Association for Iron & Steel Technology (AIST)

Decarbonization Resource Materials

Upcoming Events:

Name	Date	Description	Link
AIST European Steel Forum 2021	26-28 October 2021	The program will emphasize practical solutions and economic drivers for technology innovation within the European and North American steel industry. Sessions will be devoted to the latest developments in CO2-free steelmaking, CO2-free energy, the role of iron units in green steel, digitalization — successful applications of AI, industry strategies for attracting and retaining talent, and innovation in plant design. Panel discussions will include candid conversation from European and North American industry leaders on key issues and opportunities in the today's landscape, as well as recruiting strategies to secure the steel workforce of tomorrow.	Register

Webinars

Environmental Sustainability and Energy Conservation	25-May-21	AIST MENA Member Chapter
Steelmaking With Zero Carbon Iron Units	11-Aug-20	
► View Webinar (AIST Member login required to view)	Steelmaking would be different if the iron source were direct reduced iron produced with hydrogen: the absence of carbon would affect slag foaming and nitrogen control. With this webinar, the DRITC aims to provide members with information on steelmaking with carbon-free material.	
	Organized by: AIST's Direct Reduced Iron and Electric Steelmaking Technology Committees	
Production, Storage and Safe Handling of Hydrogen	23-Jun-20	
► View Webinar	Hydrogen has been identified by some organizations as a key part in the decarbonization of ironmaking. It shows great potential in this role, but also presents substantial challenges. With this webinar, the DRITC hopes to educate members on the current state of hydrogen production.	
	Organized by: AIST's Direct Reduced Iron Technology Committee	
Ironmaking With Alternative Reductants	9-Jun-20	
► View Webinar	There has been an increased focus on the decarbonization of the steel industry worldwide. Several technologies show potential to be vital contributors in the effort to reduce CO2 emissions. With this webinar, the DRITC hopes to educate our members on these technologies.	
	Organized by: AIST's Direct Reduced Iron Technology Committee with support from ABM-AIST Combi Membership	

AISTech 2021 - June 29 - 1 July

Paper Title	Abstract	Speaker 1 Company	Track	Digital Library
Development and Successful Evaluation of an Atmosphere-Controlled Furnace for Direct Reduction Feedstock Studies	This paper describes the development of Lhoist's atmosphere-controlled Vario-Furnace and its modification to conduct comparative metallurgical studies of iron ore feedstocks for direct reduction and blast furnaces, paving the way toward a CO_2 emission-free steel industry. This furnace is designed to perform qualitative research on reduction behaviors of (iron ore) feedstock up to 500 g sample size in mixed-gas atmospheres (CO, CO_2, H_2, N_2, O_2, CH_4, SO_x) at temperatures up to 1,000°C. The setup, the gas flow optimization and the adaptation for metallurgical tests (reducibility, swelling, reduction-disintegration) are described, as well as the metallurgical results obtained on two types of industrial pellets.	Lhoist Business Innovation Center	Virtual Program	PR-382-142
Effects of Reduction and Carburization on Strength of Direct Reduced Iron	Direct reduced iron (DRI), as a feedstock in ironmaking and steelmaking, must maintain strength and integrity during processing, transportation, and use to avoid any operational issues and loss of material as fines. This study is designed to find associations among physical properties, structural changes, and phases in direct reduced iron during reduction and carburization. The results show that carburization changes DRI strength little, whereas the gas atmosphere has a significant effect (depending on the concentrations of water vapor, hydrogen and carbon monoxide).	Carnegie Mellon University	Direct Reduced Iron	No
High-Carbon DRI for the Production of High-Purity Pig Iron	The world's iron and steel producers need a paradigm change for the future to fulfill environmental regulations and to cope with raw material availabilities and final product qualities. The ENERGIRON® technology has been characterized by innovation and this paper outlines the novel Tenova High Purity Pig Iron production process that starts with the reduction of iron-oxide pellets in a gas-based direct reduction module and follows with high-carbon-direct reduced iron melting in an electric furnace, specifically designed to produce pig iron. The carbon footprint is thereby reduced by about 50% for ironmaking of integrated steel mills, while keeping the basic oxygen furnace and downstream facilities unchanged.	Tenova HYL	Direct Reduced Iron	No
How U.S. Steelmaking Became a Green Industry and What Lies Ahead	U.S. steelmaking is the smallest contributor of CO_2 emissions per ton of steel produced in the world, doing its part to prevent climate change and global warming. This is the result of a combination of economic, financial and technological factors that contributed to make U.S. steelmaking a benchmark for green steel production. This paper proves with scientific data the current situation, the technologies that are at the base of such results and the challenges ahead in keeping the industry on this path to be an example for the rest of the world.	Tenova Inc.	Environmental	PR-382-011
Hydrogen-Based DRI EAF Steelmaking - Fact or Fiction?	This paper will present a provocative rumination of the challenges to be considered and overcome before hydrogen-based direct reduced iron (DRI) steelmaking becomes a reality, or not. Considerations such as technology needs (H_2 generation, DRI carbon content, electric arc furnace needs and overall carbon balance) and economic viability (as understood currently) will be posed and discussed, along with the impact of carbon taxes.	Global Strategic Solutions Inc.	Direct Reduced Iron	PR-382-024
Investigation of Carbon Deposition During Natural Gas and Oxygen Injection for the Direct Reduction Ironmaking Process	In the direct reduced iron (DRI) process, reducing gases are generated in a reformer and lose heat to the environment as they are transported to a shaft furnace. To maintain temperature, oxygen and natural gas are injected. In ideal operation, the natural gas combusts with the oxygen, yielding increased thermal energy. However, in existing operating scenarios, carbon formation around the natural gas ports has become a serious issue. In order to better understand this problem, a three-dimensional computational fluid dynamics model was developed to investigate flow phenomena, combustion characteristics and carbon deposition in this region of the DRI process.	Purdue University Northwest	Direct Reduced Iron	PR-382-022

Investigation of High-Rate and Pre-Heated Natural Gas Injection in the Blast Furnace	Ongoing studies are being undertaken to develop improved understanding of the impacts of pre-heated natural gas (NG) injection on blast furnace operation, given the widespread nature of NG injection and the desire to expand operation ranges for higher rates of coke replacement. Previous research has explored the impacts of pre-heating on the characteristics of combustion in the tuyere and raceway of a blast furnace injecting NG. This paper explores additional facets of the concept, including impacts on coke rate, the level of pre-heating required to maintain a given RAFT, and potential methods of achieving NG pre-heating in a practical sense.	Purdue University Northwest	Ironmaking	PR-382-016
Ironmaking, Reinvented: Gas-Based Hot Metal Process for a Clean Steelmaking Era	The integrated steelmaking route is facing its hardest challenge ever: voices are raising to close blast furnaces and basic oxygen furnace (BOF) shops for good. The demand for industry decarbonization is guiding nations' policies and traditional steelmakers around the world are struggling to balance between company profitability and carbon emissions. Now, the gas-based hot metal process, capable of producing liquid pig iron starting from high-carbon hot direct reduced iron pellets, can revolutionize the field, maintaining BOF shops for the highest quality steel production. This paper presents the different projects currently under development and the impact in terms of greenhouse gas reduction, exceeding Paris Agreement goals.	Tenova Inc.	Environmental	No
Reduced Fuel Gas Usage with Improved Reheat Furnace Pressure Control	Reheat furnaces need a stable internal pressure to optimize burner combustion. In 2019, a major steel producer in northwestern Pennsylvania replaced an existing pneumatic actuator due to poor reliability and pressure control. The new electrohydraulic actuator with patented technology can react (4-5 Hz) to small, varying changes in the control signal with a repeatability of <0.1% travel position. This approach vastly improves the positioning accuracy of the flue gas stack damper, which allows hot gases to exit the furnace. By stabilizing the pressure in the furnace, the combustion efficiency was improved with an annual fuel savings of US$103,000 per year.	REXA	Energy & Utilities	No
Searching New Horizons: The Hydrogen Revolution in Steelmaking	Several megatrends are driving society toward sustainable economic models. In the case of energy-intensive industries such as steelmaking, the evolution toward climate neutrality will mean major investments in new industrial processes that entail the use of alternative feedstock sources. In this scenario, Tenova has developed and improved technologies able to significantly reduce energy consumption and the environmental footprint of steel production, with a very particular focus on hydrogen-based solutions. This paper outlines the SALCOS and HYBRIT projects, at the forefront of steelmaking innovation, and the role of the gas-based reduction process in these innovative routes.	Tenova Inc.	Direct Reduced Iron	PR-382-026
100% H2 DRI From Nuclear Process Heat	Coupling reactor technology into direct reduction steel by high-temperature steam electrolysis, hydrogen-making from natural gas is a wasteful process that is also not economical at higher gas costs. Molten salt reactor (MSR) is uniquely suited to provide the very high temperatures (600+C working temperatures) that are needed to both generate significant amounts of hydrogen, oxygen (a feed for basic oxygen furnaces) and electricity needed for advanced steel production. Studies by TEA and Idaho National Laboratory have shown that this new generation of MSR would be the most effective to provide carbon free, inherently safe, clean, non-proliferating energy.	Thorium Energy Alliance	Direct Reduced Iron	PR-382-083
A Fundamental Study of Decarburization and Bloating Behavior of Metal Droplets on Varying Carbon Concentrations	In the oxygen steelmaking process, time of refining of metal droplets and the surface area contributing to the slag-metal reactions are controlled by the bloating behavior of the droplets. The bloating behavior is determined by the decarburization kinetics. So, understanding the fundamentals of the decarburization process is essential to modeling the droplet contribution to refining. A study of decarburization has been performed with varying carbon concentrations and mass of metal droplets. The bloating behavior has been observed to be present for carbon level as low as 0.5% to 4.5%C. The reaction is found to control electrochemically at the end stage.	McMaster University	Virtual Program	No

Addition of Scrap and DRI/HBI to the Blast Furnace — Technology to Overcome Top Temperature Limits and Reduce Greenhouse Gas Emissions	This paper is presented in three parts to describe how to overcome technical limitations of the blast furnace related to adding alternative iron units (AIUs), which are typically scrap and direct reduced iron/hot briquetted iron. First, the prior art regarding AIU additions is reviewed. From this, the energy shortfall as increasing amounts of AIUs are added the blast furnace is estimated. Lastly, stack injection of hot gas using electrically powered plasma torches is evaluated as a strategy to overcome this energy shortfall and enable greater AIU addition rates. The analysis focuses on North American blast furnace practice using an all-pellet burden and natural gas injection.	Hatch	Ironmaking	PR-382-020
Assessment of a Methodology to Measure Carbon Footprint and Support Decision-Making Process in a Company's Supply Chain	This study evaluates the potential supply chain associated carbon footprint reduction with the implementation of CO2-eq calculation in a company's strategic, tactical and operational supply chain network decisions. The proposed calculation approach, based on the NTM method, was applied in a case study for a major player in the metallurgical industry with average outbound transportation carbon footprint at 308 kt of CO2-eq for 2018-2019. The results show that application of network optimization trade-offs for the company's supply chain operations that include CO2-eq could lead to carbon footprint reductions reaching greater than 50,000 t CO2-equivalent per year, or 16% of current emissions.	Hatch Consulting and Engineering	Virtual Program	PR-382-140
Building a Credible Greenhouse Gas Abatement Plan in the Steel Industry	The global impact of climate change is placing increasing pressure on energy- and emission-intensive sectors such as the steel industry. Investors, governments, employees and community stakeholders are demanding firms build credible plans for improving the environmental sustainability of their operations. Leveraging subject matter expertise across the steel value chain, and drawing from experts in renewable energy and sustainable financing, an approach will be shared to building and communicating a credible greenhouse (GHG) abatement plan for steel producers. A high-level assessment of applicable GHG-abating technologies will be presented, along with a first-pass analysis of potentially cash-positive actions.	Hatch	Environmental	No
HBI: Steel's Most Versatile Metallic in the Transition to the Hydrogen Economy	The conversion to hydrogen ironmaking will take time because of the unavailability of green hydrogen at necessary volumes/costs, and the large capital requirements to convert from the blast furnace (BF) to the direct reduction-electric arc furnace route. During this transition phase, other ways to reduce CO2 emissions must be explored in integrated steel plants. Hot briquetted iron (HBI) can be used in the BF/basic oxygen furnace (BOF) to supplement scrap, increase productivity and lower CO2 emissions. Merchant HBI can be produced in large-scale operations at a location where logistics and reducing gas (including hydrogen) can be advantageous and transported in the right amount to existing steelmaking complexes as a flexible metallic source.	Midrex Technologies Inc.	Direct Reduced Iron	No
HIsarna: Benefits of a New Developed Smelting-Reduction Option for Ironmaking	HIsarna is a new coal-based smelting-reduction technology for ironmaking. Its benefits include: process intensification and high energy efficiency; a CCS-ready process gas; reduced emissions of dust, SOx and NOx; flexibility in raw materials; and increased circularity through reclaiming Zn from waste materials and/or Zn-coated scrap. Because HIsarna produces low-phosphorus and low-silicon hot metal, it reduces costs in steelmaking and opens opportunities for new products. The process also offers lower capex and opex compared to the blast furnace route. The HIsarna process offers the potential to replace a substantial part of the injected coal by biomass, natural gas or hydrogen.	Tata Steel	Virtual Program	PR-382-143
Hydrogen and Steel production: On-Site Containerized Hydrogen Production From Natural Gas and Biogas	Hydrogen is being progressively utilized as a clean fuel in both transportation and power generation. It has already been used in steel production for many years in heat treatments (i.e., hydrogen annealing). Currently, there is a big push to increase the use of hydrogen also as a reductant in direct reduced iron production, and in general to decarbonize the steel industry to reduce greenhouse gas emissions. This paper identifies the potential use of hydrogen in the steel production and analyzes a new compact and containerized H2 production technology that allows steelmakers to efficiently produce on-site hydrogen from natural gas and/or biogas.	Metal Consulting	Direct Reduced Iron	

MIDREX H2 - The Road to CO2-Free Iron and Steelmaking	The iron and steel industry must reduce CO2 emissions drastically during the next 30 years. The EU target is an 80% reduction by 2050, which can only be achieved by different production processes. To prepare, many steel producers plan to integrate a direct reduction (DR) plant in their existing steel works. This paper describes the Midrex H2 plant configuration for stepwise increase up to 100% H2 input. An overview about currently ongoing H2 plant projects based on Midrex shaft furnace technology will be given. Furthermore, a feasibility and case study of a DR plant operation based on H2 will be presented.	Primetals Technologies	Direct Reduced Iron	PR-382-025
Top Gas Recycling Revisited to Reduce Blast Furnace CO2 Emissions	Blast furnace (BF) top gas recycling (O2BF) was tested by the ULCOS program to reduce CO2 emissions using the LKAB experimental blast furnace. During tests, the carbon rate was reduced by about 25%. Hatch and BHP re-visited the O2BF concept to assess if additional technologies could be implemented to further reduce CO2 emissions beyond what was achieved. Using a two-stage heat and mass balance model, viable operating conditions were established for a low-carbon-rate operation, significantly less than what was achieved in the ULCOS trials. Details of the enabling technologies to reach such low CO2 emission rates will be presented.	Hatch	Virtual Program	PR-382-147
Utilization of 6- to 20-mm Waste Metallic Scrap as a Charge Material and Reduction of Carbon Rate and HM Silicon at E Blast Furnace of Tata Steel Ltd. Jamshedpur	Recycling of waste metallic scrap can be an alternative source of raw material for the blast furnace. Since scrap is a pre-reduced material and less energy is required for its melting, additional energy will help to reduce the carbon rate and lower hot metal silicon. The E Blast Furnace of Tata Steel has a reduced carbon rate and hot metal Si of 10 kg/thm and 0.1%, respectively, with 50% sinter, 47% iron ore and 3% scrap in the burden. Wall charging of scrap with constant furnace uptake temperature along with optimization of burden distribution helped the E Blast Furnace to continue low carbon rate and lower HM Si operation.	Tata Steel Ltd.	Virtual Program	PR-382-153
Why Both Hydrogen and Carbon are Key for Net Zero Steelmaking	Howe Memorial Lecture		Howe Memorial Lecture	PR-382-199
Hydrogen-Based DRI EAF Steelmaking -- Fact or Fiction?	This paper will present a provocative rumination of the challenges to be considered and overcome before hydrogen-based direct reduced iron (DRI) steelmaking becomes a reality, or not. Considerations such as technology needs (H2 generation, DRI carbon content, electric arc furnace needs and overall carbon balance) and economic viability (as understood currently) will be posed and discussed, along with the impact of carbon taxes.	S.A. Hornby		PR-382-024

Technical Papers in AIST's Digital Library

Paper Title	Abstract	Source
A Scenario for Integrated Sustainability: Application of the TRS® for the Integrated Blast Furnace Steel Industry	It has long been known that coke oven off?gas (COG) contains valuable components that can be used for shaft furnace based direct reduction of iron. The challenge has always been that the long chain and cyclic hydrocarbons indigenous to the COG are not usable and can be detrimental to the process. With the advent of the MIDREX® Thermal Reactor System™ (TRS®), it is now feasible to reform and condition the COG so that it can be used as the fuel and reductant for the MIDREX® Direct Reduction Process. In the case where the coking oven(s) are located on site of an integrated steel works, the COG may be processed by the TRS® and fed to an onsite MIDREX® Direction Plant to produce Hot Briquetted Iron (HBI). Use of HBI for up to 30% of the blast furnace burden has not only proven beneficial from a costs and production stand point, it also further reduces the environmental footprint of the steelworks per ton of steel produced. This paper will address the costs and benefits of a Midrex TRS® installation and its potential to significantly increase the sustainability of the integrated steel works.	
A Sensible Route to Energy Efficiency Improvement and CO2 Management in the Steel Industry	One can argue that the first step in any carbon management (or CO2 reduction) program should be towards getting the most from the carbon that is used, and which becomes converted into CO2. A technology termed BF Plus accomplishes this through the integration of oxygen-enriched Blast Furnace (BF) hot metal production with high-efficiency power generation.	

Achieving Carbon-free Emissions via the ENERGIRON DR Process	For more than 50 years Tenova HYL has developed technologies designed to improve DRI based steelmaking competitiveness and productivity. The recent alliance between Tenova HYL, Techint and Danieli brings a new brand - ENERGIRON - to the forefront of the direct reduction industry. The ENERGIRON process has been improved over generations and the current status of the technology, the ENERGIRON ZR (or Self-reforming) Process, was developed to allow reduction of iron ores in a shaft reactor without external gas reforming equipment. This process scheme has the ability to produce high carbon DRI, which allows producers to obtain maximum benefits of carbon in the steel making process while producing a product of higher stability. The HYTEMP® System developed to transport hot, high carbon DRI directly to the EAF meltshop, has been successfully operating since 1998, now in full operation in the 1.6 million t/y Emirates Steel plant in Abu Dhabi, continuously transporting more than 200 t/h of hot DRI to the meltshop. The ultimate objective has been the optimization of overall energy consumption, with the implicit reduction of CO2 emissions. ENERGIRON technology is characterized by its flexible reformerless process configuration which is able to satisfy and exceed the current stringent Environmental requirements worldwide. The gaseous and water effluents of the process are not only low but easily controlled. Incorporation of selective carbon dioxide (CO2) removal systems has been a key factor over the past decade in significantly reducing the emissions levels, providing an additional source of revenue for the plant operator via the captured CO2. This paper focuses on the Environmental aspects related to greenhouse gases emissions and specifically on the unique patented scheme to selectively and efficiently remove about 90% of total CO2 from the DR plant.	
Carbon Dioxide Sequestration with Steelmaking Slag: Process Feasibility and Reactor Design	The goal of this research is to develop a functional sequestration process using steelmaking slag for permanent capture of carbon dioxide emitted from steelmaking offgas. A parallel benefit of this process is rapid chemical stabilization of the slag minerals with reduced swelling or leaching potential. This paper summarizes the results of the project including mineralogical features of carbonate formation in steelmaking slag, study of the reaction mechanisms, thermogravimetric analysis of the reaction between solid-state slag and CO2, design and testing of a two-stage lab scale reactor system, METSIM modeling of possible reactor designs, and exploration of the economic feasibility of the process based on operating costs, metals recovery and credit for CO2 sequestration.	
CO2 Emissions And The Steel Industry's Available Responses To The Greenhouse Effect	The issue of Global Warming has matured significantly since the Climate Conference of Rio in 1992. On the ..scientific side, climate modeling has complexified by taking into account the coupling between atmospheric and ocean circulations and a number of interactions with the ecosphere. This has resulted into a better prediction of temperature projections caused by increased atmospheric CO2. Moreover,analysis of historical data on CO2 accumulation in the atmosphere and correlated temperature pick uphas confirmed that the trend is due to human activities while other natural explanations were discredited.	
CO2 Emissions For The Blast Furnace/Converter Route - Comprehensive Evaluation And Potential	In the context on Production-integrated environmental protection in coke, sinter and hot metal production, the key topic of C02 emissions should not be neglected, particularly against the background of the 6th UN world climate conference that took place in The Hague in November 2000. The industrialized countries are mainly made responsible for the increasing C02 levels in the atmosphere and the related global warming.	
CO2 From ENERGIRON DR Plants as a Unique, Valuable By-Product	The benefits of producing steel through the DR-EAF configuration, as compared to the integrated BF-BOF route regarding CO2 emissions, are by now well known.In general the carbon footprint of a DR-EAF plant is about 50% of that of an integrated mill; however, among available DR technologies, the ENERGIRON ZR scheme is characterized not only by 45% less CO2 emissions vs. competing technologies, but also has the possibility to further increase CO2 capture up to 90%, and its inherent commercialization as a valuable by-product.	

Cogeneration With ORC at Elbe-Stahlwerke Feralpi EAF Shop	Reducing energy consumption has been a constant concern of steelmakers over the years; making one ton of steel today uses about one half of the energy used in the 1970s [4]. These efforts must continue as further reductions are required in the steel industry as well as in other energy intensive sectors to minimize costs and to respect policies on greenhouse gas emissions. This is a major challenge to meet, particularly in Europe, where the price of energy is high, CO2 reduction targets have been set by the EU and the steel industry is still suffering the impact of the economic crisis.	
Combining New Coke and Ironmaking Technologies to Reduce the Carbon Footprint in the Production of Steel	Hatch investigated the hypothetical coupling of heat recovery cokemaking, ITmk3® ironmaking and EAF steelmaking to exploit synergies between these three processes and to use this to reduce the carbon footprint to produce hot rolled coil. The consumption of all carbon produced was accounted for including coke sales to an existing blast furnace and the additional hot rolled coil that would be produced. An analysis of the operating costs indicated financial merit, reducing the cost to produce hot rolled steel. This unique coupling of new coke and ironmaking technologies could be implemented on a stand-alone basis or integrated into an existing steel works to eliminate smaller blast furnaces and outdated by-product coke plants.	
Current Status and Future Perspective of Japanese Ironmaking Technology for Environmental Solution	The circumstances surrounding the iron and steel industry have changed greatly. While the increased demand for steel products has caused a rise in the price of raw materials such as iron ore and metallurgical coal and the quality of raw material has been deteriorating, there is a growing need for developing technology to give solutions for various environmental problems such as energy shortage, increase in CO2 and NOx emission and so on. This plenary lecture provides a summary of the developments of ironmaking technologies in Japan for environmental solution, along with some examples of the development result and practical application such as RCA (Reactive Coke Agglomerate), LCC (Lime Coating Coke), SCOPE21 (Super Coke Oven for Productivity and Environment Enhancement toward the 21st century), COURSE50 (CO2 Ultimate Reduction in Steelmaking Process by Innovative technology for Cool Earth 50) project and so on.	
Current Status and Future Perspective of Japanese Ironmaking Technology for Environmental Solution	The circumstances surrounding the iron and steel industry have changed greatly. While the increased demand for steel products has caused a rise in the price of raw materials such as iron ore and metallurgical coal and the quality of raw material has been deteriorating, there is a growing need for developing technology to give solutions for various environmental problems such as energy shortage, increase in CO2 and NOx emission and so on. This plenary lecture provides a summary of the developments of ironmaking technologies in Japan for environmental solution, along with some examples of the development result and practical application such as RCA (Reactive Coke Agglomerate), LCC (Lime Coating Coke), SCOPE21 (Super Coke Oven for Productivity and Environment Enhancement toward the 21st century), COURSE50 (CO2 Ultimate Reduction in Steelmaking Process by Innovative technology for Cool Earth 50) project and so on.	

Design of a Pilot Plant Using the Flash Ironmaking Process: The Path to Commercially Developing a New Form of Ironmaking Using Hydrogen	Innovation is key to advancement. The lofty goal of the Flash Ironmaking process was to create and develop a new commercially viable technology that would represent a transformational process for the steelmaking industry. Such a technology would provide an alternate process route that makes better use of raw materials and minimize emissions to produce steel from iron ore. It would also have the potential to offset or even replace the blast furnace and coke oven. It would also use domestic iron ores especially concentrates which the US has in abundance and greatly reduce energy requirements. Ultimately the Flash Iron objective is to increase energy productivity and reduce environmental emissions such as CO2 emissions versus the conventional blast furnace ironmaking route; however, in the development of this technology, there are clear commercial advantages for EAF Steelmakers. In this paper we will review the Flash Ironmaking process and its development through Pilot Plant design of a 3000-tpy pilot plant. We will also discuss the landscape for commercial development and how this technology could fill a technology gap in the US marketplace and enable more efficient steelmaking practices in North America.	
Design of a Pilot Plant Using the Flash Ironmaking Process: The Path to Commercially Developing a New Form of Ironmaking Using Hydrogen	Innovation is key to advancement. The lofty goal of the Flash Ironmaking process was to create and develop a new commercially viable technology that would represent a transformational process for the steelmaking industry. Such a technology would provide an alternate process route that makes better use of raw materials and minimize emissions to produce steel from iron ore. It would also have the potential to offset or even replace the blast furnace and coke oven. It would also use domestic iron ores especially concentrates which the US has in abundance and greatly reduce energy requirements. Ultimately the Flash Iron objective is to increase energy productivity and reduce environmental emissions such as CO2 emissions versus the conventional blast furnace ironmaking route; however, in the development of this technology, there are clear commercial advantages for EAF Steelmakers. In this paper we will review the Flash Ironmaking process and its development through Pilot Plant design of a 3000-tpy pilot plant. We will also discuss the landscape for commercial development and how this technology could fill a technology gap in the US marketplace and enable more efficient steelmaking practices in North America.	
DOE's Industrial Technologies Program (ITP): Assessment Efforts to Improve Energy Efficiency, Carbon Footprint and Profit in the U.S. Steel Industry	The steel industry is critical to the worldwide economy, providing the backbone for construction,transportation and manufacturing. The production process for manufacturing steel is energy-intensive andrequires a large amount of natural resources. Energy constitutes a significant portion of the cost of steelproduction; up to 40% in some countries.1 As shown in Table I, the energy used to produce a ton of steelhas decreased by about 2% from 1998 through 2002. However, the dollar cost per ton of steel increased by 35% during the same time period. Thus increasing energy efficiency is one of the most cost-effective ways to improve the Environmental performance of this industry.	

DRI Plant Operation for Steel Mill Sustainability	As economic and environmental pressures continue to increase for the traditional BF/BOF route of steel production, many steelmakers are faced with the challenge of lowering emissions while simultaneously maintaining production. Sustainability is ultimately the key issue for every steelmaker going into the future, but as how to achieve this goal in light of new challenges is the question at hand. Shale gas exploration has led to low cost natural gas in North America and other areas of the world, creating interest in new direct reduced ironmaking (DRI) facilities and DRI products. DRI products including hot briquetted iron (HBI), which were once viewed by integrated steelmakers as an electric arc furnace (EAF)-specific charge material, may actually present a long term, scalable solution that is achievable for steelmakers going forward. HBI usage as charge material especially in the blast furnace (BF) is now being seen as a powerful way to help displace CO2 emissions and increase hot metal production of the facility. This is no longer a hypothetical scenario, as the first DRI Plant to specifically supply HBI to BFs is nearing completion in Texas, USA. This paper will explore how an integrated steel mill can create a more efficient path to hot metal, significantly reduce emissions and ensure long term sustainability through the use of HBI.	
Dry Slag Granulation – The Future Way to Granulate Blast Furnace Slag	Each year, approx. 400 million tons of blast furnace slag is produced worldwide with a tapping temperature of around 1,500°C. Currently, the slag is granulated in wet granulation plants using large volumes of water and to date it has not been possible to utilize the remnant heat energy of the molten slag, with approx. 1.7 GJ of energy per ton.	
Dry Slag Granulation With Energy Recovery: Pilot Campaign at ROGESA	Paul Wurth has approached the topic of dry slag granulation with a simple but effective method, where steel balls and liquid slag are mixed to achieve fast cooling and thus full vitrification of the blast furnace slag while creating a product with highest possible energy content.	
Energy Recovery And BOS Stack Emission Reduction By Controlling The Combustion Of Waste Gas	The potential to reduce gas emission from the BOS stack and to increase the calorific value of the recovered gas from the waste gas system of the BOFs in BOS nr 2 of CORUS Ijmuiden was investigated. Possible puffing or flaring of the converter gases causes the safe margin of the waste gas flow control system to be larger than necessary.	
Environmental Benefits of Natural Gas Direct Reduction	Worldwide, there is an increasing emphasis on Environmental issues. In the area of gaseous emissions, the Kyoto Protocol and subsequent agreements have put great pressure on the industrialized countries. Under the Protocol, those countries pledged to reduce their collective emissions of “greenhouse gases” by five percent compared to 1990 levels. When compared to the emissions expected with normal economic growth, the level represents a 29 percent cut. There are six gases of interest, with carbon dioxide (CO2) the most significant. At the United Nations Climate Change Conference (COP 15) held in December 2009, the United States and numerous other countries, including China, India, and Brazil, agreed to take actions to reduce global warming. The steel industry is now under intense scrutiny because it accounts for about five percent of worldwide carbon dioxide emissions. Ironmaking and steelmaking are energy intensive and essentially all the carbon entering a steel complex leaves as CO2. Although the steel industry has reduced energy consumption and the concomitant emissions significantly, much more will be required. In addition to CO2, emissions of concern are SOx, NOx, and particulates. In certain areas, limits on those emissions are very strict. An active market in emissions trading has developed in Europe. Under the European Union scheme, companies in energy intensive industries such as steel are allowed a certain amount of CO2 emissions. For companies over the limit or considering expansions, there are two options: purchasing credits from other producers with excess or installing production technologies with lower emissions. Since the purchase of credits involves significant financial penalties, the great promise is to incorporate “cleaner” processes, which is the focus of this paper.	

Environmental Emissions Compliance and Reduction of Greenhouse Gases in a DR-EAF Steel Plant	The recent alliance between Tenova HYL, Techint and Danieli brings a new brand - ENERGIRON - to the forefront of the direct reduction industry. ENERGIRON technology is characterized by its flexible reformerless process configuration which is able to satisfy and exceed the current stringent environmental worldwide requirements. The gaseous and water effluents of the process are not only low but easily controlled. Incorporation of selective carbon dioxide (CO2) removal systems has been a key factor over the past decade in significantly reducing the emissions levels, providing an additional source of revenue for the plant operator via the captured CO2. The high pressure operation and closed system of an ENERGIRON plant combined with the HYTEMP Pneumatic Transport System reduces dust emissions to both air and settling tanks, making the process more economical and Environmentally friendly. This paper will focus on the various Environmental aspects as compared to the most stringent regulatory controls both in the U.S. and abroad.	
Fuel Savings and Reduced Emissions: Experience from 80 Oxy-fuel Installations in Reheat Furnaces	The oil crisis of the 70's sparked the first interest in reducing the consumption of and dependency on fossil fuels in steel reheat furnaces and annealing lines. Industrial grade oxygen was simply added to the combustion air to cut fuel consumption, although emission results were sometimes poor More energy-efficient heating processes and further reductions in emissions were the key issues during the 80's, resulting in Linde's first 100 % oxy-fuel installation in 1990 at Timken, USA. The new millennium focuses on even lower total costs and faces strict emission controls by legislation. This paper discusses the use of oxy-fuel combustion and its implementation in reheat furnaces and annealing lines with important developments and results. Emphasis is placed on the opportunities for reducing both fuel consumption and emissions. The commercial viability of the oxy-fuel application is further demonstrated using important references from the list of over 80 installations completed since 1990.	
Gas Purging Benefits in the BOF: A Focus on Material Efficiency and CO2 Emission Reduction	In highly competitive steel markets worldwide, an economical and climate-friendly steelmaking process is required to ensure profitable crude steel production in the future. Considering the tightening global CO2 emission requirements, which result in rising energy prices and the purchase of carbon credits, raw material and energy efficiency have to be continuously optimized. One option to increase resource efficiency in the steelmaking process chain is the use of bottom inert gas purging in the BOF. Gas purging increases mass and energy transfer in the molten metal, the mixing energy, and the bath kinetics, promoting improved decarburization and dephosphorization reaction rates. Further essential benefits include higher thermal and chemical homogeneity of the liquid metal bath, better process control, and increased yield from raw materials due to the reduced consumption of various fluxes, alloys, and oxygen.	
High-Production, Environmentally Friendly Steelmaking at BSW	Badische Stahlwerke in Kehl, Germany is located on the river Rhine close to the Black Forest, which is a recreational area. As a consequence the environmental regulations for Badische Stahlwerke are even more stringent than the already stringent German regulations. Badische Stahlwerke elaborated over the years many concepts for the reduction of environmental impact by a steel plant. These concepts deal with the reduction of emissions to air, water and soil, but also with the recycling of all by-products from steel making like slag, dust, scale and some others and also the energy recovery of waste heat. The success of these concepts can be seen by the very low emission values of Badische Stahlwerke and also the profit derived from the recycling of by-products.	
HIsarna Highly Energy-Efficient Ironmaking	The HIsarna process produces liquid hot metal from of iron ore fines using (non-coking) coal as a reductant. There is no need for ore agglomeration or coking. The HIsarna process reduces the ironmaking route presently consisting of 3 steps to a single step. With this change some significant advantages can be realized: Reduced energy consumption resulting in less CO2 emissions Reduced costs of operation, maintenance and sustaining of capital Less requirements for the raw materials and increased ability for recycling secondary raw materials Economical at smaller unit size and increased flexibility	

HIsarna — Highly Energy-Efficient Ironmaking	The HIsarna process produces liquid hot metal from of iron ore fines using (non-coking) coal as a reductant. There is no need for ore agglomeration or coking. The HIsarna process reduces the ironmaking route presently consisting of 3 steps to a single step. With this change some significant advantages can be realized: Reduced energy consumption resulting in less CO2 emissions Reduced costs of operation, maintenance and sustaining of capital Less requirements for the raw materials and increased ability for recycling secondary raw materials Economical at smaller unit size and increased flexibility	
Hot Blast Superheating — A Scalable Technology to Reduce Coke Consumption	In 1984, Ferromanganèse de Paris-Outreau, France implemented Aerospatiale plasma torches on their blast furnace1. The torches were positioned in the tuyere assembles to superheat the hot blast just before it entered the furnace. Three 2-MW plasma torches were installed to test the validity of the concept and to create experimental velocity and temperature fields. With the torches operating, the blast furnace production increased, coke consumption was reduced, and operational flexibility improved. By 1986, eight 2-MW torches were installed to enhance the blast furnace operation. Torch reliability and maintainability proved difficult and as a result, the technology was not adopted on other commercial scale blast furnaces. Since the mid-1980s, Westinghouse Plasma Corporation has improved the reliability and maintainability of their plasma torches for industrial use. With increasing awareness of greenhouse gas (GHG) emissions, carbon taxes and the high cost of coke, Hatch evaluated the benefits of superheating hot blast with plasma torches as a means to introduce electrical power as a blast furnace fuel source.	
Improving Performances and Decreasing CO2 Emissions in Blast Furnaces Installations With High-Carbon DRI/HBI	Optimization of the BF/BOF route from both productivity and environmental points of view is now one of the primary requirements not only for new installations, but also for existing ones. The integration scheme of the BF/BOF with an ENERGIRON DRP producing high-carbon DRI/HBI results in significant benefits for the integrated route, not only because of the optimized use of the COG and/or NG when used as energy supply for the DRP, but also because the DRI produced, at the required quality in terms of metallization and carbon, can be fed to the BF, thus optimizing operating conditions of both DR and BF systems. This allows increasing productivity and decreasing coke/PCI consumption while improving the environmental impact and maximizing profit.	
Influence of Charcoal Fines in Quality of Metallurgical Coke	In the current scenario of seeking the high competitiveness of the steel industry, reducing raw material costs is essential for the survival of organizations. Since coal costs at 30 to 40% the cost of steel, developing alternative raw materials becomes paramount to guarantee the perpetuity of the steel industry. The challenge of coke production lies in designing coke blends that produce low cost and high quality coke. In this context, the objective of this work is to evaluate the use of charcoal in the mineral coal mixture, reducing the need to use imported mineral coals in the formation of the metallurgical coke mixture, maintaining the quality required by the Blast Furnace, in addition to developing a route to minimize CO2 emission from the process of obtaining pig iron to coke, reducing its environmental impact.	
Injecting Different Types of Biomass Products to the Blast Furnace and Their Impacts on the CO2 Emission Reduction	Recent years more research has been focusing on utilizing biomass in the blast furnaces (BFs). One driving force is linked to the climate change mitigation, i.e. to reduce CO2 emission from fossil reducing agents or fuels, by using biomass. The amounts of biomass that could be utilized in BF is limited by different parameters, such as metallurgical properties of reducing agents, fuel properties such as volatile content, fixed carbon and oxygen content, ash chemistry (S, Na2O, K2O, etc.). In this paper, different types of biomass products in the form of solid, liquid and gas are investigated as injectants to the blast furnace. The modelling work has been done for a BF from a Nordic country. The possible amounts of injected biomass products are presented. With the replacement ratios of pulverized coal (PC), the potential CO2 emission reduction when injecting different biomass products is quantified. In addition, the strategy of using biomass at the studied iron-making plant is discussed.	

Integration of Midrex Technologies in North America Steel Plants Evaluation of Economical and CO_2 Impacts	Shale gas revolution deeply changed the North American Iron and Steel industry. Simultaneously the international sensibility towards greenhouse gas (GHG) emissions is continuously increasing. Therefore the implementation of direct reduction (DR) plants within a common integrated plant will be a feasible outlook for the North American steel plants. This paper depicts possible combinations and integrations resulting from the application of MIDREX technology (accounting a share of 63% of the overall direct reduction iron production and 79,3% of the gas based one [1.]) for which Paul Wurth was recently awarded as licensee, within an integrated plant exploiting synergies given by utilization of available gases process and different process routes to produce liquid steel. Different plant arrangements are schematically presented with quantified examples as well as the resulting main gas and energy balance process. An overview on the resulting Opex and CO_2 footprint will also be provided.	
Kinetics of Gaseous Reduction of Iron Ore Concentrate for Ironmaking with Low CO_2 Emission and Energy Requirement	Direct gaseous reduction of iron ore concentrate to iron in a suspension process would reduce energyconsumption for ironmaking by nearly 38% of the amount required by the blast furnace process and drastically lower Environmental pollution, especially CO_2 emission, from the steel industry. Some previous studies on iron oxide reduction indicated that the rate might not be fast enough for a suspension process to be possible. New rate data on the reduction of fine concentrate particles by hydrogen-containing gases indicating sufficient rates form the basis for the new technology. Details of the rate measurements are presented in this paper.	
Latest Developments of Küttner's Pulverized Coal Injection Technology	In the past decades the development of pulverized coal injection technologies have been driven by the cost optimization for blast furnace operation. Today blast furnace operators are facing one more very important topic for their hot metal production: CO_2 emissions. By further improvement of the injection technologies even in small steps Küttner's efforts in this field are significant. An optimized coal injection system can reduce the CO_2 emissions and can contribute to save expenditure for CO_2 certificates which will more and more put blast furnace operation under pressure in Europe and in particular in Germany.	
Lowering of CO_2 Emissions at the BF by Using Biocoal - Theoretical and Practical Possibilities and Limitations	The steel industry contributes to the global emissions of fossil carbon dioxide (CO_2) by around seven percent, mainly caused by the usage of coal and coke as reductants in the blast furnace (BF). The steel industry focuses on reducing the CO_2 emission and in Sweden SSAB, LKAB and Vattenfall makes development for reaching totally fossil free steel production on long term.1 Their concept includes production of H_2 using renewable electricity, use this H_2 for direct reduction of pellets producing DRI. DRI melted in the EAF with scrap will be the basis for high quality steel products. On short-term the BF will still be operating in Sweden and in other parts of the world probably will be in a foreseeable future, the most energy efficient method to produce ore based liquid hot metal. A number of concepts to minimize the emission of CO_2 have been proposed by different R&D teams, as the ULCOS TGRBF2 (top gas recycling BF), high injection rates of hydrogen3 in combination with CCS (Carbon Capture and Storage). Other options investigated, not requiring extensive modification of the BF plants are the use HBI4 , charging of activated coke5-8 or carbon composite agglomerates 9, 10 including such involving biomass products10 or the replacement of coal and coke with bio-based reductants.10 All of these modifications of the BF process have been shown to reduce the fossil CO_2 emission from the BF.	
Measures to Reduce CO_2 and Other Emissions in the Steel Industry in Germany and Europe	The integrated steel works in EU 27 operate many modern plants for the production of a wide variety of high-grade steel products.The blast furnace/converter route will remain dominant. Control of emissions is mainly related to concentration of dust, SO_2, NO_x,dioxins and other substances. One main focus is set on the emissions of CO_2 and the CO_2 emission trading system. New processes inironmaking to reduce CO_2 emissions are described. The German steel industry has made a self commitment with the government toreduce its specific CO_2 emissions by 22 % in 2012 compared to 1990.	

MIDREX H2 TM: Ultimate Low-CO2 Ironmaking and Its Place in the New Hydrogen Economy	Interest in mitigating CO2 emissions in the iron and steel industry continues to grow. The natural gas-based MIDREX® Process paired with an electric arc furnace (EAF) has the lowest CO2 emissions of any steelmaking route; yet, there is room to decrease emissions using hydrogen as a fuel and chemical reactant. The best possibility for reducing CO2 footprint is to use pure hydrogen as the energy source and reductant for DRI production. This concept is known as MIDREX H2™. This paper will review the Hydrogen Economy and its influence on next-generation iron and steelmaking, specifically by examining the MIDREX H2™.	
Mitigating CO2 Emissions in the Steel Industry: A Regional Approach to a Global Need	Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.1 Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations.2 Carbon dioxide (CO2) is the most important anthropogenic GHG.3	
Opportunities and Challenges in Steel Manufacturing: Engineering a Brighter Future, The AIST 2008 Brimacombe Lecture	The steel industry has experienced several profitable years after having weathered difficult economic times. Today, the large number of consolidations and increased foreign investment have resulted in a steel industry that is leaner and more profitable but still in a state of corporate flux. During the last three years, China has doubled their steelmaking capacity while North America's capacity has not significantly changed. Steel related research has diminished with consolidations, reductions in research staff, and reduced government support. The industry has been successful in reducing costs and remaining competitive through implementing new technologies in steelmaking and casting. Today's steel industry faces a number of opportunities and challenges especially in North America. This lecture will discuss two of the major challenges and opportunities that face the steel industry today: issues related to people – attracting and keeping the best technical leaders in the steel industry, and issues related to sustainability research – continuing excellence in solving the steel industry's challenges in the areas of energy and the environment.	
Producing Synthetic Fuel From CO2 and Excess Heat From Steel Facilities	NewCO2Fuels (NCF) is developing an innovative, cost competitive, self-sufficient system to produce fuel from CO2 and renewable energy or waste heat sources. The core technology is a high temperature driven, CO2 and water dissociation process which produces syngas (mixture of CO and H2), from which different synthetic fuels can be produced.	
Reducing Carbon Footprints with Green Hot Mill Lubricants	There have been major breakthroughs in Hot Mill lubrication in the last five years with new lubricant technologies and application methods that reduce a mill's primary carbon footprint in energy usage, conversion consumption, back-up roll and work roll service life, and pickle acid consumption. The authors have further collaborated to reduce a Hot Steel Mill's secondary carbon footprint in the base chemistries themselves. High efficiency lubricants that are made with recycled and renewable raw materials, and others that are water-based instead of petroleum–based, have allowed even greater reductions. This paper discusses the accomplishments achieved from mill performance characteristics using new versus old technologies, and the greener formulation techniques now being employed.	

Reduction of Blast Furnace Ironmaking Carbon Footprint through Process Integration	The feasibility of reducing the carbon footprint of the steelmaking process by integrating blast furnace ironmaking with combined cycle power generation was examined. Using highly-enriched oxygen blast, the CO2 content in the furnace top gas is significantly increased thus facilitating the capturing of CO2 for longterm storage to reduce the Environmental impact of ironmaking. Moreover, energy content of the blast furnace gas is enhanced and can be used for combined cycle power generation for meeting the energy demand of the process. Heat and mass balance simulations of the integrated blast furnace-combine cycle process was performed. It was observed that the net CO2 emission of the process was related to the amount of blast furnace top gas recycled for ironmaking. By optimizing the top gas recycle ratio, it is possible to reduce the net CO2 emission of the ironmaking process to 230 Nm 3/tHM, which corresponds to only 30% of the emission level of the conventional process. The incorporation of a gasifier in the proposed BF-CC process increased the flexibility of the choice of fuel for direct injection. Applying direct gasification of sustainable biomass in the BF-CC process can further reduce the net emission of the ironmaking process to 176 Nm 3/tHM or a 77% reduction as compared to the conventional blast furnace.	
Sequestration of CO2 from Steelmaking Offgas by Carbonate Formation with Slag	The alkaline earth-containing phases in steelmaking slag can form carbonates thus sequestering carbon dioxide from the surrounding atmosphere. Work has been undertaken to improve the carbonate formation kinetics, enabling steelmakers to directly remove CO2 from furnace offgas with slag, which in turn reduces the slag stabilization time. A study of basic oxygen furnace (BOF) and electric arc furnace (EAF) slags is reported in conjunction with their carbonate formation thermodynamics and capacities, yielding an overall slag CO2 capture potential. Preliminary results are presented from bench-top "wet" and "dry" slag carbonation tests on industrial slags using a slurry reactor and large-scale thermogravimetric analysis (TGA).	
Steel's Contribution to a Low-Carbon Europe 2050 Technical and Economic Analysis of the Steel Sector's CO2 Abatement Potential	This paper provides a realistic view of how the steel industry can respond to one of the most important challenges facing humankind—climate change. Dahlmann, Bodo Lüngen, Ghenda, Wörtler, et al.	
Strategic Energy/CO2 Model for ArcelorMittal Burns Harbor	As an integrated iron and steel plant with coke ovens, a sinter plant, blast furnaces, BOF steelmaking, plate and strip finishing facilities and a power plant, ArcelorMittal Burns Harbor has a number of options for how it uses the energy produced internally and for how much electricity and natural gas it purchases. These options affect both the daily operation of the plant and the strategy for long-term capital improvements. To better understand the effects of operating and capital-improvement choices on energy use and CO2 generation, a Strategic Energy/CO2 Model was developed.	
Suspension Reduction Technology for Ironmaking With Low CO2 Emission and Energy Requirement	A new technology for alternate ironmaking based on direct gaseous reduction of iron ore concentrate is under development, which would reduce energy consumption by nearly 38% of the amount required by the blast furnace and drastically lower environmental pollution, especially CO2 emission, from the steel industry. The technology is aimed toward the production of iron as a feed to the steelmaking process, eventually replacing the blast furnace. Feasibility of the technology is presented based on the material and energy balances and comprehensive rate measurements using concentrate particles, together with preliminary scale-up test results using a bench-scale test facility.	

The Use of Electrical Technologies in Blast Furnace Ironmaking	Extensive development work on the use of plasma torches in blast furnace ironmaking was completed in the 1980s. The technology developers planned to reduce blast furnace coke consumption using electrical energy and large scale coal injection through the tuyeres. Plasma torches were identified as an alternative technology to large scale oxygen enrichment which was considered too expensive at the time. Ultimately, plasma technologies were not implemented largely due to concerns with plasma torch reliability in the steel plant environment. Westinghouse Plasma Corporation has since improved torch reliability with industrial experience in solid-waste-to-energy facilities, as well as metallurgical applications. Since coke makes up one-third of the hot metal cost, savings efforts frequently seek to lower coke consumption by increasing process efficiency or replacing coke with cheaper fuels. With an increasing focus on lowering greenhouse gas emissions, plasma torches offer the opportunity to lower both coke rate and carbon dioxide emissions from the blast furnace by using a greater amount of electrical energy. Alter NRG and Hatch assessed the merits of using plasma torch technology to superheat the hot blast and reduce coke consumption in blast furnace operations. Coke rate savings, coal consumption, electrical purchase requirements for hot blast superheating, and CO_2 emission reduction values are presented.	
voestalpine Texas – A New Market for Hot Briquetted Iron	Exploration of shale gas in North America has drastically reduced the price of natural gas (NG) and opened up economic possibilities of using NG for iron and steelmaking. One such project to capitalize on this new North American NG market is the voestalpine Texas LLC, Hot Briquetted Iron (HBI) plant currently under construction and scheduled for start-up later this year. This will be North America's first ever HBI facility and the largest of its kind. The plant will also be unique in that it will be the first HBI plant built based on blast furnace demand rather than the EAF market. About half of its product will be shipped to voestalpine's blast furnaces in Austria to increase hot metal production; this practice constitutes a revolutionary step forward in carbon abatement since the carbon footprint of the blast furnace hot metal made via this route will be decreased by half.	

Past AIST Events

Title	Date	Description	Link
Decarbonizing: Background and Current BF Fuel Strategies	6-May-21		View Webinar
MENA Steel Forum 2020	10-12 November 2020		▶ MENA Steel Forum 2020 Recap
AIST European Steel Forum 2020	13–15 October 2020	Virtual Conference	AIST European Steel Forum 2020 Recap
Scrap Supplements and Alternative Ironmaking	2-4 March 2020	Orlando, FL	Course Program
Oxygen Steelmaking TC meeting	11-Feb-21	Committee Meeting	(Write-up is not online yet)
Oxygen Steelmaking TC meeting	20-Oct-20	Committee Meeting	Oxygen Steelmaking Technology Committee Activities

Other Resources

Title	Date	Description	Source
Nippon Steel - Carbon Neutral Vision 2050 - A Challenge of Zero-Carbon Steel	30-Mar-21	PDF	Nippon Steel

CALENDAR | FOUNDATION | STEEL NEWS

SEARCH

Log In

ABOUT AIST | MEMBERSHIP | LOCAL MEMBER CHAPTERS | TECHNOLOGY COMMITTEES | CONFERENCES & EXPOSITIONS | RESOURCES | PUBLICATIONS & ADVERTISING | STUDENTS & FACULTY

Latest News

Energy, Environment & Sustainability

News items focusing on evolving technologies and steps taken to create a sustainable industry and minimize environmental impact.

Technology/Environment And Sustainability

https://www.aist.org/news.aspx?topcat=Technology

Decarbonization

Industry/Energy, Environment & Sustainability

https://www.aist.org/news.aspx?category=Energy_Environment_Sustainability

Energy, Environment & Sustainability

Energy use and conservation, the environment and sustainability as it relates to the steel industry.