Syracuse University

Industrial Assessment Center

TRAINING MANUAL

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1.0 The Basics

1.1 Introduction

Welcome to the Syracuse University Industrial Assessment Center Team! As you have probably come to realize, it will take some time to bring you up to speed on the operation of the IAC. This training manual is intended to accompany your formal training and to help streamline the process. It is easy to feel overwhelmed by all that is involved in the IAC but over the next few months you will find that everything is generally easy to learn and easier than it seems. The IAC is in and of itself an "educational exercise" and team members are constantly learning new things.

1.2 What to expect

You can expect that over the next few months you will be responsible for doing your best to get up to speed on operations and procedures. You won't be expected to do it alone. Along with this manual, you are expected to read the Operations manual and the Rutgers manual (Both these manuals can be found in the office). Try and be in the office as often as possible. The best way to learn the IAC is to be present and to ask questions. As you are most likely an undergrad, your full and demanding engineering schedule will be taken into consideration. You will never be expected to devote time to the IAC that you don't have. **ACADEMICS COME FIRST.** You will not be expected to be present in the office and/or doing IAC related work when you should otherwise be studying.

Over the following months you can expect to get a mentor (one of the older IAC members) although your mentor will help guide you and is a source for answers, the IAC is a team and everyone will be happy to help you. Don't hesitate to ask questions. You will be expected to participate on site as much as possible, considering the academic schedule of undergrads it is understood that you may only be able to participate in two, one or no assessments in the beginning of your employment. That's okay! Eventually, in a few months you will be handed your first lead. It will be your responsibility to author that report and to take ownership of its responsibilities. On your first lead, you will have a "co-lead" that will help you every step of the way, the co-lead will be there on the day of the assessment to walk you through it and will be there to answer questions throughout the report writing process. Prior to your first lead, you will be expected to complete a "mock" report known as the Goatastic. This mock client features a handful of our most common recommendations and is in every way a complete report writing experience starting with bill analysis and going up to (not including) upload to Rutgers.

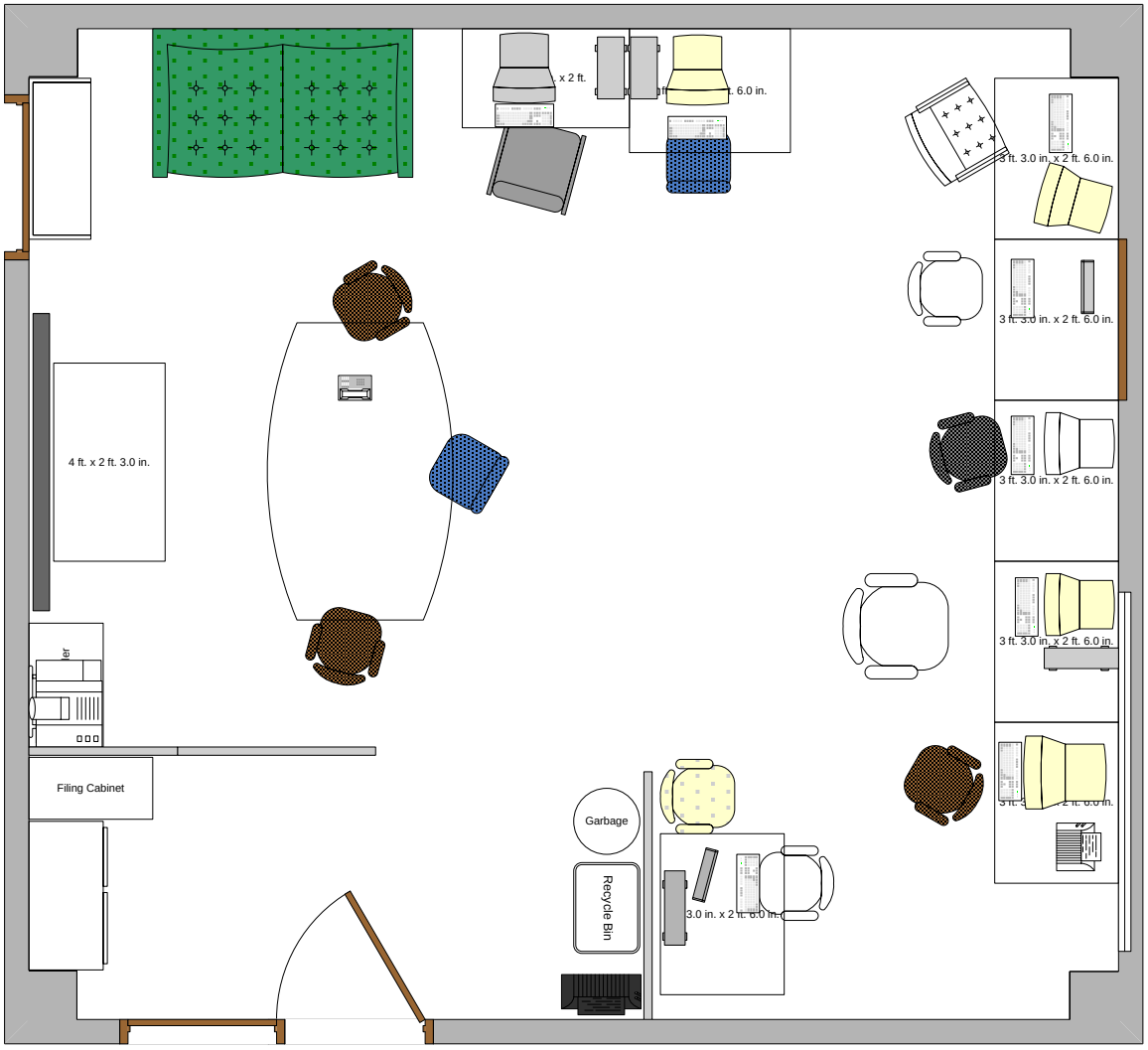
You will be expected to stay in Syracuse and work full time for the IAC in the summer. During the summer you will participate in more site visits and will be handed at least two lead assignments. Staying up in the summer is not bad. You will find that the IAC is a fun place to work, the summer will fly by.

Eventually, as your academic schedule becomes less demanding you will be expected to take on more lead assignments and to participate in more site visits throughout the semester. You will also be assigned with a specific responsibility that will change every year. These responsibilities are distributed among the team members and are handed down each year.

2.0 The office

2.1 The space

Syracuse University L.C. Smith College of Engineering and Computer Science has allotted the IAC the office space where we reside. The office can be considered a perk to working at the IAC. As a member of the team, you have as much right to its resources as anyone else. At any given moment the office is your place to work study and relax. The resources of the office, which include: computers, printers, internet, office supplies, storage, mailbox, textbooks and IAC staff expertise are available to you as needed.



2.2 Computers

Computers at the IAC are logged in via your AD (university wide Active Directory) user account. Certain resources and applications will require admission to the IAC alias/group with the CIT department located on the second floor of Link Hall. To do this, send an e-mail as follows.

To: help@ecs.syr.edu

Subject: *Add IAC Member to Alias/Share*

Body:

Hello,

We've recently added a staff member to the Industrial Assessment Center. It would be very helpful to have him added to the IAC alias and the Unix share as soon as possible. His/her credentials are below. It is important that he/she be able to access print privileges on phoebe/Link244Xerox, be able to access the IAC share at Sauron/IAC and to receive e-mails from iac@ecs.syr.edu. Please also suspend his/her print quota.

Brandon Peery
bwpeery

Thank you for your time.

Sincerely,
Matan Marom
x3-1523

The computers in the IAC are loaded with the standard ECS software package which includes the most recent version of Microsoft Office as well as other software tools that you may need throughout the engineering curriculum.

Although IAC staff members that are more senior will have computers that are apparently designated, the IAC for the most part has a sharing policy for office resources. This includes workstations.

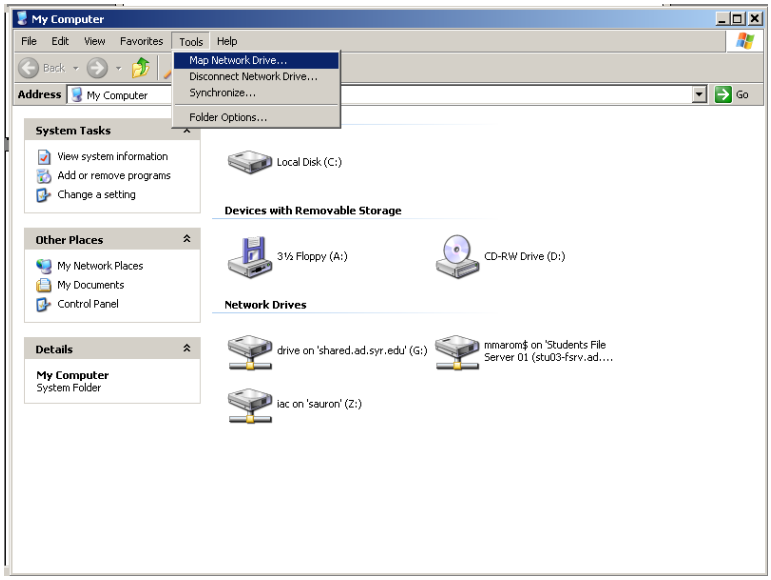
2.2.1 Logging into AD

1) Log into the computer by selecting “AD” as the domain and using your appropriate username and password.

Note: any changes you make from here on out will show up on any login to AD from any computer on campus.

2.2.2 Adding the IAC share to your account

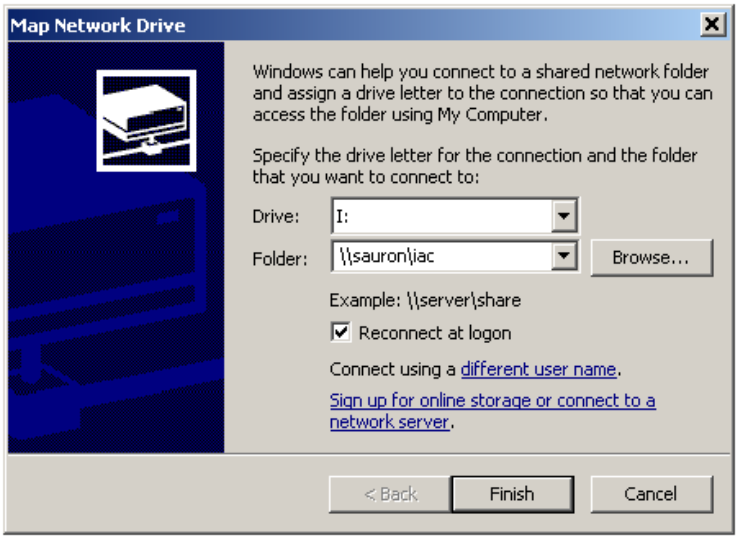
1) Double click on “My Computer”
2) From the menus at the top, select “tools”
3) Select “Map Network Drive”



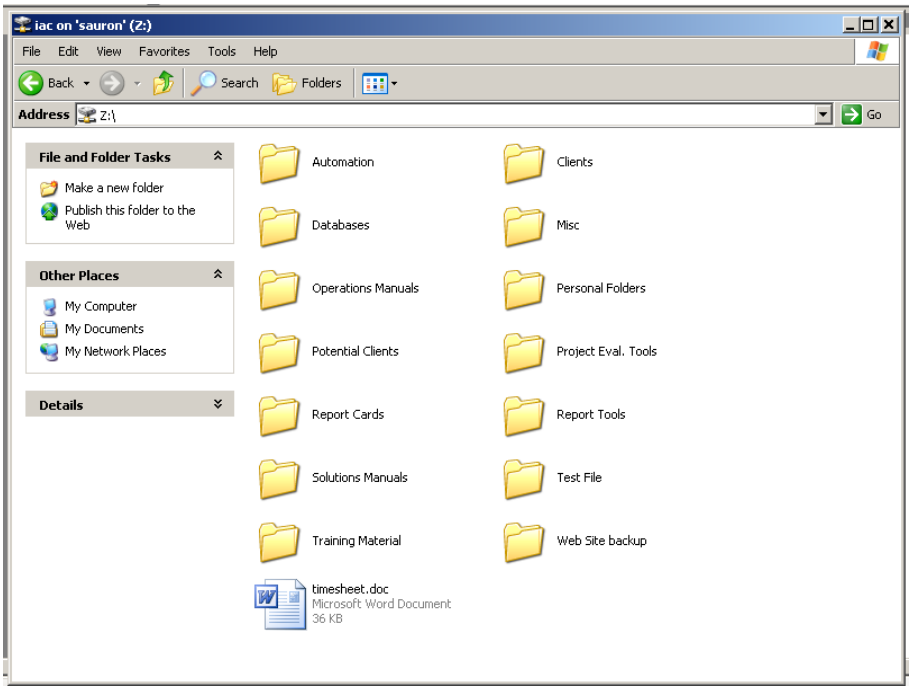
4) Select a drive letter of your choice (most members of the IAC choose “z” as the drive letter and therefore will commonly refer to the IAC share as the “**z drive**”)

In the “folder” field, type “\\sauron\iac”

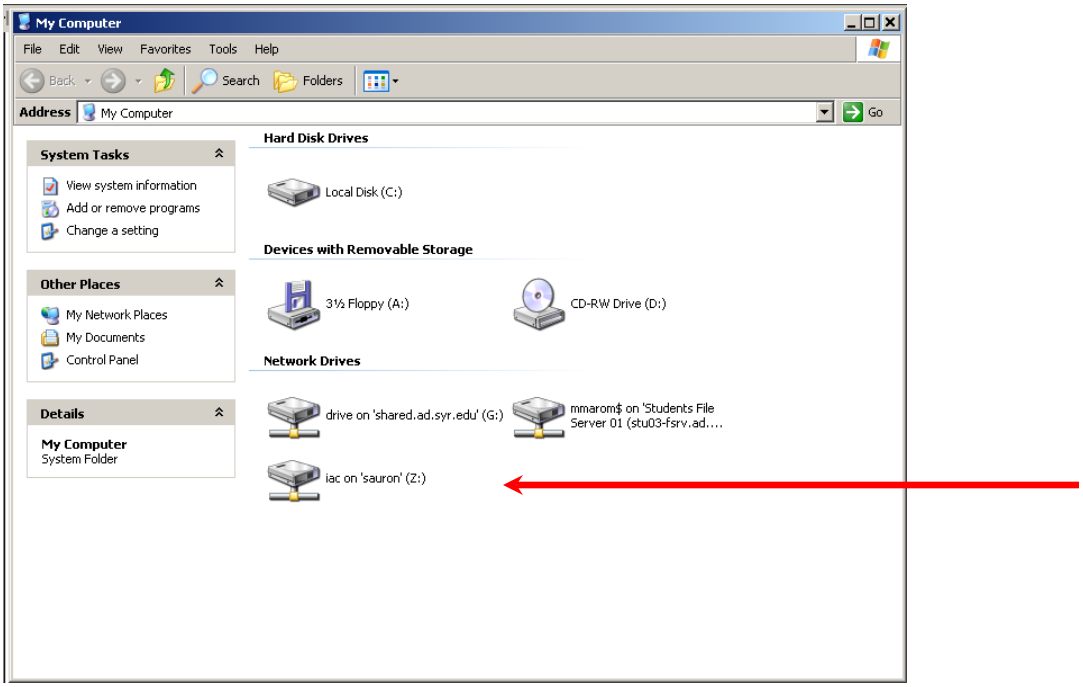
Note: Be sure to select “reconnect at logon” so that you don’t have to repeat this process next time you log in



When you click “Finish,” the following window should pop up.



This is the IAC share where all members access and store IAC files. This share will now appear in “My computer” as a network drive.



The drive contain several folders which are used by IAC members to store a variety of electronic material. The primary folder is the "**Clients**" folder. Here, clients are broken down by fiscal year and identified by client number (SUxxxx), every client has a folder containing all of the electronic files associated with it including, at a minimum, a copy of the report and billing data.

Now is a good opportunity to create a personal folder for yourself in the "**personal folders**" folder. Most every IAC employee, past and present, has a personal folder on the IAC space. Most past employees have left their files behind for the benefit of others. Your personal folder (if you choose to create one) has the benefit of unlimited file storage, increased backup and support and, by having one, it will be easier for you to share data and work with your coworkers on class projects.

Take some time to rummage around the IAC share and get acquainted with where and how files are stored.

It will also be helpful to follow the path: z:\Databases\AR Database.xls, this is known as the "**database**" and gives a listing of all of our past reports and what recommendations are in them. This database is handy when writing reports because it is keyword searchable (control F). Once a specific report or recommendation is located in the database, it can be easily found in the "clients" folder.

2.2.3 The Rutgers database

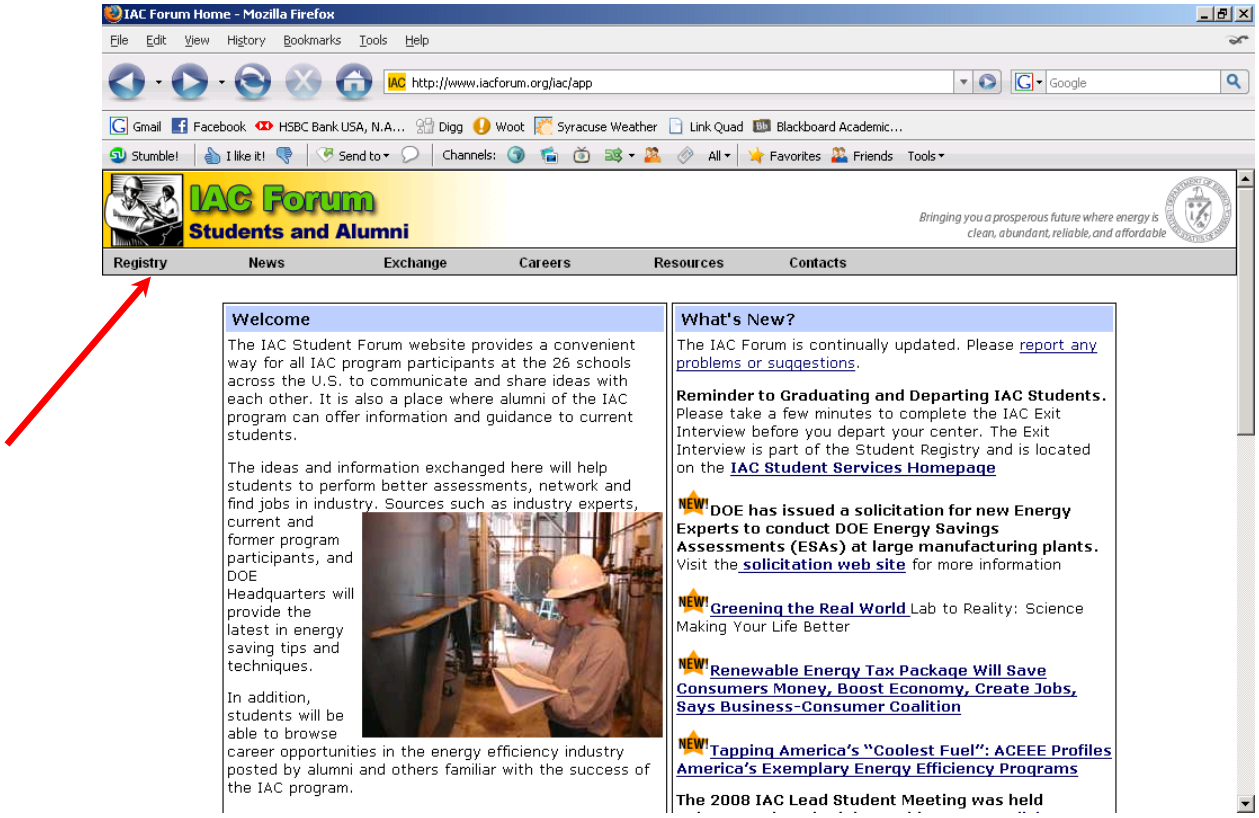
In addition to our own database, you will also hear people refer to the "**Rutgers database**" (or "**Rutgers site**"). This is a website maintained by Rutgers University which keeps track of all 26 IAC centers nationwide. The Rutgers database can be found at http://iac.rutgers.edu

By clicking the "Internal Use" button, you will be prompted for a username and password (which can be obtained from the center director). After entering the password you will be directed to the page that shows an activity log for our center. Here, completed jobs are tracked, reports are uploaded, implementation reports are uploaded and our performance is monitored.

You will be shown how to upload a report later, however, at this point you should know that it is extremely important that **NOTHING IS EVER SUBMITTED LATE TO RUTGERS!** There may be extenuating circumstances in the future, but these circumstances will be decided upon by the IAC director. As a rule, due dates with Rutgers should be considered set in stone and unbreakable.

2.2.3 The IAC Forum

If you haven't already been directed to do so, you should register with the **IAC forum**. The IAC forum is another website, maintained by one of our field offices, which tracks IAC employee activities. These activities are, at a minimum, a record of currently active members. The IAC forum can be found at http://www.iacforum.org



To register, click on "Registry" in the upper right-hand corner and follow the instructions to set up an account and log in. It should take about 5 minutes and is important that it is up to date for insurance reasons.

In the future, the IAC forum is a great place to post your resume. Several IAC alumni have gotten great jobs as a result of posting their resume on the IAC forum site.

2.3 The Department office

The department office is located in 263 Link Hall. You will become acquainted with the department office and its secretaries as part of your training program. Administrative support and the bulk of our office supplies are provided by the department office. Our mailbox is located there and outgoing mail for the IAC is sent via the department office. Fax, copy machine and binding is also available for IAC purposes. A kitchen is available to prepare food, especially during the summer. When it becomes crowded, professors, faculty and administration have priority. Weekly time sheets are handed in at the department office in a bin across from Debbie Brown's desk

2.4 Client board

The IAC is contracted for a number of assessments per year. The client board keeps track of our assessment calendar since the beginning of the year and usually projects about 5 assessments. From the day of the assessment, the report must be uploaded within 60 days. Internally, the IAC has a formal reviewing process for completed reports. The client board helps us keep track of upcoming assessments and deadlines so that everybody is kept informed.

3.0 Going On site

3.1 A word about safety

The manufacturing environment is typically very dirty, very loud and very busy. It is very important that IAC site visits be carried out in the safest way possible. You will be briefed and trained on safety extensively before your first site visit; however, it is important that safety always be kept in mind when conducting a site visit. Some key points to always remember are:

- Stay inside the marked walk way
- Watch out for forklifts
- **Do not touch anything**, unless you ask the plant tour manager
- Wear safety glasses and closed toed shoes at all times
- Do not leave the team for any reason
- Wear hearing/hard hats protection if required
- Follow all instructions provided by plant personnel
- Remember that although a machine is off it can start unexpectedly
- Do not obstruct the process of the facility in any way
- Be alert and keep your eyes open at all times

3.2 The industrial setting

The industrial setting is not necessarily what you might expect from most depictions you may have seen. In some cases the setting may be clean and organized; in others it can be loud, dark and chaotic. In some places it is very easy to get lost and disoriented and it is very important to stay with the group and listen to instructions.

Often, the person touring the team throughout the facility is very happy to show us what we need to see and to answer questions. However, the employees working on the shop floor will not always be willing to help and often times will not appreciate interruption. Inversely, some employees will approach you and ask questions and volunteer their services. It is best to stay with the group and let Suresh be a point of contact in most situations.

3.3 The dress code

There is no "dress code" in the office; however, when on assessment visits, IAC personnel should wear hard soled shoes (i.e. boots), a tucked in collared shirt and khaki pants. Jeans should not be worn.[1] In some cases, steel toe boots may be required and may be provided by the center prior to a particular site assessment. High heels can be cumbersome, and a hindrance to the pace of the group and should never be worn on site. Keep in mind that it is possible that assessments will be done in a dirty atmosphere and very expensive clothing should not be worn. However, clothing must be professional. [2]

Additionally, neck ties could be potentially dangerous in the industrial setting as they could be drawn in by machinery and therefore should **not** be worn during site visits. Similarly, dangling articles of clothing such as shirt tails should be tucked in and jewelry such as dangling or hoop earrings, bracelets, and long necklaces should not be worn on site. Long hair should be pulled back neatly in a bun, braid, ponytail, or with a headband. Remember, much of the machinery in an industrial setting can be dangerous in the event that an article of clothing, jewelry, or hair is caught. Your safety is dependent upon your ability to take preventative measures on every site visit.

Dressing to be safe is of ultimate importance, but you should also dress for the elements. Some facilities are not heated in the winter; others may have large areas of refrigeration in the summer. Additionally, a jacket that adheres to the safety considerations should be brought along in most cases.[3]

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[1] Obtained from the IAC Operations Manual, section 1.2, page 7.
[2] Obtained from the IAC Operations Manual, section 1.2, page 7.
[3] Obtained from the IAC Operations Manual, section 1.2, page 7.

3.4 Preparing for a site visit

Prior to going on site, there are a few things that must be completed. If you are the lead analyst, and you will be writing the final report, it is incumbent on you that you properly prepare. In the weeks leading up to the assessment, your timeline should look like the following:

Timeline	***Action Required***
2 weeks prior	• Complete Utility Billing Summary and submit to office for review • Submit Utility Billing Summary for Review to IAC Director at staff meeting
1 weeks prior	• Review Pre-Assessment Survey and discuss potential recommendations/equipment needed • Call company contact, and confirm date and time for site assessment • Reserve rental car • Check gear for charging/battery requirements
The day before	• Organize report folder, and site sheets to be brought on site the following morning

3.4.1 Typical schedule of an assessment day[4]

9:30am — *Arrival at client*

9:30am-10:30am — *Client Briefing*
The initial briefing can be rather intricate and lengthy, and can sometimes last an hour or more.

10:30am-12:00pm — *Plant tour*
First, data collection equipment should be mounted if necessary. Next, the plant tour should be conducted. This is also the time for the lead student to take notes on the plant background, process description, and best practices. All students should take notes of what is observed, possible AR's and any information needed to complete them. While basic information can be collected during this time be aware that if excessive time must be spent with equipment it can happen in the afternoon.

[4] Obtained from the IAC Operations Manual, section 1.5, page 12.

12:00-1:00pm	*Lunch* This time should be used to make a list of possible AR's and what information needs to be collected in order to write them.
1:00pm-3:00pm	*Collection of data* Collect data either from direct measurement or from questioning plant personnel. Each team member should be sure to write the name of the AR they are researching, what the current situation is, what should be done, and the necessary data to quantify savings.
3:00pm-3:30pm	*De-briefing and conclusion* Primarily the director, client, and lead student use this time to discuss what recommendations should be pursued. Also, this time is used to give the client an opportunity to ask questions. During this time the client should also be reminded of their obligations and the timeline for the report.

3.5 What to bring on assessments

When going on an assessment the lead for that assessment should bring any equipment that is necessary for the facility. Also, the lead prepares the day beforehand by charging all batteries when applicable and having the equipment ready to go for the next day.[5] The equipment that is most commonly brought is listed below:

A. Report file:
   1. Client folder including:
      - Utility graphs and summary created by lead analyst
      - The Save Energy Now "About Assessment" document[6]
      - The Save Energy Now "U.S. Industries: Partner with DOE to Save Energy and Money" [7]
      - The "Common Recommendations" document[8]
      - The "DOE Best Practices document"[9]
      - The Save Energy Now "Industrial Technologies Program CD
   2. Utility bills as sent by the client
   3. The "Major Energy Consumers Site Sheet" document[10] for your team
   4. The "Assessment Data Sheet" document printed double sided for your team[11]
B. Clipboards, Paper & Pens
C. Gear box with:
   1. Combustion analyzer
   2. Digital Camera
   3. Tool belt
   4. Burn kit
   5. First aid kit
   6. Light meter
   7. Measuring tape
   8. Distance meter
   9. CO2 meter
   10. Safety glasses
   11. Flashlights
   12. Thermometers:
      - Fluke and temperature wire
      - Small temperature gun

**Note: additional gear may be required for specific types of facilities and may also be brought on a site assessment.*

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[5] Obtained from the IAC Operations Manual, section 1.2, page 7.
[6] Found in \Clients\SU0XXX\Site Visit within the IAC drive.
[7] Found in \Clients\SU0XXX\Site Visit within the IAC drive.
[8] Found in \Clients\SU0XXX\Site Visit within the IAC drive.
[9] Found in \Clients\SU0XXX\Site Visit within the IAC drive.
[10] Found in \Clients\SU0XXX\Site Visit within the IAC drive.
[11] Found in \Clients\SU0XXX\Site Visit within the IAC drive.

4.0 Recommendations

4.1 Some common recommendations

A few of our most common recommendations are:

1) Duct in Outside Air to Compressors
2) Repair Air Leaks
3) Lower Compressed Air system Line Pressure
4) Install More Efficient Lighting
5) Recover Waste Heat from the Boiler
6) Install LED Exit Signs
7) Install Occupancy Sensors
8) Shop Electric Supply
9) Recover Waste Heat
10) Correct for Power Factor
11) Utilize Energy Efficient Belts
12) Utilize Synthetic Lubricants
13) Install Motion Sensors on Vending Machines

The following sections will provide a brief description of the recommendations and will include background and/or additional information relevant to the AR.

4.2 Duct in Outside Air to Compressors

In 99.9% of industrial settings, compressed air will play a major role and some type of large compressor will be present (often more than one). Compressed air is an expensive commodity and this is typically not known. For this reason, compressed air recommendations appear in 99.9% of our reports. Only about 5% of the energy consumed by compressing air is actually available for work at the point of use. Most compressor systems are volume controlled so it is important to remember that plant tends to operate for long periods at less than full load. It is usually possible to save 10-20% of the energy running costs of a compressed air system with relatively little capital costs.

Often, the intake air for the compressor(s) is drawn from the compressor room right on the compressor. On average, the outside air temperature for most cities in our operating radius is around 40 - 45 ºF (this annual average includes summer months). Colder air is denser and therefore, a compressor will not have to work as hard to compress it as it would if the intake air were drawn from the room at say 80 ºF. Ducting in outside air usually involves running standard pvc piping from an outside wall to the compressor intake and is relatively cheap. The following image illustrates a compressed

air system with outside air being ducted in. Notice the white pvc piping running down from the ceiling to the compressor intakes.

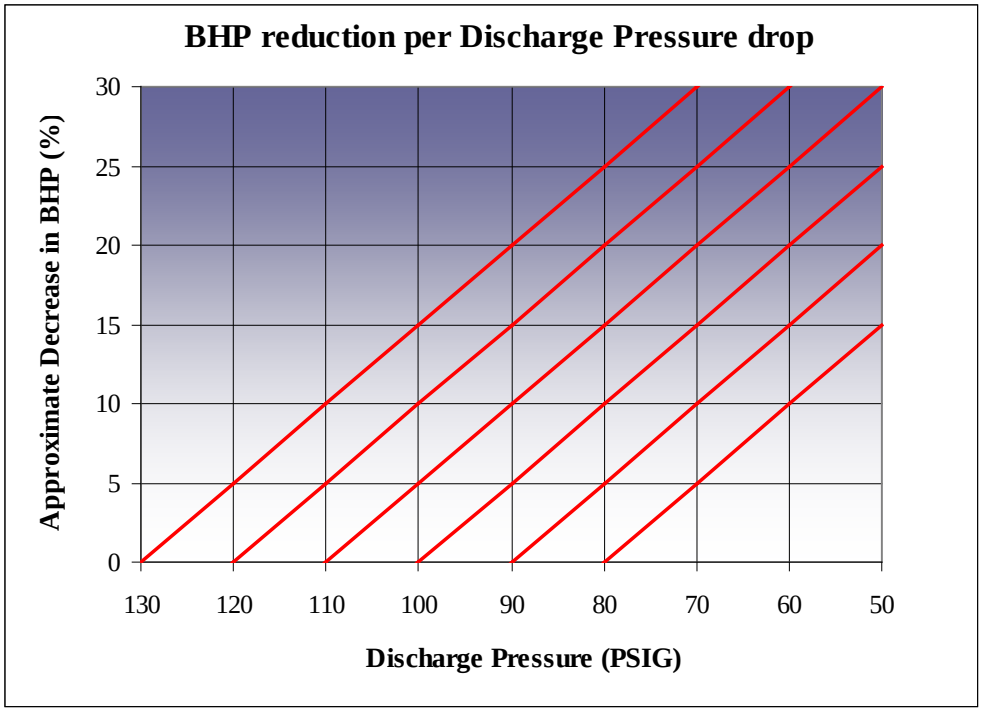
4.3 Repair Air Leaks

Compressing air costs money, it would come as no surprise then that having leaks is a waste of money. Everyone knows this, what people don't usually realize is how much money leaks cost them.

Typically, a facility will have between 30 and 60 air leaks (depending on its size). In most cases, the client will opt to have their maintenance staff take a count while the plant is shut down and will provide you with the number of leaks.

4.4 Lower Line Pressure

Just as most people realize that fixing leaks will save money, they also know that lowering the line pressure will too. Again, the role of the IAC is to show them just how much money they could save. Lowering the line pressure in a facility saves money based on a reduction in fractional work. The following graph (included with the recommendation) shows the relationship between percentage break horsepower (BHP) reduction and discharge pressure.



The energy savings associated with this recommendation are presented in the form of a table. The line pressure is shown dropped from the current condition to the proposed pressure in increments of 5 psi, each step down shows the increased savings. The idea is that the facility should gradually decrease until the lowered pressure shows an effect on production.

4.5 Install More Efficient Lighting

Lighting is perhaps the most noticeable source of energy waste in many facilities and there are indeed many opportunities for reducing lighting energy costs, ranging from simple manual switching to upgrading to more efficient types of lighting. Fully automated lighting control systems are also available.

There is a wide range of lamp types, with considerable variations in luminous efficacy.

Efficacy - Similar to efficiency, efficacy describes an output/input ratio, the higher the output (while input is kept constant), the greater the efficacy. Efficacy is the amount of lumens per watt from a particular energy source. A common misconception in lighting terminology is that lamps with greater wattage provide more light. However, light sources with high efficacy can provide more light with the same amount of power (watts), when compared to light sources with low efficacy.

In general it is important to select lamps with the highest efficacy, though the quality of lighting provided (most importantly, the color) also needs to be kept in mind. The following table gives examples of some of the most common lamp types and sizes.

Table 5 Typical load and output of various lamps

Lamp type	**Size**	**Circuit load (watt)**	**Output (lumens)**	**Efficacy (lumens/watt)**
GLS Tungsten	100 W	100	1200	12
Compact Fluorescent Lamp	16 W	20	700	35
Mercury Vapor	80W	93	3800	41
38 mm Fluorescent Tube	Varies	78	4900	63
26 mm Fluorescent Tube	Varies	71	4900	69
High Pressure Sodium SON	70 W	81	5500	68
Low Pressure Sodium SOX	55 W	68	7300	107

Lighting consumption can be estimated by multiplying the installed load in kW by the hours in use, to give the consumption in kWh. The load can be determined by estimating the number of fittings and identifying their rating. A performance index of between 10 and 20 W/m² is typical for fluorescent lighting when the load is related to floor area served. It is important to relate lighting levels and lamp types to the requirements in different areas.

IES Recommended Light Levels

The Illuminating Engineering Society (IES) is the largest organized group of lighting professionals in the United States. Since 1915, IES has prescribed the appropriate light levels for many kinds of visual tasks. For many years, lighting professionals applied the philosophy that "more light is better," and light levels recommended by IES generally increased until the 1970s. However, recently it has been shown that occupant comfort decreases when a space has too much light. Numerous experiments have confirmed that some of IES's light levels were excessive and worker productivity was decreasing due to poor visual comfort. Due to these findings, IES revised their Handbook and reduced the recommended light levels for many tasks.

Over-illuminated spaces are just as common as under illuminated ones. Optimal lighting is the aim of a lighting recommendation. The first step for a lighting retrofit is to measure the foot candles on the shop floor and to note the number, type and wattage of fixtures. The goal of the recommendation should be to set lighting to the proper level required and to do so with the highest efficacy.

In most cases, high bay fluorescent lighting banks with reflective ballasts will be best. This may not always be the case. Other times, the best you can do is replace the bulbs in a current system to more efficient ones (bulbs which present a higher efficacy).

Table 13.1 Recommended light levels for visual tasks.

Building/ Space Type	Guideline Illuminance Range (footcandles)
Commercial interiors	
Art galleries	30-100
Banks	50-150
Hotels (rooms and lobbies)	10-50
Offices	30-100
-Average reading and writing	50-75
-Hallways	10-20
-Rooms with computers	20-50
Restaurants (dining areas)	20-50
Stores (general)	20-50
Merchandise	100-200
Institutional interiors	
Auditoriums/ assembly places	15-30
Hospitals (general areas)	10-15
Labs/ treatment areas	50-100
Libraries	30-100
Schools	30-150
Industrial interiors	
Ordinary tasks	50
Stockroom storage	30
Loading and unloading	20
Difficult tasks	100
Highly difficult tasks	200
Very difficult tasks	300-500
Most difficult tasks	500-1000
Exterior	
Building security	1-5
Floodlighting (low/high brightness or surroundings)	5-30
Parking	1-5

Examples of common lighting configurations:

Metal Halide

Sodium

Fluorescent

4.6 Recover Waste Heat from Boiler

A boiler typically exhausts combustion air between 300 and 600 degrees Fahrenheit. This heat often times is expelled from the facility through a stack. There are two good uses for this heat right at the boiler.

The first method is to use what is called an **economizer** to capture the heat from this air and use it to preheat the water going into the boiler. The hotter the intake water, the less fuel will be necessary to heat it to its vaporization point. The image below is an example of shell in tube type heat exchangers.[12]

Inversely, a **recuperator** uses the exhaust heat to preheat incoming air. The same result of using less fuel toward the same end is desired. The choice of a recuperator versus an economizer will depend on the setup of the boiler and other factors. You can't have both.

British Thermal Unit (Btu) - One Btu is the amount of heat required to raise 1 pound of water 1 degree Fahrenheit in temperature. To get a perspective on this quantity, a cubic foot of natural gas at atmospheric pressure will release about 1,000 Btu when burned in a boiler with no losses. This same 1,000 Btu will produce a little less than 1 pound of steam at atmospheric conditions, starting from tap water.

4.7 Install LED Exit Signs

In most places, the exit signs are not a primary concern. Typically, at best, a facility will have fluorescent bulbs in their exit signs. Usually, facilities will have a

[12] Image of a Kentube economizer obtained from http://www.blesi-evans.com/kentube.htm

mixture of incandescents and flourescents. It's rare to see LED exit signs in sites we assess.

The savings from switching over to LED exit signs come from the drastically reduced wattage they consume, but primarily, the savings are in the expected man-hours it takes to replace traditional exit sign bulbs. The common fluorescent bulb will last approximately 2 years without burning out. An LED will have a duty life of approximately 20 years. LED retrofits will also include a battery backup, this limits the chances of an exit sign being burned up at the time of an emergency.

4.8 Install Occupancy Sensors

There are essentially two types of occupancy sensors that we recommend. The first type is a traditional motion sensor that can be installed on lighting in low traffic areas and will turn them off in the absence of plant personnel. The savings for this type of recommendation are based on a percentage that the lights in these areas will be unoccupied.

The second type of occupancy sensor that we recommend is a device called a vending miser. The vending miser is a simple, cost effective, device that attaches to the outside of a vending machine and will put it into an idle state when the area is unoccupied. Vending misers should not be recommended for vending machines that distribute dairy of any kind or food that can spoil. It is only recommended for soda and juice vending machines.

4.9 Shop Electric Supply

Electrical usage costs are broken down into two main fees, supply and delivery. The delivery company will always be the local utility; however, there are a number of third party supply companies that will typically offer a cheaper rate. Most people either don't know that they are allowed to shop their supply or they feel as though they are not eligible due to negotiated rates, aid programs, etc.

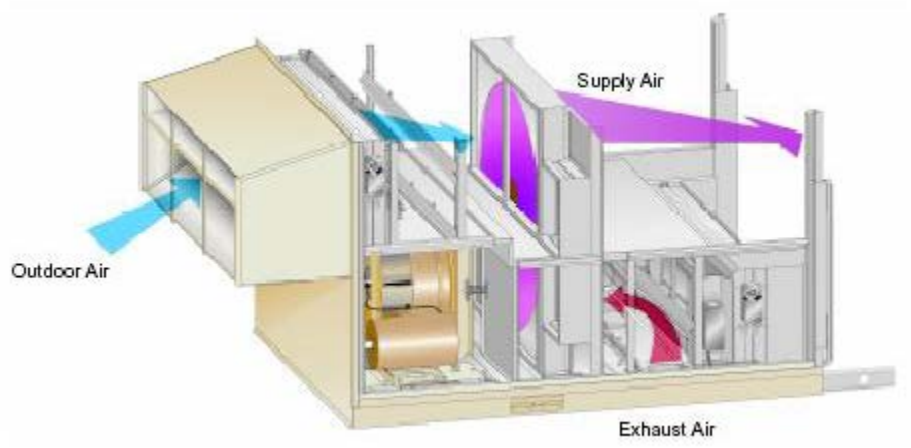
In reality, it is well within most clients' rights to shop their supply regardless of anything they have negotiated.

4.10 Recover Waste Heat

In many places, hot air is exhausted from the facility for various reasons. This output of air makes it necessary to bring in "Make-Up" air to replace it otherwise a negative pressure will develop in the facility. Since the incoming air usually comes from outside, it is typically very cold and must be heated to a comfortable temperature by means of an "air make-up unit." An air make-up unit is essentially a box with a natural

gas fueled fire inside of it. The air passes through this box to heat it up before entering the facility.

In the cases where hot air is exhausted from the facility, for whatever reason, it makes sense to recover it for use inside the facility. Recovering waste heat will allow the air make-up units to be shut down, thereby realizing energy savings. The problem with recovering exhausted hot air is that it most likely will be dirty with smoke, smog, contaminants, etc. In many cases, filtering it is impossible. There are several methods we can recommend to recover the heat content of the air; the most common recommendation is for an enthalpy wheel. An enthalpy wheel consists of two ducts, the hot exhaust runs through one duct and the air to be heated runs through the other. A wheel rotates between both ducts which allows the dirty air to pass through it while heating the wheel up, the hot portion of the wheel then bleeds off the heat energy to the colder air in the other duct. A typical enthalpy wheel is shown below.



4.11 Correct for Power Factor

A manufacturing environment consists of several different pieces of equipment that draw power. There is no such thing as a piece of equipment that draws and uses power at 100% efficiency. Industrial machinery will always draw more power than it actually commits towards work. This excess power must be supplied by the utility; however, this power isn't actually used. This inefficiency is called **power factor**. Power factor is calculated by the utility based on metered demand (kW) and reactive power (rkVa) used by the facility. A percentage is derived based on these metrics. Because there is no such thing as 100% efficiency, the utility will typically allow a power factor as low as 95%, anything below that will be charged to the company.

A poor power factor can be easily corrected by purchasing capacitor banks to make up rkVa at the main trunk of the power coming into the facility. It is also possible to pin point machines and correct locally, however, this is not usually recommended because correcting at the main allows for capacitance to be added or removed as needed.

Also, by eliminating a low power factor, the life of machinery and circuit boards plant wide will be increased due to the increased efficiency.

4.11 Utilize Energy Efficient Belts

Many manufacturing plants require both small and large motors for the machinery used in their process. Some plants may even have dozens of motors in operation at any given time. With so many motors required in plant operations, it is clear that any energy savings for the motors in such a plant could be potentially very high. Therefore it is important to request a motor inventory if available and look for motors which currently use standard V-belts.

According to Modern Industrial Assessments: a Training Manual,[13] "The use of high efficiency V-belts (also called cog-type V-belts) has been demonstrated to provide energy savings through reduction of belt slippage and reduced belt heating. Manufacturers claim energy savings of 2 to 4 percent when standard V-belts are replaced with cogged belts. For this analysis, savings are estimated as approximately 3% based on manufacturers' literature."

In order to write this recommendation, a load factor, efficiency, total motor horsepower, and number of motors is required. In the event that the HOBOS are applied to motors for data logging, the load factor and efficiency may be calculated based on the data obtained.[14] The total motor horsepower and number of motors may be obtained on site from plant personal, or by taking an informal motor inventory; however generally, the load factor, and efficiency are estimated by IAC personnel as 0.75 and 0.85 respectively.

4.12 Utilize Synthetic Lubricants

In addition to locating motors with standard V-belts on site assessments, it is recommended that IAC members also observe any motors that currently use standard petroleum based lubricants. Often, in plants with a great deal of motors, as described above, standard petroleum based lubricants are used for the lubrication of motors in th facility.

According to the Department of Energy Self- Assessment Manual, manufacturers of synthetic lubricants have found energy savings between 10 and 20 percent[15] of the energy normally lost in the operation of motors, gearboxes and mechanical joints. This is due to the ability of synthetic based lubricant to preserve viscosity with respect to temperature, and therefore have a greater resistance to temperature change than petroleum based lubricants. Writing this recommendation will require a count of the current number of motors that can be switched to synthetic lubricants, which may be obtained during the standard motor inventory taken by the IAC team while on site.

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[13] A published version of *Modern Industrial Assessments: A Training Manual*, created by the Department of Energy for IACs nationally, may be obtained in the Syracuse IAC office under the Rutgers-DOE-IAC Training Manual

[14] For more information on using the HOBOS, and other equipment, refer to Chapter 5, the Gear section of this manual.

[15] Taken from the Department of Energy Self-Assessment Manual.

4.13 Install Occupancy Sensors on Vending Machines

In addition to all the recommendations outlined in the previous sections, it is also of some importance to take a count of the number of vending machines within a plant. On a given day, such vending machines may be running internal lights and compressors while idle, which can amount to an entire year of energy wasted by vending machines in the idle state.

It is therefore often recommended that plants install occupancy sensors on vending machines which will cycle internal lights and compressors. The sensors will cycle on while a patron is in front of the machine, and off after 15 minutes of inactivity. It is important to note that this recommendation is only applicable to non-dairy, and non-perishable vending machines only. For ordinary beverage machines, the insulation of the machine will keep beverages sufficiently cool while the lights and compressor turn off, and for snack machines, lights remain off in idle state. Additionally, in some cases, a "bank" may be installed to allow one motion sensor to correspond to more than one machine. A simple count of all the beverage and snack machines, and an estimation of operation time is required to write this recommendation.

4.12 A brief history

The following list shows all the recommendations that we have recommended in the history of the center. It would be a good idea to familiarize yourself with this list and ask a team member to explain any of the recommendations that are not self explanatory.

Common Recommendations:

Lower Line Pressure
HP, LF, HRS, Line Pressure
Duct in Outside Air
HP, LF, HRS, Temp, Distance to wall/ceiling
Repair Air Leaks
Leaks, Temp. Inlet, Line pressure, Avg. Temp.
Correct for Power Factor
Metered kW, Metered rkVa, Electric Service (V)
Shop Electric/Nat. Gas Supply
Monthly $/kw / Annual Nat. gas. cost and usage
Utilize Higher Efficiency Belts
HP, Efficiency, LF, HRS
Utilize Synthetic Lubricants
HP, Efficiency, LF, HRS
Install Occupancy Sensors
Rooms, Watts, # Fixtures, # Bulbs, HRS, Traffic
Vending Machines
Machines, HRS (24/7), wattage assumed 255
Exit Signs
exit signs Incandescent, # Fluorescent, Wattage
Pay bills on time
Late Fees Incurred
Install Turbulators on Boiler
MMBtu by boiler, Efficiency, Temp. Exhaust
Install More Efficient Lighting
fixtures, # bulbs, Watts, Ft-candles, HRS, Area
Recover [Compressor] Waste Heat
HP, HRS, Exhaust: Velocity, Area, and Temp.
Insulate Steam/Hot Water Lines
Pipe Surface Area, Surface temp, Air temp., HRS
Install removable insulation on steam valves
Valves, HRS, Boiler Efficiency
Remove scale in boiler
MMBtu by boiler
Switch on Transfrmr. Primary Side
HRS downtime, Primary coil voltage → Wattage
Turn off Equipment not in use
Energy usage, HRS not in use
Adjust Boiler Fuel Air Ratio
Combustion Analysis (* Efficiencty, *Ex. Temp)
Install Economizer on Boiler
Boiler output, LF, HRS, Eff., Ex.Temp, Rm.Temp
Insulate bare tanks
Surface Area, Surface Temp., Rm. Temp
Install dual fuel burner in boiler
Price N.G., Price Fuel Oil, MMBtu by Boiler
Install soft start motor
Avoided Costs with SS (include man-hours)
Install timers on lighting
Rooms, Watts, # Fixtures, # Bulbs, HRS
Use outside air for cooling
Tax refund on process Natural Gas
Return condensate to Boiler
Charge Forklifts overnight
Turn forklifts propane to electric
Run equipment during off peak hrs
Purchase transformer from utility
Eliminate perimeter lighting
Sell waste to recycler
Use sock system heat plant floor
Install insulated docking bays
Repair/replace steam traps

Unique Recommendations:

Insulate Building
Send operators to Flexo-School
Install Combined Heat and Power
Install Incinerator to burn waste
Install a blow-molding line
Install chiller to close cooling loop
Add equipment to stop bottlenecks
Change pump to electric pump
Install centralized refrig. System
Move all production to off peak hrs
Reduce Parts handling
Install high speed roll door
Install lo flow shower heads
Burn waste for heat
Install dryer in comp. air system
Switch electric service providers
Install Hydro Cyclone System
Automate Vacuum Pumps
Advertise Product via Internet
Install nozzles on blowers
Install a filter press to dry sludge

Common Recommendations:

Install wind power
Discontinue bad use of Comp. Air
Move dumpster to avoid public use
Institute Lean Manufacturing
Institute the "Five S's"
Use Acid Life Extender
Install VFD on Boiler
Install destrafication fans
Close plant for one day per year
Install controls on comp.air system
Install hydropower
Install parking lot
Rent out unused land/space
Replace leather belts with synthetic
Mount motors in direct drive
Remove natural gas service
Install pallet stove (incinerator)

Unique Recommendations:

Install weather-stripping
Use setback timers for HVAC
Install plant rail access
Install bottling line
Replace label stickers with stamp
Recycle waste [water]
Demolish unused building(s)
Install waste water lagoon
Relocate maintenance workers
Install electrostatic paint system
Lock the stock room
Install boiler open feedwater heater
Install uninterrupted power supply
Eliminate second shift
Reduce travel time in process
Automate process
Recycle pallets
Install demand control ventilation
Install gas engine driven chiller
Install a PSA nitrogen gene

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5.0 Resources

During your time here at the IAC, there will be many instances in which you will be required to research a particular topic, either for special projects, or for new recommendations. The following is a list of some of the most commonly used resources available to you right here in the IAC office.

Implementation and Costing[16]

- McMaster
- RS Means- Electrical
- RS Means- Mechanical
- RS Means- Building Construction
- Grainger

Heating, Refrigeration, and AC Applications[17]

- ASHRAE Fundamentals
- ASHRAE Equipment
- ASHRAE Applications
- ASHRAE Refrigeration
- ASHRAE HVAC Systems and Equipment

Thermodynamics, Fluid Mechanics, and Heat & Mass Transfer

- The Fundamentals of Engineering Thermodynamics (by Moran & Shapiro)
- Basic Heat and Mass Transfer (by Mills)
- Introduction to Fluid Mechanics (by McDonald)

IAC Network and Online Resources

- Rutgers Database: http://iac.rutgers.edu/
- IAC Drive
- IAC Report Database: \Databases\AR Databases
- IAC Report Tools: \Report Tools
- IAC Miscellaneous Report Assistance: \Misc

General Online Resources

- McMaster-Carr: http://www.mcmaster.com/
- RS Means: http://www.rsmeans.com/
- Grainger: www.grainger.com
- ASHRAE: http://www.ashrae.org/
- ThomasNet: http://www.thomasnet.com/

[16] Hardcopies of the most recent editions of these text are kept in the office, however their websites should be checked for any additional or updated information.

[17] Hardcopies of the most recent editions of these text are kept in the office, however their websites should be checked for any additional or updated information.

*It should be noted that the above list is *not* comprehensive. Some resources may come from the Director of the IAC, your peers in the office, the Mechanical and Aerospace Engineering office located in 149 Link Hall, as well as outside contacts such as vendors. You should exhaust all your resources while researching information to obtain the most diverse.

6.0 Bills

6.1 An understanding

The first step in any assessment is to analyze the utility bills of the client. There are a few basic reasons for this.

1) Any recommendations that save energy need to be justified on the basis of how much money their implementation will save. In order to calculate this, energy savings must be multiplied by a **unit cost**.
2) It is important to know whether or not the client's utility structure is appropriate and correctly measured. Utility companies oftentimes do a great deal to help clients towards efficient and reasonable energy use. However, sometimes utilities can make mistakes that can be easily missed and extremely costly to the client.
3) Careful analysis and thorough understanding of a client's utilities can infer problems to be addressed.

When receiving a client at the IAC, you will be given (ideally) 12 months of utilities bills. These bills are usually for electricity and natural gas, but can also include water, sewer, process needs (such as nitrogen, acid, etc.) and hazardous waste removal.

Before going on site, you will be responsible for analyzing the clients utility bills and arriving at a utility summary (one will appear at the end of this chapter).

6.2 Supply vs. Delivery

Utility bills for industry are oftentimes broken down by supply and delivery. To understand the difference, it is important to understand that energy is generated somewhere before it is brought to the client. In the case of electricity, electricity is generated at a power plant before it is brought to the site of use via electrical transmission cables. Similarly, natural gas is delivered via pipelines.

Often, supply and delivery are both provided by the **local utility** (e.g. National Grid, Niagara Mohawk, or "**NIMO**") and will appear on the same bill. However, a company has the right to "**shop supply.**" What this means, is that the company can buy their supply of electricity or natural gas from a different supplier (e.g. it is generated somewhere else by a different entity other than their utility). However, it is physically impossible and impractical to have separate transmission lines and pipelines for each supplier so electricity and natural gas will still have to be transmitted by the local utility. In this case, the company will receive a separate set of bills from their supplier (supply) and from their utility (delivery). Both will be charged based on the amount used.

6.2 Electrical Demand and Usage

Demand (kW) is a term which refers to the instantaneous amount of electricity being used. Think of demand as the speedometer on your car's dashboard (and usage, discussed next, as the odometer). The speedometer instantaneously measures your speed (the faster your speed, the quicker you will accumulate miles on your odometer). In other words, your demand is the amount of electricity the utility has to provide at any given instant. Because the utility must have the infrastructure in place to support a client when it has everything switched on at once, the utility will break up the measured demand into 15 minute increments and take the average demand across each increment of time. The increment with the highest average demand (for the month) is what the utility will charge for the whole month. Demand is measured in kilowatts (kW).

Usage (kWh) is a term which refers to the total, accumulated, amount of electricity used by a client. Described as the odometer on your car (earlier), electrical usage is a discrete amount of electricity consumed in a given month. Usage is measured in kilowatt-hours (kWh).

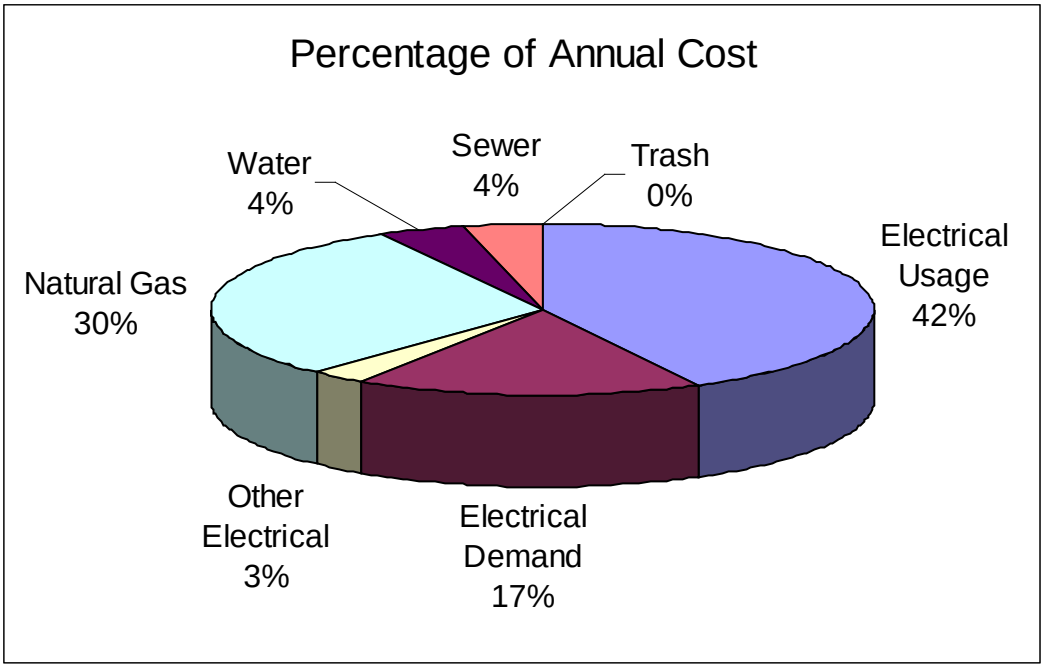
For example, suppose you have a light bulb that consumes 1,000 Watts (or 1 kW). The light bulb demands 1 kW of power when it is on. If this light bulb were left on for 1 hour it would consume (1 kW) x (1 hour) = 1 kilowatt-hour (kWh) of electricity. If it were left on for 2 hours it would consume (1 kW) x (2 hours) = 2 kilowatt-hours (kWh) of electricity, and so on.

In application, a company will have several hundred pieces of equipment: lights, motors, production equipment, compressors, etc. Each piece of equipment will have its own electrical demand (kW). All of this equipment will operate at different times and load factors throughout the month and contribute differently to the overall electrical bill.

EXAMPLE UTILITY SUMMARY

Summary

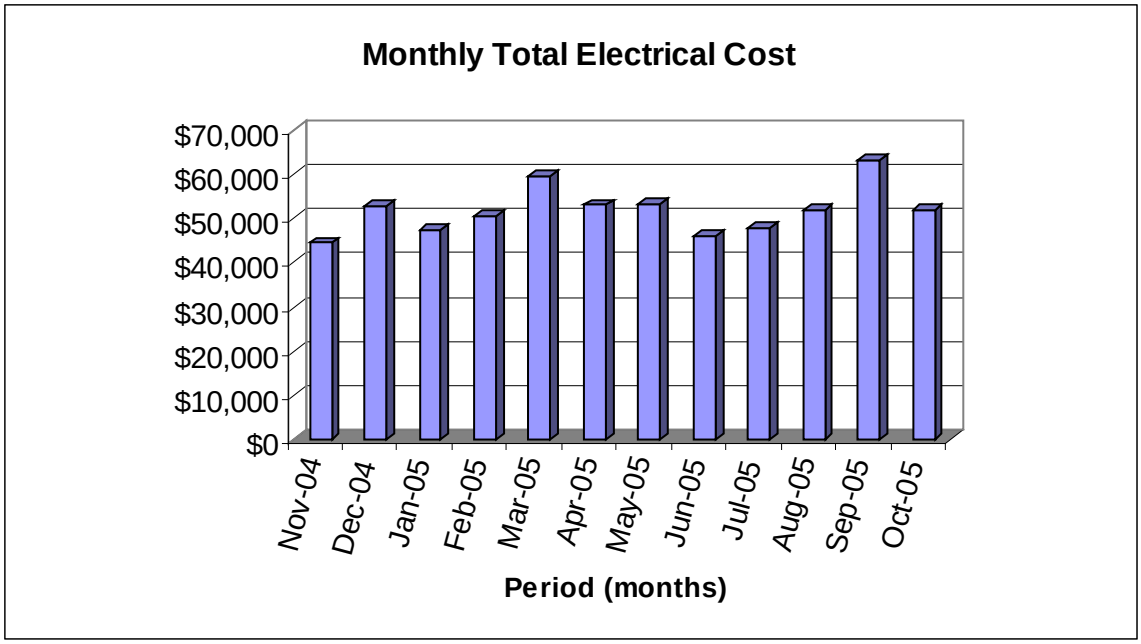
Utility Summary					
Utility	Annual Cost	Annual Usage	MMBTu	Average Cost	Cost per MMBtu ($)
Electrical Usage	$424,057	4,880,160 kWh	16,656	0.0869 $/kWh	$18.10
Electrical Demand	$168,877	12,870 kW	n/a	13.07 $/kW[18]	n/a
Other Electrical	$29,670	n/a	n/a	n/a	n/a
Natural Gas	$301,650	361,661 Therms	36,166	0.83 $/therm	$8.34
Water	$40,000	30,000,000 gallons	n/a	0.001 $/gallon	n/a
Sewer	$40,000	n/a	n/a	n/a	n/a
Trash	n/a	n/a	n/a	n/a	n/a

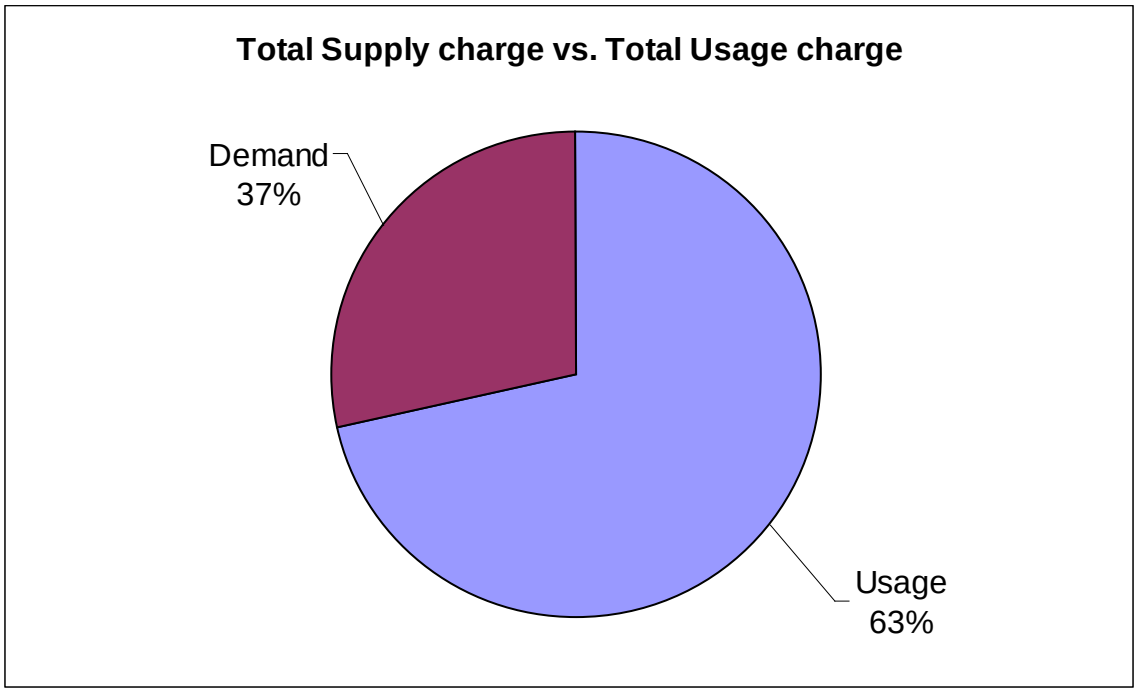


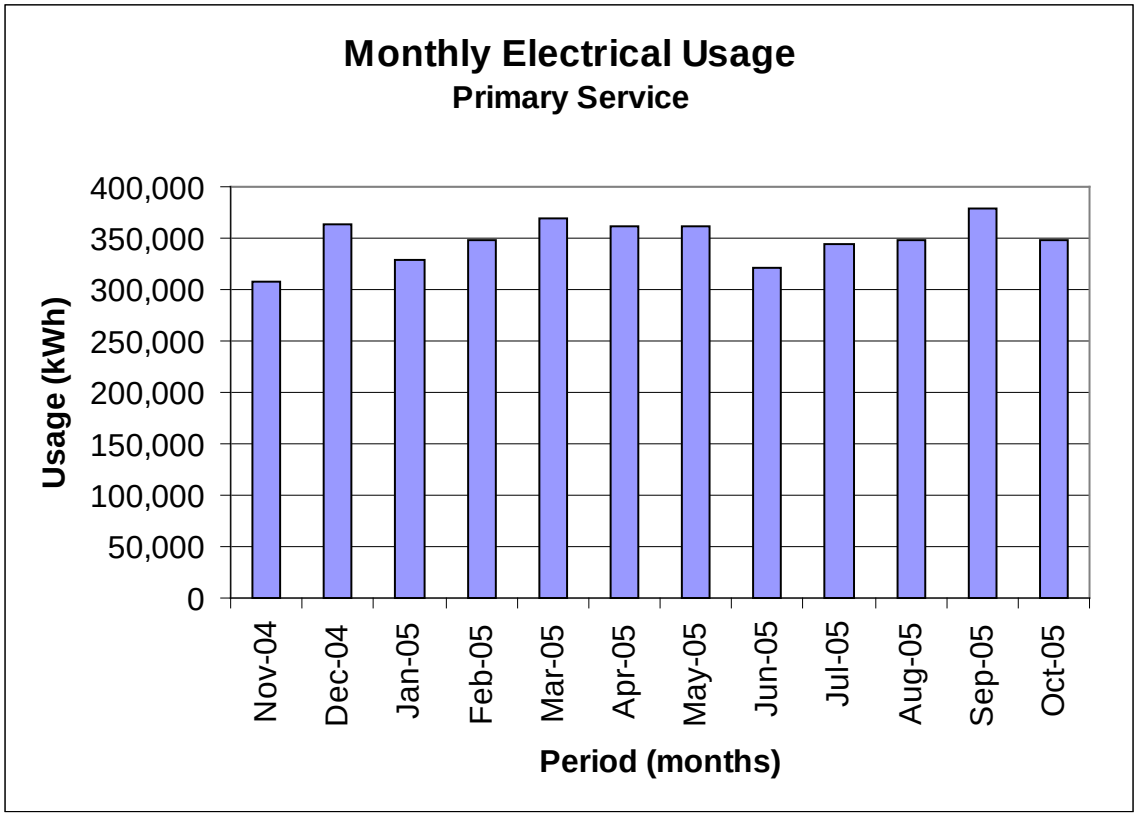
[18] Note: Demand charge is a weighted average taken for both the primary electrical service and the smaller secondary electrical service.

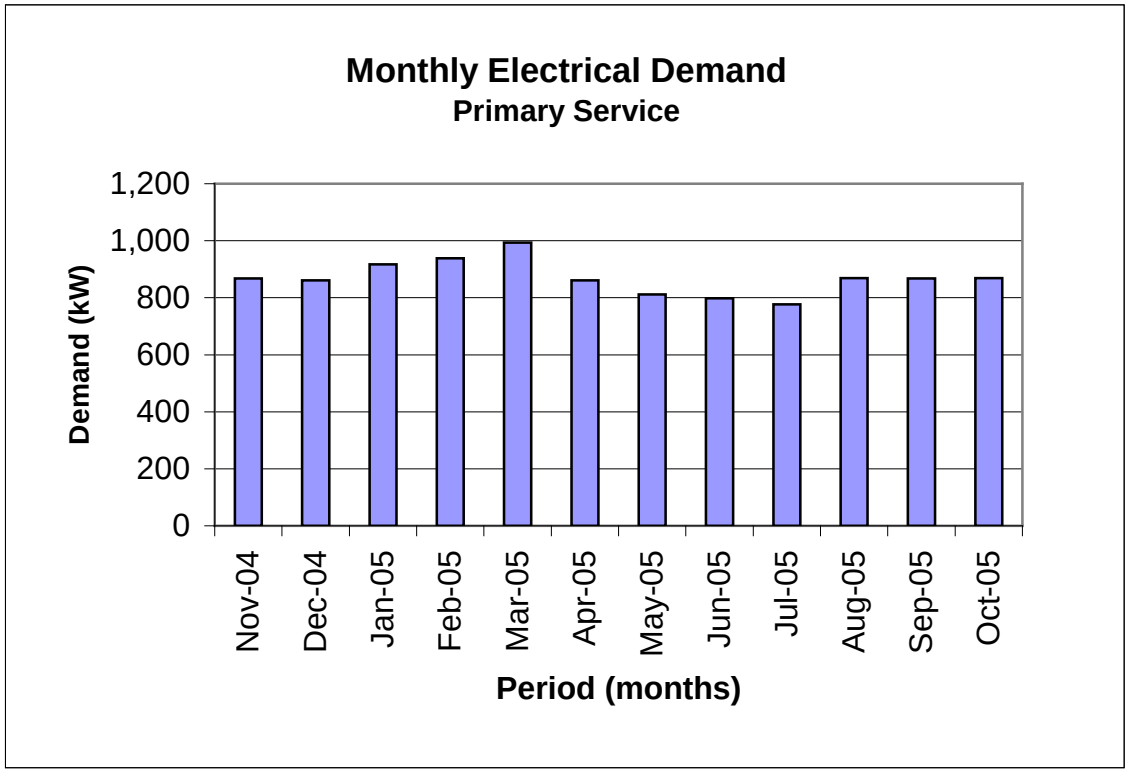
Electricity

Primary Service														
Period Ending	Supply			Delivery								Total Charges	Other Charges	Billed Total
	Usage (kwh)	$/kwh	Supply Charge	Usage (kwh)	$/kwh	Usage Charge	Demand (kw)	$/kw	Demand Charge	Reactive (RkVA)	Reactive Charge			
Nov-04	307,300	$0.0551	$16,926	307,300	$0.0217	$6,678	868	$12.69	$11,015	525	$200	$34,819	$1,825	$36,644
Dec-04	362,600	$0.0630	$22,829	362,600	$0.0217	$7,879	861	$12.69	$10,926	497	$179	$41,813	$1,890	$43,703
Jan-05	328,300	$0.0561	$18,431	328,300	$0.0217	$7,134	917	$12.69	$11,637	525	$186	$37,388	$1,152	$38,540
Feb-05	347,200	$0.0594	$20,620	347,200	$0.0217	$7,545	938	$12.69	$11,903	539	$192	$40,260	$935	$41,195
Mar-05	368,900	$0.0699	$25,797	368,900	$0.0217	$8,016	994	$12.69	$12,614	560	$194	$46,622	$2,549	$49,171
Apr-05	361,900	$0.0610	$22,083	361,900	$0.0217	$7,864	861	$12.69	$10,926	511	$190	$41,064	$1,856	$42,920
May-05	361,200	$0.0677	$24,446	361,200	$0.0217	$7,849	812	$12.69	$10,304	476	$175	$42,774	$1,772	$44,546
Jun-05	320,600	$0.0615	$19,701	320,600	$0.0217	$6,967	798	$12.69	$10,127	511	$208	$37,002	$1,814	$38,816
Jul-05	345,100	$0.0634	$21,869	345,100	$0.0217	$7,499	777	$12.69	$9,860	511	$214	$39,442	$2,127	$41,570
Aug-05	348,180	$0.0651	$22,679	348,180	$0.0217	$7,566	$869	$12.69	$11,033	$520	$196	$41,473	$1,817	$43,290
Sep-05	378,700	$0.0900	$34,083	378,700	$0.0217	$8,229	868	$12.69	$11,015	546	$218	$53,545	$2,254	$55,799
Oct-05	348,180	$0.0651	$22,679	348,180	$0.0217	$7,566	$869	$12.69	$11,033	$520	$196	$41,473	$1,817	$43,290
Totals	4,178,160		$272,143	4,178,160		$90,791	10,433		$132,392	6,241	$2,349	$497,675	$21,809	$519,485
Averages	348,180	$0.0648	$22,679	348,180	$0.0217	$7,566	869	$12.69	$11,033	520		$41,473	$1,817	$1,817


Monthly Total Electrical Cost
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Nov-04
Dec-04
Jan-05
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Sep-05
Oct-05
Period (months)


Total Supply charge vs. Total Usage charge
Demand
37%
Usage
63%

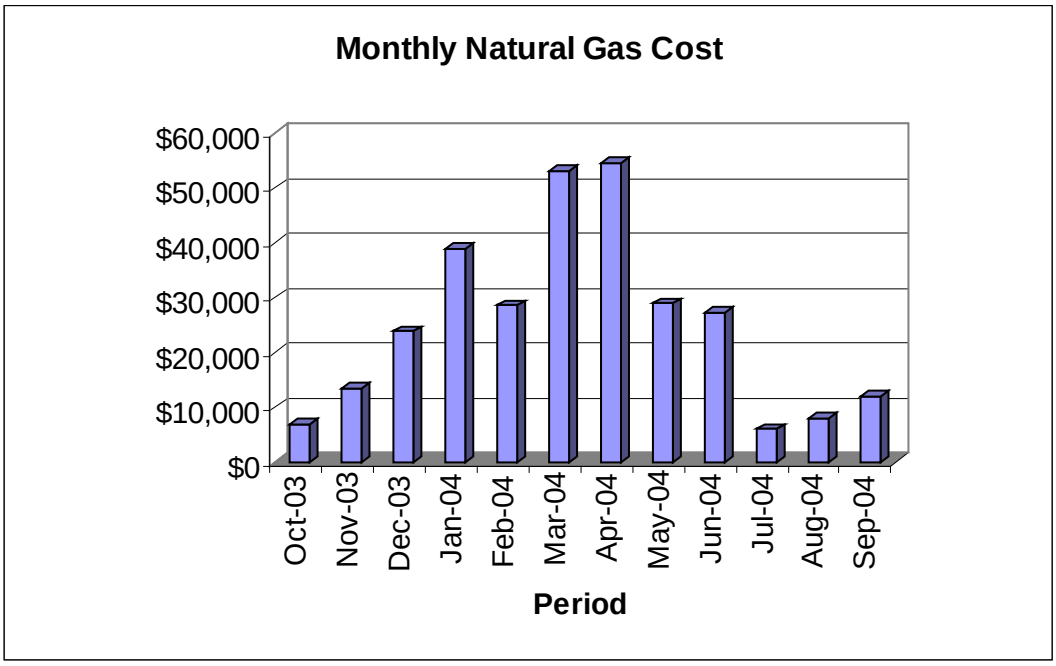

Monthly Electrical Usage
Primary Service
Usage (kWh)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Nov-04
Dec-04
Jan-05
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Sep-05
Oct-05
Period (months)


Monthly Electrical Demand
Primary Service
Demand (kW)
1,200
1,000
800
600
400
200
0
Nov-04
Dec-04
Jan-05
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Sep-05
Oct-05
Period (months)

Natural Gas

Natural Gas							
Period Ending	Supply			Delivery			Total Charges
	Usage (Therm)	$/Therm	Supply Charge	Usage (Therm)	$/Therm	Delivery Charge	
Oct-03	17,402	$0.3125	$5,438	17,402	$0.0923	$1,606	$7,044
Nov-03	17,535	$0.5933	$10,403	17,535	$0.1685	$2,955	$13,358
Dec-03	32,617	$0.5907	$19,266	32,617	$0.1382	$4,508	$23,774
Jan-04	53,614	$0.5967	$31,991	53,614	$0.1298	$6,959	$38,951
Feb-04	31,541	$0.7466	$23,547	31,541	$0.1589	$5,011	$28,558
Mar-04	48,886	$0.7162	$35,012	48,886	$0.3675	$17,964	$52,976
Apr-04	61,667	$0.7457	$45,983	61,667	$0.1399	$8,627	$54,610
May-04	29,332	$0.8327	$24,425	29,332	$0.1531	$4,491	$28,917
Jun-04	36,574	$0.6701	$24,508	36,574	$0.0775	$2,834	$27,342
Jul-04	7,495	$0.6418	$4,810	7,495	$0.1632	$1,223	$6,033
Aug-04	10,000	$0.6446	$6,446	10,000	$0.1589	$1,589	$8,035
Sep-04	15,000	$0.6446	$9,669	15,000	$0.1589	$2,383	$12,053

Totals	361,661		$241,499	361,661		$60,151	$301,650
Averages	30,138	$0.6446	$20,125	30,138	$0.1399	$5,013	$25,138



Power Factor

Month	Metered Demand (kW)	Metered Reactive Power (rkVa)	Power Factor
Nov-04	868	525	0.856
Dec-04	861	497	0.866
Jan-05	917	525	0.868
Feb-05	938	539	0.867
Mar-05	994	560	0.871
Apr-05	861	511	0.860
May-05	812	476	0.863
Jun-05	798	511	0.842
Jul-05	777	511	0.836
Aug-05	869	520	0.858
Sep-05	868	546	0.846
Oct-05	869	520	0.858
		Average:	**0.858**
		Lowest:	**0.856**

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7.0 Goatastic

7.1 Introduction

The Goatastic report will be your final training exercise before you are ready to begin taking on an IAC co-lead assignment and, subsequently, future IAC lead assignments. The report is a mock report in which all of the materials you will typically have for a report will be given in the appendix of this manual.

7.1 Your Task

Goatastic Plastic, Inc. is a mid size manufacturer in Farmingtown, NY. In the following appendix, you will be provided with the company's utility bills, a pre-assessment survey, and field notes that were taken on site. Your job is to:

1) Analyze and summarize the company's utility bills.
2) Accumulate the notes into a list of AR's (assessment recommendations)
3) Create an IAC report with all appropriate sections and calculated recommendations.
4) Self edit the report for errors and try and make it consistent with the formatting and language of other recent reports.
5) Submit your report to an IAC team member for editing.
6) Complete all of the edits assigned to you and keep a copy of the report on file for future reference.

Pre-Assessment Survey

Syracuse University
Industrial Assessment Center
Phone: 315-443-1523
Fax: 315-443-9099
Email: iac@ecs.syr.edu
http://iac.syr.edu/

Please complete this survey as best as possible, and return it to the address below along with copies of your last twelve months' electric and fuel bills.

F.J. Carranti, P.E., Director
S.U. Industrial Assessment Center
149 Link Hall, Syracuse University
Syracuse, NY 13244

CONTACT INFORMATION

Company Name: Goatastic Plastic, Inc.

Mailing Address: 101 Industrial Way.
Farmingtown, NY 13305

Street Address: Same

Contact Person: Buck Buckingham

Title: Maintenance Supervisor

Phone: 315 - 443 - 1523 Ext.

Fax: 315 - 443 - 9099

E-mail: BBuckingham@Goatastic.com

Company Website: www.Goatastic.com

How did you hear about our service? We got a letter from you.

Driving directions to your plant (please attach a separate sheet or map, if necessary):
Thru-way exit 24S, Go through 4 traffic lights, make a left, follow this road 2 or 3 miles until you cross the train tracks, take the next left after the tracks and head down this road (Turner st.) for 5 blocks or so. We are on the left side. Big sign.

1

General Information

Principal product(s): Blow Molded Plastic Parts

SIC code(s): 3559

NAICS code(s): 333220

Number of employees: 150

Are your employees in a union or collective bargaining unit? Y / N

Labor plus overhead rate for production personnel: $20.50

Labor plus overhead rate for maintenance personnel: $31.25

Shift Structure:

Shift	Time	Days/Week	Weeks/Year	Number of Employees
1st	7 AM - 3 PM	6	50	40
2nd	3 PM - 11 PM	6	50	40
3rd	11 PM - 7 AM	6	50	40
Office	8 AM - 4 PM	5	51	30

Do you have a formal startup procedure for the plant? Y / N

Utility Information

Natural Gas

Delivery Company: NIMO

Supplier: NIMO

Fuel Oil

Type of oil: N/A

Size of tank:

Delivery schedule:

Supplier:

Please list any other fuels or specialty gases (coal, propane, CO_2, nitrogen, etc.):

2

Electricity

Number of meters: 1

Do you correct for power factor? Y / N

Delivery Company: NIMO

Supplier: NIMO

Water

Cost per year: $10,000

Gallons used per year: 1,000,000 Gallons

Are you treating water? No

Sewer

Cost per year: $3,200

Trash

Cost per year: $1,500

Hazardous wastes: None

Recyclables:

Do you generate any of your own power? Y / N

Please list any processes that require heating (other than space heat):

Blow molding line, Ovens

Please list any processes that require refrigeration:

Air condioners in offices

PHYSICAL PLANT INFORMATION

Number of buildings: 3

Total plant size (ft^2): 170,000

Buildings:

Area	Size (ft^2)	Age	Use
Office	20,000	5 years	
Warehouse	50,000	8 years	
Manufacturing	100,000	12 years	

Do you have any type of contracted maintenance Y / (N)

Do you have a plant layout or floor plan? (Y) / N

If so, please make those available to us on the date of the assessment.

Do you have a motor inventory? (Y) / N

If so, please make those available to us on the date of the assessment.

Are employees and management happy with existing lighting levels? (Y) / N

Are there any lighting concerns? (Y) / N

Has the facility had a lighting retrofit installed in the past? (Y) / N

If so, what was installed? Metal Halides

HVAC Systems

Central Heating

(Steam/hot water) or forced air: _____

Is there a boiler? (Y) / N Horsepower? 150

If so, is there contracted maintenance on the boiler? (Y) / N

Does the boiler have a dual fuel boiler? Y / (N)

Fuel: _____

Pressure of boiler: 15 psig

Annual steam usage: ?

Annual steam cost: ?

4

Control Strategies

How is temperature controlled? Thermostats

Where are thermostats located? Next to the doorways mostly

Are setback timers used? Y / N

Are ceiling fans used for destratification? Y / N

Do you have any air conditioners/heat pumps? Y / N

Do you have any ventilation fans or air makeup stations? Y / N

PRODUCTION EQUIPMENT

Compressors

Type	Horsepower	Annual Hours of Operation
Gardner Denver	150 horse	24/6
Gardner Denver	125 horse	24/6
Ingersoll Rand	50 horse	500 hours (backup)

Line pressure: 115 psi

Pressure required for the plant: 90 psi

Do you have air leaks? Y / N

Do you have any motors greater than 50 hp? Y / N

Do you have any cooling towers? Y / N

Do you have any chillers? Y / N

Do you use any ovens? Y / N

Major Concerns

Please list those areas that you consider the best opportunities for savings or improvement, or items that you think are problematic. You should consider energy usage, manufacturing methods and productivity, and waste reduction. This will help us to best focus our efforts (attach an additional sheet, if necessary).

- Lowering Energy Bills
- Power Factor Concerns
- Compressed Air Usage
- Lighting
- Energy Use in Ovens

Who should receive copies of our assessment report?

Name	Title	Mailing Address
Bill Goats	President	Same as Front
Buck Buckingham	Maintenance Supervisor	Same as Front

Site Notes:

Goatastic LLC

SU0101

Morning Meeting

- Mike, Dave, Trinie
- 1/1/05
- Bill Goats, VP
- Billy Bob Thorton - maintainer

Well pumps 25, 25, 40 hp
- Monitor incoming, water - Treating

Ammonia plant - Refrigeration

(AR) Recuperator / Economizer

- Gas Fired air makeup Unit

(AR) Correct Power factor

(AR) Air leaks

(AR) Duct outside Air

(BR) Ceiling Fans

(BR) Steam Traps

(AR) Synthetic lubricants

(AR) Exit Signs

(AR) VFD's on Cooling Towers

(AR) Install Set Back Timers

(BR) Maint on Boiler

(BR) Open Minded attitude

(AR) Shop Supply on Electric/gas

(AR) Duel Fuel Burner

(BR) Bag House

* Lighting Concerns
* Compressed Air Usage.

(BR) High speed Loading dock Doors

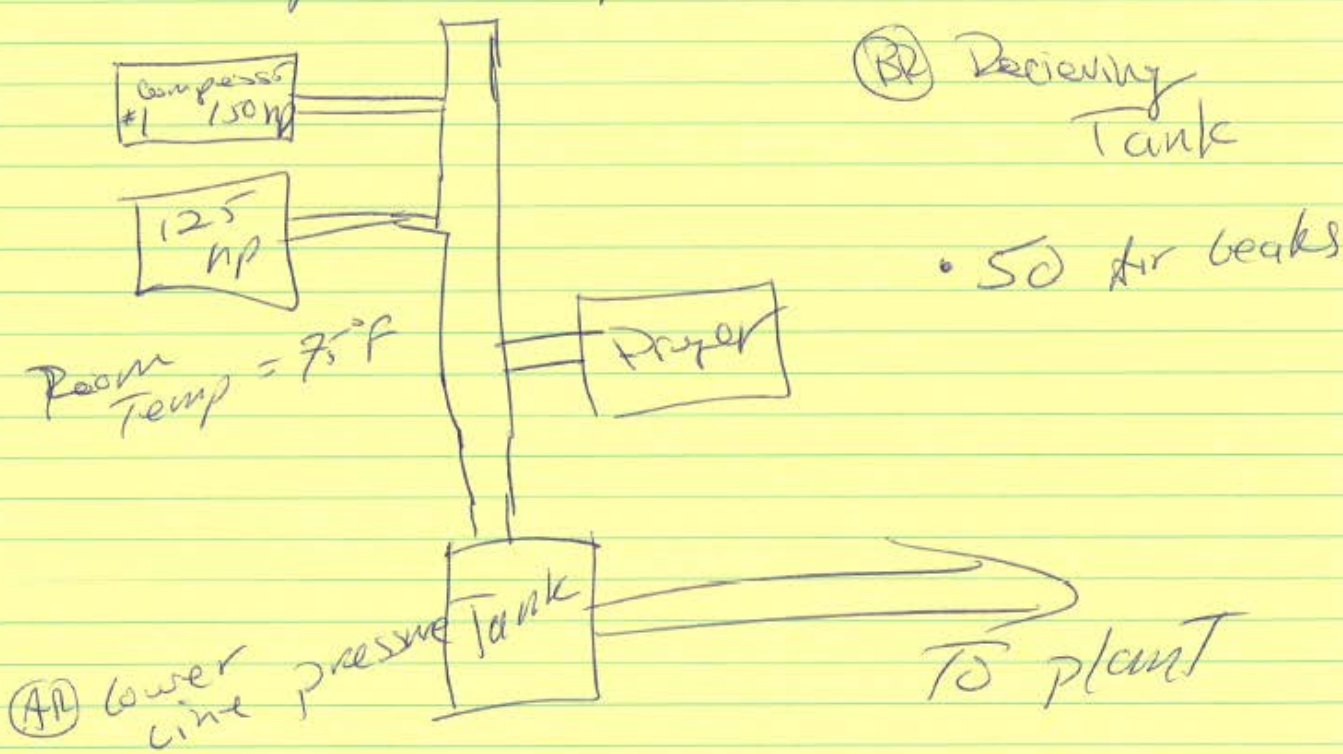
Exit Signs ~~||||~~ ~~||||~~ ~~||||~~ 2 Bulb 15 watt inc.

Boiler Nameplate

150 hp
Johnston Boiler Comp.
PFTA-500-~~#~~46-150
unit # 8046 Date: 1993

Natural gas
Min gas Firing Rate 6,270,000 Btu
Max gas Firing Rate 20,820,000 Btu

(BP) Air Dryer on Compressed Air Lines



Annual Sale $63 million @ 63 million lbs

Process

Raw Material - Truck

⇓

Silo's storage

⇓

Hopper

⇓

Heat injected w/ screw

⇓

Grind scrap

⇓

Conveyor

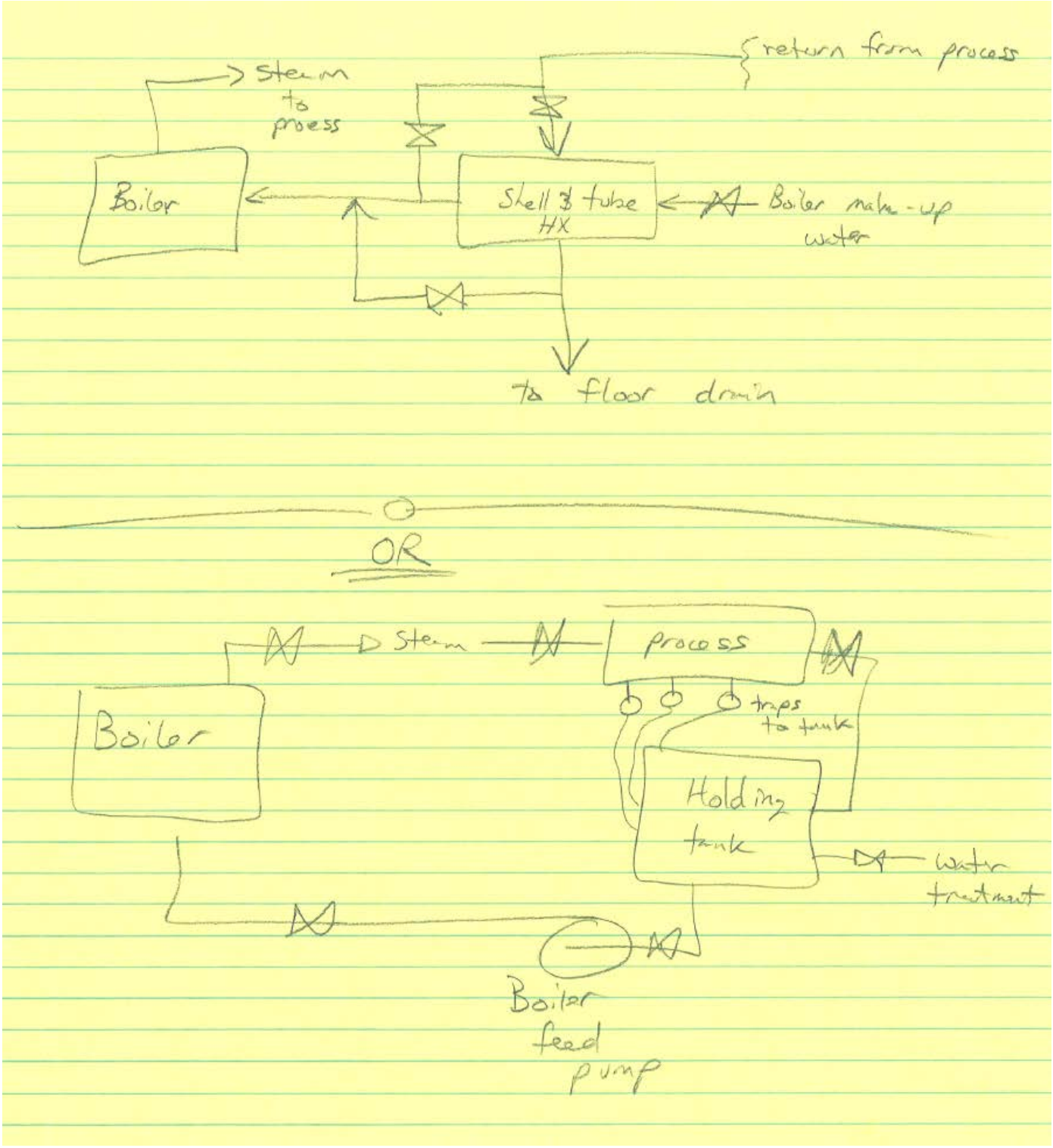
⇓

Package

(BP) Just-in-Time

⇓

Ship


return from process
Steam to process
Boiler
Shell & tube HX
Boiler make-up water
to floor drain
OR
Steam
process
traps to tank
Boiler
Holding tank
water treatment
Boiler feed pump

SU0 100

Annual Sales ($)	100,000	Peak Production	May	Labor and Burden	
Annual Production Volume	15,000	Annual Shutdown	2 weeks for X-mas	Maintenance	

Compressed Air Recommendations

Compressor	1	2	3	4	5	6	7
Model	Gardner Denver						
Horsepower	150	125	50				
Loaded Hours	6200	6964	1064				
Total Hours	6985	8954	2401				
Hours of Operation	2476	2476	500				
Current Pressure	115	115	115				
Proposed Pressure	90	90	90				
Intake Air Temperature	85	85	85				
Average Facility Temperature	75	75	75				
Piping to Outside Wall	15ft H	15ft V	27ft H				

VFD on Cooling Tower Recommendations

Equipment							
# of Fans	5						
Horsepower	30						
Hours of Operation	~~3000~~ 3600						

Install More Efficient Lighting Recommendations

Recommendation	~~MH~~ FL+MS	MS					
Location	Storage	Passage Way					
Current Lighting Type	MH	FL					
# of Fixtures	30	40					
Bulbs per Fixture	1	2					
Bulb Wattage	250	34					
Average Lighting Level							
Mounting Height	15ft	18ft					
Square Footage of Room							
Hours (Current / Proposed)	7200/3x7200	7200/3x7200					

Air Destratification Recommendations

Location							
Ceiling Temperature							
Floor Temperature							
Square Footage of Room							

Insulate Equipment Recommendations

Equipment	Pipe						
Length	5' H						
Width / Diameter	4"						
Height / Orientation (if needed)	H						
Hours of Operation	24/6						
Surface Temperature	200°F						
Air Temperature	75°F						
Wind Speed	0						

Heat Recovery Recommendations

Equipment	Comp	Comp					
Exhaust Velocity	900ft/min	1000 ft/min					
Exhaust Cross Sectional Area	2'x2'	2'x2'					
Exhaust Temperature	110 °F	109°F					
Room Set Point Temperature	75°F	75°F					
Hours of Operation	24/6	24/6					

Vending Machines

Bank	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Soda	X	XX	X	X	X									
Snack	X	X	XX	X	X									

Exit Signs

Type	Incandescent	Fluorescent
Count	15	
Bulbs per Fixture	2	
Wattage per Bulb	15	

Boiler

Temp: Room/Stack (°F)	/	/	/
Efficiency			
Excess Air %			
O2 %			

Notes:

Description	Hp / kW	Number of Equipment	Number of Belts	Synthetic Lubrication	Hours of Operation	Load Factor
Cooling Tower	30	1	–	Y (N)	3600	
Mixers	10	2	–	(Y) N		
Sifting Motor	15	4	1 ea	(Y) N		
" "	10	1	1	(Y) N		
1600 lb Mixer	75/35	1	–	(Y) N	High/Low 50/50	
2000 lb Mixer 2 speed	100/50	2	–	(Y) N	60/40	
1000 lb Mixer	37/25	1	–	(Y) N	30/70	
Floor Fans	.5	7	–	Y (N)		
Balaer Perkins	15	1	–	(Y) N		
Hamber Drive Conveyor	20	1	3	(Y) N		
Frozen Food Mixer	10	1	–	(Y) N		
Frozen Food Mixer	7.5	1	–	(Y) N		
Oven Conveyor	10	2	3	(Y) N		
FES #1	12.5	1	–	(Y) N		
#2	12.5	1	–	(Y) N		
#3	12.5	1	–	(Y) N		
Vilter #1	25	1	–	(Y) N	3600	
#2	25	1	–	(Y) N	3600	
Mycom Cooling System	5	4	3	(Y) N		
				Y N		
				Y N		
				Y N		
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For a copy of the Utility Bills please see the following file in the training manual Goatastic folder:

Goatastic Bills.pdf