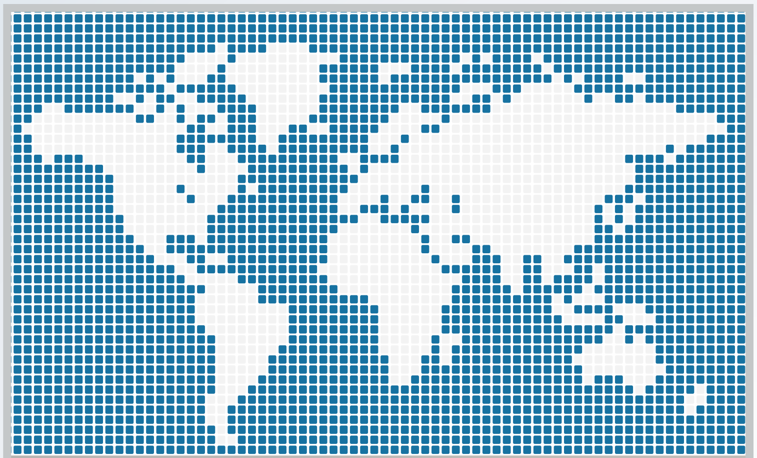

4TH QUARTER 2012

DIRECT FROM MIDREX

CONTENTS

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COMMENTARY

A WHOLE NEW JOURNEY OF DISCOVERY

By Chris Ravenscroft
Marketing Manager

Another year is at its end. And quite a year it has been. In 2012 we have seen the industry reach new heights with continued productivity growth (new MIDREX® Modules designed to produce 2.5+ million tons per year), announcements of new milestone projects such as LGOK 3 (the largest single HBI Plant to be constructed) and the unveiling of new technological advancements such as the unique Thermal Reactor System™ (TRS™) – a viable way to process Coke Oven Gas (COG) for use with the MIDREX® Process.

We are in a growing industry and with that continued growth the world of direct reduction will continue to change as well especially in the next few years. The path to discovery and innovation is a journey, not a destination. We have reached the end of 2012, but 2013 looks to be just as monumental.

Shale gas seems to be the new buzz word of the day, but it is more than just a fad as in North America it has helped to drastically lower natural gas prices. It will no doubt impact the DRI industry in North America, but its influence will span globally. In this issue we begin a two part article on Shale Gas. Part one will serve as a primer on what shale gas is and part two, which will be published next year, will take an objective look on how shale gas will change the world of direct reduction yet again.

2013 will also see the commissioning of 5 new MIDREX® Plants with a combined capacity of 7.5 million tons per year as well as announcements of new projects as the direct reduction industry continues its expansion. Each new project represents larger and larger capacities and greater flexibility for owners and operators to adapt to the conditions of the market and their own steelmaking operations.

Interest in MIDREX® Technology continues to develop as China learns more about DRI and India looks to rotary kiln alternatives and ways to lessen dependency on natural gas. With the announcement and test work of the TRS® system for COG in 2012, Midrex will be commercially offering the technology in early 2013. Developed with Praxair, the TRS is the focus of this quarter's technical spotlight. This technology no doubt will open new areas for DRI production as well as help the steel industry resolve environmental problems.

And lastly, next year will also mark the 30th anniversary of Kobe Steel's

acquisition the MIDREX® Process and of Midrex Technologies, Inc. The partnership and synergy of these two companies has led to the direct reduction industry's greatest accomplishments both in terms of production and technological innovations. Midrex is truly part of the Kobe family and together both companies look forward to the innovations and announcements ahead. Over the next year, Direct from Midrex will take a look back at the technologies and projects that defined the direct reduction industry as well as forward to even greater leaps to benefit the global steel industry.

The road ahead is filled with many new opportunities to shine and we invite you to come along for the journey.

COKE OVEN GAS OPTIONS FOR DIRECT REDUCTION

Increased Integrated and EAFs possibilities using Midrex/Praxair Thermal Reactor System™

by Gary Metius

INTRODUCTION

For years companies have considered using coke oven gas (COG) to produce direct reduced iron (DRI). In theory the concept is simple; however, due to the composition of COG, a simple solution has not been readily available.

In June of 2012, Midrex Technologies Inc. and Praxair, Inc. signed a strategic alliance agreement to develop and market a new Thermal Reactor System™ (TRS™) that will allow the production of DRI with a variety of fuels including COG. The TRS™ will use an innovative partial oxidation technology to convert hydrocarbon fuels into high quality, high temperature syngas suitable for DRI production.

COKE OVEN GAS FOR DRI

COG is a byproduct of the coke making process and consists of a complex mixture of typically 55% H_2, 7% CO, 25% CH_4, plus small amounts of CO_2, H_2O, heavy tars and volatile hydrocarbons.

There were 640 million tons of coke produced in 2011. Each ton of coke produced generates enough COG to produce one ton of DRI.

Today, most COG is used for heating applications, chemical plant feedstocks or is flared leaving its potential as a reducing gas untapped. Using COG for DRI production has always been of interest, but the challenge has been converting the methane to CO and H_2 and cleanup of the tars and volatile hydrocarbons.

Midrex first started looking at methods of using coke oven gas in direct reduction in the 1970's. The principal problems involved the presence of unsaturated hydrocarbons, tars and liquids, as well as high levels of methane and sulfur compounds in the raw gas. The earliest studies focused on conditioning the gas to use as a feed gas component for a MIDREX® Reformer. More recently, interest formed around the possible use of COG in the MXCOL® Process which is designed specifically around the use of coal derived gases as the reducing gas for the MIDREX® Process. Based upon recent developments in partial oxidation technology it was decided to investigate the possibility of its use to condition COG as an appropriate reducing gas for the MXCOL Process. (The drawback to partial oxidation has always been the necessary addition of steam to the reactants to reduce the soot formation resulting from the oxygen reactions.)

As a result of the investigations, Midrex formed an alliance with Praxair to develop and market a new process technology for the production of DRI from a variety of fuels including COG.

PRAXAIR'S HOT OXYGEN TECHNOLOGY

PRAXAIR

In mid-2011, Praxair made a presentation to Midrex that covered a variety of technology developments they were offering commercially. One of these was a partial oxidation technology. Its unique features offered the potential to do partial oxidation of hydrocarbons, soot free, without steam injection. When this technology is combined with an extended thermal reaction chamber into which a stream of preheated coke oven gas is injected, the product gas leaving the reactor is suitable for use as a reductant source for direct reduction. All together this equipment grouping, including gas compression, preheating, and reacting makes up the Thermal Reactor System™ or TRS™.

THERMAL REACTOR SYSTEM™

The TRS employs Praxair's technology for partial oxidation of a variety of fuels, including COG. The system produces an in-situ, hot extreme velocity oxygen jet that rapidly entrains preheated COG, reforms the methane, breaks down heavy hydrocarbons, and destroys the tars without the need for any catalyst.

Reformed syngas then exits the TRS and is fed into the MIDREX® Shaft Furnace to produce DRI. In pilot scale tests with the HOB, over 96% tar destruction has been achieved along with optimized methane reforming. In addition, operating conditions have been developed for avoidance of net soot generation. These results are currently being scaled up and demonstrated.

Based on the results of the pilot scale tests construction of a 1/20th scale demonstration plant is underway at Midrex's extensive research facilities in Charlotte, NC. The technology will be ready for commercial application in 2013. Midrex and Praxair will jointly market and provide the TRS and equipment. In addition, they will sell oxygen and/or syngas to the end customer, the ironmaker.

The two main TRS options are for use of COG with an MXCOL flowsheet and for use of COG with a MIDREX® Reformer.

USE OF COG WITH THE MXCOL® PROCESS

The MXCOL® Process was originally developed to utilize syngas from coal gasifiers to produce DRI. The process incorporates the use of a CO_2 removal system, typically using an amine solution based removal technology, and a radiant tube process heater to heat the reducing gas and syngas before the furnace bustle. (See *Figure 1*).

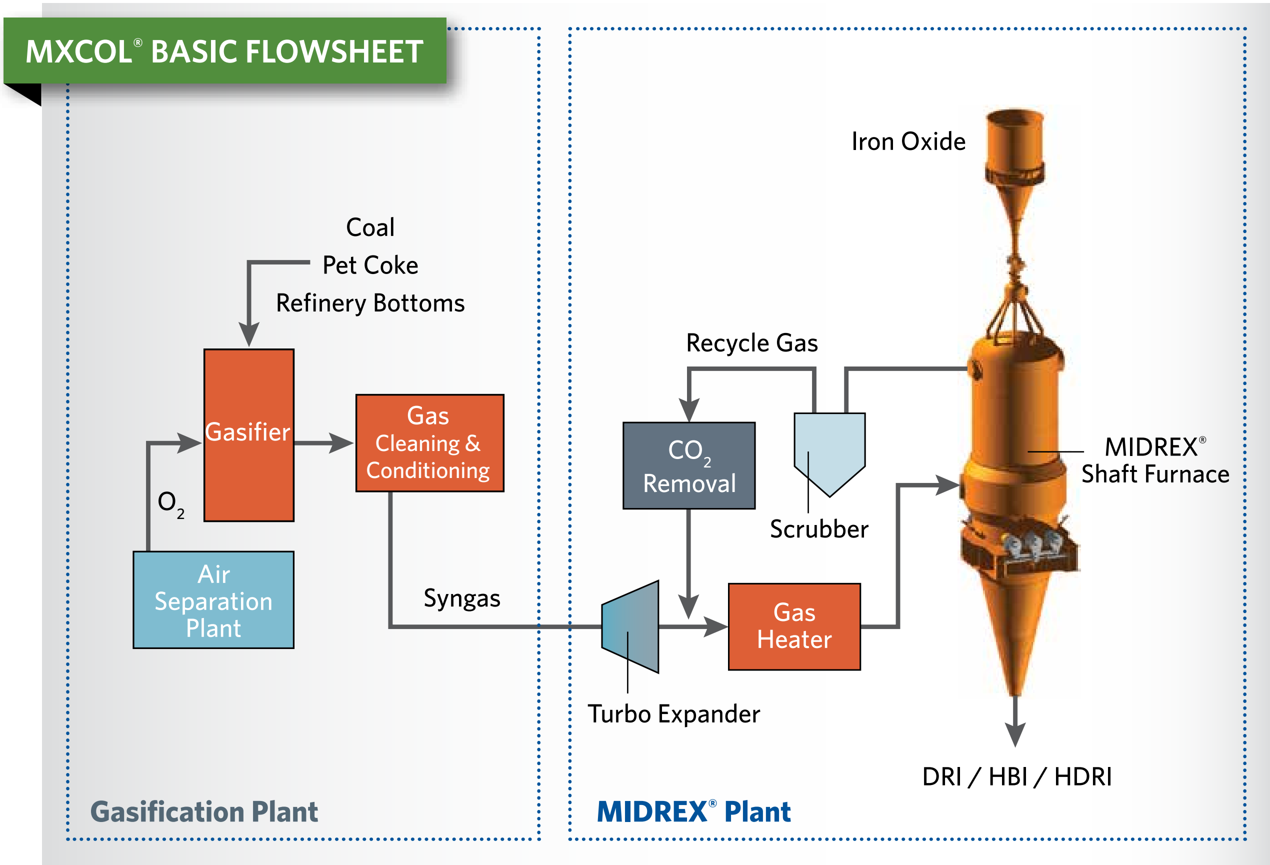


FIGURE 1 *MXCOL® Basic Flowsheet*

COG can be added to the MXCOL Process at the following locations. (See *Figure 2*). It can be used as a cooling zone addition (3), since a catalytic reformer is not part of the flowsheet and carbon deposition potential is of less concern. The cooling zone does not achieve sufficient temperature to degrade the carbon depositing potential of the COG.

If the coal gasification island in *Figure 1* is replaced with a TRS for COG, the flowsheet is virtually the same for the MIDREX Plant section; shaft furnace, top gas scrubbing, process gas compression, CO_2 removal, process gas and syngas mixing, reducing gas heating and back to the shaft furnace. (See *Figure 3*).

It is also possible to use the TRS to supply only a portion of the syngas needed for each ton of DRI. Under this arrangement, there is a further option that allows direct addition of the hot syngas from the TRS at the exit of the process gas heater and a CO_2 removal system is needed to avoid excessive export fuel resulting from the addition of reacted COG. (See *Figure 4*).

POTENTIAL USE POINTS IN THE MXCOL® PROCESS

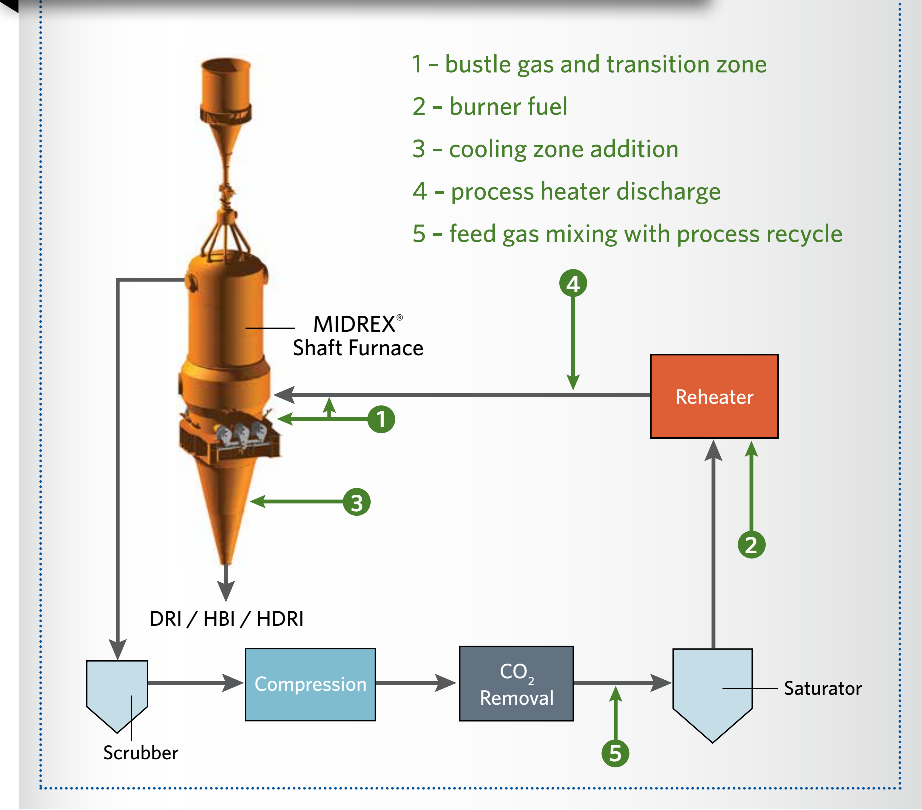


FIGURE 2 *Potential Use Points in the MXCOL Process*

MXCOL® PROCESS WITH TRS GAS SUPPLY – OPTION 1

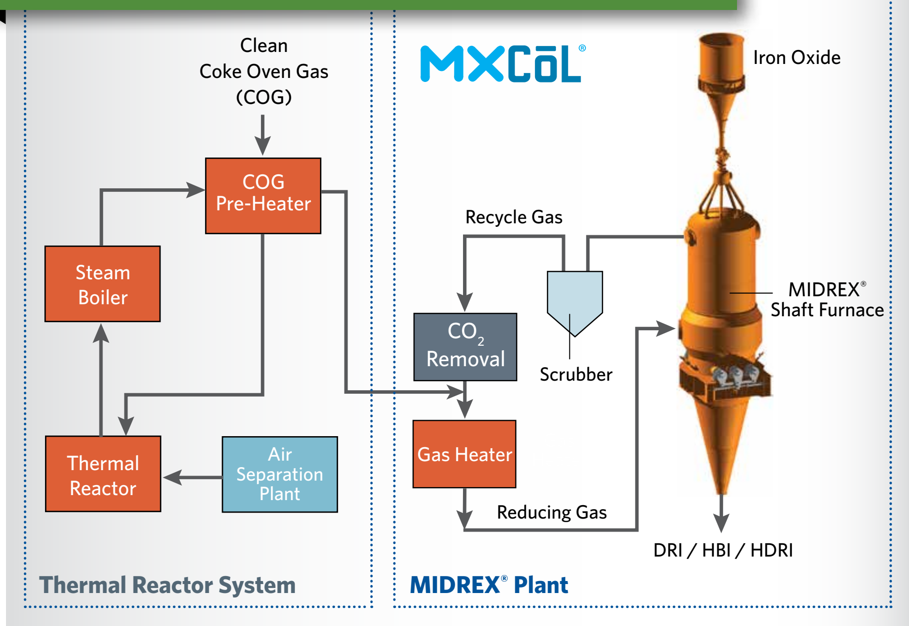


FIGURE 3 *MXCOL® Process with TRS Gas Supply – Option 1*

THE MXCOL® INTEGRATED SCENARIO

As stated previously, COG is a by-product from coke ovens which make coke for use in blast furnaces. This gas is used typically for feedstock to chemical plants, for heating applications and for production of electricity, but it can have greater economic value to the steelmaker if it is used to create additional iron units.

The MXCOL® option for COG makes possible the production of DRI, HBI or HDRI. When the coke ovens are located on the site of an integrated blast furnace steel works, HBI produced can be used onsite to increase the capacity of the blast furnace.

HBI is increasingly being used as an alternate feed material in blast furnaces. Some operators feed up to 30% HBI to their blast furnace on a consistent basis to improve its performance, lower its fuel requirements and reduce environmental emissions. (See *Figure 5*).

USE OF COG WITH A MIDREX® REFORMER

The TRS can supplement the existing supply of syngas needed for each ton of DRI. Addition of COG directly in the standard MIDREX® Process flowsheet can be accomplished by adding the gas to either the transition zone or the bustle gas (1). (See *Figure 6*). In doing this, the met zone temperatures and the reforming activity of the met zone will destroy and convert the tars and volatile hydrocarbons in the COG. The problem is that when the rate of COG addition reaches a critical point the plant will reach an export fuel condition in which more top gas fuel is generated than the reformer can consume. COG can also be used as burner as burner fuel (2), but the net effect is that COG supplied to the burners will generate an export of quantity of top gas fuel.

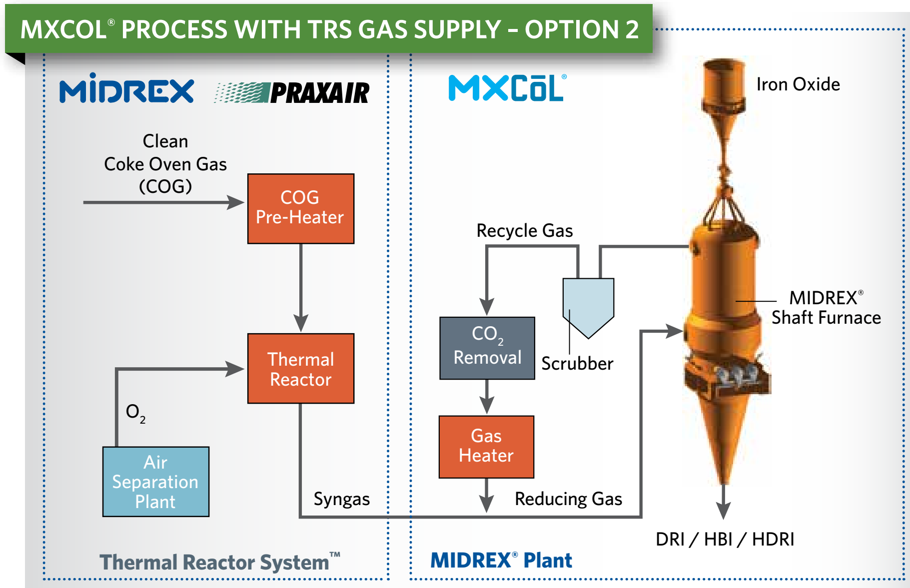


FIGURE 4 *MXCOL® Process with TRS Gas Supply – Option 2*

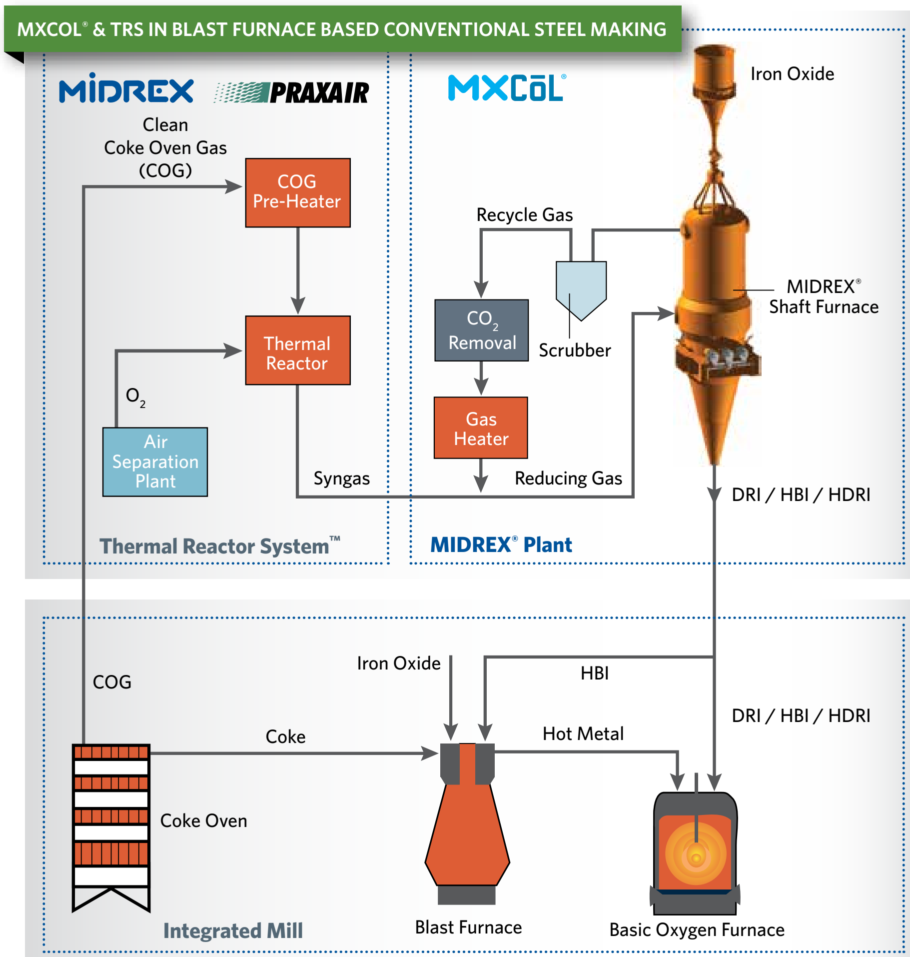


FIGURE 5 *MXCOL® and TRS in Blast Furnace Based Conventional Steel Making*

The addition of COG in the bustle gas (3) or feed gas (4) can be done using a Thermal Reactor System (TRS), which also requires the addition of a CO_2 removal system to control the export fuel that would result from the COG addition. (See *Figure 6*).

THE EAF SCENARIO FOR SUPPLEMENTING EXISTING SUPPLY OF NATURAL GAS

Typically DR Plants are built in locations where there is abundant low cost natural gas; however, occasionally the economic environment can drastically shift such as the case in India today. The escalating cost of natural gas to more than 10 times initial costs along with the limited availability of natural gas allocated within a region to make DRI can shutter a plant. The TRS system would allow supplemental gas to be used with a MIDREX® Reformer, providing a viable solution to help some of these plants continue operating and thus limit the impact of NG costs and availability.

CONCLUSION

Midrex and Praxair have created a viable solution to utilize COG for the production of DRI. The capability lends itself to several steelmaking scenarios to aid steelmakers make better use of existing energy sources. In the case of integrated mills, there is way to use COG and to produce additional iron units that can be used to increase blast furnace productivity or to be used in the BOF. In areas such as India, where EAF operators have problems in securing low cost natural gas, the TRS can help existing MIDREX Plants by providing additional reducing gas. The TRS technology will be ready for commercial application in 2013.

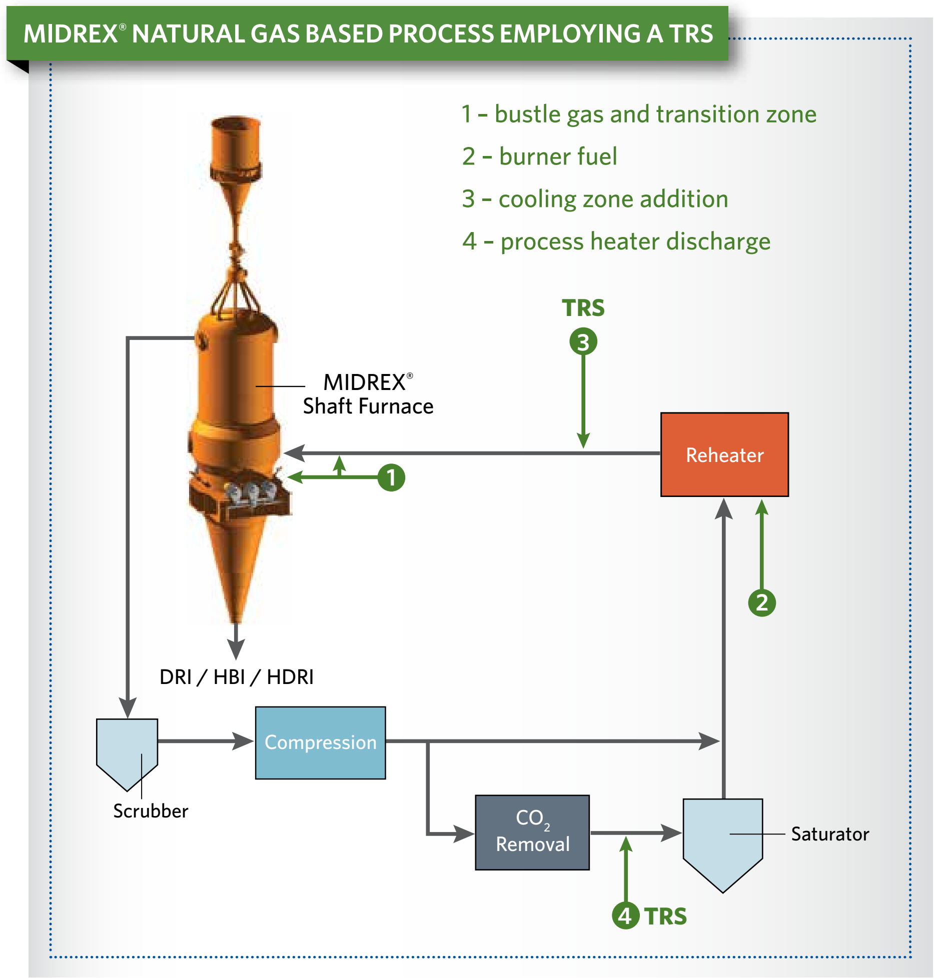
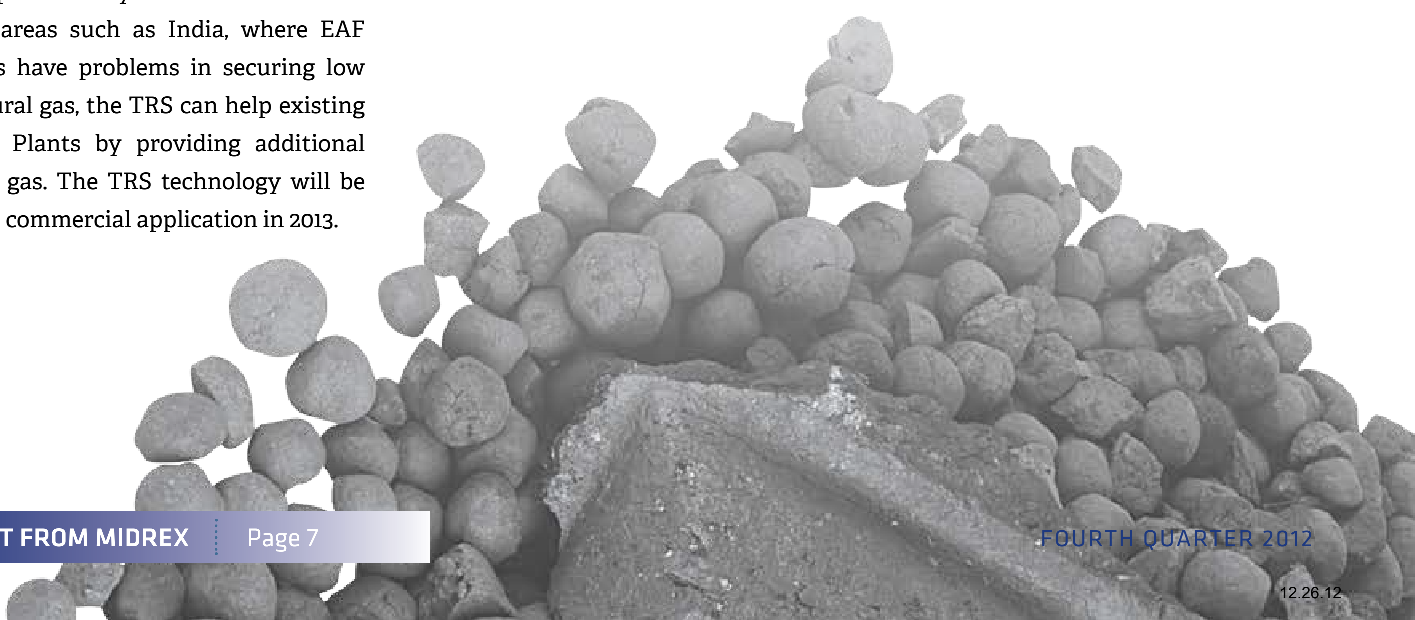


FIGURE 6 *MIDREX® Natural Gas Based Process Employing a TRS*



SHALE GAS AND ITS IMPACT ON THE WORLD:

(Part 1) Musings on a revolution in the energy sector

By Robert Hunter

Editor's Note: *This subject is too detailed to tackle in one article thus we are presenting it in two parts in issues of Direct From Midrex. Part 1 will present a foundation for the reader by delving into the phenomenon of Shale Gas and included in this issue. Part 2, "Scenarios for the Global Steel Industry" will follow in early 2013 and will address the impact of shale gas on not only on the EAF steelmaking industry but also the great impact it could hold for integrated mills.*

INTRODUCTION

Shale gas and its influence on the world's energy sector top headlines worldwide and are at the forefront of many debates and discussion. As with most developing industries there are many issues to be discussed, argued and explored. There is one fact though that cannot be easily disputed and that is shale gas will no doubt have far reaching impact into the world of iron and steel on a regional and global level. This article is designed to be a primer on shale gas for those who are not familiar with the concept and also as a medium to discuss how development of shale gas will affect the Direct Reduction Industry and beyond.

WHAT IS SHALE GAS?

To properly start we must first define Shale gas and how it is obtained. Shale gas is natural gas composed primarily of methane (CH_4) just like that from any other source. It only receives the name "shale gas" because it originates out of rocks that are mostly shale rather than coming out of sandstone as is the case with most natural gas. In addition, just like other sources of natural gas, shale gas may contain heavier hydrocarbons such as ethane and propane, and it might be mixed with carbon dioxide or with nitrogen, and it might be contaminated with various sulfur compounds. Once it is brought out of the ground it must be treated and processed for market us.

Over time, hydrocarbons under heat and pressure and in the presence of water will break down into lighter and lighter hydrocarbons. This is the type of process that is used in gasification of coal and in the production of fuel grade products from tar sands. It occurs naturally deep in the earth, but there it may take millions of years to progress to any stage where there is enough gas or other light hydrocarbons to be worth extracting.

This gas tends to migrate upward towards this surface. It rises upwards to a porous type of rock such as sandstone and can become trapped from rising further by an overlying layer of rock or 'cap' rock that is highly impermeable. If this is the case the gas accumulates in a 'reservoir' beneath the impermeable 'cap' rock. This process occurs over eons, hundreds of millions of years. Then by drilling a well through the permeable reservoir rock it is possible for the gas or oil to escape from the reservoir into the drill hole and then to rise to the surface.

This scenario was the standard way that oil and gas were produced until a 'suite' of technologies were developed that allow the oil and gas to be extracted from the actual 'source' rock, the stone where it was formed, without any need of finding special reservoir formations.

ACCESSING SHALE GAS

The necessary technologies to get to this source rock have been developed steadily over decades. Some of them are part of our everyday life. Some are unique to the petroleum industry.

SEISMIC IMAGING

Seismic imaging has developed rapidly over the past few decades. *Figure 1* shows imaging as it was around 1970 and as it can be done today.

Many of us are quite accustomed to this technology. If a physician wishes to see internal structure within the body, they'll often have a sonogram performed. The images made by the modern versions of this technology can show cross-sectional slices of internal organs by taking advantage of reflections of sound waves caused by differences in density of various tissues. The very same principles apply in seismic imaging, only the instrumentation is far more robust and the intensity of the sounds used are phenomenally greater. Often the sounds are created by dynamite or by ignition of special gas fired guns.

One major element of seismic imaging is the ability to process the data of the reflected sound waves and convert it into pictures of the underground strata. This is achieved through computation; a massive amount of computation. And, the great technological breakthrough in this is ever larger and ever faster computers. The ability to make so many calculations so rapidly is the main difference between the resolution and clarity of the two images in *Figure 1*.

"FRACKING" - HYDRO-FRACTURING OF ROCK AND PROPPING THE FRACTURES OPEN

After a concentration of shale that contains methane is found, a hole is drilled to reach the concentration. Extremely high pressure water is then pumped down the well. This water is at pressures sufficient to actually lift the one or two miles of overlying rock and to break some of rock closest to the drill hole into rubble. Close to the drill hole, holes will be broken through the rock which becomes shattered into small pieces; however, further away the rock is only cracked into chunks from approximately the size of automobiles up to that of small houses. And still further away the rock is not broken into discreet pieces, but some cracks still radiate further yet from the drill hole. This fracture of the rock is the first step. Once the rock is fractured it is necessary to 'prop' open the cracks. Otherwise they would simply close. The propping is done by injecting sand along with the high pressure water. The sand will stay between the rock fragments and hold them apart, thus creating pathways for gas and oil to flow.

The key advantage of "fracking" and propping is that it increases the effective surface area of the walls of the well.

Courtesy of Statoil

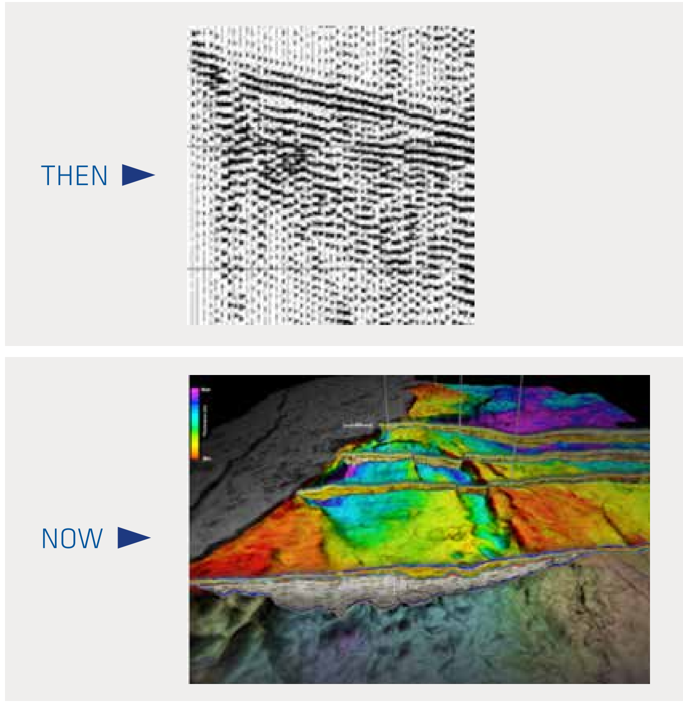


FIGURE 1 *Seismic imaging Comparison*

Consider a drill hole that is 50 cm in diameter. For each meter of length, it will present 1.57 m2 of rock wall that gas can seep out of and into the well. Now consider a well that has been "fracked" out 75 meters in each direction. The effective diameter of this fractured zone is 150 meters and the surface area per meter of length of the drill hole is 471 m2, representing a 300-fold increase.

DIRECTIONAL DRILLING

Directional drilling has been practiced for many decades. Rather than drilling a hole vertically, it is the practice of drilling off vertical. Continual changes in the drilling direction can eventually achieve a bend from the vertical to the horizontal. Thus, it is possible to have the well drilled along the width and breadth of the gas bearing strata rather than simply passing through it via its vertical thickness. By slowly changing the drill direction, a bending radius of as little as 100 meters can be achieved for small diameter pipe, but typically the bending radius will be 300 to 500 meters or even more.

GUIDANCE SYSTEMS

The guidance systems used for these wells is truly space aged technology. At two or three kilometers underground, GPS does not work. Instead the location of the drill bit is determined with an accuracy of only centimeters using gyroscopic guidance quite similar to that used for the rockets that insert satellites into orbit. When the ambient conditions of a well are taken into account, the pressure, the heat, the often highly sulfurous surroundings, it is truly amazing that such delicate and finely constructed instrumentation can operate.

MULTI-HOLE WELLS

Again, this is a technology that has been available for many years, but often did not have a valuable contribution. Today, it does.

Combining these technologies, remarkable improvements are available. Combining the high quality seismic imaging with the directional drilling and the improved drill tip guidance, it is now possible to keep a drill moving through the "pay zone" of rock for kilometers as it moves along through the rock strata. The pay zone refers to the reservoir rock in which oil and gas are found in exploitable quantities. As an example, compare a well drilled through two two- to-five kilometer pay zones to one that merely crosses the thickness of the pay zone rock, say for 200 meters. This is an improvement of from 10 to 25 fold.

Multiply this improvement times the 300-fold improvement brought about by fracking. We now have from 3,000 to 7,500 times the gas flow. In theory, if eight wells were drilled radially from one site the overall improvement is from 24,000 - 1 up to 60,000 - 1.

Thus, rock that was only ten years ago considered completely incapable of yielding gas at a sufficient rate to payback the investment required for drilling is now the revolutionary new source of energy for the United States.

The technologies are expected to spread worldwide. The question becomes: how rapidly?

The best estimate to date about how this technology will spread around the world was done by the Energy Information Agency (EIA-DOE), a unit of the U.S. Department of Energy. Rather than attempt to gather new information they merely collected the data that the U.S. government already had on file concerning various sedimentary basins around the world. Then they estimated what effect these technologies will have on hydrocarbon production in those basins. They especially noted that this study is far from being all inclusive. In only covers some of the basins in some of the countries.

The map shown below in *Figure 2* is from that report. The map shows 32 nations that the EIA-DOE had some information about. These nations are in white. The nations shown in grey are ones about which the EIA-DOE had little or no information regarding their sedimentary basins so they are ignored by this study. The red areas are basins about which there was sufficient information to make an estimate. The yellow areas are other known basins, but ones that there was too little information to make an estimate.

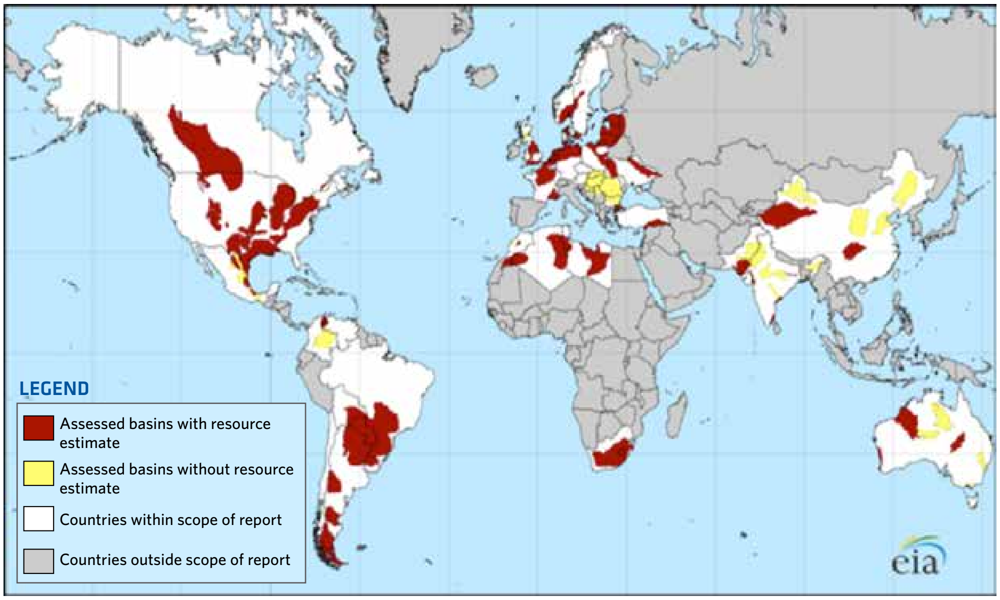


FIGURE 2 *Sedimentary Basin Map Study (by EIA-DOE)*

The overall summary for the report stated that the estimate for technically recoverable shale gas for those 32 nations exceeds the previously reported (Oil and Gas Journal) estimate of proven reserves by more than five times. Extrapolating for the entire world, using the Oil and Gas Journal estimate for proven reserves (estimate made in 2011 based upon 2010 data) one might expect total world technically recoverable shale gas to be on the order of 34,000 trillion cubic feet. That is approximately a 320 year supply based upon the current consumption rate of 106 trillion cubic feet per year.

One thing that should be stressed is that there are many possible reservoirs about which almost nothing is known. As an example there is a reservoir called the Utica Shale in the eastern United States. *Figure 3* shows a tiny portion of it where it is exposed at the surface. The Utica is in places as much as 300 meters thick and where it has been drilled, it is frequently rich with shale gas. Relatively little data is available about the Utica because it is a few hundred meters below the Marcellus shale bed over most of its range.

The Marcellus is massive. Official estimates of its recoverable gas content vary widely. A couple of years ago they were thought to be about 410 trillion cubic feet, then the estimate plummeted to 141 trillion and lately it rebounded remarkably to 330 trillion. Yes, the word is trillion. That number was 330 followed by twelve zeros. The point is that no one really can make an accurate estimate. There isn't enough data available. As one spokesperson for the EIA-DOE said, "Serious drilling in the Marcellus began only a few years ago, and many areas still have few or no wells, which makes the task of estimating reserves more difficult." In light of the fact that over 5,000 wells had been drilled into the Marcellus in the state of Pennsylvania alone this seems like a strange statement. But, actually it is an indication of the enormous size of the reserve that thousands of wells are still far too few to be able to produce an accurate estimate. Another point that should be noted is that even though these estimates are made under a constant set of conditions, variations in the conditions can greatly change the value of an estimate.

FIGURE 3 *An outcropping of the Utica Shale*

One of the most important conditions is price. If one changes the price over a 2 to 1 margin a vast difference will occur in the quantity of gas that can be recovered at that price.

AN IMPORTANT DIFFERENCE BETWEEN THE UNITED STATES AND MOST OTHER NATIONS.

There is one major difference in the United States that likely made the development of shale gas much more rapid than it will be in other nations. It is not a technical difference or a resource difference, it is a legal difference. In the United States mineral rights below the surface are usually owned by the landowner, not by the state.

It is probably much more expedient to a drilling project to negotiate the sale of these rights with individuals rather than with government entities. Even though most nations will most likely agree to use of the technologies required for development of shale gas, one should not expect the time scale of such development to proceed as rapidly as it has in the U.S.

ENVIRONMENTAL CONCERNS

The environmental effects of developing shale and other tight formation resources have received much attention, some deservedly and some not. It would be impossible to fully cover the subject here. Rather this is only a brief summary of a few aspects.

METHANE LEAKAGE

This gets very little attention from the press, but is one of the larger impacts of the technology. Simply put, pipe fittings tend to leak until they are properly sealed. As the gas collection systems from a shale gas field are built, there can be significant leakage until all the fittings are properly sealed. As one reads various reports, the estimates of this leakage vary over an extremely broad range, but there is no question that this aspect of the technology needs to be improved.

GROUND WATER CONTAMINATION

In contrast, this subject has received an enormous amount of attention from the press and almost certainly it has been overstated, far over-stated. A documentary film was made in the United States a few years ago that convinced many millions of viewers that shale gas development was contaminating wells across the United States. The key scene was filmed in the kitchen of a farm house in Colorado. The home owner goes to his kitchen faucet, turns on the water and then lights the gas coming from the faucet. It is a dramatic scene. What the documentary does not tell the viewer is that the Colorado Oil and Gas Conservation Commission tested that water in 2008 and ruled there were "no indications of oil & gas related impacts to water well." The well supplying water to the faucet was drilled through rock strata containing natural gas.

This is not to say that shale gas development does not contaminate drinking water. The same Colorado Oil and Gas Conservation Commission ruled that another well, 20 miles away, had been ruined by shale gas development. The penalty for doing so typically involves establishing a fund, for instance a trust fund, capable of supplying income to pay for carriage of potable water to the site of the well, in an amount equal to the water the well can produce, and to supply that water in perpetuity.

This is a strong penalty which drillers wish to avoid. Many thousands of shale gas wells have been drilled in the U.S.; over 10,000 in Pennsylvania alone. To date, fewer than 20 wells have been contaminated, and the intensity of the penalty is one of the main reasons why so little damage has been done.

TRUCKS- DISRUPTION TO LAND & ECOSYSTEM

This is one of the more serious problems associated with shale gas development. Typically, at least a hundred trucks (most carrying water for fracking) must travel to the well site that is normally not close to any road. This heavy traffic tends to damage soils in fields and in woodlands.

ECONOMIC BENEFIT

The economic effect of shale gas production in the United States has been enormous.

- World Steel Dynamics identified over two billion dollars of investment in the US steel industry directly related to shale gas. An additional two billion dollars of investment has been announced, but not yet contracted.
- The decline in natural gas costs to consumers in the United States was down by over $100 billion relative to costs prior to shale gas production.
- Economists estimate the lowering of fuel costs to the U.S. caused by shale gas to total over $100 billion
- Economists also estimate that this lowering of fuel costs is causing the U.S. economy to grow by ½% per year faster than it otherwise would. This does not sound like much until one considers that U.S. GDP growth is less than 2% per year in real terms. The ½% per year addition caused by lowered fuel costs is a major share.
- As recently as 2007, the United States had net imports of energy exceeding $400 billion per year. It is forecast that by 2017, the U.S. will be energy neutral, that is, imports will be approximately equal to exports. This constitutes a radical turnaround in balance of trade not only for the U.S. but for the oil producing nations too.

WILL THE TECHNOLOGY SPREAD TO OTHER COUNTRIES?

Without question the technology will spread. It already is. At present China is spending approximately $15 billion per year to explore and develop tight formations containing oil and gas. This is equal to the expenditures by the U.S.

Any place where there is a sedimentary basin that contains coal, or oil, or gas is a potential target.

In some countries the development of tight formations will not come quickly. They will need to see and be convinced first, that the technologies are by and large environmentally benign and second that the economic benefits are huge. Regardless, over the next few decades the shale gas revolution will spread around the world.

CONCLUSION TO PART 1

Shale gas is Natural gas and its growing popularity has global implications. This article described the nature of the gas and how it can accessed. The next **Direct From Midrex** will have part two of this article which will focus on the impact of this gas for the iron and steel industry, specifically the Direct reduction Industry and the positive effect for Integrated steelmakers.

Eternal Flame Falls on Shale Creek, ten miles south of Buffalo, NY - A natural phenomenon where the flame is fueled by natural gas seep just underneath the falls.

MIDREX News & Views

Pakistan's First DR plant to begin operations in 2013

Tuwairqi Steel MIDREX® DR Plant to start-up in January

Al-Tuwairqi Holding, Dammam, Kingdom of Saudi Arabia, has announced that its new MIDREX® MEGAMOD® Direct Reduction Plant at Tuwairqi Steel Mills, Ltd. in Karachi, Pakistan will begin operation the first week of January.

The Tuwairqi Steel Mills MIDREX® Plant will be the first of its kind in Pakistan, bringing the latest environment-friendly technological innovations in direct reduction ironmaking to Tuwairqi Steel Mill's capabilities and to the country.

The new DR plant has a name plate capacity of 1.28 million tons per year and the capability to produce Hot Direct Reduced Iron (HDRI) and/or Cold Direct Reduced Iron (CDRI) Plant simultaneously. Initial production will be 100% CDRI. The plant will be configured to allow the possible addition of briquette machines in the future to produce Hot Briquetted Iron (HBI). The facility will employ many of Midrex's latest innovations to minimize energy consumption and control product quality.

According to Al-Tuwairqi, the MIDREX® Process was selected because of its documented proven reliability, ability to consistently produce high quality DRI, HBI and HDRI, and because of the company's consistent history of fast start up periods.

Al-Tuwairqi also owns and operates two additional MIDREX® Plants at Direct Reduction Iron Factory adjacent to Al-Tuwairqi's Al-Ittefaq Steel Factory in Dammam, Kingdom of Saudi Arabia. Al-Tuwairqi acquired these two MIDREX DR Plants located in Mobile, Alabama from Corus Group Plc. in December 2004. The plants were originally located in Hunterston, Scotland prior to being moved to the USA. The two plants each have a production capacity of 400,000 metric tons per year.

Christopher M. Ravenscroft: Editor

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Editor's note: All references to "tons" are metric tons.

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