ZAZ 0701

Finding Green Solutions for Nypro, Inc

A Major Qualifying Project

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Table of Contents

Table of Figures

Abstract

The primary goal of our project is to analyze Nypro's current expenses on clean-room supplies and energy consumption in order to find ways for reducing the costs and to support the company's green initiative. Through extensive data collection, in-depth cost examination, and series of what-if analysis, we are able to provide Nypro not only a clear understanding of their spend structures for these two areas, but also short- and long-term plans for Nypro to become green and cost effective.

Acknowledgements

We would like to thank our advisor, Dr. Amy Zeng, for overseeing and advising this project. Also, we are grateful to Mr. Seyed Raissi, our liaison at Nypro in Clinton, MA, for his guidance as well as support throughout the project. Lastly, we are indebted to Nypro and all of its employees that provided help in many ways, without which we could not have successfully completed this project.

1 Introduction

It is important for global companies who generate multiple products and a diverse network of buyers and suppliers to manage their facilities in a cost efficient manor. Nypro Inc. of Clinton, MA, a precision plastic injection molding company deals with thousands of plastics projects each year primarily in electronics and telecommunications, as well as in consumer and industrial fields. This includes packaging, healthcare, automotive and contract manufacturers. Nypro is faced with the on-going dilemma of keeping their logistics, energy and gas, and clean room costs organized and low through-out North America in order to efficiently operate their company.

In order to create a cost efficient atmosphere throughout the plant locations in North America it is imperative that information about the logistics, energy and gas, as well as clean room supplies is gathered from each plant in North America. This data will be analyzed in order to generate recommendations for improvement in cutting back on expenses and finding suppliers that are able to reach multiple locations.

Energy and Gas is an imperative expense for every Nypro plant. It is the basis of all functions and products that are the backbone of the company. The suppliers, total electric and gas cost, electric kilowatt hours and gas therms per unit, as well as kilowatt hours and therms usage per month will be analyzed in order to determine if there is a more suitable operation for regional gas and electric expenses.

Nypro Clinton also has a large clean room facility, which is one of 11 other plants in North America. This is a large industry for the company and being able to use one provider for all supplies can be a money saving asset. Each plant must purchase gloves, gowns, hair covers, beard covers, shoe covers, and other safety coverings in order to

operate properly. The annual spend of each clean room plant will be analyzed to determine if there are any regional suppliers that have the potential to be contracted for larger more efficient orders.

Through numerous processes such as cost-benefit analysis, cash flow analysis, what-if analysis, risk analysis, sensitivity analysis, and graphical and statistical data the information collected in all three categories will be intricately examined to create recommendations to lower costs. The analysis will provide sufficient information to lead to multiple avenues that the company can choose depending on their state at the current moment. The data will be used to create short term as well as long-term plans for the company to manage their expenditures in the most efficient way possible.

It is expected that a plan of action will be created for the future of Nypro Inc. to decrease logistics, energy and gas, and clean-room expenses. It will create detailed future options for Nypro to consider to condensed spending and reduce wasted transportation of supplies.

We have many goals for our project in hopes that it will help Nypro reduce their costs in the areas of energy and gas expenses and clean-room supplies. These goals are:

- Reduce the cost of clean-room supplies
    - Find the most cost efficient supplier within a possible region within the Americas
        - Find one supplier per region that can supply multiple plants
- Reduce single plant energy costs
    - Find a single supplier to supply multiple plants
- Reduce single plant gas costs

    - Only in plants that have gas
- Give Nypro recommendations according to historical data about gas and energy prices as well as potential fluctuation in gas and energy prices as shown through numerous research techniques
- Give Nypro recommendations according to clean-room data about which suppliers would be the most cost efficient for different regions across the Americas as shown through numerous research techniques

2 Literature Review

This section we are going to review the history of clean-rooms and how they are used within the workplace. Also, we will explain the history of gas and energy expenditures throughout similar global companies to Nypro Inc. Lastly, we will explain the purchasing strategies of Nypro and their buyer-seller relationship. This means we will go into detail about whether they have contracts with the companies they purchases both their supplies and energy from.

2.1 Purchasing Strategies

There are many methods that come about when dealing with purchasing strategies and they are broken up into different areas. The first major aspect of purchasing strategies is identification. The company needs to first identify the good that are going to be purchased and their demand. Whether these are a must have item or something they can get away without really needing. Secondly, you must determine the capability of the market. This means you must breakdown if your company is able to purchase a large order. Then, you need to determine what kind of company you are within the market. Whether you're a large company that someone wants to do business with or possibly a small company no one has heard of. Next, you need to assess your current buyers and strategies and see if this is working for the company. After you do that you can then break down the different ways to save the company money by recommending other purchasing practices.(http://www.qgm.qld.gov.au/04_services/purch_strat.htm)

2.2 Energy and Gas

The cost of energy and gas throughout a large, global company can become a strain on meeting budget prices. In order for a successful company to operate properly they must have energy and gas to run equipment, heat offices and warehouses, and simply keep lights on for suitable working conditions. The price trend of energy and gas prices in the United States has been growing in the past year as a result of many economic factors.

2.2.1 Gas Trends

Figure 1 (www.gasbuddy.com) shows the history and projections of gas prices from 2006 through 2007. This graph shows that gas prices rose drastically at the beginning of 2007 and have continually grown. There are many major economic factors that are the cause of these drastic increases in gas prices.

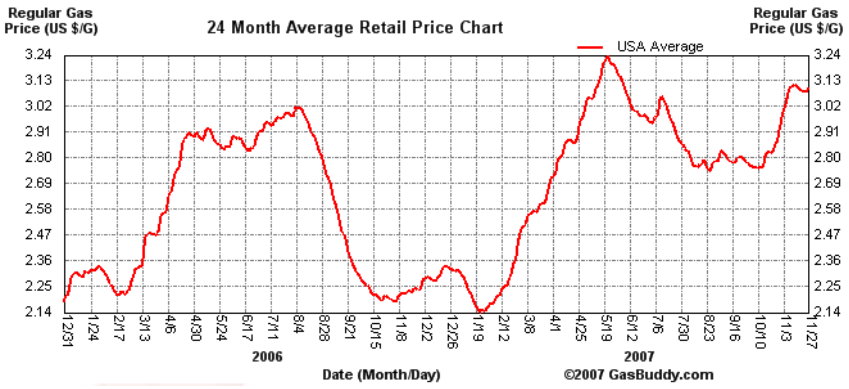

Figure 1: Average Retail Price Chart

Figure 2 (http://www.eia.doe.gov/oiaf/aeo/gas.html) shows the spot market prices for natural gas from 1990 and projections into 2030. This graph projects that gas prices will begin to decrease in the coming years and become steadier. In the 2007 reference case, lower 48 wellhead prices for natural gas are projected to decline from current levels to an average of $5.01 per thousand cubic feet in 2013, and then rise to $5.98 per thousand

cubic feet in 2030. Henry Hub spot market prices are projected to decline to $5.49 per million Btu in 2013 and then rise to $6.52 per million Btu ($6.33 per thousand cubic feet) in 2030. Figure 3 shows the natural gas prices by end-use sector. This graph shows that the price of gas for commercial and industrial use will just like the overall prices gradually decrease then become a steady rate.

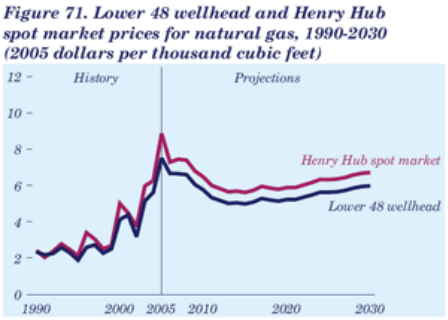

Figure 2: Prices for Natural Gas

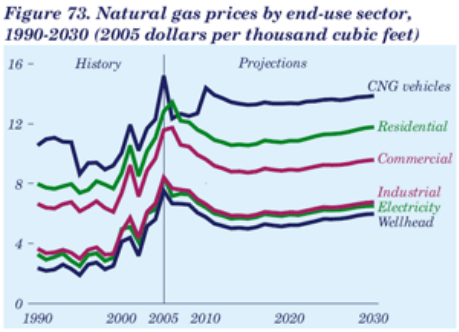

Figure 3: Gas prices by sector

The information of gas trends through historical data as well as future projections of prices and consumption is a driving factor in predicting the routes that companies should take in order to put themselves in the best position to forecast their gas expenditures and lower the cost.

2.2.2 Energy Trends

Figure 4 (http://www.eia.doe.gov/oiaf/aeo/electricity.html) shows the history and projections of energy prices from 1970 through 2030. This graph shows that energy prices have risen in the past but are projected to flatten out and become steadier with time. In the 2007 reference case, retail electricity prices peak at 8.3 cents per kilowatt-hour in 2006, then fall to 7.7 cents per kilowatt-hour in 2015 as new sources of natural gas and coal are being used. After 2013, fossil fuel prices rise at a slow rate but stay steady, and retail electricity prices also rise slowly after 2015, to 8.1 cents per kilowatt-hour in 2030. Customers in States with competitive electric markets are assumed to see changes in their electricity expenses more quickly than those in regulated States. It is projected that economic growth increases the consumption of electricity by businesses as they buy and use more electrical equipment. Figure 5 (http://www.eia.doe.gov/oiaf/aeo/electricity.html) shows the annual electric sales by sector; projecting that industrial buyers will be able to purchase electricity for a reasonable cost that is potentially the same price they are paying now as it will be in 30 years. Total electricity sales increase by 41% in the *2007* reference case, from 3,660 billion kilowatt-hours in 2005 to 5,168 billion kilowatt-hours in 2030. The biggest growth is in the commercial sector and electricity demand is projected to grow by 63% and 17% respectively in the industrial sector.

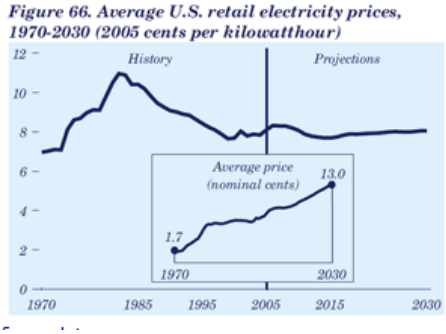

Figure 4: Retail Electricity prices

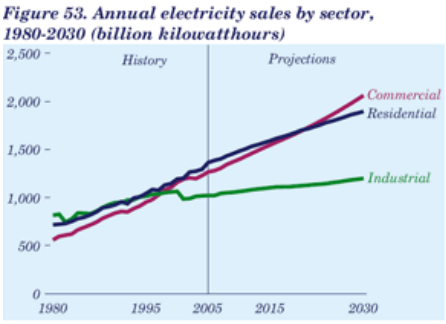

Figure 5: Annual electricity sales sector

The information of energy trends through historical data as well as future projections of prices and consumption is a main factor in determining the options that companies should choose to take in order to put themselves in the best position to forecast their energy expenditures and lower their costs.

2.2.3 Case Studies in Energy and Gas Reduction

There have been many case studies done showing the effects of companies who in many different ways have consciously put forth an effort to conserve energy and gas. These studies range from collaboration with the U.S. Department of Energy (DOE) to creating energy assessments and teams at different plants throughout global companies to implement energy saving projects. These projects include modifying natural gas pilots on boilers, recovering condensate, and repairing leaks in compressed air systems as well as many other energy efficient approaches. These projects have shown to save companies millions of dollars each year. Other companies are taking other routes to save

money on energy and gas expenses by creating contracts with their suppliers in order to set-up a fixed rate and devise certain payment options depending on the market that has the potential to be cost effective. Analysis will be done in numerous ways to determine what the most effective way is for Nypro Inc. to globally reduce their energy and gas expenditures. Cost flow analysis, cost- benefit, multiple risk analysis, and sensitivity analysis will provide the evidence to support the most appropriate decision.

A case study that was conduct at Formosa Plastics Corporation in Point Comfort, Texas is a good benchmarking study to compare tools that could be beneficial to Nypro Inc. Formosa is a company that manufactures and supplies plastic resins and petrochemicals for a multitude of products and processes as does Nypro. They are both global companies and use energy and gas for the same processes to develop their product. This means that their expenditures will be roughly similar and projects that helped Formosa reduce their energy and has expenses could be formatted to do the same for Nypro Inc. Formosa put together a team to create a plant-wide assessment that analyzed process energy requirements, reviewed new technologies for applicability and improved overall energy efficiency. The team was able to estimate the total annual energy savings would be about 115,000 MMBtu for natural gas and nearly 14 million kWh for electricity equaling a total annual cost savings of about $1.5 million. Another case study done at the U.S. Steel's (USS) Edgar Thomson Plant in Braddock, Pennsylvania created a team like Formosa plastics to define ways to lessen the expense of energy and gas but to begin with they hired a consultant to being the brainstorming process. They have so far completed 40 projects and saved about $2 million a year.

A third case study on the conservation of energy and gas was analyzed at Alcoa North American Extrusions. They are the world's leading producer of primary aluminum, fabricated aluminum, and alumina. The company is composed of 24 Business Units, with 103,500 employees at 215 operating locations in 31 countries. They are a global company like Nypro which make it easy to compare results because outcomes of annual saving differ drastically when the company is dealing with many different markets and cultural business practices. Alcoa North American Extrusions developed a corporate energy conservation program. They believe energy conservation is a way to eliminating waste and increasing sustainability. The energy-efficient production processes they created not only lessen the amount of money it costs to purchase energy, but also has benefits such as improved product quality, reduced equipment maintenance, reduced environmental contact. They set a goal to reduce their energy consumption by 15 percent annually. An energy alert program was created so that any conservation ideas could be quickly spread to all facilities. These alerts were sent electronically to all facilities and archived on the company web site. They developed a strong relationship with the Department of Energy and now because of their corporate energy conservation program they are able to save about $2.5 million annually.

2.2.4 Contracts

Another way to lower energy and gas cost for global companies is to create contracts with their suppliers. This is the most common solution to keeping to an energy and gas budget because they are able to calculate exactly what they will paying or have an average idea of what to expect when paying their bill. Some of the more used contracts are a fixed rate contract which allows the company to have a fixed price for gas

or electricity supply for a fixed period of time. The price and the term are set out in the contract. The price for gas supply will be fixed. The regulated charges from the utility may change if the regulator gives them permission. This type of contract gives the benefit of knowing energy costs for a certain period of time. When prices rise above the contract price it allows the company to benefit. The marketer is at no risk if prices rise because they buy a fixed price long term gas contract from the wholesale market. For companies who operate in certain drastic climates there are Weather Protection Contracts. The supplier will guarantee that the customer won't pay any more than a fixed dollar amount for their energy for the year. This is based on the customer's usage pattern over the past year and adjustments for weather. For example this contract type transfers the risk of a long cold winter to the energy marketer. It's a form of insurance for which the customer pays a small premium. Companied also have the option to create a fixed volume contract where suppliers pass the volume risk and some spot market exposure to the customer. A customer estimates their monthly consumption based on past years and any expansion plans. The supplier then contracts for that amount on the customer's behalf. The customer is financially responsible for differences between estimated and actual use bought for them on the spot market by the supplier. This spot market buying and selling happens for each hour by comparing actual consumption with the electricity purchased for that hour. There is also a contract called a structured block contract where the company can purchase a series of blocks of electricity to match as closely as possible the consumption of a facility. Electricity trades in blocks of a number of kilowatts for specified periods of time an example is:

7 × 24 - 7 days a week, 24 hours a day

5 × 16 - 5 days a week, 16 hours a day

These blocks are stacked to meet the electricity needs. Companies can also elect to purchase a single block contract which is technically a buying strategy more than a type of contract. It involves the purchase of a single block of electricity to cover the period of greatest electricity need, or to cover the period in which electricity is expected to be most expensive. For example, it could be the purchase of a 5 x 16 block to cover week day, daytime. Another type of contract is a blended rate contract that is a combination of a fixed and variable rate. Half of the rate is guaranteed for the term of the agreement, similar to a Fixed Rate, and the other half of the rate is variable. The variable portion is usually reset periodically based on market prices. The result is some protection against price increases, but some opportunity to benefit if prices decline.

3 Methodology

The goal of our project was to help Nypro Inc reduce their cost in both clean-room supplies and gas and energy expenses. By assessing Nypro locations within the America's we identified the key concerns and solutions to help reduce the cost throughout the Nypro Americas. Set procedures were designed in order to efficiently and properly analyze the gas, energy, and clean room situation at Nypro Inc. in order to effectively reduce costs in all areas. A meeting was conducted with Nypro employees who were sponsoring the project. They discussed their goals for the project and how they expected the analysis to be conducted.

A survey was used that had been previously created for help in the process of collecting gas and energy data. It was sent to all controllers in the Americas through an e-mailed hyperlink. The data was then saved on the company's inter-computer network called the Nypro Net. The final data entries were only allowed to be viewed by the project group. The survey encompassed questions such as average expenditures on energy and gas, amount of therms and kilowatts, billing patterns and contract types over the course of one year. An excel spreadsheet was also sent by e-mail to each controller which was set-up in order to analyze the past six months (May 2007- October 2007) of energy and gas consumption and costs. It asked controllers to share the information of their monthly gas and energy bills; such as the total bill amount, therms or kilowatts per month, and the price per therm or kilowatt. A deadline was set for the completion of the survey and spreadsheet. Any plant that did not meet this deadline was contacted first with a reminder e-mail and then a personal phone call in order to gather the information

needed. This data compiled provides a sufficient history of purchasing data for all plants in the Americas.

The U.S. Department of Energy analyzes the market each year and with historical data from past experiences in the energy and gas markets can project the turn the prices may take; this is for all purchasers, residential, commercial, and industrial. It was imperative that the information posed by the DOE was analyzed in comparison with the gas and energy data that was collected from Nypro's plants in order to make solid recommendations for the future of the company.

Next, methods of reducing gas and energy cost had to be reviewed, researched and analyzed to determine what the best route would be for Nypro Inc. would be. The first method that was reviewed was certain types of contracts that are offered by the local companies in each plants area that would help lessen the monthly costs of gas and energy. A major example would be creating a fixed rate contract for plants in the northern part of the Americas that endure cold winters. This would refrain from drastic pikes during the winter months and allow the company to maintain a steady expenditure they could count on each month. The next method was to look at the new types of energy sources such as green energy. Green energy is an environmentally safe way to produce energy and had the potential to be an economic factor for the company as well. At the moment for many companies it is an unconventional pattern of energy sources because it is still expensive and many times in order to utilize these green sources other energy adapters must be purchased and installed. It may also take time for the company to see its savings from green energy after they have expended much money into the process. The last method look at was finding suppliers that could support multiple plants in the same region. Nypro

has 17 plants throughout the Americas and a few that fall within the same boundaries of certain gas and energy companies. If these companies gain multiple contracts from a single company it can reduce the price per kilowatt or therm and create a buyer-seller relationship that can become cost-reducing for the company.

The methods used to compile data on clean room supplies and suppliers for Nypro Inc. were slightly different. In gathering this data, no survey and cumulative spreadsheet was sent out to employees. Instead, personal interviews were conducted. Nypro has 13 plants within the 17 that are operating in the Americas that have clean room plants. This made it easier to make personal contact with each controller at the 13 facilities and gain the information needed to analyze the situation. In each interview the controller was asked who their suppliers were and what types of supplies they purchased from each seller; also, the cost and number of each item they purchased and how often they placed these order.

Each seller of clean room supplies was researched. The main focus was to find suppliers who were able to efficiently and cost-effectively supply equipment to multiple plants. As with gas and energy, this can create a buyer-seller relationship where more contracts are being processed through one supplier and the goods are then able to be purchased at a lower cost. Not every plant orders the same products, but when dealing with the same seller it is easy to create shipment plans that are delivered on a consistent basis with certain specified items each time.

Next, spreadsheets were created in order to organize this data. They itemized each supply that was purchased and its cost compared to every other plant. Also, a yearly analysis was done per plant to determine the total cost per year on clean room supplies.

The billing patterns and calculated ordering times were also analyzed to find some type of shipping strategy that would be most effective for each plant.

This data compiled for energy, gas, and clean room allowed for the analysis of information in order to make recommendations on purchasing supplies effectively. This methodology was a project plan that leads to recommendations in reducing costs and finding ways to properly compile orders and shipments to make running a large global company more collected.

The project had six objectives. They were:

- Determined the different Gas and Energy consumptions within the Nypro America's by conducting a survey.
- Determine the different clean-room suppliers throughout the Nypro Americas.
- Conduct a financial analysis of gas and energy consumption.
- Conduct a financial analysis of clean-room supplies.
- Interviewed representatives from different plants to gain an understanding of their annual cost consumption of energy and gas.
- Interviewed representatives from different plants to gain an understanding of their clean-room purchases and supplies.

The methods that we implemented to accomplish these objectives were:

- Interviewed representatives on their current clean-room suppliers.
- Interviewed representatives on their current Gas and Energy supplier.
- Collected and analyzed clean-room purchases from 13 different Nypro locations within the Americas.

- Collected and analyzed gas and energy consumption from 17 Nypro locations within the Americas.
- Conducted phone interviews with managers from Nypro locations within the Americas.
- Designed an online survey that was conducted online
    - Replied by managers from Nypro locations within the Americas.
- Analyzed the online survey results into an excel file.

As stated in the Introduction, our project had many goals that we wanted to achieve in order to help Nypro. These goals are:

- Reduce the cost of clean-room supplies
    - Find the most cost efficient supplier within a possible region within the Americas
        - Find one supplier per region that can supply multiple plants
- Reduce single plant energy costs
    - Find a single supplier to supply multiple plants
- Reduce single plant gas costs
    - Only in plants that have gas
- Give Nypro recommendations according to historical data about gas and energy prices as well as potential fluctuation in gas and energy prices as shown through numerous research techniques
- Give Nypro recommendations according to clean-room data about which suppliers would be the most cost efficient for different regions across the Americas as shown through numerous research techniques

The techniques we used to complete this project were:

- Data Collection
- What If Analysis
- Microsoft Office expertise
- Forecasted market trends and made future recommendations from this analysis

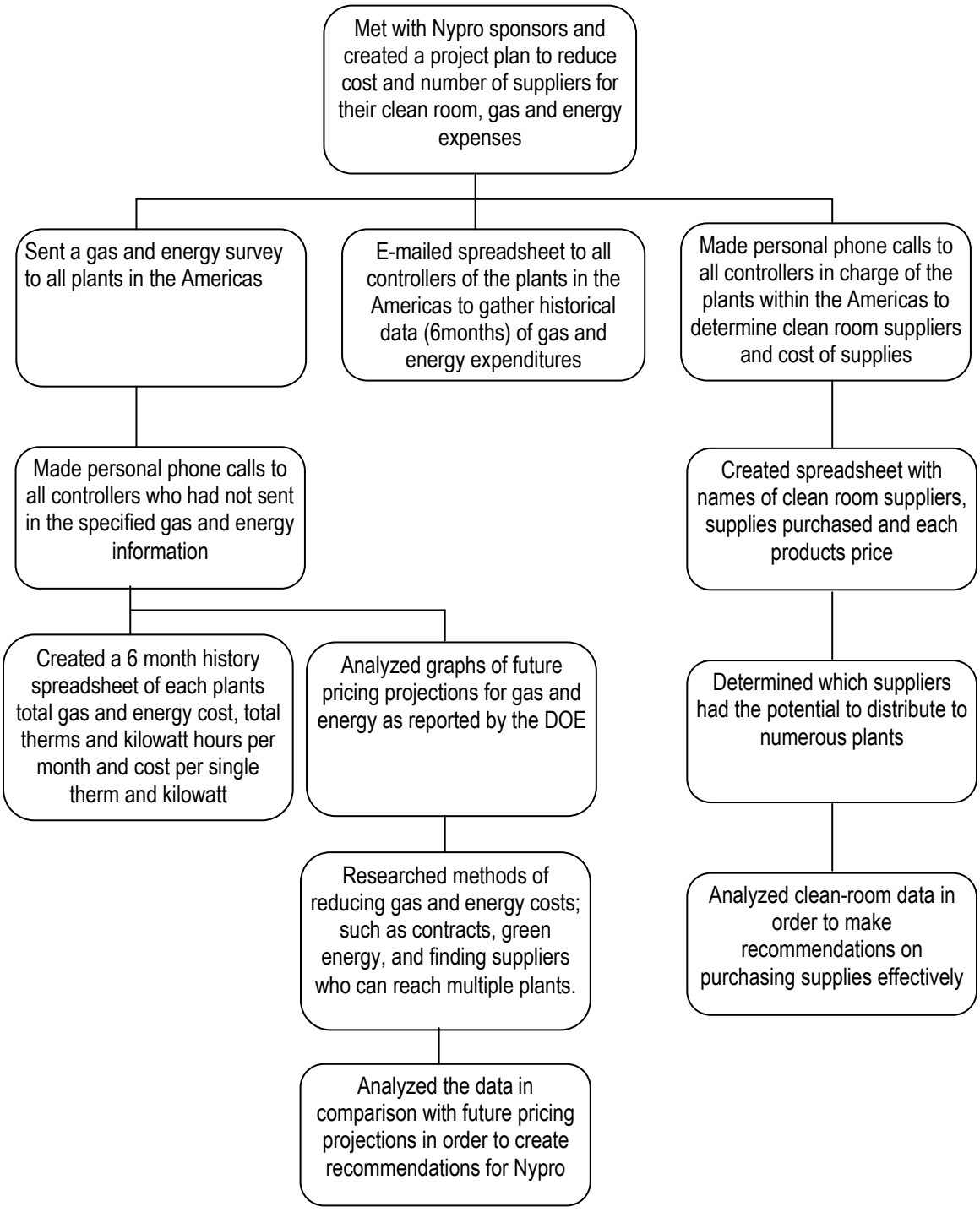

Figure 6: Flowchart of our Methodology

4 Preliminary Study of Nypro

In this chapter, we will breakdown the company profile of Nypro and what products they produce. Also in that section, we will discuss the locations and the different plants Nypro has throughout the world.

In the section of clean-rooms, we will break down what classifies a clean-room. Also, the federal regulations that determine whether it is classified as a clean-room. Lastly, we will discuss the different materials worn in a clean-room. The materials in that section are only the materials that Nypro uses within their clean-room facilities.

4.1 Company Profile

Nypro INC, a plastic company, was first established in 1955 in Clinton, Massachusetts is one of the largest employee-owned companies in the world. This means it is owned by all the people within the organization from the lowest level to the highest. Currently Nypro is located in seventeen different countries and has 52 businesses within these countries.

Nypro creates plastic molds for a variety of markets: Electronics and Telecommunications, Health Care, Consumer and Industrial, Automotive, Packaging, and Contract Manufacturers. For the electronics and telecommunications Nypro creates molds for mobile phones, PDA's, laptop computer components and many other accessories. Unlike the other plastic departments, in the Health Care facilities these products are created within clean-rooms. In the Health Care field, Nypro creates products such as test tubes, drug containers, pipettes and other products. Some companies Nypro create products for are Abbott, Baxter, Johnson & Johnson, Lily and many others. Consumer & Industrial creates molds for small appliances, electrical components, power system and many more products. Automotive molding consists of

door handles, glove box assemblies, steering wheels and many other products that are necessary for automobiles.

Nypro has many packaging plants throughout the world. These plants produce products that are used for our everyday life. Some of these products are beverage containers, food storage, bath products, and products for our everyday needs.

The last product Nypro creates is contract manufacturing. Nypro has built relationships with Tier 1 contract manufacturers to help increase their market share. Nypro understands that the contract manufacturers are becoming the end users rather than the original equipment manufacturers (OEM). (http://www.nypro.com/Company/Company.aspx)

4.2 Clean-rooms

Clean-room is a name given to an environment, which is mainly used with scientific research that has a low level of environmental pollutants such as dust, airborne microbes, aerosol particles and chemical vapors. (http://en.wikipedia.org/wiki/Clean_room).

Clean rooms are used to protect a company's product by keeping any negative element from entering and infecting a product. In order to ensure that negative elements do not enter the clean-rooms, employees must wear full body suits covering their clothes and shoes. Along with body suits and shoe covers, employees put on gloves, earplugs, eyes protectors and caps to ensure that no negative element is brought into the clean room.

4.2.1 Federal Regulations

There are two standards for classifying a clean-room. In Table 1 it shows the federal standards for a clean-room and the sizes in which particles are allowed in the air. Table 2 shows the measurement of concentration and how many particles are allowed within the facility. They are measured in a mechanism that breaks down how many particles are allowed in the air depending on the size of the room. For example, Class 1 and 10 are the measurements for production laborites for electronic integrated circuits. Class 100 is the measurement for production areas for photo labs and medical implants. Class 10,000 is the measurement for production locales for TV tubes and hospital operating theaters. Class 100,000 is the measurement for production of ball bearings.(http://www.engineeringtoolbox.com/clean-rooms-d_932.html)

(http://www.mssl.ucl.ac.uk/www_clean-room/clean-room/cr_standards.html#fs209)

Table 1: Federal Standard 209D Class Limits

CLASS	MEASURED PARTICLE SIZE (MICROMETERS)				
	0.1	0.2	0.3	0.5	5.0
1	35	7.5	3	1	NA
10	350	75	30	10	NA
100	NA	750	300	100	NA
1,000	NA	NA	NA	1,000	7
10,000	NA	NA	NA	10,000	70
100,000	NA	NA	NA	100,000	700

Table 1 shows the Federal Standard 209D of measurement. Unlike Table 2 this measurement method is in metric units.

(http://www.mssl.ucl.ac.uk/www_clean-room/clean-room/cr_standards.html#fs209)

Table 2: Federal Standard 209E Airborne Particle Cleanliness Classes

Class Name		Class Limits									
		0.1m m		0.2m m		0.3m m		0.5m m		5m m	
		Volume Units		Volume Units		Volume Units		Volume Units		Volume Units	
SI	English	(m^3)	(ft^3)	(m^3)	(ft^3)	(m^3)	(ft^3)	(m^3)	(ft^3)	(m^3)	(ft^3)
M 1		350	9.91	75.7	2.14	30.9	0.875	10.0	0.283	--	--
M 1.5	1	1 240	35.0	265	7.50	106	3.00	35.3	1.00	--	--
M 2		3 500	99.1	757	21.4	309	8.75	100	2.83	--	--
M 2.5	10	12 400	350	2 650	75.0	1 060	30.0	353	10.0	--	--
M 3		35 000	991	7 570	214	3 090	87.5	1 000	28.3	--	--
M 3.5	100	--	--	26 500	750	10 600	300	3 530	100	--	--
M 4		--	--	75 700	2 140	30 900	875	10 000	283	--	--
M 4.5	1 000	--	--	--	--	--	--	35 300	1 000	247	7.00
M 5		--	--	--	--	--	--	100 000	2 830	618	17.5
M 5.5	10 000	--	--	--	--	--	--	353 000	10 000	2 470	70.0
M 6		--	--	--	--	--	--	1 000 000	28 300	6 180	175
M 6.5	100 000	--	--	--	--	--	--	3 350 000	100 000	24 700	700
M 7		--	--	--	--	--	--	10 000 000	283 000	61 800	1 750

Table 2 represents the particle size vs. particles per cubic foot for various clean-room classes. This graph is the newer version of classifying a clean room. This method is known as the TC 209 from the International Standards Organization (http://www.ee.byu.edu/clean-room/particlecount.phtml). Although this is a different standard, both Table 2 and Figure 7 classify a clean room by the number of particles within the facility.

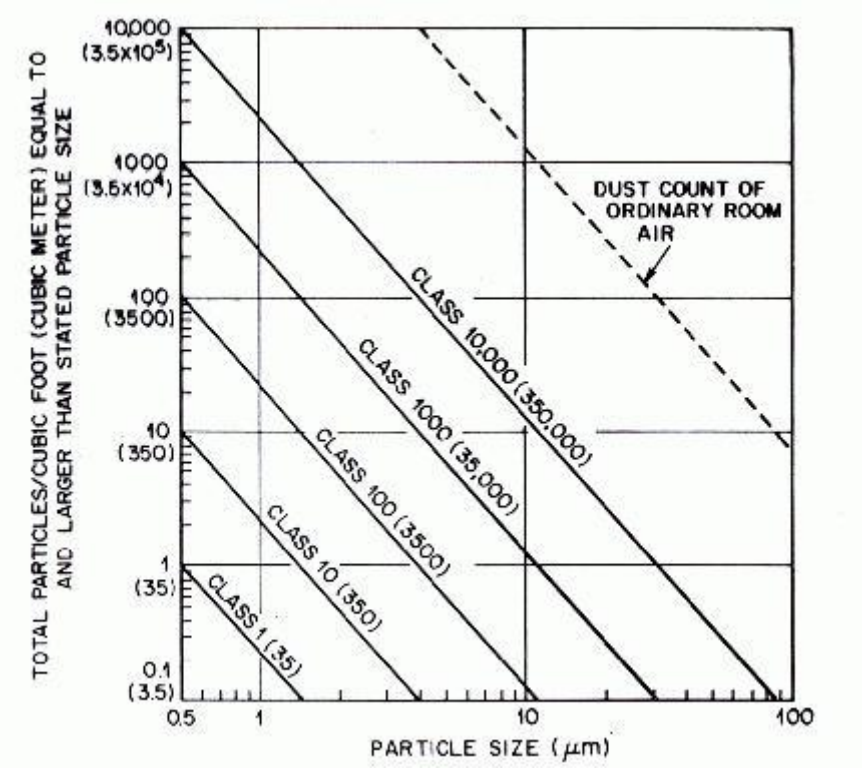

Figure 7: Classification of Clean-rooms

4.2.2 Clean-room Apparel

Employees enter the different clean-room facilities in their correct apparel. It varies with each different clean room on what employees must wear. They put on this apparel before entering the facility and then dispose of the material after leaving.

Most clean-rooms require coveralls be worn before enter the facility. These are worn to protect exposure to the air and the materials within the clean-room. Also, these coveralls have elastic bands around the ankles and wrists so that they cannot be opened. A good thing about the coveralls is that you can put them over your clothes you wore into work. Figure 8 shows what coveralls looks like and how they are worn in a clean-room facility (http://www.clean-roomeng.com/products_apparel.cfm). (http://i.b5z.net/i/u/1348671/i/c3_coverall_ezr.JPG)

Figure 8: Coveralls

Disposable hats are worn within a clean-room facility. These hats prevent any hair from being shown and getting out into the clean-room. Disposable hats come in one size with an elastic band around them to fit to your head. This allows for a comfortable fit and is cost effective for most companies because they only have to buy one size. Figure 9 below shows what hair covers look like. (http://www.clean-roomeng.com/products_apparel.cfm) (http://terrauniversal.com/products/clean-rooms/Images/clr_eyesonlyhood.jpg)

Figure 9: Hair Cover

Another article of clothing that is required in most clean-rooms is gloves. They come in latex and are disposable. Gloves come in a variety of sizes ranging from small, medium and large. Therefore they can be purchased for the employers needs. In Figure 10 there is a picture of the latex glove. As you can see these gloves expand to fit the employee's hand and their comfort need.

http://www.latex-glove.biz/latex-gloves.jpg

Figure 10: Latex Gloves

Beard covers are something that must be worn by men who have facial hair. These covers keep hair from falling out into the facilities. Beard covers have elastics around the ears that make it easy for applying and removing them. Figure 11 shows what a beard cover is and how it is worn.

(http://www.daltoninternational.co.nz/beardcover.jpg)

Figure 11: Beard Cover

One of the last major articles of clothing that must be applied upon entering a clean-room are shoe covers. These disposable covers prevent any unwanted body parts to be exposed within the facility. They have an elastic band around the top which make it easy for them to stay on. Also, some shoe covers come with non-skids on the bottom. This prevents slipping within the facility. Figure 12 displays a shoe cover and the non skid on the bottom of the material. (http://www.tristate.biz/productimages/shoe-cover.gif)

Figure 12: Shoe Cover

4.3 Green Energy

There are also ways to reduce energy and gas prices by being environmentally conscious. Many energy companies offer what is called green energy; which is another word for reusable and environmentally safe energy. Electricity generated from these outlets is becoming more available and by choosing to use a source of green power instead of conventional electricity businesses can support the increase in clean technologies.

Electricity purchasing agreements make it viable for consumers to purchase green electricity from their utility or a green power provider. The company usually pays a small premium. When energy is purchased from the electricity network, the power reaching the consumer will not necessarily be generated from green energy sources; but the local provider buys their electricity from electricity producers who may be generating from fossil fuel, nuclear or renewable energy sources. Generally, green energy provides a very small amount of electricity, contributing to less than 2 to 5% of the overall energy resources.

There is a different protocol for purchasing green energy through the gas grid because it is not as advanced and widely used. The market for heating is mostly serviced by gas and oil instead of electric power which has been honed by many techniques to be able to be reusable. Using the same principles bionatural gas has the potential to be made available and reusable to companies using the existing natural gas grid.

Another option companies can research is purchasing their own green energy equipment. This can range from a few solar panels to help with energy costs, or completely shielding a side of a warehouse or roof with panels to run all operations or purchasing their own windmills to generate energy throughout a plant.

Green energy sources include solar power which can be used for water heating and electricity generation that can be attained through grid-connected, remote, and hybrids. Wind power which produces electricity generation that can be attained through grid-connection, remote, hybrids, and water pumping. Biomass which can be used for **t**ransportation through the use of biofuels or for electricity generation by direct burn or gasification. Geothermal energy can be used for **s**pace heating, district heating, and electricity generation.

Solar energy has many advantages for large companies. PV (Photovoltaic) grids which generate the energy can be sized to meet the need. The greater the demand for electricity the more arrays are present. It can easily generate utility-scale electricity. It works in cold weather and does not need maintenance. There are no moving parts to break and it works in high-latitude, low-light regions. Using this type of green energy could be a huge advantage for Nypro Inc. because they have many location that have large facilities that need utility scale electricity, as well as multiple location such as Clinton, Massachusetts that will endure cold winters and ice storms. This technique will allow the company to become a more environmentally conscience corporation as well as save millions of dollars over a long period of time.

Wind is another green energy option that could be advantageous for Nypro Inc. Wind can supply electricity on-site in remote locations. This would save Nypro money in such locations at Puerto Rico, where the cost of supplying electricity and gas to an island comes with a high premium. If they are able to generate their own power it will inevitably cut energy spending over the lifetime of the equipment. In order to generate this type of energy windmills or wind turbines would have to be installed. The

disadvantage to this would be making sure that there is enough land to place this specific equipment on but the wind turbines do not leave a large "footprint" on the land and allow other uses of the land to continue as usual.

The use of biomass for production of green energy would be burning wood chips directly to generate electricity, or they can be processed and gasified to generate electricity with fewer emissions. Also, for transportation purposes Bioethanol can reduce the need for gasoline and imported oil. This is not a feasible option for Nypro Inc. because of the size of the company and the amount of woodchips needed on an annual basis to produce enough energy to properly run operations would become tedious and cumbersome and create more problems than sufficient energy help. They also do not need many money saving options in their transportation division.

Lastly, geothermal options are a possibility for green energy consumption. Geothermal means "Earth Heat", so this type of energy is located in the ground. This energy is gathered through geothermal heat pumps (GHP) which have the capabilities to heat whole complexes of buildings. The world's largest GHP complex is located at Galt House Hotel & Waterfront Office Buildings in Louisville, Kentucky; this is also the location of one of Nypro's plants. There a 4,700- ton GHP system saves $25,000 every month in reduced system costs and frees up 2,323 square meters of commercial space not needed for heating, ventilation, and air conditioning equipment.

There are many up and coming companies, as well as established energy providers that are turning to green energy all over the United States and even the world. A number of companies have been located in the regions where Nypro Inc. operates in the United States. Appendix shows the breakdown of multiple companies by region in the United

States that could be a possible green energy provider for Nypro. The charts show the utility company name, their green energy program name, their locations, what type of green energy they offer, and their premium price. Many of these companies also have the ability to supply multiple Nypro locations making them eligible for discounts because of the amount they would be purchasing to operate.

Future projections for green energy are shown in **Figure 13**, which shows the continued growth of renewable s through 2030. Total renewable generation grows by 2.1% per year, from 385 billion kilowatt-hours in 2006 to 631 billion kilowatt-hours in 2030.

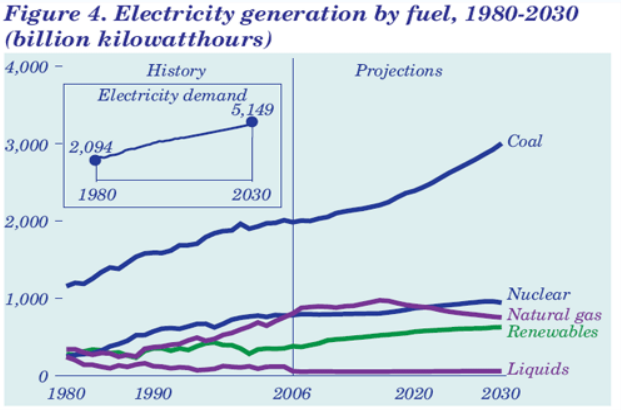

Figure 13: Electricity generation by fuel 1980-2030

5 Spend Analysis of Clean-room

In this chapter we will break down the current spend for the Nypro locations that have either a packaging plant or have a clean-room. Currently Nypro spends $439,901.64 annually on clean-room supplies and we researched ways to lower those costs.

In this chapter we will discuss What If Analysis and how it can be used to help Nypro. A What If Analysis is used to change the values in excel to get a variety of answers. We used that to determine the costs for Nypro if they changed some of their plants to different purchasers. (http://office.microsoft.com/en-us/excel/HA102431641033.aspx)

5.1 Nypro Spend Analysis

After comprehensive research we determined the amount of spend for Nypro Inc. within the Americas. Nypro Inc. annually spends approximately $ $439,901.64 on supplies such as: gowns, gloves, hair and beard covers, shoe covers, and other materials (ear plugs, mats, coveralls, and masks). We broke up the different facilities into three categories, North America-East, North America-West, and Latin America. North America-East consists of: Asheville, Atlanta, Carolina, Clinton, Chicago, and Hanover Park. North America-West consists of only Oregon. Latin America consists of Chihuahua, Guadalajara, Juarez, Monterrey, Puerto Rico and Tijuana. Figure 14 shows Nypro's annual spend and spend percentage per plant within the North America regions. Figure 15 shows Nypro's annual spend and spend percentage per plant within the Latin America regions.

NA-East	Spend	Spend %
Asheville	$140,322.17	59.2%
Atlanta	$5,093.28	2.1%
Carolina	$26,770.22	11.3%
Chicago	$22,629.55	9.6%
Clinton	$24,444.36	10.3%
Hanover Park	$4,469.52	1.9%
Oregon	$13,219.44	5.6%
Total	$236,948.54	
Spend %	54%	

Figure 14: North America Spend Percentage

LA	Spend	Spend %
Chihuahua	$ 15,792.12	7.8%
Guadalajara	$ 6,997.56	3.5%
Juarez	$ 16,774.80	8.3%
Monterrey	$ 36,673.06	18.1%

Puerto Rico	$ 49,320.00	24.3%
Tijuana	$ 77,232.00	38.1%
Total	$202,789.54	
Spend %	46%	

Figure 15: Latin America Spend Percentage

5.1.1 Nypro's Spend Percentage

In order to determine who spends the most within the plants, we calculated the spend percentage per material and per plant. Figure 16 shows the total per plant; Asheville spends 32% of Nypro Inc. costs, which is the highest amongst the other plants. The highest Latin America spender is Tijuana at 18%. Once we finished these calculations we were able to breakdown at least three different buyers for the three locations. We did not want to take a high spend percentage and try and change their purchasing strategies. Instead, we took the highest percentages and tried to use their purchasers for other locations.

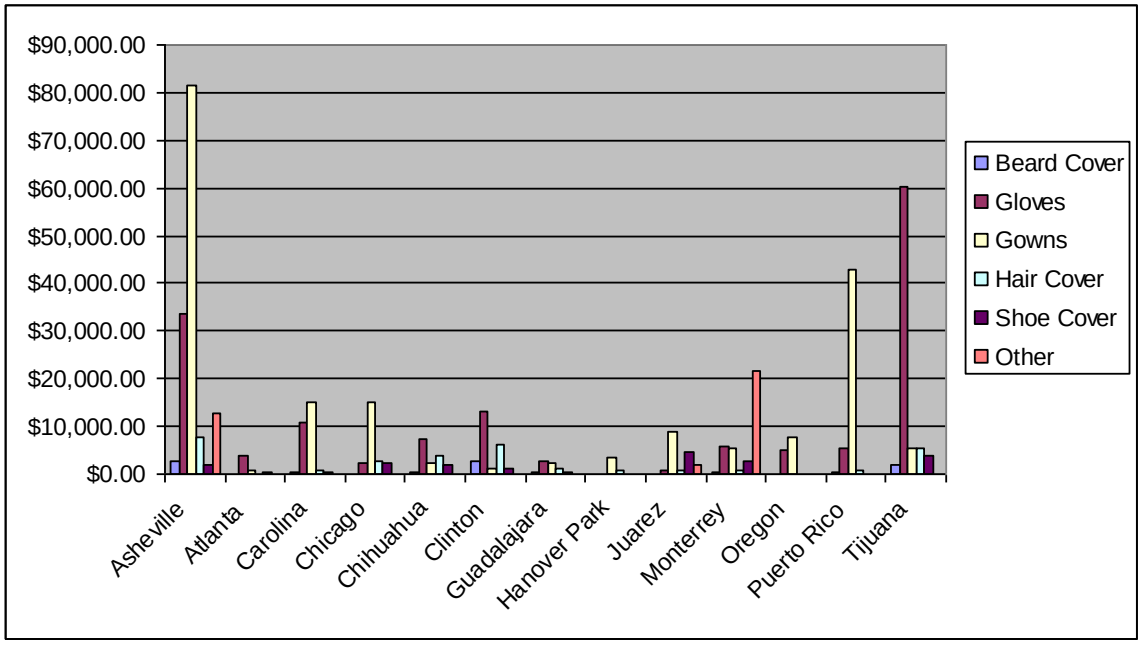

Figure 16: Plant Spend

Some plants have lower costs because they may not purchase the same materials as another plant. Only six plants purchase other materials and that varies in price from $142.56-$21,700.80. Since Hanover Park is more of a packaging plant compared to a clean-room facility, they don't need all the necessary products so they save money on buying beard and shoe covers because their plant doesn't require them.

5.1.2 Nypro's Annual Glove Spend

Annually, Nypro spends $151,541.89 on gloves. These gloves vary from latex, nylon, cotton, and nitrile. Figure 17 breaks down the different plants and their annual spend on gloves. Tijuana has the highest spend $60,384/year, but they purchase their gloves at an expensive price of $0.15/glove.

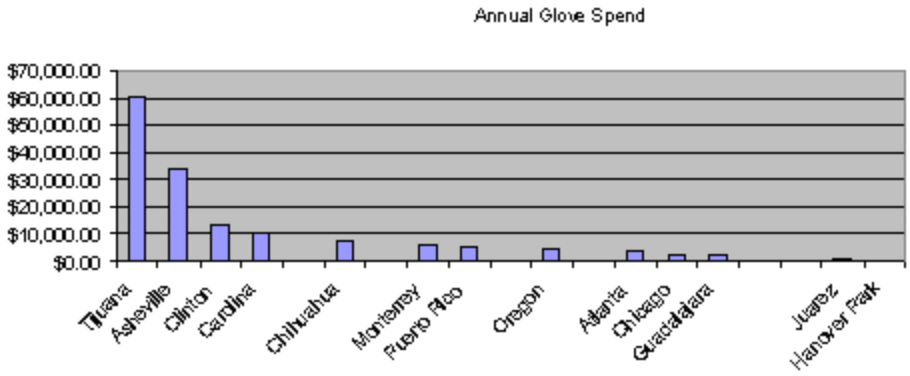

Figure 17: Annual Glove Spend

5.1.3 Nypro's Annual Gown Spend

Nypro's highest spend annually is on gowns. Figure 18 shows the gown spend and it is obvious that Asheville has the highest spend $81,546/year. That is almost double of Puerto Rico and is five times more than any other plant's gown spend.

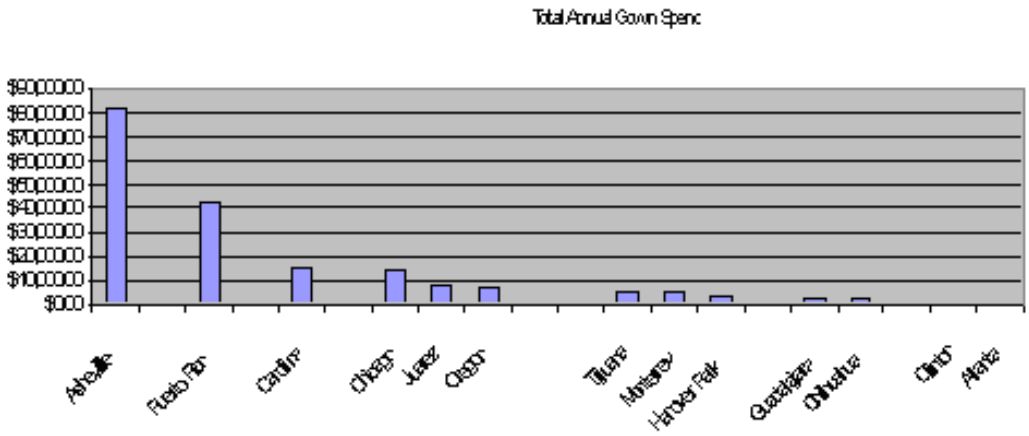

Figure 18: Annual Gown Spend

5.1.4 Nypro Annual Shoe Cover Spend

Nypro does not spend as much on their shoe covers, hair covers, beard covers, and other materials. Annually, Nypro spends $19,526.73 on shoe covers. Figure 19 shows the shoe cover spend of all the plants and Juarez has the highest spend at $4,665.60 and this makes up 24% of Nypro's shoe cover spend.

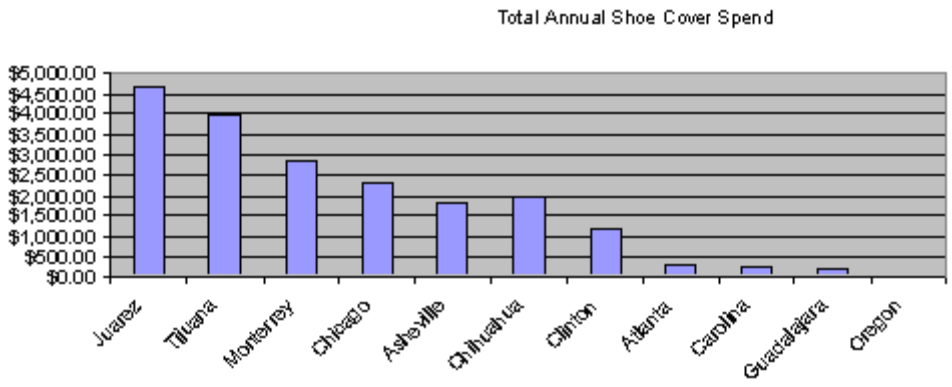

Figure 19: Annual Shoe Cover Spend

5.1.5 Nypro Annual Beard Cover Spend

Annually Nypro spends $8,786.16 on beard covers. The beard covers are used to protect the men's facial hair. Asheville has the highest beard cover spend $2,776.80 which makes up 31.6% of Nypro's annual beard cover spend. Figure 20 shows the different plants and their annual spend. As shown, not all plants use/have beard covers.

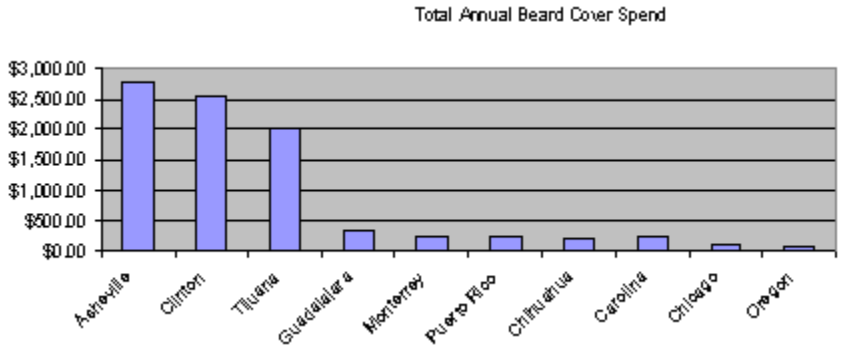

Figure 20: Annual Beard Cover Spend

5.1.6 Nypro Annual Hair Cover Spend

Annually Nypro spends $31,099.33 on hair covers. These are disposable materials that must be worn in the clean-room. Asheville has the highest annual spend $7,740 which is 25% of Nypro's annual spend. Figure 21 shows the different plants and their annual hair cover spend.

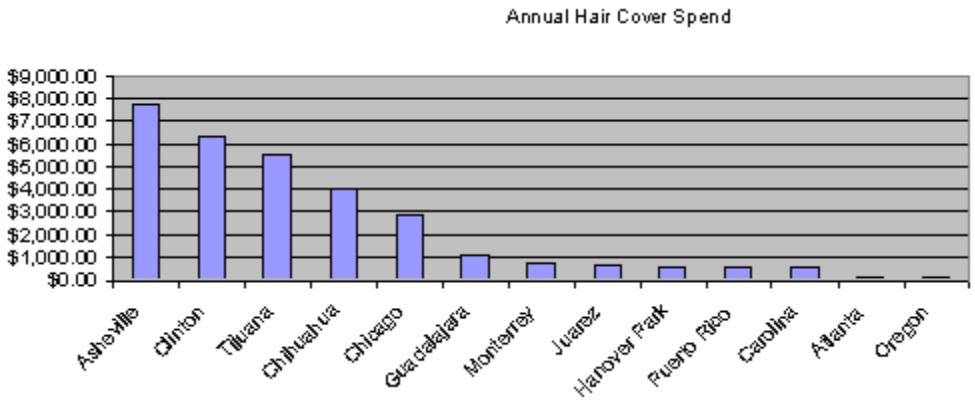

Figure 21: Annual Hair Cover Spend

5.1.7 Nypro Annual Other Spend

Annually Nypro spends $36,692.40 on other materials. These other materials can be classified as ear plugs, tacky mats, coveralls, and masks. Monterrey has the highest annual other spend $21,700.80 which is 59% of Nypro's total other spend. Figure 22 shows that not all plants have other spend and that only five plants have other spend.

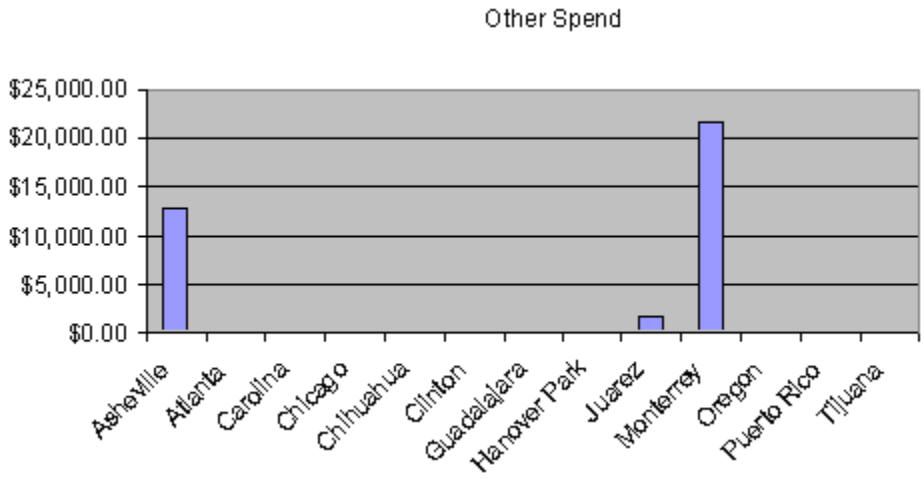

Figure 22: Annual Other Spend

We had to look up each individual purchaser to try and find their location. For example, we could not take a local company and try to make it national. We found both local and national and broke down the different aspects and calculated their costs if Nypro switched the different plants to certain suppliers.

5.2 What If Analysis

Once we compiled the information about the different purchasers, we then could calculate the different costs associated with the different purchasers. We only calculated the purchasers with the lowest cost within a material. For example, with hair cover the lowest in North America was out of Oregon at $0.01/hair cover. Although Oregon has the cheapest spend, we were able to do A What If analysis if Nypro changed their buyer to Norwest Safety. Hanover Park is spending $.12/hair cover. What If Hanover Park switched to Norwest Safety they would save $571.80/year. That may not seem like a lot of money right now, but other plants would save money. Asheville their highest spender would save annually $4,740.

What If Nypro switched their gown purchasers in Latin America to Cadillac Uniform? Cadillac Uniform has the lowest cost for the Latin America region. Their gowns costs are $0.83/gown, which are cheaper than $1.10, $3.95, $3.21 and $2.36. Figure 23 shows how much Monterrey, Juarez, Chihuahua, and Guadalajara would save by switching to Cadillac Uniform. Switching to Cadillac would save Nypro annually $7,327.93.

LA-Cadillac	**Gowns**			
	Current Spend	Usage	Cadillac Cost	Savings
Monterrey	$ 5,389.09	2280	$ 1,892.40	$3,496.69
Juarez	$ 8,725.20	7932	$ 6,583.56	$2,141.64
Chihuahua	$ 2,283.00	120p/300d	$ 2,465.40	$ (182.40)
Guadalajara	$ 2,370.00	600	$ 498.00	$1,872.00
			total savings	$7,327.93

Figure 23: Cadillac Cost

What if the North America locations switched their glove purchasers to Cintas? Cintas is a national company and would be able to support all of these plants. Figure 24 shows Clinton would benefit the most and save Nypro the most amount of money by

switching to Cintas. Cintas would save Nypro $5,482.99/year. This would benefit Nypro in the future as time goes on, if they switch then in seven years Nypro would save $38,380.93.

NA-Cintas	Glove			
	Current Spend	Usage	Cintas Cost	Savings
Clinton	$ 13,248.00	120,000	$ 9,600.00	$3,648.00
Chicago	$ 2,319.19	6,480	$ 518.40	$1,800.79
Hanover Park	$ 178.20	1,800	$ 144.00	$ 34.20
Atlanta	$ 3,840.00	48,000	$3,840.00	$ -
			total savings	$5,482.99

Figure 24: Cintas Spend

What if Nypro in both Clinton and Hanover Park switched their purchasers to Stauffer Glove & Safety for hair covers? Clinton currently has a high spend of $6,346.80 and switching to Stauffer would save them $2,746.80. As shown in Figure 25 both Clinton and Hanover Park would save Nypro $3,214.92, which in ten years would add up to $32,149.20.

NA-Stauffer	Hair Cover			
	Current Spend	Usage	Stauffer Cost	Savings
Clinton	$6,346.80	120,000	$3,600.00	$2,746.80
Hanover Park	$623.64	5,184	$155.52	$468.12
			total savings	$3,214.92

Figure 25: Stauffer Spend

Figure 26 shows if Latin American countries Monterrey, Chihuahua, and Guadalajara switching to the purchaser Namisco, which is located in El Paso/Juarez and Chihuahua they would save $2,634.54 on their shoe cover spend. This would add up and

continue to save Nypro money in the long run. In ten years, Nypro will have saved $26,345.40.

LA-Namisco	Shoe Cover			
	Current Spend	Usage	Namisco Cost	Savings
Monterrey	$ 2,873.70	18,600	$ 1,488.00	$1,385.70
Chihuahua	$ 1,944.00	10,800	$ 864.00	$1,080.00
Guadalajara	$ 197.64	360	$ 28.80	$ 168.84
			total savings	$2,634.54

Figure 26: Namisco Savings

The data analysis of clean-room shows the different possibilities that Nypro can use in determining their future buyers for clean-room products. We believe that the data we compiled will aid Nypro in saving money on their clean-room supplies.

6 Spend Analysis of Energy

The energy and gas consumption at Nypro Inc. has been analyzed in order to modify their practices and research improved ways of operation. The process began by collecting the energy and gas spend over a six month period for all plants in the Americas (17 plants). This included Nypro locations in the United States, Mexico, and Puerto Rico. Their suppliers were analyzed as well as other local suppliers in order to compare and find cost-saving methods. Nypro has also chosen to look at the cost-benefits of local green energy suppliers in order to become a more environmentally conscience global corporation.

6.1 Nypro's Average Electric Spend per Plant

The first information that was analyzed was the energy consumption of the individual plants located in the Americas. Each plants' spend was broken down into a total monthly cost for the months of May through October of the previous billing year and the total kilowatts that each plant used in the given months. A spreadsheet was created to compare each plant and determine the price locations were spending on average per kilowatt. See Figure 27.

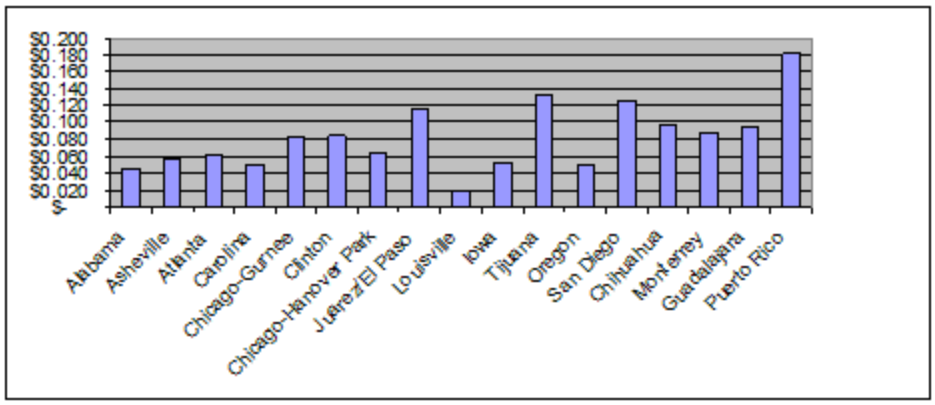

Figure 27: Nypro Americas Average Cost/KwH

The chart above shows that the Puerto Rico plant has the highest cost per kilowatt hour. They pay on average $0.18 per kilowatt to run their plant. This is very high when compared to the four plants (Atlanta, Carolina, Louisville, and Iowa) that pay on average the least amount for their energy at $0.05 per kilowatt. This makes a range of approximately $0.13 per kilowatt throughout the average pricing of Nypro's facilities in the Americas. After researching the Puerto Rico location the reason the cost per kilowatt hour is so high is because they are an island and it is difficult to supply such a remote location with such a high demand for electricity. The second highest plant is Tijuana at $0.13 per kilowatt hour for the same reason. Next is the Clinton plant; one of the largest facilities that Nypro operates because it houses local operations as well as the global headquarters, they pay approximately $0.12 per kilowatt. If the plants that pay the highest price per kilowatt could find suppliers that had the ability to offer the average calculated price per kilowatt hour of approximately $0.09 this could drastically improve Nypro's electric spend by.

The total annual spend per plant on electricity in the Americas was also analyzed. See Figure 28. In order to produce this information the monthly spend from the months of May through October (6 month data) from the previous billing year were added together according to individual plant information and multiplied by two to create an approximate yearly spend on energy per plant in the Americas. The chart below shows the comparison of each plant and their total annual electric spend.

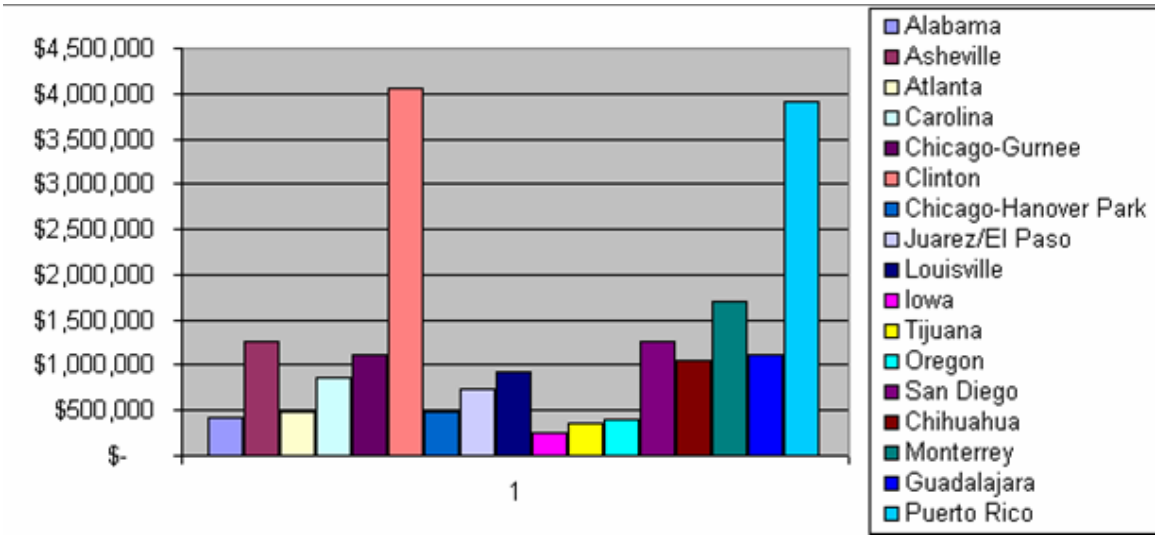

Figure 28: Annual Total Spend Per Plant

After analysis of the two previous charts, it can be reasonably stated that because plants such as Puerto Rico and Clinton have inconvenient locations and have to pay a high premium to attain the electricity needed, or because of the capacity that the plants operates at and requires massive quantities of energy they have the highest annual electric spend. The intriguing result was from the Tijuana plant. They pay the second highest rate for kilowatts per hour but are among the lowest plants for annual electric spend. They pay approximately $359,563 per year on electricity. After researching this facility they operate at a low capacity in comparison to other plants and therefore do not accumulate the wattage that other locations endure.

6.2 Nypro's Average Electric Spend Per Segment

The plants in the Americas were also segmented into three different categories depending on what type of mold they specifically used and produced certain products. The three categories were healthcare, packaging, and auto. The plants analyzed under healthcare were Tijuana, Clinton, Chicago-Gurnee, Asheville, Oregon, and Puerto Rico. The plants analyzed under packaging were Carolina, Alabama, Iowa, and Chicago

Hanover-Park. The plants analyzed under auto were San Diego, Monterrey, Guadalajara, Louisville, Juarez/El Paso, Chihuahua, and Atlanta. The same research was done on all three segments as with the entire company. The spend and kilowatts per month for a six month period were compiled determining the average price paid per kilowatt hour for each plant.

6.2.1 Nypro Healthcare Electric Spend

The first segment analyzed was the healthcare segment. Figure 29 below shows the comparison of price paid per kilowatt hour in the healthcare segment. The average price per kilowatt hour that plants in the healthcare segment at Nypro pay is $0.11.

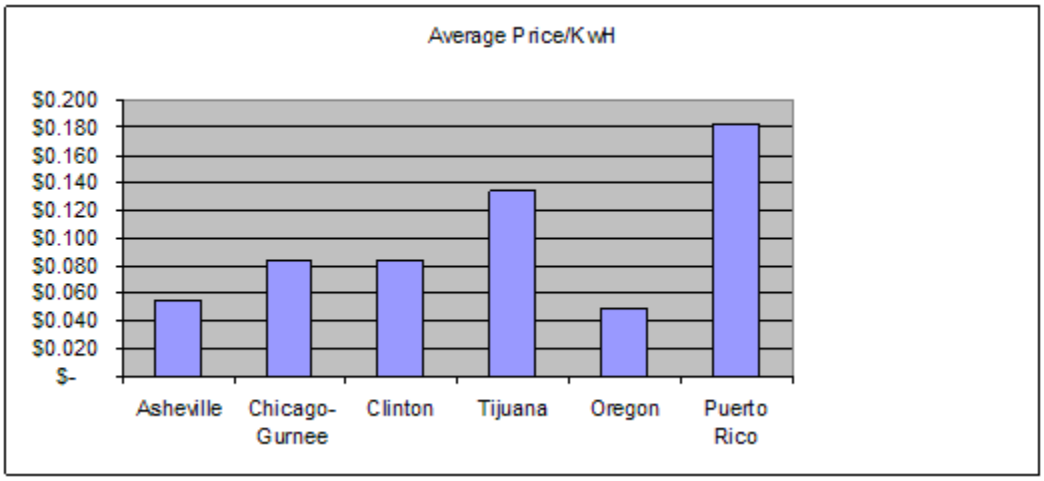

Figure 29: Health Care Average Electric Cost/KwH

6.2.2 Nypro Packaging Electric Spend

The second segment that was analyzed was Nypro's packaging plants. Figure 30 shows the comparison of price paid per kilowatt hour in the packaging segment. The average price per kilowatt hour that plants in the packaging segment at Nypro pay is $0.10.

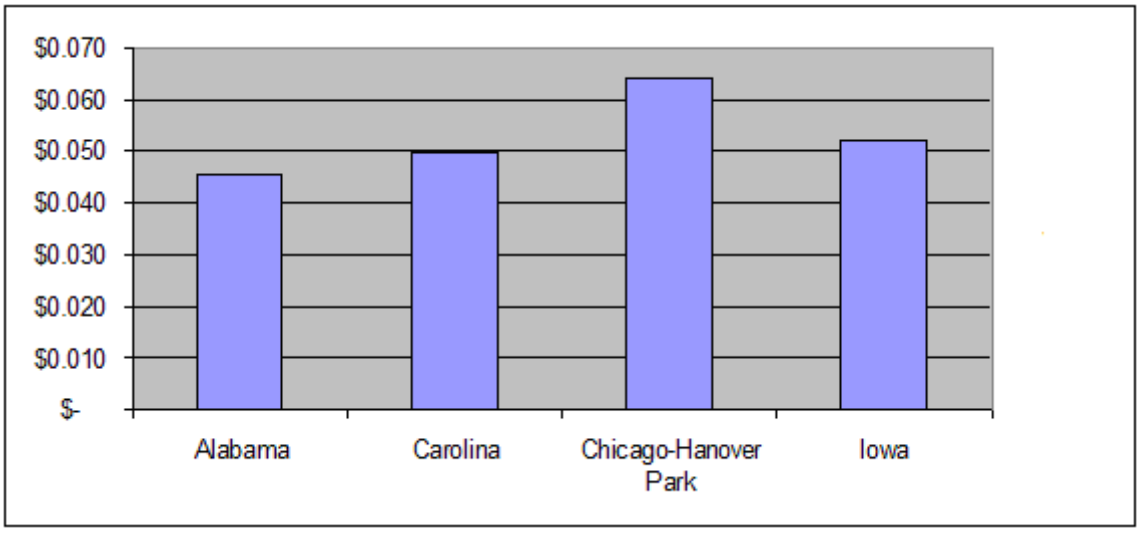

Figure 30: Packaging Plants Average Electric Cost/KwH

6.2.3 Nypro Auto Electric Spend

The final segment that was analyzed was Nypro's auto segment. Figure 31 shows the comparison of price paid per kilowatt hour in the auto segment. The average price per kilowatt hour that plants in the auto segment at Nypro pay is $0.09.

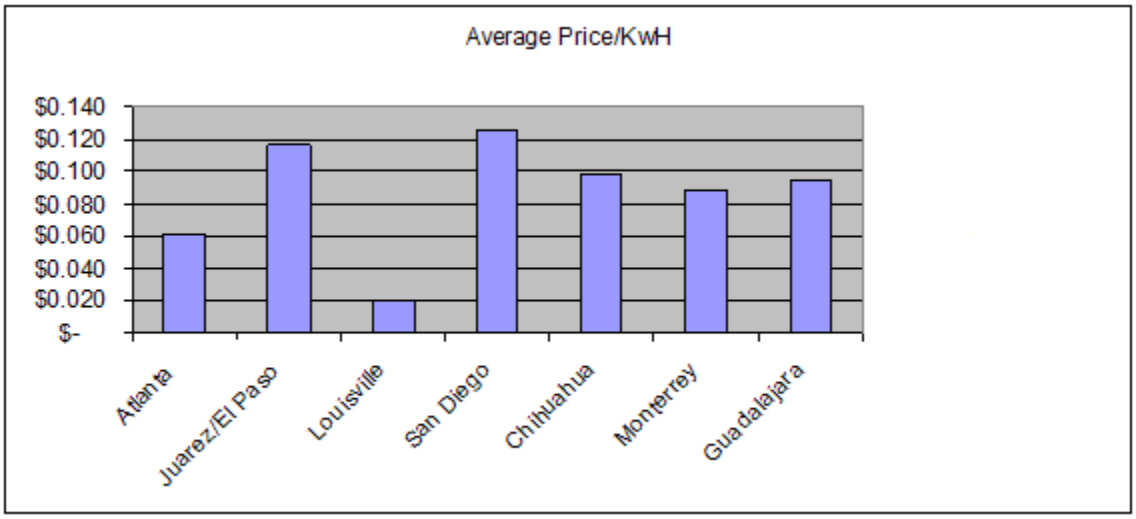

Figure 31: Auto Plants Average Electric Cost/KwH

This analysis proves that each division of Nypro Inc. is evenly distributed. The range of price per kilowatt in the segments version is only a difference of $0.03. The segments of

healthcare and packaging could also lessen their average price per kilowatt greatly when Nypro Inc. uses a different supplier or new option in their Puerto Rico facility. Puerto Rico is in both the healthcare and packaging segment and averages the highest price per kilowatt, when this problem is alleviated each segment will show an improvement in average price per kilowatt as well as annual spend.

6.3 Nypro's Average Gas Spend Per Plant

The next step in the analysis was the gas consumption of the individual plants located in the Americas. Each plants' spend was broken down into a total monthly cost for the months of May through October of the previous billing year and the total therms that each plant used in the given months. A spreadsheet was created to compare each plant and determine the price locations were spending on average per therm. See Figure 32.

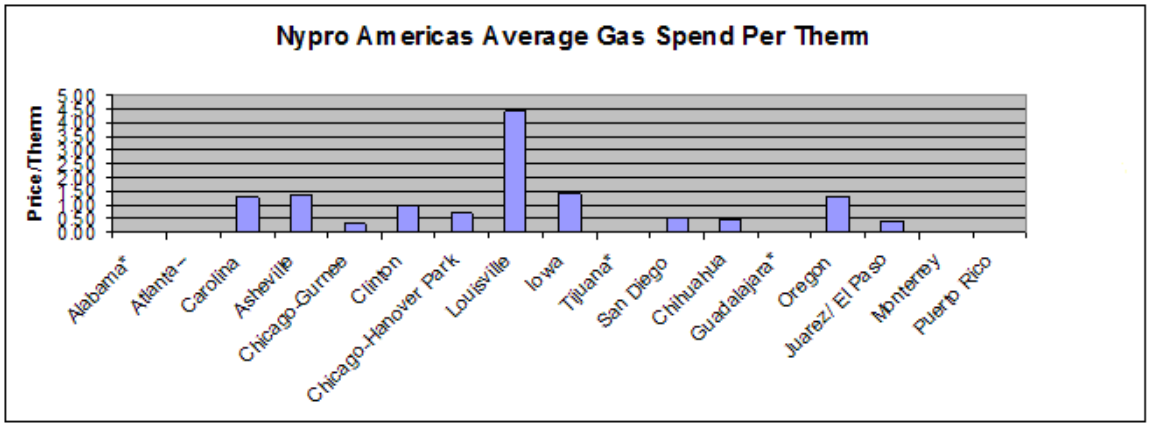

Figure 32: Nypro Americas Average Gas/Therm

According to Figure 32 it is clear that the plant located in Louisville, Kentucky pays the highest premium for their gas consumption at $4.43 per therm. This is very high compared to the calculated average of price per therm for all plants in the Americas of $1.19. Iowa, Asheville, Oregon and Carolina are within $0.25 of the average and the rest

of the plants are below; excluding Monterrey and Puerto Rico which do not use gas in their plants.

The total annual spend per plant on gas in the Americas was also analyzed. See Figure 33. In order to produce this information the monthly spend from the months of May through October (6 month data) from the previous billing year were added together according to individual plant information and multiplied by two to create an approximate yearly spend on energy per plant in the Americas. The chart below shows the comparison of each plant and their total annual gas spend.

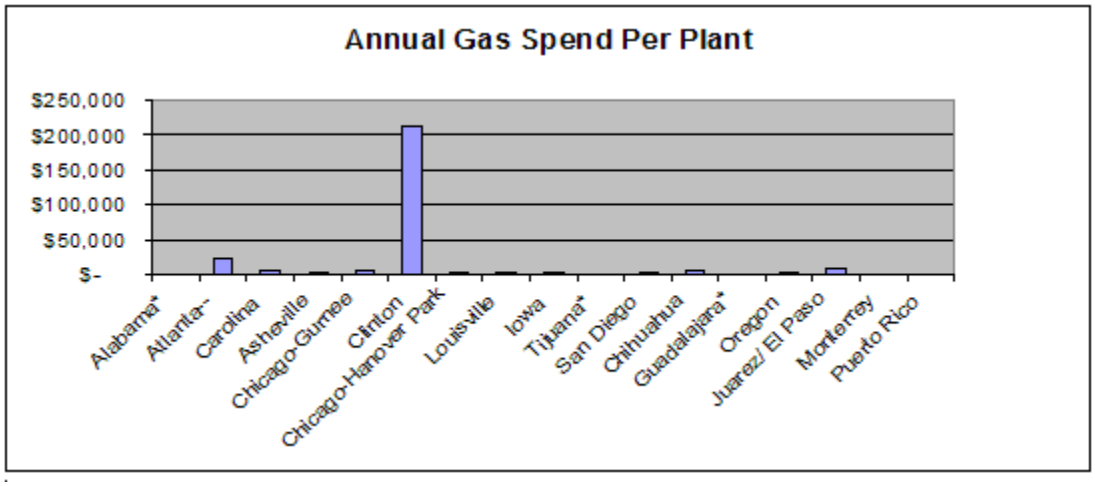

Figure 33: Annual Gas Spend Per Plant

Figure 33 shows that Clinton has the highest annual gas spend by a large margin. They spend $211,950 annually on gas, which is $187,950 greater cost per year than the next closest plant, Atlanta that spends $24,000. The reason for such a drastic margin is that Clinton is one of the largest plants holding both local and global head-quarters; but even so this gas analysis only took into consideration 75% of the plant which excludes the global side of the operations ran in this location.

6.4 Nypro's Average Gas Spend Per Segment

The plants were also broken up into three segments like the electricity analysis; healthcare, packaging, and auto. The same research was done on all three segments as with the electricity analysis. The spend and therms per month for a six month period were compiled determining the average price paid per therm for each plant.

6.4.1 Nypro Healthcare Gas Spend

The first segment analyzed was Nypro's healthcare department. Figure 34 below shows the comparison of price paid per therm in the healthcare segment. The average price per therm that plants in the healthcare segment at Nypro pay is $1.32. Asheville pays the highest in the healthcare segment at $1.38 per therm and the rest of the plants fall within $0.02 of the average.

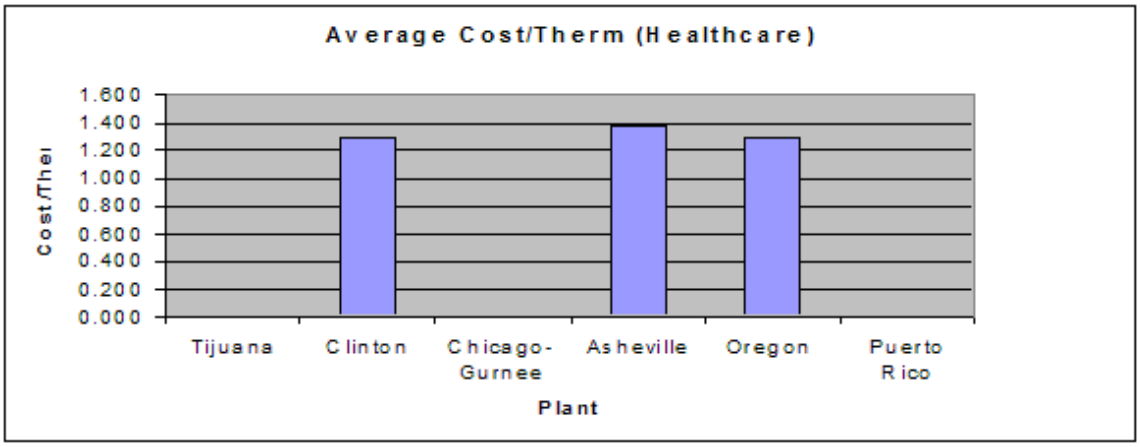

Figure 34: Average Cost/Therm (Healthcare)

6.4.2 Nypro Packaging Gas Spend

The second segment that was analyzed was Nypro's packaging department. Figure 35 shows the comparison of price paid per therm in the packaging segment. The average price per therm that plants in the packaging segment at Nypro pay is $1.35. Iowa pays the highest rate per therm at $1.43 followed by Carolina at $1.26 per therm.

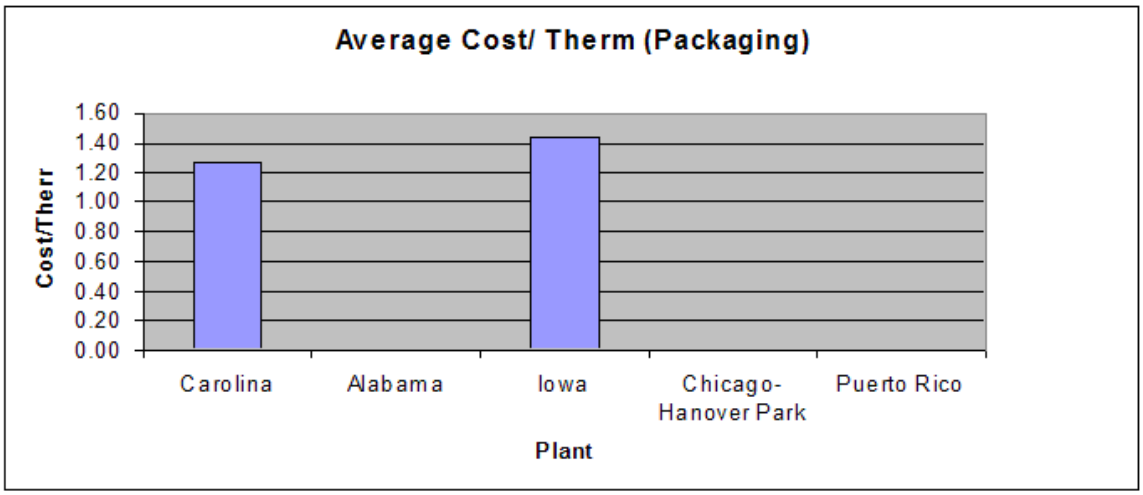

Figure 35: Average Cost/Therm (Packaging)

6.4.3 Nypro Auto Gas Spend

The final segment that was analyzed was Nypro's Auto department. Figure 36 shows the comparison of price paid per therm in the auto segment. The average price per therm that plants in the auto segment at Nypro pay is $1.44. This average is slightly higher because of the high average cost that Kentucky pays for gas per therm. If this location's gas consumption or supplier is able to be reconstructed it will significantly lower the automotive segment.

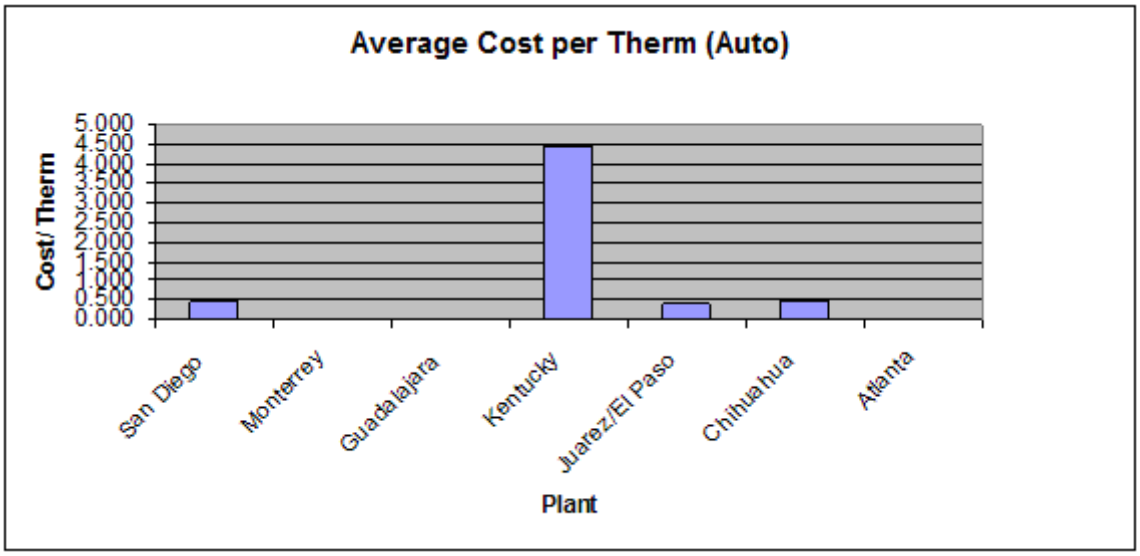

Figure 36: Average Cost per Therm (Automotive)

7 Recommendations, Discussions, and Conclusions

This section will breakdown the different recommendations Nypro should take into consideration in both the clean-room, gas and energy savings. We believe this will help in lowering Nypro's annually costs and allow for them to save money in the future. Also, in this chapter we will recommend which Nypro plants should switch to hydrologic power due to the high energy prices. Lastly, we will use the data from Chapter 5 to help aid Nypro is choosing one main supplier in either Latin America or North America for specific materials.

7.1 Clean-Room Recommendations

After twenty-one weeks of data collection and analysis we have compiled proposed ideas for Nypro and the future of their clean-room purchasing. First, as stated in the data analysis section of the report, Nypro should switch to one buyer for certain materials. For example, Nypro should switch to Cintas because it would save the company $5,482.99/year. Also, they would not have to change their highest spend plant, Asheville to Cintas because they already purchase from them. Cintas is a national company and would be able to provide for the different Nypro plants within the North America district.

Second, Nypro should look into ways of reducing their cost within the Latin America locations. They should go with Cadillac Uniform as their supplier for gowns. Annually this would save Nypro $7,327.93.

If Nypro only switched these two things then they would save $12,810.92. That may not seem like a lot of money, but in ten years Nypro would have saved $128,109.20.

That is a lot of money that Nypro can prevent from spending annually, but they just need to change some of their suppliers.

7.2 Energy and Gas Recommendations

Nypro Inc. being a global company has many plants and operations that are run on a consistent basis in order to keep their business profitable and successful. Their spend on energy is a constant topic that is being refined in order to lower costs and become more environmentally conscience. The new trend of green energy has become more popular in the recent years because of the money saving options it can offer. Energy companies through different contracts and negotiated rates also offer other plans. After the analysis of the average annual spend per year for all plants in the Americas there are many routes that Nypro can take in order to lower their annual energy spend.

The first short term recommendation that will satisfy Nypro's needs to lower energy costs will be to create contracts. This option will be able to take effect the quickest. This is because they can stay with their current providers and purchase blocks of energy based on their previous records of spends. They can also purchase weather protection, or fixed bill contracts. That will guarantee that the company will not have to pay any more than a fixed dollar amount for their energy for the year. This is based on the customer's usage pattern over the past year and adjustments for weather. Nypro can also purchase fixed volume contracts where they will estimate their monthly consumption based on past years and any expansion plans. The supplier then contracts for that amount on the customer's behalf. The customer is financially responsible for differences between estimated and actual use bought for them on the spot market by the supplier. Lastly, they can use a structured block contract, which is purchasing a series of blocks of electricity to match as

closely as possible the consumption of a facility. They can use this to match their most consumption during the week and use a fixed rate for weekends and quieter days.

Nypro can also take smaller measures within their individual plants to save on energy costs. Some plants have already installed censored lighting fixtures throughout their facilities, but Nypro can make this a mandatory procedure. They can also shut down certain operations that are not needed on a daily basis which will give a longer lifespan to some machines, as well as cut back on energy usage. They could produce a schedule where certain plants completely shut down for a number of hours. These small energy saving ideas can truly creating savings because Nypro is such a large company running almost 24 hours a day, 365 days a year.

The first long term recommendation that would be beneficial to Nypro is to regionalize their energy providers. Energy companies can only supply to a certain radius. Therefore it is difficult to find a single provider that Nypro can use for all their plants in the Americas. This leaves the option of regionalizing. They have multiple plants on the west coast, Middle America, southern region and the east coast. In our research we have located multiple providers that are able to reach more than a single plant. By using one provider Nypro has the opportunity to lower their monthly rate because of the amount of business they will be giving the energy company.

Nypro is also looking to enter the green energy market. It is essential that companies are taking a look at becoming environmentally aware. The green energy market is fairly new and therefore more expensive. Companies will have to pay a flat rate as well as premium for green energy. The positive for Nypro looking into these options sooner is that they will gain a foothold in the industry and create contracts and good

customer supplier relationships that with their large amount of business they would be giving to these providers they will be able to create money saving contracts.

Nypro also has the option to install their own green energy solutions. They can use solar power, hydropower, geothermal power, or wind generated power. They have multiple plants that are located in remote areas of the United States and Latin America. The cost for energy in these regions is very high. If they are able to generate energy on their own it would be an expensive initial cost, but the long term effects would be thousands of dollars saved on energy costs per year.

We conclude that Nypro can save money from doing a variety of things. There are many steps Nypro can take quickly to begin saving on their energy spend, as well as long term routes that will be able to make Nypro into an environmentally sound company while still saving annual. We had innovative results from this project and believe it will help Nypro in the future to lower its energy costs.

7.3 Discussion of Future Work and Conclusions

This chapter will discussion the future routes that Nypro can take based on the information and conclusions found in the study of their clean-room supplies and energy spend analysis. It will take the recommendations that have been posed in the previous chapter and elaborate on other ventures and options based on our analysis that will be able to propel Nypro to save more money on these expenses.

The clean-room conclusions that we recommend to Nypro are they have both long and short-term goals. These goals are the possible future work for Nypro and their clean-room expenses. A short-term goal for Nypro would to set up a pilot study to determine whether some materials are considered to be reusable. By setting up this pilot study,

Nypro could look into the possible ways of reusing their materials rather than just using disposable materials. This study will show the feasibility of using permanent over disposable materials. However, there are some materials that may not be reusable and the study will aid in determining which materials are reusable and which must only be disposable.

A long-term goal for Nypro would be to lower the amount of suppliers. As shown in the Appendix, Nypro has many suppliers throughout both North and Latin America. If they were able to cut down to a couple suppliers within certain regions, Nypro would begin saving money.

There are many other suppliers that Nypro could switch to throughout both North and Latin America. However, Nypro needs to decide which plants should switch their suppliers and which should keep their suppliers. From the calculations in Chapter 5, it is obvious of money Nypro can save by switching plant suppliers to a main supplier per specified clean-room material.

We conclude that Nypro can save money from doing a variety of things. The What If Analysis opened many doors for Nypro to see the different savings for each material. We had great results from this project and believe it will help Nypro in the future to lower its clean-room costs.

The energy conclusions that were recommended to Nypro are both long and short-term goals. These goals are the possible future work for Nypro and their energy expenses. Nypro has created an energy saving strategy by setting forth a new machine engineering plan for each plant. Nypro uses two different types of machines one that runs on hydraulics, which is more energy efficient and the second type, mechanical which

creates a higher energy cost. Nypro's plan is to use the energy analysis to determine which plants use the most energy and have the highest costs and make sure that these locations have the hydraulic machines. They will then move the mechanical machines into locations that do not have the highest usage and will not be as affected by equipment that may need a higher energy supply.

Nypro will also be able to use this analysis in order to determine the energy usage in each individual plant in comparison with the main type of product they are producing and the rate that each plant is paying. An example is the Clinton, MA facility, which is one of the larger Nypro operations. It has the highest annual gas costs but it pays an average rate per therm; its usage just ranks higher than most plants located in the Americas. This information will allow Nypro to determine which plants are paying an unnecessarily high-energy rate and need to determine if green energy sources would be a sufficient option or a new energy provider would be appropriate.

The future of Nypro's energy spend can take many different routes based on the information and conclusions found in this study of their energy spend analysis. These recommendations have been and elaborated on in order to offer Nypro new options based the previous conclusion from the initial study. These new plans of study and analysis as well as, direct changes that can be made in the field on electricity and gas expenses will allow Nypro to be a flexible company as well as an energy aware operation.

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Appendix A- North American Suppliers

	Supplier	Location	Plants	Products Rendered
1	Stauffer Glove&Safety	PA, NC, IN, OH	Asheville	Hair Cover, Beard Cover, Gown
2	Butler Deardon	Boylston, MA	Clinton	Hair Cover, Glove, Beard Cover, Gown, Shoe Cover
3	Panbor	Illinois	Chicago	Hair Cover, Glove, Beard Cover, Shoe Cover
			Hanover Park	Hair Cover, Glove, Gown
4	Xpedx	National	Carolina	Hair Cover, Glove, Shoe Cover
5	Miller		Atlanta	Hair Cover, Glove, Gown, Shoe Cover
6	Norwest Safety	Oregon	Oregon	Hair Cover, Glove, Beard Cover, Shoe Cover
7	Cintas	National	Carolina	Gown
			Asheville	Glove
8	Overall Laundry	WA, National	Oregon	Gown
9	Alsco	National	Asheville	Shoe Cover
			Chicago	Gown
10	Aramark	National	Hanover Park	Gown

Appendix B- Latin American Suppliers

	Supplier	Location	Plant	Products Rendered
1	Beresa Janitorial	Tijuana	Tijuana	Hair Cover, Glove, Beard Cover, Gown, Shoe Cover
2	H.L Fastener		Chihuahua	Hair Cover, Beard Cover, Shoe Cover
3	Provasi		Guadalajara	Hair Cover, Glove, Beard Cover, Shoe Cover
4	Seguridad	Monterrey	Monterrey	Hair Cover, Glove, Beard Cover, Gown
5	Namisco	El Paso/Juarez, Chihuahua	Juarez	Hair Cover, Glove, Gown, Shoe Cover
6	Steri Tech		Puerto Rico	Hair Cover, Glove, Beard Cover
7	Guantes Vargas	Mexico City	Chihuahua	Glove, Gown
8	Cadillac Uniform	Caribbean	Puerto Rico	Gown