbon capture and storage facility in the world that is connected to a pulverized coal-fired generating plant. Southern Company estimates that starting this year, 150,000 tons of carbon dioxide will be captured annually for permanent

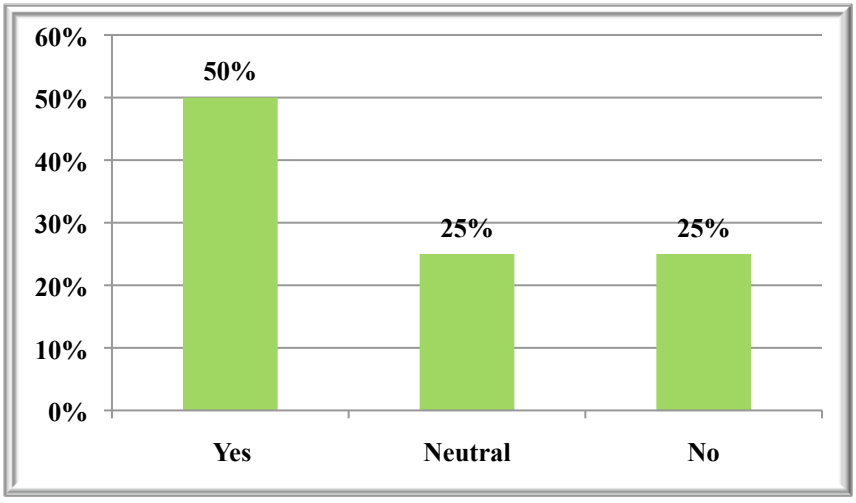
underground storage in deep saline reservoirs. This is the equivalent of 25 megawatts; to put into perspective, 1 megawatt can power 1000 homes per year.

Question 2 Results: Addressing the Viability of Biomass and Solar Power Generation in the Southeastern United States

The second question reads,

"Are biomass facilities and solar panels viable power generation options for the Southeastern United States? Why or why not?" This question elicited the following response as shown in Figure 6 below:

Figure 6: Reponses to Question 2



It is evident, that in the opinion of those surveyed that the only way to make biomass and solar power more cost competitive in the Southeast is to introduce more legislative investment incentives for the industry. One respondent argued that the sunlight we receive in the Southeast is diffused as a result of increased humidity, which reduces the efficiency of some photovoltaic technologies which therefore increases costs. Another respondent commented that,

> *"Given our ability to grow biomass in our environment, this seems to be the most prevalent renewable fuel source."*

Biomass plants are conveniently capable of using the current transmission grid because they essentially burn a renewable substance instead of coal to create a reliable baseload of electricity as opposed to solar and wind electricity generation; which is variable based on weather conditions. Overall, an attitude that an electricity generation portfolio composed of primarily coal, natural gas, nuclear, and hydro, along with incremental increases of renewable generation in the area of biomass seems to be the consensus. It is duly noted that both biomass and solar power have severe limitations for large scale power production compared to more traditional forms of generation.

Southern Company is currently constructing a 100-megawatt biomass plant, the Nacogdoches Generating Facility, in Sacul, Texas, that will be one of the largest biomass facilities in the United States. This plant will serve the city of Austin, Texas. In Georgia, Southern Company is also planning to convert a coal-fired power plant, Plant Mitchell, into a biomass plant pending on regulatory uncertainties. One respondent commented that:

> *"Southern Company operating subsidiaries are evaluating opportunities to convert existing fossil units to biomass over the next decade. Decisions on individual projects will depend on costs, regulatory/legislative requirements, biomass fuel availability and other site-specific factors."*

Southern Company is also currently conducting research at several plants on the most cost-effective feedstock to use in biomass generation including wood chips, wood pellets, sawdust, urban wood waste, peanut hulls, switch grass, as well as others.

Alabama Power has been co-firing biomass grass fuel materials with coal for nine years at Plant Gadsen, as well as co-milling wood in various forms (including wood chips and sawdust) for eight years. In addition, Southern Company has entered into a partnership with The Westervelt Company to provide 7.5 MW of renewable energy from wood byproducts in Alabama. Additionally, the Table 3 on the following page outlays the demonstration projects which are currently under way:

Table 3: Demonstration Projects Currently Under Construction

• **Alabama Power and the Electric Power Research Institute (EPRI) are conducting a demonstration of four different solar photovoltaic technologies with microinverters at the Alabama Power headquarters in Birmingham.**
• **Georgia Power and EPRI are conducting an 18-month study to evaluate how solar power systems may affect the utility's distribution system.**
• **Georgia Power is conducting a demonstration of seven different solar PV technologies at its headquarters building in Atlanta.**
• **Georgia Power has received regulatory approval to build a 1-MW portfolio of medium-scale solar demonstration projects across the state.**

<u>Question 3 Results:</u> Addressing EPA Rules

The third question in the survey addressed the recent EPA ruling on biomass generation and reads:

"Given the recent events with the EPA announcing that Biomass electricity is no longer considered a renewable form of energy, do you think that the Southeastern United States' Biomass Industry has a chance to develop? Why or why not?"

Responses all agreed that the current economic stimulus for the biomass electricity industry is not cost effective. Although government mandates have the potential to be cost effective; current legislation does not recognize biomass as a renewable form of energy. Therefore there is no opportunity for this industry to develop.

One respondent did point out that the EPA's regulation of GHG's, via the "Tailoring Rule," did not exclude biomass sources' carbon dioxide emissions from preconstruction PSD (prevention of significant deterioration) and title V permitting requirements. The EPA has recently released a plan to defer for three years the application of PSD and title V permitting requirements for carbon dioxide emissions from biomass sources. During this three year period, the EPA plans to create a rulemaking plan on how carbon dioxide emissions should be treated and accounted for in the Clean Air Act.

One respondent also stated that corporate research has indicated that an abundant supply of feedstock, typically within a 75-mile radius of potential biomass plant sites means that the use of woody stock as a fuel would not compete with enterprises, such as the furniture industry, that rely on commercial timber products

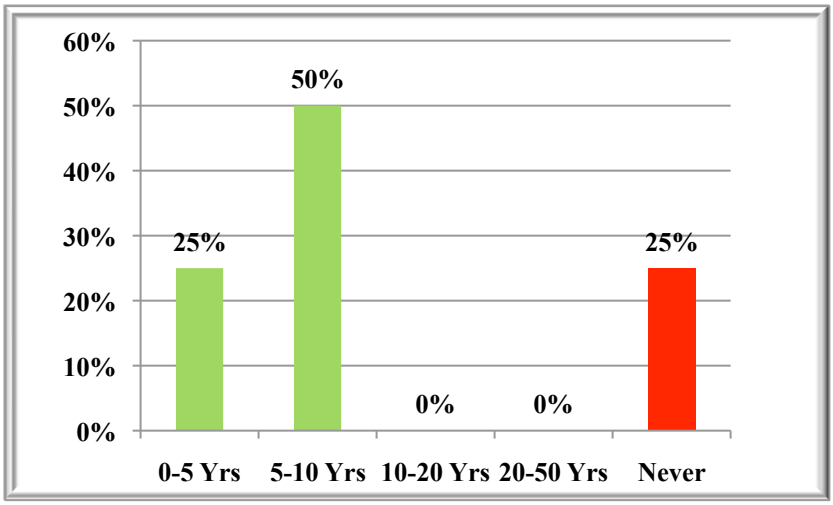
<u>Question 4 Results:</u> Addressing the potential Time Horizon for Renewable Energy Mandates to be Enacted

The fourth question reads:

> **"In which time frame do you feel that renewable energy mandates and/or emissions caps will be enacted?"**

Figure 6 on the following page displays the responses:

Figure 6: Responses to Question 4



These results are somewhat surprising when one considers that 75 percent of respondents believe renewable energy mandates or emissions caps will be enacted within the next 10 years. These respondents are employed at one of the most fiscally conservative electric utilities in the United States. If it is assumed that these experts are conservative, then one must conclude that the enactement of some federal reuglation of GHG emissions in the near future is quite eminent. It must also be noted, however, that these responses were made in the late spring of 2011, at which time the overall economic outlook of the United States was much positive than the present outlook.

<u>Question 5 Results:</u> Addressing the Likelihood of a Renewable Energy Mandate

Question five reads:

> **"How likely is the United States capable of producing at least 25% renewable energy by the year 2025?"**
>
> **a. Very unlikely**
> **b. Neutral**
> **c. Somewhat likely**
> **d. Very likely**

All respondents choose "*very unlikely*" for their answer. One respondent commented that,

> *"This depends on how one defines "renewable energy." Most conversations now are directed toward "clean energy," which would include nuclear, hydro and well-controlled coal in addition to wind, solar and biomass. With a broad definition and including existing clean resources it is possible that the nation could reach 25% by 2025. If one only counts wind, solar and biomass then it is <u>very unlikely</u> that a 25% level would be reached by 2025."*

<u>Question 6 Results:</u> Addressing the Likelihood of a Renewable Energy Mandate

Questions 6 reads:

> **"What level of monthly increase in energy cost do you feel a residential consumer can afford?"**
>
> **a. 0-15%**
>
> **b. 15-30%**
>
> **c. 30-45%**
>
> **d. 45-60%**

Responses highlighted that to ensure affordable generation, Southern Company uses a mix of fuels. The risk of price spikes in any one fuel can be hedged away by the use of alternate fuels. Contracts for baseload fuels also can be purchased in advance to avoid supply-constrained price spikes in spot markets. One respondent commented that,

> *"Energy companies should seek to hold down costs. Additionally, they should work with customers to educate them on all of the inputs and dynamics of energy production and associated costs such that they understand as prices increase over time."*

Another respondent argued basically the same message,

> *Southern Company does not have data to substantiate such tolerance. Rates are based on the cost of service and regulations. The company strives to keep operating costs low and works with regulatory agencies and legislative bodies to balance the cost of regulation – ensuring that the appropriate level of benefit is provided while not having a negative impact on rates. A Southern Company*

priority is providing high reliability at affordable prices with the goal of having very satisfied customers.

The other respondents refused to answer this question with one citing their reason as,

"For what??? Hard to answer unless I know for what."

It is evident that the question may not have been as straightforward as the author intended it to be. It was the author's intent to ask survey participants to make an educated guess as to what level of increase in residential electricity bills (using the most current residential energy bill as a base) residential customers would be able to afford. This question was intended to reveal which, if any percentage increase Southern Company utility managers anticipate would be economically feasible given that renewable energy generation would be more expensive in the current than coal-fired generation in the question of electricity production. In a future study, the researcher might word the question as:

"Please indicate below which level of monthly increase in energy cost you feel a residential consumer can afford, if their most recent bill were used as a base. (For example, if a residential bill was $100, a 0-15% increase would be anywhere from $100-$115)"

e. 0-15%

f. 15-30%

g. 30-45%

h. 45-60%

As evidenced in the results of this study, it is always extremely important remember that when giving issuing a questionnaire that targets qualitative information, the questions

must be straight-forward and easy to understand in order to ensure the highest quality answers from participants. It is also important to note that **Question 6** from the survey used in this study may have been seen by the survey participants as a leading question, which could have been why some respondents refused to answer it.

Conclusion

Based on the data collected from the interviews of Southern Company personnel, renewable energy generation, in particular biomass energy generation is not cost effective unless federal and/or state emissions mandates are introduced. This answer would be expected since renewable energy costs more money to produce per mega-watt hour than coal. (As evidenced in **Table 2: Estimated Levelized Cost of New Generation Resources** on page 37.)

Since Southern Company is a publicly traded corporation, its ultimate goal is to create shareholder wealth. To take on renewable energy generation projects without the real and present risk of government mandates would arguably be in conflict with this ultimate goal. However, the pilot projects which are currently under development within the corporation are helping to ensure that Southern Company will have sufficient types of energy generation options should a federal renewable energy production mandate be enacted in the future. It is logical to infer that it is Southern Company's objective to provide a balanced approach in the management of the business risks associated with the cost of service and environmental impacts.

Although 29 states have already enacted their own renewable energy mandates, there is still currently no federal mandate. According to the results of this study, it is very likely that a federal renewable energy standard/ and or emissions cap will be enacted

within the next decade. However, with the instability of the political climate, and the current economic recession, it is reasonable to forecast that GHG emissions regulation will not take a radical turn at any time in the near future, or at least until the economic horizon does not look so grim.

Recommendations for Further Research

To better understand the sentiments of all experts in Mississippi, a study could be conducted administering the survey from this study to employees of the other major electric utilities in the state, Entergy and TVA (Tennessee Valley Authority). Also, the survey could be administered to expert managers of electric cooperatives such as Singing River Electric. Research should be conducted to understand the underlying motivations of the experts while also recognizing any parallel views or contrasting opinions.

The State of Mississippi should commission a comprehensive economic analysis from a neutral third party to analyze the potential renewable energy opportunities available which includes estimates on job creation, resource sustainability (i.e. wood forests suitable to be harvested for biomass feedstock) and the potential for direct business investment.

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Appendix

Appendix A-1.1

Questionnaire

2. Does clean coal technology represent a cost effective means for generating the future energy needs of the Southeastern United States? Why or why not?

3. Are biomass facilities and solar panels viable power generation options for the Southeastern United States? Why or why not?

4. Given the recent events with the EPA announcing that Biomass electricity is no longer considered a renewable form of energy, do you think that the Southeastern United States' Biomass Industry has a chance to develop? Why or why not?

5. In which time frame do you feel that renewable energy mandates and/or emissions caps will be enacted?

   0-5 Years
   5-10 Years
   10-20 Years
   20-50 Years
   Never

6. How likely is the United States capable of producing at least 25% renewable energy by the year 2025?

   Very unlikely
   Neutral
   Somewhat likely
   Very Likely

7. What level of monthly increase in energy cost do you feel a residential consumer can afford?
    a. 0-15%
    b. 15-30%
    c. 30-45%
    d. 45-60%

Appendix A-1.2

Scale for Kilowatts and Megawatts	
Household	~10 kW
Community	~100kW
Industrial	~ variable

Glossary

Allowances/ Permits:

A credit issued by a government to specific business entities which allows those entities to produce a specific amount of GHG emissions

Bioenergy:

Renewable energy generated from biological sources.

Carbon Capture and Sequestration/ Storage (CCS), Carbon Sequestration Process:

The means of mitigating the GHG emissions created from fossil fuel fired power plants. It is based on capturing CO_2 from the plants and storing it in a way that it cannot enter the atmosphere.

Combustion of Biomass:

Burning of biological material in order to generate electricity.

Co-generators:

Machines used to simultaneously create power and useful heat.

Construction Work in Progress (CWIP):

A long-term asset account in which the costs of constructing long-term assets are recorded.

Disaggregation:

The breaking up of a total (integrated) parts.

Energy portfolio:

The various forms of generation that an entity uses to create electricity

Gasification:

A process that converts carbon materials such as coal, lignite, or biomass into carbon monoxide and hydrogen by reacting the raw material at high temperatures with a controlled amount of oxygen and/or steam.

Hectares:

Unit of area the metric system which is equal to 100 ares, 10,000 square meters, or 2.471acres.

Integrated Gasification Combined Cycle (IGCCC):

A technology which converts carbon materials into synthesis gas.

Levelization:

The present value of the total cost of building and operating a generating plant over its economic life converted into equal annual payments.

Retail Energy Market:

The market for the sale of electricity to consumers rather than to producers or intermediaries.

Smart Grid:

An energy transmission system which incorporates two-way digital communication to control appliances in consumers' homes.

Steam Rankine Cycle:

The thermodynamic cycle used to create electricity through a process of heat addition in a boiler at constant pressure, conversion of water into super-heated steam, the steam then passes through a turbine and moves it to create electricity.

Transported Integrated Gasification (TRIG) Technology:

A type of clean coal technology developed by Southern Company, in collaboration with KBR, which make the IGCCC process even more efficient in order to use low rank coals, such as lignite, to generate electricity.

Wholesale Energy Market:

A wholesale electricity market exists when competing generators offer their electricity output to retailers such as an electricity cooperative. The retailers then re-price the electricity and sell it to consumers.