Greening Algoma Steel

A Case Study

March 2024

FOCAL Initiative

About the FOCAL Initiative

The Future of Canadian Automotive Labour force (FOCAL) Initiative, funded by the Government of Canada, is a collaboration of the Canadian Skills Training and Employment Coalition (CSTEC), the Automotive Policy Research Centre (APRC) and Prism Economics and Analysis.

The FOCAL Initiative has produced labour market information and data related to Canada's automotive manufacturing sector, examined key trends affecting the automotive labour market, and produced forecasts of supply and demand for key occupations in the broader automotive sector. The project has also provided support to employers in the automotive manufacturing sector to recruit and train workers.

This project is funded in part by the Government of Canada's Sectoral Workforce Solutions Program

Acknowledgements

Algoma Steel Inc. cooperated in the production of this report. The FOCAL Initiative would like to thank the following people for participating in the research and assisting the FOCAL Initiative researchers:

- Autumn McLean, Community Stakeholder Liaison & Strategy Support Analyst
- Brad Horton, Superintendent - Steelmaking Operations
- Graeme Burt, Front Line Supervisor – Steel Flow & Shearline
- Josh Ableson, Superintendent – DSPC Maintenance
- John Whittington, General Manager - EAF Operations
- Laura Devoni, Director of Strategy, Corporate Affairs, & Sustainability
- Mark Lewis, President, Insightworks Training Technologies and staff
- Norm Lasante, former Manager - Workforce Optimisation, People & Culture
- Tharindra Nawarathna, Coordinator - Organisational Development
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Executive Summary

This case study of 'greening' steel at Algoma Steel Inc. highlights important technical, economic, labour policy and management factors which must be considered in creating successful outcomes for all stakeholders.

Algoma Steel Inc. (Algoma) is one of Canada's largest steel manufacturers and the most significant employer in the City of Sault Ste. Marie (The Soo) in Northern Ontario. This paper is a case study of the plant's latest modernisation efforts focusing on greening of plant operations, and its related workforce development initiatives in achieving sustainability goals and long-term financial viability to the benefit of the local community and region. It should be of interest to companies seeking to green their operations, policy-makers at all levels of government, plant engineers, environmental and safety workers, NGOs delivering training, human resources personnel, academia and post-secondary students.

Figure 1: Greening Algoma and Policy Actors

- **Government Policy and Support – A Response to Climate Change**
  Government policy is driving change. The company has responded to carbon reduction targets of net-zero by 2050 of the federal government, through proactive environmental strategies that include modernisation of technology. The company is switching from integrated blast furnace liquid iron-based steelmaking to **electric arc furnace (EAF) steel-making** which relies on scrap steel and involves **retrofitting** the plant with new equipment and machinery. Algoma could have remained an integrated blast furnace steel producer but recognised the growing demand for low-carbon-intensity steel and the opportunity to position themselves as a sustainable leader in steel production. Additionally, this transition was motivated by and aligns with the increasing value of carbon credits, further reinforcing the strategic and economic benefits of adopting more sustainable production practices. Supporting Algoma's greening was the financial and technical support provided by the federal and provincial governments, and support of local government who all understand that the longer-term sustainability of Algoma is tied to the economic viability of The Soo.

- **Training for Workforce Transition**
  Algoma is training its workforce to operate the new machinery and tools which are changing processes and how they work. Approaches to address new skills needs include **reskilling/upskilling; digitisation** and **digital twinning** to support on-demand training, and introduction of **integrated human resources tools** to assess and train employees and manage training. Training allows better utilisation of the workforce and promotes retention, while improving labour productivity and workplace safety. Central to the transition is *good* **labour-management relations** at the plant, which are essential for a smooth transition to new technologies. *Federal investments* in training is helping the transition to greener technology. Canadian Skills Training and Employment Coalition (CSTEC), through the federally-funded **Focal Initiative**, has funded training initiatives for the EAF switch and other modernisation efforts.

- **Economic Impact of Technology Modernisation for Algoma and the Community**
  Over the years, the company has undergone technological upgrades and financial challenges in the context of shifts in the price of steel since its start in 1901. But management, employees, unions, and the provincial, federal and local governments, and other local policy actors have all worked to promote the success of the company given its economic impact in the region. Algoma is essential to the community as the largest employer with high-paying jobs, along with the spin-off activities and jobs generated from the company's operations. Technology changes will improve productivity and efficiency in operations which will contribute to profitability and capacity for expanded sales and exports. Green steel production will make the company more viable and competitive in the global market in terms of volume, product quality and diversification, and reputation. The actions of the company to switch to EAF technology will secure the future of the company and the town of Sault Ste. Marie.

- **Environmental Impacts of the Switch to EAF Steelmaking**
  Technology and processes over time have also improved workers safety and quality of life of the community through ongoing improvements and reduction in the environmental footprint of the steel mill. The EAF switch will be a major contributor to these efforts, with some outcomes outlines below.

Pollutant Type	Activities and planned outcomes
	Approximately 70% reduction in greenhouse gas emissions (GHGs); an equivalent of taking more than 900,000 passenger vehicles off the road. New bag houses will capture gas and particulate emissions.
	Land currently used for slag deposits is reduced and can be repurposed.
	Switch to over 90% non-emitting electricity from the grid.
	Waste water is treated in new treatment facilities and recycled, meeting environmental standards

Introduction

The promotion of cleaner production in industry has ramped up in recent years, since the *United Nations Framework Convention on Climate Change (UNFCCC)* came into force on 21 March 1994 to reduce Greenhouse Gases (GHGs)[1]. Canada has committed to achieve net-zero (GHGs) by 2050[2] and the greening of Industry will help in reaching that goal. In Industry, primary metal manufacturing[3] which includes steel manufacturing, is among the top subsector for emissions in Canada.

There are **key components to a greening strategy**:

- establishing science-based targets to reduce the environmental footprint;
- costing and funding mitigation and change which includes physical plant; people – workers and community, and supply chain;
- embedding 'greening 'and climate risk in management planning (e.g., strategic plan, human resources plan, business plan, business continuity plans, etc.) and practices.

Cleaner production (CP) involves proactive environmental strategies (greening) to prevent waste generation through good housekeeping; input substitution; better process control; equipment modification; technology change; product modification; efficient use of energy resources; and on-site recovery/reuse.

This paper is a case study which presents the journey of Algoma Steel Inc. in greening its operations to reduce its environmental footprint through **electric arc furnace (EAF**) technology, with a focus on reducing the carbon dioxide (CO_2) emissions which is the

[1] Subsequent international protocols (Kyoto 1997, Paris Agreement 2016, etc) continue to strengthen international goals and requirements for countries to reduce pollution including GHGs.
[2] See Net-zero emissions by 2050 at https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html
[3] This subsector comprises establishments primarily engaged in smelting and refining ferrous and non-ferrous metals from ore, pig or scrap in blast or electric furnaces. Metal alloys are made with the introduction of other chemical elements. The output of smelting and refining, usually in ingot form, is used in rolling and drawing operations to produce sheet, strip, bars, rods and wire, and in molten form to produce castings and other basic metal products.

greatest factor in climate change. The paper looks at the *retrofitting* changes and impacts, workforce implications, economic impact and community impact. The paper reviews activities to date and planned outcomes.

Purpose of the case study

The purpose of the case study is to present a real-world example of a company that is modernising and introducing new technologies while reducing its environmental footprint; improving its productivity and efficiency; and creating a safer workplace for employees, and enhanced environment for the broader community. It highlights important **technical, economic, labour policy** and **management** issues which must be considered in creating successful outcomes for greening strategies. It shows the broader policy impacts of supporting smaller towns and cities through government investments in projects that maintain or grow local economic activity. The investments, activities, changes, innovations, challenges, and lessons learnt in the transformation will be useful to policymakers, business schools, colleges and universities, labour unions, NGOs, and businesses, in particular, to inform the decarbonisation agenda in the broader policy context of achieving climate change goals.

Methodology

Research methods included collection of both primary and secondary research to write the case study. Secondary research involved documentary research; a literature review on EAFs; and use of archival information from Algoma including photos, press releases and public reports/documents. Interviews (virtual and in-person) were conducted by staff and a plant tour by various staff was provided to CSTEC in December 2023. Consent was obtained from Algoma to do the case study and use non-proprietary information publicly. The conversion to EAF will not be done by the time the paper is written but the work done so far with plant changes, proposed changes, and skills development of workers are discussed.

Research questions
The research was guided by the following research questions:

i. What is the impact of modernisation and greening of technologies on production, productivity, and workers?
ii. How will the transition to EAF technology impact workers and the community from a technological, skills, OSH, and environmental perspective?
iii. What can other companies, policymakers and others learn from the Algoma transition to apply in their own work?

Methodological Note on Projections

The projected carbon emissions reductions presented in this document are based on calculations derived from legacy data. These projections utilise international standards and benchmarks for electric arc furnace steelmaking and related processes. While every effort has been made to ensure accuracy, these calculations may not fully reflect the latest technological advancements, operational changes, or real-time emissions data. Actual reductions in carbon emissions may vary based on site-specific factors, new innovations, and evolving industry practices. This information should not be interpreted as a definitive guarantee of future environmental performance or sustainability outcomes.

A brief history of Algoma Steel

Algoma Steel Inc. is a fully integrated steel producer based in Sault Ste. Marie, Ontario, Canada. Algoma's transformation to EAF steelmaking marks a significant step forward on their path towards a greener future. It is the largest employer in The Soo. It offers a wide range of hot and cold rolled steel sheet and plate products that supplies many sectors, the automotive sector being one of them.

Algoma Steel[4] started construction in 1901 with two small blast furnaces, a Bessemer furnace and a 23-inch bloom rolling mill and rail mill, and the first steel was cast in 1902. The company expanded its facilities and product lines and in 1912, Algoma Steel Corporation was formed. The company went into administration receivership during the Great Depression which impacted the local community. Its partnership with General Motors in the 1950s and 1960s led to expansion with a new bar and strip mill that produced flat rolled steel. From 1988 to 1991, the company was owned by Dofasco. The economics of the steel industry in the 1980s and

[4] See https://algoma.com/history/

1990s resulted in restructuring in 1992, when it became employee-owned. The **Direct Strip Production Complex (DSPC**) was constructed in the 1990s, making Algoma one of the leaders in the North American hot rolled sheet market. The turn of the 21st century saw a second restructuring in 2002 and it was no longer an employee-owned company.

Photo 1: Algoma Steel facilities near St. Mary's River

In June 2007, Algoma became part of Essar Global for nearly a decade. The company went into CCAA protection in 2015 and emerged from creditor protection in October 2018. In October 2021, Algoma Steel Inc. and Legato Acquisition Corp. (an acquisition company) finalised a merger where Algoma became a publicly traded company in the United States and Canada. The new Algoma Steel Inc. notes that it is committed to investing in the plant to expand capacity and grade capability to meet market demand for advanced grades of steel for customers in **automotive manufacturing**, ship building, energy, mining and defence industries. It has also set its focus on **sustainability**.

Modernisation of Production Technology

Greening steel in the Algoma plant involves an evolution over many years with implementation of different upgrades in technology to the current point of conversion to EAF technology. EAF technology is not new, first appearing in the 19th century. According to the American Iron and Steel Institute[5], in the US, over 70% of steel production uses EAF technology. One short-term action to facilitate greening is the plan to create a **3D design** of the entire mill to understand technology change and impacts on production and people. The company notes that Environmental, Social, and Governance (ESG) factors 'have the potential to impact our operations, employees, contractors, suppliers, local communities, investors, and the long-term value of our company' (2023 ESG Report).

Environmental principles of the **3 Rs – reduce, reuse, recycle** – has been applied in the steelmaking process at Algoma over the years, wherever the production process allowed and in keeping with environmental regulations. For each tonnes of steel, an ordinary steel plant generates approximately 0.6 tonnes of by-products, such as steelmaking slag, EAF dust, and mill scale. Various mitigation processes have to be put in place to reduce emissions and effluents. Some of these activities are elaborated throughout the case study.

[5] See https://www.steel.org/steel-technology/steel-production/

Current Production Technology and Process

Algoma has a liquid steel production capacity of 2.8 million tonnes per year. It currently uses one of two **blast furnaces**, three **coke ovens**, two **basic oxygen furnaces**, and two **ladle metallurgy**

Photo 2: Steelmaking Shop

furnaces (LMFs) for refining steel. Raw materials used for ironmaking are coke, iron ore pellets and limestone. There is no pellet plant at Algoma so the company buys pellets. The current process in iron-making uses a blast furnace No. 7 to make molten iron. The pellets, coke, and limestone and natural gas are used to create liquid iron through a chemical reaction and the impurities (slag) rises to the top. Photo 2 shows the steelmaking furnace from outside. The steps in steelmaking at the plant is outlined below.

The various steps in the production process is explained below and illustrated in Figure 2, which also shows the various lines of steel products manufactured.

Step 1: Coke-making – Coke is needed in the conversion of iron ore to molten iron. Bituminous coal is sourced from mines in Virginia, Minnesota to make coke. Since volatile constituents are

driven off during the coking of coal, coke forms a desirable fuel for blast furnaces. Coke has a dual role in the ironmaking process – it provides the heat needed to drive a chemical reaction that then strips oxygen from the iron ore, leaving only the pure iron behind. **Coal carbonisation** involves heating of coal in the absence of oxygen thus distilling the volatile matter out of the coal which produces a variety of solid, liquid and gaseous products. Coke is used as a reducing agent in smelting iron ore in the blast furnace. A coke oven is used for this high temperature carbonisation. The coke-making process in the coke oven produces by-products such as raw coke oven gas which contains valuable chemicals that are removed from the gas such as coal tar and light oil.

Environmental impact and mitigation: Coke-making

Coke gases: The coke-making gases are currently used to power slab reheat furnaces in the facility. Coke-making byproducts**,** light oil and coal tar, are sold in the open market so it does not go to waste and provides a source of revenue to the company.

Step 2: **Making Molten Iron** – Oxygen, natural gas, coke and limestone go into the blast furnace with iron ore to produce **molten iron**.

Environmental impact and mitigation

During this stage of the steelmaking process, there are environmental impact mitigation activities that occur to deal with byproduct and effluents.

Slag: Slag is a byproduct of making the molten iron produced at the #7 Blast Furnace. There are two types of slag produced during the production of molten iron.

- Granulated Slag: It is granulated by Algoma and sold to market. It is water quenched to form granulate when it's in lava form. Once granulated and sold it is used in the cement industry.
- Air Cooled Slag: This slag is poured into slag pits and allowed to cool on its own. This is used for both cement additive and/or road construction.

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Effluents: Steel manufacturing consumes a large quantity of water for processing and cooling purposes, so it discharges a large quantity of effluents. The wastewater generated from manufacturing **crude steel** and from finishing operations to make steel products is also sent to the wastewater treatment plant. The treated water can be used in steelmaking and some is also released into a natural water system. In this case, treated wastewater that meets environmental standards is released into the St. Mary's River.

Step 3: Steelmaking – The molten iron from the blast furnace is then transported to the Basic Oxygen Furnace (BOF) to make steel. Recycled **scrap steel** is also added along with lime and alloys and processed with oxygen to refine the iron into liquid steel.

Step 4: Steel refining – The liquid steel is then transported to the steel refining facility with alloys added to make refined steel in the Ladle Metallurgy Furnaces (LMF). The LMF is used to refine molten steel into specialty grades while remaining in the ladle. This relieves the primary steelmaking furnace of most secondary refining operations.

Step 5: Steel products – The refined steel is then transported to either the Direct Strip Production Complex (DSPC) or the Slab Caster. See Figure 2.

Slab Caster

From the LMF, the liquid steel is put through a slab caster to make **slabs** which are then cut to size and conditioned in the slab yard. The slab caster is an older technology. The slabs are then run through the **re-heat furnaces**, then **roughing mill** and **plate finishing mill** to create large plates of steel. At this point two things can happen:

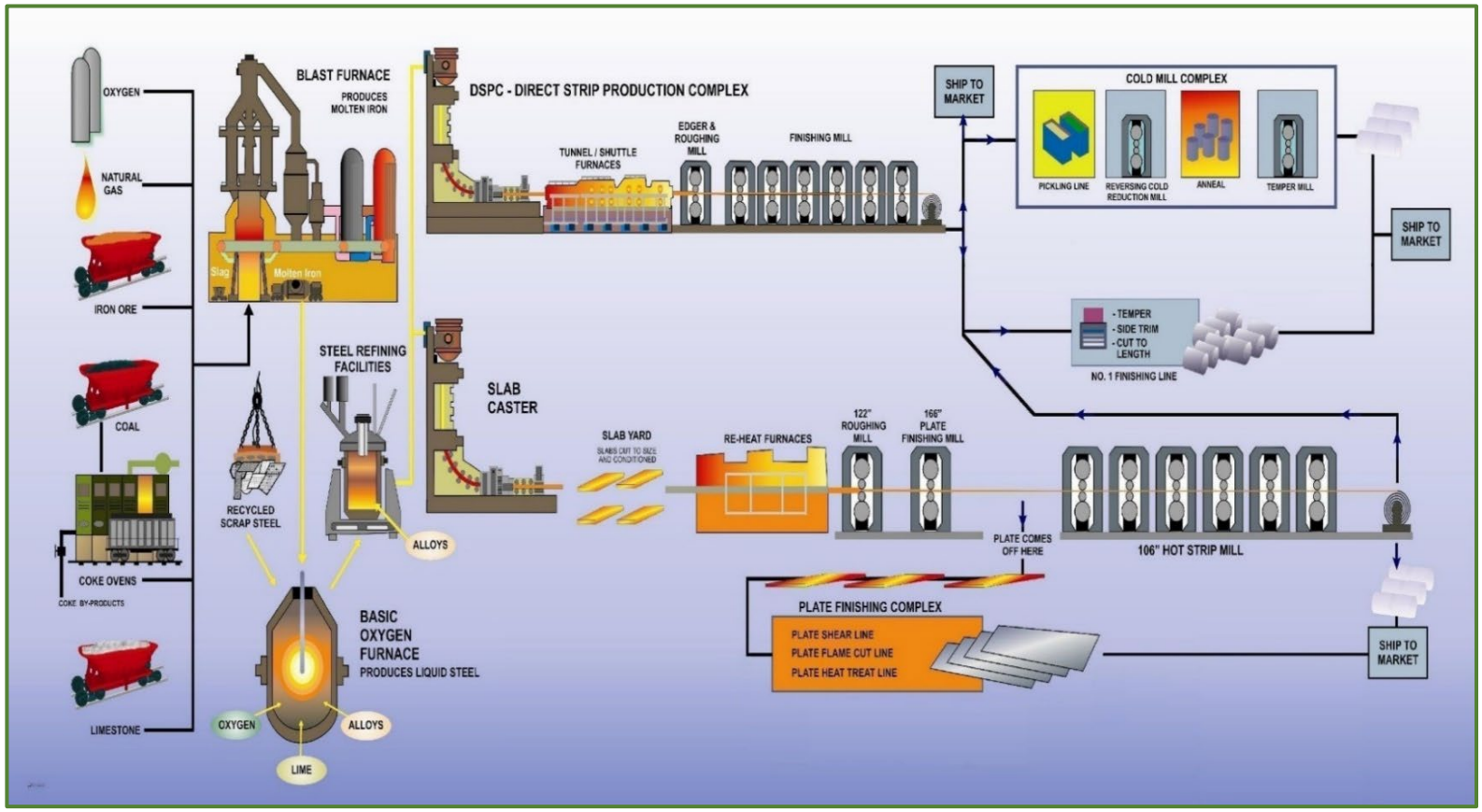
(i) the plates can be taken off the line and moved to the **plate finishing complex**, where they are further treated in the plate shear line; plate flame cut line; or plate heat treat line. These treated plates are then shipped to customers; or

(ii) the slabs can also go to the **hot strip mill** where coils of steel are created and then shipped to customers. The coils of steel can also go to the No. 1 finishing line for tempering, side trimming and cut to length per customer requirements, before shipping to customers.

DSPC

From the LMF in the DSPC, the refined steel is run through a thin **slab caster, tunnel/shuttle furnaces, edger & roughing mill**, then the **finishing mill** to produce hot rolled sheets of steel. The coils of steel can then go through three processes: shipped to customers; sent to the No. 1 finishing line for tempering, side trimming and cut to length per customer requirements, before shipping to customers; or sent to the Cold Mill Complex to the pickling line, reversing cold reduction mill, annealing, or the temper mill, and then shipped to customers. The DSPC has a continuous process which saves energy and money.

Figure 2: Current Steel-making Production process at Algoma Steel, 2024



Electric Arc Furnace (EAF) transition

The company is switching to EAF technology (electricity-based steelmaking) from the blast furnace technology run with coke oven batteries.

Costs and funding

The company has been investing its own money in the transformation to EAF technology. Algoma had spent approximately $500 million on the EAFs at December 2023. In addition, Algoma received CDN $200 million as a loan from the Net Zero Accelerator (NZA) initiative of the Federal Strategic Innovation Fund[6] (SIF) to support transition to EAF steelmaking and other modernisation efforts. Algoma received $100 m of the SIF commitment on July 22, 2022. Project spend as of September 30, 2024 was $672 million, from a total estimated project budget of $870 million.[7]

Government Greening Policy: The NZA initiative, launched in 2020, hopes to encourage Canadian companies to contribute to Canada's target to reduce GHG emissions by 40 to 45% by 2030, and achieve net zero by 2050. The NZA supports the Government of Canada's climate plan, *A Healthy Environment and a Healthy Economy,* and has up to $8 billion to support large-scale investments in key industrial sectors (Government of Canada, 2023). The NZA has two goals:

- Help Canada remain competitive in a net-zero economy;
- Reduce GHG emissions.

The SIF is prioritizing projects that can deliver near-term emissions reductions to help meet the 2030 target.

EAF technology

The Electric Arc Furnace involves a flexible steel-making process that can produce steel from a variety of input materials. Primarily used to recycled scrap steel, it is also able to accommodate DRI (Direct Reduced Iron) and pig iron produced from the Blast Furnace. The EAF steelmaking process is different from the traditional integrated process (Blast and Basic Oxygen Furnace route) as it uses electrical energy to melt and refine the scrap steel without the large carbon emissions required to reduce iron ore at the Blast Furnace.

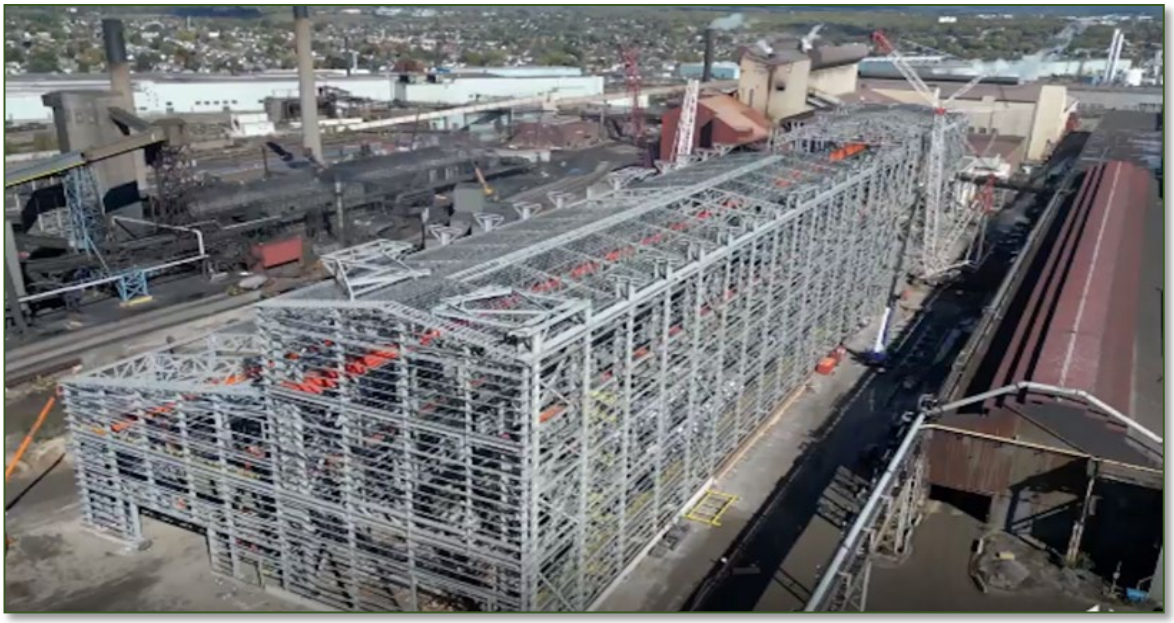
Algoma Steel's new facility will have a capacity to increase production at the site from 2.5 million to 3.7 million tonnes of liquid steel. The two Danieli supplied 250-tonne AC powered EAFs

[6] SIF funding is repayable, but some aspects may be non-repayable based on GHG performance of the company.
[7] See (https://ir.algoma.com/static-files/2513615b-0974-4aca-8b77-85698878f077).

will be controlled by two Q-One digital power systems that provide high speed voltage and current control. This improves the energy efficiency of the furnace, reduces the electrode consumption as well as controls flicker induced on the network. The design also provides for **best-in-class environmental performance** with engineered enclosures encapsulating the two furnaces to minimise noise and emissions.

The EAFs and the associated scrap handling facility are being built adjacent to the current steel shop, with minimal interference with ongoing operations. The first EAF should begin commissioning in late 2024, and the second one will be commissioned shortly thereafter.

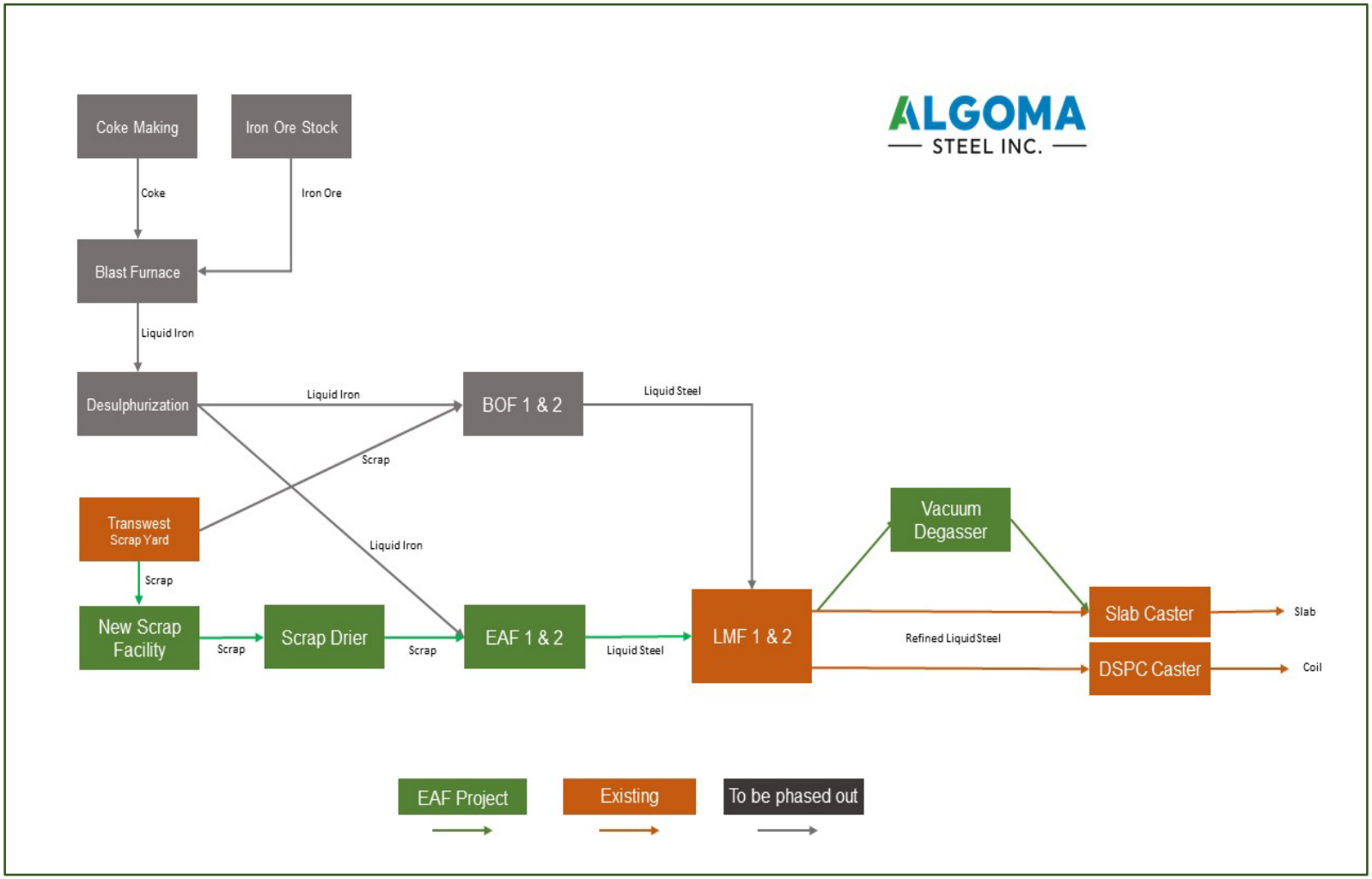
Photo 3: EAF 2 under construction, 2023-2024



Source: Algoma Steel

A new Twin-Tank Vacuum Degasser with an oxygen blowing facility will also be added to the process which will deliver advanced grades of steel, enhance steel cleanliness, and final product quality.

Figure 3: Production Process Transition from Blast Furnace to EAFs



Source: Algoma Steel

Scrap steel

The company will need more scrap metal (prime and obsolete scrap) which they will procure from the Great Lakes region. A joint venture with Triple M Metals will provide the scrap metal. The new facility design will have an automated scrap yard with automatic cranes, scrap visual recognition, and automatic scrap sorting and charging. There will also be a scrap drier to prepare the scrap material before use in the EAFs. New cranes suitable for EAFs have been purchased to operate in the new scrap facility.

Transition period

The plans are to construct two electric arc furnaces that feed steel into the existing LMF melt shop and hot-rolling and finishing operations. The company will do a phased introduction of the EAF. They will continue to operate the blast furnace and coke oven batteries until sufficient grid power supply becomes available to run both EAFs simultaneously. With the EAF transition, the company will no longer need the old equipment. The coke will be eliminated by the EAF conversion. Figure 2 shows the changes in the shift from a blast furnace to an EAF. The production facilities and processes that will close are shown in grey boxes and arrows, once the EAFs are in operation. The benefit of the *phased approach* allows the company to plan better for change and its impact on the workforce. Workers run the old process until shut down, as other workers who worked in the old process are switched out to train for operating the new EAFs. See Section on *Labour Force Impacts and Initiatives*.

Electricity generation

Part of greening manufacturing is shifts in end-to-end operations which includes backward and forward linkages in the supply chain. The goal is to shift to an energy source for the EAF which is 100% grid-based electricity. Algoma Steel will require **300 MW of power** to run both furnaces simultaneously with each requiring 150MWs. Fifteen years ago, under the ownership of Essar, the cogeneration facility was built to produce electricity and steam from the byproducts of cokemaking and ironmaking. Previously, the gas used to be flared. The coke oven gas (COG) and the blast furnace gas (BFG) are byproduct fuels used to run the cogeneration facility to make electricity which provides 50% of the electricity required for the current operation, and the local utility in Sault Ste. Marie provides the other 50% of the electricity.

Electrical capacity has to be increased to supply the EAFs. As such the company completed a refurbishment and upgrades and replacement of power generation equipment in the Lake Superior Power plant. Power is needed to allow the company to run one EAF at a time. *GE Gas Power* was contracted to upgrade the natural gas power plant to provide internal generation capability to power phase one of the transition to EAF steelmaking. GE installed two gas turbine packages (LM6000 aero derivative gas turbines) with new control systems and a new control system for the existing GE steam turbine. The refurbished facility generation capacity is 110 MW of electricity. Sault Ste. Marie and area local contractors were involved in the equipment installation, providing employment for members of the local community.

A new 230kV utility line is being installed by the local distribution company (PUC) owned by the municipality, to provide more grid electricity required to run both EAFs. The current line is now 115 KV and is at capacity, so the PUC is upgrading to a new 230 KW line**.** The switch to EAFs will also benefit from the province's investment in additional electricity regional transmission. The provincial government has issued a directive to expedite the building of three new transmission lines, two of which are in Northeastern Ontario (Della-Mattia, 2023). The electricity needs of the new EAFs will make Algoma among the largest consumers of electricity in Ontario.

Once the project is completed, Algoma is expected to be 'one of the lowest-cost green-steel production facilities in North America expanding annual steelmaking capacity from 2.8 million tonnes to 3.7 million tonnes with a significant reduction (estimated at approximately 70%) in carbon emissions' (Algoma, 2023). The needs of all policy actors are aligned on the EAF switch with support from the federal and provincial governments and the municipality.

Greening Impacts of retrofits

Environmental Impacts of EAFs - Managing waste and hazardous materials

The plant uses best available control technologies to manage air emissions, water treatment and waste management, and will continue to do so in the EAF switch. Algoma plans to construct state-of-the-art fume and water treatment plants. The EAF has the best air contaminant capture controls from new steelmaking technology.

- **Scrap steel** – Recycling by using scrap steel in production reduces the need for virgin iron, reduces waste, and so reduces the environmental impact of steelmaking.
- **Water** – Algoma plans to construct a water treatment plant that conserves water by recycling non-contact water from the EAF steelmaking process. The dedicated recirculating water treatment plant will minimise water consumption from the new facility.
- **Noise** – The new EAF steelmaking facilities include new engineered furnace enclosures for noise abatement. These enclosures feature large doors which seal shut before the arcing process begins, containing any sound, sparks, or dust particles. The building design for the EAF includes heavy gauge steel and acoustic insulation to further buffer sound from the operation.
- **Greenhouse Gas Emissions** – EAF operations generate more steel and approximately 70% less greenhouse gas emissions, compared to traditional production processes. There will be a reduction of the plant's greenhouse gas emissions by more than three million metric tonnes from historical emissions via the blast furnace route. By using electricity from the grid, energy use will be 90% non-emitting.
- **Particulate matter (dust) –** Two new fume treatment plants will perform emission control - capturing air and dust emissions. The dust produced by the EAF processes will be captured by two large baghouses with both primary and secondary hood collection systems to contain the dust. The

fume treatment plants include activated carbon injection systems for controlling the release of dioxins and furans which will then be captured by the baghouses.

- **Landfill** – EAF dust is considered a hazardous waste in Canada; however, it contains a significant amount of zinc which can be recovered and reused in other steelmaking applications. In order to avoid disposing of the dust in hazardous waste landfills, Algoma plans to send its EAF dust to recycling facilities to recover zinc and other precious metals contained in the dust. Additionally, Algoma is working on the development of alternative beneficial uses to prevent steelmaking slags from going to landfill.

Environmental Key Performance Metrics (KPIs)

Investments in green technology assumes there are payoffs for the environment and community in reducing emissions and effluents that may impact the non-human (air, water, land) and human. Companies must develop metrics and baselines to demonstrate shifts in pollutants and success for various aspects of its operations and publicly report. In its annual ESG Report 2023, Algoma published[8] various ESG metrics related to sustainability and environmental management. Some key metrics that are used are outlined below:

- **GHGs** – Scope 1 and 2 (% and intensity); % of coke and iron in steel production; % using EAF; internal carbon price[9]; Investments ($) in climate related risks and opportunities.
- **Air emissions** – carbon monoxide, oxides of nitrogen, oxides of sulphur, particulate matter <10 µm[10], manganese, lead, volatile organic compounds, Polycyclic aromatic hydrocarbons.
- **Energy management** – Total energy consumed (Gigajoules); % energy consumed that is grid electricity; (%)

[8] The Sustainability Accounting Standards Board (SASB) publishes industry-specific sustainability accounting Standards for disclosure of financially material, decision-useful ESG information to investors. Algoma use this standard to report applicable metrics from the Iron & Steel Producers Standard.

[9] The regulatory carbon price covering 100% of Scope 1 GHG emissions is the same carbon price Algoma applies internally for decision-making and planning. (ESG 2023 Report, p. 75)

[10] Those with a diameter of 10 microns or less (PM10) are inhalable into the lungs and can induce adverse health effects.

energy consumed that is renewable energy; total fuel consumed (gigajoules); % of total fuel consumed that is coal; % of total fuel consumed that is natural gas; % of total fuel consumed that is renewable.

- **Waste & Hazardous Materials Management** – Amount of waste generated (metric tonnes); % of waste recycled; Number of hydrocarbon spills; Aggregate volume of hydrocarbon spills (litres).
- **Water Management** – Total freshwater withdrawn (cubic metres); % of fresh water withdrawn in regions with 'High' or 'Extremely High' Baseline Water Stress.
- **Workforce Health & Safety** – Incident Rate; Injury rate; Near Miss Frequency Rate; OSH training hours; First Aid Use for full-time and contract employees.

Algoma is tracking **scope 1 and 2 emissions** but is not tracking **scope 3 emissions**, as yet. Scope 1 emissions are direct greenhouse (GHG) emissions that occur from sources that are controlled or owned by an organisation (e.g., emissions associated with fuel combustion in boilers, furnaces, vehicles). Scope 2 emissions are indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling. Scope 3 encompasses emissions that are not produced by the company itself and are not the result of activities from assets owned or controlled by them, but by those that it's indirectly responsible for up and down its value chain. (e.g., when consumers buy, use and dispose of products from suppliers). These are hard to track. All steel producers report Scope 1 emissions as part of the performance standards in Ontario. The sector is regulated and reporting is mandatory.

The EAF switch will also create a safer workplace for employees working near the furnace and with molten iron. Proper training on new systems, equipment and processes is key to workforce safety and is an indicator of how well the transition is progressing.

Shifts in pollutants

There are some preliminary estimates of emission reduction outlined in Figure 4 below. The overall change in emissions and pollutants will take a few years to assess after full operation of the EAFs.

Figure 4: Preliminary Estimates on Emission Reductions

		Preliminary Estimated Reduction[1]	% Reduction
GHG Emissions	CO_2	3.0 MM tonnes	70%
	CO_2/NT production	1.33 tonnes	75%
SOx Emissions		4,060 tonnes	82%
NOx Emissions		1,604 tonnes	52%
Cokemaking Emissions		Complete elimination of Cokemaking Stack and Fugitive Emissions	100%

Source: ESG Report

Other Industry modernisation initiatives

DSPC 2.4 Modernisations

According to its website, 'Algoma Steel's DSPC high strength, high performance steels are ideal for use in automotive unexposed structural systems, offering excellent bending capability and unmatched dimensional control.' The company became employee-owned for a short period in the 1990s, during which time employees opted to build the *Direct Strip Production Complex (DSPC)*. According to Algoma's advisor at the time, Ken Delaney (current Executive Director of CSTEC), the employees were willing to make the capital investment and wait for a return, because they felt the investment would result in improved productivity and secure jobs for the long term (Interview, 2024).

Recently, the DSPC has been undergoing further modernisation to improve productivity and efficiency. The DSPC recycles 95% of water used in the process.

Steel Plate and Strip Mill modernisation

The Plate and Strip Mill Department underwent modernisation with major renovations and improvements to the department to upgrade equipment in 2021. Approximately one million tonnes of the steel plates are used in Canada.

Photo 4: Platemaking Line Upgrades

The changes enhances product quality and efficiency in the production process. There was a complete upgrade of the 166-in. wide plate mill. The changes will allow manufacture of 'wider plate products, to better control shape and surface quality and to improve logistics – making it possible to offer enhanced ship on time performance' (Danieli, 2019).

The plant was completely re-automated from Level 0 to Level 2 systems. Automation included the reheat process to finished goods and the installation of a new primary de-scaler, a new hot-leveler and a new cooling bed uniting the Hotmill to the new Danieli Shear line, drastically reducing crane handling of plate, and improving ship on time. New process equipment and new digital drives will allow normalised or controlled rolling. Algoma will now

be able to supply new grades of plate to the shipbuilding, energy and bridgebuilding sectors.

The blue sections in Photo 4 indicate where changes have been made to the plate-making line to improve product movement, workflow and productivity. The SIF fund was used for the plate and strip mill modernisation, accessing $30 million. The plate mill modernisation required upskilling of millwrights and technicians. Hydraulic training and electrical training were completed by employees.

Robotics

Industrial robots are being integrated into steel mills in Europe and the US to improve efficiency and product quality. Automation through the use of robot applications helps plant personnel to work better and safely. Algoma introduced three anthropomorphic robots in the Rolling Mill area which accurately stamps the products using digital technologies in a short time cycle. These tasks are repetitive and dangerous. This helps the operator to work safely, saving time and increasing reliability and efficiency. The operator's work changes to monitoring of the robots which requires a different skill set or they may undertake other activities in the line or department. The operators can take over and operate the robots manually, if needed.

Labour Force Impacts of Retrofits and Greening

This section provides a summary of some of the human resources impacts of modernisation and production changes, and human resources strategies, most of which are related to greening of the company. Algoma notes that it partners with regional higher education institutions and training providers 'to create a system of multi-generational supports to provide new skills training to Algoma's current employees and to build career pathways for regional youth in science, technology, engineering and mathematics (STEM) subjects and the trades' (Algoma, 2021). Investing in workers and students allows the company to have the skills they need as the company modernises its facilities.

There are different aspects to human resources changes discussed in this section:

(i) Skills upgrading related to ongoing modernisation of various aspects of the existing Algoma facilities;
(ii) training required for operating the two EAFs;
(iii) Labour-management collaboration;
(iv) Managing training and human resources productivity tools;
(v) Digitisation and training.

Workforce Transitions – Reskilling and Upskilling

According to an Algoma employee: 'The EAF will shift processes and the way people work' (Interview, 2023). In the Units and departments where modernisation is underway, workers have to be trained on new machinery, tools and changes in processes, and outcomes. Modernisation efforts, including the EAF transition, involves changes in occupations – skills required within occupations and new occupations – for which people have to be trained. Part of the strategy to address new skill needs is reskilling/upskilling; digitisation and digital twining to support on demand training, and introduction of integrated human resources tools to assess and train employees. Employees will have to leave redundant jobs and get training for new jobs. Some courses that have been set up to train workers at the plant are outlined in the table below:

Table 1: Reskilling and Upskilling Training for Technology, Process and System Changes

Training	Types of training
Asset Management Program training, EAF	EAF - Technical training
EAF introductory eLearning course	EAF - Technical training
EAF helper	EAF- Technical training
EAF theoretical training	EAF - Technical training
EAF Computer Based Training	EAF - Technical training
EAF Hydraulic and Electrical Schematics	EAF - Technical training
Online Learning Platform Access- LMS	Human Resources
Artificial Intelligence/Machine Learning	Industry 4.0
CDN-Automation-Drive Technology	Industry 4.0
CDN-Automation-TIA Portal Programming	Industry 4.0
Inventory Management Module	Inventory Management
DSPC training	Technical
Material Master Governance	Materials Management
Procurement Process Module	Procurement
Strategic Sourcing	Procurement
Vendor Master Compliance Module 4	Procurement
Hydraulics Training, Iron Making Dept.	Technical training
Hydraulics Training	Technical training
Overhead Crane DC Electrical Course	Technical training
Overhead Crane Electrical Training	Technical training
Plate Mill Project (EMT and MMT; Modernisation training)	Technical training
Scrapyard Project and Crane Training	Technical training
Height	Technical training
Forklift	Technical training
Pulpit	Technical training

Source: Algoma Steel

According to senior management, the transition to the EAF and upskilling of the workforce should end by 2025. Human Resources staff have been developing training plans; analysing jobs and determining training needs for the switch to the EAF. Workers from the blast furnace are already being re-trained. Some workers with experience are leaving to go to other areas of the factory - DSPC, the Cold Mill, and Steelmaking departments. They are selected based on their interest and seniority rights in the bargaining unit.

Human Resources staff created content – two hours of foundational training as an eLearning module in the LMS – for new workers who have to take over coke making until the EAF transition is complete. Given the safety and emission issues within coke making, this is considered a worthwhile investment while other employees go to the EAF to get trained. Emissions will go up if workers are not trained properly to take over the jobs vacated by the transferred workers. Many employees have already been trained and Algoma continues to upskill and reskill for changes in current or new jobs required for the EAF operation. All training is customised since the plant has specific needs. Training is provided to employees in all departments and all functions, with a focus on process improvement, productivity improvement, worker safety and environmental impact mitigation.

Managing Training and Human Resources Productivity Tools

Algoma has introduced the latest technologies to manage human resources including training management. Algoma is using HR and talent management modules from SAP SuccessFactors, a cloud-based SaaS solution but companies can use any tool or suite of tools that works for them considering functionality, ease of use, and affordability. These tools allow the company to better assess and train employees and other workers on site. These tools also improve productivity for a small human resources staff and equips them to better manage resources and time. The human resources approach is creating a modern workplace with skills development and succession opportunities.

In 2019, the *recruitment module* and *performance management and goals module* (*PMGM)* were introduced. The Recruiting module supports the hiring process and includes Recruiting Management; SAP SuccessFactors[11] mobile – a collaborative recruiting management platform; Recruiting Marketing, a social recruiting marketing platform that includes a search engine optimisation career website builder; and Recruiting Posting, a platform used to

[11] SAP SuccessFactors is targeted at large organizations. HR functions such as payroll, time and benefits are not offered to companies with less than 2,000 employees. SMEs can procure a more affordable line of HR tools. It also cannot be customized. Companies need to investigate what is the best and most affordable software for them to manage their human resources.

post jobs on different job boards. The recruiting process is easy and engaging for candidates. A third-party implementation party (IBM) was hired to do provisioning, that is, the back-end work to set up the system and train staff.

The *Learning Management System (LMS) module* was implemented to support training and development in March 2023. Previously, the company used SAP ECC qualification system which did not allow online developmental training. The LMS is being utilised in the EAF transition to assess and train workers. A list of jobs and responsibilities was stored but it was difficult to access information and one could not track training of employees. Training documents and historical data from the previous four years will be loaded into the new system which is currently stored in flat files. The goal is to introduce the *succession and development planning module*, which will allow for better succession planning and training of employees.

The new LMS will improve the effectiveness of how human resources assesses skills gaps and individual training needs and provide the required training for up-skilling/reskilling. Employees can view the different levels of training required for occupations, self-assess their skills gaps and find training for themselves. Employees can self-assess and self-develop or the company can help them develop. Some modules link better, so the LMS linked to PMGM allows one to see how people are rated in PMGM. The Recruiting module works on its own. The Onboarding module is needed to link to Recruiting. The PMGM is only used for certain employees – management and supervisory – non-union employees. The company has acquired LinkedIn licences for all employees and eLearning packages have been created and linked to LinkedIn. Folders for competencies have been set up for non-union jobs at levels 1, 2, 3, 4 learning[12].

The Kirkpatrick Model is the standard used for assessing investments in employee development. It uses the four levels of learning:

- Level 1: Reaction - participants find the training favourable, engaging, and relevant to their jobs;

[12] See https://www.kirkpatrickpartners.com/the-kirkpatrick-model/

- Level 2: Learning -participants acquire the intended knowledge, skills, attitude, confidence, and commitment based on their participation in the training;
- Level 3: Behaviour - participants apply what they learned during training when they are back on the job;
- Level 4: Results - targeted outcomes occur as a result of the training and the support and accountability package.

Most companies assess employee learning and impact at Levels 1 and 2. The tool allows better assessment and impact of investments in training and productivity.

Human Resources staff are creating training classes within the system so that training will be centralised and stored in one location for better information management and tracking of employee development and learning needs. What learning from training is applied on the job (level 3) and impacts on planned outcomes (Level 4 learning) will become relevant for succession planning. Managers can assign goals to employees to complete; they complete training and then do the tasks back on the job. They can be assigned a higher level of competency (e.g., up from 2 to 3.). Planning and goal setting is linked to learning which is linked to competency, which is then attached to employee development and succession planning. The company feels this is a transparent, fair and equitable way of assessing employees for promotion. By linking LinkedIn training to competencies (e.g., Leadership) employees have the content to develop. Providing access to unionised employees was raised at JTT and there were no objections to introducing competency-based training to them, as it would not be a contravention of the collective agreement.

Managing change and ‘resistance’ when introducing the new technologies were important by getting employee and union buy-in. To get results and benefits from workforce development, employees take time to adjust and change in order for new systems to become fully integrated into operations and become routine in the way employees use the new technologies. Some people are hesitant to switch over to the new way of learning and tracking learning but there is more focus on training, better assessment of employee skills deficiencies, and more awareness of training and the need for training among employees. The

company continues to train employees on an ongoing basis on how to use the LMS. It will take one full year for full integration and they have been on track to achieve these goals.

Digitisation and training

One approach to making the learning process more effective is through the use of digitisation of processes, which can be used for instructional materials and on-demand learning. Algoma hired InsightWorks Training Technologies (ITT), a company based in The Soo, to digitise various aspects of the operations in the plant for training purposes. ITT notes that its digital platform can 'enhance productivity and add value to daily operations while making learning a natural and engaging activity'. A replica of a new site or workspace on the floor can be used for upskilling.

The digitisation of processes and layout in a plant can employ various techniques:

- **3D maps and animation** - Replication of the plant environment, processes, and equipment for 3D simulations. The workforce can immerse themselves in a visually compelling learning environment.
- **Virtual reality models** of processes in the plant - After re-creating the environment, a worker can immerse himself and interact with 3D worlds, explore maps, view information and images in full virtual reality.
- **Simulation and VR** - simulations imitate the operation of a process or system. The cost varies depending on the level of detail required. Employees learn how to perform certain tasks or activities in various real-world scenarios, better preparing them should the event actually occur.
- **Digital twinning** – Algoma plans to create a digital twin of the entire plant to improve management, training and productivity. In digital twinning of a process, part of a process or an entire plant – sensors on the equipment can provide live information back to the computers for analysis for process improvement, safety issues, treating issues, learning and training, etc.

ITT's tools are used for training and onboarding at Algoma. Initially, ITT gathers existing training /SOP information, then adds or improves the quality of content through a review of the process

with plant operators and others. They then expand the knowledge base to cover cost, quality and customer related information or training as well as the impact of each role on upstream and downstream processes. The goal is to create a consistent understanding of processes from a high level and then understanding at a detailed level in every role. Until now SOPs were in large, printed binders which are difficult to use but digitisation improves understanding and retention.

Modelling of the majority of facility will include the EAF, Plate and Strip, LMF and Steelmaking Scrap Crane. Every department that will be impacted by the large-scale change will be digitised including the Blast Furnace because of turnover; the LMF because of the impact on upstream processes; and departments such as the Segment Shop which provides a critical maintenance service to the EAF and other process departments.

Benefits of digitisation
Employee turnover is a concern due to the aging workforce and role changes due to the new EAF. There is a need for faster time to competency building. It was noted that every employee is critical to operating success and need to have an awareness about the impact of their decisions in terms of customers, quality, cost and upstream/downstream processes. This is more important today as opposed to 10–15 years ago and will continue to become more elevated as technology advances (Interviews, 2023).

- The primary goal is building operating or maintenance process consistency through detailed SOPs and a broad baseline of operator knowledge. This leads to operating efficiency and process optimisation. It also means providing accurate process related content so the organisation has accurate process steps that communicate how why they want the work to be completed. Process consistency between crews, operating efficiency and better performance of workers leads to better business performance, and consistency in product quality.
- Training is related to process knowledge, terminology, performance expectations, how the role fits within the process and how the department fits before setting foot on the shop floor.
- They are creating real-time operating metrics that are tied to training materials and SOPs.

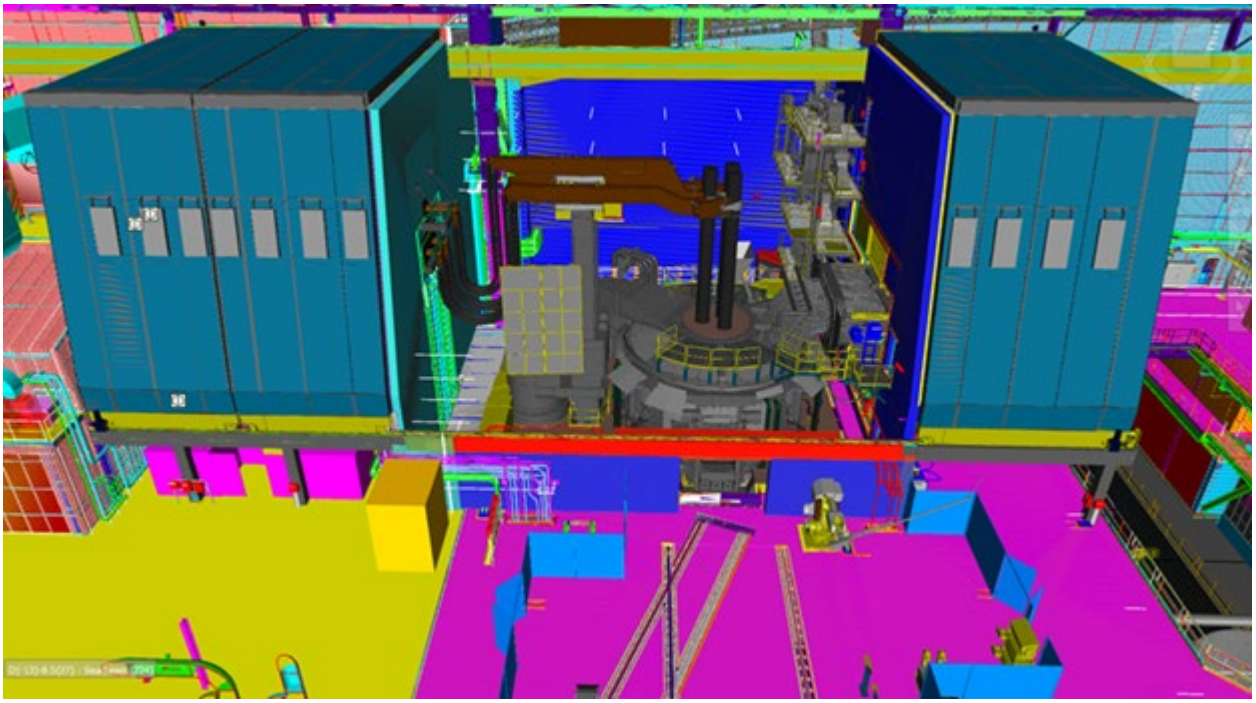
- The overall outcome is improved and more consistent operating performance, heightened operator awareness, a shorter time to competency, and a resource for existing employees to refresh knowledge and learn new content.
- People can be trained and qualified much faster.
- Improving digital literacy – An unexpected learning outcome of digital training is that initially many workers were concerned as they lacked familiarity with computers. But management noticed that many workers started using computers for both life and work afterwards including using the company email.

The plan is to update materials and continue to develop simulations and begin to use AI to support process knowledge and operator decisions.

Figure 3 shows a 3D image which is part of the digitising of the EAF and various work processes/tasks and machinery. It shows the inside of the EAF and the graphite electrodes used to produce high-power electric arcs to make the steel. 3D models has been done of the EAF including inside the oven, so that workers can 'see' the inside of the furnace where they cannot see it in the real world. This digitisation allows them to better understand the process and safety implications of how they work. The availability of these 3D images of the plant and work processes is improving training and learning outcomes of employees and workers[13] in different ways especially for **people with learning disabilities and older workers**. One example is the scrapyard crane 3D training that teaches in an engaging module how to use the crane to pick up scrap and drop it in the bins. Cranes are used in different departments so the training can be modified for the different types of activities in the departments that use a crane.

[13] Employees and other contracted workers will have access to relevant training to maintain safety at the plant.

Figure 5: 3D image of inside the EAF



Source: Algoma Steel

Accessibility

VR/AR allows for immersive learning. The equity aspect of this type of learning is that people with learning disabilities or those who cannot memorise material will be able to learn better. There is accessibility through digital to voice options. Closed captioning and voice over helps with accessibility and learning. SOPs, HR policies, health and safety instructions (MSDS) are being put on the LMS. The LMS team in human resources, IT staff and 3rd party providers are working to integrate the training platform with the LMS so employees have easy access. Content via the LMS is mobile-ready so workers can access instructions in real time on the shop floor on their phone as they work, which helps with on-site problem-solving. Digitised training and instructional materials/manuals for processes and 3D images allows for breaking up content which can improve retention. English language of newcomers is a challenge and a safety concern so introducing other languages in the software will address this issue. Employee learning can be tracked and matched to outcomes on the job. Algoma plans to digitise the entire plant as part of a shift to being a **smart factory.**

Labour-Management Collaboration

Central to a smooth technology transition is trust and good labour-management relations. While plants in other jurisdictions are facing resistance to changing technologies, Algoma has been fortunate to have good communications and relations with unions. The USW has a long history in The Soo and has been active for over 50 years. USW District 6 in The Soo represents approximately 4,000 members and has a had strong history with Algoma. At Algoma, 95% of the workforce is unionised and represented by two locals of the USW under two collective bargaining agreements. The company successfully ratified agreements with the two union locals, Local 2724 and Local 2251. The agreement with Local 2251, which represents production workers in the plant, is a 5-year agreement. Local 2724 is the staff association representing engineers, frontline supervisors, IT workers, accountants, and other staff except for managers (2023 ESG Report).

The Joint Training Committee (JTT) has been involved in addressing any labour transition discussions regarding modernisation and training needs of the workforce including EAF conversion. Regular meetings are required between the company and the unions to discuss labour relations and training and retention to minimise displacement of workers. The JTT has been exploring all opportunities to train, upskill or reskill, where possible. Reskilling and upskilling people to be retained in the company is more important in a time of labour shortages, especially outside of metropolitan areas.

At a meeting with FOCAL researchers with Algoma Steel in December 2023, union representatives appreciated the need for the EAF but wants training and retention of workers to be addressed, noting: ‘We are happy to hear that older employees were learning and becoming computer literate and were more engaged with Siemens (hydraulics) training and InsightWorks training’. Contractors can be used sporadically for surge work and to conduct one-time work that will not be ongoing at the plant, where the expertise is not available in-house. But the contracting clause is comprehensive in the collective agreement. Training of the employees as part of technology change is expected by workers’ representatives.

Partnership

Partnering with government and other policy actors are key to the success of the transition to new technologies.

Government support

Government policy and international policy is driving shifts in companies. Government support in decarbonisation efforts from a technology perspective and labour perspective, are key to a faster and successful transition. The provincial Ministry of Labour and the federal government has, in the past, supported Algoma workers in periods of labour adjustment and transitions. According to the company, government at all levels is a partner with Algoma from a financial and labour perspective in the current transition, taking into account the longer-term sustainability of both Algoma Steel and The Soo. The federal government across Ministries have been supportive of the company in the transition to cleaner production technologies.

The government of Ontario (especially Ministry of the Environment, Conservation and Parks, the Office of the Premier, Ministry of Energy, Ministry of Economic Development, Job Creation and Trade, Ministry of Energy) have also been supportive of Algoma's journey to net-zero. The local government has always worked collaboratively with Algoma in meeting their obligations as good corporate citizens to the local community.

CSTEC as a partner in workforce development

In the 1990s, **Canadian Skills Training and Employment Coalition (CSTEC)** started a partnership with Algoma for reskilling/upskilling workers for new jobs at the plant; supporting displaced workers to get training and find new employment outside of the company (waged and self-employment); and transition to retirement. CSTEC did this labour adjustment work in the 1990s during a period of upheaval and labour displacement and were very successful in assisting workers.

Through the federally-funded **Focal Initiative**, CSTEC has funded reskilling and upskilling of workers for the EAF switch and other process improvements in the plant. Almost 1000 workers have been funded for training by the FOCAL project. CSTEC will continue to collaborate with the company and unions to support workforce recruitment and training in the future.

Educators/Trainers

Algoma also collaborates with the local higher education institutions (HEIs) and training organisations to train their current and future workforce. Algoma recruits both domestic and foreign students from the HEIs, which also has an economic impact in the community.

Economic Benefits to the company

There are many opportunities with the new facilities of the EAF. The output can be purchased by companies that are currently using foreign products, thus reducing 60%-70% of imports which are used in infrastructure, bridges, subways, wind towers and other uses. The EAF technology will have an economic impact by improving productivity and production, making it competitive for the future. As demand rises for **near-zero emissions steel**, Algoma will be positioned to benefit from changes in the market. Capital investments will improve capital productivity and allow the company to increase volume and create new products for different market segments in North America. From a labour perspective, high-paying sustainable jobs are being created that will allow workers to be retained. The company's investments in the EAFs and new waste treatment facilities, along with the elimination of the coke making and blast furnace process will not only allow increase in sales and revenue but also lead to cost savings.

Community Impact of Algoma

The fortunes of Algoma and The Soo are inexorably conjoined and helps to sustain the regional economy. Algoma has a multiplier effect on the economy of the city as it is the largest employer in The Soo with over 70% of the city's population directly or indirectly economically dependent on its operations. It represents around

40% of the city's GDP. The company has provided employment for different generations of families from the community. According to Algoma's Vice-president of Strategy, the community has responded positively to the transition: 'We're seeing a lot of individuals that have a history with Algoma Steel, they're third or fourth generation of workers. And they like to see the fact that we're investing in the facility, we're ensuring the competitive nature of the business for decades to come' (Wyman, 2022).

- **Construction** –The EAF transition has created construction jobs with the contracting of companies, materials purchase, employment of local workers, etc. As of March 31, 2023, the company notes that it spent $55.2 million in the community on constructing the EAF and engaged with 47 local suppliers.
- **Upstream Jobs** – Jobs will be generated from the need for a new utility line in the plant. New transmission lines being brought to the community to meet electricity needs of Algoma will also benefit other businesses and the community.
- **Downstream Jobs** – The plant being competitive and staying operational will be positive for the community and SMEs in various sectors. There are also new goods and services that local third-parties can provide to the company.

Algoma conducts outreach activities to keep the community informed of changes and impacts on them (Algoma, 2023, p. 64). The company receives environmental approvals from government which also includes public consultations.

Conclusion

The case study shows how a company, as a good corporate citizen, works on greening its operations reducing its environmental footprint over time through retrofits and upgrading of facilities. It demonstrates how to adapt to meet climate change goals to reduce emissions while improving efficiency and productivity to compete in the global market. It is implementing cleaner production strategies to prevent waste generation including equipment modification, technology change, efficient use of energy resources, and on-site recovery/ reuse of byproducts. With a significant decline in carbon emissions, the company is positioning itself for economic growth and competitiveness by meeting national and international standards

of operations and procurement, which will attract more customers and orders which leads to more jobs. The importance of developing human resources – through reskilling and upskilling – to take on new tasks and jobs as technology changes, is highlighted in the transition. The case study demonstrates how policy actors enact environmental, labour market, and other government policies, working together to support greening of the company's operations that bring benefits to everyone affected. The support of the provincial government, federal government, municipal government, labour unions, and the community have been essential to its greening process and continued success. Suppliers and customers are also key to the transition to green steel. There have been obstacles along the way but its management notes that reducing its environmental impact has always been important for Algoma. The lessons learnt from this transition can assist other companies with their own greening efforts.

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