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UN Development Programme

Brazil - Brasilia

Project: 00077784
Project Title: BRA/14/G31 PIMS 4675 Production of biomass-based charcoa
Start Year: 2014
End Year: 2019

Implementing Partner: DIRECT EXECUTION

Responsible Parties: UNDP

Revision Type: Initial Project Approval

Budget (US\$) as of Last Revision on 29-April-2015

Donor	Fund	Amount
GEFTrustee	62000 GEF Voluntary Contribution	7,150,000.00
Total Budget (2015 and Beyond)		7,150,000.00
Total Utilization (2014 and Prior)		0.00
Project Total		7,150,000.00
Unprogrammed/Unfunded		0.00

Project Description:

The proposed UNDP/GEF initiative is aimed at reducing the greenhouse gas emissions from the iron and steel sector in the Brazilian State of Minas Gerais, by (i) developing and demonstrating enhanced, clean conversion technologies for renewable, biomass-based charcoal production, and (ii) implementing an effective, supportive policy framework. The renewable biomass resources for charcoal production are obtained from sustainably-grown eucalyptus plantations. The use of renewable charcoal provides an alternative development path to mitigate large quantities of global greenhouse gas emissions by improving resource efficiency during the charcoal conversion process and by offsetting the use of mineral cokes for pig iron production. The Project will push the status of clean charcoal conversion technologies from the level of small-scale pilots by the industry to successful demonstration of advanced commercial production facilities.

Agreed by: Emb Fernando Abreu - ABC

Agreed by: Agência Executora - MMA

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Agreed by: Date 12/06/2015

Francisco Gaetani
Secretário Executivo
Ministério do Meio Ambiente

02/06/2015

United Nations Development Programme

Country: BRAZIL

PROJECT DOCUMENT



Project Title:	BRA/14/G31 – Production of sustainable, renewable biomass-based Charcoal for the iron and steel industry in Brazil.
UNDAF Outcome(s):	#5: More efficient use of available resources is ensured to promote an equitable and environmentally sustainable economic development
UNDP Strategic Plan Environment and Sustainable Development <u>Primary</u> Outcome: Mainstreaming environment and energy.	
UNDP Strategic Plan <u>Secondary</u> Outcome: Environmental considerations are mainstreamed in sector and local-level strategies and plans.	
Expected CP Outcome(s): Capacities for integrating sustainable development and productive inclusion for poverty reduction.	
Expected CPAP Output(s): Low-carbon strategies with LECRDS concept adopted in Brazil and widely disseminated .	
Executing Entity/Implementing Partner: UNDP	
Implementing Entity/Responsible Partners: Ministry of Environment (MMA)	
<p align="center">Brief Description</p> <p>The proposed UNDP/GEF initiative is aimed at reducing the greenhouse gas emissions from the iron and steel sector in the Brazilian State of Minas Gerais, by (i) developing and demonstrating enhanced, clean conversion technologies for renewable, biomass-based charcoal production, and (ii) implementing an effective, supportive policy framework. The renewable biomass resources for charcoal production are obtained from sustainably-grown eucalyptus plantations. The use of renewable charcoal provides an alternative development path to mitigate large quantities of global greenhouse gas emissions by improving resource efficiency during the charcoal conversion process and by offsetting the use of mineral cokes for pig iron production. The Project will push the status of clean charcoal conversion technologies from the level of small-scale pilots by the industry to successful demonstration of advanced commercial production facilities.</p>	

Programme Period:	2010-2014
Atlas Award ID:	00077784
Project ID:	00088390
PIMS #	4675
Start date:	January 2015
End Date	December 2019
Management Arrangements	DEX
PAC Meeting Date	_____

Total resources required	US\$ 43,950,000
Total allocated resources:	_____
• Regular	US\$ 300,000
• Other:	
○ GEF	US\$ 7,150,000
○ Government	US\$ 33,600,000
○ In-kind	US\$ 2,900,000

Agreed by (Government): _____

Date/Month/Year

Agreed by (Executing Entity/Implementing Partner):

Ministry of Environment

Date/Month/Year

Agreed by (UNDP): Date/Month/Year _____

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List of acronyms

CDR	Combined Delivery Report
CO2	Carbon dioxide
ABC	Brazilian Cooperation Agency
AMS	Associação Mineira de Silvicultura
BDMG Gerais)	State Development Bank of Minas Gerais (Banco de Desenvolvimento de Minas Gerais)
BNDES	National Economic and Social Development Bank (Banco Nacional de Desenvolvimento Econômico e Social)
CCA	Common Country Analysis
CCF	Country Cooperation Framework
CCM	Climate Change Mitigation
CCP	Climate Change Program
CDM	Clean Development Mechanism
CGEE Strategic	Centro de Gestão de Estudos Estratégicos (MCTI's Center for Management and Studies)
CH4	Methane
CIM	Brazilian Committee on Climate Change
CO	Country Office (UNDP)
COP	Conference of Parties (UNFCCC)
CO2	Carbon Dioxide
CO2eq	Carbon Dioxide Equivalents
FINEP	Studies and Projects Financing Institution (Financiadora de Estudos e Projetos)
Fundo Clima	National Climate Change Fund (Fundo Nacional sobre Mudança do Clima)
GEF	Global Environment Facility
GEx	Executive Group (CIM)
GHG	Greenhouse Gas
HQ	Headquarter (UNDP)
IPCC	Intergovernmental Panel on Climate Change
I&S	Iron and Steel
LUCF	Land Use Change and Forestry
LULUCF	Land Use, Land Use Change and Forestry
MCTI e	Ministry of Science, Technology and Innovation (Ministério da Ciência, Tecnologia e Inovação)
MDIC	Ministry of Development, Industry and Trade (Ministério do Desenvolvimento, Indústria e Comércio)
MG	State of Minas Gerais
MMA	Ministry of Environment (Ministério do Meio Ambiente)
MOU	Memorandum of Understanding
NMHC	Non-Methane Hydrocarbons
NPFE	National Portfolio Formulation Exercise
PNMC	National Climate Change Policy (Política Nacional sobre Mudança do Clima)
SNC	Second National Communication
UNDP	United Nations Development Program

UNFCCC	United Nations Framework Convention on Climate Change
GDP	Gross Domestic Product
GWh	Gigawatt (GW)-hours (1 x 10 ⁶ kWh)
kWh	kilowatt (kW)-hours
MTE	Mid-term Evaluation
MWh	Megawatt (MW)-hours (1 x 10 ³ kWh)
M&E	Monitoring and Evaluation
PM	Project Management
PSC	Project Steering Committee
RCU	Regional Coordinating Unit (UNDP)
RTA	Regional Technical Advisor
TWh	Terawatt (TW)-hours (1 x 10 ⁹ kWh)
TA	Technical Assistance (GEF)
TNA	Technology Need Assessments
SCTC	Sustainable Charcoal Technical Commission
STAP	Scientific Technical Assistance Panel (GEF)
UNDAF	United Nations Development Assistance Framework

1. SITUATION ANALYSIS

Policy conformity

The present Project “Production of sustainable, renewable biomass-based charcoal for the iron and steel industry in Brazil” supports the GEF-5 CCM Objectives #2 and #3. The Project is supportive to Objective #2 (“*Promote market transformation for energy efficiency in industry and the building sector*”) because it applies a cleaner production strategy to the iron and steel production chain that pursues an increased charcoal yield from renewable biomass resources. As part of this improvement, the energy efficiency in the production chain is enhanced proportionally. The initiative is also aligned with Objective #3 (“*Promote investment in renewable energy technologies*”) as it promotes the use of a renewable energy carrier (biomass-based charcoal from sustainable sources) by the iron and steel sector (I&S) to offset the use of a fossil source (mineral coal). This can be viewed as a market transformation based on a fuel-switch process throughout the sector.

Country ownership and drivenness

Brazil adopted its National Plan on Climate Change in December 2008, which defines actions and measures aimed at mitigation and adaptation to climate change. Federal Law No. 12,144 (December 9 2009) established the Brazilian Climate Change Fund (*Fundo Clima*) to financially support mitigation and adaptation action using resources from the oil royalties. Federal Law No. 12,187 (December 29, 2009) provides the principles, objectives, guidelines and implementation mechanisms of the Brazilian Climate Change Policy. This Law is a milestone since it creates a legal basis for actions already being implemented by the Federal Government and for developing further policies by the Federal, state and local Governments.

The national iron and steel sector is prioritized in Brazil’s climate change policy presented at the COP in Copenhagen, December 2009¹. Brazil presented voluntarily emission reductions to the UNFCCC for the iron and steel industry of the order of 8-10 million tons CO₂eq by 2020². These mitigation actions have been included in the National Policy on Climate Change in 2009³. The ultimate body responsible to guide the implementation of the National Plan is the Brazilian Committee on Climate Change (CIM) that aggregates 17 Ministries and the Brazilian Climate Change Forum (civil society together with numerous other public and private organizations) The Ministry of Environment acts as the Secretariat of the CIM’s Executive Group (GEx) and supports the Committee in implementing and monitoring the National Climate Change Plan.

In 2010, a Decree was issued⁴ based on the National Plan, which established that sector plans for mitigation and adaptation measures be developed and detailed throughout 2011. In response, an emission reduction plan was outlined and by the Ministry of Development, Industry and Trade (MDIC)⁵, that comprised two GHG mitigation goals: (i) to increase the amount of planted forests stocks to supply the iron and steel industry with renewable and sustainable biomass; (ii) to improve the charcoal production process to reduce emissions and increase efficiency in the use of biomass. From the outset these objectives are part of the broader goal to improve the competitiveness of Brazil’s alternative charcoal-based development path for the iron and steel sector, in the understanding that cokes-based production is the standard worldwide.

It is important to emphasize that the Minas Gerais State holds the biggest charcoal production and consumption of the Brazilian Iron and Steel industry. The Federal emission reduction programme is

¹ See: http://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/brazilcphaccord_app2.pdf.

² Other actions proposed are energy efficiency measures (with an expected voluntary emission reduction of 12~15 million tons of CO₂eq by 2020) and the increased use of biofuels (expected voluntary emission reduction of 48~60 million tons of CO₂eq by 2020).

³ Law 12,187 (National Policy on Climate Change), 29th December 2009.

⁴ Decree n° 7.390, 9 December 2010.

⁵ See: http://www.mma.gov.br/estruturas/smcq_climaticas/_arquivos/plano_setorial_siderurgia_sumrio_executivo_04_11_10_141.pdf

consistent with the “Sustainability Pact”, agreed by the State authorities, iron and steel industry, and local NGOs that served as a basis for the forestry law No. 18.365/09 implemented in Minas Gerais, defining 2018 as the deadline for phasing out non-renewable charcoal in the iron and steel industry in Minas Gerais. The proposed UNDP/GEF initiative is consistent with national and state priorities to develop a sustainable and low-carbon iron and steel production chain. The Project’s strategy and outputs can provide a more sustainable paradigm for the northern states Maranhão and Pará, where ore mining and iron and steel production have become major economic activities during the last decades.

Country eligibility

Brazil was the first signatory to the UNFCCC on June 4th, 1992. Ratification by the Congress followed through Decree No.1, which was issued on February 28, 1994. The Convention entered into force for Brazil on May 29, 1994 (90 days after its ratification by the National Congress).

Alignment with UNDP Assistance Framework

UNDP provides assistance to Brazil under the Development Assistance Framework 2010-2014. It is prepared in cooperation with the Brazilian Cooperation Agency (ABC), taking into account the United Nations CCA and the UNDAF 2012-2015 and focuses on the areas in which UNDP has a clear comparative advantage within its mandate. The present initiative is aligned with the UNDAF key priority “Green economy and decent labor in poverty eradication and sustainable development context”. The Country Programme (2012-2015) outcome is “Capacities for integrating sustainable development and productive inclusion for poverty reduction” with indicator “number of national policies including the concept of sustainable development”. The conceptualization and implementation of GEF-funded projects, including the present Project, represents one of the key pillars of UNDP’s assistance in the field of Climate Change in Brazil.

Country situation and development context

Brazil is one of the largest countries in the world with an area of nearly 8.6 million km². Over the country, a variety of climates with distinct regional characteristics can be found, from rainy equatorial climate in the North region to semi-arid climate in the Northeast where annual rainfall rates are low. With its vast size and geographical position, Brazil is one of the most important repositories of the world’s forests and biodiversity, including: the Amazonian Rainforest, covering approx. 40% of the country (3.5 million km²)⁶; the “Cerrado” savannah area (2.5 million km²); the semi-arid region “Caatinga” (over 1.5 million km²); the remainders of the Atlantic Forests; and the “Pantanal” swamp region (approx. 140,000 km²).

Brazil has the fifth largest population in the world, surpassed only by China, India, the United States, and Indonesia⁷. The distribution of the population and income over the country is very uneven, giving rise to internal migration movements. These movements are especially relevant for agriculture (and related changes in land use), which employs about 20% the national labor force. Presently, the northern and central-western regions have the greatest growth rates, while population growth in the south-eastern region has reduced.

The Brazilian economy ranks tenth in the world, with a GDP of US\$ 2.03 trillion (purchase power parity) in 2008. Notwithstanding, the country still faces several social and economic problems, as well as a lack of adequate infrastructure. Industry accounts for 28.5% of national production, agriculture for approximately 5.5% and services nearly 66%. Brazil is by far the largest economy in Latin America and in the southern hemisphere based on a diversified industrial infrastructure, highly qualified research and technological facilities, the export of equipment and machinery (including

⁶ Of which 2 million km² is composed of dense forest and 1.1 million km² of open forest.

⁷ The total population of Brazil is estimated at 200 million (2012). Source: IBGE:2012.

aircraft and motor vehicles), a well-developed domestic market, and its position as a major supplier of commodities (e.g. coffee, cocoa, soybeans, corn; minerals) to the world markets.

Progress made since the Economic Stabilization Plan (1994) have resulted in inflation control, a more equitable income distribution, and a slow but steady improvement of social conditions. There has been a decline in the illiteracy rate, child mortality, and birth rate, as well as an improvement in access to education, to electricity services and clean water, an increase in the consumption of durable goods, and increased access of women to the labor market⁸. Notwithstanding Brazil is still a country marked by deep social and regional inequalities, with very large differences between rich and poor, and an extreme poverty situation in the north-eastern region. Labor situations are still often precarious and many workers have no access to a formal job and a proper salary. Therefore, social development and poverty eradication are the first and overriding priorities of Brazil, as a developing country.

The Brazilian iron and steel sector

Brazil is one of the main producers in the world. Brazil is the world's second largest exporter of iron ore (production of 375 million metric tons, in 2012⁹) and ninth largest producer of steel (34.7 million tons of crude steel, in 2012, corresponding to 3.2% of world production¹⁰). Steel consumption in the domestic market is rather low, about 100 kilograms per person per year. However, it is expected to grow on the back of infrastructure development and growing demand for vehicles and appliances. In the international market, China is expected to continue driving the demand for Brazil's iron ore exports in the coming years. Privatization during the 1990's brought significant capital into the sector, which was previously mostly state-owned, under the form of more diversity in shareholder compositions. Thus, many producers became part of industrial and/or financial groups, aiming to achieve economy of scale and competitiveness.

Brazil's steelmaking park today comprises 27 mills, mainly controlled by eight business groups, namely: ArcelorMittal Brazil, Gerdau, CSN, Usiminas, SINOBRAS, V&M do Brasil, Villares Metals and Votorantim Siderurgia. The production park is relatively new and is constantly undergoing technological updating. The sector is able to supply the all kinds of iron and steel products to the market. The iron and steel production is largely concentrated in the state of Minas Gerais, with capital Belo Horizonte. Approximately 70% of all metal is produced in this state. The other region is East Amazonia between the Carajás mineral district and the Itaqui harbor (Pará). Brazil's iron and steel (I&S) sector is unique because 34% of the iron production is obtained using charcoal instead of mineral coke as the reducing agent. Put into a historical context, Brazil's iron and steel development path can be compared to the industrialized countries a few decades after the Industrial Revolution, when wood resources from local forests became depleted and mineral cokes were introduced as an alternative, finally replacing charcoal altogether.

Brazil however, is in a position to follow a different technological path by not phasing out domestic charcoal, but developing its iron and steel sector based on a mix of sustainable, renewable wood resources and imported mineral cokes. Brazil's climate allows rapid forest growth which -together with its vast territory- is a comparative advantage compared to the traditional industrialized countries. In the context of climate change mitigation, sustainable charcoal provides a renewable source of energy (heat) to hedge the use of mineral coal in the iron production chain. Renewable biomass-based charcoal is a key asset to reduce greenhouse gas emissions from the iron and steel sector. This requires a process of rationalization of the charcoal production sector, including technological innovation, capital investment and regulation of the (still partly) informal production chain.

Use of charcoal by the sector

⁸ Child mortality is 15.6‰, overall literacy rate is 97.5‰ (Source: <http://mdgs.un.org/> 2011). Present inflation rate is 6.6%; unemployment rate 6% (source: http://www.oecd-ilibrary.org/economics/country-statistical-profile-brazil_csp-bratable-en 2011). The highly unequal income distribution is marked by the wealthiest 10% of the population, which accounts for nearly 45% of the total consumption (2004).

⁹ Source: http://minerals.usgs.gov/minerals/pubs/commodity/iron_ore/mcs-2013-feore.pdf

¹⁰ Source: <http://www.worldsteel.org/media-centre/press-releases/2012/12-2012-crude-steel.html>.

Iron production starts by transforming the mineral (ore) into pure iron by removing the oxygen from the ore (basically iron oxide). This process is called reduction; the reducing agent can be cokes obtained from mineral coal, or charcoal. The reduction process takes place in a furnace, the required energy (heat) being delivered by the coke or charcoal. The reducing agent thus has a double function (both energetic and chemical). The pure iron is poured into ingots which, due to their shape, are called “pig iron”. For steel production, pig iron, scrap material and non-ferrous elements are melted into alloys with specific material properties. Pig iron produced using charcoal is superior compared to cokes-based iron as it comes to purity and the absence of sulphur. Brazil produces about 10 million tons of pig iron using charcoal, of which 60% are exported, generating an income of US\$ 2.0 billion per year. Pig iron accounts for about 84% of total charcoal use in Brazil; steel production about 10%, and the remainder is sold on the market for other purposes.

The abundance of natural resources in Brazil has favored the development of charcoal production from native forests, which, among others, covered the iron and steel industry’s needs until the 1940s, when mineral coke was introduced by the large integrated steel mills that emerged in response to government incentives to boost industrial development. While coal coke is now generally used for iron and steel production – especially by the large, integrated steel mills privatized during the 1990s, charcoal remains widely applied for pig iron and for steel production in Brazil. Charcoal in Brazil is produced in the following states: Minas Gerais (47.8%), Mato Grosso do Sul (13.3%), Maranhão (11.6%), Bahia (9.6%) and Goiás (8.2%), according to 2004 figures.

Charcoal production in Brazil is only partly sustainable as there exists a traditional supply chain based on informal production and wood supplies from unregistered sources, including deforestation of native forests (within the territory of the state of Minas Gerais specifically the “Cerrado” forests). More recently, the larger I&S companies have invested heavily in eucalyptus plantations to secure charcoal production. In Minas Gerais, I&S companies (together with other industries including pulp and paper mills producers, and wood companies) are joined in the Associação Mineira de Silvicultura (AMS)¹¹. The forest plantations are managed as rational businesses following best practices regarding sustainability. As such, the sector is preparing itself to supply certified products capable of meeting increasingly demanding market requirements concerning the environment, biodiversity and sustainability. Several companies are actively involved in technology development aimed at increasing charcoal outputs and reducing production costs.

One driver behind the traditional, informal market is the fact that charcoal demand exceeds the current production capacity of eucalyptus plantations. AMS regularly publishes on its website the amounts of renewable and non-renewable charcoal used in Brazil. It is estimated that about 50% of all charcoal is non-renewable. However, the informal market makes it very difficult to trace. Iron producers do not commonly verify the origin of the charcoal they acquire. In the North of Brazil (Pará State), illegal wood is still widely used. Some information sources estimate the share of illegal charcoal to be 70% or higher as a total average for Brazil. In Minas Gerais State at least 11.5% of charcoal production is supposed to come from native forests comes from illegal sources¹². Government policy therefore aims at phasing out the use of charcoal from non-renewable sources (deforestation). The forestry law No. 18.365/09 of Minas Gerais will put a ban on the production and use of non-renewable charcoal by 2018. In response, AMS seeks to improve the policy framework for sustainable forestry in Minas Gerais in order to meet the increased demand for renewable biomass-based charcoal in the near future.

A second key driver behind the charcoal market is its strong price elasticity. This is primarily the result of charcoal being considered a cost factor for the I&S industry, rather than a product with added value. This perception works down the whole production chain and is a consequence of the conditions under which charcoal has historically been produced in Brazil. Charcoal makes up about 40% of pig iron production costs; therefore, pig iron producers tend to control charcoal costs to protect their profit margin. In 2005, the average price paid for charcoal was just US\$ 34 per cubic meter. (This is well

¹¹ See: www.silvminas.com.br.

¹² See: Horta Nogueira, L.A., Teixeira Coelho, S, and Uhlig, A, Sustainable charcoal production in Brazil (2007). See: <http://www.fao.org/docrep/012/i1321e/i1321e04.pdf>.

below the cost level of charcoal from planted forests (around US\$ 100 per ton). At this price difference, market forces encourage charcoal production from unregistered (illegal) sources, especially in the North of Brazil. The prices paid for charcoal prices are strongly related to the international market prices for pig iron, which range from US\$ 230 per ton (2006) to US\$ 103 per ton of pig iron ton (2002). Compared to cellulose, with a price level of around US\$ 600 per ton (2005), charcoal is very poorly valued.

The third market driver is charcoal availability. Pig iron production is also elastic in response to world prices and demand; the availability of renewable wood resources is limited however. In 2004, when the sector responded to the surge in prices for pig iron to US\$ 300 per ton as a result of massive demand from China, supply became a real concern for companies. All the available wood in Minas Gerais was used to supply the pig iron producers in Minas Gerais, and charcoal prices increased to US\$ 65 per cubic meter. When supplies ran out, industries resorted to providers from Mato Grosso and Pará, and even imported wood from Uruguay and Argentina to produce charcoal. At average price levels, transport distances are a limiting factor. Charcoal from deforestation (especially from the Amazonian) is no longer attractive to supply the iron producers above distances of around 1,000 km. This demonstrates that sourcing from illegal and increasingly remote native forests cannot be part of a sustainable charcoal production system.

Renewable biomass resources can be a major asset for the iron and steel sector towards creating a stable, competitive charcoal production sector. A supportive policy framework must: (i) establish fair conditions for renewable charcoal compared to illegal and non-sustainable charcoal; (ii) exploit the added value of renewable charcoal compared to fossil coal; and (iii) incentivize more efficient, low-emission charcoal production methods through differentiated pricing schemes. While a range of financial incentives may be devised to value the social, economic and environmental benefits of renewable biomass-based charcoal, one first needs to understand in detail the functioning of the charcoal markets. Past experiences point towards a need to stabilize supplies and charcoal prices. As yet, this aspect has hardly been covered by policy makers. The second key factor is to increase productivity by innovative charcoal conversion technologies and new business approaches.

Traditional charcoal production

Conventional charcoal production in Brazil is based on the practices and technology that are typically used in agricultural frontier regions. Small kilns built from locally available clay are filled with wood, which is converted to charcoal by pyrolysis. Cheap labor is widely available as settlers move in; land clearing and native wood resources are made profitable by selling charcoal – as the wood would be set on fire anyway. After completion of the pyrolysis process, the kilns are opened and generally abandoned. In the agricultural frontier, land and wood resources are not scarce; hence there is no need to make efficient use of the wood. With land, wood, clay and labor available at virtually zero cost, the charcoal production process is very effective, but also highly resource-inefficient.

Conventional charcoal kilns in Brazil are of the “hot-tail” type, which are more efficient (25%) than traditional kilns in other parts of the world (about 10% for a clay kiln in Sub-Saharan Africa). The “hot-tail” kiln has been kept in use also after I&S companies started to draw on wood supply from eucalyptus plantations. Charcoal production sites near forest plantations consist of rows of rechargeable kilns. The investment cost of a kiln is less than US\$ 100. A production site may be made up of 100 kilns or more. Small clusters of kilns are operated by one laborer, who is paid according to the volume of charcoal produced. Even though a large iron company is vertically integrated and owns the forest plantations, the charcoal production process is usually outsourced to local contractors, who in turn hire (or organize) the individual laborers. Although the sector strives at improving the work conditions for laborers in compliance with national law, many rural workers do not have any formal contract or legal protection, and are unaware of their rights. The practices applied in the agricultural frontier in Brazil are basically continued. With cheap labor available, there is little incentive for capital-intensive production methods.

The emphasis during the production process is therefore on the charcoal output per kiln¹³. The gravimetric yield (which is a direct measure for the efficient use of the wood input¹⁴) is 25%, well below the 35% that is currently taken as a yardstick¹⁵. As a result, more wood is consumed than strictly necessary. Under non-optimal conditions the gravimetric yield drops, and substantial methane emissions -contributing to global warming- are released during the conversion process. The conversion process is very polluting for the direct environment and difficult to control; its performance depending on the skills of the operator¹⁶. The traditional working conditions are highly unhealthy. Government action to eliminate uncontrolled logging of native forests, and the increase of more rewarding job opportunities originating from economic growth in Brazil, will expectedly reduce the availability of cheap labor for charcoal production in the near future. This scenario urges for investment in more advanced and productive charcoal technology, which will require a more skilled workforce.

Increasing revenues: green pig iron and carbon credits

At low commodity prices, profit margins become under pressure. In response, producers tend to source their charcoal from the cheapest suppliers, which are usually informal. The advanced pig iron companies aim to increase their margins by adding value to their product for example by branding "green pig iron", which is produced using charcoal from certified eucalyptus plantations. The Brazilian company Plantar S.A. in Minas Gerais¹⁷, entered into two contracts with the World Bank to deliver carbon credits under the Clean Development Mechanism. One project was based on the principle of reducing the GHG emissions generated during the pyrolysis process by flaring the methane gas. The CDM methodology has been approved by the CDM Executive Board and financed by the Carbon Prototype Fund¹⁸. However, due to the limitations of the traditional conversion method using small kilns, it proved difficult to control the process and effectively monitor the achievement of GHG benefits, so this initiative has been discontinued.

In an attempt to address the underlying technical problems, Plantar has designed a much larger charcoal kiln, for which initial field testing is occurring in some charcoal production sites. From a business perspective, however, it is more rewarding to direct the company's CDM supported efforts to the promotion of green pig iron on the market and to certify its sustainable forest resources¹⁹. Without policy support for a large green pig iron market and more stable, rewarding prices, it is unlikely that companies will invest heavily in the research and development of enhanced conversion technologies.

Technological progress

Recently, the sector has started to develop more advanced charcoal production technologies. Besides environmental concerns, the inability of the traditional kilns to achieve scale benefits has been a main driver. Until 2008, international steel markets increased sharply as a result of China's economic

¹³ I.e. the volume of charcoal produced in a kiln during a certain time period. The focus on volumetric yield is partly historical, as the outputs from forest logging are traditionally measured by volume.

¹⁴ Gravimetric yield = tons charcoal produced / tons wood inputs * 100%.

¹⁵ For financing of charcoal plants by BNDES. Under controlled conditions, a gravimetric yield of 40% can be attained.

¹⁶ The efficiency and quality of the charcoal production depend highly on the skills of the carbonization worker; relevant technical parameters are: process timing, temperature evolution, and wood humidity. Under sub-optimal conditions, methane is produced and emitted with the fume gases, together with other hydrocarbons.

¹⁷ See Plantar's website: http://ravel.plantar.com.br/portal/page/portal/plantar/principal_eng.

¹⁸ "Mitigation of Methane Emissions in the Charcoal Production of Plantar, Brazil". CDM Project Design Document, Version No. 6, March 6, 2007. Based on methodology AM0041.

¹⁹ A second project has been approved under the World Bank Carbon Fund (Project ID P120637, "Plantar Green Pig Iron Project", approval date August 3, 2011). This project explores the GHG benefits associated to eucalyptus forests compared to mineral cokes. The claimed GHG reductions are estimated at 3 tons CO₂eq per ton pig iron produced. This is based on the difference between the baseline scenario in which mineral coke releases 1.9 tons CO₂eq into the atmosphere, while in the alternative scenario eucalyptus plantations remove 1.1 tons CO₂eq per ton pig iron from the atmosphere (CDM Project Design Document "Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil", Version No. 3a, February 16, 2009).

boom. This led to a large demand for charcoal by the sector, which now faced limited production capacities. Several approaches are followed, as described in more detail in Annex E.

- Optimization of logistics, permanent production sites and improved control of the carbonization process, enabling larger clusters of traditional kilns. (The increased performance compared to traditional operation practices provided was used as a basis for CDM methodology AM0041. In practice, the GHG benefits proved very difficult to verify under field conditions). The gravimetric yield at optimum conditions can achieve about 30%.
- Large, rectangular steel kilns as developed by several I&S companies, which allow greater productivity per worker. The gravimetric yield is somewhat higher as a result of the increased capacity. Large kilns can be clustered and equipped with a piping system to capture the exhaust fumes.
- Rectangular kilns with heat recovery. The heat produced during the carbonization process, as well as the residual heat present during the cooling phase, can be used to pre-dry the wood for a next carbonization batch. This is done by creating pairs of kilns, with a heat exchanger in between. In order to justify the additional costs, a minimum kiln size is required. Also in this case, the paired kilns can be clustered to capture the exhaust gases for flaring. The gravimetric yield at its top conditions can achieve around 34%.
- Drying-Pyrolysis-Cooling (DPC) technology. This approach aims to tackle one of the main cost factors of capital-intensive charcoal conversion technologies, i.e. the long throughput time of the batch process as a result of drying and cooling. Advances in this field are made by several companies. One of the innovations is the use of transportable containers. Instead of transporting energy flows and gases, the more compact wood and charcoal are moved by truck. Fume gases are captured. The promised optimum gravimetric yield is 40%.
- Co-generation and by-products. Electricity generation represents an attractive alternative to flaring of the fume gases, as it offers additional revenues from the sales of electricity (to the grid) and carbon credits. Several companies stress the importance of co-generation in order to make capital-intensive charcoal production financially attractive²⁰. Tar capture is intrinsically related to flaring and gas utilization, because it normally condenses in the piping system. The most attractive solution is to remove the tar from the fumes for further processing and commercialization, before leading the clean gas to the engine²¹.

Sector governance and climate change policy

The entity ultimately responsible for implementing the Sustainable Charcoal Plan for the I&S sector is the Ministry of Development, Industry and Innovation (MDIC). In 2008, motivated by discussions in the Productive Development Policy under the Competitiveness Forum of the Steel Industry, MDIC hired the Center for Management and Strategic Studies (CGEE) to conduct a study in order to gather information from the academic and the private sector to develop public policies encouraging the use of sustainable charcoal from planted forests by the steel industry, with the aim to: (i) promote the reduction of emissions, (ii) avoid deforestation of native forests, and (iii) increase the competitiveness of the Brazilian I&S industry in the context of a low-carbon economy.

The study outlined low-emission scenarios for the year 2020 using renewable charcoal for pig iron production by: (scenario 1) replacing wood from native forests by planted biomass; (scenario 2) improving the conversion process of wood into charcoal, thereby controlling the emissions of methane from carbonization process; and (scenario 3) a combination of both²². The emissions in 2020 according to the different scenarios would be as indicated in the next table.

²⁰ As mentioned by representatives from Plantar, CEMIG, and RIMA.

²¹ For more information, see: "Cogeneration from charcoaling: a promising new advanced technology", by Carneiro de Miranda, R., Bailis, R., and De Oliveira Vilela, A, Energy for Sustainable Development 00218 (2013).

²² This is basically the approach followed by Plantar's CDM initiatives.

Expected GHG emissions (2020) from charcoal production for pig iron in Brazil (MT CO ₂ eq/yr)			
Baseline scenario	Scenario 1	Scenario 2	Scenario 3
15.97	13.32	5.60	2.94

These estimates form the basis for the establishment of the Brazilian voluntary commitment to reduce emissions. Scenario 3 was taken to set the target for emission reduction policies for the sector. Considering the constraints imposed by the requirement to measure, report and verify (MRV) the reductions, a conservative estimate was included in the Copenhagen Agreement (8- 10 million tons CO₂eq). To achieve this goal, forest stocks would need to increase by about 2 million ha by 2020; and the efficiency of the carbonization process of wood would need to improve.

In order to foster innovation and investment, the national Climate Change Fund (Fundo Clima) makes available resources for the sector. Fundo Clima was established by Law N° 12.114/2009 and regulated under Decree N° 7.343/2010. The Fund is an instrument under the National Climate Change Policy (PNMC) defined by Law N° 12.187/2009. Its objective is to finance projects, studies and investments targeted at mitigation of, and adaptation to, the effects of climate change. The Fund uses resources from oil exploration to finance climate change activities in the country and donations from public and private, national and international organizations²³. Fundo Clima started operations in 2011 and has a budget of about BRL 390 million (2013). Fundo Clima manages both reimbursable and non-reimbursable funds, the former being administered by BNDES and the latter by MMA. The executive secretary of MMA is the chairperson of the Managing Board of Fundo Clima.²⁴

BNDES has opened a financing window under Fundo Clima to support investments focused on improving the efficiency and sustainability of the charcoal production chain, specifically: (i) charcoal kilns with a minimum gravimetric efficiency of 35%; (ii) auxiliary systems to increase energy efficiency; and (iii) energy recovery and utilization systems. The minimum loan amount is BRL 10 million (approx. USD 4.3 million). BNDES can finance up to 90% of the total investment costs with a maximum payback period of 15 years²⁵. Credit costs are approx. 10.5%, over which 1.5% discount is given under Fundo Clima²⁶. However, the I&S sector has not responded as expected, partly because the eligibility criteria set by the Fund outmatched the performance of commercially mature charcoal technology²⁷; and partly as a result of the poor market conditions for the sector after the economic crisis of 2008/2009. By consequence, sector companies postponed new investments in production facilities (including charcoal conversion plants) and limited technological development to the level of applied research and industry-scale pilots.

In order to reactivate the process, MMA and MDIC, in close dialogue with the sector, decided to work towards improving the market drivers for renewable charcoal in order to meet the targets set for the I&S sector. MMA is the leading government entity in charge of the development of Brazilian Nationally Appropriate Mitigation Actions (NAMAs), which addresses the charcoal sector. MMA, as the Executive Secretariat of the GEx/CIM, is responsible for monitoring the implementation of the National Plan, including the design of the corresponding MRV systems. As a result of policy

²³ The Fund's resources can be applied to a range of activities, including: (a) support for sustainable production chains; (b) scientific research on impacts and vulnerabilities in the country; (c) carbon emissions reduction projects focused on deforestation, forest degradation and sustainable forest management; (d) development and diffusion of technologies to mitigate greenhouse gas emissions in different sectors such as waste management, efficiency engines, transport, industry process; and (e) public policies to solve problems related to GHG emissions.

²⁴ See: <http://www.mma.gov.br/apoio-a-projetos/fundo-nacional-sobre-mudanca-do-clima>.

²⁵ See: http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/

²⁶ [Apoio_Financeiro/Programas_e_Fundos/Fundo_Clima/carvao_vegetal.html](http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_pt/Institucional/Apoio_Financeiro/Programas_e_Fundos/Fundo_Clima/carvao_vegetal.html).

²⁷ See: [http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_pt/Institucional/](http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_pt/Institucional/Sala_de_Imprensa/Galeria_Arquivos/Apresentacao_Fundo_Clima.pdf)

²⁸ [Sala_de_Imprensa/Galeria_Arquivos/Apresentacao_Fundo_Clima.pdf](http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_pt/Institucional/Sala_de_Imprensa/Galeria_Arquivos/Apresentacao_Fundo_Clima.pdf).

²⁹ A 35% minimum charcoal conversion rate is required. Sector experts agree that 35-40% efficiencies can be reached under controlled conditions, but cannot be sustained under field operations given the present technological status and level of control of the production process.

interaction, a Sustainable Charcoal Technical Commission is foreseen to be created by the end of 2013, via a Joint Ministerial Decree signed by both Ministries (MMA and MDIC) with the task to actively support the sector transformation process. The subsequent, coordinated steps taken by both Ministries are expected to substantially improve governance of the sector and more specifically, the charcoal conversion industry. As a first step to make the Fund more attractive, the payment terms for reimbursable funds were reduced²⁸.

Problem statement

In response to national climate change policies and the international market for CO₂ certificates, the Brazilian iron and steel sector nowadays predominantly focuses on developing eucalyptus plantations for charcoal production as a carbon sink to offset the sector's GHG emissions. However, insufficient attention is being paid to the limitations of the current (traditional) charcoal production process, which may put at risk the national ambition to produce the required large amounts of renewable, biomass-based charcoal for the iron and steel sector. This problem is especially relevant because advanced and clean conversion technologies are not commercially applied in Brazil.

The limitations and adverse impacts of current charcoal conversion technology are: (i) The input resources (wood, land, labor) are used in a very inefficient manner. Once resources become scarce (such as land and wood in a planted forest), the underlying business model is no longer economically viable. (ii) The conversion process is small-scale, difficult to control and labor-intensive. The quality (and the conversion rate) of the charcoal varies according to the process conditions and operator skills. (iii) The traditional kilns offer little opportunities for obtaining scale benefits, and cannot produce the charcoal volumes demanded by Brazil's I&S sector in the future. Moreover, the prevalence of scattered, small scale production units ("hot-tail" kilns) inhibits large-scale investment. (iv) Substantial quantities of methane (CH₄) and Non-Methane Hydrocarbons (NMHCs) are produced under off-design conditions and released into the atmosphere, contributing to global GHG emissions. And: (v) The by-products and emissions of the traditional process are highly polluting for the local environment and harmful for the workers. These products can be largely avoided or captured for further treatment or productive use.

However, investment in advanced, more efficient charcoal conversion technologies is not profitable under present market conditions. These are characterized as follows. (i) Low and fluctuating prices for pig iron on the international commodity markets. (ii) Competence of charcoal from illegal sources, which reduces the market value of charcoal from renewable biomass sources (sustainable forest plantations). (iii): A reference price level for pig iron set by the international market based on mineral cokes. (iv): Supply constraints for wood and charcoal to respond to fluctuations in pig iron markets. And (v): The traditional perception by the sector of charcoal as a cost, rather than a factor to create added value.

The lack of stable, rewarding market prices inhibits rewarding returns on investment in capital-intensive charcoal production facilities. The investment risks are also high since an unstable market reduces average capacity rates and corresponding revenue flows. The present production model, based on low-cost technology and a flexible labor force, can respond more adequately to fluctuating market conditions, thereby avoiding the mentioned market risks. Adequate policy support, based on an integral assessment of the value of charcoal, can assist in stabilizing the market for charcoal and securing long-term investments for the private sector. Payment for delivered social, economic and environmental benefits can be part of a conducive policy framework for charcoal production.

Baseline project

The Ministry of Science, Technology and Innovation (MCTI) and UNDP Brazil analyzed the depicted problem in 2011 (when a PIF was prepared and submitted to the GEF). Due to changes in ministerial

²⁸ Resolution of the National Monetary Council N° 4.267, DE 30 Sept 2013; (http://www.bcb.gov.br/pre/normativos/res/2013/pdf/res_4267_v1_O.pdf).

competences under the current Government period, the charcoal portfolio is presently under the responsibility of the Ministry of Development, Industry and Trade (MDIC) with close involvement of the Ministry of Environment (MMA) as the entity leading the national Climate Change agenda MCTI remains a key stakeholder as the government entity in charge of federal research institutes and universities.

The baseline project consists of the measures and targets defined under the national Climate Change Policy, and national and sectoral plans targeting the sector. In response to these plans, the State of Minas Gerais has developed legislation to eliminate non-renewable charcoal from the market by the year 2018. Further, at national level, the Government has established voluntary emission reduction targets for the iron and steel sector which are largely based on the use of charcoal from sustainably managed eucalyptus forests. MMA and MDIC have the intention to support the transformation of the sector through the development of economic incentives as part of the implementation of the NAMA. However, these policy efforts will face difficulties given the presence of a technology barrier.

Specifically, the baseline project consists of:

- (1) The Sustainable Charcoal Plan for the I&S sector under leadership of the Ministry of Development, Industry and Innovation (MDIC) to promote the reduction of GHG emissions, avoid deforestation of native forests, and increase the competitiveness of renewable charcoal. Analytical work under this plan has led to the voluntary commitment to reduce sector emission by 8-10 Mt CO₂eq, as presented in the Copenhagen Agreement. This goal sets further targets to increase renewable forest stock for charcoal production (approx. 2 million ha by 2020), and increase carbonization yields). This Plan provides the basis for the present initiative.
- (2) The creation of credit facilities for efficient charcoal conversion plants under Fundo Clima, the instrument under the National Climate Change Policy (PNMC) for financing projects, studies and investments targeted at mitigation of, and adaptation to, the effects of climate change. Through Fundo Clima (defined by Law N° 12.187/2009) MDIC and MMA jointly aim fostering efficient and clean charcoal production, with BNDES acting as the financial entity executing low interest reimbursable loans and the MMA executing a grant component of the Fund.
- (3) In order to accelerate sector initiatives, MMA and MDIC work towards improving the market drivers for renewable charcoal to meet the GHG targets set for the sector. One of the key instruments under this approach is a voluntary Nationally Appropriate Mitigation Actions (NAMA) for the I&S sector, which is being developed by MMA as the leading government entity. MMA is responsible for monitoring the implementation of the Sectoral Plans.
- (4) Ongoing dialogue between the State of Minas Gerais and the I&S sector to follow-up on the imminent ban of non-renewable charcoal by 2018 (Law no. 18.365/09), combined with supportive policy to promote the competitive production of renewable, biomass-based charcoal. The State of Minas Gerais is assisted by the World Bank to design and implement effective development policy, and move towards a low-carbon economy in line with national objectives.²⁹ On 3 April 2012, large sector companies subscribed the “Sustainable Charcoal Protocol”, adhering to the principles of sustainable and equitable development, thereby urging the public sector to address identified barriers³⁰. The forestry association of MG (AMS) also

²⁹ The multi-donor program PROFOR and the World Bank’s BioCarbon Fund co-financed the study “Identifying Financial and Institutional Arrangements for Scaling Up Renewable Charcoal Production”, presented on 5 December 2011 in Belo Horizonte (MG). Policy is focused on sustainable forest management and increased wood supplies rather than technological breakthroughs in the field of charcoal conversion. For more information, please refer to: <http://www.profor.info/knowledge/brazil-scaling-renewable-charcoal-production>.

³⁰ The following companies subscribed the Sustainable Charcoal Protocol on 3 April 2012: Aperam South America, ArcelorMittal, Gerdau, Siderúrgica Norte Brasil – Sinobras, Thyssenkrupp CSA Siderúrgica do Atlântico, Usiminas, Vallourec & Sumitomo Tubos do Brasil, V&M do Brasil, Villares Metals, and Votorantim Siderurgia See: <http://www.acobrasil.org.br/site/english/sustentabilidade/sustentabilidade-carvao-vegetal.asp>.

subscribes to the principles of sustainable forest management and actively promotes forest plantations as carbon sinks to generate additional revenues.

- (5) Technological development activities initiated by sector industries, consultancy firms and research institutes. Research topics include: improved kilns (gravimetric yields, throughput times, outputs), capture of by-products, use of heat for wood drying, logistics, scale benefits, operational costs (wages, wood inputs), capture of exhaust gases for flaring and co-generation. Actors leading the process include: BiomTec, CharConsulting, BioCarbo, CEMIG, ArcelorMittal, Plantar, RIMA, the Federal University of Viçosa, and others. The latter also acts as the secretariat of the “G-6” platform set-up by sector industries to foster development of charcoal technology. For more information on technology development please consult Annex E.
- (6) Preparations by MMA and MDIC to design robust measurement methodologies and monitoring platforms to measure, report and verify (MRV) the GHG benefits of all activities implemented under the Sector Plan for the I&S industry in Brazil. The MRV system is instrumental for the system of sectoral Mitigation Plans “SMMARE³¹”, which are based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (see Annex D).

Identified barriers and rationale for GEF involvement

The baseline project does not adequately address three issues that are critical for enabling Brazil’s iron and steel sector to embark on a development path based on renewable biomass-based charcoal. The first issue concerns the lack of proven, clean and cost-effective conversion technologies to produce charcoal from renewable biomass resources in large quantities. The second issue relates to the lack of awareness and specific technical knowledge among stakeholders (both policy makers and the industry). The third issue, as identified and analyzed during the PPG phase, concerns the lack of financial drivers for the sector to invest in efficient charcoal technology, and to operate large production facilities.

An effective market transformation towards the use of renewable biomass-based charcoal can only take place if all major barriers are addressed. This requires key stakeholders to acknowledge the weaknesses of the charcoal supply chain; to establish a common agenda; and to put aside the necessary resources to address the problem. MMA, UNDP and niche players from the private sector individually lack the capacity to draw the attention on the technological barriers and create the needed momentum by shaping adequate market conditions. This provides a rationale for GEF involvement.

A more detailed assessment of the identified barriers³² is given in the following paragraphs:

- **Policy barrier:** Brazil, specifically Minas Gerais, has already developed policy to stimulate the sustainable production of charcoal. Banning the use of charcoal obtained from native forest resources is an important step forward to allow a market for renewable, biomass based charcoal to develop³³. This alone is insufficient however to promote sustainable charcoal as an alternative for the iron and steel industry, as mineral cokes represent a competitive alternative. Together with the sector, a detailed strategy needs to be developed to integrate the large-scale production of renewable, biomass-based charcoal into the iron production chain. Presently, a strategic and business view on charcoal production is lacking. Policy-related activities may include sustained support for research and development and a minimum pricing policy for renewable, biomass-based charcoal. While some niche players are in the process of branding “green pig iron” and “green steel” for the export markets, a sector-wide approach is needed to generate a large market for renewable, biomass-based charcoal that is based on its explicit

³¹ Sistema Modular de Monitoramento de Ações e Reduções de Emissões (SMMARE), i.e. the Brazilian Modular System to monitor Actions and GHG Emission Reductions.

³² Based on the GEF “five-pillar framework”.

³³ Enforcing such a ban, while a State and National priority, remains outside the scope and control of this GEF CC proposal.

environmental benefits. This requires the definition of quality criteria and certification procedures.

- Information barrier: A second barrier concerns the lack of information and methodologies to assess the economics of renewable charcoal. Further investigation in this field is needed to support policy and decision makers from the industry. Without this information mineral cokes will likely continue to replace charcoal in Brazil, as it is readily available and has been the option-of-choice worldwide. Alternative scenarios must be developed for transforming the sector and sector stakeholders must agree upon technically and economically viable solutions. The demonstration of advanced charcoal conversion technologies under market conditions would greatly assist in drawing the sector's attention on its potential. Apart from some highly advanced, capital-intensive companies, the majority of charcoal producers still have little awareness of the overall impact and the limitation of the traditional charcoal conversion process.
- Technology barrier: The lack of an advanced, clean and cost-effective charcoal conversion technology is a major barrier, both in Brazil and at a global level. Worldwide, charcoal is produced in different types of kilns that can be considered "appropriate technology", i.e. adapted to local circumstances in the rural area considered. In Brazil, however, this simple technology has been embedded into the production chain of the iron and steel industry. The limitations and adverse environmental impacts of the traditional conversion are: (i) inefficient use of resources (wood, land, labor), which is not sustainable; (ii) lack of control on the pyrolysis process, leading to fluctuating quality of the produced charcoal; (iii) lack of up-scaling potential to supply large markets in the future; (iv) substantial release of methane (CH₄) into the atmosphere; and (v) high pollution of the local environment and unhealthy labor conditions for the workers. Both from an economic, technological and environmental perspective, the present charcoal production process is not sustainable.
- Business models barrier: At present, the traditional charcoal conversion process is not approached as a rational business but is subcontracted to local workers who supply the charcoal at an agreed price. Wood and land are used inefficiently and potential byproducts (including process heat) are disposed of into the atmosphere. It is not fully clear yet whether the switch to a more capital-intensive conversion process will be economically rewarding for the industry. There is also little experience with the integration of (technologically more advanced) charcoal production plants into the iron production chain. Large-scale, capital-intensive charcoal production sites may be able to capture by-products and excess heat, which may contribute to operate the conversion process as a profitable business. Recently, some companies have built pilot plants with the aim to produce electricity³⁴. However, it has not been demonstrated that this is feasible in Brazil in a commercial context.
- Financing barrier: Under the baseline project, financial resources to demonstrate the market potential for clean charcoal conversion technologies, are limited. Since lenders require high levels of collateral (>100% of the lending sum) which are accumulated on the balance sheet, attracting debt capital adversely affects a company's financial performance and exposure. By consequence companies focus on rewarding technologies in terms of payback time and profitability. In the absence of strong market stimuli, this is not the case for charcoal technology. (At PIF stage, this barrier was not duly recognized because, at first glance, the I&S sector consists of large companies able to free up large amounts of capital if necessary. However, the identified market conditions are an impediment for mobilizing capital to invest in advanced charcoal technology and charcoal production facilities.) It must also be noted that – in spite of the I&S sector being composed of large, international conglomerates – charcoal production is largely subcontracted to local players which are predominantly informal, undercapitalized and hardly creditworthy. The ownership model prevailing in the charcoal production sector is interrelated with finance limitations and the general low level of

³⁴ Such as a joint CEMIG/ArcelorMittal project. See: http://www.cemig.com.br/sites/Imprensa/en-us/Pages/projects_make_electric_energy_generation.aspx.

technological development. Financial resources are therefore needed for promotion and awareness raising activities to complement the budget of sector stakeholders. This provides a rationale for GEF involvement.

Long-term solution

Though all types of barriers affect the implementation of the baseline project, the technology barrier is considered as critical for initiating the envisaged market transformation process. This barrier can be addressed directly by supporting a technology development programme with the objective to increase the gravimetric yield of charcoal production processes, reduce the costs of advanced technology, and facilitate access to such technology for the sector. The underlying barrier (root cause) is the weak market (finance) environment for charcoal, which inhibits tapping into the sector's potential to attract and mobilize investment capital. This barrier can only be addressed indirectly, by creating a more favorable policy environment for (renewable biomass-based) charcoal production and increasing the economic value that is added to charcoal along the overall production chain. Rewarding the sector for delivered social, economic and environmental benefits fits into an approach to maximize the value of renewable charcoal produced in Brazil. Lines of action supportive to removing this market barrier are: (i) awareness raising among sector stakeholders and policy makers, (ii) the implementation of appropriate policy measures; and (iii) to devise and implement sustainable business models for charcoal production.

The envisaged solution aims at pushing the status of clean charcoal conversion technologies from the level of applied research to beyond successful demonstration in a commercial context. At that point - and with conducive market conditions in place, it is expected that industries from the I&S sector will incorporate advanced charcoal technologies into their specific business situation ("deployment")³⁵, either by ongoing in-house technology development or by acquiring technology from third parties. At this stage, large-scale investment in advanced charcoal production facilities by private companies will take place.

2. STRATEGY

Project rationale

The rationale behind the Project is to reduce GHG emissions by increasing the efficiency of the conversion process from wood to charcoal. The Project will also support Brazil's policy of promoting the use of sustainable charcoal in the iron and steel industry, thereby offsetting the use of mineral cokes. The common iron production process, based on mineral cokes, is a major source of anthropogenic greenhouse gas releases (CO₂), causing global warming. The use of a renewable source of carbon (charcoal) provides an alternative course of action to mitigate large quantities of global greenhouse gas emissions. In fact, the iron and steel sector in Brazil already uses large amounts of charcoal, but (i) the input wood resources are used very inefficiently; (ii) the traditional charcoal production process is polluting, releases significant amounts of methane (contributing to global warming) and is difficult to control; (iii) the charcoal production process releases gases and other substances which can be used productively if captured (for electricity cogeneration and bio-refinery purposes); and (iv) the input wood resources used are only partly renewable. With more advanced conversion technologies and improved process conditions, much more charcoal can be produced per unit wood input, while the adverse environmental and health impacts of the present production process can be avoided; in addition, by-products can contribute to enhance and diversify charcoal production as a commercial business.

³⁵ The various phases of technological development are based on the "technology development cycle and innovation chain" as described in the GEF Programming Document, p. 18 (document GEF/R.5/31/CRP.1, May 12, 2010).

Project goal and objective

The objective of the proposed UNDP/GEF Project *“Production of sustainable, renewable biomass-based charcoal for the iron and steel industry in Brazil”* is: to reduce the greenhouse gas emissions from the iron and steel sector in the Brazilian State of Minas Gerais, by (i) developing and demonstrating enhanced, clean conversion technologies for renewable, biomass-based charcoal production, and (ii) implementing an effective, supportive policy framework.

The proposed Project is targeted at addressing the identified barriers that currently impede the clean and efficient conversion of (renewable) biomass resources to charcoal for the iron and steel sector in Brazil. The Project promotes the availability of sustainable, renewable biomass-based charcoal, produced efficiently and at a competitive cost level compared to mineral coke. The budget of the project is US\$ 43,950,000, of which US\$ 7,150,000 is provided as a grant under GEF CCM-2 and CCM-3, and US\$ 36,800,000 is provided as cofinancing by the national Government, private sector and universities, and by UNDP CO in Brazil.

The Project will be focused on reducing the technology barrier as the sector as a whole lacks the specific knowledge to develop efficient charcoal conversion plants and implement them as a rational business. In addition, the more advanced I&S companies will be invited to invest in efficient charcoal conversion facilities by offering a financial incentive through a dedicated bidding procedure, and by facilitating project design and implementation through specialized technical assistance. The bidding process capitalizes on the progress made by private companies on clean charcoal production since 2009. The financial benefits for participants will offset the higher perceived risks related to early-market introduction, and provide an acceptable rate of return for investors. The bidding process implies a change in approach compared to the PIF, which foresaw the Project taking the lead in the technology development process. The expected benefits of the bidding process include: (i) ability to foster and demonstrate several technologies and business contexts; (ii) market-pull approach rather than technology push; and (iii) greater cost-effectiveness. The new approach also avoids potential issues related to intellectual property, which turned out to be relevant.

Work in the field of policy and regulation pursues expanding the existing framework (which is primarily restrictive by banning non-renewable charcoal) by establishing positive incentives for renewable, clean and resource-efficient charcoal production, and by facilitating implementation of advanced charcoal production facilities in Minas Gerais. In the end-of-project situation, I&S companies are expected to have readily access to information and technology, thereby supported by favorable regulation and incentives to foster investment in charcoal conversion. While some companies have embarked on an internal technology development programme, others may opt to acquire access to technology under appropriate intellectual property arrangements (such as licenses). The Project will pursue its objective through the following components:

- I. Information and policy development.
- II. Strengthening of technological development and human capacity.
- III. Investment and performance monitoring.

The scope of the Project consists in (i) bringing together government actors, industries, sector stakeholders and research institutes; (ii) constructing a clear path towards market transformation by policy development in Minas Gerais; (iii) providing assistance for technological development; and (iv) implement a first batch of commercial, advanced charcoal production facilities by providing specific financial incentives for the use of renewable charcoal.

Project components

Component I. Information and policy development.

Outcome 1: A policy framework has been implemented to promote the use of renewable biomass-based charcoal by the I&S sector, supported by an internationally recognized system for monitoring achieved GHG emission reductions (GEF US\$ 875,000; cofinance

US\$ 1,200,000). The objective of this project component is to establish a conducive policy framework for clean, resource-efficient charcoal production obtained from renewable biomass sources, and for its effective utilization by the I&S sector in Minas Gerais. Specifically, this project component aims to promote the introduction of advanced technologies and business models enabling the social, environmental, economical and technically feasible production of renewable biomass-based charcoal. This charcoal is based on biomass stock grown in (existing) eucalyptus forest estates owned and sustainably managed by the I&S companies associated in the AMS³⁶.

Policy development will be supported by the implementation of a system to monitor the sector initiatives focused on enhanced charcoal production and reduced greenhouse gas emissions as drafted in the Mitigation Plans “SMMARE”. The SMMARE envisages two scenarios: (1) monitoring of GHG emissions reductions based on existing data (and/or data that can be easily obtained), which can be implemented at a national level in the short-term; (2) monitoring of GHG emission reduction at a disaggregated level (which would require improved data collection to enable spatial analyses of emission reductions). Each Mitigation Plan under SMMARE has a specific monitoring module associated based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (see Annex D).

Building forth on the dialogue between sector stakeholders and the MG and Federal Governments, this component will design and implement a detailed strategy to incentivize the production and use of renewable charcoal in MG. To this purpose, existing information gaps will be closed, specifically in the field of: (i) social and environmental impacts; (ii) costs and benefits for the national economy; (iii) operational and logistical constraints; (iv) access to finance; and (v) monitoring and verification of GHG benefits achieved by the sector. Based on updated information, existing policies, strategies and regulatory instruments will be enhanced to facilitate project development and improve financial conditions for investment. At Project termination, this component is expected to have established a conducive regulatory framework to foster investment in clean, sustainable charcoal conversion technologies and production chains, and have established capacity to monitor and verify claimed GHG benefits.

Output 1.1 A detailed strategy is put into place by the Government (MMA & MDIC) to promote the use of renewable biomass-based charcoal by the I&S sector in MG (GEF US\$ 175,000; cofinance US\$ 100,000 (MMA) and US\$ 100,000 (MG)). Building upon the dialogue maintained between sector stakeholders, the Government of MG, and the Federal Government (MCTI, MDIC, MMA) during the PPG phase, this output aims to formalize a common work agenda in order to design and implement a detailed strategy to foster the production and use of renewable charcoal through the support of the work of the Sustainable Charcoal Technical Commission. The strategy will build upon a review of the present institutional and regulatory framework governing the I&S sector in MG and in Brazil, including management arrangements of sector-owned forests and charcoal production systems. Based on this review, proposals for amendments to the regulatory framework will be prepared and presented to the incumbent authorities. The process will be led by MMA and MDIC with the aim to link the “greening process” of the I&S sector with Brazil’s national greenhouse gas mitigation agenda³⁷. Specific support programmes will be issued at the level of the State of Minas Gerais as part of the Sustainable Charcoal Protocol signed by the I&S sector. GEF support to this output will consist of specialized international and national consultancies and mediation of negotiations. This output extends to socio-economic aspects (including gender and labor issues), environmental aspects, and sector governance (including informal charcoal producers).

Output 1.2 A Monitoring and Certification Platform to register GHG emission reductions achieved by efficient charcoal production facilities implemented by the I&S sector (GEF US\$ 400,000; cofinance US\$750,000 (MMA)). This output will establish the methodology and tools (including a

³⁶ Efficiently produced, renewable charcoal fits into AMS’ agenda to meet the emission reduction targets set by the I&S industries, but also as an option to add value to the wood obtained from forestry stock.

³⁷ MMA envisages taking benefit of the outcomes of the present UNDP/GEF initiative to support the existing NAMA for the sector.

web-based platform) for monitoring, verification and communication of the emission reductions achieved by agents from the I&S sector. This output will contribute to the Project's exit strategy and be continued under Brazil's NAMA for the sector. The set-up and use of the system will be detailed in technical papers and presentations. The system is further intended as an information basis enabling transparency of supply chains for international companies, NGOs and consumers. Such transparency is crucial for branding of climate-friendly pig iron and steel products, including adequate labeling thereof. As such, the MRV system fits into a strategy towards adding value to the charcoal and I&S production chain.

Output 1.3 The environmental impact and resource efficiency of clean, renewable biomass-based charcoal production chains are assessed using analytical tools (GEF US\$ 150,000; cofinance US\$ 100,000 (MG)). The output consists of specialized studies to analyze and quantify the efficiency of alternative charcoal production chains for the I&S industries. Relevant analytical methodologies include energy efficiency analysis, exergy analysis, and life-cycle assessments (LCA). The purpose of this work is to identify weak elements in the production chains and propose solutions to enhance overall robustness and performance. This output will further assess the effect of economic parameters on the present charcoal production system and its upscaling potential, specifically the constraints in terms of labor availability, labor costs, and the opportunity costs of land. The results of this work will feed into the design of an implementation strategy and supportive framework (Outputs 1.1 and 1.2). GEF support to this output consists of financial resources for contracting specialized consultancies.

Output 1.4 Financial incentive schemes to promote the use of renewable biomass-based charcoal (e.g. tax exemptions, soft loans, performance based payments) are assessed on their merits (GEF US\$ 150,000; cofinance US\$ 150,000 (MMA)). This output will deliver a detailed evaluation of options to provide adequate financial incentives for prospective investors in renewable charcoal technology. Such incentives may be (i) tax-based, including VAT exemptions and accelerated depreciation; (ii) preferential loans through national and state development banks (BNDES, respectively BDMG); (iii) guarantee mechanisms to facilitate access to commercial and public bank loans; and (iv) environmental labeling for internalization of socio-environmental costs (such as reduced greenhouse gas emissions) with associated price benefits. A SWOT analysis of the various options will be performed, which will be used as a basis of future (post-project) market development. This output will evaluate the experiences gained with the investment pilot under Component III, which foresees financial incentives based on delivered (environmental) outputs ("performance based payments")³⁸.

Component II. Strengthening of technological development and human capacity.

Outcome 2: The technology and human capacity base for clean charcoal conversion in Brazil is strengthened by technical assistance and targeted training (GEF US\$ 1,325,000; cofinance US\$5,600,000). This component pursues complementing and supporting private sector technology development with the aim: (i) to accelerate market penetration of clean, resource-efficient charcoal technologies; (ii) to widen the range of business cases supporting the financial and economic sustainability of efficient charcoal production by the I&S sector³⁹; and (iii) to enhance knowledge about the benefits and access to conversion technology for less advanced companies in the I&S sector. This project component further aims to increase awareness and specific knowledge concerning advanced charcoal production technologies among stakeholders. Upon attainment of this outcome, it is expected that proven, advanced charcoal conversion technologies are available at a lower cost compared to the baseline situation, and made available to a larger number of industries.

Output 2.1. Baseline technology development for clean charcoal conversion is enhanced by supporting the design, testing and evaluation of key system components (GEF US\$ 500,000;

³⁸ A critical issue related to performance based payment (PBP), is the verification of delivered results. In the case of a variety of charcoal conversion technologies and monitoring capabilities, verification is not trivial. PBP has the particular interest of the MMA, as it would establish a direct link with delivered environmental benefits (GHG reductions). If successful, it would establish a very strong case justifying the effectiveness of a NAMA programme for the I&S sector.

³⁹ By optimization of the production chains and by exploiting the economic value of by-products.

cofinance US\$ 1,200,000 (MCTI), US\$ 50,000 (MG) and US\$ 250,000 (MMA)). This output builds forth on ongoing research on charcoal conversion technology by the sector. Several companies have made substantial progress on charcoal technology R&D. Considering the potential economic value of such innovation, specific details are not shared with the sector but protected by intellectual property rights (including patents). Under the present market conditions, characterized by low commodity prices and barriers identified as in this Project, these advanced systems (kilns, logistical solutions, process integration) are not commercially viable. By consequence, charcoal technology development is not a priority for the private sector, moreover since the financing costs of R&D are high. Although companies are reluctant to disclose technological advances, they are eager to reduce the cost of charcoal technology through publicly funded research as this would make private technology development more rewarding. The University of Viçosa, being a public, federal entity, is well positioned to assume a leading role in this process and has a long track record in charcoal technology and knowledge about the environmental benefits associated with its innovation processes. The results of this research are shared by the group.

Output 2.2. Support is given to optimize technologies to capture by-products from the charcoal conversion process, including tar products, hydrocarbons, and process heat (GEF US\$ 400,000; cofinance US\$ 400,000 (MCTI) and US\$ 2,900,000 (Private Sector)). The purpose of this output is to expand the technological options to exploit by-products obtained during the pyrolysis process converting wood into charcoal. Such products include tars, volatile hydrocarbons, and methane, while also heat is released during the exothermal phase. Technological challenges consist in controlling the conditions in the kiln, which is difficult to achieve in small traditional kilns, gas collection and condensation, flaring of GHG emission and process design. The drawbacks of a batch process can partially be offset by upscaling of the kilns; all private developments work towards this solution. Logistics also plays an important role, as capital-intensive solutions are only economically justified if larger wood volumes can be processed. Specific technologies to exploit charcoal by-products will therefore depend on the layout and location of a charcoal production site and generally be more feasible for large establishments. GEF support to this output consists in expert consultancies and equipment to enhance the baseline programme, including the quantification of GHG emission impacts.

Output 2.3. Efficient business models are developed (accounting for variations in plant size, logistical set-up, use of by-products, ownership models) to accelerate the widespread introduction of clean charcoal conversion technology (GEF US\$ 275,000; cofinance US\$ 200,000 (MCTI) and US\$ 200,000 (MG)). This output aims to assist the sector by developing business models to optimize the economic performance of investments in advanced charcoal production plants. Work under this output will be carried out for: (i) relevant types of charcoal producers (ranging from large, integrated companies to smaller, subcontracted suppliers); (ii) charcoal production with commercialization of by-products; (iii) the specific case of charcoal production with heat recovery for electricity generation; (iv) a range of logistical set-ups (ranging from large centralized units to decentralized production); and (v) different levels of capital intensity. The purpose of this output is to provide recommendations and guidelines for charcoal producers and policy makers to support rationalization of businesses and enhance productivity of the sector as a whole, which, in the longer term, will translate into a more competitive unit cost of charcoal produced in MG. GEF support to this output consists in expert consultancies.

Output 2.4. Training material on clean charcoal conversion is developed and used for (i) technical training targeting I&S companies, universities and research institutes; (ii) policy and decision makers; and (iii) project developers and financiers (GEF US\$ 150,000; cofinance US\$ 200,000 (MMA), US\$ 200,000 (MCTI)). The output will deliver training on charcoal technology and the evaluation of investments in clean charcoal production facilities, for technical and financial experts from the I&S sector, the academic sector, policy makers and officials from the Government of Minas Gerais, financiers including BNDES and BDMG, and relevant federal entities. Upon completion of this output, the target groups are expected to have adequate capabilities to evaluate charcoal conversion plants and assist project developers during the design and financing process. Educational

material will be developed (using cofinancing resources) to support training activities; GEF support to this output will facilitate the organization and cost of training events and hiring of experts.

Component III. Investment and performance monitoring.

Outcome 3: Commercial charcoal production facilities are built under a competitive bidding mechanism to deliver objectively verifiable renewable biomass-based charcoal and GHG emission reductions (GEF US\$ 4,650,000; cofinance US\$28,800,000). The objective of this component is to trigger the I&S sector in Minas Gerais to finance, procure and put into operation advanced charcoal production facilities. To this purpose, the Government of Brazil, through MMA and BNDES, will offer financial incentives to investors in such technology. Proposals will be reviewed and selected through a public tender mechanism. The GEF Project will give additional support by providing targeted technical assistance during project design and implementation, liaison activities and consultancy support to facilitate permitting processes, and to mitigate higher upfront costs and project risks, as and if required. At the end-of-project situation, the procured charcoal facilities are expected to be in successful operation in compliance with previously established performance criteria. With a view on further replication, information about the technical and financial operation will be made available to prospective investors. After Project termination, MMA will continue to monitor the performance of the charcoal production facilities as part of the NAMA implementation.

Output 3.1. A tender mechanism is set up by MMA to support investment in a first batch of commercial production facilities for clean, renewable charcoal (GEF US\$ 75,0000; cofinance US\$ 300,000 (MMA) and US\$100,000 (MG)). This output consists in the detailed design, preparation and implementation of a tender mechanism to provide technical assistance and financial support to selected proposals for charcoal conversion facilities in Minas Gerais. The eligibility and performance criteria for the offers will be drafted during the final design phase of the tender mechanism⁴⁰ and reflect the feedback received from the sector. The tender will be convoked by the Ministry of Environment (MMA) and UNDP Brazil in collaboration with the State Government of Minas Gerais and the development banks BNDES and BDMG.

Output 3.2. Targeted support is given to facilitate planning and permitting for the charcoal conversion projects selected under the tender process (GEF US\$ 425,000; cofinance US\$ 800,000 (MMA) and US\$150,000 (MG)). This output consists of technical assistance to prepare the full documentation and technical engineering of the selected charcoal conversion projects, including socio-environmental impact studies, waste and water management, and compliance with safety and labor regulation. The purpose of this output is to ensure compliance of the presented projects with applicable regulation and minimize social and environmental externalities, and to contribute to mitigating project development costs for the proponents. GEF resources will be used to hire expert consultancies in these matters, as and if required. Cofunding resources, provided by MMA, will further be used to assist proponents in the design and implementation of a monitoring and verification system of results (MRV)⁴¹ using the web based platform.

Output 3.3. A first batch of commercial, renewable biomass-based charcoal production facilities is procured and put into operation by the private sector, and greenhouse gas emission reductions are being monitored and verified, and payments are made for delivered performance (GEF US\$ 4,000,000; cofinance US\$ 25,000,000 (private sector, envisagedly through BNDES loans), US\$ 900,000 (MG) and US\$ 700,000 (MMA)). This output involves the procurement of the selected charcoal conversion facilities and monitoring thereof to ensure successful plant operation and the attainment of emission reductions. Monitoring will be based on the MRV platform developed for the sector. GEF funds will be used as follows: (a) 50% grant money to reduce capital costs for applicants, thereby enabling the private sector to obtain an acceptable return on investment and mitigate financial

⁴⁰ Further details are presented in the Annex E of this document.

⁴¹ The results required by the Brazilian Government will be: verifiable emission reductions per ton of charcoal produced and/or the amount of charcoal produced per ton of wood inputs.

risks and: (b) 50% as conditional payments as part of the PBP mechanism. Disbursement decisions of GEF funds will be authorized by the Project Steering Committee. UNDP envisages taking a stepwise approach to mitigate technology-related project risks (underperformance), maximize the added value of the available GEF funds, and accelerate market penetration of advanced charcoal technology. The amount of GEF support per project will be determined in function of the final design of the performance-based payment (PBP) mechanism set forth to reward project owners for delivered environmental benefits.

Output 3.4. Best practices and lessons learnt are collected and disseminated to promote clean charcoal production across the I&S sector in Brazil and abroad (GEF US\$ 150,000; cofinance US\$ 100,000 (UNDP) and US\$ 250,000 (MMA) and US\$ 500,000 (MG)). The purpose of this output is to collect best practices and lessons learnt from the installed first batch of charcoal production facilities, and cover technical aspects, business and ownership modalities, structuring of finance, mitigation of project risks, and issues related to policy, and institutional and human capacity. The design and functioning of the monitoring and verification system, and of the performance-based payment mechanism will also be reviewed. GEF funding of this output will (i) support the implementation of an effective monitoring system of the installed charcoal plants; (ii) finance a national consultancy to collect, analyze and systemize experiences and information generated by the Project; (iii) support the organization of an event (seminar or workshop) to disseminate the experiences with clean charcoal production among stakeholders from Brazil and abroad; and (iv) cover the costs of the GEF Terminal Evaluation of the Project.

Socio-economic benefits

For long-term economic sustainability, capital-intensive, clean charcoal production technology must be competitive compared to mineral cokes and sufficiently attractive compared to the price of charcoal from informal sources. The Project aims at creating a market for clean, renewable biomass-based within the state of Minas Gerais by policy support and by contributing to the development of cost-effective charcoal conversion technology. If this is achieved, the global environmental benefits compared to the baseline situation will be sustained by the sector itself. Branding of green pig iron relies on the ability to verify the origin of charcoal supplies, which extends to the inclusion of other sustainability aspects of the production chain, such as fair labor conditions, certified forest management practices etcetera. Additional revenue flows are obtained by reducing externalities, including reduced GHG emission and reduced land usage. The more efficient wood use translates into lower unit production costs of charcoal, with indirect positive impacts on the use of water resources, land, and agroindustrial inputs.

Efficient charcoal production translates into great savings in terms of wood resources, required land area and inputs, which leads to lower production costs. Therefore, the higher the gravimetric yield, the less land is needed. A one-percent (1%) increase in mean gravimetric yield translates into a reduction of the costs of forest and land, equivalent to R\$ 30 per ton pig iron produced⁴². Therefore, sustainability of the I&S sector must deal with the efficiency of the carbonization process, which can be fostered through GHG mitigation approach. can help in creating this awareness in the sector. Adding value to the production chain and reduced production costs enhances sector competitiveness, which is crucial for the resilience of the Brazilian I&S industry in a highly competitive, globalized context. The Project therefore contributes (indirectly) to the consolidation of jobs throughout the I&S sector.

With respect to charcoal production, a transition to renewable charcoal from sustainable biomass sources implies a change in production model. Traditional charcoal conversion sites are usually temporary and operated by a migrating, unskilled workforce. Laborers are organized by local contractors which are largely informal businesses. Industrial charcoal conversion units, linked to sustainable forest plantations, are permanent installations which justify investment in capital-intensive

⁴² The specific consumption of charcoal to produce one ton of pig iron is around 630 kg/t pig iron. Investment required to plant on hectare of sustainably managed forest is of 6,500 (R\$/ha) and the value of land 5,000 (R\$/ha).

technology. This requires a trained workforce which is characterized by a higher economic output per worker. By consequence, the Project is expected to contribute to a process of formalization of charcoal production, which should translate into improved living standards for workers in terms of education, housing, medical care, and acceptable income levels. These are great benefits for workers compared to the baseline situation; but expectedly less people can be employed than under the traditional, informal model.

Gender aspects

On 11th July 2012, the Brazilian state of Minas Gerais, in partnership with UNDP Brazil, published its Millenium Development Goals revision report. As most MDG targets in Minas Gerais appeared on track or were already achieved in 2010, the State Government decided on the establishment of new and more ambitious development targets, relying on UNDP's technical advice after a specific request for support by the State Governor resulting in a MoU. As far as MDG 3 (gender equality) is concerned, average years of schooling for females were used to measure women's empowerment⁴³. The present Project can assist in promoting gender equality and empowering women in Minas Gerais in several ways.

In the traditional kilns ("rabo quente") the charcoal production tends to be dominated by men, given that it is physically demanding. The charcoal workers receive payment for the amount of charcoal delivered. Women also take part in the charcoal production, but in an indirect and informal way, often by accompanying her husband. There are significant differences between male and female earnings, where the men get in the production process up to seven times more than women, and in the distribution area about nine times more than women. Usually, there are no social benefits and family members are not paid⁴⁴.

In temporary charcoal production units, workers live or stay near the ovens in makeshift facilities, usually covered by tarpaulins, and lack of minimum conditions of hygiene and sanitation⁴⁵. More modern technologies in the carbonization process reduce the intensity of physical labor, which tends to benefit gender equality in job's opportunities and increases the economic output per individual, which should translate into better salaries.. More modern production processes also require organizational and executive knowledge in the area of carbonization and potential by-products. Capacity building programs, aimed at enhancing such knowledge, tend to benefit women, who find more opportunities in technical and administrative functions.

In stimulating the production of renewable biomass-based charcoal from sustainably grown eucalyptus plantations, more jobs opportunities are available for women, especially in the production of eucalyptus seedlings. In many seedling companies, such as the "Centro Norte Mudás e Sementes" (founded in 1971 and certified by the Bureau Veritas Quality International - BVQI in accordance with ISO 9001) most workers are women, given that they have more delicate hands. Hence, by phasing out the use of non-renewable charcoal originated from biomass from deforestation female inclusion in the supply chain of sustainable charcoal is likely to improve.

Environmental benefits

The Project will reduce greenhouse gas emissions from the iron and steel sector in Minas Gerais in two ways; (a) improving the energy and resource efficiency of the charcoal production chain; and (b) increasing the use of charcoal by the I&S sector thereby offsetting mineral cokes.

The Project will claim direct emission reductions as a result of the methane emission reductions resulting from increased efficiency in the conversion process. The market transformation effects

⁴³ <http://www.regionalcentrelac-undp.org/images/stories/POVERTY/bulletin2012/bulletin13.pdf>

⁴⁴ Source: Pró-Carvão: Diagnóstico sobre a Cadeia Produtiva de Carvão Vegetal e Lenha do Estado de São Paulo, Ciência Florestal, Santa Maria, v. 15, n. 1, p. 105-118 – Setembro de 2000.

⁴⁵ Source: DIAS et al. Processo de trabalho e saúde dos trabalhadores na produção artesanal de carvão vegetal em Minas Gerais, Brasil. Cad. Saúde Pública, 2002.

resulting from substitution of coal by renewable biomass will be claimed as indirect benefits. Additional emission reductions can be associated to the use of methane captured for electricity cogeneration and the development of bio-refinery byproducts, which are renewable energy sources. Since the active promotion of the use of these renewable biomass products (methane and biorefinery) is outside the scope of the Project, related eventual emission reductions will not be claimed.

(a) Increased energy efficiency (CCM-2) in charcoal production is achieved by introducing more advanced and efficient conversion technologies which reduce the methane emissions caused by sub-optimal charcoal production methods. The link between increased efficiency in charcoal production and methane emission reduction is documented in CDM methodology ACM0021 (originally AM0041). Hence data from this methodology is utilized for the emission reduction calculation. As an estimate of the emission reductions as a result of the increased efficiency of advanced charcoal kilns, a (conservative) average figure of 0.27 ton CO₂eq per ton of charcoal is taken. This figure corresponds to the shift from well-operated hot-tail kiln technology to large rectangular kilns under normal field conditions. The corresponding increase in yield is from approx. 29.2% to 33.3%. The emissions of methane produced per ton of charcoal during the carbonization process (M), are given by the empirical formula: $M [kg CH_4/ton charcoal] = 139.13 - 313.80 * Y$, in which Y represents the carbonization yield (tons of charcoal obtained per ton wood input). This formula derived from research underlying CDM methodology ACM0021, approved by the IPCC. The avoided CH₄ emissions are then 12.8 kg CH₄/ton charcoal produced, which is equivalent to 268.86 kg CO₂eq, or approximately 0.27 ton CO₂eq/ton charcoal. Please note that emission reductions can increase to 0.99 ton CO₂eq/ton charcoal if sub-optimum technology (25% yield) is substituted by high-tech DPC systems.

The Project has set itself the goal to trigger investment in a first batch of advanced charcoal production facilities, with a total annual capacity of 80,000 tons. The size and technologies per plant will vary, and be specified by the offerers responding to MMA's call for tender. (The expected, reduced GHG emissions, will also vary per plant; with support of the GEF Project, the offerers are expected to present a GHG monitoring and verification protocol for each plant.) At this stage, a figure of 0.27 ton CO₂eq per ton charcoal is taken as an average value. The resulting direct emission reductions are then 21,600 tons CO₂eq per year, equivalent to 432,000 tons over the 20-year lifetime of the plants. Assuming a market penetration of advanced charcoal technology for pig iron production of 15% in the 10-year period after Project termination, the impact (indirect emission reductions) of efficient conversion technology (CCM-2) on the pig iron sector in Brazil is estimated at 700 ktons CO₂eq per year⁴⁶.

(b) Replacement of mineral cokes by renewable biomass-based charcoal (CCM-3) in the I&S sector through a process of market transformation. The GHG benefits of renewable charcoal consumption to offset mineral cokes are 1.9 ton CO₂eq per ton of pig iron produced. The emissions associated to the annual pig iron production in Brazil (11 million ton) are 20.9 Mton CO₂eq. Even a modest contribution of the GEF project to increasing the market penetration of renewable charcoal (CCM-3) for pig iron production will translate in a reduction of GHG emissions of 200 ktons CO₂eq per year⁴⁷ or more. These will be claimed as indirect benefits of the Project.

It is noted that charcoal may also be used by the I&S industry beyond pig iron production. However, this requires strategic investments in suitable (blast) furnaces and control equipment, which will only be taken as part of updated business strategies and attractive market prospects. Some companies will focus on large-volume production for the commodity markets, while other may seek production of specialized products and alloys. It is therefore not feasible to make reliable, generalized market predictions for the sector as a whole. For this reason, the presented GHG emissions are limited to pig iron production alone in Brazil. The direct environmental benefits in terms of GHG emission reductions (CCM-2) are about 432 ktons. The combined indirect benefits (CCM-2 and CCM-3) are of

⁴⁶ By assuming an average 15% market penetration and a GEF causality factor of 60%.

⁴⁷ By assuming that 10% of the present cokes volume is replaced by renewable biomass-based charcoal, and a GEF causality factor of 20%.

the order of 900 ktons per year, which is significant (around 10%) in view of the sector's overall emission reduction targets.

Furthermore, while Brazil is the largest consumer of charcoal for industrial production in the world, other countries in Africa and Asia also use charcoal as a major source of energy⁴⁸. Therefore, the Project possesses a substantial potential to be replicated by other countries.

Replicability

The outcomes pursued by the Project can establish a successful paradigm for charcoal production chains in Brazil outside Minas Gerais, primarily in Pará and Maranhão:

- (1) Technological advances on efficient charcoal production, by private actors and public entities, will be available for application throughout Brazil.
- (2) Methodologies to create and verify sustainable, low-emission charcoal production chains fit into the national Climate Change Plan and subsequent NAMA initiatives, and can be replicated elsewhere. The tested MRV and supportive tools can be applied in anywhere in Brazil.
- (3) Policy support (Outcome 1) is partially specific for Minas Gerais, as it builds on: (a) the existence of a ban on charcoal from non-renewable sources; (b) the scarcity of nearby native forest sources, making forest plantations a necessary and cost-effective alternative. In the North of Brazil, these conditions are not yet in place. Also sector governance and law enforcement are likely stronger in Minas Gerais than in the new iron mining areas. Notwithstanding, a successful policy framework, enabling renewable charcoal production at a competitive price, may provide a clear case for the sector in other States.

There is a large demand for efficient charcoal conversion technologies worldwide. As found during the PPG, leading companies have acknowledged the commercial value of advanced, capital-intensive charcoal technology and seek to protect intellectual property rights, for example through patents. Such technology may be licensed to other industries and act as a new source of revenues. More modest improvements can be found in the field of logistics, wood drying, and the use excess heat for co-generation. Such benefits are highly relevant for rural and peri-urban areas across the world, specifically in Sub-Saharan Africa.

Social and environmental sustainability safeguards

In regards to social and environmental impacts directly or indirectly attributable to the Project, several issues should be taking into account, including:

- Brazil has currently one of the strictest environmental legislations in the world, and every forestry project is required to undergo a rigorous environmental licensing process. In Brazil, Iron producers claiming the use of renewable charcoal must comply with a series of laws and regulations as to ensure the origin of their sources and to minimize the environmental impacts, including biodiversity effects. The legal compliance requirements, particularly the environmental licensing process, ensure that the producers will eliminate or minimize significant negative environmental impacts of a project. Environmental & Social Impact Assessment Studies are among the most important instruments to demonstrate compliance with legal requirements. Producers must ensure that the wood used in the charcoal production is sourced from forests that are managed in a sustainable manner.

⁴⁸ World charcoal production was 49.3 million tons in 2008, of which 47.8 million tons in Latin America and the Caribbean, Africa and Asia. Source: FAOSTAT, 2009.

- Moreover, Brazil is one of the few countries in which landowners are obliged to set aside, without any economic countervailing measure, a relevant portion of rural properties as preservation areas.
- Through Brazilian Environmental Law, areas with protected species must to be preserved to improve the biodiversity of the region. The fire protection policies and infrastructure, and the setting-aside of preservation areas enhances the biodiversity of the areas of production. Furthermore, large monoculture plantations must be avoided. Production forests are interspersed between preservation areas with native vegetation, which are interconnected to create vast ecological corridors allowing free roaming and reproduction of native fauna.
- The 1988 Federal Constitution established new roles for the Federation, States and Municipalities with respect to the preservation and maintenance of forests, fauna and flora by allowing the States to legislate on environmental issues. In 1991 Minas Gerais became the first Brazilian State to have its own forestry regulation, with the creation of the State Forestry Law (Law n.10.561/91). This was revoked and replaced by Law n.14.309/2002, which obliged all organizations that consume or commercialize forest products to use a minimum of 90% of wood coming from planted forests. It allowed a maximum of 10% for native forests consumption, provided a fee is paid. Forestry products coming from other states shall present documentation guaranteeing the origin of the wood.
- Over the past 15 years, law enforcement and inspection operations have significantly grown both in terms of frequency and strictness, increasing the production and use of renewable charcoal in sustainable basis. Criminal and financial penalties have been applied, such as apprehensions, embargoes, fines and imprisonment of infractors.
- Eucalyptus plantations are sometimes associated with potential adverse social and environmental impacts, including depletion of water resources, loss of biodiversity, soil erosion, and replacement of food crops. Extensive literature is available today assessing specific aspects of eucalyptus cultivation. As a general appreciation, research points out that eucalyptus species perform better than other trees in terms of wood outputs per input of land claims, energy and water usage. Forest companies emphasize these benefits, while recognizing that plantations are agroindustrial enterprises – not natural forests. Adverse impacts of eucalyptus plantations are generally not caused by the introduction of the species itself, but by the loss of social, economic, cultural and environmental qualities as a result of improper planning and/or the failure to respect local land ownership, livelihoods and habitats. In this sense, when evaluating the eucalyptus impacts (positive and negative) in the environment, it is important to consider the previous land use of the plantations areas. Labor abuses, including forced labor, debt bondage and child labor have been reported widely by international organizations and the international media in association with charcoal production in Brazil. While illegal practices still exist, these are aggressively combatted by the Brazilian Government. Also, companies are actively trying to eradicate illegal labor by increasing control over the production process. According to the U.S. Department of Labor's report, 2012 List of Goods Produced by Child Labor or Forced Labor⁴⁹, the Government of Brazil has "taken an exemplary approach to the elimination of child and forced labor, including forced child labor, through both broad policy measures and targeted actions in specific industries, including charcoal production." The International Labour Organization (ILO) has also highlighted Brazil's efforts to combat forced labour as an example to be followed⁵⁰. The project strongly enforces the development of a legal productive chain that eradicates all possible human rights violations. All charcoal projects supported by the UNDP/GEF Project will have to present evidence of compliance with national legislation.

⁴⁹ See: . <http://www.dol.gov/ilab/programs/ocft/pdf/2012TVPPRA.pdf>.

⁵⁰ See "Fighting forced labour, the example of Brazil", Patricia Trindade Maranhão Costa, ILO, 2009 (http://www.ilo.org/wcmsp5/groups/public/---ed_norm/---declaration/documents/publication/wcms_111297.pdf)

3. PROJECT RESULTS FRAMEWORK:

This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD: Outcome 2: Green economy and decent work in the context of for sustainable development and poverty eradication.					
Country Programme Outcome Indicators: Low carbon strategies with LECRD concept adopted in Brazil and widely disseminated.					
Primary applicable Key Environment and Sustainable Development Key Result Area (same as that on the cover page, circle one): 1. Mainstreaming environment and energy					
Applicable GEF Strategic Objective and Program: GEF-CCM 2 and CCM 3.					
Applicable GEF Expected Outcomes: CCM-2 Outcome 2.2: Sustainable financing and delivery mechanisms established and operational; CCM-3 Outcome 3.1: Favorable policy and regulatory environment created for renewable energy investments.					
Applicable GEF Outcome Indicators: CCM-2 Output 2.2: Investment mobilized; Output 2.3: Energy savings achieved; CCM-3 Output 3.1: Renewable energy policies and regulation in place; Output 3.3: Electricity and heat produced from renewable sources					
Strategy	Indicators	Baseline	Target (End of Project)	Sources of verification	Assumptions
Project Objective: To develop and demonstrate enhanced, clean conversion technologies for renewable, biomass-based charcoal production, supported by an effective policy framework.	Number of commercially demonstrated efficient charcoal conversion technologies.	at least three (3) technological concepts under development by private firms ⁵¹ ; no (0) commercial demonstration (as of 2013).	at least three (3) charcoal production plants in commercial operation; at least three (3) successful business models; at least one (1) proven conversion technology	project reports, project documents, field visits.	(1) A favorable environment for investment exists in the iron and steel industry in Brazil.
	Average gravimetric yield implemented technologies	25% for small producers (hot-tail)	32% or better	reports delivered by MRV system; field visits	(2) Sustained government commitment to strengthen policy framework and sector governance
	Policy and regulatory framework (for renewable charcoal use in Minas Gerais) ⁵²	1 (no strategy in place)	4 (strategy adopted)	PSC minutes, official publications	
	GHG emissions reductions (Mton CO ₂ eq)	0	direct: 432 kton (CCM-2) indirect: 700 kton/yr (CCM-2); 200 kton/yr (CCM-3)	project reports, sector statistics, independent verification	
	Investment capital leveraged for efficient charcoal production	0	US\$ 40,000,000	BNDES - Fundo Clima; I&S sector reports	
Outcome 1 ⁵³ : A policy framework has been implemented to promote the use of	Renewable charcoal strategy in MG	No strategy to stimulate charcoal technology development (0) ⁵⁴	Detailed strategy designed and adopted by MG State Government (1)	Official publications, I&S sector documents, project reports	(1) Sustained government commitment to strengthen policy framework and sector governance;

⁵¹ Including Plantar, ArcelorMittal, CEMIG, RIMA.

⁵² Indicator and rating (from 0 to 5) according to GEF Tracking Tool for CCM Objective 3 (Renewable Energy).

⁵³ All outcomes monitored annually in the APR/PIR. It is highly recommended not to have more than 4 outcomes.

of renewable biomass-based charcoal by the I&S sector, supported by an internationally recognized system for monitoring achieved GHG emission reductions	renewable biomass-based charcoal by the I&S sector in MG.	MRV system for charcoal production and GHG benefits for I&S sector agents	No system in place (0)	MRV system implemented and operational (1)	project reports, official publications	(2) Adequate coordination between MMA, MDIC, State of MG and sector stakeholders. (1) Sustained government commitment to strengthen policy framework for renewable charcoal; (2) Technical and auditing implications of MRV can adequately be addressed. (3) Sector companies are willing to implement MRV systems for renewable charcoal and GHG reductions.
1.2 A Monitoring and Certification Platform to register GHG emission reductions achieved by efficient charcoal production facilities implemented by the I&S sector	1.3 The environmental impact and resource efficiency of clean, renewable biomass-based charcoal production chains are assessed using analytical tools.	Acceptable methodologies and criteria to assess charcoal production chains.	No acceptable methodology in place (0).	Acceptable methodologies in place to perform quantitative evaluations/assessments (1)	Reports with reliable input data; described methodologies and calculation methods.	(1) Project activities can be implemented according to plan; (2) Sufficient input information is available and/or shared by sector agents to enable realistic analysis.
1.4 Financial incentive schemes to promote the use of renewable biomass-based charcoal (e.g. tax exemptions, soft loans, performance based payments) are assessed on their merits.	Financial incentives for (a) use of renewable charcoal by I&S sector in MG; (b) investment in efficient, clean charcoal production chains	(a) No incentives for renewable charcoal use (0); (b) No incentives for investment in efficient, clean charcoal production chains (0).	(a) Incentives for renewable charcoal use in place (1); (b) Incentives in place for investment in efficient, clean charcoal production chains (1).	Official publications, sector reports, project progress reports.	(1) Sustained government commitment to strengthen policy framework for renewable charcoal; (2) Economic benefits of sustainable charcoal are acknowledged.	
2.1 Baseline technology development for clean charcoal conversion is enhanced by supporting the design, testing and evaluation of key system components.	Charcoal technology test program carried out.	Isolated technology development efforts with low sector coordination level (0).	Concerted charcoal technology development program executed (1)	project reports, visual inspections, project evaluation.	(1) Sector agents and research institutes continue to support a joined technology development programme on efficient charcoal conversion; (2) Planned activities can be implemented timely and successfully.	
2.2 Support is given to optimize technologies to capture by-products from the charcoal conversion process, including tar products, hydrocarbons, and process heat.	By-products utilization technology program carried out.	Isolated private initiatives to develop technologies for utilization of charcoal by-products (0).	Concerted by-products technology program carried out (1).	project reports, visual inspections, project evaluation.	(1) Sector agents and research institutes continue to support a joined technology development programme on efficient charcoal conversion; (2) Planned activities can be implemented timely and successfully.	
2.3 Efficient business models are developed (accounting for variations in plant size, logistical set-up, use of by-products, ownership models) to accelerate the widespread introduction of clean charcoal conversion technology.	(a) Number of developed business models; (b) number of expressions of interest (Eol) from local charcoal producers; (c) seminar/workshop on efficient charcoal production chains.	(a) Some business models conceived but not commercially proven yet (0); (b) No (0) Eol's; (c) No (0) seminar held;	(a) At least four (4) different business models developed and accepted by charcoal producers; (b) At least six (6) Eol's signed; (c) One (1) seminar held.	project reports, sector publications, interviews with stakeholders.	Industries, public agencies and CSO's share information to evaluate and design innovative business models for clean charcoal production.	

	2.4 Training material on clean charcoal conversion is developed and used for (i) technical training targeting I&S companies, universities and research institutes; (ii) policy and decision makers, and (iii) project developers and financiers.	(a) Training material; (b) Number of training programs implemented	(a) No training material developed (0); No training program (0)	(a) Training material developed (1); At least three (3) training programs being executed.	project documents, progress reports, project evaluation.	(1) Sector stakeholders show sustained commitment to the objectives of the Project. (2) Envisaged activities can be executed as planned.
Outcome 3: Commercial charcoal production facilities are built under a competitive bidding mechanism to deliver objectively verifiable renewable, biomass-based charcoal and GHG emission reductions.	3.1 A tender mechanism is set up by MMA to support investment in a first batch of commercial production facilities for clean, renewable charcoal	Tender mechanism negotiated and formalized	Proposal for tender MMA (0)	Tender mechanism negotiated and formalized (1)	project reports, agreements and contracts	(1) Adequate coordination between MMA, MDIC, BNDES, BDMG and the Project to set up a consistent financial mechanism. (2) The value of the proposed mechanism is understood by the targeted companies.
	3.2 Targeted support is given to facilitate planning and permitting for the charcoal conversion projects selected under the tender process.	Consultancies to support project development	No (0) consultancies	At least three efficient charcoal conversion facilities are ready for the investment phase of the program.	project reports, official permits and contracts	(1) Eligible project proposals for efficient, clean charcoal production facilities are presented by the private sector. (2) Experts and specialized services can be mobilized to offer adequate support.
	3.3 A first batch of commercial, renewable biomass-based charcoal production facilities is procured and put into operation by the private sector, and greenhouse gas emission reductions are being monitored and verified, and payments are made for delivered performance.	(a) Number of efficient, clean charcoal production facilities in place; (b) Charcoal production per plant (tons/yr); (c) Wood-charcoal conversion rate per plant (%); (d) GHG emission reductions per plant (tons CO2eq/yr)	(a) No (0) facilities in place; (b) No production (0 tons/yr); (b) baseline technology conversion rates are 25-30%; (c) No emission reductions (0 tons CO2eq/yr).	(a) At least three (3) commercial facilities including one small-scale (under 1,000 tons); (b) 80,000 tons charcoal produced per year; (c) at least 33% conversion rate (weighted average); (d) 21.6 kton CO2eq/yr	project documents, visual inspection, sector statistics, independent verification.	(1) Appropriate technological solutions are available, offering bankable investments. (2) Private sector agents are able and willing to attract financing for planned charcoal investments. (3) External market factors are sufficiently positive to justify private sector investment. (4) The added value of the proposed payment mechanism is acknowledged by the sector.
	3.4 Best practices and lessons learnt are collected and disseminated to promote clean charcoal production across the I&S sector in Brazil and abroad.	(a) Documents and presentations with best practices; (b) international event to disseminate clean charcoal production	(a) No documents (0); No event (0)	(a) Documents and presentations compiled (1); (b) International event held (1).	project progress report, project evaluation	(1) Sector stakeholders show sustained commitment to the objectives of the Project. (2) Envisaged activities can be executed as planned.

TOTAL BUDGET AND WORKPLAN

Award ID:	00077747	Project ID(s):	88369								
Award Title:	PIMS 4675 Production of sustainable, renewable biomass-based charcoal for the iron and steel industry in Brazil										
Business Unit:	BRA10										
Project Title:	Production of sustainable, renewable biomass-based charcoal for the iron and steel industry in Brazil										
PIMS no	PIMS 4675										
Implementing Partner (Executing Agency)											
Ministry of Environment (MMA)											
GEF Outcome/Atlas Activity	Responsible Party/Implementing Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Amount Year 5 (USD)	Total (USD)
Outcome #1 A policy framework has been implemented to promote the use of renewable biomass-based charcoal by the I&S sector, supported by an internationally recognized system for monitoring achieved GHG emission reductions.	MMA	62000	GEF	71200	International Consultants	25,000	30,000	30,000	15,000	0	100,000
				71300	Local Consultants	50,000	50,000	50,000	40,000	20,000	210,000
				71600	Travel	8,000	7,000	7,000	5,000	3,000	30,000
				72100	Contractual Services - Companies	50,000	180,000	150,000	50,000	50,000	480,000
				72200	Equipment and Furniture	10,000	10,000	10,000	0	0	30,000
				74200	Audio Visual & Print Prod Cost	3,000	4,000	3,000	3,000	3,000	16,000
				74500	Miscellaneous	3,500	2,500	2,000	1,000	0	9,000
sub-total GEF						149,500	283,500	252,000	114,000	76,000	875,000
Outcome #2 The technology and human capacity base for clean charcoal conversion in Brazil is strengthened by technical assistance and targeted training.	MMA	62000	GEF	71200	International Consultants	18,000	20,000	20,000	20,000	15,000	93,000
				71300	Local Consultants	15,000	30,000	30,000	30,000	15,000	120,000
				71600	Travel	7,500	10,000	7,500	7,500	7,500	40,000
				72100	Contractual Services- Companies	110,000	200,000	150,000	100,000	75,000	635,000
				72200	Equipment and Furniture	82,500	125,000	125,000	75,000	0	407,500
				74200	Audio Visual & Print Prod Cost	2,500	4,000	5,000	3,000	3,000	17,500
				74500	Miscellaneous	2,000	4,000	3,000	2,000	1,000	12,000
sub-total GEF						237,500	393,000	340,500	237,500	116,500	1,325,000
Outcome #3 Commercial charcoal production facilities are built under a competitive bidding mechanism to	MMA	62000	GEF	71200	International Consultants	10,000	10,000	35,000	30,000	10,000	95,000
				71300	Local Consultants	15,000	15,000	20,000	20,000	15,000	85,000
				71600	Travel	6,000	4,000	4,000	4,000	2,000	20,000
				72100	Contractual Services - Companies	575,000	850,000	1,000,000	1,500,000	500,000	4,425,000

Budget Notes

International consultants	
Output 1.1 (30k\$)	Bioenergy / forestry specialist for technical backstopping
Output 1.2 (38k\$)	Sector specialist I&S industry for technical backstopping
Output 1.4 (32k\$)	Energy efficiency/bioenergy finance specialist
Output 2.1 (25k\$)	Charcoal technology specialist for technical backstopping
Output 2.3 (38k\$)	Charcoal technology specialist for technical backstopping
Output 2.4 (30k\$)	International experts to participate in training events and knowledge transfer
Output 3.2 (43k\$)	Climate change/bioenergy specialist for technical backstopping advanced charcoal production plants.
Output 3.4 (52k\$)	Two GEF evaluation specialists for MTE and FE.
Local consultants	
Output 1.1 (130k\$)	Specialists to support sustainable charcoal strategy development: (1) Sector specialist I&S industry for liaison and negotiations; (2) Legal expert; (3) Sociologist; (4) Gender specialist.
Output 1.2 (50k\$)	1-2 specialists on GHG monitoring and verification methodologies and to act as counterpart (coordination and supervision) for subcontracted services.
Output 1.3 (20k\$)	Environmental expert/industrial engineer, acting as counterpart for subcontracted services.
Output 1.4 (10k\$)	Forestry/bioenergy expert, acting as counterpart for subcontracted services.
Output 2.1 (50k\$)	Charcoal technology expert/engineer to coordinate and supervise technology development activities, including subcontracted activities
Output 2.3 (50k\$)	Charcoal Consultant/I&S market specialist to initiate business model development and act as counterpart for subcontracted services.
Output 2.4 (20k\$)	(1) Communication/training expert to coordinate development of training material and activities, and other events for knowledge-sharing; (2) one or more local experts to provide short-term training (teachers).
Output 3.2 (75k\$)	1-2 Charcoal technology/bioenergy specialists for technical, legal, financial, and socio-environmental backstopping, acting as counterpart (supervision, monitoring) for subcontracted services.
Output 3.4 (10k\$)	Professional to prepare and support GEF evaluations an assist in monitoring process.
Contractual services	
Output 1.2 (270k\$)	(1) contracted company for detailed design of MRV system; (2) contracted company for design and implementation of IT solutions (web-based applications), related services and training for end-users
Output 1.3 (110k\$)	Contract with specialized technology organization on clean charcoal production chains.
Output 1.4 (100k\$)	Contract with specialized consultancy organization to evaluate alternative financial incentive schemes and issue recommendations for policy

	development and design of financing instruments.
Output 2.1 (200k\$)	One or more contracts with R&D institutes to perform a technological research and test programme on charcoal conversion, according to a pre-established work plan.
Output 2.2 (200k\$)	One or more contracts with R&D institutes to perform a technological research and test programme on byproducts of charcoal conversion, according to a pre-established work plan.
Output 2.3 (175k\$)	1-2 contracts with specialized consultancy firms to analyze and detail business models for clean charcoal production, including risk analysis, market analysis, legal aspects, preparation of formats and evaluation tools.
Output 2.4 (60k\$)	(1) contract with educational institute to organize training programme; (2) contracts with host organizations (rent of spaces, services, lunches, etc).
Output 3.1 (75k\$)	Contract with specialized consultancy firm to prepare and detail technical and legal aspects of bidding mechanism, on behalf of MMA.
Output 3.2 (275k\$)	Several contracts with specialized organizations to provide technical assistance for selected charcoal projects during preparation phase on design, engineering, environmental impacts, social impacts (as and if required by law and/or due diligence practices).
Output 3.3 (4,000k\$)	Individual contracts with winning offerers under the tender mechanism, stipulating the conditions of the performance-based payments (for GHG reductions and charcoal outputs).
Direct Project Costs (80k\$)	\$): Direct project costs – These costs, based on the UPL are agreed between the Government of Brazil and UNDP for project execution services above and beyond those covered by the implementing agency fee, please refer to Annex F for a budget breakdown. LOA to be signed with Gov of Brazil.
Audit (20k\$):	These are mandatory audit costs. Audit should be done annually as per indicated in the UNDP financial rules and regulations.



Annual Work Plan

Brazil - Brasilia

Project: 00077784

Project Title: BRA/14/G31 PIMS 4675 Production of biomass-based charcoal

Year: 2015

Report Date: 30/4/2015

Output	Key Activities	Timeframe		Responsible Party	Planned Budget			
		Start	End		Fund	Donor	Budget Descr	Amount US\$
00088390 BRA/14/G31-Biomass-based charc	Outcome1 - Policy Framework	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	72200 Equipment and Furniture	10,000.00
				UNDP	62000	GEFTrustee	71600 Travel	8,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	50,000.00
				UNDP	62000	GEFTrustee	71300 Local Consultants	50,000.00
				UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	3,000.00
				UNDP	62000	GEFTrustee	71200 International Consultants	25,000.00
	Outcome2 - Techn Assist &	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	3,500.00
				UNDP	62000	GEFTrustee	72200 Equipment and Furniture	82,500.00
				UNDP	62000	GEFTrustee	71300 Local Consultants	15,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	110,000.00
	Outcome3 - Comm Charc Pl	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71200 International Consultants	18,000.00
				UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	2,500.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	2,000.00
				UNDP	62000	GEFTrustee	71600 Travel	7,500.00
				UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	1,000.00
				UNDP	62000	GEFTrustee	71600 Travel	6,000.00
	Outcome4 - Project Manage	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71300 Local Consultants	15,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	1,000.00
				UNDP	62000	GEFTrustee	71200 International Consultants	10,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	575,000.00
TOTAL				UNDP	62000	GEFTrustee	72200 Equipment and Furniture	5,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	22,000.00
				UNDP	62000	GEFTrustee	71600 Travel	2,000.00
				UNDP	62000	GEFTrustee	72200 Equipment and Furniture	5,000.00
				UNDP	62000	GEFTrustee	74100 Professional Services	4,000.00
				UNDP	62000	GEFTrustee	71300 Local Consultants	35,000.00
TOTAL								1,068,000.00



Annual Work Plan

Brazil - Brasilia

Project: 00077784

Project Title: BRA/14/G31 PIMS 4675 Production of biomass-based charcoal

Report Date: 30/4/2015

GRAND TOTAL

1,068,000.00

Thaís Rick
UNDP - BRASIL



Annual Work Plan

Brazil - Brasilia

Project: 00077784

Project Title: BRA/14/G31 PIMS 4675 Production of biomass-based charcoal

Year: 2016

Report Date: 30/4/2015

Output	Key Activities	Timeframe		Responsible Party	Planned Budget			
		Start	End		Fund	Donor	Budget Descr	Amount US\$
00088390 BRA/14/G31-Biomass-based charc	Outcome1 - Policy Framework	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	180,000.00
				UNDP	62000	GEFTrustee	71300 Local Consultants	50,000.00
				UNDP	62000	GEFTrustee	71200 International Consultants	30,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	2,500.00
				UNDP	62000	GEFTrustee	71600 Travel	7,000.00
				UNDP	62000	GEFTrustee	72200 Equipment and Furniture	10,000.00
				UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	4,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	4,000.00
	Outcome2 - Techn Assist &	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71300 Local Consultants	30,000.00
				UNDP	62000	GEFTrustee	72200 Equipment and Furniture	125,000.00
				UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	4,000.00
				UNDP	62000	GEFTrustee	71200 International Consultants	20,000.00
				UNDP	62000	GEFTrustee	71600 Travel	10,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	200,000.00
				UNDP	62000	GEFTrustee	71600 Travel	4,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	850,000.00
	Outcome3 - Comm Charc Pl	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71300 Local Consultants	15,000.00
				UNDP	62000	GEFTrustee	71200 International Consultants	10,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	1,000.00
				UNDP	62000	GEFTrustee	72200 Equipment and Furniture	10,000.00
				UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	1,000.00
				UNDP	62000	GEFTrustee	71600 Travel	2,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	19,000.00
				UNDP	62000	GEFTrustee	71300 Local Consultants	35,000.00
	Outcome4 - Project Manage	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	74100 Professional Services	4,000.00
				UNDP	62000	GEFTrustee		
TOTAL								1,627,500.00
GRAND TOTAL								1,627,500.00



Annual Work Plan

Brazil - Brasilia

Project: 00077784

Project Title: BRA/14/G31 PIMS 4675 Production of biomass-based charcoal

Year: 2017

Report Date: 30/4/2015

Output	Key Activities	Timeframe		Responsible Party	Planned Budget			
		Start	End		Fund	Donor	Budget Descr	Amount US\$
00088390 BRA/14/G31-Biomass-based charcoal	Outcome1 - Policy Framework	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71600 Travel	7,000.00
				UNDP	62000	GEFTrustee	71200 International Consultants	30,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	150,000.00
				UNDP	62000	GEFTrustee	72200 Equipment and Furniture	10,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	2,000.00
				UNDP	62000	GEFTrustee	71300 Local Consultants	50,000.00
				UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	3,000.00
	Outcome2 - Techn Assist &	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	5,000.00
				UNDP	62000	GEFTrustee	71200 International Consultants	20,000.00
				UNDP	62000	GEFTrustee	72200 Equipment and Furniture	125,000.00
				UNDP	62000	GEFTrustee	71600 Travel	7,500.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	150,000.00
				UNDP	62000	GEFTrustee	71300 Local Consultants	30,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	3,000.00
	Outcome3 - Comm Charc P	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71300 Local Consultants	20,000.00
				UNDP	62000	GEFTrustee	71600 Travel	4,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	1,000,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	1,000.00
				UNDP	62000	GEFTrustee	72200 Equipment and Furniture	5,000.00
				UNDP	62000	GEFTrustee	71200 International Consultants	35,000.00
	Outcome4 - Project Manage	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71300 Local Consultants	35,000.00
				UNDP	62000	GEFTrustee	71600 Travel	2,000.00
				UNDP	62000	GEFTrustee	74100 Professional Services	4,000.00
				UNDP	62000	GEFTrustee	74500 Miscellaneous Expenses	18,000.00
TOTAL								1,716,500.00
GRAND TOTAL								1,716,500.00



Annual Work Plan

Brazil - Brasilia

Project: 00077784

Project Title: BRA/14/G31 PIMS 4675 Production of biomass-based charcoal

Year: 2018

Report Date: 30/4/2015

Output	Key Activities	Timeframe		Responsible Party	Planned Budget				
		Start	End		Fund	Donor	Budget Descr	Amount US\$	
00088390 BRA/14/G31-Biomass-based charc	Outcome1 - Policy Framework	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71200	International Consultants	15,000.00
				UNDP	62000	GEFTrustee	71600	Travel	5,000.00
				UNDP	62000	GEFTrustee	72100	Contractual Services-Companies	50,000.00
				UNDP	62000	GEFTrustee	71300	Local Consultants	40,000.00
				UNDP	62000	GEFTrustee	74500	Miscellaneous Expenses	1,000.00
	Outcome2 - Techn Assist &	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	74200	Audio Visual&Print Prod Costs	3,000.00
				UNDP	62000	GEFTrustee	74500	Miscellaneous Expenses	2,000.00
				UNDP	62000	GEFTrustee	71300	Local Consultants	30,000.00
				UNDP	62000	GEFTrustee	74200	Audio Visual&Print Prod Costs	3,000.00
				UNDP	62000	GEFTrustee	72100	Contractual Services-Companies	100,000.00
	Outcome3 - Comm Charc Pl	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	72200	Equipment and Furniture	75,000.00
				UNDP	62000	GEFTrustee	71200	International Consultants	20,000.00
				UNDP	62000	GEFTrustee	71600	Travel	7,500.00
				UNDP	62000	GEFTrustee	71300	Local Consultants	20,000.00
				UNDP	62000	GEFTrustee	71600	Travel	4,000.00
	Outcome4 - Project Manage	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	72100	Contractual Services-Companies	1,500,000.00
				UNDP	62000	GEFTrustee	71200	International Consultants	30,000.00
				UNDP	62000	GEFTrustee	74100	Professional Services	4,000.00
				UNDP	62000	GEFTrustee	74500	Miscellaneous Expenses	13,000.00
				UNDP	62000	GEFTrustee	71600	Travel	2,000.00
TOTAL				62000	GEFTrustee	71300	Local Consultants	40,000.00	1,964,500.00
GRAND TOTAL									1,964,500.00



Annual Work Plan

Brazil - Brasilia

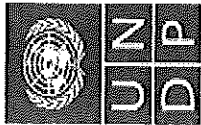
Project: 00077784

Project Title: BRA/14/G31 PIMS 4675 Production of biomass-based charcoal

Year: 2019

Report Date: 30/4/2015

Output	Key Activities	Timeframe		Responsible Party	Planned Budget			
		Start	End		Fund	Donor	Budget Descr	Amount US\$
00088390 BRA/14/G31-Biomass-based charc	Outcome1 - Policy Framework	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71300 Local Consultants	20,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	50,000.00
				UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	3,000.00
				UNDP	62000	GEFTrustee	71600 Travel	3,000.00
	Outcome2 - Techn Assist &	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71200 International Consultants	15,000.00
				UNDP	62000	GEFTrustee	74200 Audio Visual&Print Prod Costs	3,000.00
				UNDP	62000	GEFTrustee	71300 Local Consultants	15,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	75,000.00
	Outcome3 - Comm Charc Pl	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71600 Travel	7,500.00
				UNDP	62000	GEFTrustee	Miscellaneous Expenses	1,000.00
				UNDP	62000	GEFTrustee	72100 Contractual Services-Companies	500,000.00
				UNDP	62000	GEFTrustee	71200 International Consultants	10,000.00
	Outcome4 - Project Manage	1/1/2015	31/12/2019	UNDP	62000	GEFTrustee	71600 Travel	2,000.00
				UNDP	62000	GEFTrustee	Local Consultants	15,000.00
				UNDP	62000	GEFTrustee	Miscellaneous Expenses	13,000.00
				UNDP	62000	GEFTrustee	71600 Travel	2,000.00
	TOTAL			UNDP	62000	GEFTrustee	74100 Professional Services	4,000.00
				UNDP	62000	GEFTrustee	71300 Local Consultants	35,000.00
GRAND TOTAL								773,500.00



United Nations Development Programme

BRA/14/G31 [00088390] - PIMS 4675 Production of biomass-based charcoal

Initial Budget Revision - 29-April -15

Main Source of Funds: Global Environment Trust Fund

Executing Agency: UNDP

Thais Rick
UNDP - BRASIL

Donor	Funding	Total	2014	2015	2016	2017	2018	2019
10003	62000	Net Contrib.	-	1.068.000,00	1.627.500,00	1.716.500,00	1.964.500,00	773.500,00
		Total	-	1.068.000,00	1.627.500,00	1.716.500,00	1.964.500,00	773.500,00

4. MANAGEMENT ARRANGEMENTS

The project will be implemented over a five-year period. The Government of Brazil has requested UNDP's assistance for the design and implementation of this Project based on UNDP's comparative advantages, which include vast experience in supporting the Government in project implementation in Brazil, but also considering its role as the Global Environmental Facility (GEF) Implementing Agency (IA).

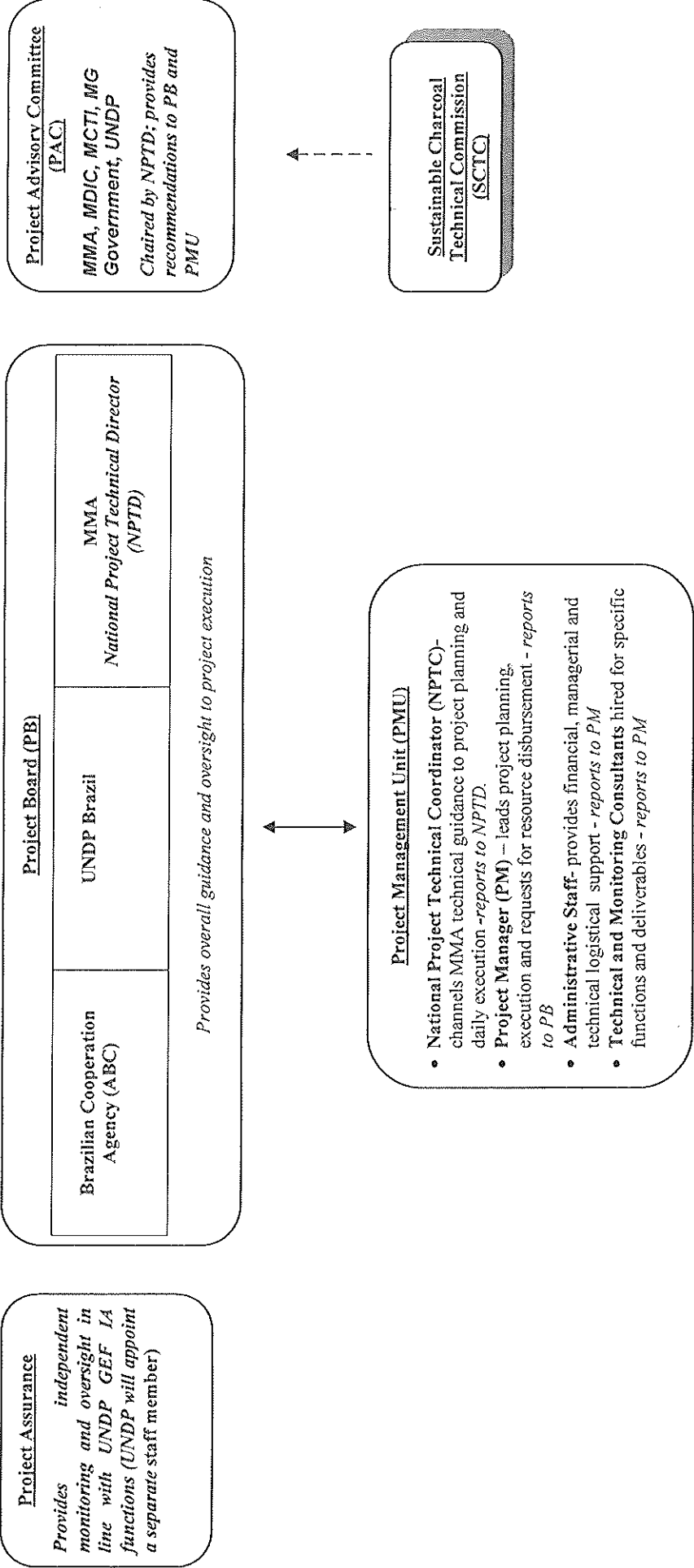
As the GEF IA, UNDP is ultimately accountable and responsible for the delivery of results.. In its GEF IA oversight role UNDP shall provide project cycle management services defined by the GEF Council including the following:

- Providing financial and audit services to the project;
- Overseeing financial expenditures against project budgets;
- Ensuring that activities including procurement and financial services are carried out in strict compliance with UNDP/GEF procedures;
- Ensuring that the reporting to GEF is undertaken in line with GEF requirements and procedures;
- Facilitating project learning, exchange and outreach within the GEF family;
- Contracting the project mid-term and final evaluations and trigger additional reviews and/or evaluations as necessary and in consultation with the project counterparts.

Implementation Modality

The project will be implemented under UNDP's Direct Execution modality (DEX). In line with UNDP Internal Control Framework (ICF) there will be a clear division between UNDP oversight function as GEF IA and its role as executing agency. The management arrangements, described below and summarized in Figure 1, constitute the Project Board; Project Management Unit, an Advisory Committee and a Sustainable Charcoal Technical Commission. The Ministry of Environment (MMA) will be UNDP's lead government partner and will have responsibility in the technical oversight and management through its role in the Project Board; in the Project Management Unit; in the chairing of the Project Advisory Committee; in the coordination of the Sustainable Charcoal Technical Commission and in designating a wide range of staff for delivery of different project activities.

Figure 1 - Project Organization Structure



Project Board (PB)

The Project Board (PB) will provide the overall managerial guidance for project execution. It will: (i) Analyze and discuss the development of the Project activities and recommend changes as required based on project monitoring and evaluation processes and products and in line with GEF and UNDP policies; (ii) Discuss and approve the Annual Work Plan ensuring that required resources are committed; (iii) Discuss and approve the Progress Reports and Final Report of the Project; (iv) Analyze Project achievements and assure these used for performance improvement, accountability and learning; and (v) Settle controversies arbitrating on any conflicts within the project or negotiating a solution to any problems with external bodies. In order to ensure UNDP's ultimate accountability for the project results, PB decisions will be made in accordance to standards that shall ensure management for development results, fairness and integrity.

The PB will be composed by the UNDP, the Brazilian Agency for Cooperation (ABC) and MMA and their respective alternate members. The Board can be expanded upon mutual agreement between the Parties. UNDP will represent the project ownership, chairing the PB and organizing its meetings at least once a year or upon request of either of the Parties. The ABC as the institution responsible, within the government, for following up the activities that stem from this Project; and the MMA will represent the parties that will provide funding for cost-sharing and will lead the technical expertise and guidance to the project. For this MMA will appoint a National Project Technical Director (NPTD) who will be a senior staff member and will be responsible at the highest level for providing guidance on technical feasibility of the project ensuring its implementation leads to the achievement of project's results. He/she will represent MMA on the PB; will chair the Project Advisory Committee (PAC); will keep MMA updated on Project advances and challenges as needed and will represent the Project at high-level national and international meetings. This is a part-time position continuing for the duration of the Project.

The Project Board's role in project management will be complemented by inputs and recommendations from a Project Advisory Committee (PAC) - see above. In addition the PB will approve the appointment and responsibilities of a Project Manager who will be responsible for the daily project execution.

UNDP also will provide Project Assurance support to the Project Board by carrying out objective and independent project oversight and monitoring functions related to UNDP project cycle management services as GEF IA. UNDP will appoint a representative for the Project Board; another for Project Assurance support and another for the approval of transactions. None of these 3 UNDP staff will be the Project Manager.

Project Advisory Committee (PAC)

The MMA through its NPTD in the PB; and the NPTC in the PMU will lead technical responsibilities during the executing of the project and ensure alignment with relevant national policies and programmes. In this role MMA will closely coordinate with the Ministry of Development, Industry and Commerce (MDIC), the Ministry of Science, Technology and Innovation (MCTI), and the Government of the State of Minas Gerais (MG). The vehicle for this coordination will be a Project Advisory Committee (PAC) to be constituted at Project inception as the highest level for providing technical coordination for the project. It will consist of MMA as chair and MDIC, MCTI, MG and UNDP. The PAC will play a critical role in facilitating inter-ministerial coordination and ensuring complementarity of actions among different stakeholders and co-financiers. The main responsibility of the PAC is to see that the project's activities lead to the required outcomes as defined in the Project Document.

The PAC will meet twice per year to review progress and obstacles and to advice on strategic and critical Project issues. Matters of institutional concern (i.e. going beyond the Project's scope and contents) will be

addressed at the appropriate levels of dialogue between UNDP and the Government of Brazil. It will provide recommendations to the PB on progress and on any changes that may be required for improving efficiency and effectiveness. The NPTD will instruct the National Project Technical Coordinator (NPTC) to provide detailed project information to the PAC as needed, to convene meetings and to prepare PAC minutes. He/ she will be assisted by the Project Manager in these. Extraordinary PAC meetings can be held if deemed necessary by one of the PAC members. If appropriate, the PAC can invite external consultants to assist in the monitoring process.

Project Management Unit (PMU)

A Project Management Unit (PMU) will be responsible for overseeing the day-to-day execution of Project activities. The PMU will have responsibility for, among others: (i) operational planning, managing and executing the project including the direct supervision of project activities sub-contracted to specialists and other institutions, as well as those that are to be implemented through the MMA, if applicable; (ii) coordinating the management of financial resources and procurement; (iii) reporting on the application of resources and results achieved; (iv) preparing management reports for the MMA, PSC, the GEF, and UNDP including annual reports (PIR) and any proposals for the adaptive management of the Project if required and based on inputs from the Project M&E plan; (v) promoting inter-institutional linkages; and (vi) disseminating project results.

The PMU will consist of a full-time Project Manager, one Technical and Monitoring Consultant and one Administrative Assistant hired with GEF resources and a National Project Technical Coordinator (NPTC) assigned by the Project National Technical Director. The NPTC will be an MMA staff member and will collaborate with the PMU in project implementation channeling MMA's technical inputs and guidance into the planning and execution of project activities. The NPTC will hold internal meetings in MMA as needed to integrate MMA specialist's guidance into project implementation and consistency between the various project elements and activities provided or funded by other donors. This is a part-time position continuing for the duration of the Project, reporting directly to the NPTD.

The PMU will be led by the Project Manager and will be responsible for the overall management and implementation of the project's activities and requesting disbursement of Projects resources for their execution. Upon request of the GoB (see Annex X) implementation will be through the DEX modality with UNDP providing direct project services such as procurement and hiring of consultants following best value for money, transparency and effective competition. These will follow current UNDP policies and procedures including those for cost recovery (see para XX). Under the PM's lead and guidance the PMU team will prepare Annual Operational Plans (AOP) for the effective and efficient implementation of the project activities to achieve stated objectives; will be responsible for all substantive reports from the Project; will prepare and/or oversee the development of Terms of Reference for consultants, subcontractors and partnerships hired for specific technical assignments and their close monitoring, ensure consistency between the various project elements and activities provided or funded by other donors; and develop reports on project progress on the project for PSC and technical meetings, and other appropriate forums. This is a full-time position continuing for the duration of the Project, reporting directly to the PB.

Sustainable Charcoal Technical Commission (SCTC)

The Sustainable Charcoal Technical Commission (SCTC) is foreseen to be created by the end of 2014, via a Joint Ministerial Decree signed by both Ministries (MMA and MDIC) with the task to actively support the sector transformation process. This commission will be headed by MDIC and MMA, and will consist of representatives from Government agencies (Federal and State level) and the I&S and forestry

sector. The Commission will serve as permanent technical consultative body that will aim to promote the articulation of public and private entities to implement, monitor and revise the sectoral Plan on Sustainable Charcoal, an important policy instrument of the National Climate Change Policy and NAMA for the I&S sector.

The SCTC will provide technical inputs for the implementation of activities and to ensure alignment of the Sustainable Charcoal Plan with other relevant industrial policies such as the Greater Brazil Plan (PBM - Plano Brasil Maior)⁵⁷. The Commission will also provide technical support on a consultative basis for the following activities: (i) to guide implementation, monitoring, evaluation and revision of the Sustainable Charcoal Plan; (ii) to propose priority actions under the Sustainable Charcoal Plan; (iii) to identify and propose to the competent bodies normative instruments necessary for the implementation of the Sustainable Charcoal Plan; (iv) to facilitate communication and dissemination of the Sustainable Charcoal Plan; (v) to support the articulation needed to undertake joint activities, exchange of experience and training; and (vi) to identify and propose studies and technical papers to support the implementation and revision of the Sustainable Charcoal Plan, and establish Working Groups, if needed.

In relation to the present UNDP/GEF project, the SCTC will: (i) review the MRV system proposal that will be used under the Project; (ii) provide technical recommendations for the PSC on how to improve the allocation of Project funds to catalyze resources for the operationalization of the Sustainable Charcoal Plan; (iii) issue recommendations concerning implementation, monitoring, evaluation and revision of project activities as requested by the PSC. The NPTC will be responsible for drafting the minutes of the SCTC meetings that are relevant for the GEF Project, distribute them among its members for approval, and submit a copy to the PAC.

Acknowledgement of UNDP and GEF property rights and security

In order to accord proper acknowledgement to GEF for providing funding, a GEF logo should appear on all relevant GEF project publications, including among others, project hardware and vehicles purchased with GEF funds. Any citation of publications regarding projects funded by GEF should also accord proper acknowledgement to the GEF. Any material for promotional and/or dissemination purposes must be submitted to UNDP CO for revision and approval prior to publication. Since UN visibility is important for security purposes, the UNDP logo should possibly appear more prominently - and separated - from the GEF logo on hardware items (in particular on vehicles).

Audit arrangements

It will be performed an auditing by independent audit firm or individuals, hired by the project or by the UNDP Evaluation, Auditing and Investigation Office, as provided for in the UNDP rules applicable to the projects executed by the direct execution modality. When the regional Bureau authorizes the execution of the projects by this modality, UNDP Office in Brazil becomes in charge of fully enforcing the UNDP rules and procedures during the project implementation, monitoring and evaluation, as well as must guarantee that the costs will be recovery within the scope of this project. The office will also provide and keep records about the project on the corporate databases.

Compilation of learning experiences

During implementation, the Project team is expected to identify processes, sub-processes, outputs and approaches that may be useful for monitoring purposes and for sharing of knowledge with stakeholders in Brazil and the region.

⁵⁷

<http://www.brasilmaior.mdic.gov.br/>

5. MONITORING FRAMEWORK AND EVALUATION

Project monitoring and evaluation (M&E) will be conducted in accordance with established UNDP and GEF procedures and be led by the project team and the UNDP Country Office (UNDP-CO) with support from UNDP/GEF. The Strategic Results Framework (SRF, see Section II) provides performance and impact indicators with their corresponding means of verification. The SRF will be the reference for monitoring the Project's implementation and for (independent) evaluation of performance and impact. The Project Management Unit will prepare a detailed M&E plan to be presented at the Inception Workshop. This Workshop (see below) provides a platform for reviewing and fine-tuning of indicators and means of verification, in a manner consistent with the expected outcomes for the project.

Monitoring and reporting

Project monitoring consists of a number of day-to-day and periodic activities, including: (i) day-to-day monitoring by the PMU (Project Coordinator); (ii) periodic monitoring by UNDP-CO (Programme Officer) on a quarterly basis or more frequent if appropriate; and (iii) annual monitoring through Tripartite Reviews (MMA, UNDP-CO, GEF). UNDP-CO and the UNDP/GEF Regional Coordinating Unit will conduct visits to the project and field sites on a yearly basis or more often if agreed upon in the Annual Work Plan.

Project monitoring reporting consists of the periodical submission of standardized reports by the PMU to UNDP-CO: (i) project Inception Report, to be prepared immediately after the Inception Workshop; (ii) harmonized Annual Progress Report/Project Implementation Review, which is used by UNDP-CO, and UNDP/GEF RCU for review of project progress and as input for reporting at an aggregate level; (iii) quarterly progress reports, outlining main updates in project progress; (iv) GEF Tracking Tool; (v) project terminal report, to be prepared within three months before project termination.

For a detailed description of UNDP and GEF M&E mechanisms and requirements, please refer to the corresponding manuals.

Inception Workshop and Report

The key objective of the Inception Workshop (IW) is to assist the Project Team to understand and take ownership of the Project's goals and objectives and to finalize the first Annual Work Plan (AWP). The Inception Workshop will be convoked by the PMU (Project Coordinator) within two months after project start-up and be assisted by the host Government (Executing Agency and other counterparts), co-financing partners, UNDP-CO and UNDP/GEF RCU. Representatives from UNDP-GEF headquarters can assist as appropriate. UNDP-CO will provide assistance to the Executing Agency during the inception phase.

The Inception Workshop provides an opportunity for all parties to understand their roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and mechanisms for conflict resolution. The Terms of Reference for project staff and decision-making structures will be discussed again, as needed.

The Inception Report will be prepared immediately following the Inception Workshop and will include the detailed Annual Work Plan for the first year, divided in quarterly periods, specifying: (i) the activities and progress indicators that will guide implementation; (ii) the project budget for the first full year of implementation; (iii) monitoring and evaluation requirements to effectively measure project performance during the first year; and (iv) a procurement plan for the first Project Year. The AWP will include a calendar of specific field visits, support missions from the UNDP-CO and RCU or consultants, as well for meetings of the Project's decision-making structures.

The Inception Report will further include a more detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners. In addition, a section will be included on progress to date concerning project establishment and start-up activities, and an update of any changed external conditions that may effect project implementation. When finalized, the report will be circulated to Project counterparts who will be given a period of one (1) month to respond. Prior to this, UNDP-CO and UNDP/GEF RCU will review the document.

Annual Project Report (APR) / Project Implementation Review (PIR)

The Annual Project Report is a UNDP requirement, providing input for the CO reporting process and for the Project's Tripartite Project Review (TPR). The APR will be prepared on an annual basis prior to the TPR to reflect progress achieved in meeting the project's Annual Work Plan and assess project performance towards the outcomes set forth.

The Project Implementation Review (PIR) is an annual monitoring process mandated by the GEF. A Project Implementation Report must be completed by the CO together with the Project Team. The PIR is ideally prepared prior to the Tripartite Review, where it can be discussed and agreed upon by the Project Team, the Executing Agency, and UNDP CO. The GEF M&E Unit provides instructions concerning the scope and content of the yearly PIRs. The PIR is reviewed by the UNDP/GEF Regional Coordinating Unit prior to sending them to the Focal Area clusters at the UNDP/GEF headquarters.

Quarterly Progress Reports (QPR)

Quarterly Progress Reports are short reports outlining updates on project progress on key issues that are to be provided to UNDP CO and the UNDP-GEF regional office by the project team. A standard format will be made available by UNDP.

Risk Assessment Reports

The PMU will prepare quarterly risk analysis reports that include identification of new risks, specification and proposed mitigation or prevention measured according to the available UNDP format.

Mid-Term Review (MTR)

The Mid-Term Review will determine progress being made towards the achievement of outcomes and will identify corrective actions if needed. It will focus on the effectiveness, efficiency and timeliness of Project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about Project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the second half of the Project's term. The MTR will take place after approx. 50% of the project execution time (after 24 months), unless otherwise agreed with UNDP. The terms of reference for the MTR will be prepared by UNDP CO. The selection and contracting process will be assumed by UNDP CO. The associated budget commitments will be drawn from UNDP CO's resources allocated to the Project.

Terminal Evaluation (TE)

An independent Terminal Evaluation will take place three months prior to the terminal TPR meeting. The TE will focus on similar issues as the MTR and further look at impact and sustainability of results, including the Project's contribution to capacity development and to the achievement of global environmental goals and lessons learnt. The TE will also provide recommendations for follow-up activities. The terms of reference will be prepared by UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF⁵⁸. The selection and contracting process will be assumed by UNDP CO. The associated budget commitments will be charged to the GEF resources allocated to the Project.

M&E Budget

The Budget for M&E is US\$ 150,000 (US\$ 70,000 GEF grant and US\$ 80,000 co-financing).

Day-to-day monitoring of the status of the activities under implementation, standard reporting including the preparation of APR/PIR, is considered as part of Project Management and financed from the PM budget.

M&E workplan and budget

Type of M&E activity	Responsible Parties	Budget US\$ <i>Excluding project team staff time</i>	Time frame
Inception Workshop and Report	<ul style="list-style-type: none"> Project Coordinator UNDP CO, UNDP GEF 	US\$ 10,000 (GEF) US\$ 10,000 (GOB)	Within first two months of project start up
Measurement of Means of Verification of project results.	<ul style="list-style-type: none"> UNDP GEF RTA/Project Coordinator will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members. 	To be finalized in Inception Phase and Workshop.	Start, mid and end of project (during evaluation cycle) and annually when required.
Measurement of Means of Verification for Project Progress on <i>output and implementation</i>	<ul style="list-style-type: none"> Oversight by Project Coordinator Project team 	To be determined as part of the Annual Work Plan's preparation.	Annually prior to ARR/PIR and to the definition of annual work plans
APR/PIR	<ul style="list-style-type: none"> Project Coordinator and team UNDP CO UNDP RTA UNDP EEG 	None	Annually
Periodic status/ progress reports	<ul style="list-style-type: none"> Project Coordinator and team 	None	Quarterly
Mid-term Review	<ul style="list-style-type: none"> Project Coordinator and team UNDP CO UNDP RCU External Consultants (i.e. evaluation team) 	US\$ 22,500 (GEF) US\$ 10,000 (GOB)	At the mid-point of project implementation.
Terminal Evaluation	<ul style="list-style-type: none"> Project Coordinator and team, UNDP CO UNDP RCU External Consultants (i.e. evaluation team) 	US\$ 27,500 (GEF) US\$ 10,000 (GOB)	At least three months before the end of project implementation

⁵⁸

See: "Handbook on Planning, Monitoring and Evaluating for Development Results", UNDP, 2009 (www.undp.org)

Type of M&E activity	Responsible Parties	Budget US\$ <i>Excluding project team staff time</i>	Time frame
Project Terminal Report	<ul style="list-style-type: none"> Project Coordinator and team UNDP CO local consultant 	US\$ 0	At least three months before the end of the project
Audit	<ul style="list-style-type: none"> UNDP CO Project Coordinator and team 	US\$ 20,000 (4,000 per year)(GEF)	Yearly
Visits to field sites	<ul style="list-style-type: none"> UNDP CO UNDP RCU (as appropriate) Government representatives 	For GEF supported projects, paid from IA fees and operational budget	Yearly
Dissemination of lessons learnt	<ul style="list-style-type: none"> Project Coordinator and team Local consultant 	US\$ 10,000 (GEF) US\$ 50,000 (GOB)	At least three months before the end of the project
TOTAL indicative COST		Total: US\$ 170,000	
Excluding project team staff time and UNDP staff and travel expenses		(GEF: US\$ 90,000; GOB: US\$ 80,000)	

6. LEGAL CONTEXT

This Project Document shall be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement between the Government of Brazil and the United Nations Development Programme, signed on December 29, 1964. The host country implementing agency shall, for the purpose of the Standard Basic Assistance Agreement, refer to the government co-operating agency described in that Agreement.

The UNDP Resident Representative in Brazil is authorized to effect in writing the following types of revision to this Project Document, provided that he/she has verified the agreement thereto by the UNDP-GEF Unit and is assured that the other signatories to the Project Document have no objection to the proposed changes:

- (a) Revision of, or addition to, any of the annexes to the Project Document;
- (b) Revisions which do not involve significant changes in the outcomes, outputs or activities of the Project, but are caused by the rearrangement of the inputs already agreed to or by cost increases due to inflation;
- (c) Mandatory annual revisions which re-phase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility; and
- (d) Inclusion of additional annexes and attachments only as set out here in this Project Document

7. COST RECOVERY POLICY

As per Determination and Decision of the UNDP's Executive Board on the *Policy on Cost Recovery from Regular and Other Resources*, UNDP shall recover costs for the provision of project related general management services (GMS) and direct project services (DPS). In GEF funded projects, GMS costs are incurred by UNDP in undertaking its Project Cycle Management Services as a GEF IA and are not included in the project budget as they are covered by GEF fees and provided to the UNDP Country Office through UNDP internal distribution. DPS costs are those incurred by UNDP for the provision of services

requested by a host Government and that are execution driven and can be traced in full to the delivery of project inputs. They relate to operational and administrative support activities carried out by UNDP offices on behalf of the Direct Execution Modality (DEX) or Country Office support to National Execution Modality (NEX) and include the provision of the following estimated services:

- Payments, disbursements and other financial transactions.
- Recruitment of staff, project personnel, and consultants.
- Procurement of services and equipment, including disposal.
- Organization of training activities, conferences, and workshops, including fellowships.
- Travel authorization, visa requests, ticketing, and travel arrangements.
- Shipment, custom clearance, vehicle registration, and accreditation.

These execution-related costs are separate and distinct from the GMS costs. In accordance with UNDP policy on cost recovery (2010) and the BOM and UNDP GEF guidance on Direct Project Costs (2012) the costs incurred by UNDP for the provision of direct project services needs to be recovered on the basis of estimated actual costs expected to be incurred or on a per-transaction basis using the Universal price list or Local Price List costing template and should be charged directly to project budgets. The estimated costs are included in the project budget and are funded within the total project management Costs (PMC) allocation provided by GEF to the implementation Parties and cannot exceed the total PMC allocation. Once incurred after each of the above services is provided by UNDP, costs shall be charged against budget code line 74599.

8. ANNEXES

A. Terms of Reference

B. Risk Analysis

C. Agreements

D. Support Program of Sustainable Charcoal Plants

E. Additional Information Charcoal Conversion Technologies

ANNEX A - Terms of Reference

The **Project Technical Advisor** will be responsible for the management, planning and coordination of the technical activities of the Project. He/she will provide supervision of project implementation and be the key contact person for the project. He/she will be responsible for communicating with UNDP CO and MMA, Project Steering Committee and co-financiers. In coordination with UNDP CO, he/she will undertake yearly operational planning and provide technical guidance on implementation of overall project activities and their compliance with the Project Document. In addition, he/she will be responsible for preparing Terms of Reference for consultants, subcontracts and partnerships, to be revised by the National Project Coordinator, and for supervising their technical assignments, ensuring consistency between various project elements and sources of funding. He/she will also prepare technical reports, as requested. He/she shall report to the Project National Coordinator and to UNDP CO. This is a full-time position for the duration of the Project.

The **Monitoring Consultant** shall be hired to support the monitoring of public policies for the sector and the overall project implementation. He/she will prepare progress reports and undertake field visits, systematizing project technical results and indicators measurement, assisting in the production of knowledge products, including best practices and lessons learned.

The **Technical Assistant** shall give support in database updating, including monitoring and GHG verification of the charcoal conversion projects. He/she shall assist in the technical design and implementation of the MRV system and its monitoring mechanisms, undertaking field visits and preparing specific technical reports on conversion mechanisms and technical issues. He/she shall lead the preparation of the technical content of training materials and other data for the dissemination of information.

Mid-term review and terminal evaluation – International and/or local consultants with ample experience in project evaluation to perform independent assessments of project implementation, in order to determine progress being made towards the achievement of outcomes and identify course corrections, as needed. Findings of the mid-term review will be incorporated as recommendations for enhanced implementation during the second half of the Project's term.

ANNEX B - Risk Analysis

Project Title: Production of sustainable, renewable biomass-based charcoal for the iron and steel industry in Brazil					Award ID: 77784	Date: CEO Endorsement			
#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Mngt response	Owner	Submitted, updated by	Last Update	Status
1	Government policies and programmes would not be continued and project results would not be mainstreamed.	PIF	Governance	Enter probability on a scale from 1 (low) to 5 (high) P = 2 Enter impact on a scale from 1 (low) to 5 (high) I = 4	Brazil has presented explicit voluntary GHG emission mitigation actions in the iron and steel industry. However, sector ownership needs further strengthening as market stimuli for charcoal are rather weak. Federal and State Government entities and the private sector will be partners in the Project and take part in work groups. A more market-oriented approach was devised during PPG to provide financial triggers for the private sector to deliver charcoal and GHG reductions under a performance-based payment mechanism.	National Project Director	UNDP CO	Submission date	No change
2	The private sector and technology institutions would fail to develop and implement clean and resource-efficient charcoal conversion technologies.	PIF	Development	P = 2 I = 4	Since PIF approval, several I&S companies have made progress on advanced charcoal technology. The Project seeks to incentivize further development by making full-scale demonstration financially rewarding, and by facilitating ongoing technical development. Different to the PIF, the Project will now support several technological propositions in parallel, which reduces this risk, enriches the lessons that can	National Project Director	UNDP CO	Submission date	No change

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Mngt response	Owner	Submitted, updated by	Last Update	Status
					be learnt, and widens the scope for replication. However, one cannot exclude the possibility that one or more technologies will underperform or be installed with delay.				
3	It would prove unfeasible to verify the GHG emission reductions delivered by advanced charcoal production facilities.	PPG	Development	P = 3 I = 4	With a view on a sector-wide GHG reduction programme, verification of results is made a key aspect of the full-scale demonstration component. To this purpose, an acceptable methodology must be agreed between the proponent and the Project (UNDP and MMA). During operation, results needs to be verified, which is challenging. The Project will draw on technical knowledge and expertise to implement a robust monitoring and verification system in collaboration with national and international experts.	National Project Director	UNDP CO	Submission date	No change
4	The unit cost of the renewable charcoal produced would be too high for commercial use.	PIF	Development	P = 3 I = 3	The production costs of renewable charcoal need to be kept close to the price of mineral coal. Depending on the market context, this is more or less the case. During PPG, this problem statement was refined, by acknowledging that renewable charcoal can be an acceptable prime material, as long as it fits into a profitable business case. By seeking innovative products and alloys, more value is added to the charcoal; for basic commodities,	National Project Director	UNDP CO	Submission date	No change

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Mngt response	Owner	Submitted, updated by	Last Update	Status
					charcoal is less attractive. The Project addresses competitiveness by: (i) aiming for efficient, cost-effective charcoal production; and (ii) exploring more attractive business models for the charcoal sector.				
5	Global climate change would have a negative effect on biomass production from forest plantations.	PIF	Sustainability	P = 1 I = 3	Global climate change effects are expected to be negligible within the time-frame of the Project. In the longer term, the forestry sector will likely develop new tree varieties that are better adapted to the prevailing climatic conditions.	National Project Director	UNDP CO	Submission date	No change
6	Conflicts of interests between sector stakeholders would hamper the implementation of the Project.	PPG	Fiduciary	P = 2 I = 5	I&S companies are competitors and may have conflicting interest. The Project builds for on the creation of the Sustainable Charcoal Technical Commission (SCTC) as an expertise provider and a platform for mediating viewpoints and interests, thereby contributing to sector governance. This approach further strengthens the link between the sector and the national climate change agenda under leadership of MMA.	National Project Director	UNDP CO	Submission date	No change
7	Sector companies would not respond to the market triggers and incentives created through the bidding mechanism as expected	PPG	Development	P = 2 I = 5 (critical)	The high-level objective of the Project is to make a contribution to the emission reduction agenda of the I&S sector. During PPG, it was observed that companies are hesitant to take the lead on this, as (i) present market conditions are not favorable (by consequence, investments are not attractive), (ii)	National Project Director	UNDP CO	Submission Date	No change

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Mngt response	Owner	Submitted, updated by	Last Update	Status
8	Adverse social impacts (such as labor loss) would affect the introduction of advanced charcoal production technology	PIF	Sustainability	P = 2 I = 3	<p>charcoal technology is becoming a valuable asset, which leads to intellectual property issues (technology is not always shared). This makes a technology-driven approach (as proposed in the PIF) less appropriate.</p> <p>This risk is mitigated by including carefully shaping the financial conditions for the tender mechanism in close dialogue with sector stakeholders and independent experts.</p> <p>Stepping-up from labor-intensive, traditional charcoal production to capital-intensive, large-scale conversion will certainly have its impact on labor demand. The total labor demand will likely become smaller. On the other hand, present labor conditions are generally unhealthy and workers are often informally employed, with no access to social and medical security. A market transformation will expectedly lead to more secure jobs. Such a transformation is already taking place as the I&S sector increasingly draws on large forestry plantations.</p> <p>The Project is embedded within a broader context of collaboration between the State of Minas Gerais and UNDP (as expressed in a MoU), which supports poverty</p>	National Project Director	UNDP CO	Submission date	No change

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Mngt response	Owner	Submitted, updated by	Last Update	Status
9	Exchange rate risk	PPG	Financial	P = 2 I = 3	<p>eradication and social equity initiatives, to ensure that the social dimensions of the project are well addressed.</p> <p>The exchange rate between the US dollar and the BR Real may decrease and/or fluctuate, potentially leading to a reduced value of GEF resources. This external risk has affected the performance of previous GEF Projects in Brazil. Careful financial planning should help anticipate such situation.</p>	National Project Director	UNDP CO	Submission date	No change

ANNEX C - Agreements

Two sets of letters are presented in this section. Co-financing letters are included in the project co-financing budget and listed in Part I, Section C of the CEO Endorsement Request. Letters of interest from the private sector are submitted to demonstrate private sector interest in the project, but are not included in the budget or listed as co-financing. The following table summarizes the letters, which are submitted as a separate file. UNDP's co-financing is confirmed through the inclusion of its cash and in-kind commitment in the Project Document.

Co-Financing letters

Letter source	Amount UDD (Converted from Brazilian Reais)	Type
Ministry of Environment	4,500,000	cash
Ministry of Development, Industry and Foreign Trade / Ministry of Environment	25,000,000	loans
State of Minas Gerais	2,100,000	Cash (MG Gov't)
	2,900,000	In kind (private sector)
Ministry of Science and Technology	2,000,000	cash
TOTAL	36,500,000	

Additional Private Sector interest letters

- Arcelor Mittal
- CEMIG
- Minas Gerais Forestry Association

ANNEX D - Support Program for Sustainable Charcoal Plants

This annex presents the rationale and features of the strategy to disburse the GEF Grant resources allocated to support investment in efficient carbonization processes as part of Component 3 of the project. The proposed strategy is focused on the creation of a technological development and a demonstrative Support Program that will promote cleaner technology facilities to yield renewable biomass-based charcoal through more efficient and less GHG intensive production processes. It is important to note that the full design of the system requires legal, financial, and technical expertise and will be conducted during the first year of project implementation, taking into consideration the parameters described in this annex.

This program will enable the development and diffusion of new technological routes for efficient carbonization. The PPG phase studies identified that there are several competing possibilities of technological development that are being explored by the private sector, but they are not fully implemented due to the risks associated to new technology development. Hence, to ensure that the investment of GEF funds catalyzes additional resources to achieve the expected technology development results, the Program will be based on the following features:

- I. The Program shall generate new investments that will catalyze a minimum of 80,000 tonnes of charcoal of annual production capacity using cleaner processes with higher gravimetric yield than the identified in the sector's common practice scenario. This amount can be by multiple investments that in combination will reach the minimum expected production capacity of the Program. At this time, the project expects to support 4 facilities, including large and small scale ones.
- II. The Program will generate a minimum of new and additional emission reduction of 270 kgCO₂e per ton of charcoal produced using the new process/technological arrangements. Hence, as indicated in the approved PIF, by the end of the 5th year of the Project it will generate a minimum amount of 21,600 tonnes annually of CO₂e directly reduced by the supported production arrangements.
- III. The program will generate the description of technical parameters to enable the monitoring, reporting and verification of GHG emissions and gravimetric yield efficiency according to the standards of each process/technological arrangement adopted and supported;
- IV. The program will generate the description of management parameters that enable monitoring of economic, social and environmental performance to support the maintenance and diffusion of sustainable business models funded by the Project;
- V. The performing activities supported by the program shall leverage a total investment of R\$ 60 million reais (depending on the exchange rate this amount would be in the range of US\$ 25 million to US\$ 30 million dollars) distributed among the following types: grant, loan and/or in kind resources.

The three main steps of the strategy to catalyze the necessary additional funding sources required to enable the operation of the project are presented below:

1) Program implementation via PRODOC signature and establishment of the NAMA MRV system to support the program in the market transformation.

UNDP Brazil will put in place a cooperation agreement with the executing Ministry (Ministry of Environment) to support sustainable carbonization projects. On one hand, UNDP Brazil will be the responsible entity to carry out the disbursement of GEF funds (equivalent to around R\$ 10 million reais) that should be treated as grant funding, and that will be transferred after evidence of actual results of the proposed processes/technological arrangements supported are provided by the

beneficiaries, as per the details presented in the steps below. On the other hand, the project's financial partners (BNDES and BDMG) will commit specific funding lines worth about R\$ 60 million (Fundo Clima low interest loans) to provide further financing support and fulfil the co-financing requirements for interested private entities to participate in the Program.

Additionally, as part of the sustainable charcoal sectoral plan, the NAMA MRV system will be designed and implemented with the technical support from the Sustainable Charcoal Technical Commission. The most effective way in guiding the sector towards sustainable charcoal use is to identify the origin of the wood and control the areas from where the renewable biomass resources for charcoal production are coming. The proposed MRV system will apply a comprehensive supply-chain approach that will serve as the basis of the monitoring that will support the recognition and certification of the emission reductions of the submitted proposals to participate in the performance based system.

The certification of the area where the renewable biomass resources are originated for charcoal production, which is the basis for the MRV system that is being designed, is the main procedure through which the state law (phase-out by 2018) will start to be enforced.

Hence, in addition to providing the technical basis for the incentives provided by the project, the MRV system will also allow for: a) its use as a tool for the enforcement agency (at state level) to check compliance with the law requirements; and b) strengthening of the legal and market framework for sustainable wood sources, thereby adding to the economic value of wood resources.

2) Technical criteria for evaluation of Proposals from interested stakeholders.

The receipt of proposals under the performance based program will occur through rounds of bidding processes, starting from Program's launching date. The first round of receiving bids shall be closed 2 months after the starting date. The first round shall aim to receive proposals to reach the level of the minimum production capacity expected by the program as presented in the previous section. However, additional rounds will be conducted as necessary until the full commitment of the project budget is achieved. The Program will consider proposals that deliver effective results by the end of the year 2018 (expected timeframe for the conclusion of the GEF Project). Only proposals that present proof and guarantee of traceability that all wood used in the carbonization process is from planted forests (as per the full supply-chain monitoring defined in the MRV system) will be considered eligible.

Proposals will be classified into two types: small scale and large scale. Proposals for small scale are those considered with productive technological arrangements that have an annual installed capacity of less than 1000 tons of charcoal. To support the effective results generated by one or more small scale proposals, the program will provide R\$ 500,000 thousand in grant resources.. The large scale proposals are those with an annual production capacity of over 1000 tons. The Program will make available the amount of R\$ 9.5 million for one or more approved proposals.

All proposals must provide a detailed description of the following items:

- Process/technological arrangements proposed to be developed and/or implemented, including engineering design;
- Expected annual production capacity of charcoal and total production by 2018 (by weight);
- Expected production efficiency based on the wood to charcoal ratio (gravimetric yield, in percentage): minimum, maximum and average by 2018, and specific methodology to be applied;
- Expected emission reduction based on CO₂e emissions per ton of charcoal produced using the new process/technological arrangements, presenting the expected emissions data: of minimum, maximum and average CO₂e emissions per ton of charcoal produced;
- Annual and total GHG emissions reduction by 2018, contained in the proposal;
- Replication potential of the process/technological arrangements proposed to be developed and/or implemented;

- If applicable, information on additional opportunities of the project to produce by products (types, cost-effectiveness, final output) and its co-generation potential (MW/installed capacity), as well as specific measurement methodology(ies) to be applied;
- Monitoring Plan, containing:
 - a) Description of technical parameters used to enable the monitoring of GHG emissions and gravimetric efficiency according to the standards of each process/technological arrangement adopted
 - b) Description of management parameters and safeguards that enable monitoring economic, social and environmental performance to support the maintenance of sustainable business models;
- Total investment proposed and presentation of the financial analysis of the proposal (in the standard template to be included in the bidding terms):
 - a) Co-financing ratio by the project proposal;
 - b) Classification of co-financing resources according to the amounts in R\$ for each category of funds (grant and/or in kind and/or loans);
 - c) List of items considered as counterpart resources of type in kind.
 - d) If applicable, provide the total amount (in R\$) and the percentage of funding (grant) provided by the private company in the proposal.
 - e) If applicable, state the amount of loans being requested to the financial partners of the Program.

Proposals will assess based on a number of eliminatory and classificatory elements presented below.

Eliminatory elements – Projects will not be accepted unless they demonstrate compliance with the following criteria:

- a) Fulfillment of all the requirements indicated under the item above, “Required elements to be included in the proposals”;
- b) Demonstration that the project will generate a minimum of new and additional emission reduction of 270 kgCO₂e per ton of charcoal produced using the new process/technological arrangements;
- c) Presentation of proof and guarantee of traceability that all wood used in the carbonization process is from planted forests;

Classificatory elements- Projects will be evaluated according to the following criteria (classified into two types – small and large scale; the latter with an annual production capacity of over 1000 tons):

- a) Expected emission reduction based on CO₂e emissions per ton of charcoal produced using the new process/technological arrangements;
- b) Expected percentage of production efficiency based on the wood to charcoal ratio (gravimetric yield), presenting the expected efficiency data of the process/ technological arrangement adopted, and specific methodology to be applied;
- c) Co-financing ratio of the project.
- d) Replication potential of the process/technological arrangements proposed to be developed and/or implemented;
- e) Additional opportunities of the project to produce by products (types, cost-effectiveness, final output) and its co-generation potential (MW/installed capacity), as well as specific measurement methodology(ies) to be applied.

3) Rationale of the transfer of grants funds under the performance based approach.

The approval of proposals to participate in the performance based payments program will be done by the Project Steering Committee. The approval will take into account the analysis performed by UNDP

Brazil, project staff, and the Executing Ministry, with validation from an independent auditor overseeing the bid allocation process.

The transfer of funds for approved proposals will be done based on two major steps:

1. Operational Check Step: 50% of the grants will be available to the approved private entity following the two sub-steps:

a) Initial implementation: 25% of the requested grants for each proposal will be provided up front to the approved private entity to support the initial purchase of equipment and services needed.

b) Full operationalization: 25% of the grants will be disbursed to the approved private entity when the facility is ready to start the charcoal production using the new process/technological arrangement; i.e. when the investments and the monitoring requirements outlined in the approved proposal are in place. A report will be presented by each private entity, which will be verified by an independent auditor and approved by the Project Steering Committee and UNDP Brazil.

1. Performance Payment Step: 50% of the grants will be disbursed to the approved private entity based on the performance of projects and upon verification of compliance with expected GHG Emission Reduction results. Partial payments for partial compliance will be allowed, with a penalty system for gaps between commitments and effective results to be applied. The payments will be executed upon approval by the Steering Committee of the technical reports presented by the project (including an independent auditor), following all MRV procedures.

At least one annual field verification per project will be conducted by the program. The Project Steering Committee shall ensure that the results obtained and properly paid by the Program will not be used/paid by other international compliance schemes linked to GHG emissions reduction. All efficiency results and GHG emission reductions received and properly paid by the Program will be owned by the Brazilian Federal Government, and may or may not be used to fulfill national voluntary commitments and/or integrated into systems developed or recognized by Brazil to monitor GHG emissions reductions. The approval of the final payment will be based on the verification of solid evidence that the proposed emissions reductions were real and followed the Project's monitoring arrangements of the designed MRV system. The results payment can only be undertaken after a full year of production/ emissions reductions were achieved.

At the end of the project (December 2018) information on lessons learned, monitoring reports and business models supported will be widely disseminated to facilitate technological diffusion, and contribute to generating market transformation. For this purpose, all the information included in the MRV reports will be publicly available. Projects will also be required to report on the financial performance of the charcoal production facilities to allow for an economic assessment of the technological options.

It is expected that the most successful models of charcoal production and technology development in the program become "business case" stories to trigger replication. Likewise, the program's success is expected to result in the inclusion of additional activities within the program, as part of the full implementation of the sustainable charcoal sectoral plan and NAMA.

Additional information on the structure of Monitoring Modules under the SMMARE system.

The SMMARE is designed to be a tool able to provide information, in particular in relation to the mitigation actions implemented in each Mitigation Plan and its associated methodologies and assumptions, the progress made in their implementation and information on domestic measurement, reporting and verification. In the case of this project, SMMARE can be the tool to give conditions to the performance based payment to work, once the GHG emissions reduction results can be informed in this system.

The SMMARE is planned to be supported by a software platform that will be responsible for ensuring transparency and cost effectiveness to the system. Each Monitoring Module - directly related to a specific Mitigation Plan - will have its own software application with features to gather the data and to calculate the indicators of the GHG emissions reduction required to assess the goals established in the Mitigation Plan. All Monitoring Modules are expected to share information through standardized interfaces, in order to provide centralized coordination and supervision of the efforts undertaken by the country. The Monitoring Modules will encompass the following elements:

- List of mitigation actions assessed (including their degree of implementation);
- Methodological assumptions;
- Results per mitigation action – “Indicators” (disaggregated at the appropriate level, and to the extent possible, according to the scenario in which the monitoring takes place);
- Quality Assurance and Quality Control procedures.

As results of the development and implementation of the SMMARE it is possible to say that:

- 1 The participation of technical experts, with wide experience in national GHG inventory planning, implementation and review in the development phase is vital to achieve methodological robustness;
- 2 Each Mitigation Plan should have a Monitoring Module, able to assess the GHG emissions reduction achieved through the actions implemented by each Plan;
- 3 The on-going dialogue with the Ministries responsible for each Mitigation Plan will provide the necessary political and operational guidance for each Monitoring Module;
- 4 The use of "external" institutions, with the necessary technology and human capital, will produce the key Indicators for each Monitoring Module in a cost effective manner;
- 5 A software platform connecting all Monitoring Modules, will ensure transparency and cost effectiveness of the system;
- 6 A general coordination is necessary to promote synergies and avoid the duplication of efforts.

Annex E - Additional Information on Charcoal Conversion Technologies

(The following section is based on data gathered during the PPG phase, and on the article "Sustainable charcoal production in Brazil" by Luiz Augusto Horta Nogueira, Universidade Federal de Itajubá; Suani Teixeira Coelho, CENBIO & Alexandre Uhlig, Instituto Acende Brazil. Available at: FAO website: www.fao.org/docrep/012/i1321e/i1321e04.pdf.)

Charcoal production techniques are still the same as one century ago. Operating the kiln is very simple and usually there is neither qualitative nor quantitative production control. Moreover, the current technology discards tons of valuable chemical components as gas emission, (although some companies manage to recover these gases). This is so since in the carbonization process, 24 to 40% of wood dry mass is transformed into charcoal the rest is released to the atmosphere. Gases from wood carbonization contain more than a hundred organic chemical components, including fuel gases, acetic acid, methanol and tar.

Fuelwood carbonization takes place in a traditional way at masonry kilns with cycles of heating and cooling that last for many days. At present, the rectangular kilns equipped with systems of steam condensation and tar recovery are the most advanced being tested in the country. However, the kilns with small production capacity, without mechanization and without systems of tar recovery, known as "*rabo-quente*", continue to be the most used charcoal kilns (see Figure 8-1). They are constructed with ordinary bricks and roughly have a semi-spherical form. The temperature of carbonization is approximately 500°C.



8-1 Photograph of traditional brick kiln "*rabo-quente*" for charcoal production in Brazil.

The carbonization operation consists of filling the kilns through the doors with dry wood, closing the kiln completely, leaving a small hole on the top to make the ignition and a several other small holes on the floor level to allow air entrance. The completion of the carbonization process is indicated by the changing of the color of the smoke through the top holes. When this occurs, all the small holes are closed and the oven is left to cool for three to four days. A typical charcoal kiln is a battery composed by six kilns. This number is related to the carbonization cycle process, which lasts for a duration of six days. The procedure is such that one day is allotted to fill the kiln, another day and two nights for the carbonization process to take place, two days for the cooling and one day for the discharging. This way, each day, there is at least one kiln to be loaded with wood, another to be discharged with the

semi-finished products and four ovens to allow the carbonization process. Other configurations with even longer cycles also exist.

Large-scale charcoal production is done by organization of local laborers by contractors and modular expansion of the rabo quente technology. This is shown in Figure 8-2. The productivity of the charcoal production is affected by the operation conditions, kiln project and wood humidity. On average, the traditional way/technology the charcoal production tends to be an unusual day-to-day main business. Usually it is identified that carbonization sites have very low cost facilities (without any additional utilities). Moreover, they tend to have a very low gravimetric yield (~ 25%), meaning for every ton of wood placed at the beginning of the process below 250 kg results as the output of the charcoaling activity.



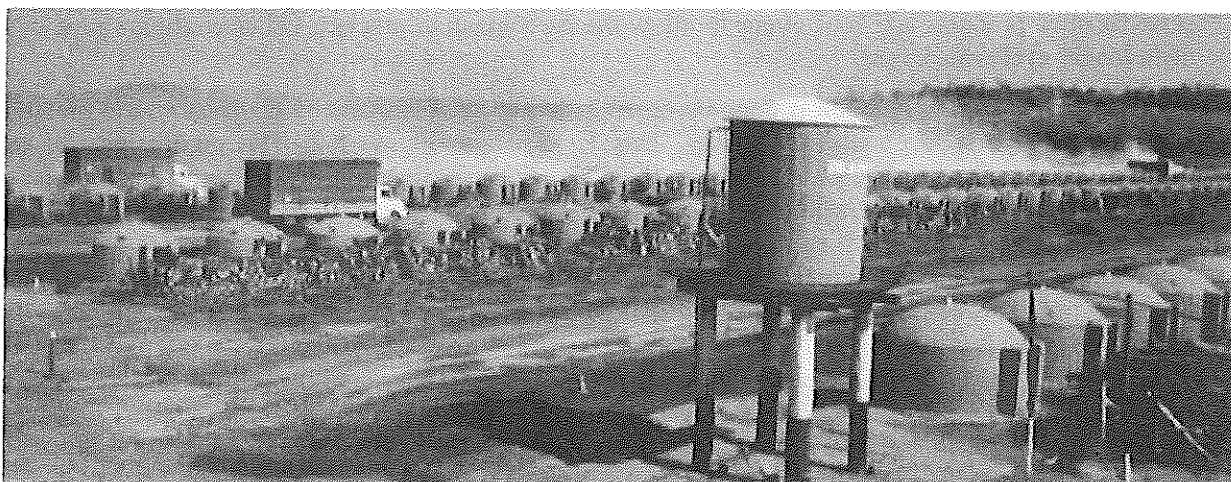
8-2 Set-up of traditional brick kilns into modular sections to allow larger outputs. Work is organized by local contractors. No economies of scale are achieved.

(The following section is summary of technological assessment based on a technical report "Assessment of Technologies for Charcoal Production" received from Maria Cristina Rezende, Charconsulting, who attended UNDP's PPG mission in Belo Horizonte on June 2013 and prepared the report on November 2013, and additional data gathered during the PPG phase. Her work provides an update on technological and logistical improvements, including a comparison of economic performance.)

For comparison purposes, three technologies for charcoal production were selected beyond what is identified as the business-as-usual "rabo-quente" kilns. They are presented in the following items and figures.

1. Circular brick kilns. If properly operated, a gravimetric yield of 30% can be achieved. For a large-scale production site, the following figures are given:

- Wood load per kiln and per cycle: 6.9 tons.
- Charcoal output is 1.9 tons per cycle.
- Productivity: 67 tons of charcoal per worker, per month;
- Unit production costs charcoal: 575 BRL/ton;
- Typical investment cost: BRL 101 per ton charcoal per year

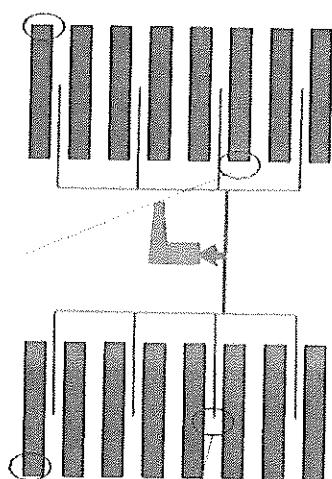


8-3 Large-scale production site based on row of improved circular kilns.

2. Rectangular brick kilns (Viena Model). Larger kilns are made of bricks with metal support pillars and doors and known as the Missouri or Vienna type. An optimum performance gravimetric yield of 32% can be attained. For a large-scale production site, the following figures are given:

- Wood load per kiln and per cycle, is 109,5 tons.
- Charcoal output is 35 tons per cycle.
- Productivity: 67 tons of charcoal per worker, per month;
- Unit production costs charcoal: 478 BRL/ton;
- Typical investment cost: BRL 177 per ton charcoal per year

The rectangular brick kilns are also being tested in the following arrangement where the fume gases of the individual kilns can be collected per cluster of kilns and flared. The following figure presents a layout of the technological approach suggested.



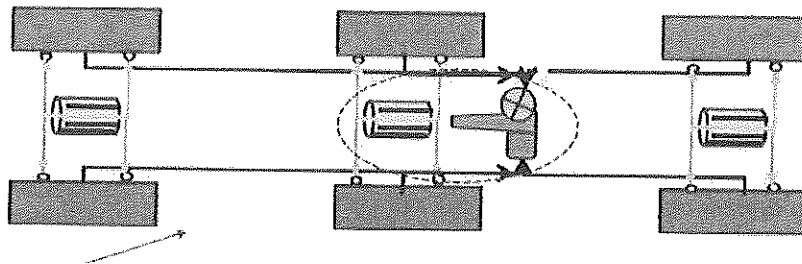
8-4 Capture and flaring of fume gases of Viena-type kilns.

Another testing possibility is to use heat recovery peripherals for wood drying. Advances in this field are being tested by ArcelorMittal and include rectangular brick kilns of various sizes. The kilns are paired in clusters of six units, in which the excess heat produced during the carbonization process in one unit is transferred to the paired kiln, which is filled with wood (Figure 8-6). This heat inflow

allows pre-conditioning of the wood before starting of the pyrolysis phase. A gravimetric yield of 34% can be achieved at its top testing conditions.



8-5 Big Rectangular brick kiln supported with metal pillars and doors with heat recovery and testing gas capture peripherals.



8-6 Paired setup of Big Missouri kilns allowing heat recovery for wood drying.

3. DPC (Drying-Pyrolysis-Cooling) technology. This approach aims to tackle one of the main cost factors of capital-intensive charcoal conversion technologies, i.e. the long throughput time of the batch process as a result of drying and cooling. Advances in this field are made by several companies. One of the innovations is the use of transportable metal containers.. Fume gases are captured. Although a promising technology, DPC still need effective demonstration. A unit with 40 kilns was installed by the in Goianesia, state of Pará. Given economic difficulties faced by the Steel Industry owner, this plant operated for a short period of time. Figure 3-7shows the sketch of the arrangement of kilns and photos with details of the unit deployed. The DPC system (Drying, Pyrolysis and Cooling) differs by having full control over the process, in which the operation cycle, including loading and unloading, is carried out in 72 hours. The DPC process works with buckets or containers that are moved by roll-on trucks.

For demonstration effect of the importance of seeking aggregate revenue via byproducts, it was considered the recovery of tar attached to DPC kilns. In an ideal situation in the application of the DPC technology, it would be possible to recover 10% of the weight of the wood raw material in the form of tar. This product has calorific value above 6,000 kcal/kg and specific weight greater than 1.10, which makes possible its use for industrial heating and/or electricity generation. At the tables and

figures this combination was named DPC+TAR. When the technological approach of the DCP was taken separately without taking into consideration the tar recovery scenario the label DPC was used.

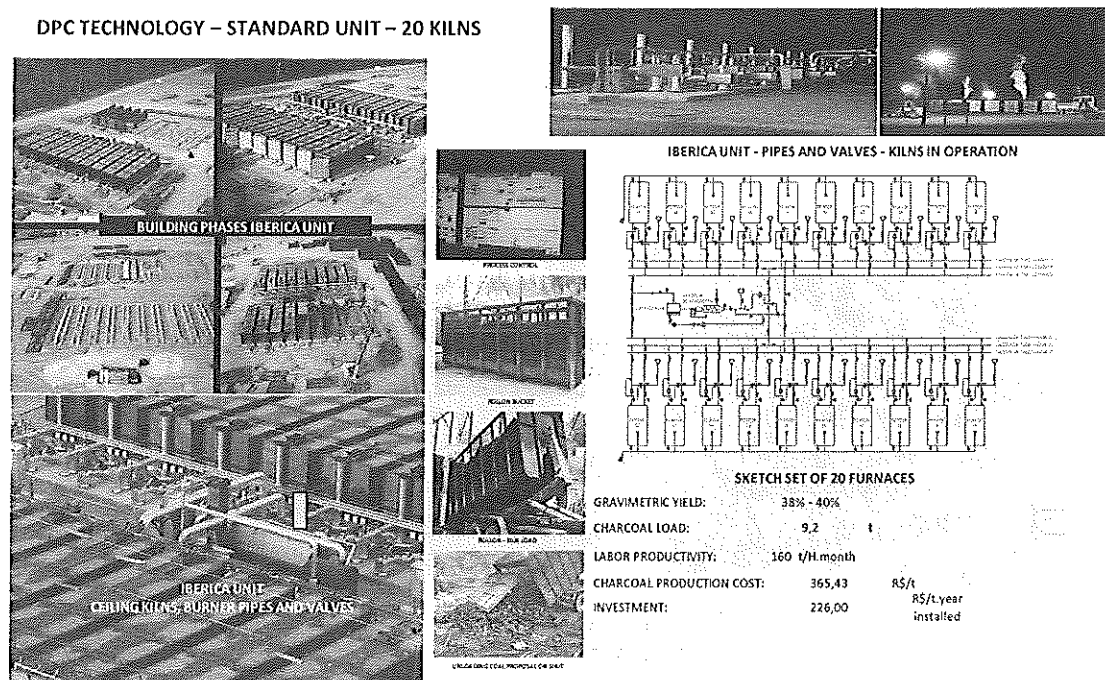


Figure 8-7 – DPC technology

Comparative Study of Technology and Economic Feasibility

It is worth highlighting that the costs presented are related to information that was accessible and reflect the pricing conditions in Brazil as of February 2011. The analysis and conclusions presented in this annex remain valid in order to make a comparison of the costs and investments of the various technologies.

OPERATING CYCLE AND PRODUCTIVITY

Figure 5 below indicates that as far as brick/clay kilns are concerned, the circular kiln presents better productivity. It makes 0.47 kg/h of charcoal for each cubic meter of kiln, while the rectangular brick kilns do not exceed 0.3 kg/h. This is due to both manual load, which leaves less empty spaces than the mechanical load, as well as to the fact that more cooling time is needed in rectangular brick kilns.

Figure 5 - Comparative assessment of Kilns – cycle and productivity

FIGURE 5: KILN MODEL	COMPARATIVE EVALUATION OF KILNS – CYCLE AND PRODUCTIVITY							
	TIME (hours)					DAYS PER CYCLE	CYCLES / MONTH	PRODUCTIVITY (kg/m ³ .h)
	LOAD	DISCHARGE	CARBONIZATION	COOLING	TOTAL			
CIRCULAR KILN	6	6	108	120	240	10,0	3,00	0,440
RECTANGULAR VIENA MODEL	3	4	120	192	319	13,3	2,26	0,258
DPC	0,25	0,25	48	23,5	72	3,0	10,00	1,298
DPC + TAR	0,25	0,25	48	23,5	72	3,0	10,00	1,298

Technology based on higher engineering content, such as DPC, presents a much higher productivity, of the order of 1.3 kg/h per m³ of kiln.

PRODUCTION CAPACITY AND INVESTMENT

For comparative purposes, the production and costs components were assessed. The circular kilns investment per unit of installed capacity is of R\$ 101/t. year. This kind of kiln has the lowest unit investment among the alternatives assessed. The DPC technology requires the highest amount of investment among the technologies that have been compared: an unit investment cost of R\$251/t. year. For the rectangular kiln of Viena model have lower investment, in the order of R\$ 166/t. year installed capacity.

STAFF AND INCREASES IN THE LABOR PRODUCTIVITY

In the operation of circular kilns it was identified that the productivity of labor is of around 17 tons of charcoal per person and this component represents 21% of the overall production cost. All other technologies promote a significant increase in the labor productivity.

The rectangular brick kilns of the conventional type, represented by the Viena model, increase labor productivity by 75%; the average productivity reaches 67-80t/month of charcoal per employee. This specific component represents 9% of the overall cost. The DPC technology tends to increase the labor productivity of the order of 89% compared to the circular kilns, and the average productivity is 150 t/month per employee, including administrative staff. The share in the production cost would be 8%.

In all the assessed scenarios the quality of the labor conditions increases significantly compared to the conditions identified in the business-as-usual scenario using the “rabo-quente” kilns.

UNIT PRODUCTION COSTS

In regards to the discussion on unit production costs when compared to the circular kilns, there is a high increment in labor productivity when more advanced technologies are applied. However, the investment costs of circular kilns holds the best indicators in terms of depreciation.

As far as machines and fuel are concerned, costs do not significantly change. The main production cost is related to the production/harvesting/transportation of the wood to be placed in the charcoal production unit. All efforts should be made to reduce wood consumption by improving the gravimetric productivity.

The graph presents the comparison of the technologies in regards to the participation of each component in the production cost of charcoal. The DPC kiln presents the higher gravimetric yield (around 40%), which significantly reduces the cost of wood (R\$ 209 compared to R\$ 348 for the circular kiln). Given that transport operation makes use of roll-on containers, it implies in a slight reduction in machinery and fuel costs for this technology. The figure 6 below presents comparative data about in a comprehensive manner.

Figure 6: Participation of each component in the production cost of charcoal (CV)

FIGURE 6: CHARCOAL COMPONENTS COSTS COMPARISON						
KILN TYPE	Wood delivered at the unit site	Staff	Machinery & Fuel	Transport	Depreciation + amortization	Unit Cost R\$/t CV
CIRCULAR	348,80	121,46	20,47	53,66	30,35	574,74
RETANGULAR / VIENA MODEL	308,53	41,04	19,85	53,66	49,81	472,89
DPC	209,94	29,45	15,16	53,66	75,38	383,59

EFFECT OF GRAVIMETRIC YIELD IN THE COST OF PRODUCTION

From the consideration of the previous item it can be verified that, generally, the higher the gravimetric yield, the lower the production cost. Figure 7 aims to quantify this effect in the light of each of the technologies assessed.

As far as the circular kilns are concerned, the cost is much higher for the same performance. Given that the productivity can hardly be of more than 30%, the cost is usually no less than R\$ 575/t of charcoal.

As far as the technologies Viena and DPC are concerned, the key factor in the choice of the technology to be used is their respective gravimetric yield. The DPC technology, with an indicative yield of 40%, would have the lowest unit production cost: R\$ 385.00. While in regard to the Viena kiln the indicative gravimetric yield of 32% represents a cost of R\$ 473/t of charcoal. This is an important conclusion: the gravimetric yield has a crucial impact on the unit production cost of charcoal.

Figure 7 (Table):

FIGURE 7: ASSESSMENT OF SENSITIVITY OF PRODUCTION COST VARIATION OF GRAVIMETRIC YIELD					
Kiln Type		Charcoal cost (R\$/t)			
		CIRCULAR	Rectangular VIENA	DPC	DPC + TAR
GRAVIMETRIC YIELD	26%	654,85	569,64	562,70	471,74
	28%	611,93	532,78	526,34	434,73
	30%	574,74	500,84	494,83	402,66
	32%	542,19	472,89	467,25	374,60
	34%	513,47	448,23	442,92	349,84
	36%	487,94	426,31	421,30	327,83
	38%	465,10	406,70	401,95	308,13
	40%	444,54	389,04	384,53	290,41
Expected cost	GY %	30%	32%	40%	40%
	COST	574,74	472,89	384,53	290,41

GHG EMISSIONS REDUCTION - POTENTIAL TO AGGREGATE REVENUES

Taking into consideration the possible results payment approach that would generate revenues regarding to emission reductions. The assessment was made using a broad carbon dioxide equivalent taking into consideration specially the reductions of the methane emissions. This could be an important tool to promote technological changes under the charcoal production supply chain. The following opportunities for emission reduction exist:

a) by the gravimetric yield improvement, the number of emission reduction can be calculated as the difference between the CO₂ emission of the technology typical yield and the baseline yield.

b) by flaring the gas from the process – if it is considered complete burning, i.e., zero methane emission, the maximum of emission reduction that can be achieved is equivalent to around 60 kgCH₄ reduced per ton of charcoal. So, in comparison to the standard business-as-usual scenario the maximum of the emissions reductions is 1.2 t CO₂ eq per ton of charcoal produced. However, due to the technical difficulties it is not plausible to assume a 100% flaring scenario.

c) by using by-products recovered from the carbonization process - the use of tar in a subsequent part of the supply chain or in a different factor such as energy/electricity generation. The by-products would be used as a fuel to replace a fossil fuel, which would translate into emission reductions.

The numbers are significant for technologies that imply in higher gravimetric yields and gas flaring, as the technologies Viena and DPC. For the DPC kiln with tar recovery, which would subsequently be used to replace fossil fuel, there would be an additional emission reduction of CO₂ that the project is considered as indirect benefits because they are placed in a different sector. Hence, assuming a conservative approach the project assumes that incremental emissions reductions can be achieved by the application of the assessed technologies resulting in an emission reduction that can vary from 132 kg of CO₂e to 800 kg of CO₂e per ton of charcoal produced. Therefore, it is considered appropriate to adopt as the minimum thresholds of 270 kg of CO₂e of emissions reductions to be applied in assessing proposal to be supported by the project.

Annex F - Estimated Direct Project Costs /UNDP Country Office (ATLAS Budget Line 74599):

Budget Description	Unit Price (a)	Amount Year 1 (USD)		Amount Year 2 (USD)		Amount Year 3 (USD)		Amount Year 4 (USD)		Amount Year 5 (USD)		Total (USD)
		USD total (a*b)	No of Units (b)	USD total (a*b)	No of Units (b)	USD total (a*b)	No of Units (b)	USD total (a*b)	No of Units (b)	USD total (a*b)	No of Units (b)	
Payment Processes	36,39	4366,8	120	4366,8	120	4366,8	120	4366,8	120	4366,8	120	17467,2
Issue checks	16,32	408	25	408	25	408	25	408	25	408	25	1632
Create Vendor Profile	20,32	2844,8	140	1016	50	1016	50	1016	50	1016	50	5892,8
AR Management Processes	37,64	3011,2	80	2258,4	60	2258,4	60	602,24	16	602,24	16	8130,24
Procurement (average)	328,56	6571,2	20	4928,4	15	4928,4	15	1642,8	5	1642,8	5	18070,8
Human Resources (average)	1535,92	4607,76	3	4607,76	3	4607,76	3	4607,76	3	4607,76	3	18431,04
Total USD		\$ 21.809,76		\$ 17.585,36		\$ 17.585,36		\$ 12.643,60		\$ 12.643,60		\$ 82.267,68

