ICMM
International Council on Mining & Metals

InBrief

The role of mining and metals in land use and adaptation

Climate Change
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InBrief

This paper forms part of a series of InBrief publications that begin to scope out the links between the mining and metals industry and the three focus areas in ICMM's climate change program.

Mining is a global industry with operations spread across developing and developed countries. In many developing countries it is often a significant contributor to GDP and poverty alleviation. Minerals and metals are also required for low carbon development – e.g. copper, aluminium, platinum and coking coal are inputs for building renewable energy infrastructure.

Climate change presents both challenges and opportunities for the mining and metals industry. The three focus areas in ICMM's climate change program offer industry-specific insights on issues important to climate policy formation.

Background

Greenhouse gas emissions (GHG) from land use, land-use change and forestry (LULUCF) contribute approximately 15-20% of global emissions. LULUCF relates to all emissions, and removal of CO_2 – from the atmosphere from the use of land conversion between land-use types, and the management, clearance and replanting of forests.

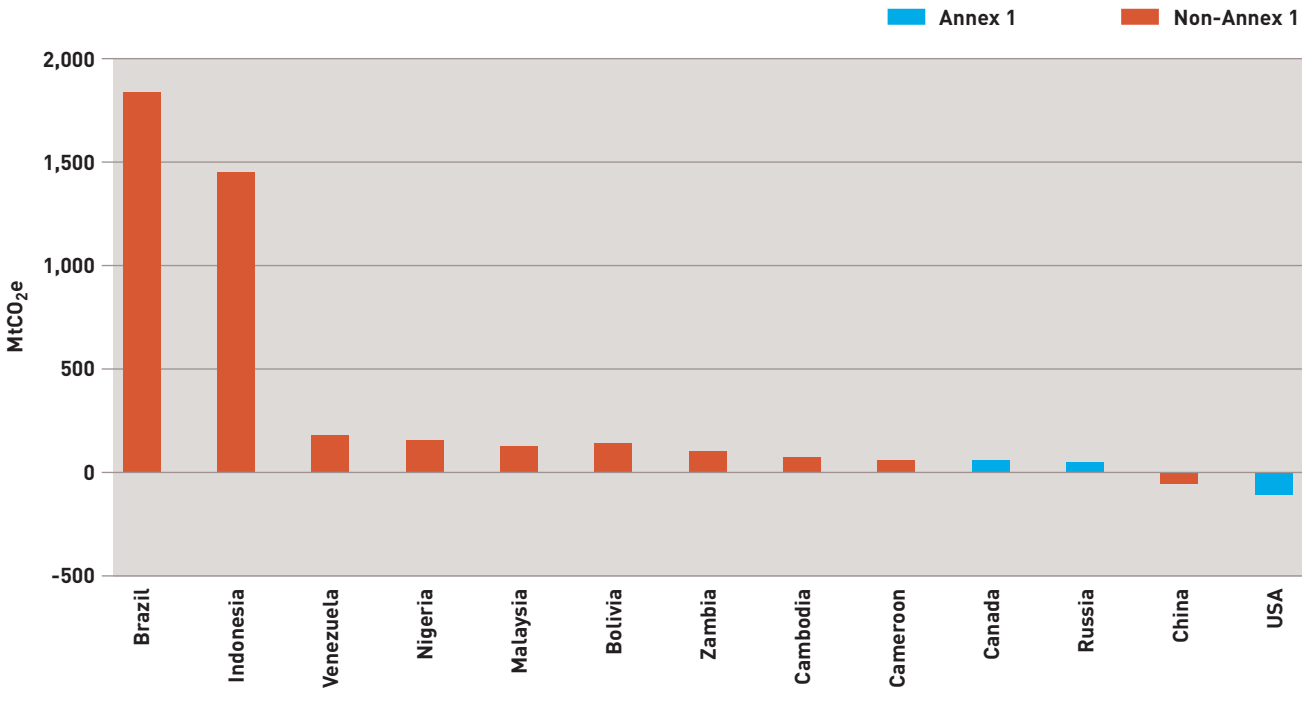
LULUCF has three main components:

1. Land-use emissions and removals relate to any emissions or removals incurred during the use of land in one classified type. For example, draining peat does not include any change in land-use but will result in the emission of CO_2 as the speed at which the peat oxidizes accelerates.
2. Land-use change emissions relate to emissions or removals resulting from land changing between land-use categories. For example, as grassland or forest is converted to settlement or infrastructure (e.g. roads or urban sprawl), carbon stored in the soil is released into the atmosphere.
3. Forestry emissions or removals relate to any emissions or removals from forest land that remains forest land – whether a net emission from unsustainable forest management that results in the carbon locked in biomass and soil being released and not entirely replenished by forest regrowth or net carbon removals from the atmosphere as a result of the replanting of trees in degraded areas.

The majority of LULUCF emissions come from land-use change and most emissions result from tropical deforestation, largely due to conversion of the forest to more lucrative economic activities such as agriculture and mining. Other categories are also important contributors, but all LULUCF categories have the potential to remove carbon from the atmosphere through sequestration. This creates carbon sinks, which contribute to addressing the climate change challenge.

Net emissions from LULUCF are concentrated in a relatively small number of countries – mostly Brazil and Indonesia. Between them, they represent almost two-thirds of emissions from LULUCF (Figure 1), mainly due to the conversion of tropical forests. The majority of emissions relating to LULUCF originate in Non-Annex 1 countries – the countries that do not have quantified emission limitations or reduction commitments under the Kyoto Protocol. Figure 1 also highlights the opportunity that LULUCF provides to address the climate change challenge. The negative levels of LULUCF emissions in China are mainly due to large reforestation programmes.

Figure 1: Land-use change and forestry emissions 2005



Source: World Resources Institute, Climate Analysis Indicators Tool (CAIT)

Land-use emissions and the mining and metals industry

Emissions from land use, land-use change and forestry (LULUCF) represent a major component of global emissions. The sources of these emissions and mitigation opportunities differ from energy and industrial emissions. Mining interests represent one of the largest private sector land owners globally. There are a range of options at every stage of the mining cycle to reduce the land-use impacts of mining. These options bring benefits not only in terms of reduced greenhouse gas emissions but also in increasing the adaptability of both mine operators and local area to the projected physical impacts of climate change, reducing environmental impacts on water and biodiversity and increasing benefits to local communities. This paper outlines some of these potential options, drawing on case studies from ICMM member companies. It outlines some of the co-benefits and discusses the implications, challenges and opportunities from the option of reduced deforestation and forest degradation in developing countries (REDD+) for mining operators worldwide.

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Our Climate Change program

In May 2011, ICMM formally launched its climate change program. Building on ICMM's 2009 *Policy on climate change: Implementing a global solution to managing a low emissions economy*, ICMM's Council of CEOs established a climate change program with three elements: principles governments should follow should they decide to regulate greenhouse gas (GHG) emissions, a set of commitments that members will meet, and three focus areas of work.

The program is aimed at: (1) ensuring ICMM companies continue to contribute to sustainable development while participating positively in the resolution of the climate change challenge; and (2) securing the continued competitiveness of the mining and metals industry in a future low carbon economy.

This initiative seeks a measured transition to a low-carbon future. The principles-based approach at its core is intended as a contribution to the evolution of climate change-related public policy when policies are being designed and implemented. This approach recognizes the reality of nation-specific solutions which need to respect the circumstances around the world and a country's different priorities (for example, poverty reduction, development, adaptation).

The core of ICMM's climate change program implementation is provided by:

a) an integrated set of seven principles for climate change policy design that build on those contained in the 2009 policy:
   1. provide clear policies for a predictable, measured transition to a long term price on greenhouse gas (GHG) emissions
   2. apply climate change related revenues to manage a transition to a low carbon future
   3. facilitate trade competitiveness across sectors
   4. seek broad-based application
   5. be predictable and gradual
   6. be simple and effective
   7. support low-emission base-load generation technology development.

b) the work program will initially focus on the following three topics:
   1. national climate policies and competitiveness
   2. land use and adaption to the impacts of climate change
   3. measurement, reporting and verification of net greenhouse gas activities.

c) a set of ICMM member company commitments. As a minimum, ICMM members accept their responsibility to:
   1. develop greenhouse gas emission reduction strategies and implement economic emissions reductions opportunities
   2. ensure efficient use of natural resources
   3. support research and development of low greenhouse gas emission technologies that are appropriate to the industry
   4. measure progress and report results.

InBrief

The mining cycle and land-use implications

Mining activity uses land at every stage of the mining cycle – exploration, construction, operation, closure and post-closure. There are many opportunities to reduce land-use impacts and associated emissions and many of these represent good environmental practice. Environmental and social impact assessments and environmental management systems (EMS) can help to identify and evaluate the actions that are possible to mitigate environmental stresses and impacts (see Box 1 for an example). Using such assessments help not only in implementing more responsible land-use techniques, but also in reducing the risk of negative impacts on biodiversity and water. EMS implementation can also help to increase resource efficiency as they help to improve business practice and identify areas of waste and opportunities for action. Involving stakeholders throughout the project cycle, especially in early phases, can help to reduce multiple impacts of mining activity on communities and the environment.

Rio Tinto, a member of ICMM, offers a conceptual outline for mitigating biodiversity impacts which is useful for understanding how to reduce mining's impact on the land (see Figure 2). Avoiding, minimizing, rectifying and finally compensating if other options are unavailable is a useful strategy in understanding how to reduce greenhouse gas emissions.

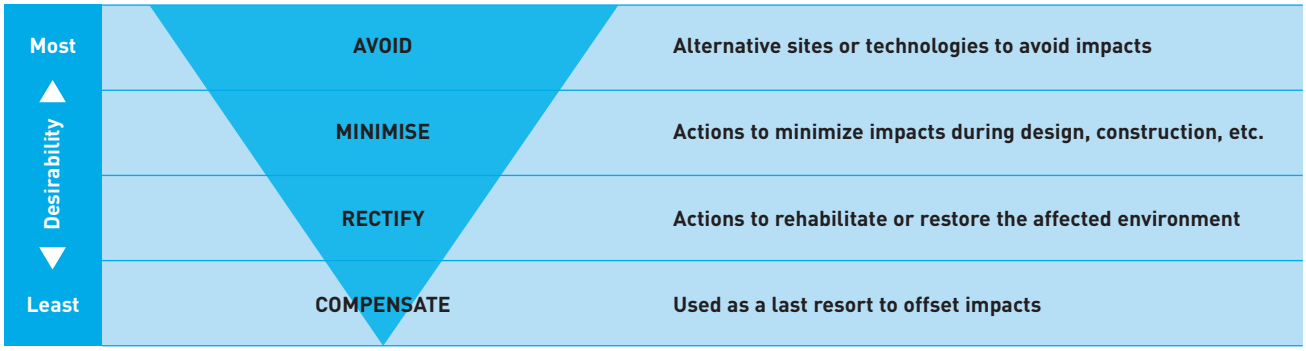
Exploration
Direct land-use impacts from exploration are relatively small. Early stages of exploration involve few invasive techniques and on-the-ground activity tends to follow existing roads and infrastructure. As exploration expands, the land-use impacts may become greater. Construction of new roads for exploratory drilling to obtain sample chips or core can cause land-use emissions both directly or indirectly through opening up forested areas. This makes the land available for more intense land-uses such as logging or even land-use change (e.g. agriculture) which are drivers of deforestation.

Increasing the use of technologies in exploration such as remote sensing or satellite imagery can reduce the need for invasive exploratory techniques. Using helicopters or existing roads instead of constructing new ones can also reduce both direct and indirect deforestation. Planning exploration around existing infrastructure can reduce the impact of roads on the forest. Academic work has identified that the impact of roads on deforestation is greatest when roads penetrate previously inaccessible forested areas. In contrast, when roads are built in and amongst other infrastructure the impacts are much smaller.

Construction
The construction phase of the mining cycle is associated with the greatest direct land-use change. Areas of vegetation are often cleared for mining areas, project facilities such as buildings and infrastructure such as access roads, pipelines and power transmission lines. The construction of roads can also result in land-use change indirectly as they facilitate the opening up of forested areas to timber harvesting, additional mining activity, agriculture and settlement.

Tools available to the mining industry to mitigate this land-use change include environmental management systems and careful decision-making on infrastructure placement and mining area design. Reducing the overall footprint of mining areas can have a significant impact in reducing land-use emissions at the construction stage. Reducing the geographical footprint and careful design of mining pits and ancillary infrastructure also has the co-benefit of reducing the pressure on ecosystems which can help preserve habitats and build resilience. This may have additional benefits within the local community, helping to ensure the provision of environmental goods and services, and strengthen relations between the two parties.

Figure 2: Hierarchy of biodiversity mitigation measures



Source: Rio Tinto, 2004.

"There are many opportunities to reduce land-use impacts and many of these represent good environmental practice."

The choice of mining methods is an important decision. Underground mining typically has a relatively small surface footprint associated with the extraction processing of ore. Open pit mines tend to deepen and widen progressively – increasing the footprint over time. Open-cast mines have a large footprint but offer options for progressive rehabilitation. Considering the land-use emissions implications of these choices, along with the wider GHG emissions impacts associated with different energy requirements, and other environmental, economic, technical and social implications is important in understanding and managing all emissions sources from the mining and metals industry.

The geographical location of mining activity also has implications for potential GHG emissions from land-use. In tropical forests the majority of the biomass, and the carbon it contains, is found in surface vegetation. In temperate forests there is a larger pool of biomass in the soil. Understanding these balances and the implications of mining construction activity on vegetation and soil is important in mitigating GHG emissions in different biomes. Decisions made during the exploration and construction stages can impact the degree of emissions from land-use change during operation, closure and post-closure. Careful planning to reduce the need for future vegetation clearance and to allow progressive rehabilitation and reforestation can help limit land-use emissions during closure and post-closure.

Operation

Land-use change during the operation phase of mining tends to be relatively small compared to the construction phase. Construction tends to take place over only a few years while operation may take decades. The operation phase is important in reducing land-use change and related emissions over the longer term.

The main land-use change implications result from progressive expansion of the mine site – and thus similar decisions discussed during construction may also be included in decision-making relating to expansion.

Some land-use impacts relating to mining operations are unavoidable but emissions associated with land-use change can be managed. For example, tailings ponds are a crucial part of both the technical operation of mining and as an important environmental control method. Factoring in emissions impacts and the potential for site rehabilitation and re-vegetation into the choice of location of tailing ponds could reduce the overall land-use emissions impact of mine operation.

The infrastructure that mining creates may also encourage migration into mining areas – a process that may not cease with the closure of mine sites. Using local labour and expertise can offer vital off-farm labour opportunities – reducing deforestation pressure. This approach can use a ready source of expertise in local areas and provide incentives for careful management of re-vegetation – a process that often requires monitoring to reduce setbacks from, for example, animal intrusions.

Box 1: Development by Design (The Nature Conservancy)

Development by Design is a science-based mitigation planning process that balances the needs of planned development, such as mining, oil and gas, and infrastructure, with those of nature conservation. It is one possible tool that can be built into the feasibility, design and construction stages. This approach supports decision-making on how best to:

- avoid conflicts between project impacts and conservation priorities
- maintain biodiversity
- determine effective and transparent mitigation responses for the development, including compensating conservation actions known as biodiversity offsets.

Closure

Closure relates to ending mining operations in an environmentally and socially responsible manner and restoring the site to a condition suitable for sustainable post-mining use. The level of restoration will depend on local circumstances and may involve the planting of native species or alternative vegetation. Considering closure provisions during the design phase of the mining cycle is important. It reduces the scale of environmental and social rehabilitation required and helps to reduce the overall cost burden.

Developing comprehensive closure plans that consider rehabilitation, re-vegetation and reforestation is an important element in reducing land-use impacts. The extent of rehabilitation and re-vegetation that is possible will vary from site to site. However, there may be potential for creating a net carbon sink from the mining cycle at this stage if mining operations were located in an already degraded or previously cleared area. Re-vegetation or reforestation of these areas can lead to a net carbon gain – and provides an opportunity for mining to make an important contribution to the climate change challenge. Careful management is required, particularly as rehabilitation will have wider social impacts as it helps to preserve and regulate the environmental services on which many communities depend. These include water, soil and the many goods that forests provide.

Post-closure

Post-closure management of sites, by either mine operators or national governments, is also important in mitigating the indirect land-use impacts that can result from the mining cycle. Sites that have been mined out by large mining interests may still hold value for small-scale operators. Creating secure environments that can enable rehabilitation and re-vegetation while reducing the threat of incursion is an important task for operators and governments. The need for continued post-closure management may also bring benefits for local communities through employment and income even after mining activity ceases.

Compensatory measures

The above discussion has outlined potential options for reducing land-use emissions when impacts cannot be avoided, minimized or rectified (see Figure 2). In addition, compensatory measures can also be considered. Providing offset measures beyond the boundary of the mining site can help to mitigate unavoidable land-use emissions and can bring with them other environmental benefits, such as biodiversity improvements. This may mean providing finance to REDD+ or other land-use emissions mitigation projects. These projects look to either reduce future land-use change, through increasing incentives or capacity to keep forests standing, or enhance removals of greenhouse gas emissions through replanting and restoration of forested areas.

Caution should be undertaken when using offsets – both in ensuring that all possible action is undertaken to mitigate emissions in the mining and metals industry and in selecting credible and robust offset projects and credits. Much of this discussion mirrors guidance on the use of biodiversity offsetting measures. In the realm of climate change, standards such as those established by the Climate, Community and Biodiversity Alliance (CCBA) help to identify existing offset projects that reach the highest standards on social and environmental impacts. Such standards also help to provide a bar to which new projects should strive to reach.

Box 2: Vale Florestar – an example of good practice

In 2007, Vale created the Vale Florestar project to promote reforestation of degraded areas using both native and exotic species, contributing to local social and economic development. The program aims to reforest over 300,000 hectares of land in the most degraded area of the Brazilian Amazon in the State of Pará, with 90,000 reforested to date. Vale Florestar will have positive social, economic and environmental impacts for the Amazon region both in the short and long-term.

The project will provide new sources of jobs and income and foster a culture concerned with environmental preservation. It will promote conservation and restoration of forest areas and reduce impacts on native forests – contributing to regional climate equilibrium.

Vale Florestar is on track to becoming Clean Development Mechanism (CDM) project, and is currently undergoing validation for submission to the Brazilian Designated National Authority (DNA).

The main goal of the project is to remove greenhouse gases from the atmosphere but Vale Florestar also targets the sustainable development of the region: the creation of a renewable wood market and subsequent additional net income for the local farmers; the recovery of degraded pastures with the deployment of renewable forests and native species; and the regularization of local properties (which are leased from the local farmers) according to the Brazilian environment legislation. This approach underlines the wider sustainable development benefits of adaptation in the land-use sector.

Synergies with broader adaptation strategies

The options discussed to mitigate emissions from LULUCF throughout the mining cycle are often examples of good environmental practice. In many cases, they could be considered as a key element of broader adaptation strategies for mine operators.

Adaptation to the impacts of climate change for both mine operators and local communities near mining activity requires many different actions. Helping to strengthen the resilience of ecosystems is an important part of this process – it helps to sustain the provision of environmental services that both operators and communities require. It also helps to reduce the impacts of severe weather events that may become more frequent due to climate change.

Planning roads and exploration to avoid watersheds and biodiversity hotspots can increase the long-term resilience of ecosystems and help secure watercourses. Avoiding forest clearance and undertaking careful rehabilitation can help to reduce soil degradation. Both of these are important elements in adaptation strategies as climate change affects water patterns and may drive weather toward more extreme events such as droughts and floods. Securing and strengthening the natural ecosystem processes that help to mitigate the impacts of such events is a vital adaptation strategy- with reducing forest clearance activities playing a crucial part. By building resilience in ecosystems, local communities and mine operators benefit: local communities retain access to the valuable ecosystem services that help provide food and so much more, mine operators also benefit from reliable access to the environmental services they require including steady water supply. Such planning can also help to reduce the threat of natural processes such as forest fires which cause significant and long-lasting damage to ecosystems.

Many of the options discussed in the sections above are in operation in various mine sites around the world. ICMM members already undertake large-scale land rehabilitation activities to limit the impacts of their mining operations post-closure, often with projects that exceed the original mine site as shown in Box 2.

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Policy drivers for reducing emissions in the land use area

The Kyoto Protocol has been the main international driver for reducing GHG emissions, yet the incentives it provided for reducing emissions from land-use are mixed.

Annex 1 countries under the protocol are required to report some elements of their land-use emissions in their national GHG inventories, but the rules are often considered complex. Countries must account for afforestation, reforestation and deforestation and then can opt to account for emissions from cropland, grazing land or forest management.

For Non-Annex 1 countries, the only provision included in the Kyoto Protocol was the possibility of afforestation and reforestation projects under the Clean Development Mechanism (CDM) – avoiding deforestation was excluded. Few of these afforestation and reforestation projects have emerged – predominantly a result of the complexities of the methodologies surrounding accounting and determining additionality – and the fact that the EU will not accept any CDM afforestation and reforestation project credits into the EU Emissions Trading Scheme (EU ETS) which would have represented a major source of demand for forestry credits. As of October 2011 less than 1% of all CDM projects were in this category and there were no certified emissions reductions (CERs).

In the latest rounds of negotiations a new option has emerged: Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+). The '+' refers to the inclusion of a provision for protection and enhancement of standing carbon stocks. REDD+ has emerged as a potential low-cost emissions reduction option that could also bring adaptation, social and wider environmental benefits. The mechanism is still in its early stages of design but pilot activities are emerging across the world – with many different options being pursued and tested. REDD+ could concentrate on small-scale projects, giving direct payments for reducing deforestation levels to communities and land-owners. It could focus on national-level payments for implementing policies and programs to reduce country deforestation rates. It could also involve some combination of both with national and sub-national activities occurring simultaneously in a nested manner: whereby localised projects are part of an overarching national approach. An example of REDD+ that is emerging on the ground today is outlined in Box 3. Such initiatives help to highlight some of the different options available to national governments looking to implement REDD+ strategies. REDD+ adopts a more program-based approach to addressing land use emissions than LULUCF which is more project or site-specific and gives rise to the risk of site-level leakage.

Box 3: REDD+ in Guyana

Guyana is a heavily forested country in the north-eastern shoulder of South America. With almost 90% of its land area covered by forest, it has been at the forefront of the international development of REDD+ policy. It has signed a groundbreaking agreement with Norway for up to US$250 million of performance-related finance over 5 years. This finance is paid into the Guyana REDD+ Investment Fund based upon reductions of carbon emissions from deforestation and degradation below a defined baseline.

Guyana is also a country heavily dependent on the mining industry. Gold and bauxite exports represented over half of all export revenue in 2010. Mining has also been identified as the major driver behind Guyana's relatively low deforestation rate. The majority of this mining activity is small-scale in nature – revolving around small operators mining gold and diamonds, although a number of international companies are currently undertaking exploration activities for a wide range of minerals.

Guyana is using the money it earns from REDD+ to undertake policies in its Low Carbon Development Strategy. These policies focus on providing infrastructure improvements, and also tightening the enforcement of environmental regulations in the extractive industries, including mining. Specific to mining, support and guidance is to be given for rehabilitating and reforesting mined out areas, along with assistance with training and guidance on the use of less environmentally destructive technologies. In addition, work is being undertaken to clarify land-use issues relating to overlapping forestry and mining concessions to reduce both threats to the forest and tension between the sectors.

Financing options for REDD+

A major question for REDD+ is how to raise finance for the projects, programmes and policies that may be required. There was much early discussion about inclusion of REDD+ credits into a global carbon market. While the failure of the US to pass federal cap-and-trade legislation has limited the robustness of such a market, schemes such as those emerging in California, and Australia should provide some demand and finance for REDD+ projects.

There are now two main sources of finance discussed for REDD+:

1. carbon markets – focusing today on voluntary markets but with potential demand from future regulatory emissions-trading schemes, e.g. California
2. funds from national and international donors, including the Forest Carbon Partnership Facility of the World Bank, and the Green Climate Fund.

Whichever route REDD+ takes in the international negotiations, national governments are likely to have a large part to play in determining reference emission levels (RELs), designing monitoring, reporting and verification (MRV) systems, managing

The International Council on Mining and Metals (ICMM) was established in 2001 to improve sustainable development performance in the mining and metals industry. Today, it brings together many of the world's largest mining and metals companies as well as national and regional mining associations and global commodity associations. Our vision is one of leading companies working together and with others to strengthen the contribution of mining, minerals and metals to sustainable development.

ICMM
35/38 Portman Square
London W1H 6LR
United Kingdom

Phone: +44 (0) 20 7467 5070
Fax: +44 (0) 20 7467 5071
Email: info@icmm.com

www.icmm.com

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finance from international funds and implementing or approving policies and projects.

REDD+ may be operationalized at a national level by implementing policies at many different scales. These could include: strengthening forest legislation at national level, amending tax and subsidy regimes, strengthening forest tenure and implementing local payment for environmental services. These policies or projects may include co-benefits such as biodiversity conservation, increasing adaptive capacity and local community development. The practice of offsetting may allow the preservation of the most bio-diverse and ecologically significant areas. However, there may be trade-offs in some areas between reducing GHG emissions and biodiversity preservation. Reforestation of areas using bio-fuel suitable vegetation may bring emissions-related benefits and commercial gains but may not necessarily encourage biodiversity improvements, and may potentially be in conflict with growing food crops. There may be trade-offs between helping to conserve areas of high carbon density and preserving biodiversity hotspots.

Donors funding projects from international funds are likely to factor these considerations into project design. The use of standards like those from the Climate Community and Biodiversity Alliance (CCBA) that include these broader environmental elements are becoming increasingly common across voluntary carbon markets. They will set the REDD+ agenda to some extent and for any compliance markets that follow. This is because country sovereignty in the UNFCCC process has always been a precise right defended by developing countries and the determination of what is good for a country the prerogative of the host country.

REDD+ offers opportunities and challenges to the mining sector. Challenges come from shifting regulatory environments and a stronger focus on emissions from forest clearance. Opportunities come from the potential finance from carbon markets to implement good land-use practice and generating co-benefits for biodiversity, adaptation and communities.

REDD+ finance is only one potential option for funding land-use mitigation projects. Other options include climate bonds, joint ventures and certification schemes.

Climate bonds are financial instruments that would offer the seller an upfront payment for the sort of large-scale investment which is often required for mitigation of GHG emissions. The buyer would receive both a stream of payments of monetary returns and a flow of mitigated carbon from LULUCF – possibly in terms of carbon credits for compliance purposes. It is possible that these financial instruments could be built into current funding structures for mining development and would help provide finance to meet climate and environmental goals.

Joint ventures with other forest and land-users offer the opportunity to manage direct and indirect land-use impacts and help achieve shared objectives. For example, where water supply is required for irrigation in agriculture and for mining operations, joint ventures offer opportunities for developing mutually beneficial environmental strategies.

Harnessing environmental good practice to create differentiated products may become increasingly important as certification schemes grow and consumer demand for certified products increase. Investor attitudes may shift as well with increasing moves to include carbon emissions in decision-making. This is occurring in developed and emerging economies – shown with the development of a Carbon Efficient Index on the Brazilian Security, Commodities and Futures Exchange in 2009. These movements may make raising finance for innovative, low land-use impact mining operations easier.

Summary and conclusions

LULUCF emissions represent a major component of global emissions and moves to address the area are growing through the development of policies such as REDD+. Addressing these emissions can potentially bring complementary benefits by improving adaptive capacity to the impacts of climate change, biodiversity and community development.

Although mining is not the main driver of emissions from deforestation, as a major land owner and an important operator in forested area, the mining and metals industry has a crucial role to play in helping to manage these emissions sources. An increased focus on LULUCF emissions brings challenges and opportunities for mine operators to demonstrate good-practice for managing emissions, resulting in broader socio-economic co-benefits, improved adaptive capacity and potentially finance through evolving REDD+ mechanisms.

Constructive engagement with governments, international institutions, industry and stakeholders will facilitate emission reductions and allow co-benefits to emerge.

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