Project Number: KJR-1100

Restructuring Massachusetts' Electric Industry

An Interactive Qualifying Project Report

submitted to the Faculty

of the

Worcester Polytechnic Institute

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

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Date: May 2, 2006

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Abstract

The controversy surrounding the newly deregulated electric industries across the United States has prompted us to review the restructuring in Massachusetts. This project includes an examination of the regulation and restructuring of this industry. Through research, interviews, and policy review, we have recognized the success of these efforts with regards to the elimination of monopolies and the development of renewable energy technologies; however, there is still much progress to be made.

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Introduction

Today, we live in a society that depends and relies on electricity. From day to day applications and activities to entertainment and enlightenment, civilization has come to need electricity. It is a commodity and resource that we could not do without. In Everything from storing food, to heating a house, to saving lives at a hospitals, electricity is everywhere and used on a non-stop basis. In fact, it is easy to say that, through technology, electricity has even become the driving force of advancement in our present day society.

Such an important resource is taken for granted. Since it has become so readily available and dependable, people forget the complex process that ends with the delivery of the precious commodity. In Massachusetts, as with the rest of the country, electricity was given the title of a utility. It was treated like many other utilities, and regulated by the government with a flat rate charged to the consumer. Before current technological advancements the electric industry was seemingly more complex. Since energy needed to be provided on a consistent basis, the only reliable and feasible market at the time became monopoly dominated. Monopolies offered security and an easily managed individual company commitment to the consumer and, to keep these monopolies from getting out of control, they were regulated by the government and served as utilities.

Today that is not the case. Around a third of the country has started or has considered deregulation. Looking at New England and focusing on Massachusetts, this project has researched the restructuring of the electric industry. Deregulation and restructuring has taken hold of the nation for many reasons. In theory, deregulation, or an opening up of the monopolies to the competitive market, would drive down prices. The principle of supply and demand was one driving force behind restructuring legislation. Restructuring was also put into effect to increase efficiency in the large process of generation and distribution of energy. Since monopoly powered utilities answered to no one besides the governmental regulators, rate increases were just a matter of convincing. Inefficiencies in the process from generating, to transmitting, to distributing, and including customer service were merely transferred to the consumer. It was hard to locate these inefficiencies and thus fix them. With a broken-up, restructured, and at some parts regulated industry, the only way for different companies to increase profit was to increase efficiency.

Another key component of restructuring was the need for new facilities offering cleaner technologies, and again higher efficiency. Legislation was put into effect to increase renewable energy and green power, while cutting back on the old, polluting generators. Many ideas such as the Massachusetts Renewable Energy Trust (MRET) and the Renewable Portfolio Standard (RPS) have been put into place to promote the use and implementation of renewable, non-polluting energy.

This project focuses on why restructuring occurred in Massachusetts and the benefits and repercussions of the massive change. It is apparent that deregulation and restructuring has benefited the industry, the consumer, and the environment.

In accomplishing this goal we interviewed experts in the electric industry, scrutinized data provided by bureaucratic organizations and departments, and researched various publications and legislative policies. Combining these sources, we will present a clear understanding of the industry and market, as well as the issues surrounding deregulation.

The Rise of a New Industry

Electricity is a phenomenon that was known to scientists for many hundreds of years, but it was an elusive enigma that no one knew exactly what it was or, more importantly, how it could be controlled to benefit society. Among the first to remove electricity from the theoretical realm into everyday life was a prominent resident of Philadelphia, Benjamin Franklin. Proving that lightning was nothing more then a giant electrical arc, he invented the first electrical product for use in private residences, and called it the lightning rod (Bellis). Slowly but surely the knowledge of electricity grew, and with it also came the ability to manipulate it.

In the late 1800s, shortly after the civil war, the northeastern United States was characterized by its centralized urban populations and manufacturing based economy. It was fertile territory for a pioneering electrical industry to grow and flourish. In 1878 an inventor by the name Charles Brush invented an arc lamp suitable for use in street illumination, which worked by creating a small electric arc between two slowly burning carbon posts (Thompson). This was the product that would give electric lighting companies the foothold necessary to challenge the long standing authority of the gas lighting companies.

The electric industry immediately ran into obstacles impeding its growth. To begin with, arc lamps are inherently noisy and give off smoke as the carbon posts burn. These characteristics made the lamps unsuitable for use in small poorly ventilated areas, which immediately removed the residential market. Another major obstruction was that the illumination of city streets was already contracted to gas companies. A market did develop for the electric industry, however, in the form of department stores looking for an impressive way to draw in more customers (Cruikshank).

It was clear that there was a demand for electricity, and there were two ways electric companies could be developed in order to meet it. First, due to the lack of any pre-existing infrastructure, department stores that wanted electric lighting would have to work from the ground up and become their own electric company. Salesmen from electric generator manufacturers adopted a door-to-door policy of assessing the demand for arc lighting. If, after perusing highly commercialized urban areas, they deemed there was sufficient demand for arc lighting and an available site nearby to house the generating equipment, the salesman would help the local businesses form into an electric company and pool their resources to buy the expensive generation equipment (Cruikshank). This system only worked, however, in big cities that had enough wealthy businessmen working in very close proximity to one another. Many communities chose a different path to creating an electric company, which was through municipal ownership. Realizing the potential electricity had to increase their standard of living, and lacking the presence of big businesses to front the start up capital, many small towns invested in building their own centralized municipal power plants, which were funded by the town's tax-payers. Some towns even went as far as to buy out the privately owned department store companies out of the fear of having private ownership of such a powerful new commodity (Cruikshank).

The next major advancement for the electric industry made electricity practical for everyone, even for people in residential communities. Thomas Edison's invention of the light bulb had all of the benefits of electric lighting with none of the drawbacks of arc lights or gas lamps. Instead of having an open spark and burning carbon, he ran current through a filament inside a vacuum, the filament would heat up and glow and it could not burn since there was no oxygen around it so there was no smoke given off (Thompson). Immediately the demand for electricity outside of major cities skyrocketed, as residential customers wanted to replace their indoor gas lamps with the cleaner and safer electric light bulb.

But Edison ran into a baffling dilemma in trying to provide power to these remote areas. The further the customer lived away from the generator the more electricity was lost en route due to resistance in the wires. This problem could only be solved by either making the wires much thicker, which was prohibited by the cost of copper, or to raise the voltage, which could only go so high before it was too dangerous. He decided that large centralized generating facilities were therefore too impractical, and decided to pursue building numerous small scale plants close to the consumers (Cruikshank). From a business standpoint Edison's strategy was doomed for failure. It is extremely inefficient to manage and operate the huge number of facilities necessary to make his plan work. It requires more employees, infrastructure, and maintenance than having one vast power plant capable of serving everyone.

While Edison was busy setting up his numerous small scale plants, another electrical pioneer by the name of George Westinghouse was thinking of a way to capitalize on the economies of scale made possible by large scale centralized power plants. His plan was centered on a new invention called alternating current, more commonly referred to as AC. Previously electric entrepreneurs had relied solely on direct current, similarly shortened to DC, which provides a constant and unwavering voltage. The advantage that Westinghouse saw in AC was that the voltage oscillated predictably between a positive and negative value, which meant, theoretically, the voltage could be "stepped-up" by increasing the amplitude of the current's waveform. After buying the patent for alternating current from its inventor Nikola Tesla, Westinghouse designed and patented the first electrical transformer, which was the device he would use to vary the voltage (George). Now, hypothetically, electricity leaving a power plant could have its voltage significantly increased, which would lower line losses, and, after traveling a majority of the distance to the customer, could then have its voltage decreased to a level that would be safe for use by consumers. This plan came to fruition when Westinghouse secured a bid to build a generating facility at Niagara Falls, which ultimately proved his theory by delivering power over 20 miles away to Buffalo, New York (Emergence).

Early Problems Facing the Electric Industry

The electric industry was now growing and expanding extremely rapidly as it frantically tried to keep pace with the ever-growing demand for electricity. The industry, however, did not grow systematically. It was thrown together haphazardly as anybody with enough start up capital, and a location for his equipment, tried to get in the game. This led to a wide variety of problems for power companies, electrical dependent industries, and consumers. The first and foremost problem was that different companies used different equipment, which led to different voltages and different frequencies. No one was working with any sense of a standard, precedent, or even a rule of thumb (Electric Power). This led to incompatibility between various companies, which caused headaches for towns and cities trying to keep the lights on. Also many industries, such as newspapers and manufacturing plants, had become extremely reliant on electricity to produce their products, because they had incorporated electric motors into their equipment to increase productivity. When the power was out, these companies stood to lose a lot of money. This left the entire electrical industry confused, disorganized, and hectic (Electric Power).

Nobody did more to reconcile the inconsistencies of the early electric industry than Samuel Insull. Getting his foot in the door as a personal secretary to Thomas Edison, Insull quickly learned the ins and outs of the industry from the ground up, and, due to his brilliant knack for business, shaped the electrical industry into the form it would follow for almost a century without being called into question. Insull was an economic genius who understood the importance of supply and demand side economics nearly fifty years before the terms were even coined (Platt).

First and foremost he realized the importance of demand side economics by introducing a concept called the load factor, which was simply "the ratio of the average daily or annual power use to the maximum load sustained during the same period" (Enron's). Insull knew that he had to have enough equipment on hand to handle the highest peak loads, but most of the time that equipment wasn't in use, therefore lowering the overall efficiency of the plant, the closer the load factor was to one the more money the company was making. Samuel Insull's second great achievement was balancing the load. At the time there was only a demand for electricity at night when the lights were on, which meant that power plants were operating less then half of the day. If Insull could find customers to use significant amounts of electricity during the day he could increase the customer base without increasing generating capacity. He accomplished this by convincing big manufacturing plants to stop producing their power on site, but rather to buy their power from him, effectively increasing the amount of electricity used during the day. He also starting offering variable power rates for on and off peak to encourage manufacturers to use more power during the day which, because of the low demand for power, was considered off peak (Enron's).

He also made great advancements in the realm of supply side economics. Realizing that there was a great economy of scale that could be obtained by merging electric companies together, he knew that bigger was always better. Electric companies had been vertically integrated from the start, but Insull started a massive campaign of horizontal integration by buying out as many electric utilities as possible. By 1907, Insull had already acquired twenty separate utilities and merged them all into one company he called "Commonwealth Edison," which was already widely recognized as "one of the most progressive and lowest cost utilities in the world" (Enron's). Due to his overwhelming success, Insull's business model became the standard for all electric utilities across the United States.

The "Natural Monopoly" Dilemma

This business model was not unique to the electric industry. Decades before electric utilities existed, the railroads already understood that they benefited from economies of scale. It is much cheaper to have one company maintaining one set of railroad tracks and fueling one set of engines, then to have multiple companies all operating and maintaining their own infrastructure. This led to a similar pattern of mergers and consolidations that would eventually be seen in the electric industry. By the time of the Progressive Era, many electric companies had already increased their efficiency through the means of horizontal and vertical integration. In order for a power company to maximize its efficiency it was deemed necessary for the company to be in control of every aspect from generation to billing to reduce redundancy and confusion. Also as some companies grew faster than others they were able to buy out many of their smaller competitors due to the free market. Because this pattern increased efficiency and lowered prices it was seen as the natural path for the industry to take, which made it a "natural monopoly" (Emergence). This put power companies in a very precarious situation, if they were going to stay in business they need to operate like a monopoly, but the government would never allow a single company unabated control over something so invaluable to peoples lives like electricity. Two options arose from this dilemma: municipal ownership or state regulation (Emergence). These patterns would also emerge in other industries such as water and telecommunications. It seemed that there were just some industries that forced their companies towards monopolies status, which means they are only cost efficient when controlled by just one company.

There are two basic concepts that are inherent in all natural monopolies. The first is that the company must benefit substantially from an economy of scale. This means that the per-unit cost of the company's product or service must decrease as output and production increase. Also, the company must require an enormous amount of infrastructure. So much infrastructure that the initial capital required to start a rival company would make their rates substantially higher, and therefore remove their ability to compete (Foldvary). It was clear that the electric industry fell easily into both categories. Two ways to deal with this dilemma were quickly brought to the table, either electric companies would have to be municipal and directly governed by the towns and cities they operated in, or, in order to remain a private company, there would have to be legislation passed governing their regulation by the state.

Municipal ownership seemed like a great solution at first, but time proved otherwise. The advantages were that all the money charged for electricity went right back to the town budget and could be used for public services. Also, because towns have no shareholders to appease, they could just charge enough to cover their operating costs. In an ideal world this would be the best solution but several factors arose that made this option seem less than desirable. One major problem was that since no one stood to profit from municipal power plants there was no interest in the maintenance or upgrading of equipment within the facility, which led to municipal plants quickly becoming less efficient and out-dated. Also the salaries offered by municipal power plants had to be low which discouraged hiring good and qualified staff members. Without the incentive of turning a profit there is no motivation to provide a quality service (Emergence). Also municipal companies meant that the power you are using is being generated in your own backyard, and many people did not want the eyesore of smokestacks deteriorating the beauty of their town.

State regulation seemed to be a happy medium between total private ownership and total municipal ownership. It allowed for a private company to take care of all the day to day operations involved with getting electricity to the public, while placing the control over pricing in the hands of the government. State governments could now come up with a standardized accounting procedure for the power company to follow, and then reserve the right to review all the financial information of the company. This transparency allowed the state to decide what a fair price for electricity would be, while company executives still had the freedom to protect the company's best interest by maintaining state of the art equipment and employing a competent staff (Emergence).

As early as 1898 many high ranking utility managers, including Samuel Insull spoke out in favor of government regulation. The government had previously met with very limited success in trying to regulate the railroads, and was very skeptical about its feasibility in working with the electric utilities. But, in 1905, the state of Wisconsin was the first to create a regulatory commission to oversee the monopoly control on railroads (Electric Reliability). This was accomplished by giving the newly created railroad commission the power to standardize the accounting procedures of the railroad companies, which enabled them to easily assess what would constitute the fairest rate. The legislation was so successful that two years later in 1907 the law was expanded to account for all utilities including electric companies. It did not take long for other states to follow suit, by 1914 forty-five states had passed some form of regulatory legislation over electric utilities (Electric Reliability). Electric utilities now had the freedom to monitor the health of their company by having quality maintenance schedules and also updating old generating equipment and power lines, while at the same time having their rates kept in check by governmental regulating committees to dispel public fear of monopoly control.

The Great Depression's Electrical Influence

The public mindset during the Progressive Era lifted electric utilities to a fruitful and lucrative level, but it was still a volatile and changing landscape. But this all changed on October 29th 1929 when the crash of the stock market sent the United States into The Great Depression (Nordeen). Electricity to this point had been viewed as a luxury commodity for wealthy businesses and manufacturers. But that's not how it was viewed through the eyes of one of the great visionaries of the twentieth century Franklin D. Roosevelt.

President Roosevelt knew early on that electricity was the way of the future and that it was foolhardy to leave something so valuable to the American people vulnerable to the rise and fall of the stock market. This is why the regulation of the electric industry was such a big part of his "New Deal" legislation. During his first one-hundred days in office, President Roosevelt started a massive campaign for domestic reform in order to help pull the country out of the depression. He strove to electrify the entire country by stretching the reach of the existing power grids to include rural communities (Sampling).

In order to accomplish this goal the government would have to create a radically new kind of organization which, in the words of President Roosevelt himself, would be "clothed with the power of government but possessed of the flexibility and initiative of a private enterprise" (From the New Deal). The answer came in the form of the Tennessee Valley Authority, or TVA, as it commonly referred to, which was created by act of Congress on May 18th 1933 (From the New Deal). The Tennessee Valley was chosen for the project because it was in desperate need of help. Encompassing parts of seven states, the Tennessee Valley consisted primarily of a fledgling agricultural and logging industry. The TVA was created to fulfill a multitude of public service and environmentally related tasks, which include flood control, forest fire prevention, replenishing forests, irrigating and fertilizing farmland, and creating a system of hydro-electric power production (From the New Deal). This was mainly accomplished by building a large number of dams in the Tennessee River to, not only provide power, but also to create much needed reservoirs to support the Tennessee Valley's large agricultural economy. The TVA not only helped to revive the Tennessee Valley's failing economy, but the electricity produced by the dams also attracted new industries, which in turn created much needed jobs during the depression. Due to the overwhelming success of the TVA, and with the Rural Electrification act of 1936, many other government sponsored electrification campaigns followed its example in providing power to rural parts of the country (From the New Deal).

The Introduction of Holding Companies

As hard as government officials and legislatures were pushing for state regulation of electric industries, the electric utilities had found a clever way to profit from it. Utilities were very pleased with doing business while being regulated. The legislation allowed them to pay for their company and still be guaranteed to turn a profit deemed fair and reasonable by the government, which is referred to as “cost-plus-return” pricing (Frate). Despite the fact that electric utilities are guaranteed to make money, this way of doing business soon presented a problem of its own. As a result of the Great Depression, the government was pushing for the expansion of the electrical grid, but in order to spread out into new service territories the electric utility would need to raise enormous amounts of capital to cover the cost of the infrastructure. In other industries this problem would be solved by trying to attract new investors who are hoping to be rewarded with large dividends. This is not possible in a regulated market with regulated returns because it causes their dividends to stay more or less constant, which is not appealing to investors looking to make money quickly. This problem was solved by creating holding companies.

A holding company is one that provides no service or product of any kind. Instead, it makes its money by buying enough stock in a company to have the controlling share, and then using the controlling vote to manipulate the company in the holding company’s own best interest in such a way that it can make the biggest dividend from its investments (Holding Company). The concept of holding companies existed for a long time prior to the advent of the electric industry, but electric utilities, with a guaranteed profit regulated by the government, provided a luxuriant landscape for the creation of these companies.

After electric utilities were regulated their stock was no longer as appealing to investors. Because their returns were regulating by the government, the utilities stock paid a virtually unwavering annual percentage rate, which is similar to investing in a high yield savings account. Although you are almost guaranteed to make money, you can not do it quickly, which lead these investments to be called "widow stocks," because they were only considered desirable to people living on a fixed income (Widow). They were good stocks to put money in for diversifying a portfolio, but no one would put a lot of money in at once. Through the power of holding companies however, this was all about to change.

Electric utilities were expanding fast, and in order to meet the demand they frequently needed to add generating capacity. If the utilities had to pay for these expenditures out of their own pockets, by the time the generator had produced enough power to pay for itself, they would already have had to expand capacity again; in essence they would constantly be trying to make their money back.

The companies that made the electric generators realized the predicament that the electric utilities were in, and recognized the financial potential that could be achieved by forming a holding company. Instead of selling an electric utility the generating equipment for cash, they, as an alternative, traded it to them in exchange for stock. This system allowed the electric utility to maintain its liquid assets, while allowing the holding company to acquire control over the utility (Emergence).

Holding companies helped to facilitate the expansion of the electric industry. Aside from allowing the electric utilities to increase the value of their physical assets without reducing the value of their liquid assets, the holding companies were able to provide services that the utility might not otherwise have been able to afford. One of these services was management. Because the holding companies controlled multiple small utilities, they were often able to consolidate them into one large utility so it is more easily manageable and less redundant. Another service they provided was engineering. The holding companies were born from the companies that manufactured electrical generation equipment, which gave them a superior ability to address concerns directly related to efficiency of the electrical equipment. Because of these increases in the efficiency of electric utilities, the transmission and distribution systems became more interconnected and service became more reliable (Emergence).

The Problem with Unregulated Holding Companies

Although initially beneficial, it did not take long for holding companies to start presenting problems of their own. Unlike the electric utilities themselves, the holding companies were not thoroughly regulated by the state. If a holding company controls utilities in multiple states, which many do, then it is exempt from investigations by state regulatory committees, and therefore free to conduct business anyway it sees fit. One major issue resulting from this regulatory loophole was that a holding company was able to jeopardize its investor's money in high-risk stocks, which hurt the electric utilities credit and would ultimately raise rates for consumers (Federal Statutory).

Holding companies also began charging utilities excessively high rates for their managerial and engineering services in order to intentionally raise customer's rates. By charging the utility more, they were forced to file with a regulatory committee for a rate increase. Once the rate increase is approved it is locked in until the utility asks for a reevaluation. The holding company would then lower the rates to the utility for their services, which effectively raised the utilities profits. The utilities stock would then yield a higher dividend which earned the holding company more money at the expense of the consumer (Federal Statutory).

Also, the term holding company could be used very loosely since all it had to do was control the securities of another company. This led to their being holding companies that owned other holding companies. This led to a pyramid structure that allowed the companies on top to control operating companies with relatively little investment (Federal Statutory). This structure, along with the rest of the United States economy, came crashing down with the fall of the stock market at the onset of the Great Depression. President Roosevelt had long been aware of the way holding companies were abusing their position in the industry, and added them to the his list for reform.

Reforming Holding Companies

This reform came in the form of the Public Utility Holding Company Act of 1935, more commonly referred to as PUHCA. The sole purpose of the act was to put a leash on the power held by holding companies by forcing them to follow procedures that would allow state governments to keep an eye on them. This first stipulation of the act regulated the cost at which a holding company can charge an operating company for services such as management and engineering. This prohibited holding companies from increasing their profit by forcing the utility to request a rate increase. The act goes on to prohibit holding companies from speculating in high risk investments with ratepayer's money. Prior to 1935 holding companies would invest wildly in the stock market because they did not face any consequences if they lost the money. This provision stopped holding companies from being able to negatively impact the electric utilities credit, which protected customers from paying unnecessary fees (Public Utility).

In order to enforce these rules legislatures made sure to add requisites and conditions for the formation of holding companies. The first was that the holding company must incorporate in the state in which the utility whose stock they hold operates in (Public Utility). This allowed the states to directly regulate holding companies without it becoming a federal matter by crossing over state lines. If a holding company did have to operate in multiple states (i.e. the operating companies service territory crosses state lines), then the act required such a company to register with the Securities and Exchange Commission, which is a federal investor protection agency. PUHCA also eliminated the possibility for the pyramid structure that had been at the heart of the financial abuses of holding companies. This was accomplished by limiting the structure to only two tiers, one holding company over one or more operating companies below it. This was chosen to retain the benefits holding companies had to offer while limiting their power (Public Utility).

The Emergence of the Modern Regulated Industry

The Federal Government had for a long time been interested in the production of electricity, mainly in the form of hydroelectric dams. The government realized that in order for the economy and military to keep pace with other powerful countries of the world that the United States had to stay on the forefront of electrical production. To oversee this initiative Congress, in 1920, created the Federal Power Commission, which is commonly shortened to FPC (*FERC*). This organization was originally overseen by a board consisting of three secretaries from the president's cabinet, namely the Secretary of War, Secretary of the Interior, and Secretary of Agriculture, but, due to a lack of a common focus between the three positions, they were replaced by a five member bipartisan committee. Although originally created to determine the most effective location for large scale hydroelectric dams, only fifteen years after its creation the FPC's role was expanded by the

Federal Power Act of 1935 into a regulatory commission for the sale and distribution of electricity and natural gas (*FERC*).

The structure of the electric industry stayed relatively constant for the next forty-five years. The majority of the country was now wired and electricity was commonplace. Most of the country was served by large private utility companies whose securities were owned and traded by a holding company; while a remaining few communities across the country still opted to produce their power municipally. Rates for electricity were determined on a rate-plus-cost basis by individual state regulatory commissions; unless the power traveled across state lines then it would be determined by the FPC. The utilities were happy because they were guaranteed to make money. The government was happy because the industry was finally under control and settled. Most importantly consumers, for the most part, were happy. With the low cost of fossil fuel, and the comfort of knowing that there were regulations in place to protect them, consumers were content to let the industry continue on operating like a monopoly.

Realizing Our Electrical Dependence

The "natural monopoly" system worked well through most of the 20th century. One company to generate, transmit, distribute, meter, and bill all the electricity in a predestinated service territory. But, starting in the 1970s, two major factors led people to question their views on the structure of the electrical industry. First being the 1973 OPEC oil embargo which made us realize how dependent we are on energy, and how we need to start taking steps to ensure to stability of the energy industry. The second factor was the northeast blackout, which made us realize how dependent on electricity we are. Realizing that a problem exists is the first step towards reforming it, and these two events brought electrical dependence to the forefront of everyone's mind.

By the mid 1900s the entire population of the United States had become dependent upon the use of petroleum in their everyday life. Burning petroleum was the primary method of heating homes, factories, and offices. It was also the preferred method for propelling motor vehicles, which kept the workforce, shipping industry, postal service, and military moving. And, most importantly, burning petroleum was the easiest way to produce electricity, which the United States had become equally dependent on (*Great Northeast*).

On November 9th 1965, the way the Northeastern United States viewed electricity would change forever. Blackouts had always been a nuisance in the electrical industry, but for the most part they were small and isolated incidents that could be fixed in no more then a few days. That was, of course, until a series of events triggered one of the largest blackouts in the history of the country. Somewhere between the Niagara Falls Hydroelectric Plant, a transmission relay stopped working properly, and because, at the time, the plant was operating at maximum capacity there was a massive amount of electricity that had to be rerouted. This led to a rise in the current being carried by the wires, which needs to be compensated for by increasing the voltage. Normally, in order to accomplish this, generating plants would begin operating at full capacity, but there was not enough extra generating capacity to properly increase the voltage. This left generators with no choice but to disconnect from the grid altogether. The consequences of this left all of New York, including New York City, and New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, and parts of Pennsylvania without power (Great Northeast).

This put the public in danger in many ways. It left people trapped in elevators, which had no other way of propelling themselves then by electric motors. Planes that had been in the air prior to the blackout had no lights to guide them to the runway, or any lights to see tall building in their path. On the ground, streetlights were out which caused major traffic problems for people trying to get home to be with their families. The sudden blackout also had to repercussions on the generating plants too. The turbines that were being used to provide power had been designed with lubrication pumps that used small electric motors. These motors would take their electricity from the power grid after the turbine produced it. When the power went off, however, these pumps could no longer lubricate the turbines that were still left spinning due to their massive flywheels (Great Northeast). This caused massive damage to the generating equipment, which added to the length of time before the power was able to come back on fully.

The Great Northeast Blackout of 1965 was the first time the people of New England were able to see just how dependent they had become on electricity. The event inspired massive reform in the structure of the power grid. New regulations were put in place to make sure that if a piece of the grid fails that only a small area would be affected, and the domino effects of failing power stations would be a thing of the past (Great Northeast).

Another time when America's energy dependence was brought into full view was the OPEC oil embargo in the mid-1970s. In the time after World War II, the United States experienced a time of wealth and prosperity. Soldiers returning home from the war were eager to settle down and start a family. This trend led to a baby boom that last twenty years from the mid-forties to mid-sixties (Oil Crisis). During this time the United States economy was flourishing. With an abundance of cheap petroleum, people began taking electricity for granted. No one really thought about how or where their power came from, they just trusted that when the flipped a switch their lights would turn on.

This mindset was about to abruptly change on October 17th 1973, when the Organization of Petroleum Exporting Countries started an oil embargo against all of Israel's allies, which includes the United States (Oil Crisis). Because of the sharp drop in the supply of oil, the cost for crude oil skyrocketed in order to reduce the demand. For the first time in a long time the American people were forced to experience life without an abundance of energy. People began to realize that energy was more complicated then flipping a switch and steps needed to be taken in order to protect such a valuable commodity.

The Seeds of Deregulation

The first step, after nearly one hundred years of monopolized utility control of the electric industry, occurred in 1992 when the United States Government passed the National Energy Policy Act (EPACT), which dramatically affected the status quo of the entire industry (Energy Policy). This act effectively tore down barriers and laid the foundation for a deregulated wholesale electric generation market. The act forced the Federal Energy Regulatory Committee (FERC) to open transmission lines to wholesale energy producers. The "freeing of the wires," as it is commonly referred to, was the crucial step that enabled privately funded generating plants to produce electricity without any affiliation to a major utility. The act itself does not actually order any changes, but instead provides the tools necessary for individual states to restructure their electric industries as they see fit (Energy Policy).

Five years after the inception of EPACT, the state of Massachusetts passed its own legislation in the form of Chapter 164 of the Acts of 1997, otherwise known as the Electric Restructuring Act (Electricity). The act primarily outlined two main objectives. The first intention of the act was to drive a wedge in the monopoly status of the utilities by adding more players to the game to encourage competition. The acts second ambition was to put in place a system of goals, incentives, and deadlines to encourage the progressive development of green and renewable energy sources throughout the state (Electricity).

The first aim of the act was to make a division in the vertical integration of the electric utilities. The split was to be made between the generation and transmission phases of the overall electricity distribution process. This meant that "Utilities" would now be known as "Distribution Companies," and would ultimately sell off one-hundred percent of their electric generation capacity. This left the distribution companies with the responsibility of maintaining all the transmission and distribution wires as well as metering, billing, and attending to customer relations. Now instead of producing their own power at their own costs, they now were faced with the task of purchasing the power at the lowest possible cost (Roughan).

Once the utilities were split, a new faction of the electric industry emerged. The new owners of the power plants would form the division of the electric industry called "Generators," which, although privately owned, may still be affiliated with a particular Distributor. The only responsibility of generators is to produce power as cheaply as possible, and negotiate a fair price to sell it for. The basic reasoning behind this structure is that if you have many generators trying to sell to a select few distributors, then they will constantly try to underbid each other for contracts, which ultimately guarantees the end customer the best price (Roughan).

Having a split between Generation and Distribution lowers the retail price of electricity. There is an inherent cost involved in producing electricity. Every kilowatt-hour produced requires generators to charge certain amount to cover the cost of overhead which consists of the cost of fuel, maintenance, and etcetera. When added to their mark-up to turn a profit, this is what constitutes the "wholesale price," which is absolute minimum price the power must be sold for the generator to stay in business. The "retail price" is how much the consumer ultimately pays for the power. The retail price minus the wholesale price equals the profit. With more generators then there are distributors that are all trying to sell their power (Frate). This competitive drive is what guarantees the lowest possible retail price, which means, in theory; end-users should be getting the absolute lowest cost for their electricity.

The second objective of the Electric Restructuring Act of 1997 was to boost the green power and renewable energy agenda in Massachusetts. The act includes provisions for a Renewable Energy Trust Fund, which establishes a charge per kilowatt hour, "to support the development and promotion of renewable energy projects (Legislation)." The act also establishes the Renewable Energy Initiative Advisory Board, to be comprised of fifteen members who are in some way affiliated with the renewable energy movement in the state, who are in charge of the renewable energy trust fund (Legislation).

Having provisions in the act for the establishment of renewable energy sources helps protect the future of the energy market. There is a fixed volume of crude oil contained within the earth, and although estimates for exactly how much vary greatly one thing is for certain; it is running out. At the present time electricity created from fossil fuels is significantly cheaper then electricity produced from renewable sources. From an economic standpoint it makes no sense to be spending so much money to integrate these renewable sources into an energy portfolio, and then have customers pay higher rates to cover these costs. But, having the foresight to pay a little more now, we will be better protected against the inevitable fall of the world oil market.

History of Regulation

The goal of regulation for the electric industry was to provide reliable power at constant frequency and voltage. Lives depend on the constant availability of energy and our market system and industrial sectors crave uninterrupted access to full power. The Internet could not exist without a steady stream of electrons to our computers. The vast office buildings in our cities would be crippled, if electric powered elevators intermittently stopped mid-transit. Street lights and traffic signals everywhere would be undependable.

Regulation gave many different groups a voice in the affairs of the power companies. The reliability of the power industry was made a primary goal, but the New York Blackout of 1965 scared many people and regulators went to great lengths to make sure that it couldn't happen again (VanDoren, pg4). This left a tangled web of interconnecting power lines criss-crossing the region. The oil shortages in the '70s led to many agencies and think tanks predicting that the cost of all fossil fuels would continue increasing. To guard against this, the utilities signed many long term contracts with alternative power producers. When oil was over $90 a barrel (in 2005 dollars) (International and Regional Environment) after the energy crisis in the 1970's and early 80's and was expected to rise, this seemed a sensible thing to do. The forward looking environmentalists approved of these contracts. The advent of commercial nuclear power seemed to herald a new age of power generation and consumption, a goal every legislator touted to draw votes (Strauss).

For the most part, the utilities have guaranteed reliability. Blackouts are nearly exclusively in the realm of stormy weather and brownouts only occur when generation capacity is too low, and that situation is rare. The energy crisis of the '70s ended and was not seen again for over 30 years. Nuclear power is responsible for roughly 13% of the power generated in Massachusetts (DOE).

The regulatory environment also had pitfalls. While the utilities were under regulation they made some very poor business decisions. Although nuclear power showed great promise, the price of construction and the unforeseen increase in maintenance and operating costs due to safety and environmental concerns ultimately made them financially unsound. The interconnected networks of transmission and distribution lines, while aiding in reliability, actually promoted weakening of the lines, when utilities relied upon that interconnectivity to delay costly repairs and investment in interconnectivity beyond what the law required. This led to the present situation where capacity on lines is limiting the flow of energy (U.S. Electric Power Grid). Because the price of oil did not rise after the energy crisis, instead it fell significantly, the alternative generators, such as solar and wind, never were able to produce enough reliable power to positively affect the costs of generation. Instead, the contracts the utilities signed locked them into paying high costs for no real benefit for very long periods of time. New technologies, which were different from the old standard school of thought that said that "bigger is better," were neglected. This includes gas-turbine technology and co-generation. Whereas coal-fired plants are often made to consume as much coal as the trains can carry for efficiency, gas plants are nearly equally efficient as small as practicality will allow. Co-generation, the process of generating electricity and using the waste gasses to provide heat, greatly increases the energy efficiency and encourages small scale generation because "waste" heat can not be moved very far. Due to the regulatory environment's guarantee of profitability an investment in utility stocks has been virtually risk-free. Utility stocks have also posted substantial gains; much higher than other risk-free investment types (VanDoren pg 11).

One group of individuals who became very influential in the decision making processes is the environmentalist group. Power generation is one of the dirtiest industrial activities simply because of the shear volume of material that is consumed in the operation of the turbines. Acid rain, mercury poisoning, and global warming are all media buzz words for environmental impact. This impact has one chief source, the power industry. Many of the larger facilities were constructed before modern environmental understanding was common. These older plants almost entirely lacked the air and water purification technologies demanded by today's lawmakers and environmentalists. Because the government demanded that the utilities use the cheapest equipment, the expensive additions needed to bring the plants up to modern code fell by the wayside in favor of cheaper power (Stier). "Clean" technologies such as "clean coal" were debuted at higher costs than it cost to improve existing generators to the current levels of regulation even though the "clean" alternatives provided substantial environmental improvements.

With deregulation making the market more volatile, the times have changed. Strict rules regarding pollution can be instated and enforced and compliance will affect the value of the company. With additional generators providing power, fines can cripple power generators while not affecting the reliability of the whole system substantially. Competition can move the industry to a healthy market economy with many suppliers for each consumer, which ultimately benefits the consumer's costs. New construction can begin on ways to increase capacity and maintenance of the grid becomes a priority because if a generator sells more power than it makes and therefore can not make good on its commitment, consumers can choose a different provider. Of course all this consumer benefit comes at a cost. That cost is seen by the former utilities that saw the value of their company drop as competition increased and they were forced to sell assets.

In an enforced, regulatory environment the generators needed only to assure reliability then collect the profits that the government would allow. With competition threatening to lower the costs of generation and regulations forcing the sale of assets, the former utilities have stranded costs. Estimates of stranded costs range from $70 billion to $200 billion (VanDoren pg.9). The cost then becomes an issue that deregulators must contend with. Who pays for the decrease in net worth and decrease in future profits as a result of this new system?

Experts at the Cato Institute suggest that there are only three possible groups who can pay for the cost of deregulation. These groups are: the consumers, the companies, and the government. The companies argue that because the legislation is geared to provide the consumers the benefits, the consumers should foot the bill for any costs incurred by the generators, transmitters, and distributors. Peter VanDoren of the Cato Institute proposes that because the utilities are publicly traded and were aware that deregulation legislation could be passed that investors are responsible for putting their own interests into the state they want, in regard to risk and potential gain.

The question then becomes, do the costs of deregulation outweigh the benefits, or is a market with relaxed or eliminated government control a superior system?

The Divestiture of the Assets of the Electric Industry

As part of the reaction to the legislation passed in 1997 the Utilities began a very comprehensive program to divest themselves of their electricity generating resources. This meant, for the most part, that the utilities began placing the power generating assets up for sale.

The opening of the assets to private investment was a solution to the largest problem that the owners and operators of the utilities had with the restructuring program demanded by lawmakers. The value of the different portions of the companies was very difficult to calculate, and lawmakers would not agree to the compensation that the utilities wanted. The utilities were being forced to separate their assets into separate companies, either a Distributor/Transmitter, Generator, or Competitive Supplier. The actual value of the property, capital equipment, and permits was new territory to all parties. The decision was made to allow the free market to determine these values through competitive bidding processes and the usual purchasing methods. This would allow new investors to place the value of the assets in their bids and the owners could then select the purchaser which offered the best compensation. Because this market was essentially "captive," because the assets were to be sold off in a set period of time, the utilities demanded compensation from the government to recoup the losses incurred by this inequality. The "Transition Charge" (see figure 1) on consumer bills reflects these losses and is typically less than the generation charges and the distribution charges. It is expected to decrease over time and eventually be removed as a charge to the consumer.

NATIONAL GRID
RATE: RESIDENTIAL REGULAR R-1

	PREVIOUS BALANCE			$	203.83
	PAYMENT – THANK YOU 10/24/03			$	-203.83
	BALANCE FORWARD				.00
DELIVERY SERVICES:					
CUSTOMER CHG			5.81		
DISTRIBUTION CHG	.02398 X	1282 KWH=	30.74		
TRANSITION CHG	.01002 X	1282 KWH=	12.85		
TRANSMISSION CHG	.00660 X	1282 KWH=	8.46		
ENERGY CONSERVATION	.00250 X	1282 KWH=	3.21		
RENEWABLE ENERGY CHG	.00050 X	1282 KWH=	.64		
TOTAL DELIVERY SERVICES				$	61.71
SUPPLIER SERVICES:					
GENERATION CHARGE					
BASIC SERVICE -FIXED	.07093 X	1282 KWH=		$	90.93
TOTAL COST OF ELECTRICITY				$	90.93
TOTAL CURRENT BALANCE				$	152.64
ACCOUNT BALANCE				$	152.64

Figure 1. A sample bill with Transition charge highlighted

The actual sale of the resources took place primarily over the course of three years (DOE). If we are to consider each year to be a particular "step" in the sale of the assets we can say that the steps are as follows: a First Step, a Major Step, and a Minor Step.

It is important to note that even before 1990 that a small portion of the electric power generated in Massachusetts was produced by independent generators other than the Utilities. This reflects the power placed on the grid according to PURPA which allowed any non-utility entity who was able to produce more than he consumed to sell the excess back to the grid. The major fuel source for independently produced electricity before 1997 was natural gas. Also, renewable power other than hydroelectric has always been the exclusive domain of the independent producer. The Massachusetts utilities produced zero megawatt hours of renewable power other than hydroelectric according to the Department of Energy (DOE). Electricity generated from cogeneration installations has accounted for between 13% and 20% of the electricity since 1992 and has shown no particular trends other than a sharp increase from 8% in 1991.

The First Step in the process occurred during 1997 and saw approximately 20% of the generated electricity switch over to independent generators. This comprised nearly three million megawatt hours of coal generated electricity, over four million megawatt hours of petroleum generated electricity, and over three million megawatt hours of natural gas generated electricity (DOE). This is a fairly even split of the three categories of fossil fuel fired generators. In 1998 coal fired plants produced 24.5% of electricity, petroleum produced 31.8% and natural gas produced 25.4%.

The Major Step was significantly more impressive as 71.5% of the electricity produced during 1999 was produced by independent producers. This means that the sale of assets including all governmental approval was completed prior to 1999, or the change in percentage of electricity produced in 1999 compared to the previous year was 49.4%! Independent power producers using coal fired and petroleum fired facilities combined to equal over 20 million megawatt hours, which is up from seven million megawatt hours from the previous year. Natural gas fired resources showed very little change producing nearly the same amount of electricity as the year before, even though nearly 70% of the energy from this fuel source came from utility owned plants. One of the most important aspects of the Major Step in the transition from the utility system to independent producing system is that in 1999 approximately 2.6 million megawatt hours of electricity generated came from facilities that operated using nuclear sources of heat.

The Minor Step came in 2000 when 77.9% of the electricity produced in Massachusetts was produced by an independent generator. This is an improvement of 6.5% over the previous year's 71.5%. There was a slight shift in the independent generation of electricity; approximately two million megawatt hours less energy was produced using petroleum sources as the previous year while natural gas produced one million more megawatt hours than the previous year. The sale of the nuclear assets in Massachusetts was completed and independent power producers generated 5.5 million megawatt hours of electricity from nuclear sources. This represents 100% of the total pool of nuclear power generated in Massachusetts. Even though the nuclear facilities have been completely transferred to new ownership the utilities that operated them for years will be responsible for the decommissioning of the sites when they reach their maximum lifetime and their permits expire. These costs are quite extensive and remain with the companies who used the reactors for that long time. Because the utilities will have no control over the maintenance and operation of the sites after the sale, they have convinced the lawmakers to allow them to subsidize the costs incurred and never recovered. They have passed these costs onto the consumers as part of the "Transition Charge" (Roughan)

In the subsequent three years for which data are available, the percentage of power produced by independent sources has climbed, but only in smaller amounts (DOE). In 2002 only 2.75% of the electricity generated in Massachusetts was produced by utilities.

In the United States as a whole, deregulation of the electric industry has become a favorite topic of lawmakers. In 1990 barely more than 1% of the power was produced from independent sources while in 2002 nearly 25% came from the independent producers. The sale of assets which began in 1997 in Massachusetts began in 1998 for the nation as a whole. Over the course of the next four years; the percentages of power produced from independent sources has climbed, there was 2.5% in 1998, 5.4% in 1999, 12% in 2000, 21% in 2001, and 24.8% in 2002. The rate of change appears to have increased, hit a maximum, and begun decreasing much as it has in Massachusetts. The total amount of electricity generated in Massachusetts represents less than 1% of the total amount of electricity generated in the nation.

The question then becomes, "Why is it that 100% of the power does not come from independent sources?" It is clear from the report issued by the United States Department of Energy (DOE) that even seven years after divestiture began, a complete turnover has not been realized. To understand this phenomenon, the reason for the sale of assets must be recalled. The separation of the generation assets from the transmission and distribution assets was the government's goal. The sale of the generators was the method that the utilities choose to achieve this goal. The equitable distribution of return on investment was the primary stumbling block facing the legislators and the utilities. It was decided that the utilities could sell their assets to investors and the market would determine the value of the assets in the usual manner and when a fair offer was made that a sale could be completed. The physical plants of generation facilities are extremely expensive as can be expected of any extremely large industrial plant. These plants were constructed when the "bigger is better" modus operandi was the way of doing things. To give some scale to the size of these facilities imagine a furnace that consumes powdered coal at the fastest rate that the coal train cars can deliver it. These plants have multiple furnaces, and all the train receiving areas, coal holding hopers, boilers, steam towers, pumping stations, dynamos, transformers, and environmental purification systems needed to keep them operating at full capacity. Any company that purchased this would instantly purchase the operation, maintenance, and control costs to operate it or would be forced to shut down. This means that they immediately become the employer of a tremendous staff of technicians, engineers, custodians, security people, and administrative and management personnel. The transition of large amounts of assets and the change of employment of many individuals is a usual situation for companies that undertake mergers, but in this case it would be an outside investor with limited primary experience in the industry (because people from inside the industry are the ones selling) who would be assuming an unusually large number of employees and assets. This situation is compounded by the special nature of electricity generation. If a generator has even a momentary failure, the effects could be far reaching and might even destabilize the Northeast Grid in a manner similar to the blackout in 1965 and 2003 which were caused by a faulty relay and a computer glitch respectively (Software Bug Linked to Blackout, The Great Northeast Blackout of 1965).

The safe and effective transition of the over 80% of the generated electricity speaks to the integrity of the companies involved in the acquisitions. There was no disruption in service and no way to distinguish the pre-sale environment from the post-sale environment from a strictly commodity standpoint. The remaining power generation that is still unsold now presents only two possible causes. The first is that the regulatory bodies have restricted or otherwise prevented the sales of these assets to bidders. This position is untenable except in extreme circumstances. As it was the regulatory bodies which supported this transition in the first place, their restrictions now would seem counterproductive unless it was to serve some greater good. Examples of this would be the blocking of acquisitions to prevent monopolies and acquisitions which would be harmful to the competitive market. The only other reason for assets to remain unsold is the one in which the utilities are not receiving bids that they deem worthy for the equipment they would be transferring. An example of this case includes coal fired generation facilities whose age makes the cost of complying with environmental rules and the costs to maintain older equipment so high that it exceeds the revenue from continued operation. Another example would be a facility whose purchase required the taking of large loans and the sale of the assets in the modern day would not provide sufficient revenue to offset these costs plus a return on the investment. These two situations describe a situation that must be quite rare. It would be quite unusual for the owner of a facility to operate it at a loss unless it would be still more expensive to decommission it. With electricity this is especially true because the shut down of a plant for this reason might destabilize the whole grid.

It should not be surprising that environmental concerns were not a factor in the decisions to sell generators. The government has repeatedly supported claims against those who are responsible for environmental damage, even if that damage was not understood or known of at the time, are liable for the clean-up and subsequent civil action (Roughan). Therefore there would be nothing to be gained for a generator to sell, for its liability remains, and there would likewise be nothing to gain by holding on to a facility when a lucrative purchase offer came to the table.

During this time, changes were underway to satisfy the later requirements for renewable-resource-fueled electricity. The regulators included provisions to gradually decrease the percentage of electricity that came from the usual nuclear, natural gas, petroleum, and coal sources. The Department of Energy reports energy generation from the following sources: Coal, Petroleum, Natural Gas, Other Gases, Nuclear, Hydroelectric, Other Renewables, and Other. For an estimate of the renewably-generated electricity we will simply consider the Hydroelectric and Other Renewables categories as the "renewable" energy. The

Department of Energy's standards as to what qualifies as renewable is different from the Massachusetts standard and to be qualified under the statute, which mandates distributors provide a minimum percentage of electricity from renewable sources, requires special licensing. However, it serves to show the state of the industry and the relative trends in it. We see a periodic system with a time between peaks of five years in this data. It stands to reason that the market will continue to grow as the state requirements grow, and it also stands to reason that the federally accepted renewable resources would become licensed in Massachusetts to qualify under the program.

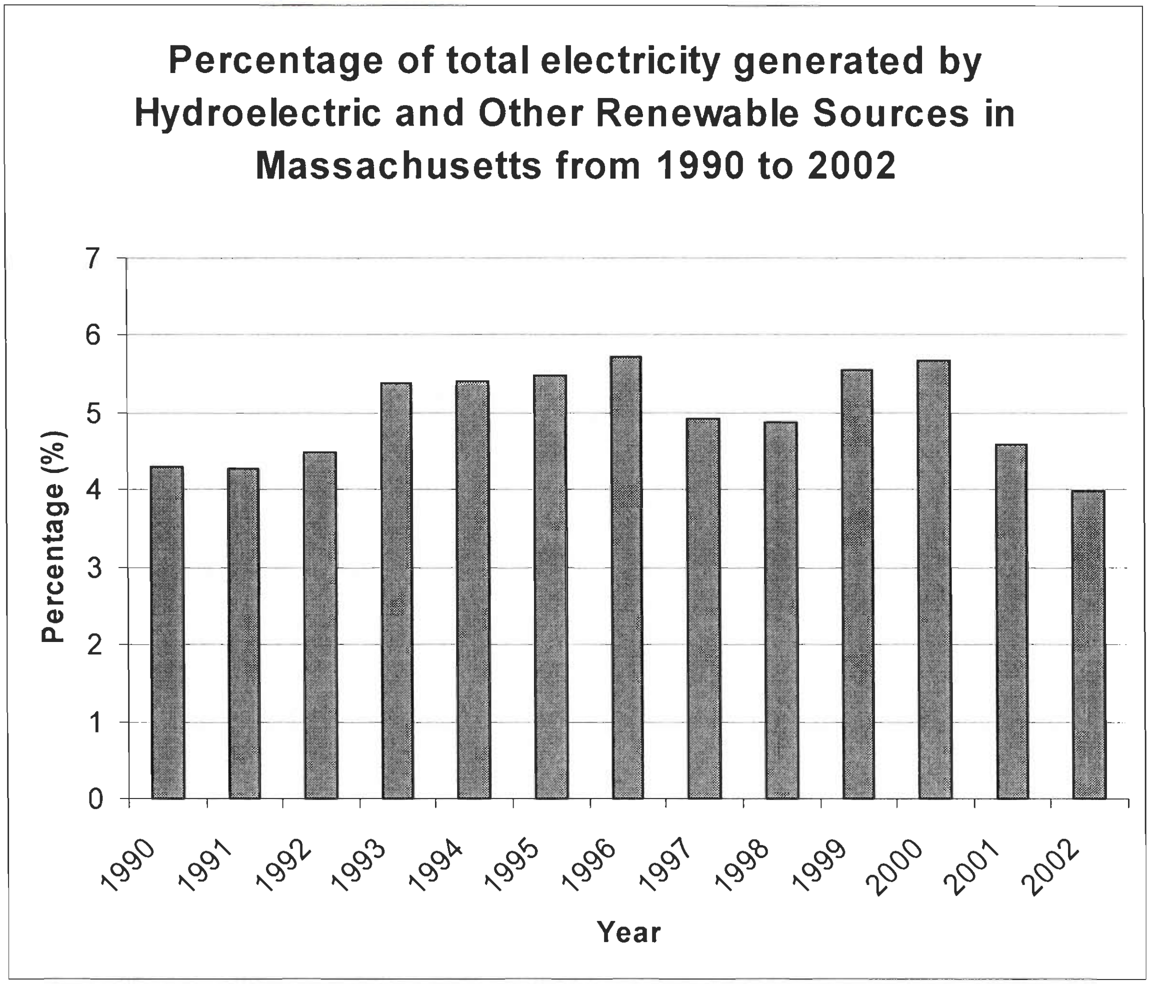


Figure 2. Percentage of Electricity from Renewable Sources
(DOE)

Deregulation Takes Effect

In January of 1997 it was finally decided by the Massachusetts Department of Telecommunications and Energy (Welcome) to open the electric industry to competition by March 1, 1998 (Carner). The decision, made official by legislature in November of 1997, was spawned from previous federal legislation promoting deregulation. This was done on the premise of driving down the prices of electricity by competing for consumers (Deregulation). In order to understand how the electric utilities were consequentially deregulated, one must first understand how they were structured in the first place.

The Electric Utility industry of Massachusetts was structured into components, companies, and regulations. The electric industry is composed of four different components; Generation, Transmission, Distribution, and Customer Services. Transmission is the delivery of electricity to substations in local areas. Distribution is the further delivery of electricity from the substations to homes and customer facilities. Customer Services is the monitoring, metering, billing, and information service that goes with sale of electricity. All of these components had changed little over the years until deregulation. Generation, however, has been the target of major deregulation campaigns. Generation, or the creation of electricity by power plants, has been 'unbundled' and separated from the other components since March 1, 1998 (Welcome). On this date rules were put into effect to outline progress in the upcoming years and the key steps involved in deregulation. In July of 2000, the DTE further considered deregulation of the Customer Services component (EIA). After studies were conducted, and evidence was gathered, it was voted to keep Customer Services 'bundled' by the Legislature on December 29, 2000 (Welcome).

When the deregulation took effect certain services were offered to consumers. In 1998 there was Standard Offer Service, Default Service, and Competitive Generation. Standard Offer Service was made as a generation service for the transition period. It was offered to those who did not choose a Competitive Supplier and was a regulated low electricity rate. This new Standard Offer Service was similar to way consumers previously paid, but by legislation and regulation it provided a 15% price reduction (Electric). The Standard Offer Service was a regulated transition for customers to become Default or Competitive in the future. If you moved during or after 1998, you were not eligible for Standard Offer Service, instead you had the option of Default or Competitive

Generation. Default Service was supplied to consumers by distribution companies, not generation companies, these rates were based on an average of the state's prices. Competitive Generation was an option given to consumers with deregulation. Here one could pick the company generating the power and negotiate a service contract that would set the rate and eventually type of electricity they wanted delivered to their homes. These retailers, whether brokers, competitive suppliers, or generators have to be licensed by the DTE (Welcome).

As of March 1, 2005, Standard Offer Service was eliminated transferring those customers into Basic Service, or what was formally known as Default Service (Nathan). As Standard Offer was eliminated another option for consumers was made. Now one could choose from Basic, Competitive Supplier, or Aggregator. An Aggregator could be a non-profit organization, local municipal or large group that one can join to purchase electricity on a wholesale level (Power). All of these services offer different rates and it is up to the consumer to research them.

Deregulation occurred in the United States and Massachusetts in hope of accomplishing many goals. Some of these goals are directly related to capitalism and the competitive market. One of the most important, was the vision of cheaper retail rates for consumers. In fact, large companies, like Raytheon, who were using huge amounts of electricity, decided they did not like the rates they were paying. Analyzing the industry they saw wholesale electricity to be a great deal cheaper than retail and threatened to leave the state unless something was done (Frate). This pressure, coupled with federal deregulation legislation, led to further thought among the regulators and legislators.

Other motives for deregulation were in the area of renewable energy. The theory was established that by opening up the monopoly of the utilities, a competitive market would drive down rates, not the part associated with cost to generate, but the margin between wholesale and retail (Frate). However, there were many other positives that would come out of deregulation. Previously the utilities' monopolies would perform the entire process of producing and delivering electricity. This led to a lump sum charge or overall rate, essentially taking the whole process and looking at it as one. As such, some inefficiencies or costs to the utilities were small in the overall picture, and consequentially ignored. And, if the utilities felt attention needed to be given, they would merely apply to the DTE for a rate adjustment.

So, costs and inefficiencies were either ignored or simply passed on to customers (Roughan). Restructuring and deregulation broke up the large utilities and continued to regulate Transmission and Distribution. As such, rates and therefore profits were fixed. The only way for both of these components to make more money was to become more efficient. Efficiency did not end with delivery. Restructuring also made generators become more efficient. Regulations, as well as the forced divulsion, made the old, environmentally unsound coal burning facilities a rare commodity. As time passed, cleaner and more efficient plants emerged. Everything was "More efficient now that the market was broken up" (Roughan). Today around 88% of New England's generation is unregulated, which is the most in the nation (About ISO-NE).

The newly deregulated industry in Massachusetts now consists of electricity brokers, distributors, transmitters, competitive suppliers, and generators. Different companies can be more than one of these, but only with certain approval and licensing. Brokers are companies that do not create the power, but sell it. They are essentially the middle man, setting up trades and contracts between generators and the consumers. They make business by commission. Brokers and competitive suppliers need to be licensed and are found on the DTE's and distributors' websites. Distributors own the distribution lines and make up that component of the electricity industry. In Massachusetts there are only four different distributors; Fitchburg Gas and Electric Light Company (now Unitil), Massachusetts Electric Company/Nantucket Electric Company (now National Grid), NSTAR Electric, and Western Massachusetts Electric Company (Power). These distributors have a certain service territory where they can provide distribution (Service). In order for a competitive supplier to be used in Massachusetts, the consumer must first make sure that their service territory distributor is marketing alongside that particular generator (Welcome, Service). There are many competitive suppliers and electric brokers. Some occupy one service territory in Massachusetts while others occupy all.

Deregulation and legislation also forced the utilities to sell a huge portion of their assets, mostly generation facilities. Utilities also consolidated distribution and transmission facilities. This change resulted in a huge number of large business transactions, companies buying and selling each other out. Between 1992 and 1999 Massachusetts Electric Company owned by New England Electric Systems changed hands with mergers three times.

One detailed graph outlining the movement and pending mergers in this time is shown below.

Merger Status	Company 1	Company 2	Name of Surviving Company or Name of New Company	States Served	Combined Assets (Year-of-Merger Dollars in Billions)	Comments/Status
Pending	**Consolidated Edison, Inc.** (a holding company for Consolidated Edison Co. of New York, Inc., and Orange and Rockland Utilities)	**Northeast Utilities** (a holding company for Connecticut Light & Power, Public Service Co. of New Hampshire, and Western Massachusetts Electric Co.)	**Consolidated Edison, Inc.** (Northeast Utilities will be a subsidiary)	NY, CT, MA, NH	Consolidated Edison: $14.4 Northeast: $10.4 Total: $24.8	Merger was announced October 13, 1998.
Pending	**BCE Energy** (a holding company for Boston Edison)	**Commonwealth Energy** (a holding company for Cambridge Electric Light Co., Canal Electric Co., and Commonwealth Electric Co.)	**NSTAR** (a new holding company; Boston Edison and Commonwealth Energy will be subsidiaries)	MA	BCE: $3.2 Commonwealth: $1.5 Total: $4.7	Under regulatory review.
Pending	**National Grid Group PLC** (a foreign company)	**New England Electric Systems (NEES)** (a registered holding company for Granite State Electric Co., Massachusetts Electric Co., Narragansett Electric Co., and New England Power Co.)	**National Grid Group** (NEES will be a wholly-owned subsidiary)	VT, NH MA	Not available because National Grid Group is a foreign company.	Pending regulatory approval.
Pending	**New England Electric System** (a registered holding company for Granite State Electric Co., Massachusetts Electric Co., Narragansett Electric Co., and New England Power Co.)	**Eastern Utility Associates** (a registered holding company for Blackstone Valley Electric Co., Newport Electric Corp., Eastern Edison Co., EUA, and Ocean State Corp.)	**New England Electric System** (EUA will be a wholly-owned subsidiary)	MA, RI VT, NH	NEES: $5.3 EUA: $1.3 Total: $6.6	EUA shareholders approved merger; pending regulatory review; expected to be completed in early 2000.
Pending	**Energy East** (a holding company for New York Electric & Gas)	**CMP Group** (a holding company for Central Maine Power)	**Energy East** (CMP Group will be a wholly-owned subsidiary)	MA, ME NY, NH	Energy East: $4.9 CMP Group: $2.3 Total: $7.2	This merger was announced on June 15, 1999.
Completed in 1996	**New England Electric Systems** (a registered holding company for Granite State Electric Co., Massachusetts Electric Co., Narragansett Electric Co., and New England Power Co.)	**Nantucket Electric** (a small electric distribution company)	**New England Electric System** (Nantucket Electric is a subsidiary)	VT, NH MA	NEES: $5.1 Nantucket: $0.1 Total: $5.2	Completed.
	Unitil Corp.	**Fitchburg Gas & Electric**	**Unitil Corp.**	NH	Total: $0.2	Completed.
	Northeast Utilities	**Public Service of New Hampshire**	**Northeast Utilities**	NH, CT, MA	Total: $10.6	Completed.

Table 1. The Changing Structure
(EIA 12-16)

Looking at the previous holding companies of 1998 and comparing them with the pending mergers above, one can see

Table A1. Registered Holding Companies, as of June 1, 1998 (continued)

Registered Holding Company / State of Incorporation	Public Utility Company Subsidiaries	Type
Eastern Utilities Association (EUA) / MA	Blackstone Valley Electric Co. (RI) Newport Electric Corp. (RI) Eastern Edison Co. (MA) EUA Ocean State Corp. (RI)	Electric
New England Electric System (NEES) / MA	Granite State Electric Co. (NH) Massachusetts Electric Co. (MA) The Narragansett Electric Co. (RI) New England Electric Transmission Corp. (NH) The New England Power Co. (MA)	Electric
Northeast Utilities (NEU) / MA	The Connecticut Light & Power Co. (CT) Public Service Co. of New Hampshire (NH) Western Massachusetts Electric Co. (MA) North Atlantic Energy Corp. (NH) North Atlantic Energy Service Corp. (NH) Holyoke Water Power Co. (MA) Northeast Nuclear Energy Co. (CT)	Electric
Unitil Corp. (UNI) / NH	Concord Electric Co. (NH) Exeter & Hampton Electric Co. (NH) Fitchburg Gas and Electric Light Co. (MA) Unitil Power Corp. (NH)	Electric & Gas

the rapid movement of the industry. Deregulation has greatly impacted the electric industry, especially the generation component. The other elements of electric energy delivery are still very much the same as before. Transmission, distribution, and customer service all remain in the hands of a few companies and are significantly regulated by the government. The consumer only received the choice of which generator to purchase from. This gave the option of a competitive supplier, an aggregator, or electric broker.

Companies Involved in Deregulation

Deregulation and restructuring affected every electric company in Massachusetts. From the small time generators, like residents with small windmills, to billion dollar transmission companies, everyone had new policies to abide by. But why now and why all the change? It started back in 1978 when Congress passed the Public Utility Regulatory Polices Act. This act would essentially pave the way for deregulation and competition by allowing non-utilities to contribute to the market. It was not until 1992 that Congress made their next step with the passage of the Energy Policy Act. Implemented in 1996 by the FERC (Federal Energy Regulatory Commission), the act opened transmission lines to all types of generators unassociated with utilities and also gave consumers the ability to choose their electricity generator (Electric Power).

Massachusetts, as did the rest of New England with the exception of Vermont, consequently deregulated its electric industry (Carner).

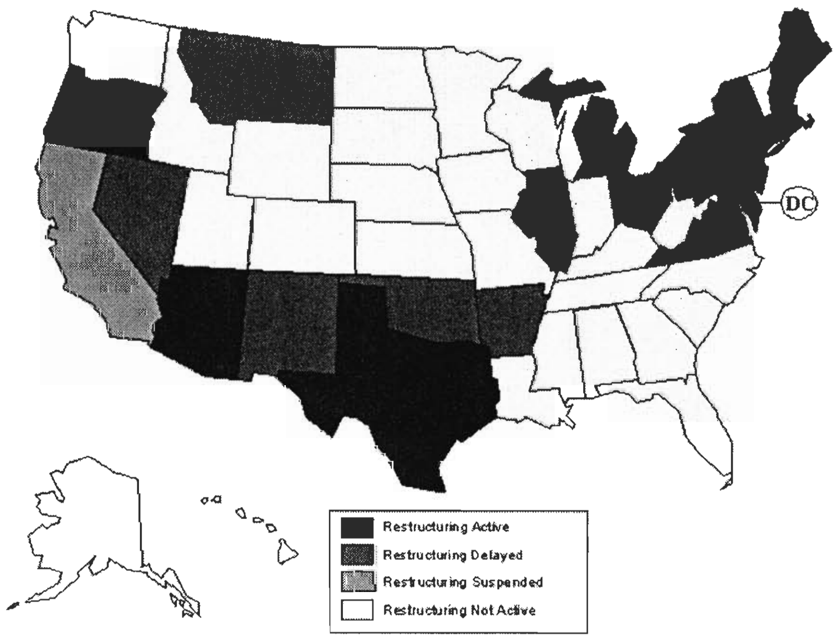


Figure 3. State of Electric Industry Deregulation in the US
(EIA RES 2003)

Looking at another graph that depicts the capability of New England Electricity between 1988-1999 in megawatts, one can see exactly where deregulation took affect and how the competitive market is growing.

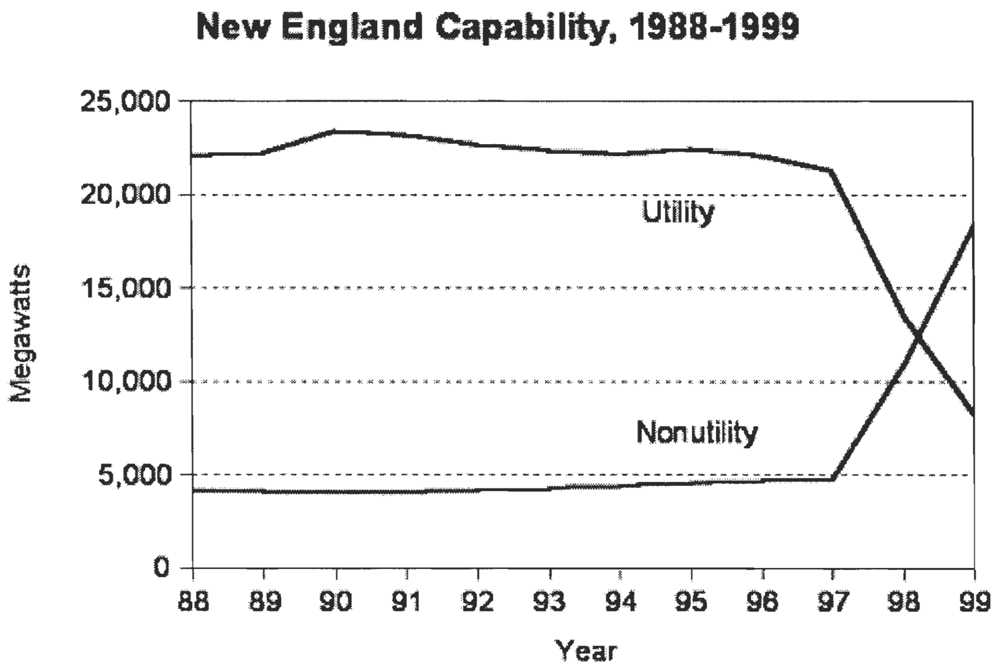


Figure 4. The Maximum Capacity for Producing Electricity by Provider (Electric Power)

As more and more research was conducted, it was noted that while distribution companies very were public, in the news and advertising, not much was known about Transmission companies. After interviewing National Grid, answers were clarified (ROUGHAN). It seems that even though distribution and transmission, "T" and "D", are separated and considered separate identities, all four distribution companies are 'affiliated' with transmission facilities in either the same name or a different one. It seems that the 'utilities', which formerly used to own everything, still own everything with the exception of "G" or generation. In fact, this seems to be the national consensus (Electric Power). The following chart shows the companies and their affiliates, most acquired through mergers (How).

Transmission Company	Distribution Company	Areas Serviced
National Grid*	Massachusetts Electric Nantucket Electric http://www.nationalgridus.com/masselectric	portions of the northeast, southeast, central, and western MA; Nantucket
NSTAR	NSTAR	Boston area, Cape, and SE MA
The Northeast Utilities System*	Western Massachusetts Electric	Western MA
Unitil Corporation*	Fitchburg Gas & Light	Ashby, Townsend, Lunenburg, and Fitchburg in north-central MA

Table 2. Service Regions of the Distribution Companies

*also provide service outside of Massachusetts (How)

Companies, like National Grid, are also trying to get away from the previous distribution company name. A National Grid employee indicated that all trucks, stationary, and company possessions bearing the logo and name of the company would soon (if did not) read National Grid (ROUGHAN). The links to the distribution company homepages also have the name and site of the transmission companies.

Distribution companies of Massachusetts have very obscure territories. As said previously, it is not the choice of a particular consumer which distribution company they can use. Instead it depends on where they are located. Below is a map of Massachusetts and the current territories served by each company. The awkward arrangement is due to mergers and acquisitions of different companies over the years.

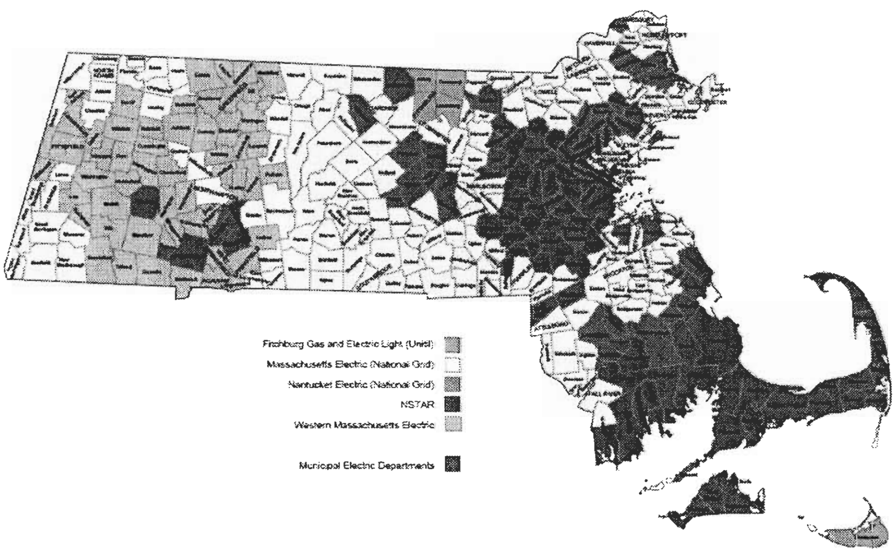


Figure 5. Areas of Massachusetts and the Distribution Company Servicing Them
(http://www.masstech.org/renewableenergy/green_buildings/ElectricUtilityMap.pdf)

Just as the 'utilities' still exist in their distribution and transmission areas, which are highly regulated, they continue to manage customer service. Customer service can be broken up into answering questions, metering, billing, handling complaints, and repairing or setting up distribution lines. As a result of deregulation and a break up of the industry, billing was no longer one general fee to one company. In order to make the system as simple as before, while getting each party their money, the DTE decided to break up the bill into categories and allow Distribution companies to send out and collect charges. Here is a sample bill with the break down of charges.

NATIONAL GRID
RATE: RESIDENTIAL REGULAR R-1

	PREVIOUS BALANCE			$	203.83
	PAYMENT – THANK YOU 10/24/03			$	-203.83
	BALANCE FORWARD				.00
DELIVERY SERVICES:					
CUSTOMER CHG			5.81		
DISTRIBUTION CHG	.02398 X	1282 KWH=	30.74		
TRANSITION CHG	.01002 X	1282 KWH=	12.85		
TRANSMISSION CHG	.00660 X	1282 KWH=	8.46		
ENERGY CONSERVATION	.00250 X	1282 KWH=	3.21		
RENEWABLE ENERGY CHG	.00050 X	1282 KWH=	.64		
TOTAL DELIVERY SERVICES				$	61.71
SUPPLIER SERVICES:					
GENERATION CHARGE					
BASIC SERVICE -FIXED	.07093 X	1282 KWH=		$	90.93
TOTAL COST OF ELECTRICITY				$	90.93
TOTAL CURRENT BALANCE				$	152.64
ACCOUNT BALANCE				$	152.64

Figure 6. A Sample Bill from National Grid
(About)

The first section on the bill deals only with delivery. The second section is extremely simple. It deals only with Generation or the competitive supplier side of the industry. This charge will be based on a customer's usage, and the rate they have either through Basic Service (which can be fixed or variable) or a competitive supplier or broker. Basic Service is a default service offered to consumers, mostly residential, that do not choose a competitive supplier or use a broker. This rate is determined on a 6 month basis for small users and on a 3 month basis for larger users. Basic Service rates are determined in this way. At the end of a term, the Distribution Company will hear bids for Basic Service from a number of Competitive suppliers/generators. The one with the lowest rate will be accepted and locked into that for the term. The distribution company will merely carry that cost onto their customers with no additional fee or charge. So, if a Competitor is delivering electricity to the Basic Service of a Distribution company they are guaranteed a large demand, but at a fixed rate.

Looking back at the bill and the section titled Delivery Services; one can see it is much more complex and more broken down then Supplier Services. This is a result of the restructuring process and all the now separate distinct parties involved. Other than the parties, a few additional charges are listed in order to make an easy transition and address future concerns. The first charge listed in the section is called a Customer Charge. This fee is attributed the cost to companies to provide customer service, actual billing, and metering of the electricity. This flat fee is paid to Distribution companies, which are responsible for all of customer service. The next rate is Distribution Charge. This is simply the cost of delivery by the distribution company. Not the cost of electricity itself, just the cost of transporting it from Distribution stations to the consumers doorstep. The next charge is Transition. This is a complex rate that was instated to provided security and compensation to the utilities, now distribution companies that were forced to sell off their generation plants, essentially losing money in the process. After the Transition Charge listed above is Transmission. The Transmission Charge is similar to Distribution just on a larger scale. This price rate is the cost of transmitting the electricity from the actual generator to the distribution companies' sub-stations. Since the distribution company collects all charges, this money is relayed to the transmission company. Next is Energy Conservation. This, like the Transition Charge, is a result of legislation. It is a fee used for energy efficiency programs, which are educational programs to lower costs by lowering usage, provided to consumers by distribution companies. In some areas it is referred to as DSM Charge or Demand Side Management. The last then is the Renewable Energy Charge. This too is a result of legislation and is a fee that goes into a Renewable Energy

Trust. This trust is, of course, to promote renewable energy usage and generation, and is discussed later in the paper (How).

A tremendously important aspect of the electric industry is dealing with peak loads, highs and lows, and tracking which electricity goes where. This is all done by an independent, not-for-profit organization known as ISO New England. ISO stands for Independent System Operator and is responsible for "ensuring the constant availability of electricity," to New England (About ISO-NE). The ISO is also responsible for regulating the rates power generators can charge to transmission companies. Established by the FERC, or Federal Energy Regulatory Commission, its job is to monitor the complex electricity grid of New England twenty-hours a day and seven days a week (How).

Previous to 1971, the utilities of the Northeast region monitored the power grid of the area they controlled. After problems NEPOOL (New England Power Pool) was created in 1971 to monitor the grid on a regional level. Around the time that restructuring was debated by Congress and FERC, ISO's were created. ISO-NE, ISO New England, was created in 1997 when deregulation legislation took place. ISO-NE continues to serve and oversee all six New England states, even Vermont the only state not restructured (About ISO-NE). Since its creation ISO-NE has been given the title of regional transmission organization (RTO). This designation by the FERC in 2003 gave ISO-NE more authority to oversee and manage New England's power grid and sales (About ISO-NE).

The Massachusetts electric industry restructuring has shown great improvements to the way electricity is generated, transmitted, distributed, and in short sold. Deregulation has shown a wholesale rate decline of 5.7% since 2000, independent of fuel price increases (About ISO-NE). In terms of environment and cleaner generation, deregulation has greatly reduced emissions as well. Between 2000 and 2004 annual CO_2 emissions have decreased by 6%, NO_x emissions by 32%, and SO_x emissions by 48%. During this time electric supply has also increased by 30% with the 9000 megawatts that new, cleaner generation facilities have provided (About ISO-NE).

History of Renewable Energy

The concept of renewable energy (often referred to as "green energy") existed for generations before it became an issue of concern in the late 20^{th} century when non-renewable energy resource scarcity came to the forefront of problems facing the global community. Made manifest primarily in the form of mills and dams, the first sources of renewable energy were windmills and water wheels, used to facilitate the operation of milling apparatus (grinding wheels, etc.). Of course, that was before electricity was available to and/or demanded by the general public.

Following the industrial revolution and the incredible new demand for the mass generation of electric power using coal and other fossil-fuel power generation plants, which were capable of producing much larger amounts of power, green energy became a very minor concern. Technologies of the day were unable to provide enough renewable-energy sources that could compete with the bigger, more productive fuel burning plants. Outputs of then "state of the art" wind turbines peaked in the tens of kilowatts (1 kW = 1,000 Watts) production range, whereas a typical nuclear power plant generates between 0.5 and 3 Giga-watts (1 GW = 1,000,000,000 Watts) of usable electrical energy. Thus, renewable energy sources were largely deemed a waste of time. There are a number of counterexamples, perhaps most notably the hydroelectric Hoover Dam, which generates up to 2.074 Giga-watts (equivalent to a large nuclear power plant); enough energy to power all of Las Vegas. However, the Hoover dam and others like it are extreme cases with extenuating circumstances, and are not an accurate representation of the nation's policies regarding renewable energy during the time of their construction.

It was not until the mid-1970's energy crisis and the creation of OPEC that green energy became of significant importance. Fossil fuel resources were not expected to last long, prices began to soar, and people began seeking renewable energy sources as an alternative. Solar power was considered the most logical source of green energy for the private consumer, and many energy-conscious homeowners installed solar panels atop their homes to minimize electricity expenses. Geothermal energy was also dabbled in, but on the whole required too large of an investment to be worthwhile. For the industrial and commercial consumers, water power from dams was the most logical option, but that required much in terms of location, availability of dammable bodies of water, and necessary construction of said dams; an incredible investment.

The Deregulation Act and "Renewable" Energy

When the energy crisis passed, the topic of green energy remained a concern, but was no longer of great importance until 1997, when the Massachusetts Deregulation Act was passed, in which a green energy requirement clause was implemented. The Act called for a small amount of total electrical power distributed by power utilities to come from "green" sources. It also required that this amount increase by a small percentage each year:

> Every retail supplier shall provide a minimum percentage of kilowatt-hours sales to end-use customers in the commonwealth from new renewable energy generating sources, according to the following schedule: (i) an additional 1 per cent of sales by December 31, 2003, or one calendar year from the final day of the first month in which the average cost of any renewable technology is found to be within 10 per cent of the overall average spot-market price per kilowatt-hour for electricity in the commonwealth, whichever is sooner; (ii) an additional one-half of 1 per cent of sales each year thereafter until December 31, 2009; and (iii) an additional 1 per cent of sales every year thereafter until a date determined by the division of energy resources. For the purpose of this subsection, a new renewable energy generating source is one that begins commercial operation after December 31, 1997, or that represents an increase in generating capacity after December 31, 1997, at an existing facility.
>
> (b) For the purposes of this section, a renewable energy generating source is one which generates electricity using any of the following: (i) solar photovoltaic or solar thermal electric energy; (ii) wind energy; (iii) ocean thermal, wave, or tidal energy; (iv) fuel cells utilizing renewable fuels; (v) landfill gas; (vi) waste-to-energy which is a component of conventional municipal solid waste plant technology in commercial use; (vii) naturally flowing water and hydroelectric; and (viii) low-emission, advanced biomass power conversion technologies, such as gasification using such biomass fuels as wood, agricultural, or food

wastes, energy crops, biogas, biodiesel, or organic refuse-derived fuel; provided, however, that after December 31, 1998, the calculation of a percentage of kilowatt-hours sales to end-use customers in the commonwealth from new renewable generating sources shall exclude clauses (vi) and (vii) herein. The division may also consider any previously operational biomass facility retrofitted with advanced conversion technologies as a renewable energy generating source. After conducting administrative proceedings, the division may add technologies or technology categories to the above list; provided, however, that the following technologies shall not be considered renewable energy supplies: coal, oil, natural gas except when used in fuel cells, and nuclear power (Chapter 164).

Problems with the Legislation

There are a number of complications that stem from the wording in the legislation. As defined by Wikipedia:

"Renewable energy (sources) or RES capture their energy from existing flows of energy, from on-going natural processes, such as sunshine, wind, flowing water, biological processes, and geothermal heat flows. The most common definition is that renewable energy is from an energy resource that is replaced rapidly by a natural process such as power generated from the sun or from the wind." (Wikipedia)

The word 'renewable' is similarly defined by Merriam-Webster as "capable of being replaced by natural ecological cycles or sound management practices" [www.m-w.com], and by the Oxford English Dictionary as "(of energy or its source) not depleted when used" (Oxford Dictionaries).

The wording of the Act does not explicitly define renewable energy; nor does it go so far as to specifically define the term 'renewable,' either in or out of context.

Based on the Oxford definition listed above, any energy source that requires the altering of the chemical formula (i.e. burning, fission, and/or fusion, which all release particles of matter during their respective processes and are thus depleted) is not renewable. The wording of the Act does not provide such a definition of renewable energy sources- rather, it provides a list of resources that shall or shall not be considered and fails to provide clear reasons as to why certain resources shall be considered, while others shall not. In addition, the law states that while waste-to-energy generation methods shall be excluded from consideration as renewable following December 1998, it does not specify "waste-to-energy" among supplies that "shall not be considered renewable." Furthermore, the Act states that hydroelectric power shall (as of December 1998) no longer be considered renewable, when it is listed previously among those that shall be considered renewable, is defined as such by dictionary definitions, and fails to appear again in the list of resources that shall not be considered renewable.

Trash/Biomass Generation

It is not the intent of this report to say that trash- and biomass burning are not good ideas. It may be easily argued that both are more beneficial than traditional fossil fuel burning generation- the burning of trash and bio-wastes not only provides a readily available, reliable, relatively low-emission energy source, it also helps to reduce the amount of solid waste that is deposited in landfills (another topic becoming increasingly of great concern). The same is true of the more recent development of burning landfill gases, in which methane and other gases are harvested from the landfill and burned to generate electricity. Yet none of these should be considered renewable.

Some may argue that there will always be trash and biomass to be burned; as true as this may be, burnable trash is created by humans, and requires the expenditure of energy to produce it via manufacturing methods, treatment processes, transportation, etc. In this sense, we are expending energy to produce energy (which is unfortunately an extremely common theme in the electrical industry, and is part of the reason why traditional generation methods are so grossly inefficient), but we are also creating unnecessary waste, when alternative methods could be employed to generate energy with zero waste products (i.e. wind, solar, and hydroelectric energy).

In the case of biomass, the vegetation that is harvested to supply the biomass to be burned must be replaced in order to create a sustainable, renewable energy source. Lumber companies have been doing this for centuries; clear cut an area, replant with a desired species (a process that has in and of itself a detrimental impact on the local ecosystem), allow it to grow, harvest it again, and repeat the cycle. This works for a period of time, but eventually the minerals in the planting soil are used up due to over-farming and irrigation, and the land becomes increasingly less productive until a harvest is virtually unusable and the land becomes barren. While this process may be extremely productive for decades, even centuries before the land becomes unusable, it is not in fact sustainable, and thus by definition neither is it renewable. There is a limited amount of available land, and even that amount is decreasing every day. Hence, trash burning and biomass power plants should be considered merely a temporary or interim alternative to traditional fuel-burning plants, which are by far the most detrimental and inefficient, until mankind either converts to completely sustainable renewable energy, or at least finds a better alternative. They should serve as mankind's stepping stone toward total sustainability, and not a final solution.

Hydroelectric Generation

Hydroelectric dams such are capable of providing enormous quantities of power. The Itaipu Dam in (the largest hydroelectric power plant in the world) has a peak generation capacity of 12.6 GW- roughly four times that of the largest nuclear power plant- with zero fuel costs and zero emissions. However, there are groups that would argue that, despite their incredible renewable generating capacity and zero emissions, hydroelectric dams are not entirely environmentally friendly.

For example, hydroelectric dams have fallen under intense scrutiny in some areas where they are thought to interfere with the environment on a species-specific level: namely, salmon. During the last decade, dams (hydroelectric or otherwise) all over New England and provinces in Canada have been blamed for the failure to repopulate the dwindling Atlantic Salmon population. The argument is that the dams block the salmon’s route (which is instinctively programmed into every member of the species to return to the very stream, river, estuary, etc. where they were born to breed, spawn, and eventually die.) and preventing them from breeding. Civil engineers and environmentalists have worked together to try and create a solution to this problem, but have met with little success. Newer dams have been constructed (or old ones retrofitted) with “pathways” that allow salmon to circumvent the dams to reach their breeding grounds, but many salmon still do not make it through, and thus the species is struggling to repopulate itself.

In addition to this species-specific problem, dams also prove to be problematic for other reasons. Damming a river is a very complicated process and has an incredible effect on the surrounding environment, primarily in the form of flooding. Dams, especially hydroelectric ones, require the flooding of large tracts of land to create a reservoir to ensure a constant water flow. Flooding land creates huge problems. In all cases, wildlife is displaced, and in many cases people are displaced as well. Displacing people is no easy task, nor is it cheap. Often the land to be flooded must be bought, and people with homes, businesses, etc. on that land more than likely do not pack up and move quickly, or happily. Also, once flooded, the land is no longer usable. This makes selecting the location for a dam extremely difficult. In addition to requiring adequate space for the reservoir, the location must allow for a large vertical drop to maximize the kinetic energy of the water and simultaneously maximize the generating capacity of the dam.

Additionally, the buildup of sediment within a dam's reservoir has been shown to cause drastic changes in water quality, as well as alter concentrations of certain chemicals, minerals, and even pollution within the river ecosystem. These concentrations may be potentially dangerous to aquatic life, and may destroy the natural food chains by artificially altering naturally occurring nutrient, waste, or even toxicity levels.

'Zero-impact' Generation

So, burning and damming are clearly not the optimum solutions to our renewable energy problem, though they do provide greater benefit, either via reduced waste production, or lower emissions than traditional fuel burning generation. Let us consider a few other methods.

In contrast with burning and damming, wind and solar generation plants require very little, and create virtually zero negative impacts on the local environment, or, for that matter, the global environment. Their only requirement is the land they are built on. As far as we know, the wind will always blow, and the sun will always shine, so to speak, so there will always be a renewable energy source for us to "harvest". And as far as "Green" energy is concerned, these energy sources fit the definition exactly: zero emissions, zero impact. So what's the problem? Why don’t we just build enough wind turbines and photovoltaic fields to power everything? The answers may surprise you.

Wind Generation

As with all generation methods, there is the ever present issue of space. Space is the one problem that all potential energy solutions, renewable or otherwise, have in common. Land has always been a prime commodity as the global population increases and people look for a place to live. But there yet remain thousands, if not millions of acres of available land in the United States and Canada alone. How can space be an issue? For the optimization of wind powered energy generation, geography makes a huge difference. A 2.0 Megawatt/hour (1 MW = 1,000,000 Watts) turbine, currently among the highest-generation capacity wind turbines in the world, require thousands of square footage for construction, (the average blade length [radius] of a turbine of this size is approximately 60 meters, or about 180 feet) and must have a constant wind speed of 15-25 miles per hour to generate at maximum capacity (Vestas).

In 1999, a wind power project near Chandler, Minnesota consisting of three *Vestas* wind turbines producing a total combined output of 2MW provides enough electricity to power approximately 600 “average American homes” per year. The project, called “Wellspring,” is managed by a cooperative group that provides local consumers with electricity- at a price of two dollars per 100 kilo-Watt hour block (Minnesota). Traditional fuel burning generation plants in Massachusetts currently market their electricity at a rate of about eleven cents per kilo-Watt hour, or eleven dollars per 100kWh block. There has since been a strong push toward incorporating more wind farms into the market in Minnesota:

> Several other wind farms recently developed in Minnesota have resulted from a state legislature mandate requiring that Northern States Power Co., a major utility based in Minneapolis, acquire 425 MW of wind generation. As of last week, NSP had contracted to buy 294 MW from various projects either currently operating or scheduled to be online sometime this year.
>
> More recently, the Minnesota Public Utilities Commission has voted to require NSP to add another 400 MW of wind capacity its generation portfolio by 2012. The total of 825 MW of wind energy would make NSP one of the world's largest buyers of wind-generated electricity (Minnesota).

Theoretically, if 2MW powers 600 homes per year, and we currently possess the technology to build a single turbine to generate more than 2MW (Vestas), a wind farm of about 10-20 turbines could power an entire city. Again, the question arises: “what’s the problem?”

Cape Wind Controversy

In Massachusetts, there is a very strong opposition to wind turbines for a purely *aesthetic* reason: people do not want to look at wind turbines, or high tension wires that would be necessary to get the electricity from the turbines to the consumers. Clearly, our priorities are not in order. Most recently and most notably, the Cape Wind Project, a proposed wind farm that would facilitate the first offshore wind farm (located in Nantucket Sound) consisting of 130 turbines with a maximum generating capacity of 420 MW of Green electricity- enough to power three quarters of Cape Cod, including the surrounding islands. This would save approximately 113 million gallons of fuel oil per year, and would also eliminate nearly 1 million tons of harmful emissions gases per year (Cape Wind).

The location of the project also makes it ideal for production; the proposed area lies out of the way of airline flight paths, shipping channels, and even ferry routes; of these pathways, the main shipping channel, at the closest point, skirts the proposed region by a safe margin. The only vessels that would pass through the region would be private recreational vessels and commercial fishing vessels. And according to the project's website, the project "has been endorsed by the Maritime Trades Council and the Seafarers International Union, the largest fleet of commercial fishermen in New England" (Cape Wind). This group would have the most direct contact with the project, since they will be fishing near the turbines, and even they approve of the project. In addition, "…Cape Wind could supply almost half of the supply of renewable energy that Massachusetts needs by 2009 to meet the target mandated by the Massachusetts Legislature's Renewable Portfolio Standard. It is doubtful Massachusetts can meet its renewable energy mandate without the Cape Wind project" (Cape Wind). (The Renewable Portfolio Standard regulates the amount of green energy required each year, and will be discussed in detail in the next section of this report).

In spite of all the support the Cape Wind project has received, and all the potential environmental and economic benefits (the project would create hundreds of jobs during the construction timeframe, as well as about one hundred fifty permanent jobs post-construction), the project has met with intense opposition from, mainly, a small group of people who own or manage land in the Cape Cod, Nantucket Island, and Martha's Vineyard areas, which are all in close proximity with the proposed construction region. By involving partisan politics and using campaign donation money as an influential tool, these few have managed to impede the progress of the project, which has, according to sources, been largely approved by the general public of Massachusetts:

The latest effort to kill Cape Wind -- a project detested by Massachusetts Sen. Edward Kennedy, patriarch of greater Hyannis shoreline mansions -- comes even though federal policy on reviewing such projects has not previously allowed a state veto power. Projects for federal waters, as is the Cape Wind proposal, are assigned for review and approval to federal agencies… Meanwhile, the people of Massachusetts overwhelmingly favor the project (a recent poll said by a 6-to-1 ratio); energy prices are soaring; and the environmental effects of our ever-increasing use of fossil fuels are becoming obvious. Massachusetts Sen. John Kerry, with characteristic indecision, has not said where he stands on the Nantucket Sound wind farm, although he has commendably opposed the midnight-rider approach to killing the project as the sleazy public policy it is.
Science, fairness, the environment, America's energy needs-- all have a tough time competing with the likes of Senator Kennedy, billionaire Bill Koch, and Mr. Koch's friends (many of whom, like him, benefit richly from the fossil-fuel industry), who demand that their "private" yachting pond -- Nantucket Sound -- remain so.
The Cape Wind case is a classic example of the abuse of public policy by arrogant wealth and power.
(Providence Journal)

The project would be a pioneer in the implementation of wind farms to provide renewable energy on a very large scale, which could potentially provide precedence for the production of similar farms all along the eastern seaboard, and eventually the western seaboard and gulf regions as well. With farms such as the Cape Wind project, the United States could potentially convert its entire coastline to a power-producing ‘membrane.’ And since, geographically, the majority of the US population is concentrated near the coast, and port cities (i.e. Boston, New York City, New Orleans, Los Angles, Portland, etc), we could effectively sustain the majority of the population with renewable, emissions free, low-cost electrical energy. The potential benefits that lie with the success of the Cape Wind project are incredible. The expenditure of trillions of dollars, billions of gallons of oil, and millions of tons of pollution could be spared.

Solar Generation

In addition to wind turbines, there is another renewable 'zero-impact' energy source- the sun. Solar energy, as previously stated, has been loosely used by private individuals to help to lower their monthly energy bills. And solar panels typically require far less space than wind turbines (for example, a friend of mine uses two photovoltaic panels, roughly measuring four feet by eight feet, atop the roof of his house to provide electricity to light his home. It works great, it doesn't effect the environment, and it saves him money on his electric bill each month).

What about at night, or on overcast days when the sun does not shine? The panels are linked to a battery storage system that acts much like a rechargeable appliance. During the day, the panels convert sunlight into electricity, which is stored in the batteries. At night, the batteries provide the power to keep the lights on, and recharge the next day.

On a larger scale, in 2004, two groups- the National Nuclear Security Administration's Sandia Laboratories and Stirling Energy Systems, Inc.- teamed up to design, build, and test six "solar dish-engine systems" that "will provide enough grid-ready solar electricity to power more than 40 homes" (Sandia).

The six units have a combined generating capacity of 150kW, and the way they work is very interesting, and based on somewhat simple principles.

The solar dish generates electricity by focusing the sun's rays onto a receiver, which transmits the heat energy to an engine. The engine is a sealed system filled with hydrogen, and as the gas heats and cools, its pressure rises and falls. The change in pressure drives the pistons inside the engine, producing mechanical power. The mechanical power in turn drives a generator and makes electricity (Sandia). The dishes can produce up to 25kW per day, per unit, and like wind turbines, do so with zero emissions, zero fuel cost, and virtually zero impact on the environment- albeit with slightly lower reliability.

The Cost of Renewable Energy

Despite the incredible benefits offered by wind and solar energy, many people argue about the cost of building these green facilities, claiming that they are simply too expensive to be feasible. Here is a fun example of what Americans are content to spend their hard earned dollars on. In 1997 (the year the Massachusetts Deregulation Act was passed) Americans spent more than $100 billion USD- on fast food (Schlosser). The proposed Cape Wind project would cost an estimated $900 million USD to complete (Cape Wind). That's less than one percent. Less than one percent of what Americans spent nearly ten years ago on fast food could provide electricity for three quarters of Cape Cod for decades to come. What if we took one percent of what the nation spent on gasoline in 2005 (approximately $210 billion (U.S. Prices, Sales Volumes & Stocks)? With just one percent of that figure, we could build the Cape Wind project twice over, with three hundred million dollars to spare.

The solar dishes in New Mexico would cost even less; the prototypes cost approximately $150,000 USD apiece, and SES says estimated costs for actual production units could run lower than $50,000 USD per unit (Sandia). For the cost equivalent of one percent of America's fast food budget, we could construct in excess of twenty thousand of these solar units. At twenty five kilo-Watts apiece, that equals five hundred million Watts (500 MW). And these units can be used on a stand-alone, unit-by-unit basis to power small neighborhoods (with the possibility of simply adding additional units to meet increasing energy demands), or they can be clustered together to create vast fields of energy producing, emissions free, environmentally neutral energy farms (Sandia).

Problems with Economics

As if the creation of renewable energy farms were not difficult enough due to controversy, politics, and geography, even greater problems lie with the post-production distribution methods and marketing green energy in a gas-guzzling economy. According to a very credible source at one of Massachusetts leading licensed distribution companies (who prefers to remain anonymous for the purposes of this report), green energy is being 'boxed out' of the market by gas burning generators.

Every generation facility has some degree of operating cost: be it maintenance costs, generation costs, distribution costs, etc. The sum of all of these costs is included in the price when the energy that each generating facility produces is sold to distribution companies, and is referred to as the "cost to dispatch." Basically, it represents how much it costs to cover the generator's overhead (the cost to make the electricity and transport it), plus a small profit. For a fuel burning generator who must accommodate for fuel costs to run the generators, the cost to dispatch is much higher than that of a trash-burning generator, hydroelectric dam, solar panel, or wind turbine, which each have virtually zero associated fuel costs. Let us examine an example scenario.

Imagine that we have five generating facilities with their own individual costs to dispatch; an oil burning generator (15 cents per kilo-Watt), a trash- or biomass-burning generator (12 cents per kilo-Watt), a hydroelectric dam (6 cents per kilo-Watt), a solar unit (5 cents per kilo-Watt), and a wind turbine (3 cents per kilo-Watt).

As a consumer, the goal is to pay the least amount of money to get the electricity that we require. That is the logic behind an open (de-regulated) market- competition between providers drives the overall price of the commodity- here, electricity- down. Naturally, one would choose to buy electricity from the wind turbine. In theory, this means that these facilities are free to sell their electricity at a lower rate than the fuel burning generator. However, most consumers don't go directly to the producer (in fact, its no longer legal to do so). Consumers must buy their electricity from a distribution company. While the distribution company may be able to make a deal on consumers' behalf with the generation company for low or fixed rates on electricity, the vast majority of consumers simply buy from the distributors at the standard rate. The distributors sell electricity- regardless of its origin or production- at one 'set' price (this price changes continuously and can be monitored (About ISO-NE) and the figure that shows up on your monthly bill is the average price during the billing period).

What does this mean? Distribution companies are not in the business of losing money, so they sell electricity at the highest rate possible, based on the cost to dispatch of the generation companies. Getting back to our scenario, what this means is that they charge the highest price (15 cents per kilo-Watt hour) for every kilo-Watt hour they sell. But they're not paying 15 cents for every kilo-Watt hour that they purchase. The difference in price from each generator turns into pure profit for the distribution company (i.e. for every kilo-Watt hour they buy from the wind turbine, they are making a 12 cent per kilo-Watt hour profit- they buy it for 3 cents and turn around and sell it for 15 cents, much like a stock broker: buy low, sell high, maximize profit).

How does this create a problem for renewable energy generators? It comes down to the economics. As long as the distribution company is selling all of its electricity at the oil generator's price, consumers do not see any real savings from the cheaper renewable energy. In fact, National Grid actually charges consumers *more* for "green energy" through their "GreenUp" program. As far as the consumer is concerned, they might as well just get their electricity from the oil generator- after all, they're already paying for it. There are currently not enough incentives, or not enough public interest in green energy to cause a change in the way the market operates. If people took the time to reduce electricity demands within their homes, the overall demand for electricity would drop. Lower demand means fewer generators operating, which opens the door for renewable sources (which typically operate at lower capacity) to meet the lower demand. If an oil generator produces 10GW and the overall demand is only 300MW, it makes much more sense and saves large amounts of money to run a few dozen wind turbines than to keep the generator running and producing far more energy than is required.

The most obvious way to reduce the overall price of electricity is to lower the overall demand and cause the oil burning generation companies to take more and more oil burning generators offline. This will cause the generators with lower costs-to-dispatch to flood the market, and people will (theoretically) gravitate toward these less harmful generators. And since the cost to dispatch will be lower, overall prices will drop. Ideally, the lowest cost-the renewable energy generators- should drive down the overall price of electricity. An open market allows for increased competition, newer and better technologies are created, and the consumer reaps the benefits.

Ultimately, it all boils down to what the consumer is willing to do to minimize demand. Currently, the 'base load' of electrical power is provided by larger generators, and once that base load is exceeded, additional generators are brought online to compensate for the increased load, starting with less costly generators, and continuing upward in price as load increases.

Simple actions like turning off lights when not in use and using low-wattage light bulbs could drastically change the way the electrical economy works by minimizing the overall load. Many distributors (National Grid, for example) provide incentives for customers who take steps to minimize energy consumption. Other incentives may include rate cuts, or even tax breaks for purchasing EnergyStar rated home appliances, or even terminable customer programs, in which consumers agree to minimize energy usage to lower demand during peak hours, and even have power turned off in case of emergency to prevent brownouts or blackouts across the grid. In the remainder of this report, these incentives will be discussed in detail, as well as federal and state regulations regarding the implementation of renewable energy into the market, how these regulations are or are not being met, and the consequences that follow.

Expanding the Green Power Industry

The Electric Industry Restructuring Act of 1997 was passed in part to aid in the development of renewable energy in Massachusetts. This act created two programs to help achieve its goal. They are the renewable portfolio standard and the Massachusetts Renewable Energy Trust.

Distributors and the Renewable Portfolio Standard Obligation

One outcome of the Act was the authorization of a renewable portfolio standard (RPS). This requires electric distributors in Massachusetts to sell energy with at least a certain percentage of their electrical energy coming from green power, or renewable energy generation. The RPS was established by the Massachusetts Division of Energy Resources (DOER). The role of the DOER is to enforce the RPS. Each year, all retail distributors must file a compliance form with the Division. The form details how much energy was sold by the utilities, what type of energy was used in the generation of this energy (renewable, fossil fuels, nuclear, etc.), and how much energy from each type of generation was sold. This can be accomplished with energy generation certificates (Annual 2003, 2).

In order for the RPS to function properly, the DOER needs reliable information regarding the source and amount of energy sold by the utilities in Massachusetts. To meet these needs, the New England Power Pool (NEPOOL) created the Generation Information System (GIS) to manage and record this information. The GIS is an electronic database that tracks all the electric energy generated and sold in New England. This is accomplished by electronic certificates. For every megawatt-hour of electricity generated, a certificate is created detailing how it was generated. All of this information is stored in the GIS account of the energy generators. Whenever a distributor purchases a megawatt-hour of energy, the certificate for that unit of energy is sold or traded to the distributor. The certificate is then placed into the GIS account of the distributor (Renewable Generator, 5).

The GIS system officially began service in 2002. As of now, this certificate market in Massachusetts is the most active compared to other states. In 2003, distributors in Massachusetts required approximately 415,000 certificates (415 megawatt-hours) from qualifying renewable energy generators to meet the RPS requirement (Renewable Generator, 6-7). With this system, the DOER can easily verify that the compliance forms submitted by the utilities are in fact accurate. If the DOER feels that the submitted form is not accurate, it retains the right to audit the accuracy of all the information submitted in the form, as well as conduct on-site inspections of the distributors (RPS, 2).

Since there were no renewable energy requirements before the act, the RPS created minimum percentages of renewable energy that must be included in the utilities' total sales of electricity. The generators' obligation towards the RPS began in 2003. In this year, it was required that 1% of total electric sales come from alternative generation sources. In 2004, this obligation rose to 1.5%, and would continue to rise by 0.5% through 2009, when it would be 4%. After 2009, the obligation will rise each year by 1%. This increase will continue until the DOER sets a final minimum percentage. If the utilities do not meet these requirements, then they must make an alternative compliance payment to make up for the difference. These payments are given to the Massachusetts Technology Collaborative to help fund renewable energy projects to develop. The DOER provides summaries of the information provided by the distributors in their compliance forms (Annual 2003, 2-3).

2003 Compliance Filing

Since there were no renewable energy requirements before the act, the RPS created minimum percentages of renewable energy that must be included in the utilities' total sales of electricity. The generators' obligation for the RPS began in 2003. In this year, it was required that 1% of total electric sales come from alternative generation sources.

For 2003, there were fourteen suppliers that were required to provide compliance filing reports to show the percentages of energy they had sold over the past year. These distributors fell into two categories. The first group was regulated utilities, also known as distribution utilities. These distributors included: Boston Edison Company, Commonwealth Electric Company and Cambridge Electric Light Company, Fitchburg Gas and Electric Company, Massachusetts Electric Company and Nantucket Electric Company, and Western Massachusetts Electric Company. The second group was competitive suppliers. These companies compete for and supply electricity to retail customers in any or all of the distribution utilities regions. These suppliers included: Constellation NewEnergy, Dominion Retail, Inc., Exelon Energy Company, Mirant Americas Retail Energy Marketing LP, Select Energy Inc. and Select Energy of New York Inc., Sprauge Energy Corporation, Strategic Energy LLC, Tractebel Energy Services Inc., TransCanada Power Marketing Ltd (Annual 2003, 3-4).

As of 2003, all of the retail utilities in Massachusetts had met their RPS obligation through certificates or through alternative payments. The DOER provided summaries of the information provided by the distributors in their compliance forms. In 2003, the total amount of electricity sold in Massachusetts was 49,834,324 MWh. Since the RPS requirement for that year was 1%, the utilities' obligation was 498,344 MWh from renewable energy sources. The total amount of renewable energy sold by the utilities in 2003 was 304,112 MWh. This amount was less than the 1% requirement because the demand from the utilities was too great for the renewable generation plants. Since the DOER knew that the development of renewable energy plants had not yet caught up to the utilities' demand, it allowed distributors to use early compliance certificates from 2002, which totaled 255,069 MWh. Only one utility had to make an alternative compliance payment because it fell short by 181 MWh. When the three amounts were combined, they totaled 559,362 MWh. This was more than enough to meet the 1% requirement. The remaining 60,353 MWh can be used to meet future compliances. These results are summarized in Table 3 (Annual 2003, 2-3).

Summary of Information from the 2003 RPS Annual Compliance Filings

		MWh
A	Total retail electricity sales in Massachusetts	49,834,324
B	One percent of total electricity retail sales (1% of A)	498,344
C	Total from 2003 New Renewable Generation	304,112
D	Total from Early Compliance (2002)	255,069
E	Total Alternative Compliance	181
F	Total of 2003, 2002, and Alternative Compliance (C+D+E)	559,362
G	Total banked for future Compliance (for 2004 and/or 2005)	60,353

Table 3. 2003 Compliance Report Summary
(Annual 2003, 3)

The DOER report also provided the percentages of each type of renewable energy used to meet the 2003 obligation. The most widely used form of renewable energy sold in 2003 came from nine landfill methane energy plants. 171,025 MWh of the renewable energy sold originated from these landfill plants. The second largest source of renewable energy was biomass. This energy mainly came from Maine. 108,106 MWh of energy came from biomass. The third largest was anaerobic digester gas, which accounted for 24,571 MWh. Only 533 MWh was obtained from wind. These results are summarized in Figure 7 (Annual 2003, 4-5).

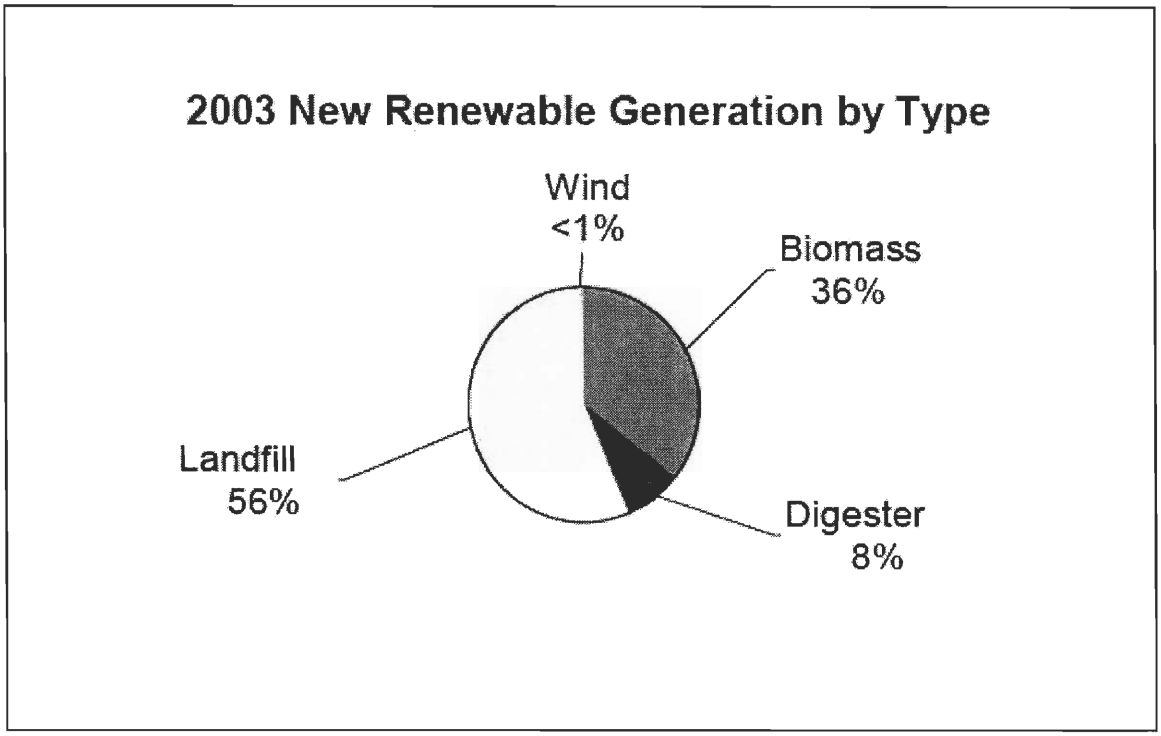


Figure 7. Percentages of Renewable Energy for 2003
(Annual 2003, 5)

Not all the renewable energy distributed in Massachusetts in 2003 originated from the state. Some came from the other states in New England. Massachusetts was the largest provider of renewable energy. 122,958 MWh was generated in Massachusetts. Most came from the anaerobic digester plant at Deer Island and from the five landfill methane energy plants located in Attleboro, Fall River, Granby, Plainville, and Randolph. The second largest amount came from biomass plants in Maine, which accounted for 108,106 MWh. New Hampshire came in third with two landfill plants in Rochester. Rhode Island and Connecticut provided the least energy with one landfill plant in each state. These results are summarized in Figure 8 (Annual 2003, 5).

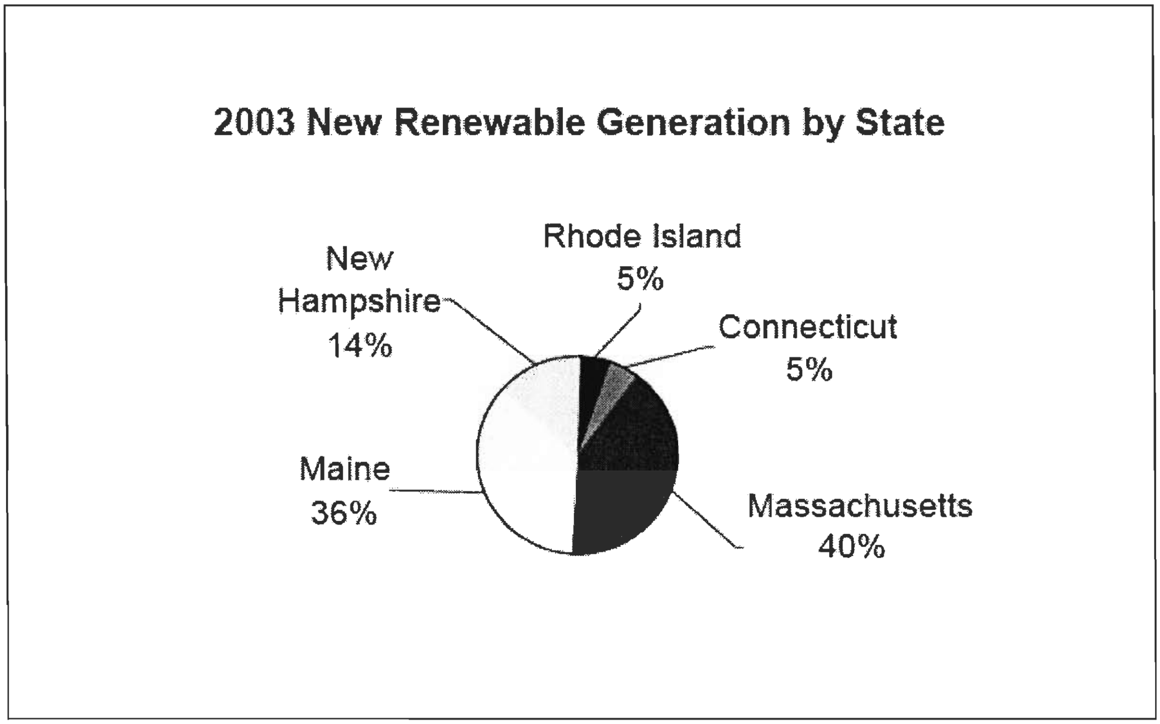


Figure 8. Percentage of Renewable Energy from Each New England State for 2003 (Annual 2003, 5)

Overall, all fourteen distributors met the one percent obligation for 2003. From these statistics, the DOER's review and prediction for future compliance indicate the program's success. The DOER does predict a shortfall for 2004; however, this will soon go away once the alternative compliance payments are invested to help further the market. Of the renewable energy produced, 40% came from Massachusetts' generators (Annual 2003, 1). To start out, the RPS obligation is aiding in the Massachusetts green power industry. The 2004 compliance filing will now be analyzed to verify the programs' continuing success.

2004 Compliance Filing

The year 2004 was the second for the Renewable Portfolio Standard (RPS). In the previous year, all the distributors met their goal of a 1% renewable energy mix. For 2004, the obligation of electric sales from renewable energy generators increased to 1.5%.

For 2004, there were thirteen suppliers that were required to provide compliance filing reports that show how much energy they had sold over the year and what type. The distributors were grouped into the same two categories as in the 2003 compliance filing. The first group, which was regulated utilities, was made up of the same five distributors as the year before. The second group, which was the competitive suppliers, did change from the previous filing. In 2004, Exelon Energy Company did not submit filings. Also, Tractebel Energy Services Inc.'s name changed in between filing years. They are now known as Suez Energy Resources NA (Annual 2004, 7).

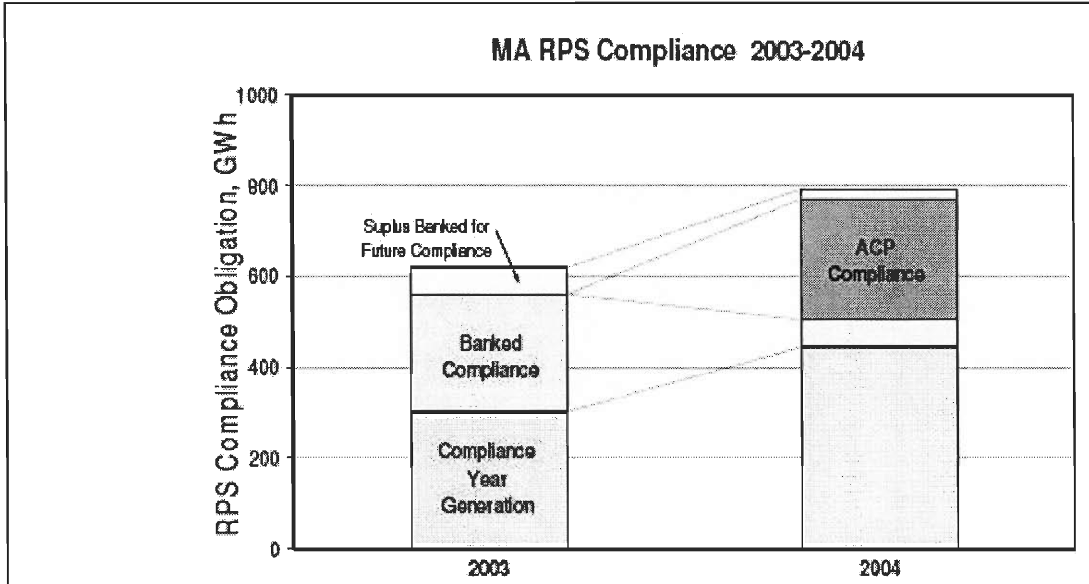
The 2004 compliance filings, which were released in mid-January, detailed the distributors' sales of renewable energy for that year. During 2004, the total amount of retail sales in Massachusetts totaled 50,063,093 MWh. The amount required to have come from renewable energy was 1.5%, which was 750,954 MWh. The total amount of renewable energy sold in 2004 was 444,680 MWh. Even though this amount was below the 1.5% minimum, the RPS obligation was met with the help of other means. Since this was the second year of the program, the DOER allowed distributors to add banked compliance (surplus from their 2003 compliance) to their 2004 compliance. The total amount the distributors used from 2003 totaled 61,147 MWh. This accounted for about one twelfth of the 2004 obligation. However, this was still not enough to make the 1.5 obligation. If a distributor still had not met the requirement, then it had to make an alternative compliance payment, which all except three had to do. The rate of the payment was $51.41 per MWh for the remaining amount. The total amount received by the DOER for alternative compliance payments was $13,645,448, which was given to the MTC to help fund green power projects. Also, even though there was a shortfall in total compliance from 2003 and 2004, four distributors had surpluses, which totaled 20,297 MWh. This surplus can be used towards their 2005 and 2006 compliance. These results are summarized in Table 2. Also in Table 4, the results from the 2003 compliance filings are placed next to the new values (Annual 2004, 3-4).

Aggregated Information from the 2004 (& 2003) RPS Annual Compliance Filings

		2004 MWh	*2003 MWh*
A	Total retail electricity sales in Massachusetts	50,063,092	*49,834,324*
B	Compliance Obligation: 1.5% for 2004 *(1.0% for 2003)*	750,954	*498,344*
C	Total from 2004 *(2003)* New Renewable Generation	444,680	*304,112*
D	Total banked from 2003 for 2004 *(from 2002 for 2003)*[17]	61,147	*255,069*
E	Total from New Renewable Generation (=C+D)	505,827	*559,181*
F	Shortfall for 2004 *(but Surplus for 2003)* (=B-E)	245,127	*(60,837)*
G	Total from Alternative Compliance Payments (ACPs)[18]	265,424	*181*
H	Total from New Renewable Generation and ACPs (=E+G)	771,251	*559,362*
I	Total banked for future Compliance (within two years)	20,297	*61,314*[19]

Table 4. 2004 and 2003 Compliance Report Summary
(Annual 2004, 4)

Figure 9 compares the types of compliance for both 2003 and 2004. In 2003, most of the RPS obligation was met from banked compliance from 2002. This reliance on banked compliance significantly reduced for 2004; however, the percentage for alternative compliance increased dramatically over the year. This was because the renewable energy market had not grown enough to meet the demand. The DOER expects that there will be another shortfall next year, since the demand for renewable energy is still growing faster than the supply. Some level of shortfall was expected for the early years, but with the help of alternative compliance payments, the market is expected to grow faster. In fact, the DOER expects the supply to increase for 2006, as new landfill and biomass capacity currently in the pipeline become operational (Annual 2004, 2-5).



	2003	2004
Surplus Banked	61	20
ACP Compliance	0	265
Banked Compliance	255	61
Compliance Year Generation	304	445

Figure 9. RPS Compliance for 2003 and 2004
(Annual 2004, 5)

As in the previous compliance filing, the DOER summarized the percentages of each type of renewable energy sold to meet the 2004 compliance. For the most part, the order of renewable energy stayed the same. Most energy was still from landfills, which actually increased over the year. 268,353 MWh of the renewable energy sold came from thirteen methane landfills located in five states. The second largest source of renewable energy was again biomass, which accounted for 154,753 MWh. This energy came from two biomass plants in Maine. The third largest was anaerobic digester gas, which provided 17,787. This was less than that of 2003. 3,781 MWh came from a wind farm in New York and 6 MWh came from photovoltaic arrays in Massachusetts. These results are summarized in Figure 10 (Annual 2004, 5-6).

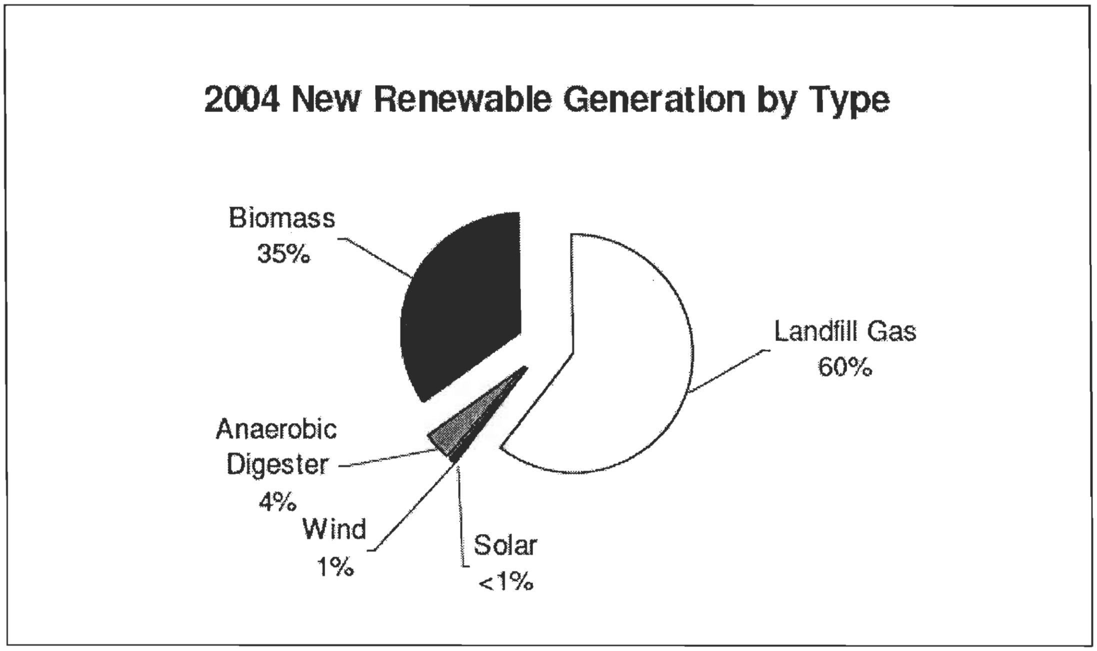


Figure 10. Percentages of Renewable Energy for 2004 (Annual 2004, 6)

Most of the renewable energy sold in Massachusetts did not originate from the state. Some came from other New England states and New York. The most energy for 2004 came from Maine. 154,753 MWh came from the two biomass plants in Maine. Massachusetts was in second place with 150,945 MWh. Most came from the anaerobic digester plant at the Deer Island Wastewater Treatment Plant and the seven qualified landfill methane plants in Attleboro, Chicopee, Fall River, Granby, Plainville, Randolph, and Westfield. New York provided the third largest amount of renewable energy, with 62,655 MWh. This energy came from two landfill plants and one wind farm. New Hampshire was in fourth, will all of its energy from two landfill plants in Rochester. Rhode Island and Connecticut were in fifth and sixth, with one landfill plant each. These results are summarized in Figure 11 (Annual 2004, 6-7).

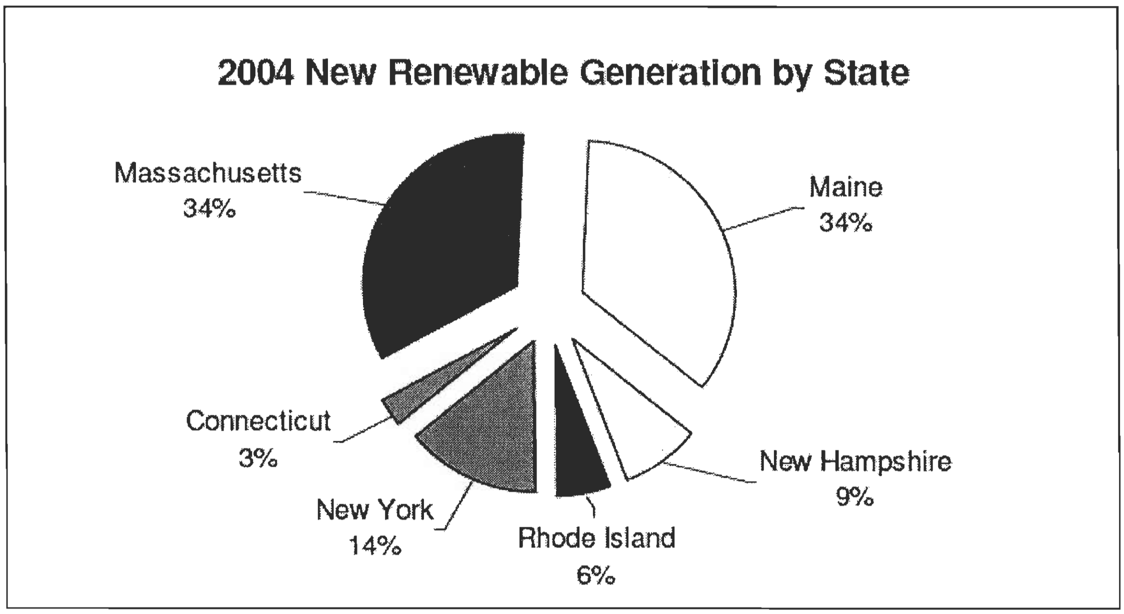


Figure 11. Percentage of Renewable Energy from Each State for 2004 (Annual 2004, 7)

Overall, the one and a half percent compliance for 2004 was met. For both 2003 and 2004, the renewable energy sold had been dominated by landfill and biomass plants. The DOER expects this trend to grow. From the data collected by the DOER, it appears that the RPS program is not operating as successfully as the DOER had hoped in the early years. Qualified sources in Massachusetts provided 22.9% more renewable energy in 2004 than 2003. To meet the 0.5 increase in yearly renewable energy obligation, this amount should have risen by 50%. However, the early stages were expected to proceed slowly. Once there are more renewable energy generators available, the yearly increase of 0.5% should be met. The number of renewable energy generators that provided energy to meet the RPS compliance increased from 12 in 2003 to 19 in 2004. It is expected that six more will be added for 2005 (Annual 2004, 1-2). With the addition of these generators, there should be a decrease in alternative compliance payments and an increase in yearly renewable energy generation. In the early stages, the RPS is aiding in the expansion of the green power industry in Massachusetts. The program is just starting out slowly.

Massachusetts Renewable Energy Trust and Its Programs

In addition to the RPS, the act created the Massachusetts Renewable Energy Trust (MRET). Its role is to expand the renewable energy market in Massachusetts by encouraging renewable generation development, creating a viable market for distributed generation, and expanding consumer choice and demand. The MRET is run by the Massachusetts Technology Collaborative (MTC) (Renewable

Energy, 1). The MRET is funded by a renewable energy charge. Every kilowatt-hour of electric energy purchased by the customer is taxed $0.005. It was estimated that this charge generated approximately $240 million through 2004. Also, alternative compliance payments help to fund the Trust (LeComte, 6-7). The MRET oversees four programs that help to promote renewable energy in Massachusetts.

Clean Energy Program

The first program is the Clean Energy Program. The purpose of this program is to increase both the supply and demand for renewable energy. On the supply side, the program funds both utility-scale and community-scale energy projects. On the demand side, the program educates the public and advances the green energy market by giving customers information and choices. These tasks are accomplished through initiatives. There are many initiatives under this program (Clean, 1).

One initiative under the Clean Energy Program is the Green Power Partnership. The MTC has committed $32 million to support projects generating 100 MW of clean energy for the New England grid. This funding comes from MTC's Massachusetts Green Power Partnership, which purchases renewable energy certificates and provides other price supports to help the financing and construction of new renewable energy facilities (Campbell 1).

Another initiative is the Public Awareness Initiative. The purpose of this program is to educate the public about renewable energy. In particular, it aims to provide visible evidence that renewable energy is being used across Massachusetts and that it can ultimately supply a large share of the state's energy. This is accomplish in various ways, including: grants to organizations for educational activities that increase public awareness of and support for renewable energy among Massachusetts residents; exhibits and activities at the Museum of Science and the Massachusetts Museum of Contemporary Arts; displays at renewable energy facilities and buildings funded by the Trust (Campbell 1-2).

Green Buildings and Infrastructure Program

Another program is the Green Buildings and Infrastructure Program. The program supports the use of renewable energy technologies in all types of buildings and provides funding to a variety of green building projects. These projects include constructing new buildings powered by clean energy, and infrastructure improvements, such as solar panel installations and efficient heating and cooling systems. These projects both promote renewable energy, as well as reduce energy consumption at a relatively low cost (Green, 1).

It encourages efforts for green buildings and renewable energy installations with the help of initiatives. One initiative is the Large Onsite Renewables Initiative. The MTC has committed $8.9 million over the next three years to expand the production and use of renewable energy technologies in Massachusetts. Through the Small Renewable Initiatives, applicants can receive rebates of up to $50,000 for design and construction of renewable energy projects that are up to 10 kilowatts and located at residential, commercial, industrial, institutional, and public facilities that will consume 90% or more of the renewable energy generated by the project on-site (Campbell, 2).

Another initiative under this program is the Green Schools Initiative. The goal of this initiative is to encourage school districts to construct or renovate school buildings that will cost less to operate and will provide healthier learning environments for students. An example of this initiative is the Whitman-Hanson regional school district, which created a green high school. Some of the green energy features include a 49.5 kW solar system mounted on the gymnasium roof and a 10 kW wind turbine erected on site to generate power for the school. Also, a storm water recycling system will collect rainwater from the school roof, funnel it to a 20,000 storage tank, and use it for sewage conveyance (Campbell, 2).

Industry Support Program

A third program supported by the MRET is the Industry Supply Program. Its goal is to advance the economic development in the Renewable Energy industry in Massachusetts, by promoting the development of technologies that lays the foundation for long-term growth of the industry. The program makes direct investments to help companies acquire capital and other resources to improve their way of generating renewable energy (Industry, 1).

One of the program's initiatives includes the Sustainable Energy Economic Development (SEED) Initiative. It was started to provide capital on affordable terms for companies undergoing new product development who are at the stage between research and design and the marketplace. Eligible companies are Massachusetts-based and provide products or services related to energy from biomass, fuel cells, photovoltaic (PV), wave, tides, hydropower, and wind. Awards range from $50,000 to $500,000. BTU International, Inc based in N. Billerica, received a SEED award to develop a materials system for intermediatetemperature solid oxide fuel cells, in partnership with Boston University. Ze-Gen, Inc. of Canton, MA also received a SEED award for developing an advanced biomass gasification technology that can turn organic and inorganic waste into a synthetic fuel for power generation and other recycled products (Campbell, 3).

Policy Unit

The last program is the Policy Unit. This program increases the availability, use, and affordability of renewable energy by collaborating with interested people to address market and regulatory barriers facing renewable energy technologies and installations. The electricity market in Massachusetts is subject both to state and regional regulation and to market rules. The MRET helps companies to deal with the legislature and get around any barriers (Policy, 1).

Through these four programs and their initiatives, it is evident that the MRET is creating an impact on the renewable energy industry. It is funding various projects that create green powered buildings, aid in the creation of renewable energy generation facilities, and help initiate new technology that will further expand the industry. Overall, the MRET, along with the RPS, is creating a small, but important, mark on the green power industry.

Conclusion

From its humble beginnings of dimly lighting streets and attracting consumers to department stores, electricity has grown into a human necessity. Our day to day lives depend on the availability of this precious commodity. But no one ever really stops to think about it until it isn't there, or unless it is too expensive. These are the two issues the electric restructuring set out to prevent

First and foremost, electric restructuring had the aim of protecting consumers from price gauging from monopolized control of the electric industry. The best way to accomplish this was by eliminating the electric monopolies. Early in the previous century this approach would have been unthinkable, there was clearly too much information to keep track of and distribute for electricity to be left to the free market. It just made more sense to let one company take care of it all to ensure that the lights stay on. But today, with the advent of computer technology and the internet, it is no longer a problem to manage and track electricity prices anywhere on the grid, which called into question the necessity of having monopoly control of the electric industry. By transitioning the industry from the monopoly system to a free market the power to set prices was no longer in the hands of a company, but rather determined by supply and demand. The most important aspect of that change was the sale of assets. Neither the government nor the utilities could come up with a good value for the assets, so they decided to put them on the open market and let that sort the value out (rather than ceding them to the government and letting the government sell them and return the profits...). Overall the transfer of assets was completed on or before 2002 for all but 2.75% of the generated electricity. If the only metric for success was the sale of the generation capacity to independents then restructuring was a resounding success.

The restructuring of the electric industry in Massachusetts had nothing but positive repercussions. Even from the beginning in March of 1998, rates were already regulated to decrease 15%. As of late, primarily the last few years, the electric industry has received much criticism. This, however, is not due to the deregulation itself, but due to the cost to produce electricity.

Since deregulation made generation competitive, allowing customers (mainly large companies) to choose generators, prices were theorized to go down. This goes with the concept of supply and demand within a capitalistic society. In actuality, and with regulation from ISO New

England, generation was not going down as much as the actual mark up in delivery. Many generators are not licensed as competitive suppliers, and therefore sell electricity through other companies, default service, or electric brokers, and, as a result, the mark up from wholesale (generation) to retail (competitive suppliers, etc.) went down.

All in all, deregulation broke up the industry and made the companies along the way more efficient. With regulations still in place on distributors and transmitters, the only way to increase profit was to become more efficient. Previously in the monopoly system of the utilities, companies would merely carry over the inefficiencies and price increases to customers. So, this goal of restructuring was met.

It is clear that the true cause of high electric rates is the high cost of fossil fuels. The explosion in the cost for oil and natural gas has occurred at the same time that the electric restructuring effort is taking place. Add to this the fact that the general public is more or less oblivious to how the industry is actually changed, and people start blaming the rising cost of electricity on the restructuring effort, when really they are being protected by it. In the summer of 2005, the cost for gasoline rose above $2.50 per gallon. Under the old monopoly system, a utility could file with FERC, and in Massachusetts the DTE, to charge a higher rate to compensate for the higher cost of fuel, except that when the price spike eventually fell the rates would not have (Roughan). With the prices now controlled by the free market the price for electricity would have fallen immediately.

The other objective the restructuring effort set out to accomplish was making sure the lights stayed on not only in the short term, but also in the long run. In order to do this, the possible threats to the stability of the industry had to be identified. The greatest threat to the industry is the dependence of non-domestic sources of non-renewable energy. There is only a fixed volume of crude oil contained inside the Earth, and every gallon that is pumped out brings the world slightly closer to having none left. Also the majority of the oil is contained in politically unstable parts of the world, and like the OPEC embargo of 1973, these governments could stop selling their oil at any time. The only solution to this dilemma is for the country to start working on producing one-hundred percent of its power independently, and from entirely renewable sources.

To an extent, the goals of the renewable energy clauses in the deregulation act are being met. While individual distributors may fall short of projected production percentage requirements, the ultimate goal of the renewable energy clauses was to initiate the inclusion of renewable energy as a permanent staple in the overall market, and for the rapid development of newer and/or better technologies that are quickly assimilated into the market. Energy farms like the Cape Wind and Wellspring projects are excellent advancements, regardless of the political issues that may hinder their success. They hint at the possibility of creating a less fossil-fuel dependent nation, a cleaner environment, and provide examples of what can be accomplished when circumstances make it necessary. Massachusetts, and similarly the United States as a whole, is on the verge of what may be called the next industrial revolution- converting to sustainable energy. With more legislation requiring larger percentages of renewable energy, the process can only accelerate. The current legislation has proven greatly beneficial to renewable energy providers as well as the environment. Consumers have yet to see the direct benefits, but so long as the requirements placed on distributors and generators continue to increase, consumers will eventually reap the benefits.

Public demand for, intelligent investments in, and sound policies regarding renewable energy are the key.

The Renewable Portfolio Standard (RPS) is helping to expand the green power industry; however, it is not moving as fast as the DOER had planned. From 2003 to 2004, there should have been an increase in renewable energy sales of 50%, but it was really only 22%. It is too early to say that the program is failing. Since the RPS only began in 2003, the demand is greater than the current supply of renewable energy. Over the next few years, the DOER feels that the supply will increase enough to meet the year-to-year increases (50% increase each year). Considering these problems, the RPS is initially helping to further the industry.

The Massachusetts Renewable Energy Trust (MRET) is also aiding in the expansion of the green power industry. Through its various initiatives, the MRET is funding renewable energy projects around the state. As with the RPS, the MRET has not made any major immediate effects on the industry, but it is slowly increasing awareness and the supply of the green power industry.

The integration of renewable sources of energy into our national energy portfolio is being met with resistance because it is initially far more expensive to produce then burning fossil fuels. But there is a very long way to go before America's energy troubles can be solved by renewable sources. If we do not start moving toward this ideal now, then there might not be enough time to become fully independent before the oil runs out.

After all is said and done Restructuring has accomplished its two goals: the price of electricity is as close as possible to the cost of fossil fuels, and renewable energy sources are being researched, developed, and implemented more every day. Because of this it is clear the electric restructuring effort has been and will continue to be a success.

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Appendix A: Interview 1

Interviewee: Louis A. Frate
Date: 2/24/06
Title/Position: CEO and Founder
Phone: 781.376.1888
Other Contact Info: lfrate@patriotenergygroup.com
Place of Work: Woburn, MA
Duration of Employment: Founded company four years ago with partner working with ever since.

- ◊ 220 CMR - DTE - Deregulation ----- look into!
  - ✓ http://www.mass.gov/dte/electric/99-38/reg.htm
  - ✓ http://www.mass.gov/dte/restruct/96-100/cmr11-2.pdf
- ◊ Also tip - compare to Texas - which worked and CA - which didn't work - tried to cap prices, generators were losing money, shut off power

1. **Are you familiar with the Deregulation Act of Massachusetts?**
    - Yes familiar with it - had experience in telecommunications, partner with energy
    - When deregulation happened saw opportunity to make money started company
2. **What is your opinion of the act and deregulation as a whole?**
    - Would not have a company if wasn't for
    - Deregulation should develop technology
        - ♦ Bring down price and demand is way to go - demand goes down price has to do (Supply and demand)
        - ♦ Makes people be more efficient - less electricity use
3. **Who are your customers? (Residential, commercial, industry, all)**
    - Customers include Residential, commercial, and industry, mostly commercial and industry.
    - Six Flags, Municipals, Sudbury
    - Shields MRI
    - WB Mason
    - Property Management Comp.
        - ♦ Need to ask in order to put into paper

4. **What role does your company play in delivering electricity to consumers?**
    - Electric broker & competitive supplier - only company in Massachusetts to have both licenses
    - Broker - arranges deal gets commission from generator who gets paid from consumer
    - Competitive Supplier - buys energy then sells it, takes title of electricity, owns it, then sells it to make profit on
    - Buys power off of market__ Call ISO for numbers
        - Interface with generators
        - ISO tells generators how much to make, need more, etc
        - ISO are managers of electricity market
5. **What role do you play in delivering electricity to consumers?**
    - Electric industry - change like stock - all the time
    - By from ISO - called SPOT PRICE - spot market flat
    - Or make deals - like him
    - Go to generator make deal and use ISO to get
    - Buy wholesale
    - Bilateral: start off with generator/wholesale then goes to ISO then him
    - Generator could sell electricity - but needs to have competitive supplier license!!!!
6. **Do your customers all pay the same rate?**
    - Why or why not?
    - Like Stock market changes
    - In New England Natural Gas dependency typically drives the market
    - What competition and deregulation does is squeeze margin
        - Going to pay wholesale no matter what, that is what affected by Natural Gas
        - But, retail is driven down by competition
    - Way ISO works is that it sets the market - does so with person highest cost to dispatch
        - Overseas grid and provides stability to six NE states
        - Also regulates rates at which generators can sell power to transmission companies
        - (http://www.masstech.org/cleanenergy/energy/delivery.htm)

- If gas if most expensive and coal is cheap, why would coal sell cheap, would sell just short of gas and make more money
- So If gas is expensive other sell around that price, even if lower to make more
- Diversifying will drive down market
- With new technologies people can't make up mind go easy already done – gas
- Patriot Energy buys from generator, could go with others besides gas
-

7. **What is some of the history behind your company – mergers, movement? (Has your company changed for the better since 1997 – have you grown or decreased in size?)**
    - Growing – started out of bedroom in apt to call businesses
    - Not owned by big company – like utilities/distributors
    - National Grid – had to sell off generators, only can make money off of transmission wires – and that is regulated by government
    - Utilities regulated by law- have to buy a certain way
    - Can't make money only over transmission
    - Analogy Car dealership – he is car dealer
    - Has 15 Employees currently in company – also by looks of office getting bigger, changing around moving – person applying for job while waiting for interview
    - Company currently does around $200 million business a year
8. **Company Plan?**
    - Patriot Energy looks at how company is going to use power
    - When will electricity demand peak for that company, is it going to use a lot of power over a small amount of time
    - Get rates to the companies need – best price over that time – buy, sell, etc.
    - All about the commodity of <u>electricity and risk management</u>
9. **What or who is your primary competition?**
    - Primary competition is Utility

- Basic Service – for customers utility either buys 2 year or 4 year agreement
  - ♦ Does so like mortgage, buy over time
  - ♦ One fixed price – buy at such and such rate, doesn't change
  - ♦ Could get lucky and buy at low & lock price – risk involved
- Basic Service – says to generator/competitive supplier – what is cheapest rate, people bid on basic service until can't make money or go lower
- Utility then takes lowest price and that person has contract for basic service at fixed rate for 2 or 4 years

10. Can you recommend anyone else in or out of your company that I can interview about other deregulation material?

- Gave us some names of people at National Grid and ISO New England, currently working on contacts already established
- If current contacts don't work, try to get in touch with people Louis mentioned

Appendix B: Interview 2

Interviewees: Scott McCabe & Tim Roughan
Date: 3/22/06
Title/Position: Senior Analyst (Rate Department) & Director of Distributed Resources
Phone: 508.421.7510
Other Contact Info: timothy.roughan@us.ngrid.com
Place of Work: Northborough, MA
Duration of Employment: Scott - approximately 5 years (Post deregulation) & Tim - Since he graduated from WPI, so around 25 years

- Italicized sections are the written responses we obtained from National Grid's employees
- We also had personal conversation with both interviewees

1. **Are you familiar with the Deregulation Act of Massachusetts?**
    •
2. **What is your opinion of the act and deregulation as a whole?**
    - *National Grid is a proponent of deregulation. National Grid is very committed to seeing the energy supply market develop so that customers can shop for their electric power supply. The Company wants the competitive energy supply market to develop and wants customers to shop for power supply opportunities.*
    - National Grid encourage customers to go to Competitive Supply
        - ♦ Hold seminars, medium and large customers
    - Still debate - more structured now
    - Success of deregulation same as company
3. **Who are your customers? (Residential, commercial, industry, all)**
    - *National Grid provides electricity delivery service to 1.2 million customers in 168 Massachusetts communities. The Company serves residential and business (commercial and industrial) customers. Roughly 90% of National Grid's customers are residential and the remaining 10% are business customers.*
    - For cities, like Marlborough is trying to do, to become aggregation municipal, must be approved from DOER

4. **What role does your company play in delivering electricity to consumers?**
   - *National Grid is an electricity distribution company. A distribution company owns and maintains the wires and associated facilities that transport electricity from distribution substations to customers' facilities and homes. Since the changes made to the electric industry in 1998, the Company delivers the power to customers' doorsteps over distribution lines, but no longer owns power generation facilities. Customers now have the3 option to purchases energy supply from alternative competitive power suppliers. The Company continues to secure power supply from independent power suppliers until these customers chose a competitive power supplier. Customers that received power from National Grid are called Basic Service customers.*
   - National Grid - Distribution & Transmission
     - ♦ Mass. Elect - Distribute
     - ♦ New England Power - Transmission
5. **What role do you play in delivering electricity to consumers?**
   - Work on rates - each utility calls tariffs - all rates are online
   - This year distribution rates will probably go down - annual discussed right around March 1st
   - Same with Transmission rates
6. **Do your customers all pay the same rate?**
   - Rates might be going down from 10.77 kWh to 9.7 kWh
   - *No, the Company offe3rs different rates for various classes of customers. Most of the Company's residential customers are on the standard residential rate, Regular Residential (R-1). However, the Company does offer come specialized rates for time-of-use, (R-4) and low-income (R-2) customers. In addition, the Company offers several different types of rates/prices for our business customers based on the amount of energy that they use. The General Service (G-1) rate is for small commercial and industrial customers with average usage less than 10,000 kWh per month or 200 kW of demand. The Demand (G-2) service rate is designed for commercial and industrial customers with average use exceeding 10,000 kWh per month and demand not exceeding 200 kW. The Time-of-Use (G-3) service is primarily available for large commercial and*

industrial customers with demand greater than 200 kW.

- Rate classes – low income rates – socialized rates – all people need electricity
- Default Service (Called "Last Resort" in RI)
    - ♦ Customers either competitive or default
        1. Month of 3 res. Rates
            a. Residential: 2% & 2% load go to market
            b. Only two compete in Nat. Grid. Dominion and MX energy
            c. Dominion make good offer lot of people jumped (like from National Grid)
        2. Small commercial (CI)
            a. 8% & 13% load to market
        3. Medium
            a. 36% of customers & 36% load go to market
        4. Large bus. Customers – biggest beneficiaries of deregulation
            a. 65% of Large Customers are with competitive suppliers
            b. 77% of entire electricity load goes to competitive suppliers
    - ♦ Basic Service:
        1. Smaller – quote for 6 months, then bids
        2. Larger – quarters or 3 months, then bids

7. **What is some of the history behind your company – mergers, movement? (Has your company changed for the better since 1997 – have you grown or decreased in size?)**
    - *The New England Electric System (NEES) divested generation in 1998*
    - *National Grid acquired NEES on March 22, 2000*
    - *National Grid acquired Eastern Utilities Associates on April 19, 2000 (188,000 customers in MA, 12,000 in RI)*
        - ♦ *Subsidies:*
        - ♦ *Easter Edison – MA*
        - ♦ *Newport Electric, RI*
        - ♦ *Blackstone*
    - *National Grid acquired Niagara Mohawk on January 30, 2002 (1.5 million electric customers, 540,000 natural gas customers)*

- *National Grid announced plans to acquire New England Gas Company on February 16, 2006 (245,000 natural gas customers)*
- *National Grid announced plans to acquire Keyspan on February 27, 2006 (2.6 million natural gas customers, 1.1 million LIPA(Long Island Power Authority) electric customers)*
- If Keyspan is approved National Grid will be the 3rd largest Utility in the USA

8. How does your company operate?

-

9. What or who is your primary competition?

- *Distribution service remains a monopoly service provided exclusively to customers in a particular service territory by the local electric company which is referred to as a distribution company. Rates for distribution service continue to be fully regulated by the Department of Telecommunications and Energy at levels that allow each distribution company a reasonable opportunity to recover the costs it incurs in providing this service to its customers. As a distribution company, National Grid doesn't have competition.*
- *However, since March 1, 1998, customers have been able to purchase their energy supply from competitive energy suppliers. Choosing who supplies the energy that the Company delivers to homeowners and businesses provides them with an important opportunity to take better control over their energy costs. The Company encourages customers to consider all available energy supply options and determine which one best meets their needs.*
- *National Grid has provided list of competitive suppliers*
-

10. Are you into Green Power/or does your company have to look into it?

- *National Grid offers a renewable energy program called GreenUp. As mentioned above, the Company is very committed to seeing the energy supply market develop. The Company sees GreenUp's options as another opportunity to encourage the further development of the power supply market and, in this case, renewable energy sources. GreenUp allows customers to choose to have all or part of their electricity generated from renewable resources-while* *keeping the Company as their electricity supplier. The Company continues to issue the bill and provide customer service. By enrolling in GreenUp and purchasing a product from one of the participating GreenUp renewable energy companies, customers are:*

- ♦ *Supporting the development and generation of renewable energy (wind, solar, biomass, and hydro) in their community.*
- ♦ *Helping to offset the environmental impact of the production of electricity from coal, gas, and nuclear energy.*
- ♦ *Taking responsibility for their environment.*

•

11. (If familiar with bill) Can you explain all of the charges a typical resident will see on a monthly bill?

- *National Grid's service bills are "unbundled," or itemized. The total bill is broken out into separate line items for various services so customers can see the costs for such services.* National Grid provided a sample bill.
- DSM – stands for Demand Side Management
    - ♦ Money allocated for Electricity use efficiency

12. Other facts out of interview:

- G,T,D – all unbundled in MA – other NE states might be different some might have G unbundled but not T and D

13. Tim's Interview:

- 1982 grad of WPI
- Was a liaison with large companies
- ****Reasons behind deregulation – companies behind like Raytheon – big and wanted it
    - ♦ Thinking about moving out if State didn't get lower rate for electricity
    - ♦ Saw wholesale half price as retail – want wholesale price
- Even though rates have gone up, need to look at things like inflation
    - ♦ Comparatively deregulation was definitely a success, especially now
    - ♦ Natural Gas driving up price not restructuring
- Competition is really for big industry
    - ♦ Comp. Supp – like because can find out when use and how much
        1. Steady and reliable

- The Volatility is associated with Natural Gas
    - ♦ Because all new generation is natural gas
        1. 1/3 or 40% of all… is natural gas
- Tim: works with companies shows what happens with deregulation, explains
- ISO – provide programs – if manage load get paid money
    - ♦ Respond to peak load get money
    - ♦ Tim teaches customers how to manage load
        1. Saves a lot of money – commodity supplier will drop rates if customer help and drop load during peak
        2. Residential can't do this!
    - ♦ Use to have off peak rates 30 years ago, now regulated and stopped
- ALL ABOUT SUPPLY AND DEMAND
- National Grid currently has 1.2 million MA customers
    - ♦ 90% are Residential - 10% Business
    - ♦ 50% of load is Res. 50% is C.I.
    - ♦ Dominion is now small C.I. "just take time"
- Rate freeze from restructuring – all people saved $
- "More efficient that market broken up" – accountability and only way for company to make money is to be more **efficient**
    - ♦ Used to be – Utilities – something cost money, just passed cost on to customers – didn't think twice about it
    - ♦ Now – If do bad job to customers penalized by DTE as distribution
    - ♦ Transmission – FERC manages since interstate
- DTE – before 97 all go through or fed. Reg.
- Use same wires– more efficient – means that even though broken up use one distributor because don't need three different lines on same street for three different companies
- TRANSITION COST:
    - ♦ Attributed to stranded cost that happened when forced to sell off power plants
    - ♦ Lost money – negotiated transition – cost goes down and depreciates
    - ♦ National Grid got 2 billion for all generation
- Decommission – Transition always be there, because of Nuclear – cost of disposable etc

- Deregulation also cut rates 15% to utilities - make them more efficient
- ISO
    - Utilities market ISO programs
    - Do a lot with ISO
    - All members of ISO
        1. All on committees
    - ****NEPOOL member if want to buy energy from ISO
    - To buy off of ISO need NEPOOL
        1. People like Pat energy and some big companies
- 200 customers have own generation - big users
    - Get around 40% generation
    - Utilities manage that
- Restructuring also make customers interconnect to generate own power!! Good thing
- Dominion - Volume - more money in big companies - more money to spend in offering to small C.I.
    - Big problem with residential level - much more in customer service costs
- Agrees that - Should diversify generation - not just natural gas
    - Problem comes to environment
- Peak hour - everybody pay high dispatch
- Not Peak hour - everybody pay low dispatch
- Restructuring also clean the environment - made first investors go bankrupt…but
    - Old plants gone + now cleaner
    - MORE EFFICIENT!!!!!!
- National Grid 30% less people working in Northborough facility since 1997
- Old - regulators - convince needed money
- But residential $ go down + up like other commodities
- Can look in rates lucky
- More choices - default drop
- DEREGULATION: JUST TAKES TIME!!!!!

MA Megawatthours
Total Electric Power Industry

Year	Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
1990	11,365,893	15,101,792	6,132,702	830	5,069,620	579,659	1,560,515	0	39,811,011
1991	11,985,593	16,159,825	6,329,862	800	4,416,611	492,449	1,634,651	0	41,019,791
1992	11,064,697	13,726,316	8,479,397	0	4,741,968	362,171	1,713,106	0	40,087,655
1993	9,930,394	11,591,852	9,050,108	0	4,338,685	203,564	1,964,605	0	37,079,208
1994	10,320,147	10,098,641	11,319,676	0	3,858,569	291,821	2,050,210	0	37,939,064
1995	10,698,263	6,151,495	14,235,010	0	4,485,845	62,446	2,021,422	0	37,654,481
1996	11,580,771	6,516,883	11,929,508	0	5,324,341	530,658	2,071,848	11	37,954,020
1997	12,526,456	11,812,417	13,626,170	0	4,310,431	543,509	2,146,345	0	44,965,328
1998	11,199,758	14,534,366	11,621,828	0	5,698,414	574,156	2,055,094	0	45,683,616
1999	11,169,847	11,241,950	11,104,399	0	4,518,426	505,201	2,035,569	0	40,575,392
2000	11,154,272	8,762,669	10,707,072	0	5,512,255	364,795	2,196,818	0	38,697,881
2001	11,051,333	8,511,572	11,697,004	0	5,144,033	-8,844	2,083,336	0	38,478,434
2002	11,502,861	6,800,295	15,868,975	0	5,768,766	20,146	2,050,777	3,869	42,015,689

USA Megawatthours
Total Electric Power Industry

Year	Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
1990	1,594,011,479	126,621,142	372,765,154	10,382,830	576,861,678	289,358,105	64,372,226	3,615,663	3,037,988,277
1991	1,590,622,748	119,751,573	381,553,017	11,335,593	612,565,087	284,452,754	68,779,264	4,738,849	3,073,798,885
1992	1,621,206,039	100,154,163	404,074,372	13,270,237	618,776,263	248,911,421	73,769,822	3,719,887	3,083,882,204
1993	1,690,070,232	112,788,180	414,926,798	12,955,798	610,291,214	276,458,436	76,213,282	3,487,156	3,197,191,096
1994	1,690,693,864	105,900,983	460,218,682	13,319,051	640,439,832	256,747,908	76,535,143	3,666,925	3,247,522,388
1995	1,709,426,468	74,554,065	496,057,945	13,869,951	673,402,123	308,107,617	73,965,385	4,103,808	3,353,487,362
1996	1,795,195,593	81,411,225	455,055,576	14,355,813	674,728,546	344,073,985	75,795,604	3,571,279	3,444,187,621
1997	1,845,015,736	92,554,873	479,398,670	13,350,634	628,644,171	352,413,390	77,182,819	3,611,990	3,492,172,283
1998	1,873,515,690	128,800,173	531,257,104	13,492,230	673,702,104	318,868,381	77,088,406	3,571,410	3,620,295,498
1999	1,881,087,224	118,060,838	556,396,127	14,125,592	728,254,124	313,439,130	79,423,002	4,023,773	3,694,809,810
2000	1,966,264,596	111,220,965	601,055,493	13,954,758	753,892,940	270,033,737	80,907,444	4,793,914	3,802,123,847
2001	1,903,955,943	124,880,222	639,129,120	9,039,473	768,826,308	208,137,599	77,985,057	4,689,931	3,736,643,653
2002	1,933,130,354	94,567,394	691,005,745	11,462,686	780,064,087	255,585,905	86,922,092	5,713,990	3,858,452,253

Electric Generators, Electric Utilities

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
11,273,069	14,556,403	5,279,993	0	5,069,620	299,525	0	0	36,478,610
11,861,344	15,612,257	3,679,433	0	4,416,611	232,713	0	0	35,802,358
10,949,228	13,282,101	3,750,925	0	4,741,968	114,079	0	0	32,838,301
9,815,909	11,112,574	2,897,352	0	4,338,685	0	0	0	28,163,544
10,209,727	9,561,302	3,736,177	0	3,858,569	100,274	0	0	27,466,049
10,586,608	5,848,663	6,206,477	0	4,485,845	0	0	0	26,971,667
11,500,536	6,221,378	4,449,799	0	5,324,341	262,823	0	0	27,758,877
12,488,802	11,586,081	5,213,021	0	4,310,431	300,362	0	0	33,898,697
8,168,608	10,019,730	1,818,857	0	5,698,414	331,272	0	0	26,036,881
1,073,628	300,040	865,627	0	1,930,943	189,273	0	0	4,359,511
1,094,848	123,931	307,009	0	0	178,865	0	0	1,704,653
1,096,681	131,797	218,432	0	0	119,581	0	0	1,566,491
0	220,435	728,570	0	0	207,646	0	0	1,156,651

Electric Generators, Electric Utilities

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
1,559,605,707	117,016,961	264,089,401	0	576,861,678	279,925,918	10,651,344	0	2,808,151,009
1,551,166,838	111,462,979	264,171,598	0	612,565,087	275,519,186	10,137,177	0	2,825,022,865
1,575,895,394	88,916,308	263,871,508	0	618,776,263	239,559,447	10,200,231	0	2,797,219,151
1,639,151,186	99,538,857	258,915,301	0	610,291,214	265,062,757	9,565,451	0	2,882,524,766
1,635,492,971	91,038,583	291,114,905	0	640,439,832	243,693,113	8,932,675	0	2,910,712,079
1,652,914,466	60,844,256	307,306,050	0	673,402,123	293,652,709	6,408,988	0	2,994,528,592
1,737,453,477	67,346,095	262,729,781	0	674,728,546	327,969,977	7,214,276	0	3,077,442,152
1,787,806,344	77,752,652	283,624,806	0	628,644,171	337,233,538	7,461,633	0	3,122,523,144
1,807,479,829	110,157,895	309,222,404	0	673,702,104	304,402,562	7,205,997	0	3,212,170,791
1,767,679,446	86,929,098	296,381,322	0	725,036,130	293,931,583	3,715,971	0	3,173,673,550
1,696,619,307	72,179,917	290,715,178	0	705,432,806	248,195,153	2,241,015	0	3,015,383,376
1,560,145,542	78,907,846	264,433,673	0	534,207,221	190,099,503	2,151,888	0	2,629,945,673
1,514,669,950	59,124,871	229,639,287	206,469	507,379,828	234,868,262	3,568,503	0	2,549,457,170

Electric Generators, Independent Power Producers

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
0	8,101	6,403	0	0	268,881	1,445,924	0	1,729,309
0	9,356	6,901	0	0	248,483	1,507,484	0	1,772,224
0	8,494	130,215	0	0	231,815	1,569,996	0	1,940,520
0	13,938	391,370	0	0	194,017	1,798,283	0	2,397,608
0	13,651	873,244	0	0	184,473	1,866,608	0	2,937,976
0	26,293	1,488,161	0	0	207,516	1,855,207	0	3,577,177
0	27,753	917,178	0	0	248,266	1,920,654	0	3,113,851
0	25,441	1,316,158	0	0	225,849	1,992,093	0	3,559,541
2,993,455	4,254,413	3,128,857	0	0	231,576	1,991,880	0	12,600,181
10,061,677	10,674,792	3,425,699	0	2,587,483	304,190	1,948,803	0	29,002,644
10,026,899	8,347,847	4,075,402	0	5,512,255	173,622	2,021,657	0	30,157,682
9,908,459	8,012,568	5,349,343	0	5,144,033	-136,664	1,898,005	0	30,175,744
11,470,817	6,216,041	8,892,923	0	5,768,766	-197,288	1,867,877	0	34,019,136

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
555,917	552,783	588,699	323	0	6,319,465	23,877,974	0	31,895,161
757,440	745,467	3,604,263	2,975	0	5,958,822	27,527,084	0	38,596,051
1,165,316	1,159,790	6,999,185	3,138	0	6,279,655	30,228,456	0	45,835,540
2,904,094	1,059,738	8,293,081	7,077	0	8,425,334	32,706,316	0	53,395,640
4,369,560	1,046,522	8,603,072	6,614	0	6,933,888	33,553,939	0	54,513,595
5,044,264	1,162,379	10,136,020	5,619	0	9,032,595	32,841,197	0	58,222,074
5,312,235	1,170,115	10,104,371	4,263	0	10,100,781	33,440,489	0	60,132,254
5,343,990	2,556,696	7,506,269	30,615	0	9,374,519	33,929,167	0	58,741,256
15,539,071	5,502,981	26,657,309	55,217	0	8,996,778	34,703,477	0	91,454,833
64,387,181	17,905,955	60,263,663	35,516	3,217,994	14,634,576	40,459,740	0	200,904,625
213,956,000	25,795,235	108,729,584	181,116	48,460,134	17,603,680	42,831,472	0	457,557,221
291,677,827	34,257,482	162,540,399	10,135	234,619,087	14,826,343	42,660,635	0	780,591,908
366,534,847	24,150,126	227,154,931	29,486	272,684,259	16,880,197	46,456,223	1,441,076	955,331,145

Combined Heat and Power, Electric Power

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
53,637	59,209	592,055	830	0	0	44,845	0	750,576
73,835	11,959	2,440,904	800	0	0	45,541	0	2,573,039
68,233	26,880	4,273,775	0	0	0	53,343	0	4,422,231
72,956	31,975	5,466,540	0	0	0	47,066	0	5,618,537
73,316	100,668	6,411,861	0	0	0	62,459	0	6,648,304
81,006	15,908	6,079,910	0	0	0	64,094	0	6,240,918
45,683	70,165	5,960,257	0	0	0	63,317	0	6,139,422
0	9,306	6,574,514	0	0	0	62,765	0	6,646,585
0	9,262	6,225,285	0	0	0	61,240	0	6,295,787
0	60,873	6,208,961	0	0	0	62,969	0	6,332,803
0	117,042	5,714,038	0	0	0	150,213	0	5,981,293
0	95,084	5,512,486	0	0	0	161,349	0	5,768,919
0	30,419	5,664,790	0	0	0	157,248	0	5,852,457

Combined Heat and Power, Electric Power

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
11,947,298	1,294,185	44,808,251	620,789	0	0	2,593,013	11,913	61,275,449
16,921,357	589,718	49,997,498	716,099	0	0	3,314,502	402,581	71,941,755
20,653,109	2,161,814	63,403,429	1,209,337	0	0	3,411,418	479,806	91,318,913
23,408,874	4,826,730	75,013,447	959,431	0	0	3,360,267	407,651	107,976,400
26,413,560	6,591,513	85,971,348	1,085,409	0	0	3,198,694	239,129	123,499,653
28,097,589	6,139,216	101,736,522	1,921,213	0	0	3,371,698	213,275	141,479,513
29,207,279	6,266,654	105,923,142	1,336,877	0	0	3,631,772	201,222	146,566,946
27,611,427	6,169,702	108,464,747	1,502,751	0	0	4,299,299	62,807	148,110,733
27,174,404	6,550,214	113,412,865	2,259,679	0	0	4,233,917	158,942	153,790,021
26,551,097	6,704,074	116,350,971	1,571,067	0	0	4,088,137	138,942	155,404,288
32,535,983	7,216,971	118,550,571	1,846,840	0	0	4,331,937	124,885	164,607,187
31,002,767	5,983,563	127,965,611	575,656	0	0	3,987,856	0	169,515,453
29,408,016	6,458,269	150,889,028	1,733,896	0	0	4,565,326	615,105	193,669,640

Combined Heat and Power, Commercial Power

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
0	292,307	13,540	0	0	0	8	0	305,855
0	271,959	36,318	0	0	0	17,580	0	325,857
0	153,053	136,870	0	0	0	27,731	0	317,654
0	134,511	144,538	0	0	0	16,038	0	295,087
0	151,209	145,880	0	0	0	17,350	0	314,439
0	124,358	252,345	0	0	0	49	0	376,752
0	31,973	405,458	0	0	0	0	0	437,431
0	76,686	270,717	0	0	0	0	0	347,403
0	135,447	221,182	0	0	0	1,974	0	358,603
0	105,181	298,624	0	0	0	23,797	0	427,602
0	91,658	309,597	0	0	0	24,948	0	426,203
0	130,545	403,671	0	0	0	23,982	0	558,198
0	189,088	356,327	0	0	3,831	25,652	0	574,898

Combined Heat and Power, Commercial Power

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
795,682	588,703	3,272,170	120,987	0	137,628	921,949	0	5,837,119
775,201	413,394	3,213,024	115,654	0	131,196	1,009,940	615	5,659,024
748,818	301,533	3,867,218	105,060	0	122,436	1,082,451	615	6,228,131
863,845	334,382	4,471,142	99,552	0	99,740	1,131,728	31	7,000,420
849,630	416,603	4,929,383	114,547	0	92,790	1,216,374	0	7,619,327
997,742	378,573	5,162,174	0	0	118,304	1,575,242	169	8,232,204
1,050,901	368,787	5,249,023	4	0	125,714	2,235,181	104	9,029,714
1,039,823	427,178	4,725,001	3,114	0	120,192	2,385,222	12	8,700,542
985,467	382,749	4,879,214	7,423	0	120,468	2,372,765	0	8,748,086
995,281	433,597	4,607,031	11	0	114,663	2,412,456	17	8,563,056
1,097,334	431,992	4,261,723	44	0	99,749	2,011,871	61	7,902,774
995,160	438,330	4,434,315	6	0	66,484	1,481,629	21	7,415,945
992,232	431,311	4,309,561	13	0	12,797	1,584,673	83,924	7,414,511

Combined Heat and Power, Industrial Power

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
39,187	185,772	240,711	0	0	11,253	69,738	0	546,661
50,414	254,294	166,306	0	0	11,253	64,046	0	546,313
47,236	255,788	187,612	0	0	16,277	62,036	0	568,949
41,529	298,854	150,308	0	0	10,523	103,218	0	604,432
37,104	271,811	152,514	0	0	7,074	103,793	0	572,296
30,649	136,273	208,117	0	0	10,856	102,072	0	487,967
34,552	165,614	196,816	0	0	19,569	87,877	11	504,439
37,654	114,903	251,760	0	0	17,298	91,487	0	513,102
37,695	115,514	227,647	0	0	11,308	0	0	392,164
34,542	101,064	305,488	0	0	11,738	0	0	452,832
32,525	82,191	301,026	0	0	12,308	0	0	428,050
46,193	141,578	213,072	0	0	8,239	0	0	409,082
32,044	144,311	226,364	0	0	5,957	0	3,869	412,545

Combined Heat and Power, Industrial Power

Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydroelectric	Other Renewables	Other	Total
21,106,875	7,168,510	60,006,633	9,640,731	0	2,975,094	26,327,946	3,603,750	130,829,539
21,001,912	6,540,015	60,566,634	10,500,865	0	2,843,550	26,790,561	4,335,653	132,579,190
22,743,402	7,614,718	65,933,032	11,952,702	0	2,949,883	28,847,266	3,239,466	143,280,469
23,742,233	7,028,473	68,233,827	11,889,738	0	2,870,605	29,449,520	3,079,474	146,293,870
23,568,143	6,807,762	69,599,974	12,112,481	0	6,028,117	29,633,461	3,427,796	151,177,734
22,372,407	6,029,641	71,717,179	11,943,119	0	5,304,009	29,768,260	3,890,364	151,024,979
22,171,701	6,259,574	71,049,259	13,014,669	0	5,877,513	29,273,886	3,369,953	151,016,555
23,214,152	5,648,645	75,077,847	11,814,154	0	5,685,141	29,107,498	3,549,171	154,096,608
22,336,919	6,206,334	77,085,312	11,169,911	0	5,348,573	28,572,250	3,412,468	154,131,767
21,474,219	6,088,114	78,793,140	12,518,998	0	4,758,308	28,746,698	3,884,814	156,264,291
22,055,972	5,596,850	78,798,437	11,926,758	0	4,135,155	29,491,149	4,668,968	156,673,289
20,134,647	5,293,001	79,755,122	8,453,676	0	3,145,269	27,703,049	4,689,910	149,174,674
21,525,308	4,402,817	79,012,939	9,492,821	0	3,824,648	30,747,367	3,573,886	152,579,786