ISO 50001 Energy Management System
Case Study

2020 CHINA

CITIC Heavy Industries Co., Ltd.

CITIC HIC Energy Saving Management of Natural Gas Industrial Furnace

Organization Profile & Business Case

CITIC Heavy Industries Co., LTD., mainly engaged in R&D and manufacturing for Technical Equipment of National Basic Industry, EPC Technical Equipment and National High-tech Equipment, which could provide Major Technical Equipment and Overall Solution in the fields of Heavy Equipment, Critical Parts, EPC Project, Spare Parts Service, Robot and Intelligent Equipment etc..

For the purpose of Saving Natural Gas, Relevant measures has been developed (Energy-saving Retrofitting of Furnace, "Internet +" Energy Management Platform is used to establish Gas Demand Side Management System, Real-time Monitoring in Furnace Working, Improving the Furnace Charging Rate, etc.) and implemented, the Energy Conservation and Emissions Reduction have been achieved.

"Rational Scheduling, Optimized Manufacturing, Energy Saving and Emission Reduction, Costs Reduction and Benefits Increasing."

—ZHIYONG ZHANG, GENERAL MANAGER.

Case Study Snapshot	
Industry	Special Equipment Manufacturing
Product/Service	Heavy Equipment such as Mining Mill, Hoist, Rotary Kiln, Vertical Mill, Crusher, High Pressure Roller Mill ect. and Large Castings & Forgings
Location	No. 206 of Jianshe Road, Luoyang City
Energy management system	ISO 50001
Energy performance improvement period, in years	1
Energy Performance Improvement (%) over improvement period	17%
Total energy cost savings over improvement period	USD 4.4464 million
Cost to implement EnMS	USD 0.63 million
Total Energy Savings over improvement period	355607 GJ
Total CO_2-e emission reduction over improvement period	18395.7 Mt

Business Benefits

CITIC HIC Energy Saving Management to Natural Gas Industrial Furnace

In 2018, the Output of Castings and Forgings is 140,774t, the consumption of natural gas is 2068517GJ, and the single consumption is 14.69GJ /t. In 2019, the Output of Castings and Forgings is 142,373t, the consumption of natural gas is 1736396GJ, and single consumption is 12.20GJ/t. Compared 2019 with 2018, the consumption of natural gas is decreased, but the output is increased. The consumption of natural gas

decreased by 2.49GJ/t, the reduction rate is 17%, and the energy saving amount in 2019 is 355607GJ compared with 2018. According to the average market price of RMB 3.35 /m3 in 2019, the natural gas cost saved in 2019 is RMB 30,601,400, which is equivalent to USD 4,446,400 in exchange rate of RMB 1 =USD 0.1453.

Implementation Cost of Energy Management System: Internal Staff time to develop and implement the ENMS is USD 0.10 million, Internal staff time to prepare for external audit is USD 0.0074 million, Additional monitoring and metering equipment installed to meet EnMS requirements is USD 0.50 million, Third party audit costs is USD 0.022 million, Total USD 0.63 million.

Because of the energy management operation and save the percentage of the total cost savings of about 98%.

Carbon Emission Reduction:

In 2018, the Carbon Emission of Natural Gas was 114,572.7 Mt, while in 2019, the carbon emission was 96,177 Mt, so during the improvement period, the Carbon Emission Reduction compared 2019 with 2018 was 18,395.7 Mt.

Plan

CITIC HIC leaders paid lots of attention to the energy saving work, and provided a strong financial support for the Enterprise's Energy Retrofitting work.

1. Increase Investment in Furnace Retrofitting

Ordinary Furnaces' Combustion Control System has been upgraded into Regenerative Heating System. From 2018 to 2019, five Natural Gas Furnaces have be upgraded into Regenerative Heating System with an investment of RMB 18.31 million, which is equivalent to USD 2.66 million.

2. Increase Investment in Energy Management Informationization

Established the Well-functioning Energy Management Platform and realized Informatization Management for CITIC HIC. For the Online Platform Project of Mass Entrepreneurship and Innovation Demonstration Base, which is comprised of "Internet +" Energy Management Platform, the investment is RMB 3.45 million, equivalent to USD 500,0 00.

Carry out Enterprise Energy Management Work in strict accordance with the Energy Management System and Energy Policy to ensure the normal operation of the system.

CITIC HIC will continue to increase investment in Energy-saving Renovation and Technological Upgrading, improve metering facilities, eliminate energy-intensive equipment, and introduce new technologies and processes to further improve energy conservation, reduce energy consumption and carbon emissions.

Energy has become an increasingly important part of many companies' operating expenses, although its price fluctuates wildly. At the same time, Industry Leaders are holding their suppliers to a commitment for sustainable business practices. Therefore, controlling energy consumption is an important step to maintain competitiveness and improve corporate image. As a result, in order to implement the Energy Management System and strengthen the leadership of the Energy Management System, Mr. Zhang Zhiyong was appointed to be the Management Representative of the Enterprise Standard Energy Management System of CITIC HIC.

3. Based on the Energy Policy and Data Analysis, Energy Consumption indicator of the Natural Gas is set up every year, and the benchmarking inspection is carried out.

4. Based on Internet + Energy Management System, Operation Data of Natural Gas Furnace is real-time monitored.

(1) Analyze Historical Data and Forecast Trends for Gas Consumption of Natural Gas Furnace.

(2) By checking and analyzing the historical gas data and the furnace plan, the Full-time Energy Consumption Planner predicted the Natural Gas Consumption of the next day, and accordingly report the daily gas consumption plan of our company to Xin Ao Gas Company. The Accuracy Rate is more than 70%, which could satisfy Xin Ao Gas Company's requirement for our Daily Gas Plan.

(3) Through real-time monitoring of the running status of each natural gas furnace, Energy Source Dispatcher could accurately control the Gas Consumption Load and rationally control the amount of start-up furnaces according to the gas consumption plan to ensure the safe operation of the natural gas system.

(4) Gas Demand Side Management Module is used to monitor the operation of 18500t, 7000t, 3000t, 1600t Open Die Forging Presses and Furnaces, 5000 Die Forging Press and heat treatment furnaces. Through the establishment Database for Natural Gas Furnace Loading Rate and Natural Gas Cost, it lays a foundation for the correlation cost analysis between the natural gas and loading rate of the furnaces.

5. Formulate Energy Policy: Reasonable Scheduling, Optimize Production, Save Energy and Reduce Emission, Reduce Cost and Increase Efficiency.

CITIC HIC is taken Energy Saving and Benefit Maximization as the core target. We insist on low energy consumption, low emissions and recycling as the concept of sustainable development. From the strategic height of long-term development, comprehensive planning and implementation of energy conservation and emission reduction, through Management Improvement, Technological Progress and Structural Adjustment to realize CITIC HIC's overall energy consumption sustained and reasonable decline, we will continue to improve the comprehensive benefits of energy conservation, emission reduction and circular economy, and eventually reach and maintain the leading energy consumption level in the world. Serve and support CITIC HIC's development strategy and objectives.

Do, Check, Act

1. Establishing the Energy Management System

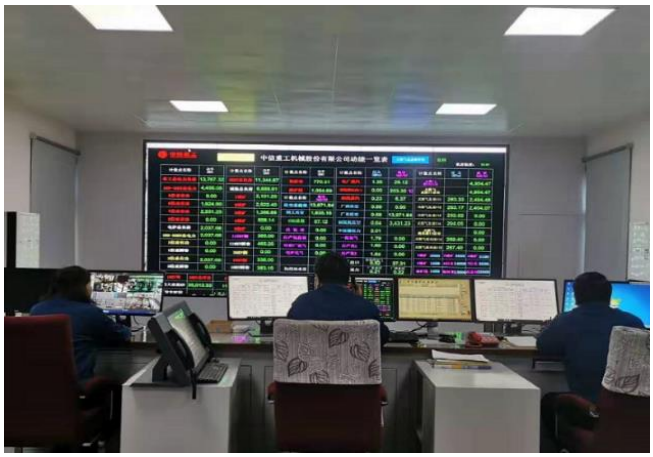
CITIC HIC General Manager is the team leader of the Energy Management System Leading Group, and clarified the functions of each unit. Financing, Capital Balance, Capital Scheduling, Capital Occupation Management and Control of the Energy-saving Project and Special Funds for Technological Renovation are responsible by Finance Department.

Established a Performance Appraisal System. Performance Management Review is conducted annually, and Improvement Plan is proposed.

2. Choose Working Direction

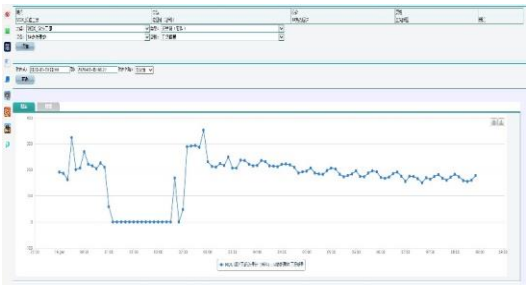
Castings & Forgings are two of the main products of CITIC HIC, and Heat Treatment Procedure is a necessary procedure in the process of manufacturing castings and forgings, then great amount of furnaces caused large consumption of Natural Gas. Take 2019 as an example: the consumption of Natural Gas is 44.6 million cm3, and the cost is RMB 120 million. The amount is huge, and the energy saving potential is also huge. The Energy Management System Leading Group has kept the Reduction of Natural Gas Consumption as a Main Task of Energy Management.

3. Implemented Key Activities for Improving Energy Efficiency

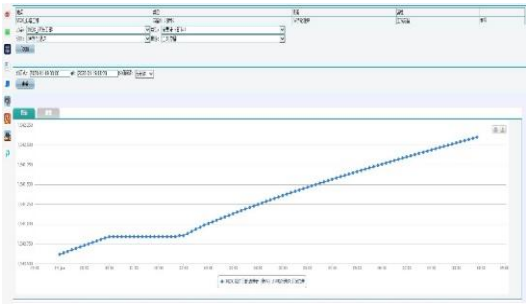


"Internet +" Energy Control Center

(1) From the advanced monitoring means and the strong ability of timely collecting &processing data by Internet + Energy, calculating the Natural Gas Consumption in heating or during heat treatment process, comparing and optimize the heating (heat treatment) process. The Gas Demand Side Management System is adapted for real-time monitor and analyzing the operation of each natural gas furnace, so as to continuously tap the energy saving potential and reduce the energy consumption level. The Production Dept. reasonably arranges the charging plan, and Management Dept. adopts the management means such as On-site Inspection and sending the Inquiry Letters to the problems, to continuously improve the Charging Rate and Working Cycle of each natural gas furnace, so as to greatly improve the working efficiency of the natural gas furnace, thus reducing the consumption of natural gas and the consumption of natural gas for single product.



Instantaneous Flow Curve of
Natural Gas Heating Furnace



Cumulative Flow Curve of
Natural Gas Heating Furnace

(2) Combined with the Heating Curves and Heat Preservation Curves of the parts in the furnace, the pressure and flow of natural gas can be calculated and controlled to minimize the cost of natural gas.

Gas Regulating Station

(3) Find pipeline leakage through timely monitoring, reduce loss and prevent potential safety hazards. Raise the Charging Rate of Furnace by Online Monitoring and On-site Inspection.

4. Site Cost Management

(1) Through monthly monitoring and analysis of natural gas consumption, the Energy Management Professional Group sends out Inquiry Letters to the Production Unit about the Abnormal Consumption of Natural Gas, by finding and analyzing the reasons by both parties, the users' awareness of reducing cost and increasing efficiency of natural gas is greatly strengthened.

(2) In order to curb the waste of energy source and investigate and punish the violation of regulations on energy use, we conducted weekly on-site inspection (natural gas is included) to energy-using units for violations of energy, Empty Burning, Running, Dripping and Leaking, etc., and required for rectify within a time limitation. This method strengthened the staff's energy conservation consciousness, and obvious energy conservation and consumption reduction effect has been received.

(3) Onsite Inspection of the operation and loading rate of Presses and Furnaces is performed.

(4) The Natural Gas Consumption in the Casting and Forging Company of CITIC HIC accounts for more than 90% of the total natural gas consumption of CITIC HIC, so it plays a decisive role in CITIC HIC's natural gas cost reduction and efficiency improvement management. In order to deepen our understanding the actual gas in use and management status, in strict accordance with the requirement to strengthen the management of natural gas cost reduction and efficiency improvement, the Energy Company of CITIC HIC send staff performed a daily morning checking for the Casting and Forging Company's 18500t, 7000t, 3000t, 1600t Open Die Forging Presses and Furnaces, 5000 Die Forging Press and Heat Treatment Furnaces. One of the reason is to familiar with manufacturing process of presses, furnaces and understand the management method at site, so as to accumulate management experience for the cost reduction and efficiency improvement management of energy-consuming equipment in the whole plant. The second reason is, through timely and full understanding of the actual production and management at site, and weekly and monthly statistics and analysis, to achieve the purpose of natural gas cost reduction and efficiency management. The comparison between 2019 and 2018 has received significant results.

5. Strengthen Terminal Management and Strictly Conduct Benchmarking Appraisal

In terms of the single consumption of Natural Gas and other major power source, CITIC HIC learned from the advanced companies in this field, absorbed advanced experience through investigation and survey, definite direction of efforts, formulated relatively advanced scientific Energy Consumption Indicators, promulgated strict Appraisal System, and implemented Monthly Inspection and Year-end Bonuses based on indicator performances, which aroused the enterprise and the staff to create the initiative for excellence.

6. Energy-saving Retrofitting of Furnace

In addition to consuming Natural Gas, Natural Gas Furnace also consumes air (assisted combustion) during working. Before the Retrofitting, air in the same ambient temperature was directly sent into the High-temperature Furnace by the blower, which directly affected the furnace temperature and caused the furnace temperature to drop. In order to compensate for the drop of temperature, Natural Gas Consumption had to be raised. At the same time, due to the temperature fluctuation, product quality was affected. The air preheater is added in front of the furnace, and the high-temperature residual heat of the flue gas is used to preheat the low-temperature air first, so as to raise the air temperature entering the furnace and reduce the influence of low air temperature on the furnace temperature, thus reducing the consumption of natural gas and improving the thermal efficiency of the furnace. At the same time, new insulation materials are used to reduce the furnace heat loss, further reduce the consumption of natural gas.

Ordinary Natural Gas Furnace before Retrofitting

Regenerative Natural Gas Furnace after Retrofitting

7. Through the establishment of the Energy Management System, the procurement process of Energy-consuming Equipment was reformulated, and the Procurement Dept. is required to purchase Energy-consuming Equipment after receiving the Joint Evaluation by both of Equipment Support Dept. and Energy Supply Company.

8. CITIC HIC has provided Energy Management Training to the Management Staff involved in the Energy Management System, and formulated a new training plan for 2020 to continuously improve the level of Energy Management.

9. The Energy Management System Manual and Related Procedure Documents have been revised to prepare for the Internal Audit.

Transparency

1. CITIC HIC obtained the “Certificate of Management System for Energy" on May 21st, 2019, and announced it in the news column of the enterprise's website on July 22nd.

公司能源管理体系通过认证

攻坚三季度任务

CITIC HEAVY INDUSTRIES 2019年07月22日 编辑 周欣

中信重工报网

News Column of the Enterprise's Website

2. In the bidding publicity materials, we promote the “Certificate of Management System for Energy" to our customers.

中国船级社质量认证公司
CHINA CLASSIFICATION SOCIETY CERTIFICATION COMPANY
能源管理体系认证证书
CERTIFICATE OF MANAGEMENT SYSTEM FOR ENERGY

编号：No.00519En1079R0L

中信重工机械股份有限公司

This is to certify that the Management System for Management System for Energy (EnMS) of

CITIC HEAVY INDUSTRIES CO., LTD.

has been found to conform to System Standard GB/T 23331-2012/ISO50001:2011 and RB/T119-2015 Energy management systems-certification requirements for machinery enterprise.

This certificate is valid to the following scope for EnMS: "THE PRODUCTION PROCESS OF MINERAL MILLS, HOISTS, GYROTARY KILN, VERTICAL MILL, CRUSHER, HPGR AND OTHER HEAVY-DUTY MECHANICAL EQUIPMENT AND LARGE FORGING AND CASTING RELATED ENERGY MANAGEMENT ACTIVITIES AND USE OF ENERGY-SAVING TECHNOLOGY".

本证书有效期至：2021 年 8 月 30 日。
This certificate is valid until 30 August 2021.

发证日期：2019 年 5 月 21 日
Issued on: 21 May 2019.

总经理：
General Manager Huang Shiyuan

Certificate of Management System for Energy

3. On the main interface of the display of the Energy Management and Control Center, the Certificate of Management System for Energy is published. The company often organized customers to visit the Energy Management and Control Center, and introduced the experience gained from the operation of the Energy Management System.

The Main Interface of the Display of
Energy Management and Control Center

Lessons Learned

- A "IE+IT" Energy Lean Management and Control Mode has been introduced, in order to realize the Cross-platform Development Mode for improvement by applying Information Technology to Management Technology.
- B It is essential to establish a well-organized and effective energy management system. The management system must be refined to each team of each department, to ensure the system could run effectively.
- C Establish an effective operation management mechanism, which can timely send the feedback of the problems on site, analyze the problems and propose improvement measures.
- D Improve the hardware facilities for on-site management, give full play to the technological advantages of "Internet +", and accurately realize the Energy Consumption Plan & Management, Trend Analysis of Energy Consumption, and Energy Consumption Forecast for Natural Gas Furnaces and other energy consumption facilities, so as to achieve balanced energy consumption, improve energy consumption efficiency, save and reduce emissions.
- E Vigorously promote the “4 New Technology” (New Technology, New Procedure, New Material, New Product) and the achievements, the "Workers’ 5 Small" Activity (Small Innovation, Small Invention, Small Retrofitting, Small Design, Small Proposal).