SIDERURGIA
SUSTENTÁVEL

Evaluation of the Support Mechanism for the Development, Improvement and Demonstration of Sustainable Technologies for the Production and Use of Charcoal in the Steel Industry of Minas Gerais State

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01.

Project Background

PROJECT BACKGROUND

Traditionally, world iron and steel production is based on the use of mineral coal as a raw material. With discussions on climate change and sustainability on the agenda in recent decades, the use of charcoal from forest plantations for iron ore and steel production has been gaining prominence internationally, nationally and in Minas Gerais state, due to its potential to reduce emissions from greenhouse gases and their renewable, traceable and legal origin.

In 2019, Brazil produced a total of 6.8 million tons of pig iron from charcoal, of which 5.5 million (80%) in the state of Minas Gerais (SINDIFER, 2020). The state is responsible for the largest production and consumption of charcoal, pig iron, steel and ferroalloys in the Brazilian iron and steel industry.

It is estimated that about 20 to 30% of charcoal production is directed to the consumption of larger industries (integrated plants) and 70 to 80% for more dispersed production chains, of medium and small producers and consumers in the sector of pig iron (Agência Minas Gerais, 2020).

Photo: Arcelor Mittal S/A

In this context, the importance of developing actions related to the iron ore and steel industry from charcoal can be highlighted, with a focus on initiatives aimed at improving the productive performance of charcoal and its by-products and sustainable production development.

1.1 "SIDERURGIA SUSTENTÁVEL" PROJECT – SIDSUS

Seeking to develop a sustainable steel production chain with low emission of greenhouse gases (GHG), the SidSus Project (BRA/14/G31 – Sustainable production of biomass-based charcoal for iron and steel industry in Brazil) was created, in cooperation with the Ministry of Environment (MMA), Ministry of Economy (former Ministry of Industry, Foreign Trade and Services), Ministry of Science, Technology and Innovation (MCTI), Ministry of Agriculture, Livestock and Supply (MAPA), and the United Nations Development Program (UNDP), in close collaboration with the Government of Minas Gerais.

The Project was approved by the Global Environment Facility (GEF) in January 2014 and the Project Document (PRODOC) was signed in June 2015 by UNDP, MMA and the Brazilian Cooperation Agency (ABC), which was formally launched in the first quarter of 2016. The Project is implemented by UNDP, under the technical coordination of MMA, which is aligned with national and state priorities of developing a sustainable and low-carbon iron and steel production chain.

Photo: Pixabay

The SidSus Project aims to reduce greenhouse gas emissions in the production chain of the pig iron, steel and ferroalloys sector in the state of Minas Gerais: (i) through the development and establishment of cutting-edge and clean conversion technologies in charcoal production based on renewable biomass; and (ii) the adoption of an effective and favorable political framework.

The use of sustainably produced charcoal provides an alternative development way to mitigate large amounts of global greenhouse gas emissions by improving resource efficiency during the charcoal conversion process. Renewable biomass resources for charcoal production are obtained from sustainable eucalyptus plantation forests.

1.2 SUPPORT MECHANISM FOR NEW TECHNOLOGIES OF CHARCOAL PRODUCTION

In 2017, the SidSus Project launched the Public Notice JOF-0191/2017 for the selection of projects aimed to the development of innovative technologies and/or technological improvement in the production of legally sourced charcoal. The main differential of this selection process was to offer a Support Mechanism and payment for results achieved for legal entities operating in the iron and steel chain.

According to the bidding notice, proposals could be submitted for the following categories:

- Sustainable charcoal production – establishment or expansion of production capacity, with or without the use of by-products;
- Improvement in the sustainable charcoal production process;
- Burning of gases/smoke generated in the sustainable charcoal production;
- Adoption and/or expansion or improvement of technological arrangements, involving the use of sustainably produced charcoal and/or its by-products in the production of pig iron, steel and ferroalloys;
- Recovery and/or processing of sustainably produced charcoal by-products; or production of complementary products (briquettes, biocoke, etc.) for the production of pig iron, steel and ferroalloys.

The Support Mechanism aimed to achieve a minimum reduction in greenhouse gas (GHG) emissions equal to or greater than 270 kg CO2e/ton of charcoal produced, in addition to catalyzing at least a production capacity of 80 thousand tons charcoal per year using sustainable technologies and/or processes.

The bidding process of the support mechanism (JOF-0191/2017) resulted in the selection of the following proposals, for one or more categories listed by the Bidding Notice:

Table 1 - Categories of the Support Mechanisms

SUPPORT MECHANISM CATEGORY (BIDDING NOTICE JOF-0191/2017)		SELECTED AND HIRED COMPANY
1	Sustainable charcoal production - installation or expansion of production capacity, with or without use of by-products	Plantar and RIMA
2	Improvement of processes in the production of sustainable charcoal	Arcelor Mittal
3	Burning of gases/smoke generated in the production of sustainable charcoal	Arcelor Mittal and RIMA
4	Adoption and/or expansion and/or improvement and technological arrangements that imply the use of sustainable charcoal and/or its by-products in the production of pig iron, steel and ferroalloys	Vallourec

Source: Bidding Notice JOF-0191/2017.

The selected companies in a nutshell:

ARCELOR MITTAL

One of the largest steel and mining companies in the world, it produces high quality long and flat steel for the automobile, household appliances, packaging, civil and shipbuilding industries. It also operates in mining, power generation, renewable bio-reducer production and information technology for domestic and international markets.


Photo: Arcelor Mittal S/A


Photo: Arcelor Mittal S/A

PLANTAR EMPREENDIMENTOS E PRODUTOS FLORESTAIS LTDA

Diversified company, which operates in forestry management of plantation forests, provision of forestry services, consultancy in climate change and sustainability, in addition to the charcoal-fired steel industry.


Photo: Plantar


Photo: Plantar

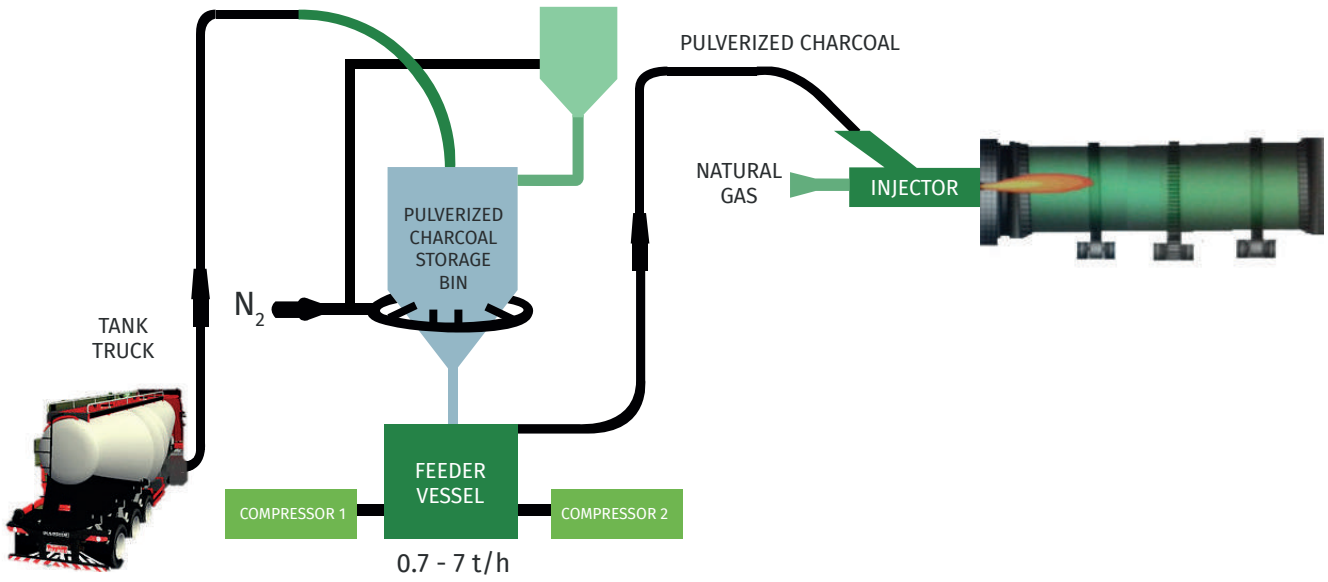
RIMA INDUSTRIAL S/A

The RIMA Group is the leader in the production and sale of alloys based on silicon and magnesium in Brazil, also operating in the production of ferroalloys, mining, forestry management and sale of carbon credits.

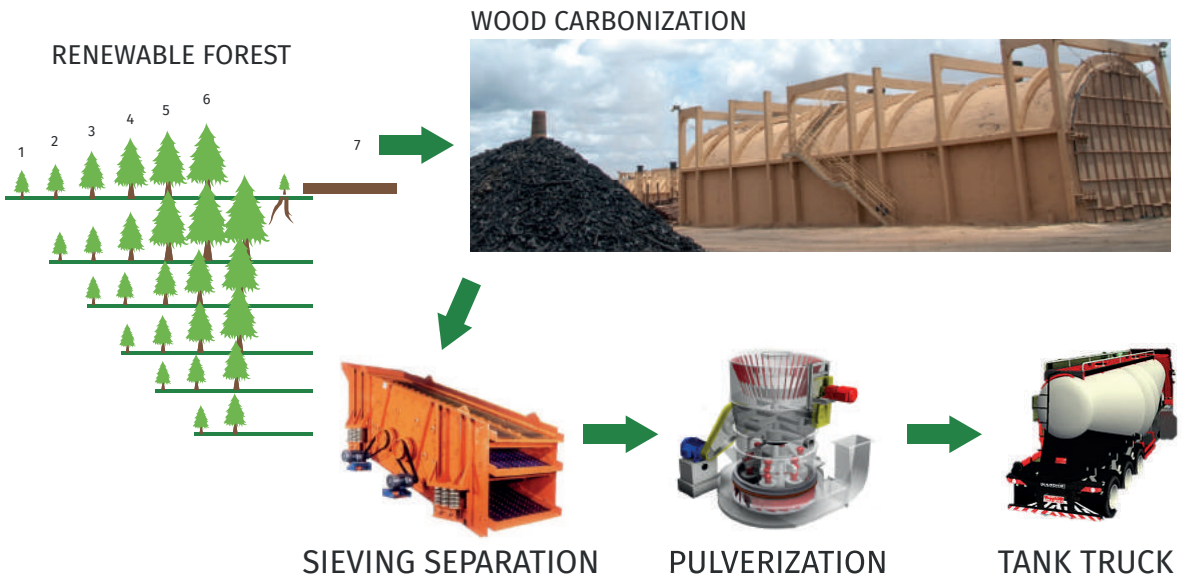
VALLOUREC SOLUÇÕES TUBULARES DO BRASIL S/A

Vallourec is focused on the production of seamless steel tubes, the production of charcoal that supplies the Blast Furnaces of the tube and iron ore production units. The company also has a Business Unit, which provides administrative services.

PELLETIZING PLANT INSTALLATION FOR CHARCOAL INJECTION AND BURNING



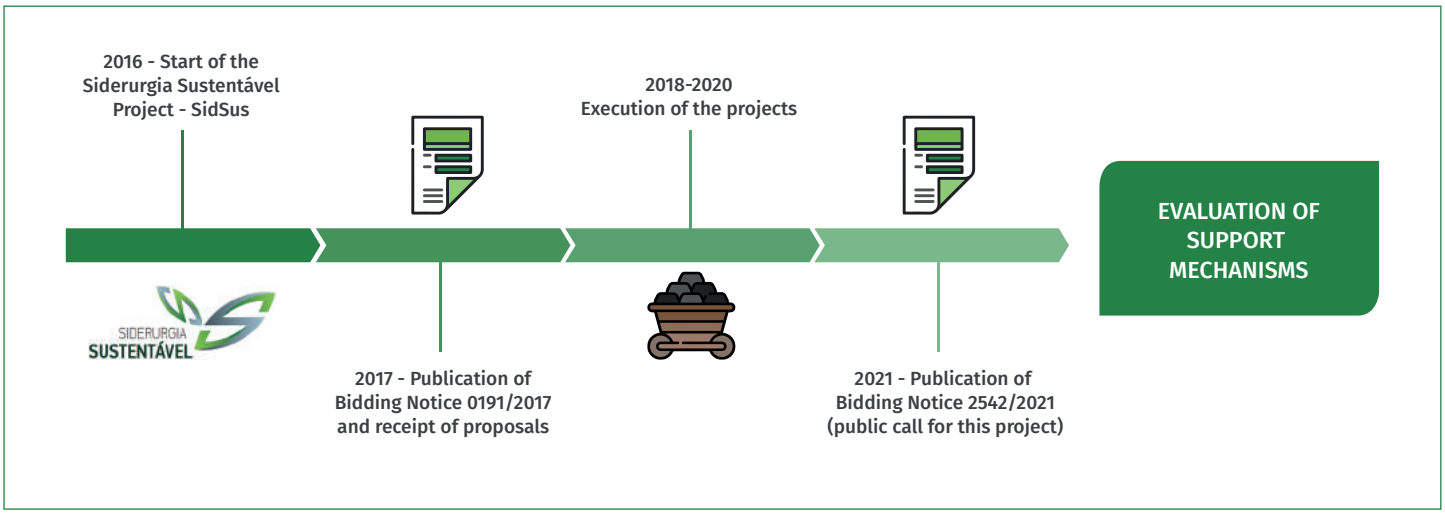
VALLOUREC RENEWABLE CHARCOAL PRODUCTION ROUTE



The companies above-mentioned executed between 2018 and 2020 a total of 06 (six) projects.

In 2021, the UNDP launched the Bidding Notice JOF-2542/2021, for hiring a specialized consultancy for the evaluation and synthesis of the Support Mechanism, whose main results are presented in this document.

Figure 1 - Timeline of the Support Mechanism for New Technologies for Charcoal Production for the Iron and Steel Industry



Source: Prepared by the Consortium (2021)

02.

Methodology

METHODOLOGY

The Support Mechanism was geographically covered by the state of Minas Gerais, the state with the highest consumption of charcoal and of major relevance to the Brazilian iron steel industry and where the SidSus Project is implemented.

The Support Mechanism evaluation was carried out between May and July 2021 and was based on:

- Primary sources of information: Interviews carried out based on a structured questionnaire, with the teams responsible for the selected projects of each company and with representatives of the stakeholders; and
- Secondary sources of information: Bidding Notice of the Support Mechanism, technical proposals from the companies, project installation and implementation reports, independent audit reports on the results achieved and other complementary documents.

The scope of the Support Mechanism evaluation, in turn, presented in this document, is composed for:

Results and companies' perception of the initiative, in terms of:
Technological results
Investments/financial contributions
Partnerships signed
Social and environmental results
Strengths and lessons learned
Evolution of the mechanism in terms of expansion

- General perception of other relevant stakeholders operating in Minas Gerais, pointed out by UNDP and experts in the initiative:
  - Minas Gerais Forest Industry Association (Associação Mineira da Indústria Florestal) – AMIF;
  - Association of Iron and Steel Industries for Forest Out Grower Scheme (Associação das Siderúrgicas para Fomento Florestal) – ASIFLOR; and
  - Union of the Iron Industry of Minas Gerais State (Sindicato da Indústria do Ferro de Minas Gerais) – SINDIFER.

03.

History of The Support Mechanism

HISTORY OF THE SUPPORT MECHANISM

The main results and perceptions about the Support Mechanism, which composes its history, are presented below.

The approach is carried out in a transversal way, presenting the results and perceptions together.

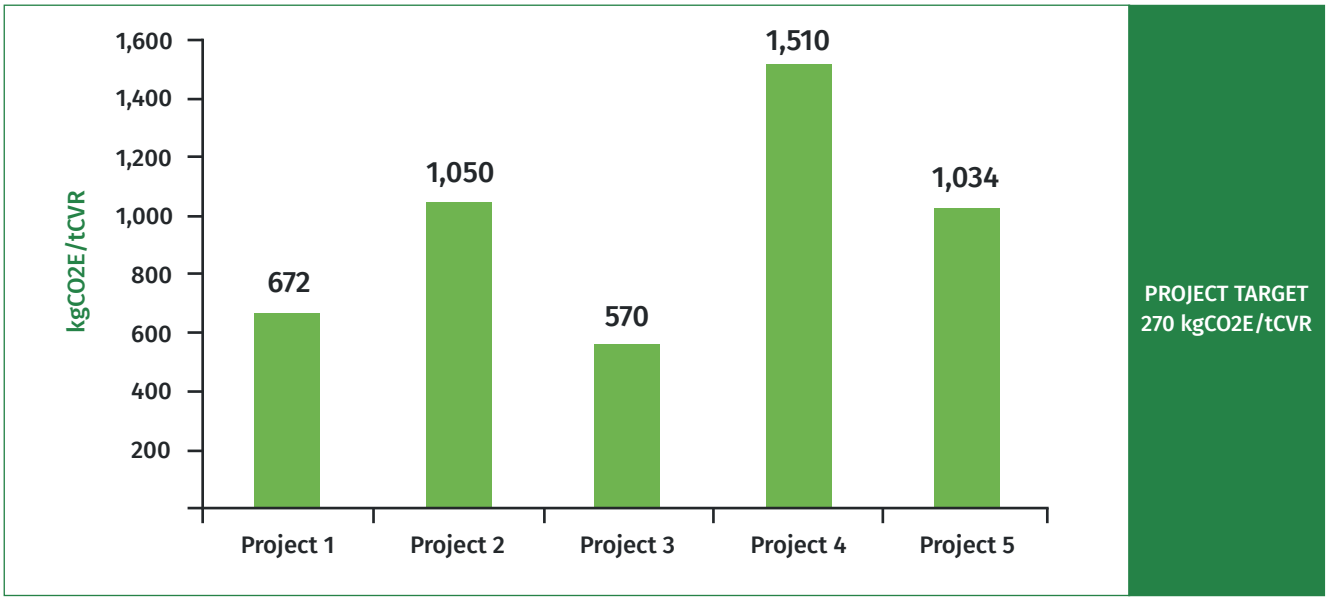
3.1 RESULTS AND COMPANIES' PERCEPTION OF THE INITIATIVE

TECHNOLOGICAL RESULTS

The perception of technology adoption and its results was positive in all companies participating in the mechanism.

Regarding the GHG emission reduction target (whose baseline established by the mechanism was 270 kgCO2E/tCVR), of the 6 (six) projects participating in the mechanism, 5 (five) of the projects exceeded the target, contributing to the generation of more efficient production processes, with less impact on air quality.

Figure 2. Emission Reduction Results Achieved by the Support Mechanism Projects[1]

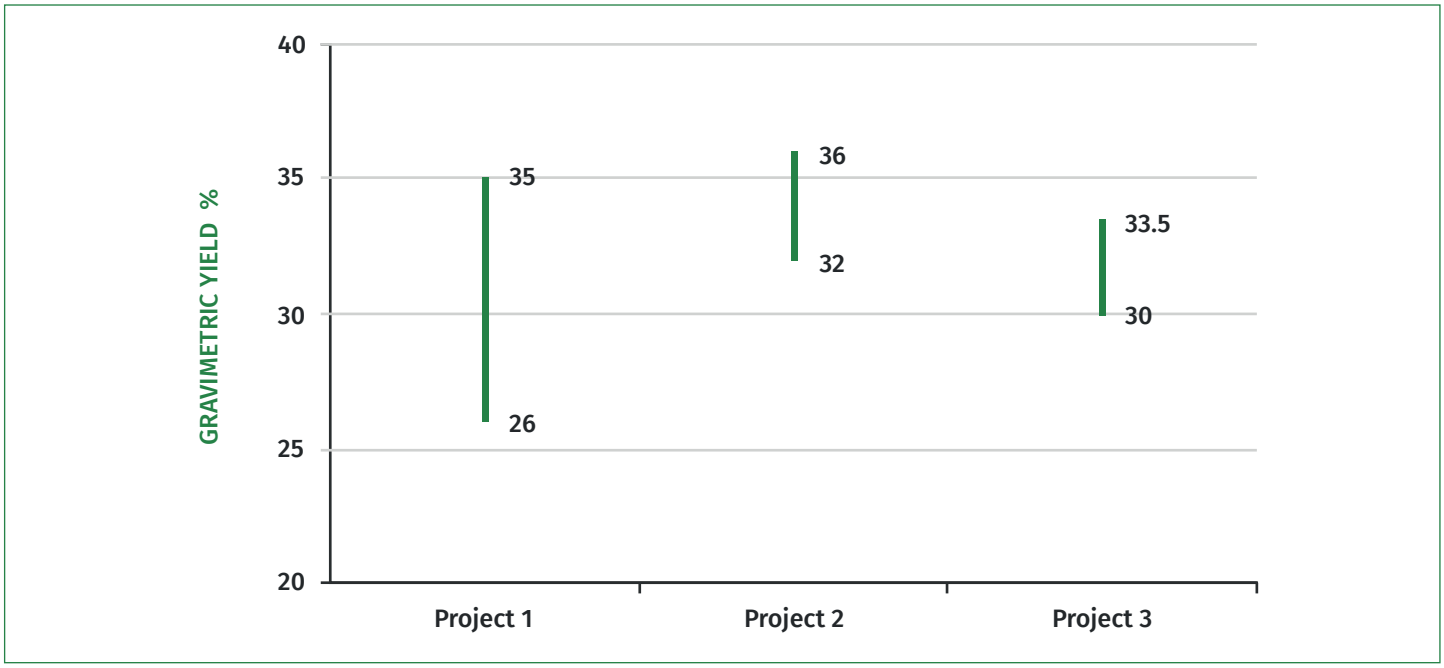


Source: Prepared by the Consortium (2021).

[1] It is important to highlight that, for Project 6, a baseline was not established, since it is the replacement of a fossil fuel (natural gas) by a renewable one (charcoal mill). The baseline is applicable when there is a comparison between a new technology and the one being replaced, with the same measurement criteria.

Regarding the increase in the Gravimetric Yield (GY %), for the categories in which the target was applicable (categories 1 or 2), the results are presented below.

Figure 3. Gravimetric Yield (%) Results Achieved by Support Mechanism Projects[2]



Source: Prepared by the Consortium (2021).

It is noted that all companies surpassed the maximum reference established in the Support Mechanism Bidding Notice, which was 33%.

It is important to highlight that the increase in gravimetric yield can result in an increase in the amount of charcoal produced or in a reduction in wood consumption. In fact, one of the companies that participated in the Support Mechanism started to consume less wood, keeping its forest stocks for reserves or for projects of new production expansions.


Photo: Pixabay


Photo: Pixabay

[2]Projects 4, 5 and 6 did not fit into the categories that set the goal of increasing GY.

INVESTMENTS/FINANCIAL CONTRIBUTIONS

Regarding the investments in technology supported by the Mechanism, they were applied as indicated below.

Table 02 – Investments in Technology under Support Mechanism Projects

PROJECT	CATEGORY	MECHANISM DISBURSEMENT (R$ THOUSAND)	COMPANY DISBURSEMENT (R$ THOUSAND)	TOTAL VALUE (R$ THOUSAND)	MECHANISM SHARE (%)
Project 1	**1**	**900,000.00**	**7,967,617.44**	**8,867,617.44**	**10**
Project 2		**2,500,000.00**	**12,457,454.50**	**14,957,454.50**	**17**
Project 3	**2**	**700,000.00**	**2,942,636.77**	**3,642,636.77**	**19**
Project 4	**3**	**1,000,000.00**	**18,302,327.64**	**19,302,327.64**	**5**
Project 5		**1,000,000.00**	**6,388,094.76**	**7,388,094.76**	**13**
Project 6	**4**	**1,000,000.00**	**7,825,872.00**	**8,825,872.00**	**11**
TOTAL INVESTED		**7,100,000.00**	**55,884,003.00**	**62,984,003**	**11**

Source: Prepared by the Consortium, based on the Audit Reports (2021).

In the 6 (six) projects developed, approximately R$ 63 million were invested, of which R$ 7.1 million (11%) came from UNDP resources and R$ 55.9 million (89%) came from the companies' financial contribution. For some projects, these investments helped to solve technical problems and achieve environmental benefits in CO2 reduction above the established target.

The financial resources were used mainly for investments in technical improvements, acquisition of goods, equipment, consultancy, complementary projects, construction and expansion of furnaces and burners.

PARTNERSHIPS

In general terms, the partnership between the companies and the UNDP was considered successful in the perception of the interviewed team, as it was essential to expand production capacity, increase productivity and result in the established target of reducing GHG emissions.

Additionally, the companies participating in the mechanism also mentioned other partnerships related to the projects:

- **Local partnerships** with suppliers of raw materials, inputs and services, increasing the **demand for local products and services**, such as wood harvesting, brick manufacturing and charcoal transport;

- **Purchase of charcoal** residues from **small-sized suppliers**, helping in the sustainable reuse of these residues, adding value to the charcoal mill from other small-sized suppliers;
- **Support from neighboring communities adjacent** to the project's area of operation, mainly in monitoring smoke reduction in the surrounding areas.

SOCIO-ENVIRONMENTAL RESULTS

Regarding the social and environmental benefits generated within the scope of the Support Mechanism projects, the following aspects should be highlighted:

- Increased engagement between the company and the surrounding communities, local entrepreneurs and employees;
- Increased labor qualification due to technological development;
- Smoke elimination and reduction of GHG emission;
- Neighboring communities and employees satisfied with the improvement in the air quality;
- Improved ergonomic conditions and work safety, by mechanizing the various stages of the process, capturing and eliminating the smoke produced during the process, making the work environment cleaner and less harmful to the worker
- Increased awareness of operators and people linked to production about environmental impacts; and
- Increased demand for local products and services, thus promoting the economy of the municipalities surrounding the projects.

STRENGTHS AND LESSONS LEARNED

The companies participating in the mechanism pointed out as the main strengths of the project:

- Multidisciplinary team with synergy and experience in the area, committed to achieving results;
- Use of innovative and differentiated equipment and systems;
- Credibility of participating companies, making some of the projects internationally recognized;
- Identification of bottlenecks, with the implementation of technology and results achieved; and
- Improvement and better control of the production process.

Among the main **lessons learned**, the following stand out:

- Importance of coherence between the proposed methodology and the actual development of the project;
- Importance of maintaining systematic and effective communication during the project's evolution;
- The replicability of technologies is fully possible, including the adoption by other companies in the sector that are developing their own projects in these lines, according to the specificity of each production model.

PROJECTS EXPANSIONS

Regarding the expansions carried out as a result of the projects success linked to the Support Mechanism, the main highlights are:

By adapting concepts and technologies discussed and consolidated with the UNDP, one of the companies built another smoke burner, in addition to developing a mobile platform to control the carbonization;

Another company, through the mechanism, developed similar production units on other sites and built more furnaces;

Through the partnership, one of the companies highlighted that was able to expand its production capacity and productivity.

There was also mention by companies participating in the Support Mechanism of the intention to expand its production capacity.

3.2 GENERAL PERCEPTION OF OTHER STAKEHOLDERS ON THE INITIATIVE

In general terms, according to the stakeholders who are familiar with the initiative and with relevant position in Minas Gerais, the Support Mechanism had as its main positive impacts:

- Initiatives such as the Support Mechanism arouse the interest of the market, which can promote the production chain;
- Payment for results is an economic incentive, which reduces the cost for the company to invest in innovative technologies, with the potential to value the final product in the international market;
- The Support Mechanism brings visibility to companies that invest in technologies aimed at reducing GHG emissions.

04.

Final Remarks

The main final considerations identified throughout the study are:

- The projects developed under the Support Mechanism implemented technologies with positive technical, social and environmental results;
- The Support Mechanism enabled participating companies to be engaged in the necessary advances for the evolution of charcoal as a sustainable and relevant commodity for the economy of Minas Gerais and Brazil;
- The experience with the Support Mechanism has brought positive results in terms of GHG reduction, the initiative's main goal, with most companies achieving a reduction above the intended equivalent carbon emissions target;
- The companies had increased production capacity, improved controls, processes and/or plant yields and/or reduced consumption of raw materials;
- The project also had as positive impacts the improvement of the air quality in its surroundings, the increase in qualified labor, the improvement of working conditions, the improvement of engagement between companies and local communities and increase in demand for local products and services;
- The technologies developed in the projects can be replicated in other companies of the sector, with a similar profile;
- Charcoal production technologies developed under the Support Mechanism initiative can be considered an important step in promoting cleaner technologies;
- The initiative gives more credibility and visibility to the Brazilian and Minas Gerais iron and steel industry, expanding the sector's growth possibilities and reaching new markets, in line with trends in socio-environmental responsibility and control of the legal and sustainable origin of products.

Testimonials

Testimonials

"The initiative has as its differential an economic incentive – the payment by results. In addition, it is important because it has synergy to the Millennium Sustainable Development Goals and the neutralization of greenhouse gases, current global trends, which values the final product and strengthens the visibility of the Brazilian iron and steel industry in the international market."

Taiana Guimarães Arriel
Forestry Industry Association of Minas Gerais (AMIF), Institutional Relations


Photo: Pexels

"The social and environmental focus shall be strong in the initiatives of the iron and steel industry, and it is important to value initiatives that invest in reduction of greenhouse gas emissions, such as the Support Mechanism."

Fausto Cançado
Union of Iron and Steel Industry of Minas Gerais State (SINDIFER), President

"When the positive results started to become evident and we started to get the gains, it was rewarding. It was the first project with non-refundable grants that we participated and that had excellent results. It is serving as an example for the entire organization."

Roosevelt de Paula Almado
Arcelor Mittal, Development and Technology Manager

Testimonials

"RIMA always had among its premises the adoption of initiatives to minimize environmental impacts. The project was important to expand production capacity of its charcoal production plant. The technology is innovative, efficient and sustainable. The partnership with UNDP was essential to expand production capacity, productivity and installation of the gas burner."

Roberval Brito
RIMA Industrial, Engineering, Research and Development Director

"The project is progressing well! It continues producing at full capacity, maintaining the proposed gravimetric yield and reducing methane emissions."

Daniel Carvalho de Moura
Plantar, Forestry Operations Director


Photo: Pexels

"With the solution of technical problems enabled by UNDP's support, we reached 100% use of charcoal, becoming the first pelletizing plant in the world to use this renewable fuel as the main one in the production process, reducing CO2 emissions. With this project, we achieved a great example of action with an environmental focus and great financial results, showing that environmental benefits can and should also bring positive financial impacts."

Davi Silva Braga
Vallourec Soluções Tubulares Brasil, Process Specialist

Testimonials

"I got to know the production situation prior to the project as a service provider at the Fazendinha production unit. Now, I had the opportunity to go back to the production plant and observe the positive result that the smoke burning project has provided for our community. Congratulations to ArcelorMittal."

José Osvaldo Bernardes
Municipal Secretary of the Environment – Quartel Geral - MG

"With the excellent results witnessed throughout the project, we envisage the bases of the strategy to encourage the sustainable charcoal production and its use by the steel industry, with a consequent reduction in greenhouse gas emissions, reducing deforestation of natural forests and increasing the competitiveness of the Brazilian iron and steel sector in a low-carbon economy.

The interviewee also suggests: Development of public policies, based on the perceptions and conclusions of the project."

Gislene Custódio
Mining, Energy and Logistics Policy Superintendency

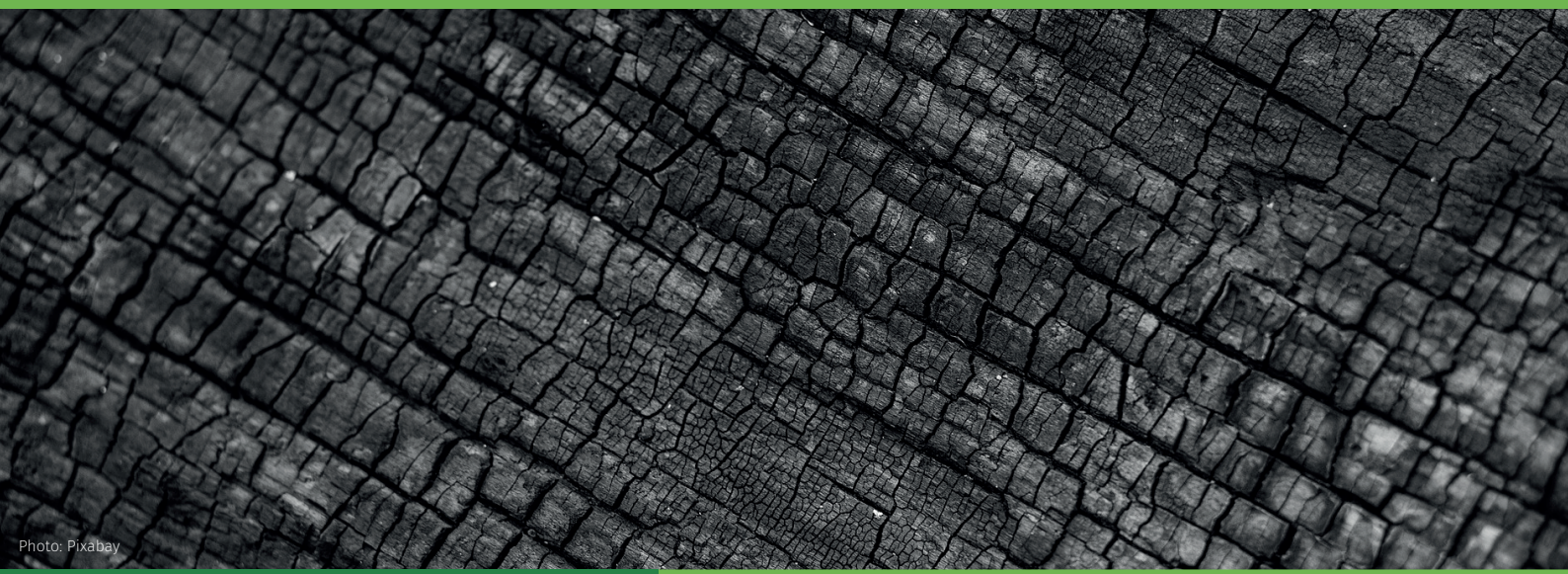


Photo: Pixabay

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PREPARED BY:

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