Technical, Economic, and Financial Assessment of Energy Efficiency Investment Options for the Jiangsu Sopo (Group) Co., LTD.

Municipality
Jiangsu Province
People's Republic of China

Draft Report

Prepared For

Jiangsu Economic and Trade Commission

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On Behalf of
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Contents

Executive Summary

This report identifies electrical energy efficiency opportunities of the Jiangsu Sopo Group (Sopo). By installing the recommended efficient equipment Sopo would save 22,144 MWh per year, representing 4.2% of the current electricity consumption of 525,000 MWh per year. This would provide Sopo with energy cost savings of 1.5 million U.S. dollars per year. These savings would produce lifetime benefits to the Jiangsu electrical system of 10 million U.S. dollars and annual emissions reductions of 18,890 metric tons Carbon Dioxide (CO_2), 218 metric tons Sulfur Dioxide (SO_2), and 48 metric tons Nitrous Oxides (NO_x).

Section 1 provides an introduction and summary of the report, the major conclusions of which are stated in the previous paragraph. Section 2 contains a facility energy usage profile and a statistical analysis of energy use and production. The primary finding in this section is that the production of caustic soda is the biggest consumer of electricity (76%). By end use, electrolysis is the largest user (74%) of electricity, followed by pumping using 10% of the total electrical usage of the facility.

Section 3 discusses each recommended efficiency measure in detail. A summary of recommended energy efficiency measures is shown in Table ES-1.

Table ES-1
Summary of Recommended Energy Efficiency Measures

	Measure	Energy Savings		Economic Cost and Savings			Emission Reduction		
		Demand Savings (kW)	Energy Savings (kWh)	Construction Cost (rmb & US$)	Energy Cost Savings (rmb & US$)	Simple Payback (years)	CO_2 (kg)	SO_2 (kg)	NO_X (kg)
EEM-1	High-E Motors	324.2	2,001,288	2,428,292 rmb $323,772	1,025,660 rmb $136,755	2.4	1,707,135	19,698	4,377
EEM-2	Variable Speed Drives	1,889.6	15,003,004	4,604,000 rmb $613,867	7,689,040 rmb $1,025,205	0.6	12,797,838	12,824	2,850
EEM-3	Synchronous Belts	168.0	1,302,897	1,647,421 rmb $219,656	667,735 rmb $89,031	2.5	925,021	4,517	1,004
EEM-4	Downsize Motors	11.3	82,117	75,232 rmb $10,031	42,085 rmb $5,611	1.8	70,048	808	180
EEM-5	Replace Transformers	123.8	1,084,410	3,100,500 rmb $413,400	555,760 rmb $74,101	7.0	1,111,395	6,156	1,368
EEM-6	Repair Compressed Air Leaks	337.8	2,670,741	270,224 rmb $36,030	1,368,755 rmb $182,501	0.2	2,278,191	147,667	32,815
	Total	**2,855**	**22,144,457**	**12,125,669 rmb $1,616,756**	**11,349,034 rmb $1,513,205**	**1.1**	**18,889,629**	**191,670**	**42,593**

Currency Conversion: 7.5 rmb/US$

Section 3 also identifies that switching part of the caustic soda production to a more efficient process provides another major energy-saving opportunity, but requires more study of the costs before making a recommendation to proceed with an accelerated transition to the more efficient process .

Section 4 provides information on best practices regarding energy-efficiency opportunities at the plant. This section provides additional energy-saving opportunities for compressed air systems, HVAC and lighting that are not examined in section 3.

Section 5 presents the economic and financial analysis of all the energy-efficiency measures studied, and the financial incentives we recommend that the Economic and Trade Commission consider offering Sopo for various combinations of energy-efficiency measures the plant might choose. All the recommended energy-efficiency measures were found to provide cost-effective efficiency power plant (EPP) resources to the Jiangsu electricity grid. Jiangsu would benefit most if Sopo installed all recommended energy-efficiency measures.

Any energy-efficiency measures that take longer than one year to repay the installation costs with energy cost savings require Sopo to raise capital, by some mix of additional borrowing and equity investment. If JETC can provide financial incentives to Sopo that allows Sopo's portion of the investment in all energy-efficiency measures together to be repaid in less than one year, Sopo can finance the investment out of operating cost savings. To make this economically superior outcome the most financially attractive choice, we recommend that JETC offer ￥1,212,567, or 10% of the total (undiscounted) costs of all energy-efficiency measures together of ￥12,125,669. At the recommended incentive, Sopo's share of the investment would be ￥10,913,102, from which it would earn a 100% annual rate of return and pay for its investment in slightly less than one year.

Savings from some of the recommended energy-efficiency measures could probably qualify for sale as Certified Emission Reductions (CERs) under the United Nations' Clean Development Mechanism. Proceeds from the sale of CERs could cover 9% of the cost of all the recommended energy-efficiency measures combined, or 11% of the contribution needed by Sopo.

Section 6 outlines our recommended approach for measurement and verifying installation and performance of the recommended energy-efficiency measures. A measurement and verification process involves site inspections of implemented projects that have received incentives through the efficiency program. Site inspections consist of documenting project installations, and often measuring to determine the facility's performance improvement after retrofit.

Measurement and verification processes are essential in determining the success of an efficiency program. Post-retrofit measurements establish the difference between theoretical projected energy savings and actual savings.

Sound measurement and verification procedures will be absolutely necessary if it is intended to pursue Certified Emission Reductions (CERs) sales through the Clean Development Mechanism (CDM).

Section 7 provides our conclusions and recommendations of the technical, economic and financial assessments. We conclude that all of the efficiency options examined in detail are technically feasible and cost effective.

To ensure that Sopo installs all of the recommended efficiency measures, we suggest offering an incentive of ￥1,212,567.

Changing the caustic soda process would provide further substantial energy savings, but needs further examination of the costs. If found to be cost effective, additional incentives should be considered for transitioning from the membrane electrolysis process to the ion fume process.

1 Summary

1.1 INTRODUCTION

This report details the recommendations and conclusions of an energy study co-sponsored by Jiangsu Economic and Trade Commission, Natural Resources Defense Council (NRDC), the Nantong Municipal Committee of Economy and Trade, the State Grid Corporation DSM Instruction Center and the Jiangsu Sopo Group (Sopo).[1]

This study targeted electrical energy efficiency measures (EEMs) addressing motors, drives, compressed air, pumps, and transformers. Section 2 contains a facility energy usage profile and a statistical analysis of energy use and production. Section 3 discusses each recommended measure in detail. A summary of recommended energy efficiency measures is shown in Table 1-3.

Section 4 provides information on best practices regarding energy-efficiency opportunities at the plant. Section 5 presents the economic and financial analysis of all the EEMs studied, and the financial incentives we recommend that the Economic and Trade Commission consider offering Sopo for various combinations of EEMs the plant might choose. Section 6 outlines our recommended approach for monitoring and verifying installation and performance of the recommended EEMs. Section 7 provides our conclusions and recommendations of the technical, economic and financial assessments.

1.2 CURRENT ENERGY USE

An actual energy breakdown by month, showing peak and off-peak consumption was not provided, but the total annual electrical consumption of the Jiangsu Sopo Group is 525,000,000 kWh/yr. The average demand was 59,930 Kilowatts.

[1] Stephen Booth of SGB PC (SGB) conducted the technical study of energy-efficiency measures. Booth also developed the measurement and verification (M&V) approach. John Plunkett and Francis Wyatt of Green Energy Economics Group conducted the economic analysis of energy-efficiency measure costs and performance developed in the technical study, and the financial analysis and incentive design. We gratefully acknowledge the information and advice provided by Timothy Hui of Natural Resources Defense Council (NRDC), the DSM Center staff, and the management and staff of Sopo.

Table 1-1 presents Sopo's electric billing structure.[2]

Table 1-1
Electricity Rate Structure

Voltage	Billing Period	Energy Cost (RMB/KVA)	Demand Cost (RMB/KVA)
35 KV	Peak	0.87	23
	Shoulder	0.532	
	Off-Peak	0.23	

The average electrical cost at the Sopo Facility is 0.5125 rmb/kWh.

The company shared information on 25 transformers reaching a total power capacity of 80,536 kVA, among which there are 4 Rectiformer units used in the Caustic Soda process with a total capacity of 53,776 KVA.

1.3 RECOMMENDED ENERGY EFFICIENCY MEASURES (EEMS)

We recommend six (6) EEMs for implementation at the Jiangsu Sopo Group Table 1-2 describes the EEMs recommended and subjected to financial analysis. Figure 1-1 compares the construction costs and energy cost savings for each measure, along with the CO_2 emission savings. The benefits from variable speed drives are very evident from this graph.

[2] The electricity billing periods are as follows. Peak billing period is from 8 am to 12pm, and from 5 pm to 9 pm. The shoulder period is from 12 pm to 5 pm, and from 9 pm to 12 am. The off-peak period is from 12 am to 8 am. The average electricity price is 0.5125 RMB per kWh.

Table 1-2
Summary of Recommended Energy Efficiency Measures

	Measure	Energy Savings		Economic Cost and Savings			Emission Reduction		
		Demand Savings (kW)	Energy Savings (kWh)	Construction Cost (rmb & US$)	Energy Cost Savings (rmb & US$)	Simple Payback (years)	CO_2 (kg)	SO_2 (kg)	NO_X (kg)
EEM-1	High-E Motors	324.2	2,001,288	2,428,292 rmb $323,772	1,025,660 rmb $136,755	2.4	1,707,135	19,698	4,377
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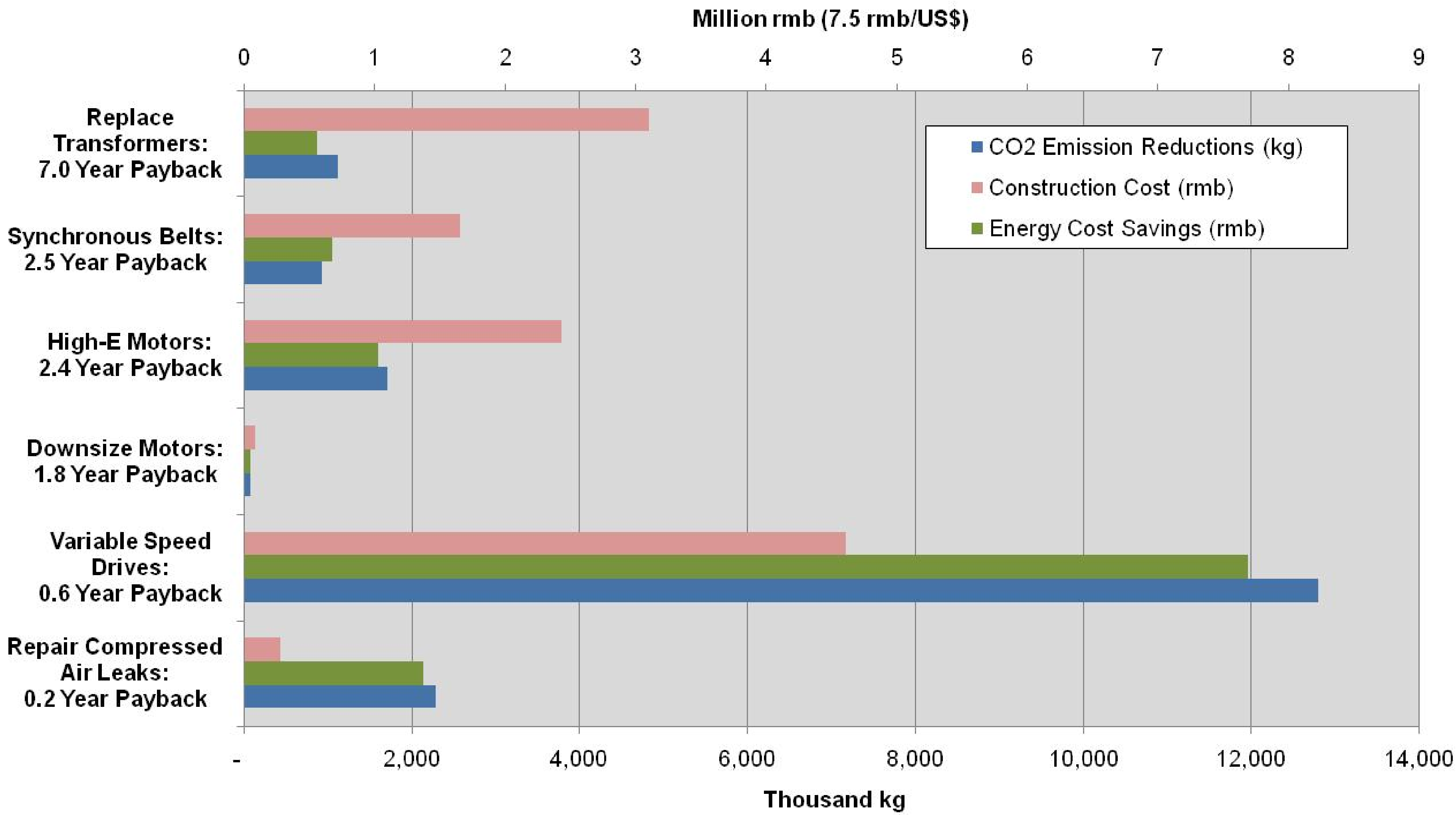
	Total	**2,855**	**22,144,457**	**12,125,669 rmb $1,616,756**	**11,349,034 rmb $1,513,205**	**1.1**	**18,889,629**	**191,670**	**42,593**

Currency Conversion: 7.5 rmb/US$

Figure 1-1
Comparison of Energy Efficiency Measure Construction Cost, Energy Cost Savings, and Emission Reductions



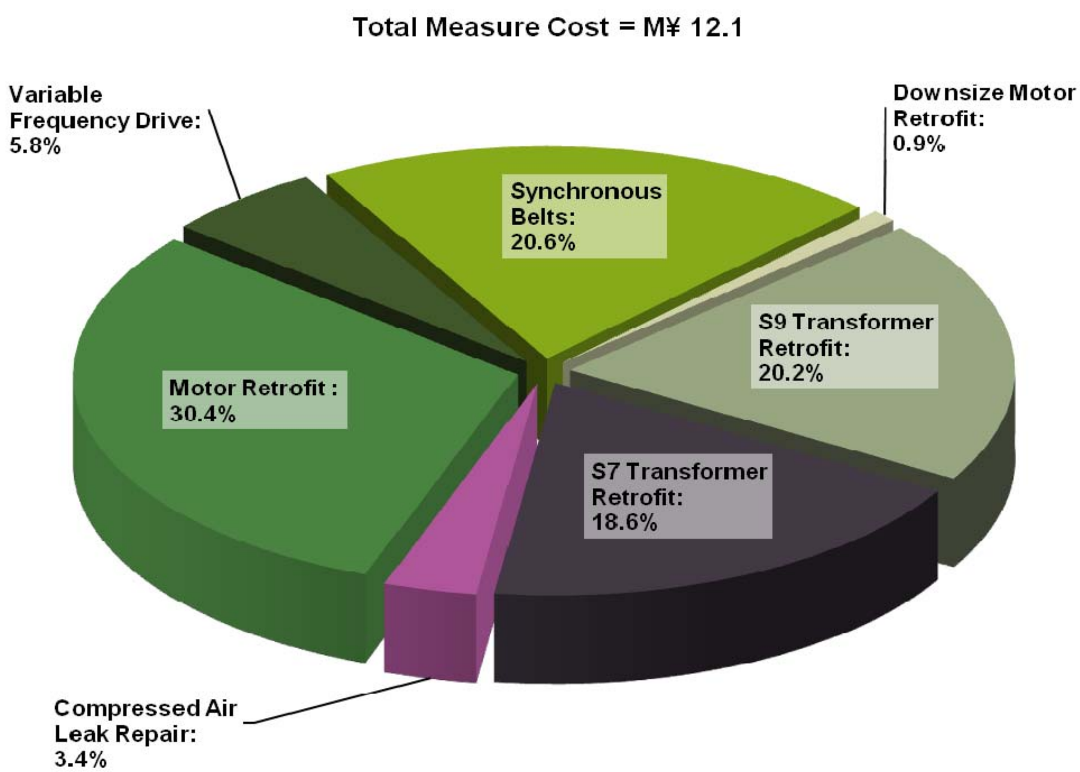
1.4 ECONOMIC AND FINANCIAL ANALYSIS RESULTS

All the recommended EEMs were found to provide cost-effective efficiency power plant (EPP) resources to the Jiangsu electricity grid. Jiangsu would benefit most if Sopo installed all recommended EEMs. Net economic benefits over the life expectancies of all recommended measures are estimated at ¥66,363,294 in 2008 present worth, on total economic costs of ¥9,184,545.

Any EEM or combination of EEMs with simple payback periods longer than one year require Sopo to raise capital, by some mix of additional borrowing and equity investment. If JETC can provide financial incentives to bring the simple payback of all EEMs together down to one year, Sopo can finance the investment out of operating cost savings. To make this economically superior outcome the most financially attractive choice, we recommend that JETC offer ¥1,212,567, or 10% of the total (undiscounted) costs of all EEMs together of ¥12,125,669 (Figure 1-2 breaks out the costs by EEM). At the recommended incentive, Sopo's share of the investment would be ¥10,913,102, from which it would earn a 100% annual rate of return.

Savings from some of the recommended EEMs could probably qualify for sale as Certified Emission Reductions (CERs) under the UN's Clean Development Mechanism. Proceeds from the sale of CERs could cover 9% of the cost of all the recommended EEMs combined, or 11% of the contribution needed by Sopo.

Figure 1-2
Breakout of Measure Costs



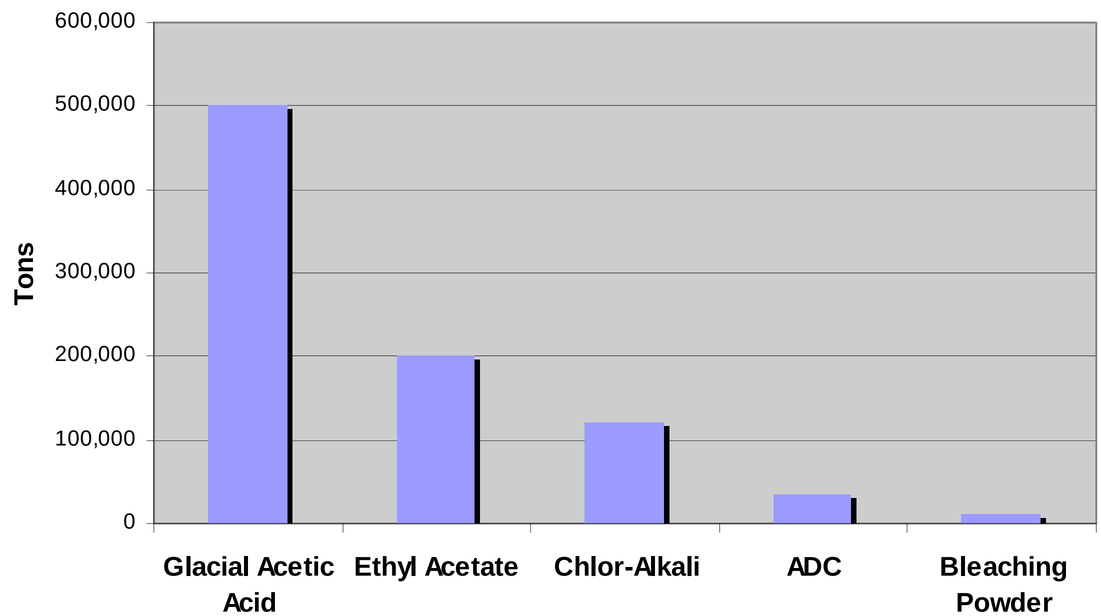
2 Energy Use Profile

2.1 Facility Description

Jiangsu Sopo Group Ltd. is a comprehensive company specializing in the production of processed chemical products including: Glacial Acetic Acid, Ethyl Acetate, Chlor-Alkali (Caustic Soda), ADC, and Bleaching Powder. By the end of 2006 the company had a total output valued at 3.71 billion yuan, the added value was 1.22 billion yuan, sales revenue 3.729 billion yuan, and a profit of 432 million yuan.

Production for that year was 500,000 tons of Glacial Acetic Acid, 200,000 tons of Ethyl Acetate, 120,000 tons of Chlor-Alkali, 35,000 tons of ADC, and 10,000 tons of Bleaching Powder, which is outlined in Figure 2-1.

Figure 2-1
2006 Production for Jiangsu Sopo Group Ltd.



The total energy consumption of the company in 2006 was 470,000 tons coal equivalent. Raw coal consumption was 407,000 tons, electrical consumption was 525,000,000 kWh. The power capacity of the facility is 125,000 KVA. The installed capacity of the thermal power plant is 21,000 kW. The grid connected electricity through the voltage boosting station connects to the secondary side of the main transformer of 75,000 KVA.

2.2 ENERGY USE PROFILE

The facility's electrical energy use is billed at ¥0.857 per kWh peak, ¥0.532 per kWh shoulder, ¥0.231 per kWh off-peak, and 23¥/KVA per month. The calculated average electricity cost is ¥0.5125/kWh.

Electric power consumption is equivalent to 11% of the total energy consumption. The thermal power plant used 61% of the total plant energy to produce 2,000,000 tons of steam per hour. Energy consumption equates to 14% of total product cost, the energy consumption of Acetic Acid accounts for 13.6 % of the total, Caustic Soda accounts for 76% of the total.

It is readily apparent that the production of caustic Soda is by far the largest consumer of energy in production. The majority of the energy is used in the electrolysis process. The facility currently employs two production processes for caustic soda the membrane electrolysis process, and the ion-fume process. Currently 80,000 tons per year are produced with the membrane process, and 40,000 tons by the ion-fume process. The membrane process consumes 0.641 TCE per ton of production. The ion-fume process consumes 0.37 TCE per ton of production.

2.3 END-USE ELECTRICAL EQUIPMENT

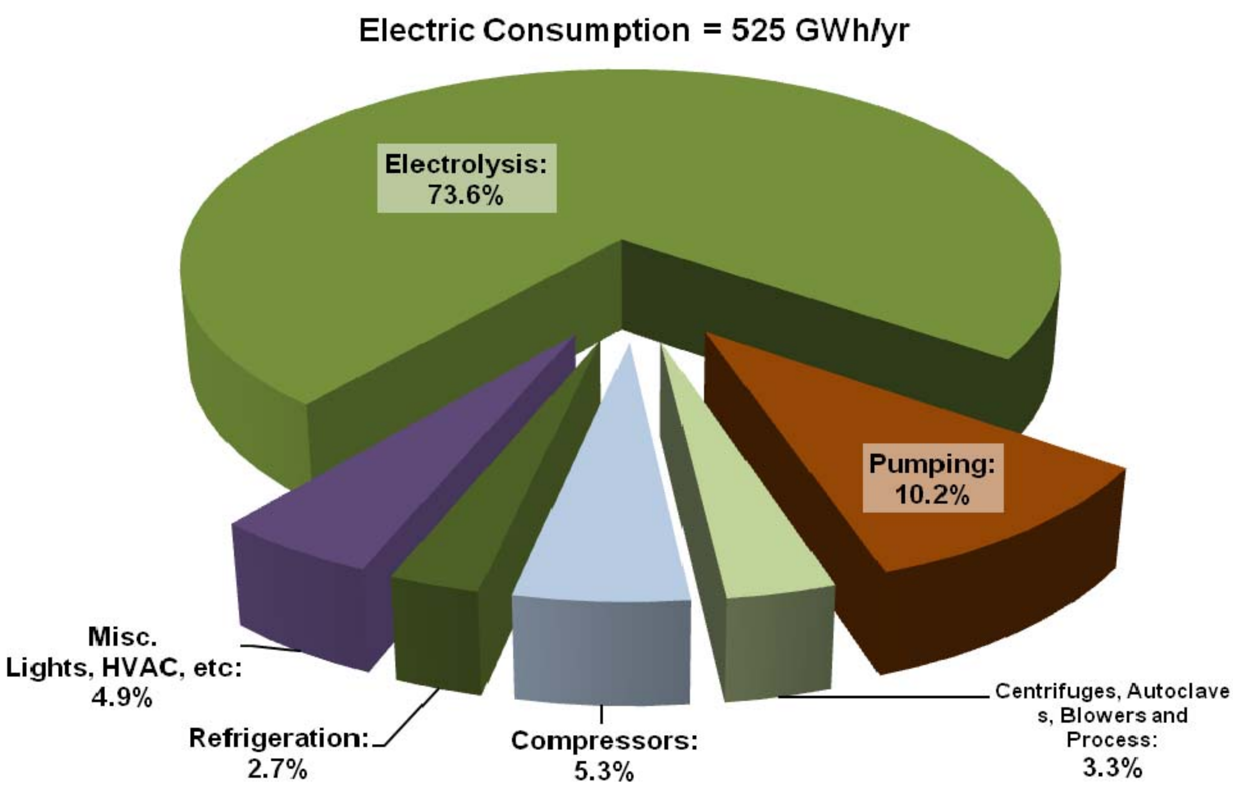
Company personnel provided us with a list of the equipment and processes used in the facility. An electrical energy end-use breakdown is presented in Table 2-1 and represented graphically in Figure 2-2. Of the end uses the anode electrolysis process used in the production of sodium hydroxide represent the largest electrical energy end use, followed by: pumping, compressors, and refrigeration. Electrical energy consumption associated with lights, HVAC, and other miscellaneous uses equates to 5% of the total load.

Company personnel provided us with the motor inventory, and motor load. The information provided is presented in Appendix 8.1 (Motor Powered Equipment). We calculated the annual electrical energy use in Appendix 8.1 to be 112,705,352 kWh/year

Table 2-1
Electrical Energy Use Breakdown by Equipment

Equipment Type	Demand (kW)	Electric Consumption (kWh/yr)	Percent by Equipment Type
Electrolysis	44,108	386,386,100	74%
Pumping	8,390	53,501,684	10%
Centrifuges	611	3,308,505	1%
Autoclaves	838	3,770,655	1%
Blowers	864	6,411,416	1%
Process	696	3,738,196	1%
Compressors	3,572	27,580,968	5%
Refrigeration	2,560	14,393,929	3%
Misc. Lights, HVAC, Etc.	2,957	25,908,530	5%
	64,596	524,999,983	100%

Figure 2-2



3 Energy Efficiency Measures

This section provides details of recommended Energy Efficiency Measures (EEMs) for Jiangsu Sopo Group located in Nantong. Six (6) EEMs have been studied and are recommended for implementation. They are listed below.

- EEM-1 Replace Y-Series and JO2-Series Motors with YX-Series Motors
- EEM-2 Install Variable Frequency Drives (VFD's) on systems with variable loads or on systems that are throttled.
- EEM-3 Replace standard V-Belts with Synchronous Belts on all belt driven systems.
- EEM-4 Replace motors that are operating at 50% or less of design load with correctly sized premium efficient motors
- EEM-5 Replace existing S7 and S9 transformers with S11 transformers.
- EEM-6 Repair compressed air leaks and maintain air distribution system.

These EEMs should be reviewed to determine if they are consistent with the actual operational requirements of Jiangsu Sopo Group and the desires of facility management. The following sections present estimated implementation costs as well as energy and cost savings for each measure.

3.1 EEM-1 Replace JO2-Series and Y-Series Motors with YX-Series Motors

Description:	The plant is equipped primarily with Y series standard efficiency motors and a number of lower-efficiency JO2-series motors. Premium YX-series motors have efficiencies of approximately 1% to 3% than their standard-efficiency counterparts. Purchasing YX-series motors would save much energy and cost over motors' lifetime.
Action:	Replace Y series and JO2-series motors with YX-series motors.
Recommendation:	This EEM is cost effective and is recommended for implementation.

ENERGY IMPACTS

Total Cost (¥)	Annual Energy Savings (kWh)	Annual Savings (¥)		
2,428,292	2,001,288	1,025,660		
			Simple Payback (years):	2.4

3.1.1. Discussion

Company personnel provided us with a list of all large motors used in the process. Most motors are standard-efficiency Y-series motors, and some are even lower-efficiency JO2-series motors. Premium-efficiency YX-series motors are commercially available, and are between 1% and 3% more efficient than standard-efficiency motors. Although they cost between 30% and 50% more to purchase than standard-efficiency motors, YX-series motors have significantly lower life-cycle costs.

Appendix 8.2 (Potential Motor Replacements) shows the motor replacement analysis. YX-series motors cost approximately ¥130/kW for motors 15 kW and larger, and up to ¥ 300/kW for motors under 15 kW.

3.1.2. Recommendation

We recommend replacing Y-series and JO2-series motors with YX-series motors. The economics are favorable for the motors to be replaced immediately due to the long run-time per year.

3.1.3. Energy Savings, Cost Savings, and Implementation Cost

Table 3.2 is a list of motor efficiencies taken directly from the publication “The Chinese Market for Electric Motors and Motor Speed Controls” (Hinge, Nadel, Yande, Lan, Chunxuan. ACEEE. 1997). These efficiencies are identical to those reported in the more recent publication “The China Motor Systems Energy Conservation Program: A Major National Initiative to Reduce Motor System Energy Use in China” (Nadel, Wanxing, Liu, McKane. DOE Office of Scientific & Technical Information. 2001). The measure cost is estimated to be ¥300/kW for motors less then 15 kW, and ¥130/kW for motors 15 kW and larger.

Table 3-2
Motor Efficiencies

Rated	Output		Chinese Motor Series			
			(IEC Test Proc.)			
(kW)	(HP)	JO2	Y(IP44)	YX	Y2	Y2E
0.55	0.75	74.0	73		71.0	73.5
0.75	1.0	76.5	74.5		73.0	75.5
1.1	1.5	79.0	78.0		75.0	76.5
1.5	2.0	80.5	79.0		78.0	79.5
2.2	3.0	82.0	81.0	86.3	80.0	82.0
4.0	5.0	85.0	84.5	88.3	84.0	86.0
5.5	7.5	86.0	85.5	89.5	85.0	87.0
7.5	10	87.0	87.0	90.3	87.0	88.0
15	20	88.0	88.5	91.8	89.0	91.0
18.5	25	89.0	91.0	93.0	90.7	92.7
22	30	89.5	91.5	93.2	91.2	93.0
30	40	90.0	92.2	93.5	92.0	93.5
45	60	91.0	92.3	94.1	93.0	94.2
55	75	91.5	92.6	94.5	93.2	94.5
75	100	92.0	92.7	94.7	93.8	94.7
90	125	92.0	93.5	95.0	94.2	95.0
110	150		93.5		94.5	
132	175		94.0		94.8	

Note: efficiencies are shown for totally-enclosed fan-cooled 4-pole motors

Source: Hinge, Nadel, Yande, Lan, Chunxuan. “The Chinese Market for Electric Motors and Motor Speed Controls.” American Council for an Energy-Efficient Economy 1997: p. 24.

3.2 EEM-2 INSTALL VARIABLE FREQUENCY DRIVES (VFDS)

Description:	Many of the systems in the facility have variable loads such as the fans on a cooling tower that vary with the seasons, or are throttled to adjust for variations in production output. By installing VFD's on motors with centrifugal loads cubic energy savings will result.
Action:	Install variable frequency drives on motors with variable loads. Control either manually, by pressure, or by temperature in accordance with the requirements of the process.
Recommendation:	This EEM is cost effective and is recommended for implementation.

ENERGY IMPACTS

Total Cost (¥)	Annual Energy Savings (kWh)	Annual Cost Savings (¥)		
4,604,000	**15,003,004**	**7,689,040**		
			Simple Payback (years):	**0.6**

3.2.1. DISCUSSION

The fan/ pump affinity laws show that the load on a motor in kW varies as the cubic function of the motor revolutions per minute. By slowing the motor down when the process is not fully load significant savings will result. Appendix 8.3 (Variable Frequency Drive Measures) shows the cost and savings associated with the installation of VFD's on selected motors.

3.2.2. RECOMMENDATION

The installation of variable frequency drives is recommended due to the large cost savings associated with the measure, the increased motor life, and the flexibility the drives provide to the operator to carefully match the motor power to the load.

3.2.3. ENERGY AND COST SAVINGS

The installation of Variable frequency drives could affect 131 motors with a total connected rating of 4,604 kW. The following formula describes the reduction in demand realized by slowing the motor speed during periods when the system is not fully loaded.

Future Demand kW2 = Existing kW x (RPM2/RPM1)^3

Where RPM is the Revolutions per minute of the motor.

3.2.4. IMPLEMENTATION COST

The implementation of variable frequency drives involves both an electrical installation component and a controls component. The electrical installation component requires the installation of the drive between the power source and the driven load. The controls component requires a signal from the process whether it is manual from the operator or, from temperature or pressure sensor that will be processed by the drive controls to modify the motor speed. The drive cost has been estimated at 850 ¥ per kW of load plus an additional 150 ¥ per kW for installation and controls for a total of 1,000 ¥ per kW.

3.3 EEM-3 Replace Standard V-Belts with Synchronous Belts

Description:	A number of compressors, vacuum pumps, condensers, fans, etc. are belt driven to transmit power and to change the drive revolutions per minute. Each of these loads is driven with standard V-belt drives. Standard V-belts of this type have an efficiency of about 92% which indicates that about 8% of the work produced by the motor is lost as heat as the belts flex and slip as they go around the pulleys. Synchronous-belts are available and have an efficiency of transmission of 98%.
Action:	Replace standard V-belts with synchronous belts.
Recommendation:	This EEM is cost effective and is recommended for implementation.

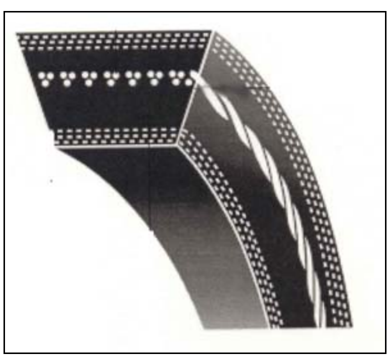
ENERGY IMPACTS

Total Cost (¥)	Annual Energy Savings (kWh)	Annual Cost Savings (¥)		
1,647,421	1,302,897	667,735	**Simple Payback (years):**	**2.5**

3.3.1. Discussion

The belt driven loads on site have motors equipped with standard V-belts with smooth inner surfaces. Figure 3-1 shows a cross-section of a standard V-belt. The smooth inner surface permits a significant amount of slip between the belts and the sheaves. The slip is exaggerated when multiple belts of slightly different lengths and wear patterns serve the same load. By installing Synchronous or toothed belts with corresponding toothed sprockets slip is virtually eliminated.

Figure 3-1
Standard V-Belt



Belt drives in motor driven applications allow flexibility in positioning the motor, and allow process rotating speed to be set based on pulley diameters. Well-maintained standard V-belts have been shown to have an efficiency of approximately 92%, meaning that about 7% of the work produced by the motor is lost as heat as the belts flex and slip going around the pulleys. Over time the efficiency of v-belts deteriorates due to uneven wear and incorrect tensioning. Synchronous belts provide a positive transmission of power similar to a chain drive but require no lubrication, resist corrosion, are un-affected by abrasive particles, can operate in wet conditions, and do not experience break-down in efficiency over time.

According to the Department of Energy's (DOE) Industrial Technologies Program (ITP), synchronous belts increase the efficiency of transmission by approximately 6%. In addition to significantly improving power-transmission efficiency, synchronous belts also last at least four times longer than standard V-belts. This considerably reduces the equipment downtime and replacement costs. However, synchronous belts are more costly than comparable standard V-belts. Table 3-4 summarizes the characteristics of different belt types.

Table 3-4
Drive Belt Characteristics Comparison

Comparison of Belt Drive Characteristics

	Typical Efficiency Range (%)	Suitable for Shock Loads	Periodic Maintenance Required	Change of Pulleys Required	Special Features
V-Belts	90–98	Yes	Yes	No	Low initial cost.
Cogged V-Belts	95–98	Yes	Yes	No	Easy to retrofit. Reduced slip.
Flat Belts	97–99	Yes	No	Yes, but low cost	Medium- to high-speed applications. Low noise. Low slip.
Synchronous Belts	97–99	No	No	Yes, with higher cost	Low- to medium-speed applications. No slip. Noisy. May have problems matching speed.

Source: de Almeida and Greenberg 1994

3.3.2. Recommendation

Because of the advantages, the use of synchronous belts is recommend in virtually all V-belt applications except for those that experience shock loading.

3.3.3. Energy and Cost Savings

The following calculations are based on actual motor loads provided by the system operators. Appendix 8.4 (Energy Savings Analysis for V-Belt Driven Motors) shows the results of demand and energy savings from replacing standard V-belts with synchronous belts. The results assume that standard V-belts are 92% efficient, and alternate synchronous belts are 98% efficient.

Two calculations incorporated into Appendix 8.4 are as follows:

Existing Demand = Qty x Actual Power Rating

Demand Savings = Existing Demand x [1 – (Std V-Belt Eff / Synchronous Belt Eff)]

3.3.4. Implementation Cost

We measured the belt size and sheave size of a number of belt driven systems throughout the facility and developed cost estimates to replace the sheaves and v-belts with synchronous sprockets and belts. The average cost of the retrofits was 517 ¥ per kW of motor load.

3.4 EEM-4 Replace Oversized Motors

Description:	Many of the facility’s motors are running at less then 50% of rated load. Motors are designed to achieve peak efficiency when 75% loaded. At less then 50% load the motor efficiency begins to drop, and at 25% load the efficiency can be reduced 10% or more from the peak. By replacing the over-sized, Y-series motors on site with correctly sized, YX efficient motors the plant will see a significant reduction in energy cost per unit of production.			
Action:	Replace Y series and JO2-series motors with correctly sized YX-series motors.			
Recommendation:	This EEM is cost effective and is recommended for implementation.			
ENERGY IMPACTS				
Total Cost (¥)	**Annual Energy Savings (kWh)**	**Annual Savings (¥)**		
75,232	**82,117**	**42,085**		
			Simple Payback (years):	**1.8**

3.4.1. Discussion

Company personnel provided us with a list of all large motors used in the process along with the loaded amperage of the motors. We were able to calculate the actual motor load based on this information. Appendix 8.5 (Oversized Motor Replacements) lists the motors that were significantly oversized for the loads served. Most of these motors are standard-efficiency Y-series motors. Premium-efficiency YX-series motors are commercially available at the required sizes and will have a significantly lower life-cycle cost.

3.4.2. Recommendation

We recommend replacing Y-series motors that are more then 50% over-sized with YX-series motors. The economics are favorable for the motors to be replaced immediately due to the long run-time per year.

3.4.3. Energy Savings, Cost Savings, and Implementation Cost

Table 3.2 is a list of motor efficiencies taken directly from the publication “The Chinese Market for Electric Motors and Motor Speed Controls” (Hinge, Nadel, Yande, Lan, Chunxuan. ACEEE. 1997). These efficiencies are identical to those reported in the more recent publication “The China Motor Systems Energy Conservation Program: A Major National Initiative to Reduce Motor System Energy Use in China” (Nadel, Wanxing, Liu, McKane. DOE Office of Scientific & Technical Information. 2001). The United States Department of Energy (DOE) Motor Challenge Fact Sheet Motor Loading, Attachment C tabulates the effect of motor loading on motor efficiency. The measure cost is estimated to be ¥300/kW for motors less then 15 kW, and ¥130/kW for motors 15 kW and larger.

3.5 EEM-5 Replace S7 & S9 Transformers with S11 Transformers

Description: Jiangsu Sopo is operating 18 S7 and S9 transformers that would be cost effective to replace with higher efficiency S11 units. Although S11 transformers are more expensive to purchase, their increased efficiency gives them a lower life-cycle cost.

Action: Consider installing S11 transformers to replace S7 and S9 transformers.

ENERGY IMPACTS

Incremental Cost (¥)	Annual Energy Savings (kWh)	Annual Savings (¥)		
3,100,500	1,084,410	555,760		
			Simple Payback (years):	7.0

Note: Since S7 transformers are likely to be replaced soon, annual savings will decline at the time of expected natural replacement. The simple payback calculation above takes this into account.

3.5.1. Discussion

Jiangsu Sopo has ten S7 transformers, that have to be phased out according Chinese relevant regulations. There are also six S9 transformers that would be cost effective to replace at the same time. Table 8.6 Transformer Data lists all the transformers present at the site. Table 8.7 Transformer Replacements shows these transformers.

Two major types of transformers are commercially available: standard-efficiency S9 transformers and high-efficiency S11 transformers. This study used costs and savings for replacing existing transformers with S11 transformers. S11 transformers may become standard practice in the next few years.

3.5.2. Recommendation

We recommend considering S11 transformers to replace existing S7 & S9 transformers immediately. According to the analysis in Table 8.7, the payback to recoup the cost of purchasing S11 transformers would be 5.6 years.

3.5.3. Energy Savings, Cost Savings, and Implementation Cost

The facility provided the loads and power factors for each of the transformers. The average efficiency improvement is 1.4 % to go from S7 to S11 transformers. The average efficiency improvement is 0.8% to go from S9 to S11 transformers. The anticipated life of the S9 or S11 transformers is 20 years. It is assumed that the S7 transformers are at the end of their life. The cost to install S11 transformers is 130¥ /KVA.

3.6 EEM-6 Repair Compressed Air Leaks and Maintain Air Distribution System

Description:	Compressed air leaks often contribute to a large portion of demand in a compressed air system. Most industrial plants have a compressed air leak load between 20% and 75%. Instrumentation and process consume large amounts of compressed air at many individual locations and these locations are susceptible to leakage. Repairing leaks is a cost-effective way to save energy in a compressed air system.
Action:	Repair compressed air leaks, and maintain compressed air distribution system on at least a semi-annual basis.
Recommendation:	This EEM is cost effective and is recommended for implementation.

ENERGY IMPACTS

Total Cost (¥)	Annual Energy Savings (kWh)	Annual Savings (¥)		
270,224	2,670,741	1,368,755		
			Simple Payback (years):	**0.2**

3.6.1. Discussion

Compressed air leaks in an air distribution system increase compressed demand and compressor power consumption. Repairing leaks and maintaining a compressed air distribution system is a cost-effective way to avoid excess compressor power consumption.

Jiangsu Sopo is equipped with twenty-one air compressors to supply compressed air primarily for instrumentation and production. We did not perform a leak inspection. However, from past consulting experience, air leaks account for between 20% and 75% of air demand in a plant with no regular maintenance policy.

Compressed air leaks most commonly exist at threaded connection points, rubber hose connections, valves, regulators, seals, and old pneumatic equipment. Air leaks in industry typically average about 0.085 m3/min.

3.6.2. Recommendation

We recommend finding all compressed air leaks and repairing the leaks. This may involve tightening fittings, replacing thread-sealing tape, patching hoses, replacing seals, or replacing leaky equipment. In addition, we recommend maintaining the compressed air distribution system by performing an inspection and repair of compressed air leaks on at least a semi-annual basis.

3.6.3. Energy and Cost Savings

Jiangsu Sopo is equipped with twenty-one air compressors with a total capacity of approximately 570 M^3/Min. See Table 8.8 Compressed Air Leakage for a list of all the compressors and the related capacities.

Although we were not able to monitor the compressors for an extended period of time, we were presented with the motor loads of each of the units.

As stated earlier, air leaks account for between 20% and 75% of air demand in a plant with no regular maintenance policy. Assuming repairable air leaks conservatively account for 10% of the air demand in Jiangsu Sopo, the air lost to leaks may be approximated at 57.4 m3/min. Because a typical compressed air leak consumes approximately 0.085 m3/min, about 675 leaks would account for 57.4 m3/min.

As shown in Table 8.7 the annual electrical energy saved would be approximately 2,670,740 kWh. At a rate of ¥0.5125 per kWh, the annual cost savings would be approximately ¥1,368,755.

3.6.4. Implementation Cost

The cost of repairing a compressed air leak, including parts and labor, is typically ¥400. The cost of repairing 675 leaks would be approximately ¥270,225.

3.7 REPLACE MEMBRANE ELECTROLYSIS PROCESS WITH THE MORE EFFICIENT ION FUME PROCESS

Description:	Jiangsu Sopo has been producing caustic soda using a membrane electrolysis process since 1983. An Ion fume process is now considered the most energy efficient means for this type of production. Currently one-third of of the sodium hydroxide produced at the facility is generated by the Ion Fume process.
Action:	Accelerate the transfer of Sodium hydroxide production from the old process to the new process.
Recommendation:	This EEM requires further study to determine the total cost to replace production.

ENERGY IMPACTS

Total Cost (¥)	Annual Energy Savings (TCE)	Annual Cost Savings (¥)		
200,000,000	**21,680**	**11,924,000**		
			Simple Payback (years):	**16.7**

3.7.1. DISCUSSION

Jiangsu Sopo Group produces approximately 120,000 tons of caustic soda per year, 80,000 tons by the membrane electrolysis process, 40,000 tons by the ion fume process. The membrane electrolysis process uses about 0.641 TCE/ton of production. The more efficient Ion Exchange Process uses about 0.37 TCE/ton of production for a net savings of 0.271 TCE/ton.

3.7.2. RECOMMENDATION

Based on the 42% increase in production efficiency associated with the new process it would be beneficial to speed-up the transfer to the new technology. To fully justify this measure much more information regarding the anticipated construction costs would have to be developed.

3.7.3. ENERGY AND COST SAVINGS

Initial reports on the energy consumption of caustic soda manufacturing indicate that there is a reduction in energy consumption of 0.271 TCE/ton of production associated with utilizing the new Ion Fume process. If the entire production of 80,000 tons of caustic soda was transferred from the old process to the new process there would be an energy savings of 21,680 TCE/yr and a cost savings of ¥ 11,924,000 per year.

3.7.4. IMPLEMENTATION COST

It can reasonably be assumed that Jiangsu Sopo Group is anticipating the phase out of the anode membrane process after 25 years of operation. At the time these systems are replaced it is expected that the replacement system will be the ion fume system. It may however be beneficial to invest any premium funds required to accelerate this development to capture the added energy savings. The incremental increase in cost to accelerate this more must be developed.

4 Best Practices in Energy Efficiency

This section provides Information for the Jiangsu Sopo Group on energy-efficiency measures that require further investigation to quantify savings and costs. This section provides information on recent technological advances and best practices for improving efficiency of energy intensive equipment not examined in detail in Section 3:

- Compressed Air Systems
- HVAC
- Lighting

4.1 Best Practices in Compressed Air Systems

Maintain Pressure at Lowest Possible Level – Greater energy is required to compress air to a higher pressure. Higher pressure compressed air not only is generated less efficiently, but also leaks faster through holes and orifices in the system, thereby causing higher output than necessary.

Compress Coldest Air Possible – Air is denser at lower temperatures, thus requires less energy to compress. For energy efficiency, it is advisable to use the coldest air possible for compression, which in most cases is outdoor air. Outdoor air can be ducted directly to the compressor's intake, or windows/doors/vents can be left open to draw outdoor into the room.

Repair Compressed Air Leaks – Air leaks in a distribution system increase compressed air demand thus increasing a compressor's electrical load.

Operate Rotary-Screw Compressors in Load/Unload Mode – Rotary-screw compressors have two major modes of capacity control: load/unload control, and modulation control. In load/unload control, the compressor's inlet valve repeatedly opens completely and closes completely to maintain air discharge pressure within a certain range. When the inlet valve is open, the compressor generates its full-load air output. When the inlet valve is closed, the compressor generates no compressed air. Sump pressure decreases when unloaded, thus causing the compressor to draw between 40% and 45% of its full-load power.

In modulation control, compressed air output is controlled by the compressor's modulating inlet valve. Power (kW) to the compressor decreases in a linear fashion as air output (scfm) decreases, but only decreases to approximately 70% of its full-load power at the point when it generates no compressed air.

Properly Stage Compressors – In a multiple compressor system, the compressors' operation should be staged so that the compressor with highest part-load efficiency operates as the trim compressor, and the compressors with the lowest part-load efficiencies carry the base load. Reciprocating compressors and variable frequency drive (VFD) compressors have the best part-load efficiency; standard rotary-screw compressors have lower part-load efficiency; and centrifugal compressors have the least part-load efficiency.

Use Electric Motor Tools Instead of Pneumatic Tools when Feasible – According to the U.S. Department of Energy's Compressed Air Challenge Program, compressed air systems are only 10% - 15% efficient. This is due in part to the requirement to reject heat when compressing air, and to the requirement that compressed air exits pneumatic equipment at a velocity greater than zero. Therefore, compressed air is not recommended to produce work if electric motors (about 90% efficient) can alternately be used.

Several pneumatic tools are used in the facilitys. It is up to the discretion of management whether any pneumatic equipment can be replaced by electric alternatives.

4.2 BEST PRACTICES IN HVAC

Buildings that support the Jiangsu Sopo Group, particularly offices, control rooms, and break rooms have heating, ventilation, and air conditioning (HVAC) systems. The following are best practices in HVAC.

Temperature Setback – Setpoint temperatures can be set back during cold season, and set forward during warm season when a room is unoccupied for long periods of time. Doing so reduces building heating and cooling load. For example, office room temperatures can be setback during night hours. To better control temperature setback, programmable thermostats can be installed to automatically setback temperature based on time of day.

Do Not Overventilate – According to building standards, a minimum of 0.57 cubic meters per minute (cmm) of fresh outdoor air is required per person occupying a commercial or office building. Ventilation rates significantly higher than 0.57 cmm cause more outdoor to be conditioned than necessary. Typically, ventilation rates can be turned down in an office building at night when not occupied. To better control ventilation rates, a demand control ventilation (DCV) system can be installed that controls ventilation based on monitored CO2 levels within the building.

Utilize Economizer Controls – Due to internal sources of heat such as machinery, people, electronics, etc., buildings often require cooling even on moderately cool days. If large amounts of cool outdoor air are brought into a building during those types of days, little or no mechanical cooling would be necessary to meet the cooling load. Economizer controls perform this function by controlling outdoor air intake based on outdoor temperature to minimize mechanical cooling. In a system with economizer controls, outdoor air intake is maximized during moderately cool days, and minimized during cold days and hot days.

Employ Variable Air Volume (VAV) System Rather than Constant Air Volume (CAV) System – A constant air volume (CAV) system delivers air to each zone in an HVAC system at a constant flow rate. Because supply air flow is constant, it often needs to be both heated and cooled (particularly during moderate temperature days) in order to balance its temperature to the zone set-point. Simultaneous heating and cooling is inefficient.

A variable air volume (VAV) system varies the amount of air delivered to each zone based on the heating or cooling load. Supply airflow is highest during peak heating and cooling days, and lowest during moderate temperature days. Varying supply air minimizes the need to simultaneous heat and cool.

Use Variable Speed Supply Fan in VAV System – A variable speed supply fan is ideal for a variable air volume (VAV) system. A variable frequency drive (VFD) can be installed on a fan motor to allow for variable speed. Without a variable speed supply fan, inlet air dampers would need to be employed, which build fan pressure and result in inefficiencies. Slowing a fan down when less flow is needed is the most efficient method of flow control.

4.3 BEST PRACTICES IN LIGHTING

The Jiangsu Sopo Group utilizes lighting in the offices, in the process buildings, and on the connecting roadways. The following are best practices in lighting.

Super T8 Fluorescent Technology – In general it is recommended that T12 fluorescent lamps and magnetic ballasts be replaced with standard T8 lamp and electronic ballast combinations. However, new “Super T8” technology is now available for 4-foot linear T8 systems that offer even greater energy and demand savings than the standard T8 replacement.

Advanced T8 lighting systems consist of high-lumen, high CRI, extended-life T8 lamps used in combination with matched “program-start” low ballast factor electronic ballasts. This lamp and ballast combination offers system efficacies (Lumens/Watt) approximately 15-20% higher than standard T8 systems. The lamps used in Super T8 systems have at least 20% longer lamp life than standard T8 lamps, decreasing maintenance costs. The incremental cost for Super T8 vs. standard T8 is about 8 rmb per lamp and 62 rmb per ballast.

Compact Fluorescents – Compact fluorescent lights (CFL’s) are premium-efficient lights designed to replace incandescent lights. CFL bulbs typically draw between 13 and 20 watts, as compared with incandescent bulbs that draw between 50 and 100 watts. CFL’s, by design, output equal or greater light than their corresponding incandescent bulbs. In addition, CFL bulbs last about 10,000 hours, whereas incandescent bulbs last about 1,000 hours.

High Bay Fluorescent Lights – High-bay fluorescent (HBF) lights, which typically consist of six 4-ft T8 lamps in specially-designed high-efficiency fixtures, are an energy-efficient alternative to high intensity discharge (HID) lights. The high-bay fluorescents lights draw about 227 W per fixture while putting out the same lumens as a HID light that draws 450 W. In addition, the color-rendering index (CRI), a measurement of light quality (daylight having a CRI of 1), of a HBF fixture is 0.85 as opposed to 0.65 for HID lights. The experience of most industrial clients who have switched from HID to HBF lighting has been overwhelmingly positive. The areas under the new lights are visibly brighter, and workers report that they can see better with the new lights.

Occupancy Controls – Occupancy controls can be used to dramatically reduce operating hours of certain types of lighting fixtures. Occupancy sensors activate lighting when someone enters the space. When the space is vacated, an adjustable delay mechanism turns off the lights after a selected time period. All occupancy sensors incorporate field adjustable time delays so that the lights will not immediately turn off when someone leaves the area. This prevents unnecessary cycling of the lighting and allows a worker in a location hidden from the sensor to finish their task before the lights turn off. In addition, most sensors incorporate field adjustable sensitivity so that the reach of the sensor will not turn the lights on when there is movement in an adjoining area.

Daylight Harvesting Sensors – A daylight-harvesting sensor senses the amount of available daylight, and turns off lights when an adjustable daylight threshold is obtained. An adjustable “lag” prevents the fixture from cycling quickly during variable day-lighting conditions. This system is also used in buildings that incorporate skylights or monitors for day-lighting. Another efficient design using this system involves controlling lighting fixtures within 10’ of glazed exterior walls, while the rest of the lighting fixtures in the space are controlled by other means.

5 Economic and Financial Analysis

We conducted an economic and financial analysis of the energy-efficiency measures (EEMs) studied in Section 3. Using the performance estimates for the EEMs, we projected the lifetime benefits as the marginal electricity supply costs that the power grid would avoid. We compared the present worth of EEM benefits with their costs to determine cost-effectiveness. The financial analysis considers the EEM as a financial investment by the customer by comparing the cash flows that would result from electricity bill savings with the initial outlay made by the customer to pay for it. EPP financial incentives to the customer reduce the customer's initial outlay for the EEM, which make the cash flow from bill reductions more financially attractive.

Based on this cash-flow analysis of cost-effective EEMs, we develop and recommend financial incentives that bring down the Facility's initial outlay low enough to make the bill savings pay for its EEM investments in about a year. In effect, the incentive recommendation would allow the facility to pay for all the recommended EEMs out of its operating budget.

Table 5-1 presents the results of our economic and cash-flow analysis of various sets of EEMs with the financial incentives that we recommend Sopo consider for various combinations over time. Note that the S11 analysis should only be considered representative. We recommend that Sopo further evaluate the technical suitability and cost-effectiveness of S13 transformers compared to the S11 series, given the likelihood that S11 will become standard practice soon and the domestic availability of S13 transformers. If suitable and cost-effective compared to S11 technology, we recommend that Sopo develop a financial incentive that brings the Facility's investment down far enough to pay for itself with one year of electricity savings as shown for S11 transformers in Table 5-1.

We also recommend that Sopo estimate the costs for modernizing the Sodium Hydroxide process. The potential energy savings and benefits equal the total of all of the other EEMs combined. Present worth benefits are approximately 88 million RMB. If the costs are less than 88 million RMB, then this measure would be cost effective. Whether this decision would be financially worthwhile for the Company would depend on whether the project is cost-effective enough to allow JETC to offer financial incentives large enough to buy the modernization down to a one-year payback period for Sopo.

Table 5-1
Summary of Sopo Efficiency Measures Economic and Financial Analysis

	Motor Retrofit	Variable Frequency Drive	Synchronous Belts	Downsize Motor Retrofit	S9 Transformer Retrofit	S7 Transformer Retrofit	Compressed Air Leak Repair	Over 1-Year Payback Package	Under 1-Year Payback Package	Total All Measures
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[1]+[3]+[4] +[5]+[6]	[2]+[7]	[1] to [7]
Total Measure Cost (not discounted)	¥2,428,292	¥4,604,000	¥1,647,421	¥75,232	¥1,612,000	¥1,488,500	¥270,224	¥7,251,445	¥4,874,224	¥12,125,669
Recommended Incentive								¥1,087,717	¥0	¥1,212,567
% of Total Measure Cost								15%	0%	10%
Customer Contribution								¥6,163,728	¥4,874,224	¥10,913,102
EPP Economic Analysis										
Benefits (Avoided Generation, T&D)	¥7,776,133	¥54,859,277	¥5,062,490	¥319,072	¥3,511,201	¥2,948,273	¥1,071,392	¥19,617,171	¥55,930,669	¥75,547,839
Total Costs (see Note)	¥1,001,399	¥4,604,000	¥1,647,421	-¥32,710	¥1,167,691	¥526,521	¥270,224	¥4,310,321	¥4,874,224	¥9,184,545
Net Economic Benefits	¥6,774,734	¥50,255,277	¥3,415,070	¥351,782	¥2,343,511	¥2,421,753	¥801,168	¥15,306,850	¥51,056,445	**¥66,363,294**
Benefit/Cost Ratio	7.77	11.92	3.07	(9.75)	3.01	5.60	3.96	4.55	11.47	8.23
CDM-CER Present Value (max 10 years)	¥528,275	Not Applicable	¥343,923	¥21,676	¥121,153	¥131,778	Not Applicable	¥1,146,805		¥1,146,805
% of Total Measure Cost	22%		21%	29%	8%	9%		16%		9%
% of Customer Contribution								19%		11%
Customer Financial Analysis										
Simple payback without incentive	2.37	0.60	2.47	1.79	7.00	7.00	0.20	4.00	0.54	1.07
Simple payback with incentive								2.69	0.54	0.96
Internal Rate of Return without incentive	44%	170%	42%	58%	16%	16%	407%	31%	178%	90%
Internal Rate of Return with incentive								37%	178%	100%

Note: Total Costs in EPP Economic Analysis reflect early retirement cost credit for postponing future scheduled replacements.
Benefits and costs in EPP Economic Analysis are all discounted to 2008.

5.1 ECONOMIC ANALYSIS

We analyzed the economics of the electricity savings estimated for several packages of EEMs as substitutes for the electricity supply they would avoid. Electric energy savings avoid coal-fired generation on the margin; peak demand savings avoid transmission and distribution capacity costs. We estimated these benefits over the life expectancy of the electricity savings using information from the DSM Center on electricity supply costs. We compared the present worth of these avoided supply costs with the total costs of the EEMs over their lifetime.

We also estimated the potential proceeds from possible sales of Certified Emission Reductions (CER) under the Clean Development Mechanism (CDM) of the Kyoto Protocols on climate change. We used a value of ¥86.74 per metric ton of CER sold, based on a review of current trading prices paid. We calculated the present worth of proceeds from 10 years of CER sales or the measure life, whichever is shorter.

For motors, we first analyzed the early retirement of existing machinery before the end of its life expectancy. All of the motors were cost effective to retire early. We then compared the net benefits of early retirement against the net benefits of scheduled replacement for motors with low hours of use. This analysis revealed that for the majority of motors, early retirement would be more cost-effective than waiting to upgrade efficiency at the time replacement would otherwise normally take place. Selecting those few motors that are more cost effective to upgrade at the time of natural replacement would only produce a minimal increase in net benefits over early retirement of all of the motors. Because of the possibility of missing the opportunity to upgrade the motor efficiency at a later date and the small additional net benefits of waiting for those few motors to be replaced, we recommend early retirement of all of the motors. We assembled these cost-effective early retirements into the Motor Retrofit package and compared their benefits and costs.

Some of the motors were also analyzed for downsizing. The cost-effectiveness of early retirement of oversized motors was so overwhelmingly great that waiting for time of natural replacement was not analyzed. Past analysis of similar projects has shown that little if any net benefits may be gained by waiting, while adding to the risk of missing the opportunity.

Variable Frequency Drives, Synchronous Belts, Compressed Air Leak Repair, and Transformers were all treated as retrofits. All were found cost effective.

Following are further details of the economic assessment of efficiency measure packages:

Motor Retrofit: Early retirement of existing motors rather than waiting to replace the motors at the end of their lifetimes.

Economic analysis of early retirement must consider two factors. The first is the future decline in initial energy savings that occurs when the existing equipment would have been replaced anyway with new technology that is more efficient than the existing model but less efficient than the high-efficiency EEM installed now. The second factor that must be accounted for in the economic analysis of early retirement is its effect on the future timing of scheduled replacement. By interrupting the normal replacement schedule, early retirement postpones all future replacement investments by the age of the existing equipment. For example, retiring early a 10-year-old motor with five years of life remaining will push back for 10 years the next scheduled motor replacement (and all subsequent replacements thereafter). The deferral of these future investments is a cost savings that is credited to the present worth of the total measure cost of the retrofit.

S11 Transformers: The existing S7 transformers are considered to be near the end of their useful lifetimes, while it is assumed that existing S9 transformers may remain in service another 10 years. The economic analysis assumed that the S7 transformers would have been replaced with S9 transformers in 2 years without intervention.

We question the economics of the S11 transformer upgrade at scheduled replacement because the technology is rapidly gaining widespread market acceptance. If the market norm is indeed S11, then no additional savings can be attributed to the EEM for EPP planning past the point of time when the transformer would have been naturally replaced (or for CDM sales of certified emission reductions). Consequently, we recommend further study of the technical suitability, performance and costs of S13 technology before committing to EPP promotion of S11 transformers.

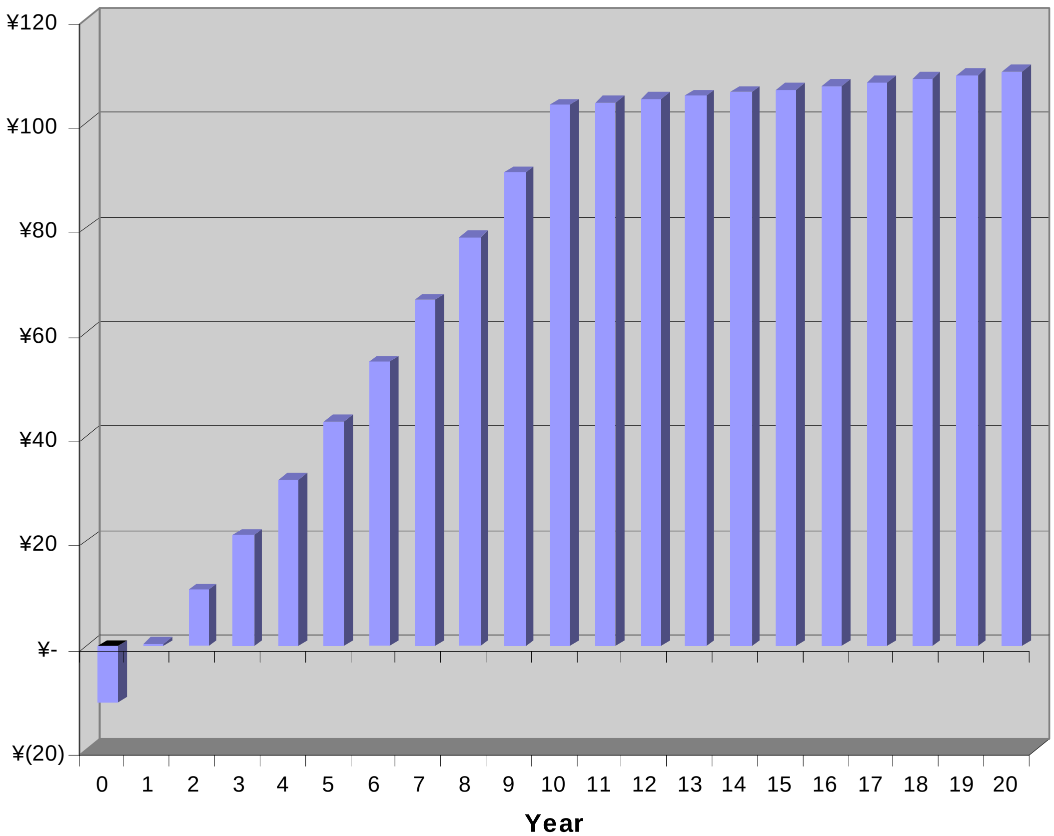
5.2 Customer Cash Flow Analysis and Financial Incentive Development

The cash-flow analysis valued the electricity savings from EEMs according to the customer's average electric rate. The cash-flow was evaluated and compared to the outlay the company would have to make absent any EPP financial incentive. We computed the simple payback period for each EEM and EEM package considered in the economic analysis. This indicates how long it would take the annual electricity bill savings to pay for the customer's total measure cost. For retrofit measures with an expected change in the baseline equipment efficiency, the future change in savings relative to the new baseline equipment was also factored into the payback.

We also computed the rate of return the cash-flows would produce based on the customer's initial outlay for the EEMs at their full measure costs. This rate of return is a better indicator of the long-term financial performance of the customer's EEM investment compared to competing investment opportunities available elsewhere in the enterprise.

Figure 5-1 shows the projected cash flow for a 20-year period. The net cumulative cash flow becomes positive in the first year reaching around 435,000 yuan. It then grows rapidly until the tenth year, when growth slows dramatically. After year 10 only the savings from transformers remain.

Figure 5-1
Net Cumulative Cash-flow (M¥)



Cost-effective EEMs offer Sopo simple payback periods ranging from 0.2 years (i.e. 2 months) for repairing compressed air leaks to 7 years for replacing inefficient transformers. The rate of return Sopo would earn from investing in each EEM ranges from 16% for transformer retrofit upgrades to 407% for compressed air leak repair.

EEMs with payback periods longer than one year require the customer to raise capital either from internal or external sources. Once the customer contribution toward the investment falls below one year, it means that no capital budgeting is necessary and that the customer could justify using its operating budget to pay for the EEMs. This leads to two complementary recommendations. First, we recommend that the utility not offer financial incentives for EEMs with simple payback periods shorter than one year. Second, we recommend that the utility offer financial incentives for all cost-effective EEMs structured to “buy down” the customer’s contribution an amount that would yield a less than one-year simple payback on its EEM investment.

Table 5-1 shows the financial incentive we recommend in order to provide Sopo with a less than one-year payback period for the total package. The incentive is shown both in RMB and as a percentage of the total measure cost. The recommended financial incentive of ¥1,212,567 represents 10% of the total measure cost, requiring a total contribution by Sopo of ¥10,913,102. This investment would yield a customer payback period of less than one year, and a return on its investment of 100% per annum. This should prove financially attractive to Sopo, enough so to garner maximum net economic benefits for Jiangsu and its power grid.

For the Over 1-Year Payback package we recommend an incentive slightly less than the Total All Measures package. The recommended financial incentive for the Over 1-Year Payback package of ¥1,087,717 represents 15% of the package measure cost. While this amount of incentive bumps up the return on investment to an attractive 37%, the simple payback is greater than 2 years. In order to lower the payback to less than one year an incentive of ¥5,000,000 would need to be offered to Sopo for this package. Since it is in the interest of both Jiangsu and Sopo to install all cost-effective measures, we want the Total All Measures package to provide an incentive higher than any partial packages. Therefore, we recommend an incentive for the partial package that is less than the total package.

Finally, Table 5-1 provides the estimated present worth of ten years of CER sales under CDM. Because the Under 1-Year Payback measures are so financially attractive to Sopo without any financial incentive, we doubt seriously that these EEMs would qualify for CDM. For the other EEMs and packages, potential CER proceeds at expected market trading prices could offset some of the customer contribution by Sopo after JETC financial incentives. For example, CER proceeds would cover anywhere from 11% of the customer contribution after JETC financial incentives up to 19%. The present worth of CER sales would offset 11% of Sopo’s required customer contribution for all measures combined. This analysis clearly indicates that pursuing these recommended EEMs as CDM projects would be attractive for Jiangsu and Sopo.

6 Measurement and Verification

Efficiency programs commonly include a measurement & verification (M&V) process to assure that specific efficiency projects and tasks have been carried out and are performing effectively. An M&V process involves site inspections of implemented projects that have received incentives through the efficiency program. Site inspections consist of documenting project installations, and often measuring to determine the facility's performance improvement after retrofit.

M&V processes are essential in determining the success of an efficiency program. Post-retrofit measurements establish the difference between theoretical projected energy savings and actual savings. Program incentives may then be modified based on realized actual savings. Repetitive problems are often discovered through the M&V process, which can be dealt with and solved. Solving problems and identifying strong and weak points is an effective way to fine tune a program. Moreover, sound M&V procedures will be absolutely necessary if it is intended to pursue CER sales through the CDM mechanism.

M&V processes have added much value to efficiency programs in New England and California. The following steps illustrate a typical M&V procedure.

Review Project Files – Invoices and documents regarding approval of efficiency projects are reviewed.

Decide Which Sites to Evaluate – Based on client type and what energy-efficient equipment each client installed, a sample of clients is chosen for evaluation. The sample selected should represent the program's entire client population with 10% relative precision.

Visually Inspect Sites – Verify that the implemented projects are consistent with project files. On site inspections, decide which pieces of equipment should be logged.

Install Loggers – Loggers should be installed on new pieces of equipment or upgraded equipment. Equipment should be logged for a period of one to four weeks.

Analyze Data – Data analysis determines energy savings. Volatile factors such as daily operating hours, building occupancy level, and weather conditions should be taken into account during analysis.

Determine Savings – Savings are determined by comparing the energy use and performance of an efficient system with the performance of standard baseline system.

Submit Report – The evaluation report is submitted to program management. The report includes a comparison of projected savings before project implementation and savings based on measurements after implementation.

Reported results help determine the effectiveness of an efficiency program, and help recommend possible improvements.

Appendix 9 provides two detailed sets of M&V procedures for EEMs addressing two types of motor loads: (1) constant loads; and (2) variable loads leading motors to operate at partial capacity.

7 Conclusions and Recommendations

Here we consolidate and reiterate the conclusions and recommendations from our technical, economic, and financial analysis of the 6 EEMs examined in this study.

7.1 Technical Assessment

We find that all EEMs studied are technically feasible. We conclude that they will save over 22 million kWh annually, and recommend that Sopo install them all as soon as possible. Each EEM is summarized below.

7.1.1. EEM-1 Replace JO2-Series and Y-Series Motors with YX-Series Motors

Most plant motors are standard-efficiency Y-series motors. Premium-efficiency YX-series motors are commercially available, and are between 1% and 3% more efficient than standard-efficiency motors. We recommend replacing J02 and Y-series with YX-series motors.

7.1.2. EEM-2 Install Variable Frequency Drives (VFDs)

Although production at the facility is nearly constant, many of the motor-driven loads are variable due to throttling that occurs in the processes, or due to seasonal variations in temperature or humidity. Slowing motor revolutions down when the motors are not fully loaded can result in significant energy savings. We recommend installing VFD's on motors with centrifugal loads that vary more then 10%.

7.1.3. EEM-3 Replace Standard V-Belts with Synchronous Belts on Belt Driven Loads

Standard V-belts have been shown to have an efficiency of approximately 92%, indicating that approximately 8% of the work produced by the motor is lost as heat as the belts flex and slip going around the pulleys. Over time the efficiency of V-belts deteriorates due to wear and incorrect tensioning. There are synchronous belts on the market that are similar to the timing belt on modern cars. These belts have raised ridges perpendicular to the length of the belt that lock into corresponding grooves machined into the sprockets similar to the meshing of gear teeth. Synchronous belts have an efficiency of approximately 98%. Synchronous belts require the replacement of both the belts and the sheaves for utilization.

7.1.4. EEM-4 Replace Oversized Motors with Correctly Sized, Efficient Units

It was noted from information provided by the facility that many of the site motors are operating at less then 50% of rated capacity. Generally motors are designed to operate at peak efficiency when approximately 75% loaded. When motor load drops below 50% the motor efficiency and power factor drops significantly. For example: a 55 kW motor that operates at 92.5% efficiency when 75% loaded will operate at 87.1% efficiency at 25% load. It is recommended that motors that are consistently loaded at less then 50% be replaced by correctly sized YX-Series motors.

7.1.5. EEM-5 Replace All S7 and Heavily Loaded S9 Transformers with S11 Transformers

Jiangsu Sopo Group is considering replacing several old style S7 transformers that are approaching their end of life. Three major types of transformers are commercially available: standard-efficiency S9 transformers, high-efficiency S11 transformers, and premium-efficiency S13 transformers. S13 transformers are most efficient because they undergo the least core losses but may not be readily available at this time. We recommend considering installing S11 and if possible S13 transformers.

7.1.6. EEM-6 Repair Compressed Air Leaks and Maintain Air Distribution System

Compressed air production is very costly from an energy consumption perspective. Due to the very large number of piping connections, seals, valves, pneumatic devices, and controls that are attached to a compressed air system the network of pipe and tubing becomes very complex in a facility of this size. Unfortunately with all the piping and connections there is often a significant portion of overall compressed air production that is lost to leakage. By initiating a comprehensive plan to find and repair leaks on a bi-annual basis large energy savings will result.

7.1.7. FURTHER ANALYZE CONVERTING ALL SODIUM HYDROXIDE PRODUCTION TO ION FUME ELECTROLYSIS

The facility manufactures 80,000 tons of sodium hydroxide a year at an energy utilization rate of about 0.641 TCE/ton using the membrane electrolysis process. They currently produce 40,000 tons/yr at an energy usage of 0.37 TCE/ton using the ion fume process. By expanding the more efficient ion fume process to replace the old membrane electrolysis process, very significant savings would result. It is anticipated that the total cost to switch the membrane process to the ion fume process could cost approximately 200,000,000 rmb. Although energy savings alone may not be enough to justify replacing this operation, it may be an incentive to accelerate the transition that is ultimately planned for the future.

Comprehensive economic analysis would be required to determine the costs and benefits associated with accelerating the planned transition to the new process. Optimizing the timing of the transition would require a detailed analysis that was beyond the scope of this assessment. Consequently, we draw no conclusions and make no recommendations on whether it is economically or financially viable to accelerate the transition.

7.2 ECONOMIC AND FINANCIAL ASSESSMENT

Table 7-1 summarizes the results of the economic and financial analysis of each of the seven EEMs studied and of all seven combined.

Table 7-1
Summary of Sopo EEM Economic and Financial Analysis

	Motor Retrofit	Variable Frequency Drive	Synchronous Belts	Downsize Motor Retrofit	S9 Transformer Retrofit	S7 Transformer Retrofit	Compressed Air Leak Repair	Total All Measures
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[1] to [7]
Total Measure Cost (not discounted)	¥2,428,292	¥4,604,000	¥1,647,421	¥75,232	¥1,612,000	¥1,488,500	¥270,224	¥12,125,669
Recommended Incentive								¥1,212,567
% of Total Measure Cost								10%
Customer Contribution								¥10,913,102
EPP Economic Analysis								
Benefits (Avoided Generation, T&D)	¥7,776,133	¥54,859,277	¥5,062,490	¥319,072	¥3,511,201	¥2,948,273	¥1,071,392	¥75,547,839
Total Costs (see Note)	¥1,001,399	¥4,604,000	¥1,647,421	-¥32,710	¥1,167,691	¥526,521	¥270,224	¥9,184,545
Net Economic Benefits	¥6,774,734	¥50,255,277	¥3,415,070	¥351,782	¥2,343,511	¥2,421,753	¥801,168	**¥66,363,294**
Benefit/Cost Ratio	7.77	11.92	3.07	(9.75)	3.01	5.60	3.96	8.23
CDM-CER Present Value (max 10 years)	¥528,275	Not Applicable	¥343,923	¥21,676	¥121,153	¥131,778	Not Applicable	¥1,146,805
% of Total Measure Cost	22%		21%	29%	8%	9%		9%
% of Customer Contribution								11%
Customer Financial Analysis								
Simple payback without incentive	2.37	0.60	2.47	1.79	7.00	7.00	0.20	1.07
Simple payback with incentive								0.96
Internal Rate of Return without incentive	44%	170%	42%	58%	16%	16%	407%	90%
Internal Rate of Return with incentive								100%

Note: Total Costs in EPP Economic Analysis reflect early retirement cost credit for postponing future scheduled replacements.
Benefits and costs in EPP Economic Analysis are all discounted to 2008.

7.2.1. Economic assessment

The recommended EEMs all provide energy savings at life-cycle costs well below the avoided cost of coal-fired electricity supply. Maximum economic net benefits to Jiangsu will be realized if Sopo installs all cost-effective EEMs as soon as possible.

The total economically feasible potential for EEP investment at the plant is 21.7 million kWh/year, with an estimated peak demand reduction of 1045 kW. The total (undiscounted) investment required is 12 million RMB. It is expected to yield benefits in the form of avoided generation and T&D costs of 75 million RMB, for net economic benefits to Jiangsu Province of 66 million yuan.

We estimated the benefits but were unable to estimate the potential costs of switching the remaining sodium hydroxide manufacturing process over to the ion fume process. We recommend that Sopo examine this option further to determine its likely costs. We further recommend that JETC work with the enterprise to determine the net economic benefits of such a strategy, and to find out if it would provide enough cost-effective savings to warrant a financial incentive large enough to yield the enterprise a one-year payback period on its contribution.

7.2.2. Financial assessment and incentive recommendation

As is typically the case with many other manufacturing enterprises, it is difficult for Sopo plant managers to raise capital needed to finance energy-efficiency investments for EEMs that take longer than one year to pay for themselves. Such investments must compete with other potential investments for inclusion in the corporate capital budget.

Our analysis of Sopo’s energy-efficiency investment opportunities found two EEMs – Compressed-air leak repair and variable frequency drives – whose annual electricity savings would repay their investment costs in less than one year. Such investments offer Sopo annual returns in excess of 170%. No additional financial incentive is necessary to make these investments more attractive to the enterprise.

Five EEMs offer simple payback periods ranging from 1.8 to 7 years. All together they would pay for themselves in 4 years. While each offers attractive financial returns, ranging from 16% to 58%, it nevertheless would probably take years before senior management of the enterprise would end up including all of them in the corporate capital budget.

We recommend that JETC offer Sopo up to 1.2 million RMB if the enterprise agrees to install all seven EEMs as part of a coordinated investment plan in the next year. Representing 10% of the total project cost, this incentive would bring Sopo’s contribution to 10.9 million RMB, which would pay for itself in one year and earn the enterprise an annual return of 100%. Eligibility for this incentive should be conditioned on implementation of the two EEMs (EEM-2 and EEM-6) offering Sopo simple payback periods of under a year.

EEM-1, EEM-3, EEM4, and EEM-5 may qualify for recognition as Certified Emission Reductions (CERs) under the UN's Clean Development Mechanism (CDM). With simple payback periods under one year, EEM-2 and EEM-6 are highly unlikely to qualify for CDM treatment. Potential proceeds of 1.1 million RMB are possible from implementation of the other five.

We recommend that JETC further examine the prospects for developing the Sopo EPP investment as a CDM project. The proceeds of the sale of CERs could be used to defray JETC's incentive contribution, thus leveraging additional EPP/CDM projects in Jiangsu.

We understand that early retirement of still-functioning equipment raises accounting issues for the enterprise. We recommend that JETC work with Sopo to isolate these issues and develop appropriate accounting treatment with a Chinese accounting expert.

8 Appendix: Project Data

8.1 MOTOR POWERED EQUIPMENT

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
	ADC Oxidizing Fluid										
1	Alkali pump A	Y160M2-2	Y	15	29	16.2	N	10	85%	4500	73,006
2	Alkali pump B	Y160M1-2	Y	11	22	12.3	N	10	85%	4500	55,384
3	Alkali pump C	Y160M2-2	Y	15	29	16.2	N	10	85%	8500	137,901
4	Crude hydrazine pump	Y1600L-4	Y	15	29	16.2	N	10	85%	8500	137,901
5	Crude hydrazine pump	Y160L-4	Y	15	29	16.2	N	10	85%	8500	137,901
6	Crude hydrazine pump	Y160L-4	Y	15	29	16.2	N	10	85%	4500	73,006
7	Crude hydrazine pump	Y160L-4	Y	15	29	16.2	N	10	85%	4500	73,006
8	Sodium hypochlorite delivery pump	Y160L-4	Y	15	29	16.2	N	10	85%	8500	137,901
9	Sodium hypochlorite delivery pump	Y160L-4	Y	15	29	16.2	N	10	85%	4500	73,006
10	Sodium hypochlorite circulating pump	Y200L-4	Y	30	55	30.8	N	10	85%	8500	261,536
11	Sodium hypochlorite circulating pump	Y200L-4	Y	30	55	30.8	N	10	85%	4500	138,460
12	Sodium hypochlorite circulating pump	Y200L-4	Y	30	55	30.8	N	10	85%	4500	138,460
13	Submerged pump	Y160M1-2B5	Y	11	22	12.3	N	10	85%	4500	55,384
	ADC Recycling										
1	1# Centrifuge	Y250M-4	Y	55	40	22.4	N	10	85%	8500	190,208
2	2# Centrifuge	Y250M-4	Y	55	40	22.4	N	10	85%	8500	190,208
3	3# Centrifuge	Y225-4	Y	45	25	14.0	N	10	85%	8500	118,880
4	4# Centrifuge	Y225-4	Y	55	40	22.4	N	10	85%	8500	190,208
5	5# Centrifuge	Y225-4	Y	55	40	22.4	N	10	85%	8500	190,208
6	3# Forcing pump	SBM		75	70	39.2	N	10	85%	8500	332,864
7	2# Forcing pump	Y315S-6	Y	75	85	47.6	N	10	85%	8500	404,193
8	1# Forcing pump	Y315L2-8	Y	110	100	55.9	N	10	85%	8500	475,521
9	3# Alkali collecting pump	Y225M-2	Y	45	46	25.7	N	10	85%	8500	218,739
10	2# Alkali collecting pump	Y200L1-2	Y	30	58	32.4	N	10	85%	8500	275,802
11	1# Alkali collecting pump	Y250M-2	Y	55	105	58.7	N	10	85%	8500	499,297
12	3# Mixing & cooling pump	Y200L1-2	Y	45	58	32.4	N	10	85%	8500	275,802
13	2# Mixing & cooling pump	Y200L1-25	Y	45	58	32.4	N	10	85%	8500	275,802
14	1# Mixing & cooling pump	Y2-250M-2		55	100	55.9	N	10	85%	8500	475,521
15	1# Underground tank pump	Y160M1-2	Y	11	12	6.7	N	10	85%	8500	57,062
16	2# Underground tank pump	Y2-160M-4		11	12	6.7	N	10	85%	4500	30,210

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
17	Water pump	Y160M1-2	Y	11	12	6.7	N	10	85%	8500	57,062
18	1# Mixed stripping pump	Y2-250M-2		55	100	55.9	N	10	85%	4500	251,746
19	1#Crude hydrazine pump	Y160L-4	Y	15	16	9.0	N	10	85%	4500	40,279
20	2#Crude hydrazine pump	Y160L-4	Y	15	18	10.1	N	10	85%	4500	45,314
21	3#Crude hydrazine pump	Y160L-4	Y	15	18	10.1	N	10	85%	4500	45,314
22	4#Crude hydrazine pump	Y200L-2	Y	30	45	25.2	N	10	85%	4500	113,286
23	1# Refined hydrazine pump	Y2-132S2-2		7.5	12	6.7	N	10	85%	8500	57,062
24	3# Refined hydrazine pump	Y200L1-2	Y	37	40	22.4	N	10	85%	8500	190,208
	ADC Condensation										
1	1# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
2	2# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
3	3# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
4	4# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
5	5# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
6	6# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
7	7# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
8	8# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
9	9# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
10	10# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
11	11# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
12	12# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
13	13# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
14	14# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
15	15# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
16	16# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
17	17# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
18	18# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
19	19# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
20	20# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
21	21# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
22	22# Condensation autoclave	M2QA180L4A		22	25	14.0	N	10	85%	4500	62,937
23	1# Hydrazine/urea pump	Y160M1-2	Y	11	16.5	9.2	N	10	85%	4500	41,538
24	2# Hydrazine/urea pump	Y160M1-2	Y	11	16.5	9.2	N	10	85%	4500	41,538
25	3# Hydrazine/urea pump	Y160M1-2	Y	11	16.5	9.2	N	10	85%	4500	41,538
26	1#Hydrazine hydrate pump	Y132M-2	Y	7.5	13	7.3	N	10	85%	4500	32,727

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
27	2#Hydrazine hydrate pump	Y132M-2	Y	7.5	13	7.3	N	10	85%	4500	32,727
28	1# circulating pump	Y160M1-2	Y	11	20	11.2	N	10	85%	4500	50,349
29	2# circulating pump	Y160M1-2	Y	11	20	11.2	N	10	85%	4500	50,349
30	1# Tail gas blower	Y132S2-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
31	2# Tail gas blower	Y132S2-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
32	3# Tail gas blower	Y132S2-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
33	4# Tail gas blower	Y132S2-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
34	1# Sulfuric acid pump	Y160M1-2	Y	11	0	0.0	N	10	85%	0	0
35	2# Sulfuric acid pump	Y160M1-2	Y	11	0	0.0	N	10	85%	0	0
	ADC Scrubbing										
1	1# Vacuum pump	Y280M-8	Y	45	90	50.3	N	10	85%	8500	427,969
2	2# Vacuum pump	Y280M-8	Y	45	90	50.3	N	10	85%	8500	427,969
3	3# Vacuum pump	Y280M-8	Y	45	90	50.3	N	10	85%	8500	427,969
4	1# Oxidizing raw material pump	Y160M1-2	Y	15	22	12.3	N	10	85%	4500	55,384
5	3# Oxidizing raw material pump	Y160M1-2	Y	11	18	10.1	N	10	85%	4500	45,314
6	1# Condensating fluid pump	Y160M1-2	Y	11	20	11.2	N	10	85%	4500	50,349
7	2# Condensating fluid pump	Y160M1-2	Y	11	20	11.2	N	10	85%	4500	50,349
8	3# Condensating fluid pump	Y160M1-2	Y	11	20	11.2	N	10	85%	4500	50,349
9	4# Condensating fluid pump	Y160M1-2	Y	11	20	11.2	N	10	85%	4500	50,349
10	5# Condensating fluid pump	Y160M1-2	Y	11	20	11.2	N	10	85%	4500	50,349
11	6# Condensating fluid pump	Y160M1-2	Y	11	20	11.2	N	10	85%	4500	50,349
12	1# Pregnant liquor pump	Y160M1-2	Y	11	19	10.6	N	10	85%	4500	47,832
13	2# Pregnant liquor pump	Y160M1-2	Y	11	19	10.6	N	10	85%	4500	47,832
14	3# Pregnant liquor pump	Y160M1-2	Y	11	19	10.6	N	10	85%	4500	47,832
15	4# Pregnant liquor pump	Y160M1-2	Y	11	19	10.6	N	10	85%	4500	47,832
16	5# Pregnant liquor pump	Y160M1-2	Y	11	19	10.6	N	10	85%	4500	47,832
17	6# Pregnant liquor pump	Y160M1-2	Y	11	19	10.6	N	10	85%	4500	47,832
18	1# Pulping tank	Y132S-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
19	2# Pulping tank	Y132S-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
20	3# Pulping tank	Y132S-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
21	4# Pulping tank	Y132S-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
22	5# Pulping tank	Y132S-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
23	6# Pulping tank	Y132S-2	Y	7.5	10	5.6	N	10	85%	4500	25,175
	ADC Condensation 2										
1	23# Condensation autoclave	Y160L-4	Y	15	30	16.8	N	10	85%	4500	75,524

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
2	24# Condensation autoclave	Y160L-4	Y	15	30	16.8	N	10	85%	4500	75,524
3	25# Condensation autoclave	Y160L-4	Y	15	30	16.8	N	10	85%	4500	75,524
4	26# Condensation autoclave	Y160L-4	Y	15	30	16.8	N	10	85%	4500	75,524
5	27# Condensation autoclave	Y160L-4	Y	15	30	16.8	N	10	85%	4500	75,524
6	28# Condensation autoclave	Y160L-4	Y	15	30	16.8	N	10	85%	4500	75,524
7	29# Condensation autoclave	Y160L-4	Y	15	30	16.8	N	10	85%	4500	75,524
8	30# Condensation autoclave	Y160L-4	Y	15	30	16.8	N	10	85%	4500	75,524
9	31# Condensation autoclave	Y160L-4	Y	15	30	16.8	N	10	85%	4500	75,524
10	32# Condensation autoclave	Y160L-4	Y	15	37	20.7	N	10	85%	4500	93,146
11	33# Condensation autoclave	Y180M-4	Y	18.5	37	20.7	N	10	85%	4500	93,146
12	34# Condensation autoclave	Y180M-4	Y	18.5	37	20.7	N	10	85%	4500	93,146
13	35# Condensation autoclave	Y180M-4	Y	18.5	37	20.7	N	10	85%	4500	93,146
14	36# Condensation autoclave	Y180M-4	Y	18.5	37	20.7	N	10	85%	4500	93,146
15	37# Condensation autoclave	Y180M-4	Y	18.5	37	20.7	N	10	85%	4500	93,146
16	38# Condensation autoclave	Y180M-4	Y	18.5	37	20.7	N	10	85%	4500	93,146
17	4# Vacuum pump	Y280M-8	Y	45	90	50.3	N	10	85%	4500	226,572
18	5# Vacuum pump	Y280M-8	Y	45	90	50.3	N	10	85%	4500	226,572
19	7# Condensating fluid pump	Y2-160M2-2		15	30	16.8	N	10	85%	4500	75,524
20	8# Condensating fluid pump	Y2-160M2-2		15	30	16.8	N	10	85%	4500	75,524
21	9# Condensating fluid pump	Y2-160M2-2		15	30	16.8	N	10	85%	4500	75,524
22	10# Condensating fluid pump	Y2-160M2-2		15	30	16.8	N	10	85%	4500	75,524
23	7# Pregnant liquor pump	Y2-160M2-2		11	22	12.3	N	10	85%	8500	104,615
24	8# Pregnant liquor pump	Y2-160M2-2		11	22	12.3	N	10	85%	8500	104,615
25	9# Pregnant liquor pump	Y2-160M2-2		11	22	12.3	N	10	85%	8500	104,615
26	10# Pregnant liquor pump	Y2-160M2-2		11	22	12.3	N	10	85%	8500	104,615
27	4# Hydrazine/urea pump	Y160M1-2	Y	11	22	12.3	N	10	85%	4500	55,384
28	5# Hydrazine/urea pump	Y160M1-2	Y	11	22	12.3	N	10	85%	4500	55,384
29	3# Water circulating pump	Y160M2-2	Y	15	30	16.8	N	10	85%	8500	142,656
30	4# Water circulating pump	Y160M2-2	Y	15	30	16.8	N	10	85%	8500	142,656
31	1# Acidcirculating pump	Y132S2-2	Y	7.5	11	6.2	N	10	85%	8500	52,307
32	2# Acidcirculating pump	Y132S2-2	Y	7.5	11	6.2	N	10	85%	8500	52,307
33	Oxidizing raw material pump	Y2-160M1-2		11	22	12.3	N	10	85%	4500	55,384
34	5# Tail gas blower	Y132S2-2	Y	7.5	15	8.4	N	10	85%	8500	71,328
35	6# Tail gas blower	Y132S2-2	Y	7.5	15	8.4	N	10	85%	8500	71,328
36	7# Tail gas blower	Y132S2-2	Y	7.5	15	8.4	N	10	85%	8500	71,328

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
37	8# Tail gas blower	Y132S2-2	Y	7.5	15	8.4	N	10	85%	8500	71,328
38	Burdening air blower	Y132S2-2	Y	7.5	15	8.4	N	10	85%	8500	71,328
39	7# Pulping tank	Y132S-4	Y	7.5	15	8.4	N	10	85%	4500	37,762
40	8# Pulping tank	Y132S-4	Y	7.5	15	8.4	N	10	85%	4500	37,762
41	9# Pulping tank	Y132S-4	Y	7.5	15	8.4	N	10	85%	4500	37,762
42	10# Pulping tank	Y132S-4	Y	7.5	15	8.4	N	10	85%	4500	37,762
	ADC Oxidization										
1	1# Oxidization autoclave	Y160L-4	Y	15	12	6.7	N	10	85%	4500	30,210
2	2# Oxidization autoclave	Y160L-4	Y	15	12	6.7	N	10	85%	4500	30,210
3	3# Oxidization autoclave	M2QA180L4A		20	15	8.4	N	10	85%	4500	37,762
4	4# Oxidization autoclave	M2QA180L4A		20	21	11.7	N	10	85%	4500	52,867
5	6# Oxidization autoclave	Y160L-4	Y	15	12	6.7	N	10	85%	4500	30,210
6	7# Oxidization autoclave	Y160L-4	Y	15	16	9.0	N	10	85%	4500	40,279
7	8# Oxidization autoclave	M2QA180L4A		20	20	11.2	N	10	85%	4500	50,349
8	9# Oxidization autoclave	M2QA180L4A		20	25	14.0	N	10	85%	4500	62,937
9	10# Oxidization autoclave	M2QA180L4A		20	18	10.1	N	10	85%	4500	45,314
10	11# Oxidization autoclave	M2QA180L4A		20	8	4.5	N	10	85%	4500	20,140
11	12# Oxidization autoclave	M2QA180L4A		20	28	15.7	N	10	85%	4500	70,489
12	13# Oxidization autoclave	M2QA180L4A		20	28	15.7	N	10	85%	4500	70,489
13	1# Alkali circulating pump	Y132S2-2	Y	7.5	8.5	4.8	N	10	85%	4500	21,398
14	2# Alkali circulating pump	Y132S2-2	Y	7.5	8	4.5	N	10	85%	4500	20,140
15	3# Alkali circulating pump	Y160M1-2	Y	11	12.5	7.0	N	10	85%	4500	31,468
16	4# Alkali circulating pump	Y160M1-2	Y	11	13	7.3	N	10	85%	4500	32,727
17	5# Alkali circulating pump	Y160M1-2	Y	11	12	6.7	N	10	85%	4500	30,210
18	6# Alkali circulating pump	Y160M1-2	Y	11	12.5	7.0	N	10	85%	4500	31,468
19	Brine pump	Y200L2-2	Y	37	32	17.9	N	10	85%	8500	152,167
20	1#ADC delivery pump	Y160M1-2	Y	11	7.5	4.2	N	10	85%	0	0
21	4#ADC delivery pump	Y132S2-2	Y	11	5	2.8	N	10	85%	0	0
22	1#ADC intermediate tank	Y160L-4	Y	15	12.5	7.0	N	10	85%	8500	59,440
23	2#ADC intermediate tank	Y160L-4	Y	15	12	6.7	N	10	85%	8500	57,062
24	3#ADC intermediate tank	Y132M-4	Y	7.5	7	3.9	N	10	85%	4500	17,622
25	Alkali pump	Y132S2-2	Y	7.5	6	3.4	N	10	85%	4500	15,105
	ADC Drying 1										
1	Flashing dryer	Y225M-6-30kw	Y	30	20.92	11.7	N	10	85%	8500	99,479
2	Air blower	Y200L2-2-37kw	Y	37	42	23.5	N	10	85%	8500	199,719

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3	ID fan	Y315L-6-110kw	Y	110	62	34.7	N	10	85%	8500	294,823
4	3# Blender	YB180M-4	Y	18.5	28	15.7	N	10	85%	4500	70,489
5	4# Blender	YB180M-4	Y	18.5	26	14.5	N	10	85%	4500	65,454
6	7# Blender	YB2180W-4	Y	18.5	0.7	0.4	N	10	85%	4500	1,762
7	8# Blender	YB2180W-4	Y	18.5	0.5	0.3	N	10	85%	4500	1,259
8	1# Dust collector blower	Y160M-2	Y	11	12	6.7	N	10	85%	8500	57,062
9	1# feeding machine	Y160M-2	Y	11	12	6.7	N	10	85%	8500	57,062
10	2# feeding machine	YCT225-4A-11kw	Y	11	9.2	5.1	N	10	85%	8500	43,748
11	Dust collector blower	YCT225-4A-11kw	Y	11	14	7.8	N	10	85%	8500	66,573
12	1# Alkali pump	Y312S2-2	Y	11	12	6.7	N	10	85%	8500	57,062
13	2# Alkali pump	Y312S2-2	Y	11	12	6.7	N	10	85%	8500	57,062
14	1# Vacuum pump	Y280M-8	Y	45	75	42.0	N	10	85%	8500	356,640
15	2# Vacuum pump	Y280M-8	Y	45	75	42.0	N	10	85%	8500	356,640
16	3# Vacuum pump	Y280M-8	Y	45	92	51.5	N	10	85%	8500	437,479
17	4# Vacuum pump	Y280M-8	Y	45	83	46.4	N	10	85%	8500	394,682
18	5# Vacuum pump	Y280M-8	Y	45	67	37.5	N	10	85%	8500	318,599
19	6# Vacuum pump	Y280M-8	Y	45	54	30.2	N	10	85%	8500	256,781
20	Cargo elevator	TTD430A		7.5	11	6.2	N	10	85%	4500	27,692
21	2# Air blower	Y200L2-2	Y	37	30	16.8	N	10	85%	8500	142,656
22	2# ID fan	Y315M1-6	Y	90	57	31.9	N	10	85%	8500	271,047
23	2# feeding machine	YCT225-4A	Y	11	9.2	5.1	N	10	85%	8500	43,748
24	2# Flashing dryer	Y225M1-6	Y	30	23.46	13.1	N	10	85%	8500	111,557
25	1# Dust collector blower	Y160M1-2	Y	11	12	6.7	N	10	85%	8500	57,062
26	2# Dust collector blower	Y160M1-2	Y	11	13	7.3	N	10	85%	8500	61,818
27	3# Acid pump	Y2160M2-2	Y	15	3	1.7	N	10	85%	8500	14,266
28	4# Acid pump	Y2180M2-2	Y	22	6.8	3.8	N	10	85%	8500	32,335
29	Water pipe pump	YB2S1-2-2	Y	7.5	11	6.2	N	10	85%	8500	52,307
30	C-950 air compressor unit	ASCK-S2030		1500	91.1	1341.2	N	10	85%	8500	11,399,981
31	1# Crushing air flower	Y132S2-2-W	Y	7.5	10	5.6	N	10	85%	4500	25,175
32	2# Crushing air flower	Y132S2-2-W	Y	7.5	11	6.2	N	10	85%	4500	27,692
33	3# Crushing air flower	Y132S2-2-W	Y	7.5	11	6.2	N	10	85%	4500	27,692
34	4# Crushing air flower	Y132S2-2-W	Y	7.5	10	5.6	N	10	85%	4500	25,175
35	5# Crushing air flower	Y132S2-2-W	Y	7.5	10	5.6	N	10	85%	4500	25,175
36	6# Crushing air flower	Y132S2-2-W	Y	7.5	9	5.0	N	10	85%	4500	22,657

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37	7# Crushing air flower	Y132S2-2-W	Y	7.5	11	6.2	N	10	85%	4500	27,692
38	8# Crushing air flower	Y132S2-2-W	Y	7.5	12	6.7	N	10	85%	4500	30,210
	ADC Drying 2										
1	1# Centrifuge	Y180L-4	Y	22	20	11.2	N	10	85%	4500	50,349
2	2# Centrifuge	Y180L-4	Y	22	20	11.2	N	10	85%	4500	50,349
3	3# Centrifuge	Y180L-4	Y	22	20	11.2	N	10	85%	4500	50,349
4	4# Centrifuge	Y180L-4	Y	22	20	11.2	N	10	85%	4500	50,349
5	Crusher	Y180L-4	Y	15	0	0.0	N	10	85%	0	0
6	ID fan	Y200L-2	Y	30	30	16.8	N	10	85%	4500	75,524
	ADC Mixing										
1	Super blender	TE-V		7.5	50	28.0	N	10	85%	4500	125,873
2	Classifier	YB2132S2-2	Y	7.5	55	30.8	N	10	85%	4500	138,460
3	Horizontal Blender	YB2180M-4	Y	18.5	13	7.3	N	10	85%	4500	32,727
	ADC Fresh Water Treatment										
1	Circulation cooling pump A	Y225M-4	Y	45	20.92	11.7	N	10	85%	4500	52,665
2	Circulation cooling pump B	Y200L2-2	Y	37	42	23.5	N	10	85%	4500	105,733
3	Sewage pump A	Y225M-4	Y	45	62	34.7	N	10	85%	4500	156,083
4	Sewage pump B	Y225M-4	Y	45	0	0.0	N	10	85%	4500	0
5	Sewage pump C	Y225M-4	Y	45	0	0.0	N	10	85%	4500	0
6	Supernate pump A	Y180M-2	Y	22	0.7	0.4	N	10	85%	4500	1,762
7	Supernate pump B	Y160L-2	Y	18.5	0.5	0.3	N	10	85%	4500	1,259
8	Biurea collecting pump A	Y160L-2	Y	18.5	0	0.0	N	10	85%	4500	0
9	Biurea collecting pump B	Y160L-2	Y	18.5	0	0.0	N	10	85%	4500	0
10	Biurea delivery pump A	Y160M2-2	Y	15	0	0.0	N	10	85%	4500	0
11	Biurea delivery pump B	Y160M2-2	Y	15	9.2	5.1	N	10	85%	4500	23,161
12	Sewage tank pump A	Y225M-4	Y	45	0	0.0	N	10	85%	4500	0
13	Sewage tank pump B	Y225M-4	Y	45	0	0.0	N	10	85%	4500	0
14	1＃Pulping tank cycloidal needle wheel type speed reductor	BLD15-23		15	75	42.0	N	10	85%	4500	188,810
15	2＃Pulping tank cycloidal needle wheel type speed reductor	BLD15-23		15	92	51.5	N	10	85%	4500	231,607
16	Supernate pump C	Y200L1-2	Y	30	67	37.5	N	10	85%	4500	168,670
17	Supernate pump C	Y200L1-2	Y	30	54	30.2	N	10	85%	4500	135,943
18	Circulation cooling pump C	Y200L2-2	Y	37	0	0.0	N	10	85%	4500	0
19	Circulation cooling pump D	Y200L2-2	Y	37	0	0.0	N	10	85%	4500	0
20	Circulation cooling pump E	Y200L2-2	Y	37	0	0.0	N	10	85%	4500	0

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21	4# Cooling tower speed reductor	3-MOtOrHM2		18.5	0	0.0	N	10	85%	8500	0
22	5# Cooling tower speed reductor	3-MOtOrHM2		18.5	0	0.0	N	10	85%	8500	0
23	Biurea delivery pump C	Y160M2-2	Y	11	0	0.0	N	10	85%	4500	0
	ADC Used Water Treatment										
1	Condensation water charging pump	Y160M1-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
2	1# Lime slurry pump	Y160M1-2	Y	11	21.8	12.2	N	10	85%	4500	54,881
3	2# Lime slurry pump	Y160M4-2	Y	11	21.8	12.2	N	10	85%	4500	54,881
4	Slag pump	Y160M4-2	Y	11	21.8	12.2	N	10	85%	4500	54,881
5	Air stripping pump	Y2160M1-2	Y	11	21.8	12.2	N	10	85%	8500	103,663
6	Chlorination pump	Y2160M1-2	Y	11	35.5	19.9	N	10	85%	4500	89,370
7	Neutralization circulating pump	Y2-160L-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
	Chlorine Alkali Evaporating										
1	Charging pump	JS117-4/180kW		180	290	162.2	N	15	85%	8500	1,379,010
2	1# water dispenser pump	Y250M-4/55kW	Y	55	95	53.1	N	10	85%	8500	451,745
3	Hot water pump	$Y200L_2$-2/37kW	Y	37	52	29.1	N	10	85%	8500	247,271
4	Weak alkali charging pump	Y225M-2/55kW	Y	55	84	47.0	N	10	85%	8500	399,437
5	Discharging pump	Y180L-2/18.5kW	Y	18.5	25	14.0	N	10	85%	4500	62,937
6	1# salt slurry circulating pump	Y180L-2/18.5kW	Y	18.5	28	15.7	N	10	85%	4500	70,489
7	2# salt slurry circulating pump	Y180L-2/18.5kW	Y	18.5	25	14.0	N	10	85%	4500	62,937
8	II-effect forcing pump	$Y315M_3$-8/110kW	Y	110	125	69.9	N	15	85%	8500	594,401
9	III-effect forcing pump	$Y315M_3$-8/110kW	Y	110	125	69.9	N	15	85%	8500	594,401
10	1# air blower for cooling tower	Y200L-6-B_5/18.5kW	Y	18.5	28	15.7	N	10	85%	8500	133,146
11	2# air blower for cooling tower	Y200L-6-B_5/18.5kW	Y	18.5	28	15.7	N	10	85%	8500	133,146
12	Air blower for 3# cooling tower	$Y132S_4$-4/11kW	Y	11	15	8.4	N	10	85%	8500	71,328
13	tap water in-line pump	$Y132S_1$-2/5.5kW	Y	5.5	8	4.5	N	10	85%	8500	38,042
14	II-effect salt stripping pump	$Y200L_1$-2/30kW	Y	30	56	31.3	N	10	85%	8500	266,292
15	III-effect salt stripping pump	Y180L-2/22kW	Y	22	41	22.9	N	10	85%	8500	194,963
16	Centrifuge proper	Y225M-$4F_1$/45kW	Y	45	65	36.4	N	10	85%	8500	309,088
17	Centrifugal engine oil pump	Y180M-$4F_1$-22kW	Y	22	26	14.5	N	10	85%	8500	123,635
18	2# water dispersing pump	$Y160M_2$-2/45kW	Y	45	70	39.2	N	10	85%	8500	332,864
19	Washing liquor pump	$Y160M_2$-2/15kW	Y	15	27	15.1	N	10	85%	4500	67,971

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20	Circulating pump	$Y160M_2$-2/15kW	Y	15	26	14.5	N	10	85%	4500	65,454
21	alkali-salt slurry pump	$Y160M_2$-2/15kW	Y	15	26	14.5	N	10	85%	4500	65,454
22	1# cooling pump	Y180L-2/18.5kW	Y	18.5	28	15.7	N	10	85%	4500	70,489
23	2# cooling pump	Y180L-2/18.5kW	Y	18.5	28	15.7	N	10	85%	4500	70,489
24	3# alkali delivery pump	Y225M-2/45kW	Y	45	70	39.2	N	10	85%	4500	176,222
25	4# alkali delivery pump	Y225M-2/45kW	Y	45	70	39.2	N	10	85%	4500	176,222
26	1# salt slurry pump	Y225M-2/45kW	Y	45	50	28.0	N	10	85%	4500	125,873
27	Alkali delivery pump	$Y160M_2$-2/15kW	Y	15	26	14.5	N	10	85%	8500	123,635
28	1# alkali delivery pump	Y225M-2-45kW	Y	45	70	39.2	N	10	85%	4500	176,222
29	2# alkali delivery pump	Y225M-2-45kW	Y	45	70	39.2	N	10	85%	4500	176,222
30	Alkali turnover pump	$Y160M_2$-2/15kW	Y	15	27	15.1	N	10	85%	4500	67,971
31	Vacuum pump	Y280M-8	Y	45	65	36.4	N	10	85%	4500	163,635
32	Bench drill	JW7124/0.55		0.55	0	0.0	N	10	85%	0	0
33	Vertical sanding machine	___		0.75	0	0.0	N	10	85%	0	0
34	AC/DC electric welding machine	___		___	0	0.0	N	10	85%	0	0
35	AC electric welding machine	___		___	0	0.0	N	10	85%	0	0
36	AC electric welding machine	___		___	0	0.0	N	10	85%	0	0
37	Radial drilling machine	___		4	0	0.0	N	10	85%	0	0
38	DC electric welding machine	___		___	0	0.0	N	10	85%	0	0
	Chlorine Alkali Synthesis										
39	Acid condensate pump	YZ-100L2		3	4.5	2.5	N	10	85%	4500	11,329
40	Elevated tank pump	YZ-100L2		7.5	13	7.3	N	10	85%	4500	32,727
41	Elevated tank pump	YZ-160M2-2		7.5	13	7.3	N	10	85%	0	0
42	Highly pure acid pump	YZ-160M2-2		15	27	15.1	N	10	85%	4500	67,971
43	highly concentrated acid pump	Y132S-2		5.5	8	4.5	N	10	85%	4500	20,140
44	HP pump	YZ-132S2-2		5.5	9	5.0	N	10	85%	4500	22,657
45	Intermediate water pump	YZ-132S2-2		5.5	9.5	5.3	N	10	85%	4500	23,916
46	Highly concentrated acid pump	YZ-160M1-2		11	16	9.0	N	10	85%	4500	40,279
47	Highly pure acid pump	YZ-160M2-2		15	26	14.5	N	10	85%	8500	123,635
48	Intermediate water pump	YZ-132S2-2		5.5	9.5	5.3	N	10	85%	4500	23,916
49	Pure water pump 1A	YZ-132S1-2		15	26	14.5	N	10	85%	0	0
50	Pure water pump 1B	YZ-132S1-2		15	26	14.5	N	10	85%	8500	123,635
51	Pure water pump 2A	YZ-160M2-2		15	23	12.9	N	10	85%	8500	109,370
52	Pure water pump 2B	YZ-160M2-2		15	23	12.9	N	10	85%	0	0
53	Regenerative pump	YZ-100L-2		3	4	2.2	N	10	85%	4500	10,070

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54	Back flush pump	YZ-225-4		37	61	34.1	N	10	85%	4500	153,565
55	Chemical cleansing pump	Y132S2-2		0.075	124	69.4	N	10	85%	4500	312,165
56	Wastewater pump	YZ-112M2		4	6.5	3.6	N	10	85%	4500	16,364
57	RO flushing pump	YZ132S2-2		0.04	0	0.0	N	10	85%	4500	0
58	Reductant mixer	___		0.37	0	0.0	N	10	85%	4500	0
59	1# reductant metering pump	___		0.04	0	0.0	N	10	85%	0	0
60	2# reductant metering pump	___		0.04	0	0.0	N	10	85%	4500	0
61	1# germicide metering pump	___		0.04	0	0.0	N	10	85%	0	0
62	2# germicide metering pump	___		0.04	0	0.0	N	10	85%	4500	0
63	1# scale inhibitor metering pump	___		0.04	0	0.0	N	10	85%	0	0
64	2# scale inhibitor metering pump	___		0.04	0	0.0	N	10	85%	4500	0
65	scale inhibitor mixer	___		0.37	0	0.0	N	10	85%	0	0
66	Flucculant mixer	___		0.37	0	0.0	N	10	85%	4500	0
67	1# flucculant metering pump	___		0.04	0	0.0	N	10	85%	4500	0
68	2# flucculant metering pump	___		0.04	0	0.0	N	10	85%	0	0
69	cleaning water tank mixer	___		0.37	0	0.0	N	10	85%	4500	0
	Chlorine Alkali Cell										
70	Motor hoist	___		7.5	11	6.2	N	10	85%	4500	27,692
71	Motor hoist	___		7.5	11	6.2	N	10	85%	4500	27,692
72	Multi-stage pump	Y160L-2	Y	15	22	12.3	N	10	85%	4500	55,384
73	1# vacuum pump	J02-81-6	J	30	41	22.9	N	10	85%	4500	103,216
74	2# vacuum pump	J02-81-6	J	30	41	22.9	N	10	85%	4500	103,216
75	Overhead crane	$ZDY_1$21-4		0.8×3	0	0.0	N	10	85%	4500	0
76	Drilling machine	___		1.5	0	0.0	N	10	85%	4500	0
77	Sanding machine	___		0.75	0	0.0	N	10	85%	4500	0
78	Electric oven	8024-TD		85	75	42.0	N	11	85%	4500	188,810
79	Electric oven	___		3	5	2.8	N	10	85%	4500	12,587
80	Overhead crane	BZDY21-4		0.8×3	0	0.0	N	10	85%	4500	0
81	Overhead crane	BZDY21-4		0.8×3	0	0.0	N	10	85%	4500	0
82	Motor hoist	___		7.5	11	6.2	N	10	85%	4500	27,692
83	Overhead crane	___		0.75×3	0	0.0	N	10	85%	4500	0
84	Motor hoist	___		5.5	8	4.5	N	10	85%	4500	20,140
	Chlorine Alkali Liquid Cooling										
85	1# compressor	$JO_3$280S-6/75kW	J	75	141.1	78.9	N	12	85%	8500	670,960
86	3# LP compressor	Y280M2-6/75kW	Y	75	141.1	78.9	N	16	85%	8500	670,960

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
87	3# HP compressor	Y280M-6/55kW	Y	55	104.1	58.2	N	12	85%	8500	495,017
88	4# LP compressor	Y280M2-6/75kW	Y	75	141.1	78.9	N	16	85%	8500	670,960
89	4# HP compressor	Y280M-6/55kW	Y	55	104.1	58.2	N	12	85%	8500	495,017
	Chlorine Alkali Electrolysis										
90	1# elevated pump	Y225M-2	Y	45	65	36.4	N	10	85%	0	0
91	2# elevated pump	$Y200L_2$-2	Y	37	61	34.1	N	10	85%	8500	290,068
92	1# diluted alkali pump	$Y200L_1$-2	Y	30	47	26.3	N	10	85%	4500	118,321
93	2# diluted alkali pump	$Y200L_1$-2	Y	30	47	26.3	N	10	85%	0	0
94	Filtered brine pump A	Y3-$200L_1$-2		30	51	28.5	N	10	85%	0	0
95	Braine recycling pump	Y_2-160MI-2		11	16	9.0	N	10	85%	4500	40,279
96	Wastewater pump	Y_2-$200L_1$-2		22	31	17.3	N	10	85%	4500	78,041
97	Weak brine pump A	Y_3160M_2-2		15	27	15.1	N	10	85%	0	0
98	Weak brine pump B	Y_3160M_2-2		15	27	15.1	N	10	85%	8500	128,391
99	Filtered brine pump B	Y3-$200L_1$-2		30	51	28.5	N	10	85%	8500	242,516
100	Alkali liquor pump	Y_2-$200L_1$-2		37	62	34.7	N	10	85%	0	0
101	Alkali liquor pump	Y_2-$200L_1$-2		37	62	34.7	N	10	85%	8500	294,823
102	Anolyte drain pump	Y_3132S_2-2		7.5	11	6.2	N	10	85%	4500	27,692
103	Chlorinated water pump A	$Y_3$112M-2		4	6.5	3.6	N	10	85%	0	0
104	Chlorinated water pump B	$Y_3$112M-2		4	6.5	3.6	N	10	85%	8500	30,909
105	Dechlorinating vacuum pump A	JEC-2137-2000	J	18.5	31	17.3	N	10	85%	0	0
106	Dechlorinating vacuum pump B	JEC-2137-2000	J	18.5	31	17.3	N	10	85%	8500	147,411
107	Oil pump A	HL165LR3578W		11	18	10.1	N	10	85%	0	0
108	Oil pump B	HL165LR3578W		11	18	10.1	N	10	85%	8500	85,594
109	Dechlorinated brine pump A	Y_3-$160M_2$-2		15	23	12.9	N	10	85%	0	0
110	Dechlorinated brine pump B	Y_3-$160M_2$-2		15	22	12.3	N	10	85%	8500	104,615
111	Catholyte drain pump	Y_2-$132S_2$-2		5.5	7.5	4.2	N	10	85%	4500	18,881
111	Diaphragm electrolysing cell					0.0	N	10	85%	0	0
111	Ion diaphragm electrolyzing cell					0.0	N	10	85%	0	0
	Chlorine Alkali Transceiving										
112	1# acid pump	Y132S-2/5.5kW	Y	5.5	8	4.5	N	10	85%	4500	20,140
113	2# acid pump	Y132S-2/5.5kW	Y	5.5	8	4.5	N	10	85%	4500	20,140
114	Riverside acid pump	Y132S-2/5.5kW	Y	5.5	8	4.5	N	10	85%	4500	20,140
115	Centrifugal ventilator	A_1-7132/0.75kW		0.75	1.3	0.7	N	10	85%	4500	3,273
116	Riverside alkali pump	$Y160M_2$-2/18.5kW	Y	18.5	30	16.8	N	10	85%	4500	75,524
117	1# alkali pump	$Y132S_2$-2/7.5kW	Y	7.5	14	7.8	N	10	85%	4500	35,244

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118	2# alkali pump	$Y132S_2$-2/7.5kW	Y	7.5	14	7.8	N	10	85%	4500	35,244
	Chlorine Alkali Submerging										
119	1# discharging pump	$Y160M_2$-2	Y	15	18	10.1	N	10	85%	4500	45,314
120	2# discharging pump	$Y160M_2$-2	Y	15	18	10.1	N	10	85%	4500	45,314
121	3# discharging pump	$Y160M_2$-2	Y	15	18	10.1	N	10	85%	4500	45,314
122	4# discharging pump	$Y160M_1$-2	Y	11	18	10.1	N	10	85%	4500	45,314
123	5# discharging pump	$Y160M_1$-2	Y	11	18	10.1	N	10	85%	4500	45,314
124	1# alkali delivery pump	$Y160M_2$-2	Y	15	18	10.1	N	10	85%	4500	45,314
125	2# alkali delivery pump	$Y160M_1$-2	Y	11	18	10.1	N	10	85%	4500	45,314
126	1# feed pump	$Y132S_1$-2	Y	5.5	10	5.6	N	10	85%	4500	25,175
127	2# feed pump	$Y132S_1$-2	Y	5.5	10	5.6	N	10	85%	4500	25,175
128	Alkali-salty water pump	$Y160M_1$-2	Y	11	18	10.1	N	10	85%	4500	45,314
129	1# Roots blower	160L-6	Y	11	20	11.2	N	10	85%	8500	95,104
130	2# Roots blower	160L-6	Y	11	20	11.2	N	10	85%	8500	95,104
131	Oil pressure unit	$Y100L_2$-4	Y	3	5	2.8	N	10	85%	8500	23,776
132	Air compressor	Y225M-8IP44	Y	22	41	22.9	N	10	85%	4500	103,216
	Chlorine Alkali Drying										
133	1# chlorine pump	JB315S-3-6	J	110	190	106.3	N	16	85%	0	0
134	2# chlorine pump	JB315S-3-6	J	110	190	106.3	N	16	85%	8500	903,489
135	3# chlorine pump	JB315S-3-6	J	110	190	106.3	N	16	85%	8500	903,489
136	4# chlorine pump	JB315S-3-6	J	110	190	106.3	N	16	85%	8500	903,489
137	5# chlorine pump	JB315S-3-6	J	110	190	106.3	N	16	85%	8500	903,489
138	6# chlorine pump	Y3-355M1-6		160	200	111.9	N	2	85%	8500	951,041
139	7# chlorine pump	Y3-355M1-6		160	200	111.9	N	2	85%	8500	951,041
140	8# chlorine pump	Y3-355M1-6		160	200	111.9	N	2	85%	0	0
141	9# chlorine pump	JB315S-3-6	J	110	190	106.3	N	9	85%	0	0
142	1# Roots blower	YB225M-6	Y	30	50	28.0	N	10	85%	0	0
143	2# Roots blower	YB225M-6	Y	30	50	28.0	N	10	85%	0	0
144	3# Roots blower	YB225M-6	Y	30	50	28.0	N	10	85%	8500	237,760
145	1#Sulfuric acid pump	$Y132S_2$-21/7.5kW	Y	7.5	15	8.4	N	10	85%	4500	37,762
146	2#Sulfuric acid pump	$Y132S_2$-21/7.5kW	Y	7.5	15	8.4	N	10	85%	0	0
147	1#Chlorine water pump	$Y160M_2$-2/30kW	Y	30	35	19.6	N	10	85%	0	0
148	2#Chlorine water pump	$Y160M_2$-2/30kW	Y	30	35	19.6	N	10	85%	8500	166,432
149	Sulfuric acid pump A	Y2-160L-2		18.5	25	14.0	N	10	85%	0	0

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150	Sulfuric acid pump B	Y2-160L-2		18.5	25	14.0	N	10	85%	8500	118,880
151	Chlorine water pump A	Y2-160L-2		18.5	25	14.0	N	10	85%	8500	118,880
152	Chlorine water pump B	Y2-160L-2		18.5	13	7.3	N	10	85%	0	0
153	Wastewater pump	Y132S2-2		7.5	12	6.7	N	10	85%	4500	30,210
154	Waste sulfuric acid pump	FSBL		2.2	3.5	2.0	N	10	85%	4500	8,811
155	Absorption tower circulating pump A	Y160M2-2	Y	15	24	13.4	N	10	85%	8500	114,125
156	Absorption tower circulating pump B	Y160M2-2	Y	15	24	13.4	N	10	85%	0	0
157	Tail gas tower ciruclating pump A	___		15	23	12.9	N	10	85%	8500	109,370
158	Tail gas tower ciruclating pump B	___		15	22	12.3	N	10	85%	0	0
159	Sodium hypochlorite pump	___		7.5	11	6.2	N	10	85%	4500	27,692
160	product sodium hypochlorite shipping pump	___		7.5	10	5.6	N	10	85%	4500	25,175
161	Alkali lifting pump	___		7.5	12	6.7	N	10	85%	4500	30,210
162	Titanium air blower A	Y132S1-2	Y	5.5	9	5.0	N	10	85%	0	0
163	Titanium air blower B	Y132S1-2	Y	5.5	9	5.0	N	10	85%	8500	42,797
164	Motor hoist	ZDY111-4		0.2	0	0.0	N	10	85%	0	0
165		ZDY31-4		3	0	0.0	N	10	85%	0	0
	Chlorine Alkali Packaging Test										
166	Light-duty chlorine pump	Y180L-4/22kW	Y	22	37	20.7	N	10	85%	4500	93,146
167	Light-duty chlorine pump	Y180L-4/22kW	Y	22	37	20.7	N	10	85%	0	0
168	Light-duty chlorine pump	Y180L-4/22kW	Y	22	34	19.0	N	10	85%	4500	85,594
169	Overhead crane	ZDY21-4/0.8kW		0.8	1.5	0.8	N	10	85%	4500	3,776
170	Motor hoist	ZDY21-4/0.4kW		3	5	2.8	N	10	85%	4500	12,587
171	Air compressor	Y160M-4H/11kW	Y	11	18	10.1	N	10	85%	4500	45,314
172	Electric pressure test pump	Y90S-4/11kW	Y	11	18	10.1	N	10	85%	4500	45,314
	Chlorine Alkali H2 Compression										
173	1# chlorine compressor	YB280S--8/45kW	Y	45	78	43.6	N	10	85%	4500	196,362
174	2# chlorine compressor	YB280M--8/75kW	Y	75	95	53.1	N	2	85%	4500	239,159
175	3# chlorine compressor	YB280S--8/37kW	Y	37	64	35.8	N	10	85%	4500	161,118
176	4# chlorine compressor	YB315S-8/75kW	Y	75	95	53.1	N	3	85%	4500	239,159
177	Water pump	Y132S2-2/7.5kW	Y	7.5	12	6.7	N	10	85%	4500	30,210
178	Overhead crane	BD35613.5kW		3.5	6	3.4	N	10	85%	4500	15,105
	Chlorine Salt Dissolving										
179	1# bucket elevator	YB-132M-4	Y	7.5	8.5	4.8	N	10	85%	4500	21,398
180	Raw brine pump	$Y160M_2$-2/15	Y	30	48	26.9	N	10	85%	8500	228,250

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181	Clarified brine pump	Y160M$_2$-2/15	Y	15	28	15.7	N	10	85%	8500	133,146
182	Water preparation pump	Y160M-2/15kW	Y	15	28	15.7	N	10	85%	8500	133,146
183	Dole pump	Y180M-2/22	Y	22	40	22.4	N	10	85%	8500	190,208
184	1# clarified brine pump	Y180M-2/22	Y	22	38	21.3	N	10	85%	8500	180,698
185	Back flush pump	Y160M-2/15	Y	15	18	10.1	N	10	85%	4500	45,314
186	Barium chloride pump	Y160M$_2$-2/2.2	Y	2.2	3.6	2.0	N	10	85%	8500	17,119
187	2# clarified brine pump	Y180M-2/22	Y	22	38	21.3	N	10	85%	0	0
188	1# Dole speed reductor	YAB02-4×4/0.75	Y	0.75	1.3	0.7	N	10	85%	8500	6,182
189	2# Dole speed reductor	YAB02-4×4/0.75	Y	0.75	1.3	0.7	N	10	85%	8500	6,182
190	2# bucket elevator	YB-132M-4	Y	7.5	8.5	4.8	N	10	85%	0	0
191	Pure caustic soda pump	Y132S$_2$-2	Y	5.5	8.5	4.8	N	10	85%	4500	21,398
192	TXY-pure caustic soda pump	Y132S2-2/7.5	Y	7.5	11	6.2	N	10	85%	4500	27,692
193	1# plate-and-frame filter press	LYM31043		5.5	9	5.0	N	10	85%	4500	22,657
194	2# plate-and-frame filter press	LYM31044		5.5	9	5.0	N	10	85%	4500	22,657
195	1# slurry pump	Y160M$_2$-2/15	Y	15	25	14.0	N	10	85%	4500	62,937
196	2# slurry pump	Y160M$_2$-2/15	Y	15	25	14.0	N	10	85%	4500	62,937
197	Speed reductor for front reaction tank mixer	YB$_2$-132S-4	Y	5.5	11.6	6.5	N	10	85%	8500	55,160
198	1# booster pump	YP250M-2	Y	55	102	57.1	N	10	85%	8500	485,031
199	Liquor input pump for 1# filter	Y$_3$200L$_1$-2		30	55.2	30.9	N	10	85%	8500	262,487
200	1#HVM filter	___		0.3	0	0.0	N	10	85%	8500	0
201	2#HVM filter	___		0.3	0	0.0	N	10	85%	8500	0
202	1# flushing pump	TYPEY132S$_1$-2		5.5	11.1	6.2	N	10	85%	4500	27,944
203	2# flushing pump	TYPEY132S$_1$-2		5.5	11.1	6.2	N	10	85%	4500	27,944
204	1# new plate-and-frame filter press	TYPE112M-4		4	8.8	4.9	N	10	85%	4500	22,154
205	2# new plate-and-frame filter press	TYPE112M-4		4	8.8	4.9	N	10	85%	4500	22,154
206	Salt slurry pump	Y$_2$-200L$_1$-2W		30	55.5	31.0	N	10	85%	4500	139,719
207	Pickling pump	Y$_2$-132S$_2$-2		7.5	14.9	8.3	N	10	85%	4500	37,510
208	Speed reductor for sodium sulfite	YB$_2$-132M-4	Y	7.5	15.4	8.6	N	10	85%	4500	38,769
209	Sodium sulfite solution pump A	Y80$_1$-2	Y	0.75	1.8	1.0	N	10	85%	8500	8,559
210	Speed reductor for FeCl3 makeup tank	Y132M-4	Y	7.5	15.8	8.8	N	10	85%	4500	39,776
211	Speed reductor for #1 rear reaction tank	YB$_2$-132S-4	Y	5.5	8.5	4.8	N	10	85%	8500	40,419
212	1# dechlorinated brine pump	Y$_3$160M$_2$-2		15	28.8	16.1	N	10	85%	4500	72,503
213	2# dechlorinated brine pump	Y$_3$160M$_2$-2		15	28.8	16.1	N	10	85%	4500	72,503

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214	FeCl3 solution pump	Y_3-160M_1-2		15	21.3	11.9	N	10	85%	4500	53,622
215	2# booster pump	YP250M-2		55	102	57.1	N	10	85%	0	0
216	Liquor input pump for 2# filter	Y_2-200L_1-2		30	55.2	30.9	N	10	85%	0	0
217	Speed reductor for #2 rear reaction tank	YB_2-132S-4	Y	5.5	8.5	4.8	N	10	85%	8500	40,419
218	Sodium sulfite solution pump B	$Y80_1$-2	Y	0.75	1.8	1.0	N	10	85%	0	0
219	1# plate-and-frame speed reductor	YDS132	Y	2.2	3.5	2.0	N	10	85%	4500	8,811
220	1# oil pump motor set	YVF80-50-0.75-4	Y	3	5	2.8	N	10	85%	4500	12,587
221	2# plate-and-frame speed reductor	YDS132	Y	2.2	3.5	2.0	N	10	85%	4500	8,811
222	2# oil pump motor set	YVF80-50-0.75-4	Y	3	5	2.8	N	10	85%	4500	12,587
	Calcium Hypochlorite										
1	Slurry Mixer	Y160M-6	Y	7.5	17	9.5	N	10	85%	4500	42,797
2	#1 Lime Cream Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	4500	89,370
3	#2 Lime Cream Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	4500	89,370
4	#3 Lime Cream Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	4500	89,370
5	#4 Lime Cream Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	4500	89,370
6	#5 Lime Cream Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	4500	89,370
7	#6 Lime Cream Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	4500	89,370
8	Air compressor	Y132-2	Y	7.5	15	8.4	N	10	85%	4500	37,762
9	#1 Autclave	Y160M-4/L	Y	11	23	12.9	N	10	85%	4500	57,902
10	#2 Autclave	Y160M-4/L	Y	11	22.6	12.6	N	10	85%	4500	56,895
11	#3 Autclave	Y160M-4/L	Y	11	22.6	12.6	N	10	85%	4500	56,895
12	#4 Autclave	Y160M-4/L	Y	11	22.6	12.6	N	10	85%	4500	56,895
13	#5 Autclave	Y160M-4/L	Y	11	22.6	12.6	N	10	85%	4500	56,895
14	#6 Autclave	Y160M-4/L	Y	11	22.6	12.6	N	10	85%	4500	56,895
15	#7 Autclave	Y160M-4/L	Y	11	22.6	12.6	N	10	85%	4500	56,895
16	#8 Autclave	Y160M-4/L	Y	11	22.6	12.6	N	10	85%	4500	56,895
17	#9 Autclave	Y160M-4/L	Y	11	22.6	12.6	N	10	85%	4500	56,895
18	#1 Chlorine Circulating Pump	Y160M-L2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
19	#2 Chlorine Circulating Pump	Y160M-L2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
20	Chlorination Tail Gas Blower	Y200L-4	Y	30	56.8	31.8	N	10	85%	8500	270,096
21	Circulating Water Pump	Y255M-2	Y	45	84.2	47.1	N	10	85%	4500	211,970
22	#1 Centrifuge	LYM54001-4		45	84.2	47.1	N	10	85%	4500	211,970
23	#2 Centrifuge	LYM54001-4		45	84.2	47.1	N	10	85%	4500	211,970
24	#3 Centrifuge	LYM54001-4		45	84.2	47.1	N	10	85%	4500	211,970
25	#4 Centrifuge	LYM54001-4		45	84.2	47.1	N	10	85%	4500	211,970

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
26	#5 Centrifuge	LYM54006-1		55	84.2	47.1	N	10	85%	4500	211,970
27	#6 Centrifuge	LYM54006-1		55	84.2	47.1	N	10	85%	4500	211,970
28	#7 Centrifuge	LYM54006-1		55	84.2	47.1	N	10	85%	4500	211,970
29	#8 Centrifuge	LYM54006-1		55	84.2	47.1	N	10	85%	4500	211,970
30	#9 Centrifuge	LYM54006-1		55	84.2	47.1	N	10	85%	4500	211,970
31	#10 Centrifuge	LYM54006-1		55	84.2	47.1	N	10	85%	4500	211,970
32	#1 Wet Powder Elevator	Y1160M-6	Y	7.5	17	9.5	N	10	85%	4500	42,797
33	#2 Wet Powder Elevator	Y160M-4	Y	11	23	12.9	N	10	85%	4500	57,902
34	Bleaching Liquor Pump	Y160M1-2	Y	11	23	12.9	N	10	85%	4500	57,902
35	Bleaching Liquor Pump	Y2001-2	Y	30	56.9	31.8	N	10	85%	4500	143,244
36	HP Water Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	4500	89,370
37	#1 Centrifugal Tail Gas Blower	Y225S-4	Y	37	69.8	39.0	N	10	85%	8500	331,913
38	#2 Centrifugal Tail Gas Blower	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
39	#1 Centrifugal Circulating Pump	Y225-6	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
40	#1 Pelletizer	Y225-6	Y	33	60	33.6	N	10	85%	4500	151,048
41	#2 Pelletizer	Y160-2	Y	33	60	33.6	N	10	85%	4500	151,048
42	#1 Drying Tail Gas Blower	Y160-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
43	#2 Drying Tail Gas Blower	Y160-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
44	#3 Drying Tail Gas Blower	Y160-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
45	#4 Drying Tail Gas Blower	Y160-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
46	#5 Drying Tail Gas Blower	Y225S-4	Y	37	69.8	39.0	N	10	85%	8500	331,913
47	#6 Drying Tail Gas Blower	Y225S-4	Y	37	69.8	39.0	N	10	85%	8500	331,913
48	Packaging Tail Gas Blower	Y160-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
49	#7 Drying Tail Gas Blower	Y160-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
50	Wet Powder Tail Gas Blower	Y160M2-2	Y	15	29.4	16.4	N	10	85%	4500	74,013
51	#1 Air Blower	Y132S1-2	Y	7.5	14.3	8.0	N	10	85%	8500	67,999
52	#3 Air Blower	Y132S1-2	Y	7.5	14.3	8.0	N	10	85%	8500	67,999
53	#5 Air Blower	Y160L-4	Y	15	30.3	17.0	N	10	85%	8500	144,083
54	#6 Air Blower	Y160L-4	Y	15	30.3	17.0	N	10	85%	8500	144,083
55	#7 Air Blower	Y160L-4	Y	7.5	14.3	8.0	N	10	85%	8500	67,999
56	#1 Drying Circulating Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
57	#2 Drying Circulating Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
58	#4 Drying Circulating Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	8500	168,810
59	#1 Pulverizer	Y180M-2	Y	22	41.5	23.2	N	10	85%	8500	197,341
60	#2 Puverizer	Y10DL-4	Y	55	102.5	57.3	N	10	85%	8500	487,409

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
61	#1 Stocking Bleaching Liquor Pump	Y160M2-2	Y	15	29.4	16.4	N	10	85%	4500	74,013
62	#2 Stocking Bleaching Liquor Pump	Y160L-2	Y	18.5	35.5	19.9	N	10	85%	4500	89,370
	Utility Refrigeration 2										
1	#1 Screw	ILA4502-2CN60		1250	0	0.0	N	10	85%	0	0
2	#2 Screw	ASCK-TK001		830	68	600.7	N	10	85%	8500	5,105,590
3	#3 Screw	ILA4502-2CN60		1250	99	874.5	N	10	85%	8500	7,433,138
4	#1 Brine Pump	Y315-4	Y	110	117	65.5	N	10	85%	8500	556,359
5	#1 Brine Pump	Y315-4	Y	110	0	0.0	N	10	85%	0	0
6	#1 Brine Pump	Y315-4	Y	110	105	58.7	N	10	85%	8500	499,297
7	#1 Brine Pump	Y315-4	Y	110	118	66.0	N	10	85%	8500	561,114
8	#1 Brine Pump	Y315-4	Y	110	123	68.8	N	10	85%	8500	584,890
9	#1 Brine Pump	Y315-4	Y	110	143	80.0	N	10	85%	8500	679,994
10	Underground Brine Tank Pump	Y160S-4	Y	15	0	0.0	N	10	85%	0	0
11	#1 Air Compressor	Y315M2-8	Y	132	190	106.3	N	10	85%	8500	903,489
12	#2 Air Compressor	Y315M2-4	Y	250	380	212.6	N	10	85%	8500	1,806,978
13	#3 Air Compressor	Y315M2-4	Y	250	380	212.6	N	10	85%	8500	1,806,978
14	#4 Air Compressor	Y315M2-4	Y	250	380	212.6	N	10	85%	8500	1,806,978
15	#5 Air Compressor	YP280M-4	Y	132	220	123.1	N	10	85%	8500	1,046,145
16	#6 Air Compressor	YP280M-4	Y	132	220	123.1	Y	10	85%	8500	1,046,145
17	#7 Air Compressor	YP280M-4	Y	132	220	123.1	N	10	85%	8500	1,046,145
18	#8 Air Compressor	YP280M-4	Y	132	220	123.1	N	10	85%	8500	1,046,145
19	#9 Air Compressor	YP280M-4	Y	132	220	123.1	N	10	85%	8500	1,046,145
20	#1 Circulating Pump	Y315L1-4	Y	160	290	162.2	N	10	85%	8500	1,379,010
21	#2 Circulating Pump	Y315L1-4	Y	160	290	162.2	N	10	85%	0	0
22	#3 Circulating Pump	Y315L1-4	Y	160	260	145.5	N	10	85%	8500	1,236,354
23	#4 Circulating Pump	Y315L1-4	Y	160	240	134.3	N	10	85%	0	0
24	#5 Circulating Pump	Y315L1-4	Y	160	250	139.9	N	10	85%	8500	1,188,802
25	#1 Cooling Tower	ID280S-4		75	87	48.7	Y	10	85%	8500	413,703
26	#2 Cooling Tower	ID280S-4		75	122	68.3	N	10	85%	8500	580,135
	Utility Refrigeration 1										
1	#1 Air Compressor	Y315M-4	Y	132	200	111.9	N	10	85%	2800	313,284
2	#2 Air Compressor	JY2-250M-6	J	65	60	33.6	N	10	85%	2800	93,985
3	#3 Air Compressor	Y280S-6	Y	75	60	33.6	N	10	85%	2800	93,985
4	#3 Air Compressor	Y315M-4	Y	132	200	111.9	N	10	85%	890	99,580
5	#1 Ammonia Chiller	J03-250S6	J	55	70	39.2	N	10	85%	890	34,853

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
6	#2 Ammonia Chiller	Y315M1-6	Y	90	150	83.9	N	10	85%	890	74,685
7	#3 Ammonia Chiller	Y315M1-6	Y	90	150	83.9	N	10	85%	890	74,685
8	#4 Ammonia Chiller	JS116-6	J	95	150	83.9	N	10	85%	890	74,685
9	#5 Ammonia Chiller	JS116-6	J	95	150	83.9	N	10	85%	890	74,685
10	#6 Ammonia Chiller	JS116-6	J	95	150	83.9	N	10	85%	890	74,685
11	#7 Ammonia Chiller	J03-250S6	J	55	70	39.2	N	10	85%	890	34,853
12	#1 Screw Chiller	JK2132-2	J	220	420	235.0	N	10	85%	890	209,117
13	#2 Screw Chiller	JK2132-2	J	220	420	235.0	N	10	85%	890	209,117
14	#1 Centrifugal Pump	Y250M-4	Y	55	70	39.2	N	10	85%	8500	332,864
15	#3 Centrifugal Pump	Y250M-4	Y	55	70	39.2	N	10	85%	8500	332,864
16	#4 Centrifugal Pump	Y225S-4	Y	37	50	28.0	N	10	85%	8500	237,760
17	#5 Centrifugal Pump	Y200L2-2	Y	37	55	30.8	N	10	85%	8500	261,536
18	#6 Centrifugal Pump	Y225S-4	Y	37	55	30.8	N	10	85%	8500	261,536
19	#7 Centrifugal Pump	Y225S-4	Y	37	55	30.8	N	10	85%	8500	261,536
20	#8 Centrifugal Pump	Y2315M-4W	Y	132	200	111.9	N	10	85%	8500	951,041
21	#9 Centrifugal Pump	Y2315M-4W	Y	220	320	179.0	N	10	85%	8500	1,521,666
22	#10 Centrifugal Pump	Y2315M-4W	Y	220	320	179.0	N	10	85%	8500	1,521,666
23	#1 Air Blower	Y160L-4-V1	Y	15	17	9.5	N	10	85%	8500	80,839
24	#2 Air Blower	Y160L-4-V1	Y	15	17	9.5	N	10	85%	8500	80,839
25	#3 Air Blower	Y200L2-6	Y	22	28	15.7	Y	10	85%	8500	133,146
26	#4 Air Blower	Y200L2-6	Y	22	28	15.7	N	10	85%	8500	133,146
27	#5 Air Blower	HM2-180L-4		22	28	15.7	N	10	85%	8500	133,146
28	#6 Air Blower	Y2-200L2-2		22	28	15.7	N	10	85%	8500	133,146
29	Pump #1 to Brine Tank 1	Y225M-4	Y	37	55	30.8	N	10	85%	8500	261,536
30	Pump #1 to Brine Tank 2	Y225M-4	Y	45	70	39.2	N	10	85%	8500	332,864
31	Pump #2 to Brine Tank 2	Y200L1-4	Y	45	70	39.2	N	10	85%	8500	332,864
32	Pump #1 to Brine Tank 3	Y200L1-2	Y	30	35	19.6	N	10	85%	8500	166,432
33	Pump #2 to Brine Tank 3	Y200L1-2	Y	30	35	19.6	N	10	85%	8500	166,432
34	Pump #1 to Brine Tank 4	Y200L1-2	Y	37	35	19.6	N	10	85%	8500	166,432
35	Pump #2 to Brine Tank 4	Y2-200L2-4W		37	35	19.6	N	10	85%	8500	166,432
36	#1 Screw water supply pump	Y2-315S-4W		110	180	100.7	N	10	85%	8500	855,937
37	#2 Screw water supply pump	Y2-315S-4W		110	180	100.7	N	10	85%	8500	855,937
38	#1 Charging Pump for Ammonia	Y225S-4	Y	37	60	33.6	N	10	85%	8500	285,312
39	#2 Charging Pump for Ammonia	Y2-250M-4W		55	75	42.0	N	10	85%	8500	356,640
40	#1 Water Supply Pump	Y280S-4	Y	75	90	50.3	N	10	85%	8500	427,969

Motor Number	Equipment	Motor Model Number (1)	Motor Series	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Variable Frequency Driving or Not	Years in Service (5)	Assumed Power Factor	Annual Operating Time (Hour) (6)	Annual Energy Consumption kWh (7)
41	#2 Water Supply Pump	Y280S-4	Y	75	90	50.3	N	10	85%	8500	427,969
42	#1 Cooling Water Pump	Y280S-4	Y	75	120	67.1	N	10	85%	8500	570,625
43	#2 Cooling Water Pump	Y280S-4	Y	75	120	67.1	N	10	85%	8500	570,625
44	#3 Cooling Water Pump	Y280S-4	Y	75	120	67.1	N	10	85%	8500	570,625

Notes:
1. Motor Model number provided by owner's representative.
2. Motor kW rating.
3. Motor operating amperage as measured by enterprize.
4. Actual kW load on motor = (380 volts) x (Amperage) x (Power Factor) x (1.732) / (1000. watts/kW)
5. Age of motor in years.
6. Annual operating hours. Enterprize reported either "continuous", or "Intermittent". "Continuous" is assumed to be 8,500 hours per year. "Intermittent" is assumed to be 4,500 hours per year unless more precise data was provided.
7. Annual energy consumption kWh = (Annual Operating Hours) x (Actual kW)

8.2 POTENTIAL MOTOR REPLACEMENTS

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
	ADC Oxidizing Fluid													
1	Alkali pump A	Y160M2-2	15	29	16.2	10	4500	88.5%	91.8%	0.7	2,965	1,520	2,280	1.5
2	Alkali pump B	Y160M1-2	11	22	12.3	10	4500	87.0%	90.3%	0.5	2,326	1,192	3,322	2.8
3	Alkali pump C	Y160M2-2	15	29	16.2	10	8500	88.5%	91.8%	0.7	5,601	2,871	2,280	0.8
4	Crude hydrazine pump	Y1600L-4	15	29	16.2	10	8500	88.5%	91.8%	0.7	5,601	2,871	2,280	0.8
5	Crude hydrazine pump	Y160L-4	15	29	16.2	10	8500	88.5%	91.8%	0.7	5,601	2,871	2,280	0.8
6	Crude hydrazine pump	Y160L-4	15	29	16.2	10	4500	88.5%	91.8%	0.7	2,965	1,520	2,280	1.5
7	Crude hydrazine pump	Y160L-4	15	29	16.2	10	4500	88.5%	91.8%	0.7	2,965	1,520	2,280	1.5
8	Sodium hypochlorite delivery pump	Y160L-4	15	29	16.2	10	8500	88.5%	91.8%	0.7	5,601	2,871	2,280	0.8
9	Sodium hypochlorite delivery pump	Y160L-4	15	29	16.2	10	4500	88.5%	91.8%	0.7	2,965	1,520	2,280	1.5
10	Sodium hypochlorite circulating pump	Y200L-4	30	55	30.8	10	8500	92.2%	93.5%	0.5	3,944	2,021	4,560	2.3
11	Sodium hypochlorite circulating pump	Y200L-4	30	55	30.8	10	4500	92.2%	93.5%	0.5	2,088	1,070	4,560	4.3
12	Sodium hypochlorite circulating pump	Y200L-4	30	55	30.8	10	4500	92.2%	93.5%	0.5	2,088	1,070	4,560	4.3
13	Submerged pump	Y160M1-2B5	11	22	12.3	10	4500	87.0%	90.3%	0.5	2,326	1,192	3,322	2.8
	ADC Recycling													
7	2# Forcing pump	Y315S-6	75	85	47.6	10	8500	92.7%	94.7%	1.1	9,208	4,719	11,400	2.4
8	1# Forcing pump	Y315L2-8	110	100	55.9	10	8500	93.5%	95.4%	1.2	10,129	5,191	16,720	3.2
9	3# Alkali collecting pump	Y225M-2	45	46	25.7	10	8500	92.3%	94.1%	0.5	4,533	2,323	6,840	2.9
10	2# Alkali collecting pump	Y200L1-2	30	58	32.4	10	8500	92.2%	93.5%	0.5	4,159	2,132	4,560	2.1
11	1# Alkali collecting pump	Y250M-2	55	105	58.7	10	8500	92.6%	94.5%	1.3	10,841	5,556	8,360	1.5
12	3# Mixing & cooling pump	Y200L1-2	45	58	32.4	10	8500	92.3%	94.1%	0.7	5,716	2,929	6,840	2.3
13	2# Mixing & cooling pump	Y200L1-25	45	58	32.4	10	8500	92.3%	94.1%	0.7	5,716	2,929	6,840	2.3
14	1# Mixing & cooling pump	Y2-250M-2	55	100	55.9	10	8500	93.2%	94.5%	0.8	7,019	3,597	8,360	2.3
15	1# Underground tank pump	Y160M1-2	11	12	6.7	10	8500	87.0%	90.3%	0.3	2,397	1,228	3,322	2.7
16	2# Underground tank pump	Y2-160M-4	11	12	6.7	10	4500	87.0%	90.3%	0.3	1,269	650	3,322	5.1
17	Water pump	Y160M1-2	11	12	6.7	10	8500	87.0%	90.3%	0.3	2,397	1,228	3,322	2.7
18	1# Mixed stripping pump	Y2-250M-2	55	100	55.9	10	4500	93.2%	94.5%	0.8	3,716	1,904	8,360	4.4
19	1#Crude hydrazine pump	Y160L-4	15	16	9.0	10	4500	88.5%	91.8%	0.4	1,636	839	2,280	2.7

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
20	2#Crude hydrazine pump	Y160L-4	15	18	10.1	10	4500	88.5%	91.8%	0.4	1,841	943	2,280	2.4
21	3#Crude hydrazine pump	Y160L-4	15	18	10.1	10	4500	88.5%	91.8%	0.4	1,841	943	2,280	2.4
22	4#Crude hydrazine pump	Y200L-2	30	45	25.2	10	4500	92.2%	93.5%	0.4	1,708	876	4,560	5.2
23	1# Refined hydrazine pump	Y2-132S2-2	7.5	12	6.7	10	8500	87.0%	90.3%	0.3	2,397	1,228	2,265	1.8
24	3# Refined hydrazine pump	Y200L1-2	37	40	22.4	10	8500	92.2%	93.5%	0.3	2,868	1,470	5,624	3.8
	ADC Condensation													
1	1# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
2	2# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
3	3# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
4	4# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
5	5# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
6	6# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
7	7# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
8	8# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
9	9# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
10	10# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
11	11# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
12	12# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
13	13# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
14	14# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
15	15# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
16	16# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
17	17# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
18	18# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
19	19# Condensation	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
	autoclave													
20	20# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
21	21# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
22	22# Condensation autoclave	M2QA180L4A	22	25	14.0	10	4500	91.5%	93.2%	0.3	1,255	643	3,344	5.2
23	1# Hydrazine/urea pump	Y160M1-2	11	16.5	9.2	10	4500	87.0%	90.3%	0.4	1,745	894	3,322	3.7
24	2# Hydrazine/urea pump	Y160M1-2	11	16.5	9.2	10	4500	87.0%	90.3%	0.4	1,745	894	3,322	3.7
25	3# Hydrazine/urea pump	Y160M1-2	11	16.5	9.2	10	4500	87.0%	90.3%	0.4	1,745	894	3,322	3.7
26	1#Hydrazine hydrate pump	Y132M-2	7.5	13	7.3	10	4500	87.0%	90.3%	0.3	1,375	705	2,265	3.2
27	2#Hydrazine hydrate pump	Y132M-2	7.5	13	7.3	10	4500	87.0%	90.3%	0.3	1,375	705	2,265	3.2
28	1# circulating pump	Y160M1-2	11	20	11.2	10	4500	87.0%	90.3%	0.5	2,115	1,084	3,322	3.1
29	2# circulating pump	Y160M1-2	11	20	11.2	10	4500	87.0%	90.3%	0.5	2,115	1,084	3,322	3.1
30	1# Tail gas blower	Y132S2-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
31	2# Tail gas blower	Y132S2-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
32	3# Tail gas blower	Y132S2-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
33	4# Tail gas blower	Y132S2-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
	ADC Scrubbing													
1	1# Vacuum pump	Y280M-8	45	90	50.3	10	8500	92.3%	94.1%	1.0	8,869	4,546	6,840	1.5
2	2# Vacuum pump	Y280M-8	45	90	50.3	10	8500	92.3%	94.1%	1.0	8,869	4,546	6,840	1.5
3	3# Vacuum pump	Y280M-8	45	90	50.3	10	8500	92.3%	94.1%	1.0	8,869	4,546	6,840	1.5
4	1# Oxidizing raw material pump	Y160M1-2	15	22	12.3	10	4500	88.5%	91.8%	0.5	2,250	1,153	2,280	2.0
5	3# Oxidizing raw material pump	Y160M1-2	11	18	10.1	10	4500	87.0%	90.3%	0.4	1,903	976	3,322	3.4
6	1# Condensating fluid pump	Y160M1-2	11	20	11.2	10	4500	87.0%	90.3%	0.5	2,115	1,084	3,322	3.1
7	2# Condensating fluid pump	Y160M1-2	11	20	11.2	10	4500	87.0%	90.3%	0.5	2,115	1,084	3,322	3.1
8	3# Condensating fluid pump	Y160M1-2	11	20	11.2	10	4500	87.0%	90.3%	0.5	2,115	1,084	3,322	3.1
9	4# Condensating fluid pump	Y160M1-2	11	20	11.2	10	4500	87.0%	90.3%	0.5	2,115	1,084	3,322	3.1
10	5# Condensating fluid pump	Y160M1-2	11	20	11.2	10	4500	87.0%	90.3%	0.5	2,115	1,084	3,322	3.1
11	6# Condensating fluid pump	Y160M1-2	11	20	11.2	10	4500	87.0%	90.3%	0.5	2,115	1,084	3,322	3.1
12	1# Pregnant liquor pump	Y160M1-2	11	19	10.6	10	4500	87.0%	90.3%	0.4	2,009	1,030	3,322	3.2

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
13	2# Pregnant liquor pump	Y160M1-2	11	19	10.6	10	4500	87.0%	90.3%	0.4	2,009	1,030	3,322	3.2
14	3# Pregnant liquor pump	Y160M1-2	11	19	10.6	10	4500	87.0%	90.3%	0.4	2,009	1,030	3,322	3.2
15	4# Pregnant liquor pump	Y160M1-2	11	19	10.6	10	4500	87.0%	90.3%	0.4	2,009	1,030	3,322	3.2
16	5# Pregnant liquor pump	Y160M1-2	11	19	10.6	10	4500	87.0%	90.3%	0.4	2,009	1,030	3,322	3.2
17	6# Pregnant liquor pump	Y160M1-2	11	19	10.6	10	4500	87.0%	90.3%	0.4	2,009	1,030	3,322	3.2
18	1# Pulping tank	Y132S-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
19	2# Pulping tank	Y132S-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
20	3# Pulping tank	Y132S-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
21	4# Pulping tank	Y132S-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
22	5# Pulping tank	Y132S-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
23	6# Pulping tank	Y132S-2	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
	ADC Condensation 2													
1	23# Condensation autoclave	Y160L-4	15	30	16.8	10	4500	88.5%	91.8%	0.7	3,068	1,572	2,280	1.5
2	24# Condensation autoclave	Y160L-4	15	30	16.8	10	4500	88.5%	91.8%	0.7	3,068	1,572	2,280	1.5
3	25# Condensation autoclave	Y160L-4	15	30	16.8	10	4500	88.5%	91.8%	0.7	3,068	1,572	2,280	1.5
4	26# Condensation autoclave	Y160L-4	15	30	16.8	10	4500	88.5%	91.8%	0.7	3,068	1,572	2,280	1.5
5	27# Condensation autoclave	Y160L-4	15	30	16.8	10	4500	88.5%	91.8%	0.7	3,068	1,572	2,280	1.5
6	28# Condensation autoclave	Y160L-4	15	30	16.8	10	4500	88.5%	91.8%	0.7	3,068	1,572	2,280	1.5
7	29# Condensation autoclave	Y160L-4	15	30	16.8	10	4500	88.5%	91.8%	0.7	3,068	1,572	2,280	1.5
8	30# Condensation autoclave	Y160L-4	15	30	16.8	10	4500	88.5%	91.8%	0.7	3,068	1,572	2,280	1.5
9	31# Condensation autoclave	Y160L-4	15	30	16.8	10	4500	88.5%	91.8%	0.7	3,068	1,572	2,280	1.5
10	32# Condensation autoclave	Y160L-4	15	37	20.7	10	4500	88.5%	91.8%	0.8	3,783	1,939	2,280	1.2
11	33# Condensation autoclave	Y180M-4	18.5	37	20.7	10	4500	91.0%	93.0%	0.5	2,201	1,128	2,812	2.5
12	34# Condensation autoclave	Y180M-4	18.5	37	20.7	10	4500	91.0%	93.0%	0.5	2,201	1,128	2,812	2.5
13	35# Condensation autoclave	Y180M-4	18.5	37	20.7	10	4500	91.0%	93.0%	0.5	2,201	1,128	2,812	2.5
14	36# Condensation autoclave	Y180M-4	18.5	37	20.7	10	4500	91.0%	93.0%	0.5	2,201	1,128	2,812	2.5
15	37# Condensation autoclave	Y180M-4	18.5	37	20.7	10	4500	91.0%	93.0%	0.5	2,201	1,128	2,812	2.5

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
16	38# Condensation autoclave	Y180M-4	18.5	37	20.7	10	4500	91.0%	93.0%	0.5	2,201	1,128	2,812	2.5
17	4# Vacuum pump	Y280M-8	45	90	50.3	10	4500	92.3%	94.1%	1.0	4,696	2,406	6,840	2.8
18	5# Vacuum pump	Y280M-8	45	90	50.3	10	4500	92.3%	94.1%	1.0	4,696	2,406	6,840	2.8
19	7# Condensating fluid pump	Y2-160M2-2	15	30	16.8	10	4500	89.0%	91.8%	0.6	2,588	1,326	2,280	1.7
20	8# Condensating fluid pump	Y2-160M2-2	15	30	16.8	10	4500	89.0%	91.8%	0.6	2,588	1,326	2,280	1.7
21	9# Condensating fluid pump	Y2-160M2-2	15	30	16.8	10	4500	89.0%	91.8%	0.6	2,588	1,326	2,280	1.7
22	10# Condensating fluid pump	Y2-160M2-2	15	30	16.8	10	4500	89.0%	91.8%	0.6	2,588	1,326	2,280	1.7
23	7# Pregnant liquor pump	Y2-160M2-2	11	22	12.3	10	8500	87.0%	90.3%	0.5	4,394	2,252	3,322	1.5
24	8# Pregnant liquor pump	Y2-160M2-2	11	22	12.3	10	8500	87.0%	90.3%	0.5	4,394	2,252	3,322	1.5
25	9# Pregnant liquor pump	Y2-160M2-2	11	22	12.3	10	8500	87.0%	90.3%	0.5	4,394	2,252	3,322	1.5
26	10# Pregnant liquor pump	Y2-160M2-2	11	22	12.3	10	8500	87.0%	90.3%	0.5	4,394	2,252	3,322	1.5
27	4# Hydrazine/urea pump	Y160M1-2	11	22	12.3	10	4500	87.0%	90.3%	0.5	2,326	1,192	3,322	2.8
28	5# Hydrazine/urea pump	Y160M1-2	11	22	12.3	10	4500	87.0%	90.3%	0.5	2,326	1,192	3,322	2.8
29	3# Water circulating pump	Y160M2-2	15	30	16.8	10	8500	88.5%	91.8%	0.7	5,795	2,970	2,280	0.8
30	4# Water circulating pump	Y160M2-2	15	30	16.8	10	8500	88.5%	91.8%	0.7	5,795	2,970	2,280	0.8
31	1# Acidcirculating pump	Y132S2-2	7.5	11	6.2	10	8500	87.0%	90.3%	0.3	2,197	1,126	2,265	2.0
32	2# Acidcirculating pump	Y132S2-2	7.5	11	6.2	10	8500	87.0%	90.3%	0.3	2,197	1,126	2,265	2.0
33	Oxidizing raw material pump	Y2-160M1-2	11	22	12.3	10	4500	87.0%	90.3%	0.5	2,326	1,192	3,322	2.8
34	5# Tail gas blower	Y132S2-2	7.5	15	8.4	10	8500	87.0%	90.3%	0.4	2,996	1,536	2,265	1.5
35	6# Tail gas blower	Y132S2-2	7.5	15	8.4	10	8500	87.0%	90.3%	0.4	2,996	1,536	2,265	1.5
36	7# Tail gas blower	Y132S2-2	7.5	15	8.4	10	8500	87.0%	90.3%	0.4	2,996	1,536	2,265	1.5
37	8# Tail gas blower	Y132S2-2	7.5	15	8.4	10	8500	87.0%	90.3%	0.4	2,996	1,536	2,265	1.5
38	Burdening air blower	Y132S2-2	7.5	15	8.4	10	8500	87.0%	90.3%	0.4	2,996	1,536	2,265	1.5
39	7# Pulping tank	Y132S-4	7.5	15	8.4	10	4500	87.0%	90.3%	0.4	1,586	813	2,265	2.8
40	8# Pulping tank	Y132S-4	7.5	15	8.4	10	4500	87.0%	90.3%	0.4	1,586	813	2,265	2.8
41	9# Pulping tank	Y132S-4	7.5	15	8.4	10	4500	87.0%	90.3%	0.4	1,586	813	2,265	2.8
42	10# Pulping tank	Y132S-4	7.5	15	8.4	10	4500	87.0%	90.3%	0.4	1,586	813	2,265	2.8
	ADC Oxidization													
4	4# Oxidization autoclave	M2QA180L4A	20	21	11.7	10	4500	91.0%	93.0%	0.3	1,249	640	3,040	4.7
6	7# Oxidization autoclave	Y160L-4	15	16	9.0	10	4500	88.5%	91.8%	0.4	1,636	839	2,280	2.7
7	8# Oxidization autoclave	M2QA180L4A	20	20	11.2	10	4500	91.0%	93.0%	0.3	1,190	610	3,040	5.0

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
8	9# Oxidization autoclave	M2QA180L4A	20	25	14.0	10	4500	91.0%	93.0%	0.3	1,487	762	3,040	4.0
11	12# Oxidization autoclave	M2QA180L4A	20	28	15.7	10	4500	91.0%	93.0%	0.4	1,666	854	3,040	3.6
12	13# Oxidization autoclave	M2QA180L4A	20	28	15.7	10	4500	91.0%	93.0%	0.4	1,666	854	3,040	3.6
13	1# Alkali circulating pump	Y132S2-2	7.5	8.5	4.8	10	4500	87.0%	90.3%	0.2	899	461	2,265	4.9
14	2# Alkali circulating pump	Y132S2-2	7.5	8	4.5	10	4500	87.0%	90.3%	0.2	846	434	2,265	5.2
15	3# Alkali circulating pump	Y160M1-2	11	12.5	7.0	10	4500	87.0%	90.3%	0.3	1,322	677	3,322	4.9
16	4# Alkali circulating pump	Y160M1-2	11	13	7.3	10	4500	87.0%	90.3%	0.3	1,375	705	3,322	4.7
17	5# Alkali circulating pump	Y160M1-2	11	12	6.7	10	4500	87.0%	90.3%	0.3	1,269	650	3,322	5.1
18	6# Alkali circulating pump	Y160M1-2	11	12.5	7.0	10	4500	87.0%	90.3%	0.3	1,322	677	3,322	4.9
24	3#ADC intermediate tank	Y132M-4	7.5	7	3.9	10	4500	87.0%	90.3%	0.2	740	379	2,265	6.0
	ADC Drying 1													
2	Air blower	Y200L2-2-37kw	37	42	23.5	10	8500	92.2%	93.5%	0.4	3,012	1,544	5,624	3.6
4	3# Blender	YB180M-4	18.5	28	15.7	10	4500	91.0%	93.0%	0.4	1,666	854	2,812	3.3
5	4# Blender	YB180M-4	18.5	26	14.5	10	4500	91.0%	93.0%	0.3	1,547	793	2,812	3.5
8	1# Dust collector blower	Y160M-2	11	12	6.7	10	8500	87.0%	90.3%	0.3	2,397	1,228	3,322	2.7
9	1# feeding machine	Y160M-2	11	12	6.7	10	8500	87.0%	90.3%	0.3	2,397	1,228	3,322	2.7
11	Dust collector blower	YCT225-4A-11kw	11	14	7.8	10	8500	87.0%	90.3%	0.3	2,796	1,433	3,322	2.3
12	1# Alkali pump	Y312S2-2	11	12	6.7	10	8500	87.0%	90.3%	0.3	2,397	1,228	3,322	2.7
13	2# Alkali pump	Y312S2-2	11	12	6.7	10	8500	87.0%	90.3%	0.3	2,397	1,228	3,322	2.7
14	1# Vacuum pump	Y280M-8	45	75	42.0	10	8500	92.3%	94.1%	0.9	7,391	3,788	6,840	1.8
15	2# Vacuum pump	Y280M-8	45	75	42.0	10	8500	92.3%	94.1%	0.9	7,391	3,788	6,840	1.8
16	3# Vacuum pump	Y280M-8	45	92	51.5	10	8500	92.3%	94.1%	1.1	9,066	4,647	6,840	1.5
17	4# Vacuum pump	Y280M-8	45	83	46.4	10	8500	92.3%	94.1%	1.0	8,180	4,192	6,840	1.6
18	5# Vacuum pump	Y280M-8	45	67	37.5	10	8500	92.3%	94.1%	0.8	6,603	3,384	6,840	2.0
19	6# Vacuum pump	Y280M-8	45	54	30.2	10	8500	92.3%	94.1%	0.6	5,322	2,727	6,840	2.5
20	Cargo elevator	TTD430A	7.5	11	6.2	10	4500	87.0%	90.3%	0.3	1,163	596	2,265	3.8
25	1# Dust collector blower	Y160M1-2	11	12	6.7	10	8500	87.0%	90.3%	0.3	2,397	1,228	3,322	2.7
26	2# Dust collector blower	Y160M1-2	11	13	7.3	10	8500	87.0%	90.3%	0.3	2,597	1,331	3,322	2.5
29	Water pipe pump	YB2S1-2-2	7.5	11	6.2	10	8500	87.0%	90.3%	0.3	2,197	1,126	2,265	2.0
31	1# Crushing air flower	Y132S2-2-W	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
32	2# Crushing air flower	Y132S2-2-W	7.5	11	6.2	10	4500	87.0%	90.3%	0.3	1,163	596	2,265	3.8
33	3# Crushing air flower	Y132S2-2-W	7.5	11	6.2	10	4500	87.0%	90.3%	0.3	1,163	596	2,265	3.8
34	4# Crushing air flower	Y132S2-2-W	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
35	5# Crushing air flower	Y132S2-2-W	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
36	6# Crushing air flower	Y132S2-2-W	7.5	9	5.0	10	4500	87.0%	90.3%	0.2	952	488	2,265	4.6
37	7# Crushing air flower	Y132S2-2-W	7.5	11	6.2	10	4500	87.0%	90.3%	0.3	1,163	596	2,265	3.8
38	8# Crushing air flower	Y132S2-2-W	7.5	12	6.7	10	4500	87.0%	90.3%	0.3	1,269	650	2,265	3.5
	ADC Drying 2													
1	1# Centrifuge	Y180L-4	22	20	11.2	10	4500	91.5%	93.2%	0.2	1,004	514	3,344	6.5
2	2# Centrifuge	Y180L-4	22	20	11.2	10	4500	91.5%	93.2%	0.2	1,004	514	3,344	6.5
3	3# Centrifuge	Y180L-4	22	20	11.2	10	4500	91.5%	93.2%	0.2	1,004	514	3,344	6.5
4	4# Centrifuge	Y180L-4	22	20	11.2	10	4500	91.5%	93.2%	0.2	1,004	514	3,344	6.5
6	ID fan	Y200L-2	30	30	16.8	10	4500	92.2%	93.5%	0.3	1,139	584	4,560	7.8
	ADC Fresh Water Treatment													
2	Circulation cooling pump B	Y200L2-2	37	42	23.5	10	4500	92.2%	93.5%	0.4	1,594	817	5,624	6.9
3	Sewage pump A	Y225M-4	45	62	34.7	10	4500	92.3%	94.1%	0.7	3,235	1,658	6,840	4.1
16	Supernate pump C	Y200L1-2	30	67	37.5	10	4500	92.2%	93.5%	0.6	2,544	1,304	4,560	3.5
17	Supernate pump C	Y200L1-2	30	54	30.2	10	4500	92.2%	93.5%	0.5	2,050	1,051	4,560	4.3
	ADC Used Water Treatment													
1	Condensation water charging pump	Y160M1-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
2	1# Lime slurry pump	Y160M1-2	11	21.8	12.2	10	4500	87.0%	90.3%	0.5	2,305	1,181	3,322	2.8
3	2# Lime slurry pump	Y160M4-2	11	21.8	12.2	10	4500	87.0%	90.3%	0.5	2,305	1,181	3,322	2.8
4	Slag pump	Y160M4-2	11	21.8	12.2	10	4500	87.0%	90.3%	0.5	2,305	1,181	3,322	2.8
5	Air stripping pump	Y2160M1-2	11	21.8	12.2	10	8500	87.0%	90.3%	0.5	4,354	2,232	3,322	1.5
6	Chlorination pump	Y2160M1-2	11	35.5	19.9	10	4500	87.0%	90.3%	0.8	3,754	1,924	3,322	1.7
7	Neutralization circulating pump	Y2-160L-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
	Chlorine Alkali Evaporating													
1	Charging pump	JS117-4/180kW	180	290	162.2	15	8500	92.0%	95.8%	7.0	59,456	30,471	27,360	0.9
2	1# water dispenser pump	Y250M-4/55kW	55	95	53.1	10	8500	92.6%	94.5%	1.2	9,809	5,027	8,360	1.7
3	Hot water pump	Y200L_2-2/37kW	37	52	29.1	10	8500	92.2%	93.5%	0.4	3,729	1,911	5,624	2.9
4	Weak alkali charging pump	Y225M-2/55kW	55	84	47.0	10	8500	92.6%	94.5%	1.0	8,673	4,445	8,360	1.9
5	Discharging pump	Y180L-2/18.5kW	18.5	25	14.0	10	4500	91.0%	93.0%	0.3	1,487	762	2,812	3.7
6	1# salt slurry circulating pump	Y180L-2/18.5kW	18.5	28	15.7	10	4500	91.0%	93.0%	0.4	1,666	854	2,812	3.3
7	2# salt slurry circulating pump	Y180L-2/18.5kW	18.5	25	14.0	10	4500	91.0%	93.0%	0.3	1,487	762	2,812	3.7

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
8	II-effect forcing pump	Y315M$_3$-8/110kW	110	125	69.9	15	8500	93.5%	95.4%	1.5	12,661	6,489	16,720	2.6
9	III-effect forcing pump	Y315M$_3$-8/110kW	110	125	69.9	15	8500	93.5%	95.4%	1.5	12,661	6,489	16,720	2.6
10	1# air blower for cooling tower	Y200L-6-B$_5$/18.5kW	18.5	28	15.7	10	8500	91.0%	93.0%	0.4	3,147	1,613	2,812	1.7
11	2# air blower for cooling tower	Y200L-6-B$_5$/18.5kW	18.5	28	15.7	10	8500	91.0%	93.0%	0.4	3,147	1,613	2,812	1.7
12	Air blower for 3# cooling tower	Y132S$_4$-4/11kW	11	15	8.4	10	8500	87.0%	90.3%	0.4	2,996	1,536	3,322	2.2
13	tap water in-line pump	Y132S$_1$-2/5.5kW	5.5	8	4.5	10	8500	85.5%	89.5%	0.2	1,989	1,019	1,661	1.6
14	II-effect salt stripping pump	Y200L$_1$-2/30kW	30	56	31.3	10	8500	92.2%	93.5%	0.5	4,016	2,058	4,560	2.2
15	III-effect salt stripping pump	Y180L-2/22kW	22	41	22.9	10	8500	91.5%	93.2%	0.5	3,887	1,992	3,344	1.7
16	Centrifuge proper	Y225M-4F$_1$/45kW	45	65	36.4	10	8500	92.3%	94.1%	0.8	6,406	3,283	6,840	2.1
17	Centrifugal engine oil pump	Y180M-4F$_1$-22kW	22	26	14.5	10	8500	91.5%	93.2%	0.3	2,465	1,263	3,344	2.6
18	2# water dispersing pump	Y160M$_2$-2/45kW	45	70	39.2	10	8500	92.3%	94.1%	0.8	6,898	3,535	6,840	1.9
19	Washing liquor pump	Y160M$_2$-2/15kW	15	27	15.1	10	4500	88.5%	91.8%	0.6	2,761	1,415	2,280	1.6
20	Circulating pump	Y160M$_2$-2/15kW	15	26	14.5	10	4500	88.5%	91.8%	0.6	2,659	1,363	2,280	1.7
21	alkali-salt slurry pump	Y160M$_2$-2/15kW	15	26	14.5	10	4500	88.5%	91.8%	0.6	2,659	1,363	2,280	1.7
22	1# cooling pump	Y180L-2/18.5kW	18.5	28	15.7	10	4500	91.0%	93.0%	0.4	1,666	854	2,812	3.3
23	2# cooling pump	Y180L-2/18.5kW	18.5	28	15.7	10	4500	91.0%	93.0%	0.4	1,666	854	2,812	3.3
24	3# alkali delivery pump	Y225M-2/45kW	45	70	39.2	10	4500	92.3%	94.1%	0.8	3,652	1,872	6,840	3.7
25	4# alkali delivery pump	Y225M-2/45kW	45	70	39.2	10	4500	92.3%	94.1%	0.8	3,652	1,872	6,840	3.7
26	1# salt slurry pump	Y225M-2/45kW	45	50	28.0	10	4500	92.3%	94.1%	0.6	2,609	1,337	6,840	5.1
27	Alkali delivery pump	Y160M$_2$-2/15kW	15	26	14.5	10	8500	88.5%	91.8%	0.6	5,022	2,574	2,280	0.9
28	1# alkali delivery pump	Y225M-2-45kW	45	70	39.2	10	4500	92.3%	94.1%	0.8	3,652	1,872	6,840	3.7
29	2# alkali delivery pump	Y225M-2-45kW	45	70	39.2	10	4500	92.3%	94.1%	0.8	3,652	1,872	6,840	3.7
30	Alkali turnover pump	Y160M$_2$-2/15kW	15	27	15.1	10	4500	88.5%	91.8%	0.6	2,761	1,415	2,280	1.6
31	Vacuum pump	Y280M-8	45	65	36.4	10	4500	92.3%	94.1%	0.8	3,391	1,738	6,840	3.9
	Chlorine Alkali Synthesis													
55	Chemical cleansing pump	Y132S2-2	75	124	69.4	10	4500	92.7%	94.7%	1.6	7,112	3,645	11,400	3.1
	Chlorine Alkali Cell													
72	Multi-stage pump	Y160L-2	15	22	12.3	10	4500	88.5%	91.8%	0.5	2,250	1,153	2,280	2.0
73	1# vacuum pump	J02-81-6	30	41	22.9	10	4500	90.0%	93.5%	1.0	4,293	2,200	4,560	2.1
74	2# vacuum pump	J02-81-6	30	41	22.9	10	4500	90.0%	93.5%	1.0	4,293	2,200	4,560	2.1

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	Chlorine Alkali Liquid Cooling													
85	1# compressor	JO$_3$280S-6/75kW	75	141.1	78.9	12	8500	92.0%	94.7%	2.4	20,793	10,657	11,400	1.1
86	3# LP compressor	Y280M2-6/75kW	75	141.1	78.9	16	8500	92.7%	94.7%	1.8	15,286	7,834	11,400	1.5
87	3# HP compressor	Y280M-6/55kW	55	104.1	58.2	12	8500	92.6%	94.5%	1.3	10,748	5,508	8,360	1.5
88	4# LP compressor	Y280M2-6/75kW	75	141.1	78.9	16	8500	92.7%	94.7%	1.8	15,286	7,834	11,400	1.5
89	4# HP compressor	Y280M-6/55kW	55	104.1	58.2	12	8500	92.6%	94.5%	1.3	10,748	5,508	8,360	1.5
	Chlorine Alkali Electrolysis													
91	2# elevated pump	Y200L$_2$-2	37	61	34.1	10	8500	92.2%	93.5%	0.5	4,374	2,242	5,624	2.5
92	1# diluted alkali pump	Y200L$_1$-2	30	47	26.3	10	4500	92.2%	93.5%	0.4	1,784	914	4,560	5.0
95	Braine recycling pump	Y$_2$-160MI-2	11	16	9.0	10	4500	87.0%	90.3%	0.4	1,692	867	3,322	3.8
96	Wastewater pump	Y$_2$-200L$_1$-2	22	31	17.3	10	4500	91.2%	93.2%	0.4	1,836	941	3,344	3.6
98	Weak brine pump B	Y$_3$160M$_2$-2	15	27	15.1	10	8500	89.0%	91.8%	0.5	4,400	2,255	2,280	1.0
99	Filtered brine pump B	Y3-200L$_1$-2	30	51	28.5	10	8500	92.0%	93.5%	0.5	4,229	2,167	4,560	2.1
101	Alkali liquor pump	Y$_2$-200L$_1$-2	37	62	34.7	10	8500	92.0%	93.5%	0.6	5,141	2,635	5,624	2.1
102	Anolyte drain pump	Y$_3$132S$_2$-2	7.5	11	6.2	10	4500	87.0%	90.3%	0.3	1,163	596	2,265	3.8
104	Chlorinated water pump B	Y$_3$112M-2	4	6.5	3.6	10	8500	84.0%	88.3%	0.2	1,792	918	1,208	1.3
106	Dechlorinating vacuum pump B	JEC-2137-2000	18.5	31	17.3	10	8500	89.0%	93.0%	0.8	7,124	3,651	2,812	0.8
108	Oil pump B	HL165LR3578W	11	18	10.1	10	8500	87.0%	90.3%	0.4	3,595	1,843	3,322	1.8
110	Dechlorinated brine pump B	Y$_3$-160M$_2$-2	15	22	12.3	10	8500	89.0%	91.8%	0.4	3,585	1,837	2,280	1.2
111	Catholyte drain pump	Y$_2$-132S$_2$-2	5.5	7.5	4.2	10	4500	85.0%	89.5%	0.2	1,117	572	1,661	2.9
	Chlorine Alkali Transceiving													
112	1# acid pump	Y132S-2/5.5kW	5.5	8	4.5	10	4500	85.5%	89.5%	0.2	1,053	540	1,661	3.1
113	2# acid pump	Y132S-2/5.5kW	5.5	8	4.5	10	4500	85.5%	89.5%	0.2	1,053	540	1,661	3.1
114	Riverside acid pump	Y132S-2/5.5kW	5.5	8	4.5	10	4500	85.5%	89.5%	0.2	1,053	540	1,661	3.1
116	Riverside alkali pump	Y160M$_2$-2/18.5kW	18.5	30	16.8	10	4500	91.0%	93.0%	0.4	1,785	915	2,812	3.1
117	1# alkali pump	Y132S$_2$-2/7.5kW	7.5	14	7.8	10	4500	87.0%	90.3%	0.3	1,480	759	2,265	3.0
118	2# alkali pump	Y132S$_2$-2/7.5kW	7.5	14	7.8	10	4500	87.0%	90.3%	0.3	1,480	759	2,265	3.0
	Chlorine Alkali Submerging													
119	1# discharging pump	Y160M$_2$-2	15	18	10.1	10	4500	88.5%	91.8%	0.4	1,841	943	2,280	2.4
120	2# discharging pump	Y160M$_2$-2	15	18	10.1	10	4500	88.5%	91.8%	0.4	1,841	943	2,280	2.4
121	3# discharging pump	Y160M$_2$-2	15	18	10.1	10	4500	88.5%	91.8%	0.4	1,841	943	2,280	2.4

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
122	4# discharging pump	$Y160M_1$-2	11	18	10.1	10	4500	87.0%	90.3%	0.4	1,903	976	3,322	3.4
123	5# discharging pump	$Y160M_1$-2	11	18	10.1	10	4500	87.0%	90.3%	0.4	1,903	976	3,322	3.4
124	1# alkali delivery pump	$Y160M_2$-2	15	18	10.1	10	4500	88.5%	91.8%	0.4	1,841	943	2,280	2.4
125	2# alkali delivery pump	$Y160M_1$-2	11	18	10.1	10	4500	87.0%	90.3%	0.4	1,903	976	3,322	3.4
126	1# feed pump	$Y132S_1$-2	5.5	10	5.6	10	4500	85.5%	89.5%	0.3	1,316	674	1,661	2.5
127	2# feed pump	$Y132S_1$-2	5.5	10	5.6	10	4500	85.5%	89.5%	0.3	1,316	674	1,661	2.5
128	Alkali-salty water pump	$Y160M_1$-2	11	18	10.1	10	4500	87.0%	90.3%	0.4	1,903	976	3,322	3.4
129	1# Roots blower	160L-6	11	20	11.2	10	8500	87.0%	90.3%	0.5	3,995	2,047	3,322	1.6
130	2# Roots blower	160L-6	11	20	11.2	10	8500	87.0%	90.3%	0.5	3,995	2,047	3,322	1.6
131	Oil pressure unit	$Y100L_2$-4	3	5	2.8	10	8500	81.0%	86.3%	0.2	1,803	924	906	1.0
132	Air compressor	Y225M-8IP44	22	41	22.9	10	4500	91.5%	93.2%	0.5	2,058	1,055	3,344	3.2
	Chlorine Alkali Drying													
134	2# chlorine pump	JB315S-3-6	110	190	106.3	16	8500	92.0%	95.4%	4.1	35,000	17,937	16,720	0.9
135	3# chlorine pump	JB315S-3-6	110	190	106.3	16	8500	92.0%	95.4%	4.1	35,000	17,937	16,720	0.9
136	4# chlorine pump	JB315S-3-6	110	190	106.3	16	8500	92.0%	95.4%	4.1	35,000	17,937	16,720	0.9
137	5# chlorine pump	JB315S-3-6	110	190	106.3	16	8500	92.0%	95.4%	4.1	35,000	17,937	16,720	0.9
138	6# chlorine pump	Y3-355M1-6	160	200	111.9	2	8500	94.8%	95.8%	1.2	10,472	5,367	24,320	4.5
139	7# chlorine pump	Y3-355M1-6	160	200	111.9	2	8500	94.8%	95.8%	1.2	10,472	5,367	24,320	4.5
144	3# Roots blower	YB225M-6	30	50	28.0	10	8500	92.2%	93.5%	0.4	3,585	1,838	4,560	2.5
145	1#Sulfuric acid pump	$Y132S_2$-21/7.5kW	7.5	15	8.4	10	4500	87.0%	90.3%	0.4	1,586	813	2,265	2.8
148	2#Chlorine water pump	$Y160M_2$-2/30kW	30	35	19.6	10	8500	92.2%	93.5%	0.3	2,510	1,286	4,560	3.5
150	Sulfuric acid pump B	Y2-160L-2	18.5	25	14.0	10	8500	90.7%	93.0%	0.4	3,242	1,661	2,812	1.7
151	Chlorine water pump A	Y2-160L-2	18.5	25	14.0	10	8500	90.7%	93.0%	0.4	3,242	1,661	2,812	1.7
153	Wastewater pump	Y132S2-2	7.5	12	6.7	10	4500	87.0%	90.3%	0.3	1,269	650	2,265	3.5
155	Absorption tower circulating pump A	Y160M2-2	15	24	13.4	10	8500	88.5%	91.8%	0.5	4,636	2,376	2,280	1.0
157	Tail gas tower ciruclating pump A	___	15	23	12.9	10	8500	88.5%	91.8%	0.5	4,442	2,277	2,280	1.0
159	Sodium hypochlorite pump	___	7.5	11	6.2	10	4500	87.0%	90.3%	0.3	1,163	596	2,265	3.8
160	product sodium hypochlorite shipping pump	___	7.5	10	5.6	10	4500	87.0%	90.3%	0.2	1,057	542	2,265	4.2
161	Alkali lifting pump	___	7.5	12	6.7	10	4500	87.0%	90.3%	0.3	1,269	650	2,265	3.5
163	Titanium air blower B	Y132S1-2	5.5	9	5.0	10	8500	85.5%	89.5%	0.3	2,237	1,147	1,661	1.4
	Chlorine Alkali Packaging Test													

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
166	Light-duty chlorine pump	Y180L-4/22kW	22	37	20.7	10	4500	91.5%	93.2%	0.4	1,857	952	3,344	3.5
168	Light-duty chlorine pump	Y180L-4/22kW	22	34	19.0	10	4500	91.5%	93.2%	0.4	1,706	874	3,344	3.8
171	Air compressor	Y160M-4H/11kW	11	18	10.1	10	4500	87.0%	90.3%	0.4	1,903	976	3,322	3.4
172	Electric pressure test pump	Y90S-4/11kW	11	18	10.1	10	4500	87.0%	90.3%	0.4	1,903	976	3,322	3.4
	Chlorine Alkali H2 Compression													
173	1# chlorine compressor	YB280S--8/45kW	45	78	43.6	10	4500	92.3%	94.1%	0.9	4,069	2,086	6,840	3.3
174	2# chlorine compressor	YB280M--8/75kW	75	95	53.1	2	4500	92.7%	94.7%	1.2	5,449	2,792	11,400	4.1
175	3# chlorine compressor	YB280S--8/37kW	37	64	35.8	10	4500	92.2%	93.5%	0.5	2,430	1,245	5,624	4.5
176	4# chlorine compressor	YB315S-8/75kW	75	95	53.1	3	4500	92.7%	94.7%	1.2	5,449	2,792	11,400	4.1
177	Water pump	Y132S2-2/7.5kW	7.5	12	6.7	10	4500	87.0%	90.3%	0.3	1,269	650	2,265	3.5
	Chlorine Salt Dissolving													
179	1# bucket elevator	YB-132M-4	7.5	8.5	4.8	10	4500	87.0%	90.3%	0.2	899	461	2,265	4.9
180	Raw brine pump	Y160M$_2$-2/15	30	48	26.9	10	8500	92.2%	93.5%	0.4	3,442	1,764	4,560	2.6
181	Clarified brine pump	Y160M$_2$-2/15	15	28	15.7	10	8500	88.5%	91.8%	0.6	5,408	2,772	2,280	0.8
182	Water preparation pump	Y160M-2/15kW	15	28	15.7	10	8500	88.5%	91.8%	0.6	5,408	2,772	2,280	0.8
183	Dole pump	Y180M-2/22	22	40	22.4	10	8500	91.5%	93.2%	0.4	3,792	1,943	3,344	1.7
184	1# clarified brine pump	Y180M-2/22	22	38	21.3	10	8500	91.5%	93.2%	0.4	3,602	1,846	3,344	1.8
185	Back flush pump	Y160M-2/15	15	18	10.1	10	4500	88.5%	91.8%	0.4	1,841	943	2,280	2.4
186	Barium chloride pump	Y160M$_2$-2/2.2	2.2	3.6	2.0	10	8500	81.0%	86.3%	0.2	1,298	665	664	1.0
191	Pure caustic soda pump	Y132S$_2$-2	5.5	8.5	4.8	10	4500	85.5%	89.5%	0.2	1,119	573	1,661	2.9
192	TXY-pure caustic soda pump	Y132S2-2/7.5	7.5	11	6.2	10	4500	87.0%	90.3%	0.3	1,163	596	2,265	3.8
195	1# slurry pump	Y160M$_2$-2/15	15	25	14.0	10	4500	88.5%	91.8%	0.6	2,556	1,310	2,280	1.7
196	2# slurry pump	Y160M$_2$-2/15	15	25	14.0	10	4500	88.5%	91.8%	0.6	2,556	1,310	2,280	1.7
197	Speed reductor for front reaction tank mixer	YB$_2$-132S-4	5.5	11.6	6.5	10	8500	85.5%	89.5%	0.3	2,883	1,478	1,661	1.1
198	1# booster pump	YP250M-2	55	102	57.1	10	8500	92.6%	94.5%	1.2	10,531	5,397	8,360	1.5
199	Liquor input pump for 1# filter	Y$_3$200L$_1$-2	30	55.2	30.9	10	8500	92.0%	93.5%	0.5	4,577	2,346	4,560	1.9
206	Salt slurry pump	Y$_2$-200L$_1$-2W	30	55.5	31.0	10	4500	92.0%	93.5%	0.5	2,436	1,249	4,560	3.7
207	Pickling pump	Y$_2$-132S$_2$-2	7.5	14.9	8.3	10	4500	87.0%	90.3%	0.4	1,576	808	2,265	2.8
208	Speed reductor for sodium sulfite	YB$_2$-132M-4	7.5	15.4	8.6	10	4500	87.0%	90.3%	0.4	1,629	835	2,265	2.7
210	Speed reductor for FeCl3 makeup tank	Y132M-4	7.5	15.8	8.8	10	4500	87.0%	90.3%	0.4	1,671	856	2,265	2.6

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211	Speed reductor for #1 rear reaction tank	YB_2-132S-4	5.5	8.5	4.8	10	8500	85.5%	89.5%	0.2	2,113	1,083	1,661	1.5
212	1# dechlorinated brine pump	Y_3160M_2-2	15	28.8	16.1	10	4500	89.0%	91.8%	0.6	2,485	1,273	2,280	1.8
213	2# dechlorinated brine pump	Y_3160M_2-2	15	28.8	16.1	10	4500	89.0%	91.8%	0.6	2,485	1,273	2,280	1.8
214	FeCl3 solution pump	Y_3-160M_1-2	15	21.3	11.9	10	4500	89.0%	91.8%	0.4	1,838	942	2,280	2.4
217	Speed reductor for #2 rear reaction tank	YB_2-132S-4	5.5	8.5	4.8	10	8500	85.5%	89.5%	0.2	2,113	1,083	1,661	1.5
219	1# plate-and-frame speed reductor	YDS132	2.2	3.5	2.0	10	4500	81.0%	86.3%	0.1	668	342	664	1.9
220	1# oil pump motor set	YVF80-50-0.75-4	3	5	2.8	10	4500	81.0%	86.3%	0.2	954	489	906	1.9
221	2# plate-and-frame speed reductor	YDS132	2.2	3.5	2.0	10	4500	81.0%	86.3%	0.1	668	342	664	1.9
222	2# oil pump motor set	YVF80-50-0.75-4	3	5	2.8	10	4500	81.0%	86.3%	0.2	954	489	906	1.9
	Calcium Hypochlorite													
1	Slurry Mixer	Y160M-6	7.5	17	9.5	10	4500	87.0%	90.3%	0.4	1,798	921	2,265	2.5
2	#1 Lime Cream Pump	Y160L-2	18.5	35.5	19.9	10	4500	91.0%	93.0%	0.5	2,112	1,082	2,812	2.6
3	#2 Lime Cream Pump	Y160L-2	18.5	35.5	19.9	10	4500	91.0%	93.0%	0.5	2,112	1,082	2,812	2.6
4	#3 Lime Cream Pump	Y160L-2	18.5	35.5	19.9	10	4500	91.0%	93.0%	0.5	2,112	1,082	2,812	2.6
5	#4 Lime Cream Pump	Y160L-2	18.5	35.5	19.9	10	4500	91.0%	93.0%	0.5	2,112	1,082	2,812	2.6
6	#5 Lime Cream Pump	Y160L-2	18.5	35.5	19.9	10	4500	91.0%	93.0%	0.5	2,112	1,082	2,812	2.6
7	#6 Lime Cream Pump	Y160L-2	18.5	35.5	19.9	10	4500	91.0%	93.0%	0.5	2,112	1,082	2,812	2.6
8	Air compressor	Y132-2	7.5	15	8.4	10	4500	87.0%	90.3%	0.4	1,586	813	2,265	2.8
9	#1 Autclave	Y160M-4/L	11	23	12.9	10	4500	87.0%	90.3%	0.5	2,432	1,246	3,322	2.7
10	#2 Autclave	Y160M-4/L	11	22.6	12.6	10	4500	87.0%	90.3%	0.5	2,390	1,225	3,322	2.7
11	#3 Autclave	Y160M-4/L	11	22.6	12.6	10	4500	87.0%	90.3%	0.5	2,390	1,225	3,322	2.7
12	#4 Autclave	Y160M-4/L	11	22.6	12.6	10	4500	87.0%	90.3%	0.5	2,390	1,225	3,322	2.7
13	#5 Autclave	Y160M-4/L	11	22.6	12.6	10	4500	87.0%	90.3%	0.5	2,390	1,225	3,322	2.7
14	#6 Autclave	Y160M-4/L	11	22.6	12.6	10	4500	87.0%	90.3%	0.5	2,390	1,225	3,322	2.7
15	#7 Autclave	Y160M-4/L	11	22.6	12.6	10	4500	87.0%	90.3%	0.5	2,390	1,225	3,322	2.7
16	#8 Autclave	Y160M-4/L	11	22.6	12.6	10	4500	87.0%	90.3%	0.5	2,390	1,225	3,322	2.7
17	#9 Autclave	Y160M-4/L	11	22.6	12.6	10	4500	87.0%	90.3%	0.5	2,390	1,225	3,322	2.7
18	#1 Chlorine Circulating Pump	Y160M-L2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
19	#2 Chlorine Circulating Pump	Y160M-L2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
20	Chlorination Tail Gas Blower	Y200L-4	30	56.8	31.8	10	8500	92.2%	93.5%	0.5	4,073	2,087	4,560	2.2

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21	Circulating Water Pump	Y255M-2	45	84.2	47.1	10	4500	92.3%	94.1%	1.0	4,393	2,251	6,840	3.0
22	#1 Centrifuge	LYM54001-4	45	84.2	47.1	10	4500	92.3%	94.1%	1.0	4,393	2,251	6,840	3.0
23	#2 Centrifuge	LYM54001-4	45	84.2	47.1	10	4500	92.3%	94.1%	1.0	4,393	2,251	6,840	3.0
24	#3 Centrifuge	LYM54001-4	45	84.2	47.1	10	4500	92.3%	94.1%	1.0	4,393	2,251	6,840	3.0
25	#4 Centrifuge	LYM54001-4	45	84.2	47.1	10	4500	92.3%	94.1%	1.0	4,393	2,251	6,840	3.0
26	#5 Centrifuge	LYM54006-1	55	84.2	47.1	10	4500	92.6%	94.5%	1.0	4,602	2,359	8,360	3.5
27	#6 Centrifuge	LYM54006-1	55	84.2	47.1	10	4500	92.6%	94.5%	1.0	4,602	2,359	8,360	3.5
28	#7 Centrifuge	LYM54006-1	55	84.2	47.1	10	4500	92.6%	94.5%	1.0	4,602	2,359	8,360	3.5
29	#8 Centrifuge	LYM54006-1	55	84.2	47.1	10	4500	92.6%	94.5%	1.0	4,602	2,359	8,360	3.5
30	#9 Centrifuge	LYM54006-1	55	84.2	47.1	10	4500	92.6%	94.5%	1.0	4,602	2,359	8,360	3.5
31	#10 Centrifuge	LYM54006-1	55	84.2	47.1	10	4500	92.6%	94.5%	1.0	4,602	2,359	8,360	3.5
32	#1 Wet Powder Elevator	Y1160M-6	7.5	17	9.5	10	4500	87.0%	90.3%	0.4	1,798	921	2,265	2.5
33	#2 Wet Powder Elevator	Y160M-4	11	23	12.9	10	4500	87.0%	90.3%	0.5	2,432	1,246	3,322	2.7
34	Bleaching Liquor Pump	Y160M1-2	11	23	12.9	10	4500	87.0%	90.3%	0.5	2,432	1,246	3,322	2.7
35	Bleaching Liquor Pump	Y2001-2	30	56.9	31.8	10	4500	92.2%	93.5%	0.5	2,160	1,107	4,560	4.1
36	HP Water Pump	Y160L-2	18.5	35.5	19.9	10	4500	91.0%	93.0%	0.5	2,112	1,082	2,812	2.6
37	#1 Centrifugal Tail Gas Blower	Y225S-4	37	69.8	39.0	10	8500	92.2%	93.5%	0.6	5,005	2,565	5,624	2.2
38	#2 Centrifugal Tail Gas Blower	Y160L-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
39	#1 Centrifugal Circulating Pump	Y225-6	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
40	#1 Pelletizer	Y225-6	33	60	33.6	10	4500	92.2%	93.5%	0.5	2,278	1,167	5,016	4.3
41	#2 Pelletizer	Y160-2	33	60	33.6	10	4500	92.2%	93.5%	0.5	2,278	1,167	5,016	4.3
42	#1 Drying Tail Gas Blower	Y160-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
43	#2 Drying Tail Gas Blower	Y160-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
44	#3 Drying Tail Gas Blower	Y160-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
45	#4 Drying Tail Gas Blower	Y160-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
46	#5 Drying Tail Gas Blower	Y225S-4	37	69.8	39.0	10	8500	92.2%	93.5%	0.6	5,005	2,565	5,624	2.2
47	#6 Drying Tail Gas Blower	Y225S-4	37	69.8	39.0	10	8500	92.2%	93.5%	0.6	5,005	2,565	5,624	2.2
48	Packaging Tail Gas Blower	Y160-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
49	#7 Drying Tail Gas Blower	Y160-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
50	Wet Powder Tail Gas Blower	Y160M2-2	15	29.4	16.4	10	4500	88.5%	91.8%	0.7	3,006	1,541	2,280	1.5
51	#1 Air Blower	Y132S1-2	7.5	14.3	8.0	10	8500	87.0%	90.3%	0.3	2,856	1,464	2,265	1.5
52	#3 Air Blower	Y132S1-2	7.5	14.3	8.0	10	8500	87.0%	90.3%	0.3	2,856	1,464	2,265	1.5
53	#5 Air Blower	Y160L-4	15	30.3	17.0	10	8500	88.5%	91.8%	0.7	5,852	2,999	2,280	0.8
54	#6 Air Blower	Y160L-4	15	30.3	17.0	10	8500	88.5%	91.8%	0.7	5,852	2,999	2,280	0.8
55	#7 Air Blower	Y160L-4	7.5	14.3	8.0	10	8500	87.0%	90.3%	0.3	2,856	1,464	2,265	1.5
56	#1 Drying Circulating Pump	Y160L-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
57	#2 Drying Circulating Pump	Y160L-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
58	#4 Drying Circulating Pump	Y160L-2	18.5	35.5	19.9	10	8500	91.0%	93.0%	0.5	3,989	2,045	2,812	1.4
59	#1 Pulverizer	Y180M-2	22	41.5	23.2	10	8500	91.5%	93.2%	0.5	3,934	2,016	3,344	1.7
60	#2 Puverizer	Y10DL-4	55	102.5	57.3	10	8500	92.6%	94.5%	1.2	10,583	5,424	8,360	1.5
61	#1 Stocking Bleaching Liquor Pump	Y160M2-2	15	29.4	16.4	10	4500	88.5%	91.8%	0.7	3,006	1,541	2,280	1.5
62	#2 Stocking Bleaching Liquor Pump	Y160L-2	18.5	35.5	19.9	10	4500	91.0%	93.0%	0.5	2,112	1,082	2,812	2.6
	Utility Refrigeration 2													
4	#1 Brine Pump	Y315-4	110	117	65.5	10	8500	93.5%	95.4%	1.4	11,851	6,074	16,720	2.8
6	#1 Brine Pump	Y315-4	110	105	58.7	10	8500	93.5%	95.4%	1.3	10,635	5,451	16,720	3.1
7	#1 Brine Pump	Y315-4	110	118	66.0	10	8500	93.5%	95.4%	1.4	11,952	6,125	16,720	2.7
8	#1 Brine Pump	Y315-4	110	123	68.8	10	8500	93.5%	95.4%	1.5	12,459	6,385	16,720	2.6
9	#1 Brine Pump	Y315-4	110	143	80.0	10	8500	93.5%	95.4%	1.7	14,484	7,423	16,720	2.3
11	#1 Air Compressor	Y315M2-8	132	190	106.3	10	8500	94.0%	95.8%	2.1	18,059	9,255	20,064	2.2
12	#2 Air Compressor	Y315M2-4	250	380	212.6	10	8500	94.4%	95.8%	3.3	27,973	14,336	38,000	2.7
13	#3 Air Compressor	Y315M2-4	250	380	212.6	10	8500	94.4%	95.8%	3.3	27,973	14,336	38,000	2.7
14	#4 Air Compressor	Y315M2-4	250	380	212.6	10	8500	94.4%	95.8%	3.3	27,973	14,336	38,000	2.7
15	#5 Air Compressor	YP280M-4	132	220	123.1	10	8500	94.0%	95.8%	2.5	20,911	10,717	20,064	1.9
16	#6 Air Compressor	YP280M-4	132	220	123.1	10	8500	94.0%	95.8%	2.5	20,911	10,717	20,064	1.9
17	#7 Air Compressor	YP280M-4	132	220	123.1	10	8500	94.0%	95.8%	2.5	20,911	10,717	20,064	1.9
18	#8 Air Compressor	YP280M-4	132	220	123.1	10	8500	94.0%	95.8%	2.5	20,911	10,717	20,064	1.9
19	#9 Air Compressor	YP280M-4	132	220	123.1	10	8500	94.0%	95.8%	2.5	20,911	10,717	20,064	1.9
20	#1 Circulating Pump	Y315L1-4	160	290	162.2	10	8500	94.0%	95.8%	3.2	27,564	14,127	24,320	1.7
22	#3 Circulating Pump	Y315L1-4	160	260	145.5	10	8500	94.0%	95.8%	2.9	24,713	12,665	24,320	1.9
24	#5 Circulating Pump	Y315L1-4	160	250	139.9	10	8500	94.0%	95.8%	2.8	23,762	12,178	24,320	2.0
25	#1 Cooling Tower	ID280S-4	75	87	48.7	10	8500	92.7%	94.7%	1.1	9,425	4,830	11,400	2.4

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26	#2 Cooling Tower	ID280S-4	75	122	68.3	10	8500	92.7%	94.7%	1.6	13,217	6,774	11,400	1.7
	Utility Refrigeration 1													
1	#1 Air Compressor	Y315M-4	132	200	111.9	10	2800	94.0%	95.8%	2.2	6,262	3,209	20,064	6.3
2	#2 Air Compressor	JY2-250M-6	65	60	33.6	10	2800	91.5%	94.5%	1.2	3,261	1,671	9,880	5.9
3	#3 Air Compressor	Y280S-6	75	60	33.6	10	2800	92.7%	94.7%	0.8	2,141	1,097	11,400	10.4
4	#3 Air Compressor	Y315M-4	132	200	111.9	10	890	94.0%	95.8%	2.2	1,990	1,020	20,064	19.7
5	#1 Ammonia Chiller	J03-250S6	55	70	39.2	10	890	91.5%	94.5%	1.4	1,209	620	8,360	13.5
6	#2 Ammonia Chiller	Y315M1-6	90	150	83.9	10	890	93.5%	95.0%	1.4	1,261	646	13,680	21.2
7	#3 Ammonia Chiller	Y315M1-6	90	150	83.9	10	890	93.5%	95.0%	1.4	1,261	646	13,680	21.2
8	#4 Ammonia Chiller	JS116-6	95	150	83.9	10	890	92.0%	95.0%	2.9	2,564	1,314	14,440	11.0
9	#5 Ammonia Chiller	JS116-6	95	150	83.9	10	890	92.0%	95.0%	2.9	2,564	1,314	14,440	11.0
10	#6 Ammonia Chiller	JS116-6	95	150	83.9	10	890	92.0%	95.0%	2.9	2,564	1,314	14,440	11.0
11	#7 Ammonia Chiller	J03-250S6	55	70	39.2	10	890	91.5%	94.5%	1.4	1,209	620	8,360	13.5
12	#1 Screw Chiller	JK2132-2	220	420	235.0	10	890	92.0%	95.8%	10.1	9,016	4,621	33,440	7.2
13	#2 Screw Chiller	JK2132-2	220	420	235.0	10	890	92.0%	95.8%	10.1	9,016	4,621	33,440	7.2
14	#1 Centrifugal Pump	Y250M-4	55	70	39.2	10	8500	92.6%	94.5%	0.9	7,227	3,704	8,360	2.3
15	#3 Centrifugal Pump	Y250M-4	55	70	39.2	10	8500	92.6%	94.5%	0.9	7,227	3,704	8,360	2.3
16	#4 Centrifugal Pump	Y225S-4	37	50	28.0	10	8500	92.2%	93.5%	0.4	3,585	1,838	5,624	3.1
17	#5 Centrifugal Pump	Y200L2-2	37	55	30.8	10	8500	92.2%	93.5%	0.5	3,944	2,021	5,624	2.8
18	#6 Centrifugal Pump	Y225S-4	37	55	30.8	10	8500	92.2%	93.5%	0.5	3,944	2,021	5,624	2.8
19	#7 Centrifugal Pump	Y225S-4	37	55	30.8	10	8500	92.2%	93.5%	0.5	3,944	2,021	5,624	2.8
20	#8 Centrifugal Pump	Y2315M-4W	132	200	111.9	10	8500	94.0%	95.8%	2.2	19,010	9,743	20,064	2.1
21	#9 Centrifugal Pump	Y2315M-4W	220	320	179.0	10	8500	94.2%	95.8%	3.2	26,979	13,827	33,440	2.4
22	#10 Centrifugal Pump	Y2315M-4W	220	320	179.0	10	8500	94.2%	95.8%	3.2	26,979	13,827	33,440	2.4
23	#1 Air Blower	Y160L-4-V1	15	17	9.5	10	8500	88.5%	91.8%	0.4	3,284	1,683	2,280	1.4
24	#2 Air Blower	Y160L-4-V1	15	17	9.5	10	8500	88.5%	91.8%	0.4	3,284	1,683	2,280	1.4
25	#3 Air Blower	Y200L2-6	22	28	15.7	10	8500	91.5%	93.2%	0.3	2,654	1,360	3,344	2.5
26	#4 Air Blower	Y200L2-6	22	28	15.7	10	8500	91.5%	93.2%	0.3	2,654	1,360	3,344	2.5
27	#5 Air Blower	HM2-180L-4	22	28	15.7	10	8500	91.2%	93.2%	0.4	3,133	1,606	3,344	2.1
28	#6 Air Blower	Y2-200L2-2	22	28	15.7	10	8500	91.2%	93.2%	0.4	3,133	1,606	3,344	2.1
29	Pump #1 to Brine Tank 1	Y225M-4	37	55	30.8	10	8500	92.2%	93.5%	0.5	3,944	2,021	5,624	2.8
30	Pump #1 to Brine Tank 2	Y225M-4	45	70	39.2	10	8500	92.3%	94.1%	0.8	6,898	3,535	6,840	1.9
31	Pump #2 to Brine Tank 2	Y200L1-4	45	70	39.2	10	8500	92.3%	94.1%	0.8	6,898	3,535	6,840	1.9
32	Pump #1 to Brine Tank 3	Y200L1-2	30	35	19.6	10	8500	92.2%	93.5%	0.3	2,510	1,286	4,560	3.5
33	Pump #2 to Brine Tank 3	Y200L1-2	30	35	19.6	10	8500	92.2%	93.5%	0.3	2,510	1,286	4,560	3.5

Motor #	Equipment	Existing Motor Model Number (1)	Rated kW (2)	Actual Current Amps (3)	Actual kW (4)	Years in Service (5)	Annual Operating Time (Hour) (6)	Existing Motor Efficiency % (7)	Proposed Motor Efficiency % (8)	Demand Savings kW (9)	Energy Savings kWh/yr (10)	Cost Savings RMB (11)	Measure Cost RMB (12)	Simple Payback Years (13)
34	Pump #1 to Brine Tank 4	Y200L1-2	37	35	19.6	10	8500	92.2%	93.5%	0.3	2,510	1,286	5,624	4.4
35	Pump #2 to Brine Tank 4	Y2-200L2-4W	37	35	19.6	10	8500	92.0%	93.5%	0.3	2,902	1,487	5,624	3.8
36	#1 Screw water supply pump	Y2-315S-4W	110	180	100.7	10	8500	94.5%	95.4%	1.0	8,545	4,379	16,720	3.8
37	#2 Screw water supply pump	Y2-315S-4W	110	180	100.7	10	8500	94.5%	95.4%	1.0	8,545	4,379	16,720	3.8
38	#1 Charging Pump for Ammonia	Y225S-4	37	60	33.6	10	8500	92.0%	93.5%	0.6	4,975	2,550	5,624	2.2
39	#2 Charging Pump for Ammonia	Y2-250M-4W	55	75	42.0	10	8500	93.2%	94.5%	0.6	5,264	2,698	8,360	3.1
40	#1 Water Supply Pump	Y280S-4	75	90	50.3	10	8500	92.7%	94.7%	1.1	9,750	4,997	11,400	2.3
41	#2 Water Supply Pump	Y280S-4	75	90	50.3	10	8500	92.7%	94.7%	1.1	9,750	4,997	11,400	2.3
42	#1 Cooling Water Pump	Y280S-4	75	120	67.1	10	8500	92.7%	94.7%	1.5	13,000	6,663	11,400	1.7
43	#2 Cooling Water Pump	Y280S-4	75	120	67.1	10	8500	92.7%	94.7%	1.5	13,000	6,663	11,400	1.7
44	#3 Cooling Water Pump	Y280S-4	75	120	67.1	10	8500	92.7%	94.7%	1.5	13,000	6,663	11,400	1.7
					Avg:	**10.6**			**Total:**	**324.2**	**2,001,288**	**1,025,660**	**2,428,292**	**2.4**

Notes:

1. Motor Model number provided by owner's representative.
2. Motor kW rating.
3. Motor operating amperage as measured by enterprize.
4. Actual kW load on motor = (380 volts) x (Amperage) x (Power Factor) x (1.732) / (1000. watts/kW)
5. Age of motor in years.
6. Annual operating hours. Enterprize reported either "continuous", or "Intermittent". "Continuous" is assumed to be 8,500 hours per year. "Intermittent" is assumed to be 4,500 hours per year unless more precise data was provided.
7. Existing motor efficiency based on Facility provided model numbers.
8. Proposed motor efficiency assuming YX-series motor replacements.
9. Demand Savings kW = (kW draw) x [(1/Existing eff.) - (1/Proposed eff.)].
10. Annual Energy Savings kWh = (Annual hours of operation) x (Demand Savings).
11. Measure cost is assumed to be 300 rmb/kW for motors under 15 kW, and 130 rmb for motors 15 kW and above.
12. Annual Cost Savings RMB = (Annual energy savings) x (0.5125 rmb/kWh).
13. Simple Payback Years = (motor replacement cost) / (Annual cost savings).

8.3 VARIABLE FREQUENCY DRIVE MEASURES

Motor #	Equipment	Rated kW (2)	Actual kW (3)	Years in Service (4)	Annual Operating Time (Hour) (5)	Assumed Average Motor Speed w/ VFD (6)	Demand Savings kW (7)	Energy Savings kWh/yr (8)	Cost Savings RMB (9)	Measure Cost RMB (10)	Simple Payback Years (11)
	ADC Oxidizing Fluid										
10	Sodium hypochlorite circulating pump	30	30.8	10	8500	80.0%	15.0	127,630	65,410	30,000	0.5
11	Sodium hypochlorite circulating pump	30	30.8	10	4500	80.0%	15.0	67,569	34,629	30,000	0.9
12	Sodium hypochlorite circulating pump	30	30.8	10	4500	80.0%	15.0	67,569	34,629	30,000	0.9
	ADC Recycling						0.0			-	
12	3# Mixing & cooling pump	45	32.4	10	8500	80.0%	15.8	134,591	68,978	45,000	0.7
13	2# Mixing & cooling pump	45	32.4	10	8500	80.0%	15.8	134,591	68,978	45,000	0.7
14	1# Mixing & cooling pump	55	55.9	10	8500	80.0%	27.3	232,054	118,928	55,000	0.5
	ADC Condensation									-	
28	1# circulating pump	11	11.2	10	4500	80.0%	5.5	24,570	12,592	11,000	0.9
29	2# circulating pump	11	11.2	10	4500	80.0%	5.5	24,570	12,592	11,000	0.9
30	1# Tail gas blower	7.5	5.6	10	4500	80.0%	2.7	12,285	6,296	7,500	1.2
31	2# Tail gas blower	7.5	5.6	10	4500	80.0%	2.7	12,285	6,296	7,500	1.2
32	3# Tail gas blower	7.5	5.6	10	4500	80.0%	2.7	12,285	6,296	7,500	1.2
33	4# Tail gas blower	7.5	5.6	10	4500	80.0%	2.7	12,285	6,296	7,500	1.2
	ADC Scrubbing									-	
6	1# Condensating fluid pump	11	11.2	10	4500	80.0%	5.5	24,570	12,592	11,000	0.9
7	2# Condensating fluid pump	11	11.2	10	4500	80.0%	5.5	24,570	12,592	11,000	0.9
8	3# Condensating fluid pump	11	11.2	10	4500	80.0%	5.5	24,570	12,592	11,000	0.9
9	4# Condensating fluid pump	11	11.2	10	4500	80.0%	5.5	24,570	12,592	11,000	0.9
10	5# Condensating fluid pump	11	11.2	10	4500	80.0%	5.5	24,570	12,592	11,000	0.9
11	6# Condensating fluid pump	11	11.2	10	4500	80.0%	5.5	24,570	12,592	11,000	0.9
	ADC Condensation 2									-	
19	7# Condensating fluid pump	15	16.8	10	4500	80.0%	8.2	36,856	18,889	15,000	0.8
20	8# Condensating fluid pump	15	16.8	10	4500	80.0%	8.2	36,856	18,889	15,000	0.8
21	9# Condensating fluid pump	15	16.8	10	4500	80.0%	8.2	36,856	18,889	15,000	0.8

Motor #	Equipment	Rated kW (2)	Actual kW (3)	Years in Service (4)	Annual Operating Time (Hour) (5)	Assumed Average Motor Speed w/ VFD (6)	Demand Savings kW (7)	Energy Savings kWh/yr (8)	Cost Savings RMB (9)	Measure Cost RMB (10)	Simple Payback Years (11)
22	10# Condensating fluid pump	15	16.8	10	4500	80.0%	8.2	36,856	18,889	15,000	0.8
29	3# Water circulating pump	15	16.8	10	8500	80.0%	8.2	69,616	35,678	15,000	0.4
30	4# Water circulating pump	15	16.8	10	8500	80.0%	8.2	69,616	35,678	15,000	0.4
31	1# Acidcirculating pump	7.5	6.2	10	8500	80.0%	3.0	25,526	13,082	7,500	0.6
32	2# Acidcirculating pump	7.5	6.2	10	8500	80.0%	3.0	25,526	13,082	7,500	0.6
34	5# Tail gas blower	7.5	8.4	10	8500	80.0%	4.1	34,808	17,839	7,500	0.4
35	6# Tail gas blower	7.5	8.4	10	8500	80.0%	4.1	34,808	17,839	7,500	0.4
36	7# Tail gas blower	7.5	8.4	10	8500	80.0%	4.1	34,808	17,839	7,500	0.4
37	8# Tail gas blower	7.5	8.4	10	8500	80.0%	4.1	34,808	17,839	7,500	0.4
38	Burdening air blower	7.5	8.4	10	8500	80.0%	4.1	34,808	17,839	7,500	0.4
	ADC Oxidization									-	
13	1# Alkali circulating pump	7.5	4.8	10	4500	80.0%	2.3	10,442	5,352	7,500	1.4
14	2# Alkali circulating pump	7.5	4.5	10	4500	80.0%	2.2	9,828	5,037	7,500	1.5
15	3# Alkali circulating pump	11	7.0	10	4500	80.0%	3.4	15,357	7,870	11,000	1.4
16	4# Alkali circulating pump	11	7.3	10	4500	80.0%	3.5	15,971	8,185	11,000	1.3
17	5# Alkali circulating pump	11	6.7	10	4500	80.0%	3.3	14,742	7,555	11,000	1.5
18	6# Alkali circulating pump	11	7.0	10	4500	80.0%	3.4	15,357	7,870	11,000	1.4
	ADC Drying 1									-	
2	Air blower	37	23.5	10	8500	80.0%	11.5	97,463	49,950	37,000	0.7
31	1# Crushing air flower	7.5	5.6	10	4500	80.0%	2.7	12,285	6,296	7,500	1.2
32	2# Crushing air flower	7.5	6.2	10	4500	80.0%	3.0	13,514	6,926	7,500	1.1
33	3# Crushing air flower	7.5	6.2	10	4500	80.0%	3.0	13,514	6,926	7,500	1.1
34	4# Crushing air flower	7.5	5.6	10	4500	80.0%	2.7	12,285	6,296	7,500	1.2
35	5# Crushing air flower	7.5	5.6	10	4500	80.0%	2.7	12,285	6,296	7,500	1.2
36	6# Crushing air flower	7.5	5.0	10	4500	80.0%	2.5	11,057	5,667	7,500	1.3
37	7# Crushing air flower	7.5	6.2	10	4500	80.0%	3.0	13,514	6,926	7,500	1.1
38	8# Crushing air flower	7.5	6.7	10	4500	80.0%	3.3	14,742	7,555	7,500	1.0
	ADC Drying 2									-	
6	ID fan	30	16.8	10	4500	80.0%	8.2	36,856	18,889	30,000	1.6
	ADC Fresh Water Treatment									-	
2	Circulation cooling pump B	37	23.5	10	4500	80.0%	11.5	51,598	26,444	37,000	1.4
	ADC Used Water Treatment									-	
7	Neutralization circulating pump	18.5	19.9	10	8500	80.0%	9.7	82,379	42,219	18,500	0.4
	Chlorine Alkali Evaporating									-	

Motor #	Equipment	Rated kW (2)	Actual kW (3)	Years in Service (4)	Annual Operating Time (Hour) (5)	Assumed Average Motor Speed w/ VFD (6)	Demand Savings kW (7)	Energy Savings kWh/yr (8)	Cost Savings RMB (9)	Measure Cost RMB (10)	Simple Payback Years (11)
2	1# water dispenser pump	55	53.1	10	8500	80.0%	25.9	220,451	112,981	55,000	0.5
3	Hot water pump	37	29.1	10	8500	80.0%	14.2	120,668	61,842	37,000	0.6
10	1# air blower for cooling tower	18.5	15.7	10	8500	80.0%	7.6	64,975	33,300	18,500	0.6
11	2# air blower for cooling tower	18.5	15.7	10	8500	80.0%	7.6	64,975	33,300	18,500	0.6
12	Air blower for 3# cooling tower	11	8.4	10	8500	80.0%	4.1	34,808	17,839	11,000	0.6
18	2# water dispersing pump	45	39.2	10	8500	80.0%	19.1	162,438	83,249	45,000	0.5
20	Circulating pump	15	14.5	10	4500	80.0%	7.1	31,942	16,370	15,000	0.9
22	1# cooling pump	18.5	15.7	10	4500	80.0%	7.6	34,399	17,629	18,500	1.0
23	2# cooling pump	18.5	15.7	10	4500	80.0%	7.6	34,399	17,629	18,500	1.0
	Chlorine Alkali Electrolysis									-	
95	Brine recycling pump	11	9.0	10	4500	80.0%	4.4	19,656	10,074	11,000	1.1
98	Weak brine pump B	15	15.1	10	8500	80.0%	7.4	62,655	32,110	15,000	0.5
99	Filtered brine pump B	30	28.5	10	8500	80.0%	13.9	118,348	60,653	30,000	0.5
	Chlorine Alkali Submerging									-	
129	1# Roots blower	11	11.2	10	8500	80.0%	5.5	46,411	23,786	11,000	0.5
130	2# Roots blower	11	11.2	10	8500	80.0%	5.5	46,411	23,786	11,000	0.5
	Chlorine Alkali Drying									-	
144	3# Roots blower	30	28.0	10	8500	80.0%	13.7	116,027	59,464	30,000	0.5
157	Tail gas tower ciruclating pump A	15	12.9	10	8500	80.0%	6.3	53,372	27,353	15,000	0.5
163	Titanium air blower B	5.5	5.0	10	8500	80.0%	2.5	20,885	10,703	5,500	0.5
	Chlorine Alkali H2 Compression									-	
177	Water pump	7.5	6.7	10	4500	80.0%	3.3	14,742	7,555	7,500	1.0
	Chlorine Salt Dissolving									-	
180	Raw brine pump	30	26.9	10	8500	80.0%	13.1	111,386	57,085	30,000	0.5
181	Clarified brine pump	15	15.7	10	8500	80.0%	7.6	64,975	33,300	15,000	0.5
182	Water preparation pump	15	15.7	10	8500	80.0%	7.6	64,975	33,300	15,000	0.5
184	1# clarified brine pump	22	21.3	10	8500	80.0%	10.4	88,181	45,193	22,000	0.5
212	1# dechlorinated brine pump	15	16.1	10	4500	80.0%	7.9	35,381	18,133	15,000	0.8
213	2# dechlorinated brine pump	15	16.1	10	4500	80.0%	7.9	35,381	18,133	15,000	0.8
	Calcium Hypochlorite									-	
20	Chlorination Tail Gas Blower	30	31.8	10	8500	80.0%	15.5	131,807	67,551	30,000	0.4
21	Circulating Water Pump	45	47.1	10	4500	80.0%	23.0	103,442	53,014	45,000	0.8
36	HP Water Pump	18.5	19.9	10	4500	80.0%	9.7	43,613	22,351	18,500	0.8
37	#1 Centrifugal Tail Gas Blower	37	39.0	10	8500	80.0%	19.1	161,974	83,012	37,000	0.4

Motor #	Equipment	Rated kW (2)	Actual kW (3)	Years in Service (4)	Annual Operating Time (Hour) (5)	Assumed Average Motor Speed w/ VFD (6)	Demand Savings kW (7)	Energy Savings kWh/yr (8)	Cost Savings RMB (9)	Measure Cost RMB (10)	Simple Payback Years (11)
38	#2 Centrifugal Tail Gas Blower	18.5	19.9	10	8500	80.0%	9.7	82,379	42,219	18,500	0.4
39	#1 Centrifugal Circulating Pump	18.5	19.9	10	8500	80.0%	9.7	82,379	42,219	18,500	0.4
42	#1 Drying Tail Gas Blower	18.5	19.9	10	8500	80.0%	9.7	82,379	42,219	18,500	0.4
43	#2 Drying Tail Gas Blower	18.5	19.9	10	8500	80.0%	9.7	82,379	42,219	18,500	0.4
44	#3 Drying Tail Gas Blower	18.5	19.9	10	8500	80.0%	9.7	82,379	42,219	18,500	0.4
45	#4 Drying Tail Gas Blower	18.5	19.9	10	8500	80.0%	9.7	82,379	42,219	18,500	0.4
46	#5 Drying Tail Gas Blower	37	39.0	10	8500	80.0%	19.1	161,974	83,012	37,000	0.4
47	#6 Drying Tail Gas Blower	37	39.0	10	8500	80.0%	19.1	161,974	83,012	37,000	0.4
48	Packaging Tail Gas Blower	18.5	19.9	10	8500	80.0%	9.7	82,379	42,219	18,500	0.4
49	#7 Drying Tail Gas Blower	18.5	19.9	10	8500	80.0%	9.7	82,379	42,219	18,500	0.4
50	Wet Powder Tail Gas Blower	15	16.4	10	4500	80.0%	8.0	36,119	18,511	15,000	0.8
51	#1 Air Blower	7.5	8.0	10	8500	80.0%	3.9	33,184	17,007	7,500	0.4
52	#3 Air Blower	7.5	8.0	10	8500	80.0%	3.9	33,184	17,007	7,500	0.4
53	#5 Air Blower	15	17.0	10	8500	80.0%	8.3	70,312	36,035	15,000	0.4
54	#6 Air Blower	15	17.0	10	8500	80.0%	8.3	70,312	36,035	15,000	0.4
55	#7 Air Blower	7.5	8.0	10	8500	80.0%	3.9	33,184	17,007	7,500	0.4
	Utility Refrigeration 2									-	
4	#1 Brine Pump	110	65.5	10	8500	80.0%	31.9	271,503	139,145	110,000	0.8
6	#1 Brine Pump	110	58.7	10	8500	80.0%	28.7	243,657	124,874	110,000	0.9
7	#1 Brine Pump	110	66.0	10	8500	80.0%	32.2	273,824	140,335	110,000	0.8
8	#1 Brine Pump	110	68.8	10	8500	80.0%	33.6	285,426	146,281	110,000	0.8
9	#1 Brine Pump	110	80.0	10	8500	80.0%	39.0	331,837	170,067	110,000	0.6
20	#1 Circulating Pump	160	162.2	10	8500	80.0%	79.2	672,957	344,890	160,000	0.5
22	#3 Circulating Pump	160	145.5	10	8500	80.0%	71.0	603,341	309,212	160,000	0.5
24	#5 Circulating Pump	160	139.9	10	8500	80.0%	68.3	580,135	297,319	160,000	0.5
25	#1 Cooling Tower	75	48.7	10	8500	80.0%	23.8	201,887	103,467	75,000	0.7
26	#2 Cooling Tower	75	68.3	10	8500	80.0%	33.3	283,106	145,092	75,000	0.5
	Utility Refrigeration 1									-	
14	#1 Centrifugal Pump	55	39.2	10	8500	80.0%	19.1	162,438	83,249	55,000	0.7
15	#3 Centrifugal Pump	55	39.2	10	8500	80.0%	19.1	162,438	83,249	55,000	0.7
16	#4 Centrifugal Pump	37	28.0	10	8500	80.0%	13.7	116,027	59,464	37,000	0.6
17	#5 Centrifugal Pump	37	30.8	10	8500	80.0%	15.0	127,630	65,410	37,000	0.6
18	#6 Centrifugal Pump	37	30.8	10	8500	80.0%	15.0	127,630	65,410	37,000	0.6
19	#7 Centrifugal Pump	37	30.8	10	8500	80.0%	15.0	127,630	65,410	37,000	0.6

Motor #	Equipment	Rated kW (2)	Actual kW (3)	Years in Service (4)	Annual Operating Time (Hour) (5)	Assumed Average Motor Speed w/ VFD (6)	Demand Savings kW (7)	Energy Savings kWh/yr (8)	Cost Savings RMB (9)	Measure Cost RMB (10)	Simple Payback Years (11)
20	#8 Centrifugal Pump	132	111.9	10	8500	80.0%	54.6	464,108	237,855	132,000	0.6
21	#9 Centrifugal Pump	220	179.0	10	8500	80.0%	87.4	742,573	380,569	220,000	0.6
22	#10 Centrifugal Pump	220	179.0	10	8500	80.0%	87.4	742,573	380,569	220,000	0.6
23	#1 Air Blower	15	9.5	10	8500	80.0%	4.6	39,449	20,218	15,000	0.7
24	#2 Air Blower	15	9.5	10	8500	80.0%	4.6	39,449	20,218	15,000	0.7
26	#4 Air Blower	22	15.7	10	8500	80.0%	7.6	64,975	33,300	22,000	0.7
27	#5 Air Blower	22	15.7	10	8500	80.0%	7.6	64,975	33,300	22,000	0.7
28	#6 Air Blower	22	15.7	10	8500	80.0%	7.6	64,975	33,300	22,000	0.7
29	Pump #1 to Brine Tank 1	37	30.8	10	8500	80.0%	15.0	127,630	65,410	37,000	0.6
30	Pump #1 to Brine Tank 2	45	39.2	10	8500	80.0%	19.1	162,438	83,249	45,000	0.5
31	Pump #2 to Brine Tank 2	45	39.2	10	8500	80.0%	19.1	162,438	83,249	45,000	0.5
32	Pump #1 to Brine Tank 3	30	19.6	10	8500	80.0%	9.6	81,219	41,625	30,000	0.7
33	Pump #2 to Brine Tank 3	30	19.6	10	8500	80.0%	9.6	81,219	41,625	30,000	0.7
34	Pump #1 to Brine Tank 4	37	19.6	10	8500	80.0%	9.6	81,219	41,625	37,000	0.9
35	Pump #2 to Brine Tank 4	37	19.6	10	8500	80.0%	9.6	81,219	41,625	37,000	0.9
36	#1 Screw water supply pump	110	100.7	10	8500	80.0%	49.1	417,697	214,070	110,000	0.5
37	#2 Screw water supply pump	110	100.7	10	8500	80.0%	49.1	417,697	214,070	110,000	0.5
40	#1 Water Supply Pump	75	50.3	10	8500	80.0%	24.6	208,849	107,035	75,000	0.7
41	#2 Water Supply Pump	75	50.3	10	8500	80.0%	24.6	208,849	107,035	75,000	0.7
42	#1 Cooling Water Pump	75	67.1	10	8500	80.0%	32.8	278,465	142,713	75,000	0.5
43	#2 Cooling Water Pump	75	67.1	10	8500	80.0%	32.8	278,465	142,713	75,000	0.5
44	#3 Cooling Water Pump	75	67.1	10	8500	80.0%	32.8	278,465	142,713	75,000	0.5
	Totals:	**4604**					**1889.6**	**15,003,004**	**7,689,040**	**4,604,000**	**0.6**

Notes:

1. A number of assumptions were made regarding systems that could be slowed due to either changes in production or seasonal changes in temperature. The owner will have to verify that installing a drive on a given motor will not compromise production capabilities.
2. Motor kW rating.
3. Actual kW load on motor = (380 volts) x (Amperage) x (Power Factor) x (1.732) / (1000. watts/kW)
4. Age of motor in years.

5. Annual operating hours. Enterprize reported either "continuous", or "Intermittent". "Continuous" is assumed to be 8,500 hours per year. "Intermittent" is assumed to be 4,500 hours per year unless more precise data was provided.
6. Estimated average load based on seasonal variation.
7. Demand Savings kW = (calculated load) x (1-(Average load Percent ^3)).
8. Annual Energy Savings kWh = (Annual hours of operation) x (Demand Savings).
9. Annual Cost Savings RMB = (Annual energy savings) x (0.5125 rmb/kWh).
14. Measure Cost RMB = (Installed kW motor) x (1000 rmb/kW), 850 rmb for the drive, 150 rmb to install.
13. Simple Payback Years = (Installed VFD cost) / (Annual cost savings).

8.4 Energy Savings Analysis for V-belt Driven Motors

Motor #	Equipment	Rated kW (2)	Actual kW (3)	Years in Service (4)	Annual Operating Time (Hour) (5)	Demand Savings kW (6)	Energy Savings kWh/yr (7)	Cost Savings RMB (8)	Measure Cost RMB (9)	Simple Payback Years (10)
	ADC Condensation 2								-	
34	5# Tail gas blower	7.5	4.3	10	8500	0.3	2,432	1,247	3,878	3.1
35	6# Tail gas blower	7.5	4.3	10	8500	0.3	2,432	1,247	3,878	3.1
36	7# Tail gas blower	7.5	4.3	10	8500	0.3	2,432	1,247	3,878	3.1
37	8# Tail gas blower	7.5	4.3	10	8500	0.3	2,432	1,247	3,878	3.1
38	Burdening air blower	7.5	4.3	10	8500	0.3	2,432	1,247	3,878	3.1
	ADC Drying 1								-	
2	Air blower	37	12.0	10	8500	0.8	6,788	3,479	19,129	5.5
8	1# Dust collector blower	11	6.7	10	8500	0.4	3,797	1,946	5,687	2.9
11	Dust collector blower	11	7.8	10	8500	0.5	4,250	2,178	5,687	2.6
25	1# Dust collector blower	11	6.7	10	8500	0.4	3,797	1,946	5,687	2.9
26	2# Dust collector blower	11	7.3	10	8500	0.5	4,114	2,108	5,687	2.7
	Chlorine Alkali Evaporating								-	
10	1# air blower for cooling tower	18.5	8.0	10	8500	0.5	4,525	2,319	9,565	4.1
11	2# air blower for cooling tower	18.5	8.0	10	8500	0.5	4,525	2,319	9,565	4.1
12	Air blower for 3# cooling tower	11	4.3	10	8500	0.3	2,432	1,247	5,687	4.6
31	Vacuum pump	45	36.4	10	4500	2.4	10,890	5,581	23,265	4.2
	Chlorine Alkali Liquid Cooling								-	
85	1# compressor	75	78.9	12	8500	5.3	44,651	22,884	38,775	1.7
86	3# LP compressor	75	78.9	16	8500	5.3	44,651	22,884	38,775	1.7
87	3# HP compressor	55	58.2	12	8500	3.9	32,943	16,883	28,435	1.7
88	4# LP compressor	75	78.9	16	8500	5.3	44,651	22,884	38,775	1.7
89	4# HP compressor	55	58.2	12	8500	3.9	32,943	16,883	28,435	1.7
	Chlorine Alkali Submerging								-	
129	1# Roots blower	11	5.7	10	8500	0.4	3,224	1,652	5,687	3.4
130	2# Roots blower	11	5.7	10	8500	0.4	3,224	1,652	5,687	3.4
132	Air compressor	22	22.9	10	4500	1.5	6,869	3,520	11,374	3.2
	Chlorine Alkali Drying					0.0			-	
144	3# Roots blower	30	14.3	10	8500	1.0	8,089	4,146	15,510	3.7
163	Titanium air blower B	5.5	2.6	10	8500	0.2	1,471	754	2,844	3.8
	Chlorine Alkali Packaging Test								-	

Motor #	Equipment	Rated kW (2)	Actual kW (3)	Years in Service (4)	Annual Operating Time (Hour) (5)	Demand Savings kW (6)	Energy Savings kWh/yr (7)	Cost Savings RMB (8)	Measure Cost RMB (9)	Simple Payback Years (10)
171	Air compressor	11	10.1	10	4500	0.7	3,016	1,545	5,687	3.7
	Chlorine Alkali H2 Compression								-	
173	1# chlorine compressor	45	43.6	10	4500	2.9	13,068	6,697	23,265	3.5
174	2# chlorine compressor	75	53.1	2	4500	3.5	15,916	8,157	38,775	4.8
175	3# chlorine compressor	37	35.8	10	4500	2.4	10,722	5,495	19,129	3.5
176	4# chlorine compressor	75	53.1	3	4500	3.5	15,916	8,157	38,775	4.8
	Calcium Hypochlorite								-	
8	Air compressor	7.5	8.4	10	4500	0.6	2,513	1,288	3,878	3.0
20	Chlorination Tail Gas Blower	30	16.3	10	8500	1.1	9,220	4,725	15,510	3.3
21	Circulating Water Pump	45	47.1	10	4500	3.1	14,106	7,229	23,265	3.2
37	#1 Centrifugal Tail Gas Blower	37	20.0	10	8500	1.3	11,313	5,798	19,129	3.3
38	#2 Centrifugal Tail Gas Blower	18.5	10.2	10	8500	0.7	5,770	2,957	9,565	3.2
42	#1 Drying Tail Gas Blower	18.5	10.2	10	8500	0.7	5,770	2,957	9,565	3.2
43	#2 Drying Tail Gas Blower	18.5	10.2	10	8500	0.7	5,770	2,957	9,565	3.2
44	#3 Drying Tail Gas Blower	18.5	10.2	10	8500	0.7	5,770	2,957	9,565	3.2
45	#4 Drying Tail Gas Blower	18.5	10.2	10	8500	0.7	5,770	2,957	9,565	3.2
46	#5 Drying Tail Gas Blower	37	20.0	10	8500	1.3	11,313	5,798	19,129	3.3
47	#6 Drying Tail Gas Blower	37	20.0	10	8500	1.3	11,313	5,798	19,129	3.3
48	Packaging Tail Gas Blower	18.5	10.2	10	8500	0.7	5,770	2,957	9,565	3.2
49	#7 Drying Tail Gas Blower	18.5	10.2	10	8500	0.7	5,770	2,957	9,565	3.2
51	#1 Air Blower	7.5	4.1	10	8500	0.3	2,319	1,189	3,878	3.3
52	#3 Air Blower	7.5	4.1	10	8500	0.3	2,319	1,189	3,878	3.3
53	#5 Air Blower	15	8.7	10	8500	0.6	4,921	2,522	7,755	3.1
54	#6 Air Blower	15	8.7	10	8500	0.6	4,921	2,522	7,755	3.1
55	#7 Air Blower	7.5	4.1	10	8500	0.3	2,319	1,189	3,878	3.3
	Utility Refrigeration 2								-	
11	#1 Air Compressor	132	106.3	10	8500	7.1	60,126	30,814	68,244	2.2
12	#2 Air Compressor	250	212.6	10	8500	14.1	120,251	61,629	129,250	2.1
13	#3 Air Compressor	250	212.6	10	8500	14.1	120,251	61,629	129,250	2.1
14	#4 Air Compressor	250	212.6	10	8500	14.1	120,251	61,629	129,250	2.1
15	#5 Air Compressor	132	123.1	10	8500	8.2	69,619	35,680	68,244	1.9
16	#6 Air Compressor	132	123.1	10	8500	8.2	69,619	35,680	68,244	1.9
17	#7 Air Compressor	132	123.1	10	8500	8.2	69,619	35,680	68,244	1.9
18	#8 Air Compressor	132	123.1	10	8500	8.2	69,619	35,680	68,244	1.9
19	#9 Air Compressor	132	123.1	10	8500	8.2	69,619	35,680	68,244	1.9

Motor #	Equipment	Rated kW (2)	Actual kW (3)	Years in Service (4)	Annual Operating Time (Hour) (5)	Demand Savings kW (6)	Energy Savings kWh/yr (7)	Cost Savings RMB (8)	Measure Cost RMB (9)	Simple Payback Years (10)
25	#1 Cooling Tower	75	24.9	10	8500	1.7	14,085	7,219	38,775	5.4
26	#2 Cooling Tower	75	34.9	10	8500	2.3	19,742	10,118	38,775	3.8
	Utility Refrigeration 1								-	
1	#1 Air Compressor	132	111.9	10	2800	7.4	20,849	10,685	68,244	6.4
23	#1 Air Blower	15	4.9	10	8500	0.3	2,772	1,421	7,755	5.5
24	#2 Air Blower	15	4.9	10	8500	0.3	2,772	1,421	7,755	5.5
25	#3 Air Blower	22	8.0	10	8500	0.5	4,525	2,319	11,374	4.9
26	#4 Air Blower	22	8.0	10	8500	0.5	4,525	2,319	11,374	4.9
27	#5 Air Blower	22	8.0	10	8500	0.5	4,525	2,319	11,374	4.9
28	#6 Air Blower	22	8.0	10	8500	0.5	4,525	2,319	11,374	4.9
					Totals:	**168.0**	**1,302,897**	**667,735**	**1,647,421**	**2.5**

Notes:

1. Analysis based on assumption of systems likely to be belt driven. The enterprise must provide data on actual belt drive systems to increase accuracy.
2. Motor kW rating.
3. Actual kW load on motor = (380 volts) x (Amperage) x (Power Factor) x (1.732) / (1000. watts/kW)
4. Age of motor in years.
5. Annual operating hours. Enterprize reported either "continuous", or "Intermittent". "Continuous" is assumed to be 8,500 hours per year. Intermittent" is assumed to be 4,500 hours per year unless more precise data was provided.
6. Demand Savings kW = (Motor Operating kW) x ([(1/0.92)-(1/0.98)] / (motor efficiency). Adjusted for YX Series Motors and VFD's.
7. Annual Energy Savings kWh = (Annual hours of operation) x (Demand Savings).
8. Annual Cost Savings RMB = (Annual energy savings) x (0.5125 rmb/kWh).
9. Estimated measure cost. Average cost is (Rated kW) x (517 rmb/drive system).
10. Simple Payback Years = (motor replacement cost) / (Annual cost savings).

8.5 OVER-SIZED MOTOR REPLACEMENTS

Motor Number	Equipment	Motor Model Number	Rated kW	Actual kW	Years in Service	Annual Operating Time (Hour)	% Load	Efficiency at Load %	Replace Motor kW	Motor Replace Efficiency %	Savings kW	Savings kWh/year	Savings rmb/year	Cost rmb
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	ADC Recycling													
1	1# Centrifuge	Y250M-4	55	22.4	10	8500	41%	92.0%	22	93.2%	0.3	2,662	1,364	3,344
2	2# Centrifuge	Y250M-4	55	22.4	10	8500	41%	92.0%	22	93.2%	0.3	2,662	1,364	3,344
3	3# Centrifuge	Y225-4	45	14.0	10	8500	31%	88.1%	15	91.8%	0.6	5,439	2,787	2,280
4	4# Centrifuge	Y225-4	55	22.4	10	8500	41%	92.0%	22	93.2%	0.3	2,662	1,364	3,344
5	5# Centrifuge	Y225-4	55	22.4	10	8500	41%	92.0%	22	93.2%	0.3	2,662	1,364	3,344
	ADC Oxidization													
1	1# Oxidization autoclave	Y160L-4	15	6.7	10	4500	45%	88.9%	7.5	90.3%	0.1	527	270	1,140
2	2# Oxidization autoclave	Y160L-4	15	6.7	10	4500	45%	88.9%	7.5	90.3%	0.1	527	270	1,140
3	3# Oxidization autoclave	M2QA180L4A	20	8.4	10	4500	42%	90.0%	10	90.3%	0.0	139	71	1,520
5	6# Oxidization autoclave	Y160L-4	15	6.7	10	4500	45%	88.9%	7.5	90.3%	0.1	527	270	1,140
9	10# Oxidization autoclave	M2QA180L4A	20	10.1	10	4500	50%	90.0%	10	90.3%	0.0	167	86	1,520
10	11# Oxidization autoclave	M2QA180L4A	20	4.5	10	4500	22%	86.6%	5.5	89.5%	0.2	754	386	836
19	Brine pump	Y200L2-2	37	17.9	10	8500	48%	90.3%	18.5	93.0%	0.6	4,892	2,507	2,812
22	1#ADC intermediate tank	Y160L-4	15	7.0	10	8500	47%	88.9%	7.5	90.3%	0.1	1,037	531	1,140
23	2#ADC intermediate tank	Y160L-4	15	6.7	10	8500	45%	88.9%	7.5	90.3%	0.1	995	510	1,140
25	Alkali pump	Y132S2-2	7.5	3.4	10	4500	45%	85.9%	4	88.3%	0.1	478	245	1,208
	ADC Drying 1													
1	Flashing dryer	Y225M-6-30kw	30	11.7	10	8500	39%	87.7%	15	91.8%	0.6	5,131	2,630	2,280
3	ID fan	Y315L-6-110kw	110	34.7	10	8500	32%	91.1%	37.5	93.5%	1.0	8,307	4,257	5,700
10	2# feeding machine	YCT225-4A-11kw	11	5.1	10	8500	47%	88.5%	7.5	90.3%	0.1	985	505	2,265
21	2# Air blower	Y200L2-2	37	16.8	10	8500	45%	90.3%	18.5	93.0%	0.5	4,587	2,351	2,812
22	2# ID fan	Y315M1-6	90	31.9	10	8500	35%	91.7%	37.5	93.5%	0.7	5,690	2,916	5,700
23	2# feeding machine	YCT225-4A	11	5.1	10	8500	47%	88.5%	7.5	90.3%	0.1	985	505	2,265
24	2# Flashing dryer	Y225M1-6	30	13.1	10	8500	44%	89.0%	15	91.8%	0.4	3,823	1,959	2,280
27	3# Acid pump	Y2160M2-2	15	1.7	10	8500	11%	83.3%	2.2	86.3%	0.1	595	305	334
28	4# Acid pump	Y2180M2-2	22	3.8	10	8500	17%	87.3%	4	88.3%	0.0	419	215	608
30	C-950 air compressor unit	ASCK-S2030	150	51.0	10	8500	34%	92.0%	55	94.5%	1.5	12,457	6,384	8,360
	ADC Mixing													
1	Super blender	TE-V	75	28.0	10	4500	37%	90.8%	30	93.5%	0.9	4,080	2,091	4,560
2	Classifier	YB2132S2-2	75	30.8	10	4500	41%	90.8%	30	93.5%	1.0	4,403	2,257	4,560

Motor Number	Equipment	Motor Model Number (1)	Rated kW (2)	Actual kW (3)	Years in Service (4)	Annual Operating Time (Hour) (5)	% Load (6)	Efficiency at Load % (7)	Replace Motor kW (8)	Motor Replace Efficiency % (9)	Savings kW (10)	Savings kWh/year (11)	Savings rmb/year (12)	Cost rmb (13)
3	Horizontal Blender	YB2180M-4	18.5	7.3	10	4500	39%	88.3%	7.5	90.3%	0.2	821	421	1,140
	ADC Fresh Water Treatment													
1	Circulation cooling pump A	Y225M-4	45	11.7	10	4500	26%	87.7%	15	91.8%	0.6	2,682	1,375	2,280
11	Biurea delivery pump B	Y160M2-2	15	5.1	10	4500	34%	86.1%	5.5	89.5%	0.2	1,022	524	836
										Totals:	**11.3**	**82,117**	**42,085**	**75,232**

Notes:

1. Motor Model number provided by owner's representative.
2. Motor kW rating.
3. Actual kW load on motor = (380 volts) x (Amperage) x (Power Factor) x (1.732) / (1000. watts/kW)
4. Age of motor in years.
5. Annual operating hours. Enterprize reported either "continuous", or "Intermittent". "Continuous" is assumed to be 8,500 hours per year. "Intermittent" is assumed to be 4,500 hours per year unless more precise data was provided.
6. Motor load percentage.
7. Efficiency of motor at operating load.
8. Proposed rating of replacement motor.
9. Proposed motor efficiency assuming YX-series motor replacements.
10. Demand Savings kW = (Actual motor kW) x [(1/old efficiency)-(1/(new efficiency)].
11. Annual Energy Savings kWh = (Annual hours of operation) x (Demand Savings).
12. Annual Cost Savings RMB = (Annual energy savings) x (0.5125 rmb/kWh).
13. Measure cost is assumed to be 300 rmb/kW for motors under 15 kW, and 130 rmb/kW for motors 15 kW and above.
15. Simple Payback Years = (motor replacement cost) / (Annual cost savings).

8.6 TRANSFORMER DATA

No.	Transformer	Capacity (KVA)	Model	Voltage	Current Rating (A)	Operating Current (A)	Power Factor (%)	Equipment Load (%)
	6 KV Substation							
1	411 #1	1600	S9-1600/6	6000/400	154	120	90%	78%
2	411 #2	1600	S9-1600/6	6000/400	154	95	91%	62%
3	412 #1	1600	S9-1600/6	6000/400	154	70	91%	45%
4	412 #2	1600	S9-1600/6	6000/400	154	80	91%	52%
5	413 #1	1600	S9-1600/6	6000/400	154	110	91%	71%
6	413 #2	1600	S9-1600/6	6000/400	154	0	91%	0%
7	Bleaching Powder	1250	S9-1600/6	6000/400	114.6	60	90%	52%
	35 KV Substation							
1	#1 Rectiformer	20000	ZHSSPZ-20000/35	35000/540	177-252/16320	204.7	93%	62%
2	#2 Rectiformer	6000	ZHSSPZ-6000/35	35000/384-540	70-99/6411	89.2	92%	90%
3	#3 Rectiformer	6000	ZHSSPZ-6000/35	35000/384-540	70-99/6414	75.4	92%	90%
4	#4 Rectiformer	21776	ZHSSPZ-22000/35	35000/359-481	268-359/26112	135.7	85%	60%
5	#1 Utility	3150	S9-3150/35	35000/10000	52/182	27	91%	52%
6	#2 Utility	3150	S7-3150/35	35000/10000	52/182	29	90%	56%
7	#1 Evaporation	1000	S7-1000/10	10000/400	57.7/1442	30	90%	52%
8	#2 Evaporation	1000	S7-1000/10	10000/400	57.7/1442	35	91%	61%
9	#1 Refrgeration	1000	S7-1000/10	10000/400	57.7/1442	15	91%	26%
10	#2 Refrigeration	1000	S7-1000/10	10000/400	57.7/1442	15	90%	26%
11	#1 Hydrochlorination	1000	S7-1000/10	10000/400	57.7/1442	30	92%	52%
12	#2 Hydrochlorination	1000	S7-1000/10	10000/400	57.7/1442	20	90%	35%
13	Circulating Water	1250	S7-1250/10	10000/400	72/1800	48	91%	67%
14	Air Compressor	1000	S7-1000/10	10000/400	57.7/1442	30	90%	52%
15	Surface Activation	630	S7-630/10	10000/400	36.6/915	0	0%	0%
16	Solid Alkali	630	S7-630/10	10000/400	36.6/915	2	88%	5%
17	#1 Substation	50	S7-50/35	35000/400	.82/72	20	87%	28%
18	#2 Substation	50	S7-50/35	35000/400	.82/72	0	0%	0%

8.7 TRANSFORMER REPLACEMENTS

No.	Transformer (1)	Capacity (KVA) (1)	Model (1)	Power Factor (%) (1)	Eqmnt Load (%) (1)	Existing Demand (kW) (2)	Existing Energy (kWh) (3)	Demand Savings (kW) (4)	Energy Savings (kWh) (5)	Measure Cost (Yuan) (6)	Cost Savings (Yuan/yr) (7)	Simple Payback (years) (8)
	6 KV Substation											
1	411 #1	1600	S9-1600/6	90%	78%	1,122	9,829,140	8.98	78,633	208,000	40,299	5.2
2	411 #2	1600	S9-1600/6	91%	62%	898	7,868,288	7.19	62,946	208,000	32,260	6.4
	412 #1	1600	S9-1600/6	91%	45%	655	5,739,552	5.24	45,916	208,000	23,532	8.8
3	412 #2	1600	S9-1600/6	91%	52%	756	6,625,994	6.05	53,008	208,000	27,167	7.7
4	413 #1	1600	S9-1600/6	91%	71%	1,040	9,110,582	8.32	72,885	208,000	37,353	5.6
5	Bleaching Powder	1250	S9-1600/6	90%	52%	589	5,160,078	4.71	41,281	162,500	21,156	7.7
	35 KV Substation											
1	#1 Utility	3150	S9-3150/35	91%	52%	1,488	13,037,392	11.91	104,299	409,500	53,453	7.7
2	#2 Utility	3150	S7-3150/35	90%	56%	1,581	13,847,773	22.13	193,869	409,500	99,358	4.1
3	#1 Evaporation	1000	S7-1000/10	90%	52%	468	4,098,892	6.55	57,384	130,000	29,410	4.4
4	#2 Evaporation	1000	S7-1000/10	91%	61%	552	4,834,775	7.73	67,687	130,000	34,690	3.7
	#1 Refrigeration	1000	S7-1000/10	91%	26%	237	2,072,616	3.31	29,017	130,000	14,871	8.7
	#2 Refrigeration	1000	S7-1000/10	90%	26%	234	2,049,840	3.28	28,698	130,000	14,708	8.8
5	#1 Hydrochlorination	1000	S7-1000/10	92%	52%	478	4,189,978	6.70	58,660	130,000	30,063	4.3
6	#2 Hydrochlorination	1000	S7-1000/10	90%	35%	312	2,732,594	4.37	38,256	130,000	19,606	6.6
7	Circulating Water	1250	S7-1250/10	91%	67%	758	6,642,336	10.62	92,993	162,500	47,659	3.4
8	Air Compressor	1000	S7-1000/10	90%	52%	468	4,098,892	6.55	57,384	130,000	29,410	4.4
	#1 Substation	50	S7-50/35	87%	28%	12	106,697	0.17	1,494	6,500	766	8.5
	Totals:					**11,649**	**102,045,420**	**123.79**	**1,084,410**	**3,100,500**	**555,760**	**5.6**

Notes:
1. Data provided by Enterprize employees.
2. Demand kW = (KVA) x (Power Factor) x (Load %)
3. Energy Consumption kWh/year = (Demand) x (8760 hours/year)
4. Demand Savings is 0.8% for replacing S9 with S11, or 1.4% for replacing S7 with S11 transformers.

5. Energy Savings kWh/year = (kW savings) x (8760 hours/year)
6. The cost to purchase S11 transformers is estimated at 130 rmb/KVA.
7. Measure cost savings = (kWh/yr savings) x (0.5125 rmb/kWh)
8. Simple Payback Years = (motor replacement cost) / (Annual cost savings).

8.8 COMPRESSED AIR LEAKAGE

Motor Number	Equipment	Rated kW (1)	Actual kW (2)	Years in Service (3)	Annual Operating Time (Hour) (4)	Annual Energy Consumption kWh (5)	Compressed Air Flow M^3/Min (6)	Leakage M^3/Min (7)	Demand Savings kW (8)	Energy Savings kWh/yr (9)	Cost Savings rmb (10)	Measure Cost rmb (11)	Simple Payback Years (12)
	ADC Drying 1												
30	C-950 air compressor unit	1500	1341.2	10	8500	11,399,981	228	22.8	134.1	1,139,998	584,249	107,294	0.2
	Chlorine Alkali Liquid Cooling												
85	1# compressor	75	78.9	12	8500	670,960	13	1.3	7.9	67,096	34,387	6,315	0.2
86	3# LP compressor	75	78.9	16	8500	670,960	13	1.3	7.9	67,096	34,387	6,315	0.2
87	3# HP compressor	55	58.2	12	8500	495,017	10	1.0	5.8	49,502	25,370	4,659	0.2
88	4# LP compressor	75	78.9	16	8500	670,960	13	1.3	7.9	67,096	34,387	6,315	0.2
89	4# HP compressor	55	58.2	12	8500	495,017	10	1.0	5.8	49,502	25,370	4,659	0.2
	Chlorine Alkali Submerging												
132	Air compressor	22	22.9	10	4500	103,216	4	0.4	2.3	10,322	5,290	1,835	0.3
	Chlorine Alkali Packaging Test												
171	Air compressor	11	10.1	10	4500	45,314	2	0.2	1.0	4,531	2,322	806	0.3
	Utility Refrigeration 2												
11	#1 Air Compressor	132	106.3	10	8500	903,489	18	1.8	10.6	90,349	46,304	8,503	0.2
12	#2 Air Compressor	250	212.6	10	8500	1,806,978	36	3.6	21.3	180,698	92,608	17,007	0.2
13	#3 Air Compressor	250	212.6	10	8500	1,806,978	36	3.6	21.3	180,698	92,608	17,007	0.2
14	#4 Air Compressor	250	212.6	10	8500	1,806,978	36	3.6	21.3	180,698	92,608	17,007	0.2
15	#5 Air Compressor	132	123.1	10	8500	1,046,145	21	2.1	12.3	104,615	53,615	9,846	0.2
16	#6 Air Compressor	132	123.1	10	8500	1,046,145	21	2.1	12.3	104,615	53,615	9,846	0.2
17	#7 Air Compressor	132	123.1	10	8500	1,046,145	21	2.1	12.3	104,615	53,615	9,846	0.2
18	#8 Air Compressor	132	123.1	10	8500	1,046,145	21	2.1	12.3	104,615	53,615	9,846	0.2
19	#9 Air Compressor	132	123.1	10	8500	1,046,145	21	2.1	12.3	104,615	53,615	9,846	0.2
	Utility Refrigeration 1												
1	#1 Air Compressor	132	111.9	10	2800	313,284	19	1.9	11.2	31,328	16,056	8,951	0.6
2	#2 Air Compressor	65	33.6	10	2800	93,985	6	0.6	3.4	9,399	4,817	2,685	0.6
3	#3 Air Compressor	75	33.6	10	2800	93,985	6	0.6	3.4	9,399	4,817	2,685	0.6
4	#3 Air Compressor	132	111.9	10	890	99,580	19	1.9	11.2	9,958	5,103	8,951	1.8
	Totals:		**3377.8**		**7907**	**26,707,408**	**574**	**57.4**	**337.8**	**2,670,741**	**1,368,755**	**270,224**	**0.2**

Notes:

1. Motor kW rating.
2. Actual kW load on motor = (Volts) x (Amperage) x (Power Factor) x (1.732) / (1000. watts/kW)
3. Age of motor in years.
4. Annual operating hours. Enterprize reported either "continuous", or "Intermittent". "Continuous" is assumed to be 8,500 hours per year. "Intermittent" is assumed to be 4,500 hours per year unless more precise data was provided.
5. Annual energy consumption kWh = (Annual Operating Hours) x (Actual kW)
6. Compressed air flow rate M^3/Min = Operating kW x (0.17 M^3/Min-kW)
7. Typical plant leakage is approximated at 20% to 75%. We have assumed 10% can be recoveredfor this measure.
8. Demand Savings = (Actual demand) x (leakage recovery rate)
9. Annual Energy Savings kWh = (Annual hours of operation) x (Demand Savings).
10. Annual Cost Savings RMB = (Annual energy savings) x (0.5125 rmb/kWh).
11. Assumes average leak size is 0.085 M^3/Min, and leak repair cost averages 400 rmb/leak.
12. Simple Payback Years = (motor replacement cost) / (Annual cost savings).

9 Appendix: Recommended Measurement And Verification Guidelines For Energy-Efficiency Measures Addressing Constant Motor Load And Measures Addressing Variable Motor Loads

9.1 OPTION A: SIMPLIFIED M&V GUIDELINES FOR CONSTANT LOAD MOTOR MEASURES

9.1.1. OVERVIEW

This measurement and verification (M&V) method is appropriate for projects involving existing motors serving a constant load being replaced with higher efficiency motors of equal or lesser capacity (horsepower). The rated efficiency of the new motor must exceed the minimum efficiency standard defined in the Table of Standard Motor Efficiencies (need this) to be eligible for the program. Potential retrofit equipment includes:

- Constant load chilled water, hot water, or condenser water pumps
- Constant speed exhaust, return, and supply fans without dampers or pressure controls
- Single-speed cooling tower fans
- Constant load industrial processes
- Similar capacity, constant speed, energy efficiency motors
- Smaller, constant speed, energy efficiency motors when the existing motor is oversized

These M&V procedures are not appropriate for motor change outs that are accompanied by:

- Changes in operating schedule
- Changes in operating hours
- Changes in flow rate
- Changes in motor controls (except VSDs)

If the proposed retrofit does not meet the constant load requirements, or involves scheduling or operational changes, refer to the *Full M&V Guidelines for Generic Variable Loads* for appropriate M&V techniques.

The calculation of demand and energy savings for motor replacements is based on the baseline and post-installation kW, the difference in efficiency of the baseline and new motors, and the motor operating hours. The operating hours are assumed the same for existing and new motors. The baseline motor efficiency is based on the minimum efficiency rating defined by the Table for Standard Motor Efficiencies. The Table of Standard Motor Efficiencies is categorized by motor size and rotation speed. Incentive offers are not made for replacement motors with efficiencies equal to or less than the baseline efficiency. In addition to having a higher efficiency than baseline motors, all new motors should meet minimum equipment standards as defined by the central and/or provincial governments.

The recommended M&V approach for motors includes some or all of the following data collection activities:

- Compiling inventories for existing and new motors
- Short-term metering of existing motors to verify constant loading (if warranted)
- Spot metering of all existing and new motors
- Short-term metering of a sample of the new motors to determine operating hours

9.1.2. Determination of Baseline Operating Characteristics

The M&V steps that characterize the existing motors are:

1. Pre-installation equipment survey (to be conducted by the Jiangsu ETC Center)
2. Spot measurement of demand (kW), and short-term metering of existing motors, where needed (to be conducted by the facility)
3. Pre-installation inspection (to be conducted by Jiangsu ETC or its contractor)

Pre-Installation Equipment Survey

The facility should conduct a pre-installation survey to inventory the equipment to be replaced and record data about each motor. Motor location and corresponding facility mechanical plans should be included with the survey submittal as part of the project application. At a minimum, the surveys should include the following for each existing motor:

- Motor name
- Load served
- Motor location

- Operating schedule
- Equipment manufacturer
- Nameplate data including model, horsepower, and speed

The baseline motor efficiency should be determined from the Table of Standard Motor Efficiencies based on the existing motor data provided in the project application.

Any M&V activities that need to be conducted prior to the demolition of existing equipment (i.e., short-term measurements) should take place at this time. **Demolition of existing equipment and/or installation of new equipment cannot begin until baseline M&V activities are completed, the pre-installation inspection is completed, and Jiangsu ETC has approved the application and issued a project authorization.**

Spot and Short-term Measurement of Existing Motors

To establish the baseline kW, the facility must conduct spot measurements of the power draw of the existing motors. If the constant load criterion cannot be verified by visual inspection, then short-term metering of the power draw or current (amperes) of the existing motors may also be required.

The verification of constant motor loading by short-term metering is warranted in situations where the effect of piping, valves, controls, or processes on motor load is uncertain. A motor load is considered to be constant if **90%** of all non-zero observations are within ±**10%** of the running average kW. If short-term metering demonstrates that the proposed retrofit does not meet the constant load definition, then the facility should refer to the *Full M&V Guidelines for Generic Variable Loads* for appropriate M&V techniques.

To compensate for the variations in spot measurements that occur even in constant-load motors, the facility may need to develop normalization factors for groups of like motors serving similar loads. A normalization factor is the ratio of a motor's average current (from short-term metering) to its spot measured current. Jiangsu ETC may require the use of a normalization factor for projects with a group or groups of identical motors.

The minimum efficiency standard for the existing motor type is listed in the Table of Standard Motor Efficiencies. If the efficiency of the existing motor is greater than or equal to the minimum efficiency standard, then the baseline demand is equal to the spot measured value. If not, then the baseline demand is calculated according to Equation 1.1.

Equation 1.1:

$$\text{Baseline Demand [kW]} = \frac{\text{Existing Motor Efficiency}}{\text{Standard Minimum Efficiency}} * \text{Spot Measured Existing Motor Demand [kW]}$$

Pre-Installation Inspection

Jiangsu ETC will conduct a pre-installation inspection to verify that the existing condition is as reported in the pre-installation equipment survey in the Final Application. Jiangsu ETC will require the facility to make any necessary corrections to their application based upon the results of the inspection.

Demolition of existing equipment and/or installation of new equipment cannot begin until the pre-installation inspection is completed and Jiangsu ETC has approved the project application and issued a project authorization.

9.1.3. Document Post-Retrofit Operating Characteristics

The M&V steps that characterize the new motors are:

1. Post-installation equipment survey (to be conducted by the facility)
2. Spot measurements of the power draw (one-hour average values) of all the new motors (to be conducted by the facility)
3. Post-installation inspection (to be conducted by Jiangsu ETC or its contractor)
4. Short-term metering of operating hours for a sample of existing motors (to be conducted by the facility)

Post-Installation Equipment Survey

The facility shall conduct a post-installation equipment survey and record data about each motor. The survey shall reflect the actual, as-built conditions of the project. The post-installation survey will be included in an installation report.

Spot Measurements of Motor Demand

The facility must conduct spot measurements of the power draw (one-hour average values) of each new, high-efficiency motor in order to establish the post-installation demand. The facility will report the measured kW as part of an installation report.

Post-Installation Inspection

Once Jiangsu ETC receives an installation report for the motor project, Jiangsu ETC or its contractor will conduct a post-installation inspection to verify that the equipment specifications are correctly reported in the Installation Report. Jiangsu ETC will require the facility to make any necessary corrections to the Installation Report based upon the results of the inspection.

Short-Term Metering of Motor Operating Hours

Baseline motor operating hours are assumed to be the same as post-installation operating hours, and should be determined after new motor installation. Short-term metering is used to determine both pre- and post-installation operating hours.
After Jiangsu ETC approves an installation report, the facility should begin short-term metering of motor operating hours. The metering must be conducted for a minimum period of one week, or a sufficient amount of time to capture the full range of operation. The motor annual operating hours are calculated from the metering data according to Equation 1.2.

Equation 1.2:

$$\text{Annual Operating Hours [hrs/yr]} = \frac{\text{Motor On-time during Metering Period [hrs]}}{\text{Length of Metering Period [hrs]}} * 8{,}760 \text{ [hrs/yr]}$$

For projects in which a large number of equal-sized motors with the same application and operating schedule will be replaced, metering may be conducted on a sample of the motors and the results extrapolated to the applicable population. If this approach is adopted, Jiangsu ETC will assist the facility in selecting the motors to be metered.
The facility should include electronic copies of the unprocessed data files as part of a savings report.

9.1.4. Calculation of Peak Demand and Energy Savings

Demand savings are calculated for equipment that operates during the summer peak period, which is defined as weekday afternoons. The peak demand savings and energy savings are calculated according to Equation 1.3 and Equation 1.4, respectively.
Equation 1.3:

$$\text{Peak Demand Savings [kW]} = \text{Baseline Demand [kW]} - \text{Spot Measured New Motor Demand [kW]}$$

Equation 1.4:

$$\text{Energy Savings [kWh]} = \text{Peak demand savings [kW]} * \text{Annual Operating Hours [hrs]}$$

The facility reports the peak demand and energy savings to Jiangsu ETC in the project Savings Report.

Example

A constant-speed process motor at an mineral processing plant will be replaced with a smaller, high-efficiency motor. As indicated on its nameplate, the existing motor is a 200 hp, 1800 RPM enclosed motor with a nominal efficiency of 0.91. This motor will be down-sized to a 150 hp motor with a nominal efficiency of 0.96.

As the first step in the M&V, a spot measurement of the existing motor was made and indicated a power draw of 165.3 kW.

The minimum efficiency standard for the existing motor is 0.95 (as given in the Minimum Standard Motor Table) which is greater than the efficiency of the existing motor; therefore, the baseline demand is calculated according to Equation 1.1.

(a) Baseline motor demand = (0.91/0.95) * 165.3 **= 158.3 kW**

Following installation of the new motor, a spot measurement was made, and indicated an average, one hour, power draw of 117.9 kW.

Post-installation metering of operating hours was then conducted for a one-week period. The metering results show that the motor was operating for 81 hours out of the 168 hours in the metering period. The annual operating hours were calculated using Equation 1.2, as shown below.

(b) Annual operating hours = (81/168)*8760 **= 4224 hrs**

The peak demand savings and energy savings were then calculated using Equations 1.3 and 1.4, respectively, as shown below.

(c) Peak demand savings = 158.3 - 117.9 **= 40.4 kW**

(d) Annual energy savings = 40.4 * 4224 **= 170,650 kWh**

9.1.5. Variable Speed Drives on Constant Baseline Motors

Installing variable-speed drive (VSD) controllers on motors that serve a constant baseline load requires a modified motor M&V procedure. In order to qualify for the Jiangsu ETC incentive, VSDs must be installed in conjunction with other energy efficiency measures that deliver demand as well as energy savings. Potential retrofit projects that might include VSDs include:

- Replacing standard efficiency electric motors with high efficiency models

Motors that are scheduled for the installation of VSDs follow the same **Determination of Baseline Operating Characteristics** described earlier in this chapter. If the efficiency of the existing motor is greater than or equal to the minimum listed in the Table of Standard Motor Efficiencies, then the baseline demand is equal to the spot measured value; if not, then it is calculated according to Equation 1.1.

After the VSD and associated project retrofit has been installed, the facility will again **Document Post-Retrofit Operating Characteristics**. The **Post-installation equipment survey** and the **Post-installation inspection** procedures are the same as described earlier in this chapter.

After Jiangsu ETC has conducted a post-installation inspection and approved the project installation report, the facility should begin short-term metering[3] of the power draw (kW) of the motors. The data must be recorded at intervals of 15 minutes or less. However, averaged one-hour values are used in the calculation of demand and energy savings. For calculating peak demand, the metering must occur during the summer peak period.

The duration of the metering period must be sufficient to capture the full range of motor operation. If the motor load varies only on a daily basis and not seasonally, then a metering period of one week is generally sufficient. If the motor load or operating hours vary with weather or other seasonal parameters (e.g., production schedules), then at least two weeks of metering during each operating period is generally necessary. For example, if the motor serves cooling equipment, then the metering should occur for at least two weeks during the winter months and two weeks during the summer months.

The metering data are used to determine three values:

1. **Peak summer period demand (kW):** Equal to the maximum-recorded peak summer period demand (one hour average values, where the summer peak period is defined as weekday afternoons).
2. **Average demand (kW):** Equal to the average recorded demand. For motors with seasonal load patterns, the average demand should be weighted according to the relative length of each seasonal period (see VSD example).
3. **Annual operating hours:** Calculated from the metering data according to Equation 1.5. For motors with seasonal load patterns, the annual operating hours should be weighted according to the relative length of each seasonal period.

Equation 1.5:

$$\text{VSD Annual Operating Hours [hrs/yr]} = \frac{\text{Motor On-time during Metering Period [hrs]}}{\text{Length of Metering Period [hrs]}} * 8{,}760 \text{ [hrs/yr]}$$

For projects in which a large number of equal-sized motors with the same application and operating schedule will be replaced, M&V may be conducted on a sample of the motors and the results extrapolated to the applicable population. If this approach is adopted, the Jiangsu ETC will select the motors to be metered.

The peak demand savings and energy savings are calculated according to Equation 1.6 and Equation 1.7, respectively.

[3] Long-term monitoring may be required for motors with non-uniform or unpredictable load patterns.

Equation 1.6:

VSD Peak Demand Savings [kW] = Baseline Demand [kW] - Peak Summer Period Demand [kW]

Equation 1.7:

VSD Energy Savings [kWh] = (Baseline Demand [kW] – Average Demand [kW]) * Annual Operating Hours [hrs]

VSD Example

The constant air volume compressed air system at a industrial facility will be converted to a variable air volume system. The conversion involves retrofitting two 50 hp air compressors motors with variable speed drives (VSDs). The M&V procedures for a single compressor are illustrated below. In general, the same procedure would be followed for all compressors.

A spot measurement of the power draw of the existing motor was made and gave a reading of 42.3 kW. The nameplate on the existing motor indicates that it is an 1800 RPM, enclosed motor with a nominal efficiency of 0.92. The minimum efficiency standard for this type of motor is 0.93; therefore, the baseline demand is calculated according to Equation (a)

(a) Baseline demand = (0.92/0.93)*42.3 = 41.8 kW

Because the motor load is weather dependent, short-term post-installation metering must be conducted during both summer and winter months. Thus, after the VSD is installed, short-term metering of the motor's power draw (kW) is conducted for two weeks in January (winter) and two weeks in July (summer).

The metering data indicates that the peak (one hour) summer period demand was 37.6 kW. The average demand during the January metering period was 5.3 kW, and the average demand during the July metering period was 19.8 kW. The summer and winter periods are assumed to account for equal portions of the year; therefore, the metering results are weighted evenly for the two periods. Thus, the average demand is 12.6 kW.

The metering data indicates that motor was operating for 88 hours during the 336-hour January metering period, and for 110 hours during the 336-hour July metering period. As discussed above, the results from the two metering periods are weighted evenly; thus, the annual operating hours are calculated as shown in Equation (b).

(b) Annual operating hours = [(88/336+110/336)/2]*8760 = 2581 hours

The peak demand savings and energy savings for this compressor are calculated according Equations (c) and (d), respectively.

(c) Peak demand savings = 41.8-37.6 = 4.2 kW

(d) Energy savings = (41.8-12.6)*2581 = 73,365 kWh

9.2 OPTION B: GENERIC M&V PLAN FOR VARIABLE LOAD MEASURES CONTINUOUS POST-INSTALLATION METERING

9.2.1. PROJECT DEFINITION

This M&V method covers projects that improve the efficiency of end-uses that exhibit variable energy demand or operating hours. Examples of such projects include:

- Replacing motors that serve variable loads with high-efficiency motors.
- Upgrading building automated systems.
- Installing new industrial process equipment.

For this M&V method, it is assumed that the savings associated with the Energy Efficiency Measures (EEM) can be verified with end-use metering.

9.2.2. OVERVIEW OF METHOD

The facility must audit existing systems to document relevant components (e.g., piping and ductwork diagrams, control sequences, and operating parameters). The facility must also document the proposed project and expected savings. All, or a representative sample, of the existing systems should be metered by the facility to establish regression-based equations (or curves) for defining baseline system energy use as a function of appropriate variables (e.g., weather or cooling load).

Once the EEM is installed, the general approach for determining savings will be:

- Continuously measuring post-installation energy use and the appropriate variables. Post- installation variable data are used with the baseline "equations" to calculate baseline energy use.

The facility will apply the results of post-installation metering to determine the difference between pre- and post-installation input energy use (and demand). This difference represents the system savings.

9.2.3. METERING AND CALCULATING BASELINE DEMAND AND ENERGY SAVINGS

Audit Baseline System

The facility must audit system(s) that will be affected by the project to document all relevant components, such as motors, fans, pumps, and controls. For each piece of equipment, documented information should include the manufacturer, model number, rated capacity, energy use factors (such as voltage, rated amperage), nominal efficiency, the load served, and a listing of independent variables that affect system energy consumption. Equipment location and corresponding project site floor plans should be included with the survey.

Establishing Baseline Model

The facility must meter system input energy (e.g., kWh) and demand (e.g., kW) over a representative time period before any efficiency modifications are made. Such metering will be applied to those devices directly affected by EEM. Duration of input metering will be sufficient to document the full range of system operation. The facility will propose an appropriate duration in the site-specific M&V plan, subject to approval by Jiangsu ETC on a case-by-case basis. Typically, observations will be made of 15-minute intervals, unless the facility demonstrates that longer intervals are sufficient and such intervals are approved by Jiangsu ETC.

If multiple similar equipment components or systems are to be modified (e.g., 10 water pumps), the facility may propose in the site-specific plan to meter only a sample.

9.2.4. Post-Installation Metering and Calculating Savings

There is one approach defined in this section for calculating savings:

- Continuously measuring post-installation energy use (and demand) and the appropriate variables. Post-installation variable data used with the baseline “equations” to calculate baseline energy use (and demand).

Metering Post-Installation Energy Use and Variables

After installing the EEM, the facility must continuously meter system energy input and monitor output (e.g., tons of cooling) over the life of the claimed energy savings. Such metering and monitoring will be conducted in the same way as the monitoring performed to model performance of the baseline system.

The post-installation metered input energy will be used directly in the savings calculation. The monitored data will be used to calculate pre-installation energy input.

Energy savings over the course of a single observation interval will be calculated by the facility using the following equation (assuming an electricity measure):

$$\text{Energy savings}_I = (kW_b - kW_m) * T_i$$

Where:

- KW_b = baseline kW corresponding to same time interval, system, output, weather, etc., condiitions as kW_m.
- kW_m = Measured kW obtained through continuous post-installation metering.
- T_I = Length of time interval.

For a particular observation interval, the facility must apply the monitored data to the baseline to determine what the baseline-system energy input would have been. From this amount, the facility must subtract the metered-system post-installation input. Energy savings are determined by multiplying this difference by the length of the observation interval.