FINAL
SCIENTIFIC/TECHNICAL REPORT

DOE Grant Award Number: DE-EE0002729

Recovery Act: ArcelorMittal USA Blast Furnace Gas Flare Capture

Recipient Organization:

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Grant Funding: $31,603,993.00

Grant Term: January, 2010 through January, 2013

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Abstract

The U.S. Department of Energy (DOE) awarded a financial assistance grant under the American Recovery and Reinvestment Act of 2009 (Recovery Act) to ArcelorMittal USA, Inc. (ArcelorMittal) for a project to construct and operate a blast furnace gas recovery boiler and supporting infrastructure at ArcelorMittal's Indiana Harbor Steel Mill in East Chicago, Indiana.

Blast furnace gas (BFG) is a by-product of blast furnaces that is generated when iron ore is reduced with coke to create metallic iron. BFG has a very low heating value, about 1/10th the heating value of natural gas. BFG is commonly used as a boiler fuel; however, before installation of the gas recovery boiler, ArcelorMittal flared 22 percent of the blast furnace gas produced at the No. 7 Blast Furnace at Indiana Harbor.

The project uses the previously flared BFG to power a new high efficiency boiler which produces 350,000 pounds of steam per hour. The steam produced is used to drive existing turbines to generate electricity and for other requirements at the facility. The goals of the project included job creation and preservation, reduced energy consumption, reduced energy costs, environmental improvement, and sustainability.

This final report describes the project objectives, activities, and accomplishments.

Executive Summary

Introduction

ArcelorMittal's Indiana Harbor steel mill in East Chicago, Indiana is the largest steel mill in the Western Hemisphere and home of the No. 7 blast furnace (IH-7), the largest blast furnace in the United States. Blast furnace gas (BFG) is a by-product of blast furnaces that is generated in large volumes when iron ore is reduced with coke to create metallic iron. BFG has a very low heating value, about 100 BTU/cubic foot, because it consists of about 47 percent nitrogen, 22 percent carbon dioxide, 25 percent carbon monoxide, and 5 percent hydrogen. BFG from IH-7 blast furnace was used as the primary fuel for three boilers at the No. 5 Boiler House. The existing boilers could not consume all the BFG and ArcelorMittal typically sent 22 percent to a flare stack for burning off the excess. The result was that approximately 46 billion cubic feet (4.6 trillion BTU) of BFG per year was flared into the atmosphere.

The project team realized that if boiler capacity could be increased, this wasted fuel could be put to beneficial use. The excess fuel was enough for a boiler rated to produce 350,000 pounds per hour (PPH) of high pressure steam. A review of the existing steam distribution network was performed and it was determined that the additional steam could be used at existing steam turbine generators to produce more internally generated electric power. This would reduce the amount of power that must be purchased off the grid thus reducing manufacturing costs and carbon footprint (greenhouse gas emissions). The team prepared a detailed scope, schedule and budget for the BFG flare capture project. Due to the limited availability of capital funds during the economic downturn, the project team applied for a DOE grant in 2009 to help fund the project.

Project Objectives

- Deploy energy efficient technology for waste energy recovery. The goal was deployment of technologies to increase our energy security, provide job opportunities for manufacturing and construction, and provide long term job opportunities for operation and maintenance of the technologies. The objective was to be met through the installation a new high efficiency boiler to consume excess BFG. Further goals were:
    - Install in 30 months at a cost of $63.2 Million
    - Employ nearly 150 construction workers at the peak of construction.
    - Reduce BFG flared from 22% to 5%.
    - Reduce steel manufacturing costs and preserve manufacturing jobs by consuming less purchased power thus improving competitiveness of the facility.
    - Reduce green house gases by using clean BFG to produce electric power instead of purchasing coal fired power off the grid.

Project Outcomes

- The boiler was installed and operates at 88% efficiency producing 350,000 PPH.
- The project cost was $64.7 Million and was completed in 35 months, slightly above plan.
- The project employed over 175 construction workers at the peak of construction.
- BFG flared has been reduced from 22% to less than 9%.
- Internal power has increased and purchased power costs have been reduced thus improving competitiveness of the facility.
- The project was awarded "Best Operational Improvement" for 2012 by American Metal Market.

Introduction

Background: ArcelorMittal's Indiana Harbor steel mill in East Chicago, Indiana is the largest steel mill in the Western Hemisphere and occupies about 3,100 acres. Total employment at Indiana Harbor is about 5,900 employees. Indiana Harbor is the home of the IH-7 blast furnace, the largest blast furnace in the United States.

Blast furnace gas (BFG) is a by-product of blast furnaces that is generated when the iron ore is reduced with coke to metallic iron. It has a very low heating value, about 100 BTU/cubic foot, because it is about 47 percent nitrogen and 22 percent carbon dioxide which are not flammable. The balance is 25 percent carbon monoxide, which has a low heating value, and 5 percent hydrogen. BFG is commonly used as a fuel at steel manufacturing facilities, and can be used in boilers equipped to burn it. Particulate matter is removed from BFG at blast furnaces so that it can be burned more cleanly. Blast furnace gas which is not consumed internally is flared without generating steam or electricity.

Before this project was completed, approximately 78% of the BFG that was generated by the IH-7 blast furnace was used at the mill to heat blast furnace stoves and fire three existing boilers at the No. 5 Boiler House. The remaining 22%, or about 46 billion cubic feet of BFG per year was wasted when it was flared into the atmosphere through an exhaust stack.

ArcelorMittal is committed to the efficient use and conservation of energy. ArcelorMittal has Energy Teams and Energy Champions at each of its facilities. The Energy Team at Indiana Harbor performed benchmark studies comparing Indiana Harbor to the best practices for energy performance at other ArcelorMittal facilities. The 22% flare rate for blast furnace gas at No. 7 Blast Furnace / No. 5 Boiler House was the highest of all ArcelorMittal USA facilities. The Energy Team realized that capturing the BFG flare at No. 7 Blast Furnace was a key project to improve the energy efficiency and competitiveness of the facility.

A project team was assembled to study the situation and prepare a detailed scope, budget and schedule for the BFG flare capture project. The scope of the project included the boiler, feed water systems, fuel systems and associated buildings and utilities. The project uses the waste gas to power a new 88 percent efficient boiler to produce 350,000 pounds of steam per hour, and then use the steam to drive existing turbines to generate electricity. The new steam generates about 38 megawatts of electricity (333,000 megawatt-hours per year), enough to power 30,000 homes. The project will save an estimated 4.6 trillion Btu and reduce CO2 emissions by 340,000 tons annually. The total estimated cost of engineering, site preparation, equipment installation, and start-up of the proposed project was $63.2 Million and the forecast duration of the project was 30 months.

The economics of the flare capture project were reviewed and the estimated annual benefit was not enough to justify the project. The calculated Net Present Value of the project was less than the cost. However, in early June 2009 the project team was made aware of the potential to receive matching funds from the government for the project.

The American Recovery and Reinvestment Act of 2009 (ARRA) enacted legislation to create jobs, restore economic growth, and strengthen America's middle class through measures that modernize the nation's infrastructure, enhance America's energy independence, expand educational opportunities, preserve and improve affordable health care, provide tax relief, and protect those in greatest need. In support of the ARRA,

the DOE requested applications for, and awarded deployment projects for district energy systems, Combined Heat and Power (CHP) and waste energy recovery applications, and energy-efficient industrial equipment.

ArcelorMittal submitted an application in July 2009 for a 50% matching grant to fund the flare capture boiler project. The project team then gained approval for the ArcelorMittal share of the funding and continued preliminary engineering while it waited for grant approval.

Energy Secretary Steven Chu announced in November 2009 that the U.S. Department of Energy awarded a financial assistance grant under the American Recovery and Reinvestment Act of 2009 to ArcelorMittal USA, Inc. for a project to construct and operate a blast furnace gas recovery boiler and supporting infrastructure at ArcelorMittal's Indiana Harbor Steel Mill in East Chicago, Indiana. DOE's Proposed Action was to provide ArcelorMittal with a $31.6 million grant in a cost-sharing arrangement.

The project will promote the use of combined heat and power, district energy systems, waste energy recovery systems, and energy efficiency initiatives in hospitals, utilities, and industrial sites. Combined Heat and Power and District Energy Systems generate both the heat and power needed for industrial processes on-site, instead of using electricity from the grid, and are nearly twice as efficient as conventional heat and power production.

Project Objectives

The objective of the project is to support the retention of nearly 5,900 direct and an additional 26,800 indirect jobs at ArcelorMittal's Indiana Harbor steel mill in Northwest Indiana and create approximately 360 manufacturing and construction jobs through the construction of a waste energy recovery boiler system. The boiler will convert Blast Furnace Gas (BFG) that is generated in the iron making process and which is currently flared to the atmosphere, into steam and electricity, thus lowering energy costs, reducing emissions and improving the competitiveness of the mill.

Project objectives were to:

- Deploy energy efficient technologies for cogeneration and waste energy recovery. The project provided for the installation of an 88% efficient waste energy recovery boiler using 545 MMBtu/hour of previously flared BFG to produce 350,000 pounds per hour of steam.
- Provide job opportunities for manufacturing and construction. The recovery boiler project was expected to create approximately 360 manufacturing and construction jobs and employ nearly 150 construction workers at the peak of construction activity, as well as countless jobs at the companies that will supply the boiler and related equipment.
- Provide long term job opportunities for operation and maintenance of the technologies. The project will support the retention of nearly 5,900 direct and an additional 26,800 indirect jobs at ArcelorMittal's Indiana Harbor steel mill in East Chicago, Indiana. The steam will be used to drive existing generators at the facility to self generate 333,000 MWH of electricity annually. This will reduce steel manufacturing costs and preserve US manufacturing jobs by consuming less purchased power, thus enhancing the cost competitiveness of the plant, which directly employs nearly 5,900 people in a portion of the country that has been especially hard-hit by the recession.
- The project will reduce CO2 emissions by 340,000 tons annually, which is equivalent to taking approximately 62,000 cars off the road. The system will convert waste Blast Furnace Gas, a by-product fuel of the iron-making process that is currently flared to the atmosphere, into electricity, thus lowering energy costs and improving the competitiveness of the mill. The project will eliminate wasteful emissions and increase environmental efficiency. Blast furnace gas that is currently flared will be captured, used to make steam in a new boiler and converted into electricity through existing generators. This will result in the displacement of electric energy produced by coal fired utility power generation facilities thus reducing overall GHG emissions. The proposed project would result in a reduction of the amount of waste gas that is flared to 5%. The project will utilize 46 billion cubic feet of waste BFG (energy content of 4.6 TBTU/year), generate 333,000 MWH of power, and reduce CO2 emissions by 340,000 tons annually.

Project Approach

The scope was performed through the following Tasks:

Task 1.0 Project Management and Planning

ArcelorMittal is very experienced at planning and executing capital investment projects. ArcelorMittal managed the project for scope, cost, and schedule through all stages of the project.

The ArcelorMittal Capital Investment Projects Methodology (CIPM) was used in project planning and implementation for this project. This process ensured limited risk in regard to costs, scope, and schedule while delivering safety and quality in both project implementation and resulting asset design. The objective of the ArcelorMittal capital investment methodology is to install equipment and processes that reach the industrial objectives and the environmental requirements while ensuring the safety of people in accordance with the company strategy.

The key factors of the capital investment methodology are:

- A clear industrial objective in compliance with company strategy
- A maximized profitability
- The respect of commitments for Safety, Performance, Budget, and Schedule
- An efficient project organization & professional project team

The technology of BFG fired boilers is well developed and understood. This was the fourth BFG fired boiler on site at Indiana Harbor's number 7 Blast Furnace. By proper project planning and benchmarking, the main risks of project implementation and technical requirements were minimized or eliminated. Functional design was undertaken before project approval using experienced employees as well as competent engineering firms and construction advisors.

Asset Risk Management (ARM) is a strategic policy for the ArcelorMittal Group. ARM ensures and demonstrates that assets deliver the required function and level of performance in terms of service or production in a sustainable manner at an optimum whole life cost without compromising health, safety, environmental, or the organizations reputation. ARM policy includes a comprehensive set of organizational and material guidelines aimed at preventing accidents or incidents and to limit their impact on people, equipment and company assets. ARM guidelines are aimed at providing the means of assessing the level of industrial safety and ensuring its consistency through all plants of the Group. ARM guidelines provide a reference at the design stage for improving the safety of installations.

A hazard and operability study (HAZOP) was completed by a multi-disciplinary team during the design and construction of the project in order to identify and evaluate problems that may represent risks to personnel or equipment, or prevent operation. Project risk was also mitigated through the analysis of potential failure modes within the system for classification by the severity and likelihood of the failures. Finally, a Pre-Startup Safety Review was held as final confirmation before startup of the boiler system to ensure that all key inspections and reviews have been conducted.

The following Subtasks were performed during the project:

- *Subtask 1.1 – Maintain Project Management Plan-* ArcelorMittal maintained a Project Management Plan (PMP) for use as a management tool to establish the cost and time schedule for accomplishing the planned work. The PMP was maintained at a Subtask level supporting the Tasks provided in the Statement of Project Objectives (SOPO). The PMP served as the baseline for tracking performance of the project and identified critical path project milestones for the entire project. The PMP included a Work Breakdown Structure (WBS), Project Milestone Schedule and Timeline, Project Budget and Spend Plan, and a Project Team Organization Chart.

  The PMP provided schedule and cost data for purchase, installation, and operation of all capital equipment. The schedule included the following milestones:
    - AM Board Approval & DOE Grant Award
    - Place Engineering Contract
    - Obtain Environmental Permit
    - Equipment Procurement & Construction Contracts
    - Equipment Delivered to site
    - System Construction and Installation Complete
    - System Commissioned and Operational
    - Installed System Shakedown Complete - Ramp Up
    - Full Scale System Verification Complete – Performance Testing
    - Project Complete

  During the project performance, ArcelorMittal reported the PMP as part of the required quarterly Progress Reports as prescribed.

  The Project Milestone Schedule is shown in Table 1 and the Project Spend Plan is shown in Table 2.

Table 1 – Project Milestone Schedule

TASK/MILESTONE SCHEDULE						
Task/ Milestone Number	**Title or Brief Description**	**Task/Milestone Completion Date**				**Progress Notes**
		Original Planned	**Revised Planned**	**Actual**	**Percent Complete**	
1	Obtain AM Board Approval	9/16/09	10/25/09	10/25/09	100	Complete
2	Obtain final DOE Grant	11/16/09	5/15/10	5/27/10	100	Complete
3	Place Engineering Contract	11/30/09	4/30/10	5/20/10	100	Complete
4	Place boiler contract	1/15/10	8/15/10	11/1/10	100	Complete
5	Obtain Environmental Permit	3/30/10	9/15/10	9/4/10	100	Complete
6	Issue boiler building order.	Sep 2010	Dec 2010	Feb 2011	100	Complete.
7	Issue piling installation order	Nov 2010	Feb 2011	Mar 2011	100	Complete
8	Issue boiler foundation order	Dec 2010	Mar 2011	Apr 2011	100	Complete
9	Complete piling	Mar 2011	May 2011	May 2011	100	Complete
10	Complete foundations	Jun 2011	Aug 2011	Aug 2011	100	Complete
11	Boiler building erection.	Jul 2011	Aug 2011	Jan 2012	100	Complete
12	Place main construction order	Aug 2011	Sep 2011	Sep 2011	100	Complete
13	Place water building order	Aug 2011	Aug 2011	Sep 2011	100	Complete
14	Receive major equipment	Aug 2011	Apr 2012	May 2012	100	Complete
15	Complete equipment installation	Dec 2011	Jun 2012	July 2012	100	Complete
16	Water System Operational	Mar 2012	May 2012	May 2012	100	Complete
17	Boiler Operational	Mar 2012	Aug 2012	Aug 2012	100	Complete
18	Boiler Stable Operation	May 2012	Sep 2012	Sep 2012	100	Complete
19	Boiler Performance Testing	Jul 2012	Nov 2012	Nov 2012	100	Complete

Table 2– Project Spend Plan

Project Spend Plan							
Quarter	**From**	**To**	**Estimated Federal Share of Outlays***	**Actual Federal Share of Outlays**	**Estimated Recipient Share (Cost Share) of Outlays***	**Actual Recipient Share (Cost Share) of Outlays**	**Cumulative Actual Outlays (Federal + Recipient)**
1Q10	Start	3/31/10		$ 15,668		$ 15,800	$ 31,468
2Q10	4/1/10	6/30/10		$ 30,451		$ 30,622	$ 61,073
3Q10	7/1/10	9/30/10		$ 143,959		$ 144,768	$ 288,727
4Q10	10/1/10	12/31/10		$1,590,241		$1,599,172	$ 3,189,413
1Q11	1/1/11	3/31/11		$ 891,196		$ 896,200	$ 1,787,396
2Q11	4/1/11	6/30/11		$2,513,400		$2,527,514	$ 5,040,914
3Q11	7/1/11	9/30/11		$4,025,995		$4,048,450	$ 8,074,445
4Q11	10/1/11	12/31/11		$6,467,612		$6,504,042	$12,971,654
1Q12	1/1/12	3/31/12		$3,645,436		$3,665,675	$ 7,311,111
2Q12	4/1/12	6/30/12		$5,609,393		$5,640,826	$11,250,219
3Q12	7/1/12	9/30/12		$5,384,323		$5,414,495	$10,798,818
4Q12	10/1/12	12/31/12		$1,286,319		$1,499,509	$ 2,785,828
1Q13	1/1/13	3/31/13		$ 0		$1,139,244	$ 1,139,244
Totals				**$31,603,993**		**$33,126,317**	**$64,730,310**

Subtask 1.2 Environmental and Regulatory Compliance – ArcelorMittal is committed to being a leader in environmental management and minimizing environmental impact. The environmental department assigned key personnel to the boiler project team throughout the project. ArcelorMittal completed all permitting requirements and satisfied all regulatory requirements (local, state, and federal) necessary for installation and operation. Permitting activities took longer than originally planned.

Subtask 1.3 Execution of Required Financing Agreements - ArcelorMittal provided funds for its share of the project through its capital budgeting plan. This included all requirements necessary for installation and operation.

Subtask 1.4 Engineering Design –ArcelorMittal used a competitive bidding process and hired experienced engineering companies to perform all necessary design activities necessary for implementation of the flare capture boiler project.

- *Scope change for Water Treatment System* – During the engineering design phase of the project, ArcelorMittal realized that there was another large source of inefficiency in the system. The existing boiler feedwater treatment system was not able to remove sufficient amounts of impurities (calcium, magnesium, iron, silica, etc.) from the feedwater. In order to control impurity levels and prevent deposition, carryover, and corrosion in the boiler system and steam turbines, ArcelorMittal followed a practice of flushing about 10% of the feedwater on a regular basis. The project team determined that a reverse osmosis system would best remove minerals from the boiler water and increase system efficiency and production. The increase in internal power generation from the new water system was estimated to be at least 3 megawatts. The scope for a new 1200 gallon per minute water treatment system was incorporated into the project without a delay in the schedule. The increased cost was absorbed by ArcelorMittal with no increase in the amount of the grant.

Subtask 1.5 – Prepare Reports and Briefings – ArcelorMittal prepared briefings and submitted progress, financial, technical, and administrative reports in accordance with contractual requirements throughout the project. Project reporting requirements included the reports required by the US Department of Energy Federal Assistance Reporting Checklist including:

1. Management Reporting - Progress
2. Financial Reporting
3. ARRA Reporting

Reports also included periodical progress reports and cost reports for ArcelorMittal management.

Task 2.0 Procurement of Equipment, Controls, and Ancillary Supplies

ArcelorMittal procured long lead-time and capital equipment, controls, and ancillary supplies required for installation of the equipment and balance of plant (BOP) modifications required for equipment installation and operation. All purchases were entered and approved through the ArcelorMittal corporate purchasing system. Requisitions were entered into the system by the project team and issued for quotation by the purchasing department. Resulting bids were reviewed by the appropriate project team members and a technical analysis was provided to the purchasing department for commercial analysis and negotiation. Upon selection of the winning bid, the purchases were approved by the appropriate level of management before the purchase order is issued.

Payments were disbursed by the Finance Department upon verified receipt of the materials.

Task 3.0 Installation and integration

ArcelorMittal installed all capital equipment and ancillary systems for operation of the technology. This included major equipment, buildings, control systems, electrical connections, fuel supply, and other balance-of-plant (BOP) equipment required for operation of the BFG flare capture boiler.

The ArcelorMittal Safety Management System (SMS) was used during the construction phase of the project to ensure the safety of all employees and contractors. This resulted in good safety performance during the project.

The new boiler system was installed next to the existing No. 5 Boiler House. All significant processes (blast furnace gas, fuel, feed water, steam, etc.) were interconnected to allow the highest level of efficiency during the capture of the flared BFG and the production of steam and electric power.

ArcelorMittal procured construction services required for the installation of the equipment and BOP modifications required for equipment installation and operation using the same procedure as in Task 2.0 above

Payments were disbursed by the Finance Department upon verified receipt of the construction services.

Figure 1 shows the construction site in April, 2012.

Figure 1 – A View of the BFG Flare Capture Boiler during Construction in April, 2012.

Task 4.0 Commissioning, Shakedown and Startup

ArcelorMittal coordinated startup activities including verification of mechanical completion, operability of the equipment, and operator training. The major commissioning and startup activities included:

- Inspection for mechanical completion to verify that the system meets installed project specifications;
- Control system checkout and documented verification; and
- Performance testing to confirm the proper operation of all subsystems

Task 5.0 Operational Data Collection

ArcelorMittal conducted performance testing of the integrated system upon completion of the startup activities to insure operational safety, reliability and performance sufficient to proceed to long-term demonstration operations. ArcelorMittal identified and corrected any items preventing long-term reliability and efficiency of the flare capture boiler. ArcelorMittal has operated the BFG flare capture boiler for sufficient time to validate system efficiency, durability and sustainable employment. ArcelorMittal continuously monitors all operational data of the system including fuel use, steam and power production. Operational data is presented in the next section of this report.

Project Outcomes

Project results by objective are as follows:

1. **Objective** - Deploy energy efficient technologies for cogeneration and waste energy recovery. The project provided for the installation of an >80% efficient waste energy recovery boiler using 545 MMBtu/hour of previously flared BFG to produce 350,000 pounds per hour of steam (350 MLbs. /hour).

   Result - The BFG boiler has been installed and was connected to the high pressure steam system at No. 5 Boiler House on September 19th, 2012. The boiler efficiency was verified at 88%. Due to the high efficiency of the boiler, it consumes about 490 MMBtu/hour of BFG to produce 350,000 pounds per hour of steam. Hourly data is collected by ArcelorMittal Utility Data System. See Table 3 for boiler fuel use, steam and power production by month since start up.

   Table 3 – BFG Flare Capture Boiler Production Data

Month	Blast Furnace Gas Consumed MCF	Natural Gas Consumed MCF	High Pressure Steam Produced MLbs.	Incremental Power Produced MWh
September, 2012	238,936	7,901	26,572	4,080
October, 2012	1,047,893	16,777	95,473	5,787
November, 2012	1,570,480	13,495	127,950	8,146
December, 2012	2,281,399	3,823	175,819	6,333
January, 2013	3,255,903	4,249	236,494	13,357
February, 2013	2,818,754	3,667	207,686	15,756
March, 2013	2,369,269	1,875	184,939	22,682

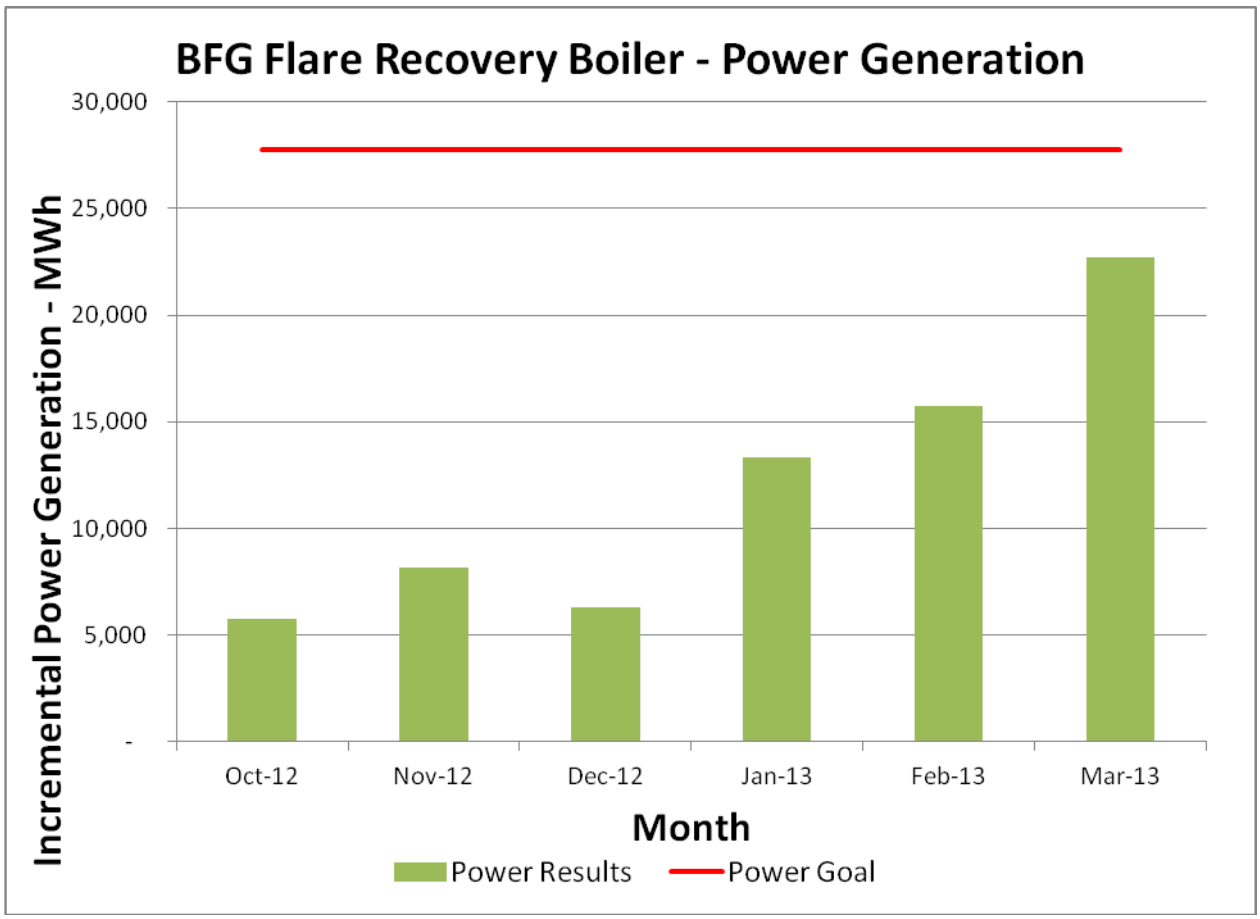
2. **Objective** - Provide job opportunities for manufacturing and construction. The recovery boiler project was expected to create approximately 360 manufacturing and construction jobs and employ nearly 150 construction workers at the peak of construction activity, as well as countless jobs at the companies that will supply the boiler and related equipment.

   Result – Approximately 480 purchase orders were issued by ArcelorMittal during the project. This resulted in the creation of hundreds of jobs throughout the USA. Most of the jobs created were in the Manufacturing and Construction Industries. Over 175 workers were on site daily at the peak of construction.

3. **Objective** - Provide long term job opportunities for operation and maintenance of the technologies. Reduce steel manufacturing costs and preserve US manufacturing jobs by consuming less purchased power. The project will support the retention of nearly 5,900 direct and an additional 26,800 indirect jobs at ArcelorMittal's Indiana Harbor steel mill in East Chicago, Indiana. Most importantly, the project would save the facility nearly $20 million in energy costs, which has the effect of lowering the production costs of steel by $5 per ton, thus enhancing the cost competitiveness of the plant, which directly employs nearly 5,900 people in a portion of the country that has been especially hard-hit by the recession. The steam will be used to drive existing generators at the facility to self generate 333,000 MWH of electricity annually, which is roughly equivalent to the electricity needs of 30,000 homes.

Result – Internal power generation has increased at ArcelorMittal Indiana Harbor. The amount of purchased power has been reduced resulting in lower production costs and improved competitiveness. Employment at ArcelorMittal Indiana Harbor has been maintained. Figure 2 shows the monthly incremental internal power generation at Indiana Harbor since October compared to the target rate of 333,000 MWh/year. The project was awarded "Best Operational Improvement" by American Metal Market.

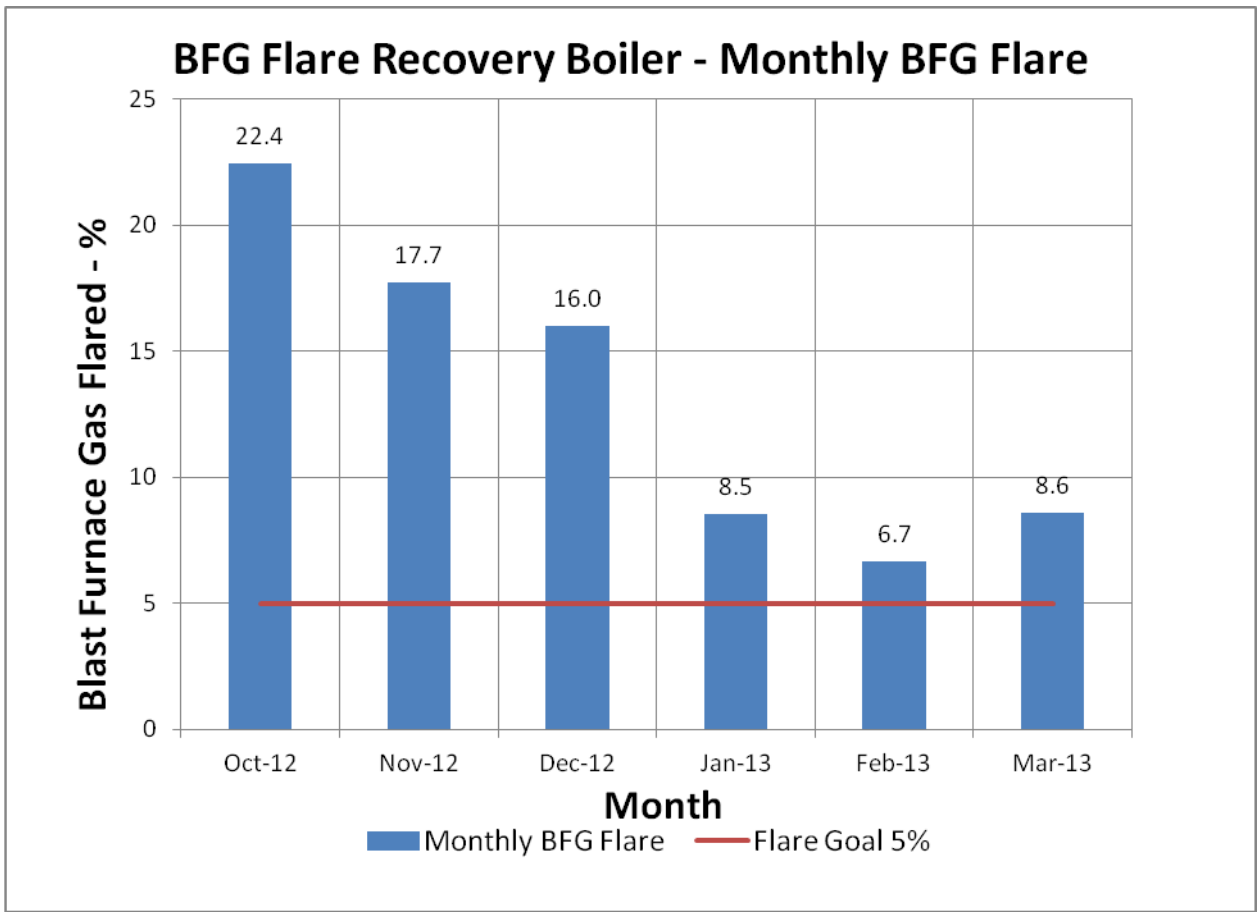
Figure 2 – Internal Power Generation at Indiana Harbor East



4. **Objective** - The system will convert waste Blast Furnace Gas (BFG), a by-product fuel of the iron-making process that is currently flared to the atmosphere, into electricity, thus lowering energy costs and emissions and improving the competitiveness of the mill. Eliminate wasteful emissions and increase environmental efficiency. Blast furnace gas that is currently flared will be captured, used to make steam in a new boiler and converted into electricity through existing generators. This will result in the displacement of electric energy produced by coal fired utility power generation facilities thus reducing overall GHG emissions. The project will reduce CO2 emissions by 340,000 tons annually, which is equivalent to taking approximately 62,000 cars off the road. The proposed project would result in a reduction of the amount of waste gas that is flared from 22% to 5%. The project will utilize 46 billion cubic feet of waste BFG (energy content of 4.57 TBTU/year), generate 333,000 MWH of power, and reduce CO2 emissions by 340,000 annually.

Result – The flare has been reduced and internal power generation from gas fired boilers has increased. The amount flared has been reduced below 9% and can be controlled below 5% during normal blast furnace operations. Figure 3 depicts the reduction in blast furnace gas flare percentage since October.

Figure 3 – Blast Furnace Gas Flare Reduction



Conclusions

As a result of DOE funding for the blast furnace gas flare capture project, ArcelorMittal has been able to deploy energy efficient technology for waste energy recovery. The outcome has increased our energy security, reduced costs, enhanced the environment, provided engineering, manufacturing and construction jobs during the project, and resulted in long term job opportunities for operation and maintenance of the technologies in the future.