

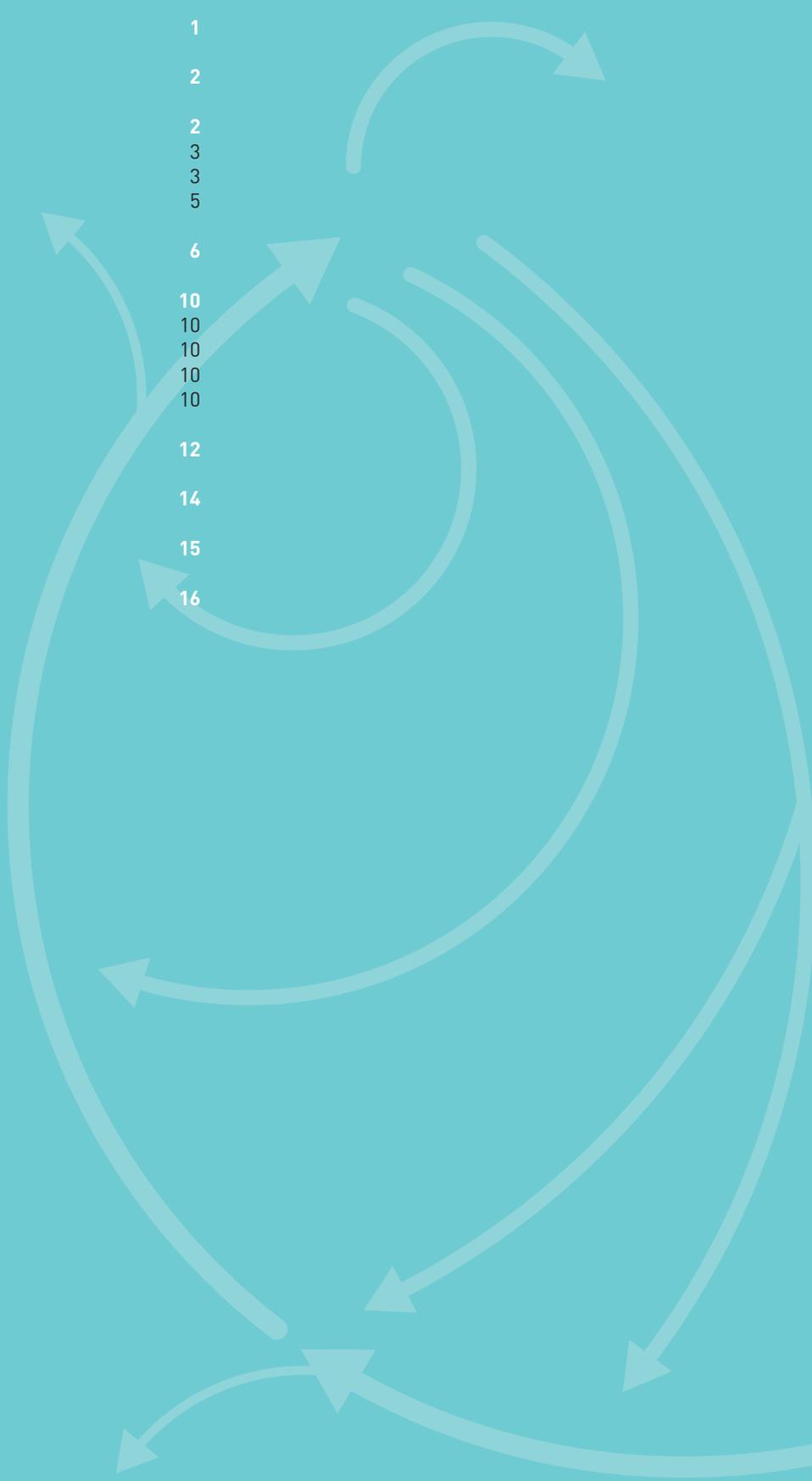
# Materials Stewardship

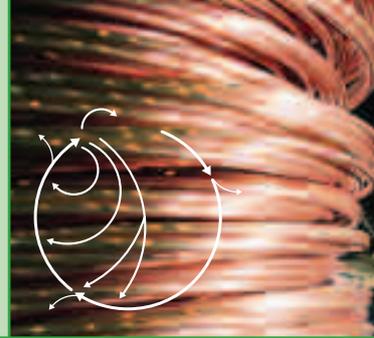
Eco-efficiency and Product Policy



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Metals are highly durable chemical elements that can, in theory, be recycled infinitely with no inherent degradation in properties and are thus highly eco-efficient materials. This publication explores the relationship between three concepts – materials stewardship, eco-efficiency and product policy – that are being applied to help make the most of these benefits in the real world.

The first of these – materials stewardship – has been defined by ICMM as an overarching model required to ensure the optimal and appropriate production and use of minerals and metals in society. Through the activities of ICMM's Materials Stewardship Task Force, for example the publication of *Maximizing Value* (September 2006), the concept is becoming a key element of the mining and metals industry's contribution to sustainable development.

Secondly we discuss eco-efficiency. This concerns 'doing more with less' and it supports materials stewardship by helping to improve the design, manufacture and delivery of materials and products from an ecological as well as economic standpoint. Eco-efficiency harnesses the business imperative of creating value but links it to environmental performance and presents companies with the opportunity to maximize both.

The final element – product policy – is the regulatory tool that many governments apply in relation to improving resource efficiency and reducing the environmental impact of goods and services. Generally entire product systems are considered from raw material extraction through to the end-of-life and analyzed for ways to improve the system. Many of these are the same systems that the mining and metals industry is seeking to optimize through the application of materials stewardship and eco-efficiency.

By understanding the often complex interrelationship between these three concepts, the mining and metals industry is better able to identify specific opportunities for improvement. These will include the integration of best practice and broader communication between all stakeholders in the life cycle of minerals and metals. This will result not only in optimized production, but also in an increased understanding of the attributes of our materials by those managing downstream processes and products, as well as by policy makers who influence their patterns of use in society.

**Paul Mitchell**  
President, ICMM

# 1. Scope

This paper explores the relationships between materials stewardship, eco-efficiency, and the product policies of governments. In doing so, a focus is maintained on the relevance of these industrial strategies and policies to the minerals and metals industry.

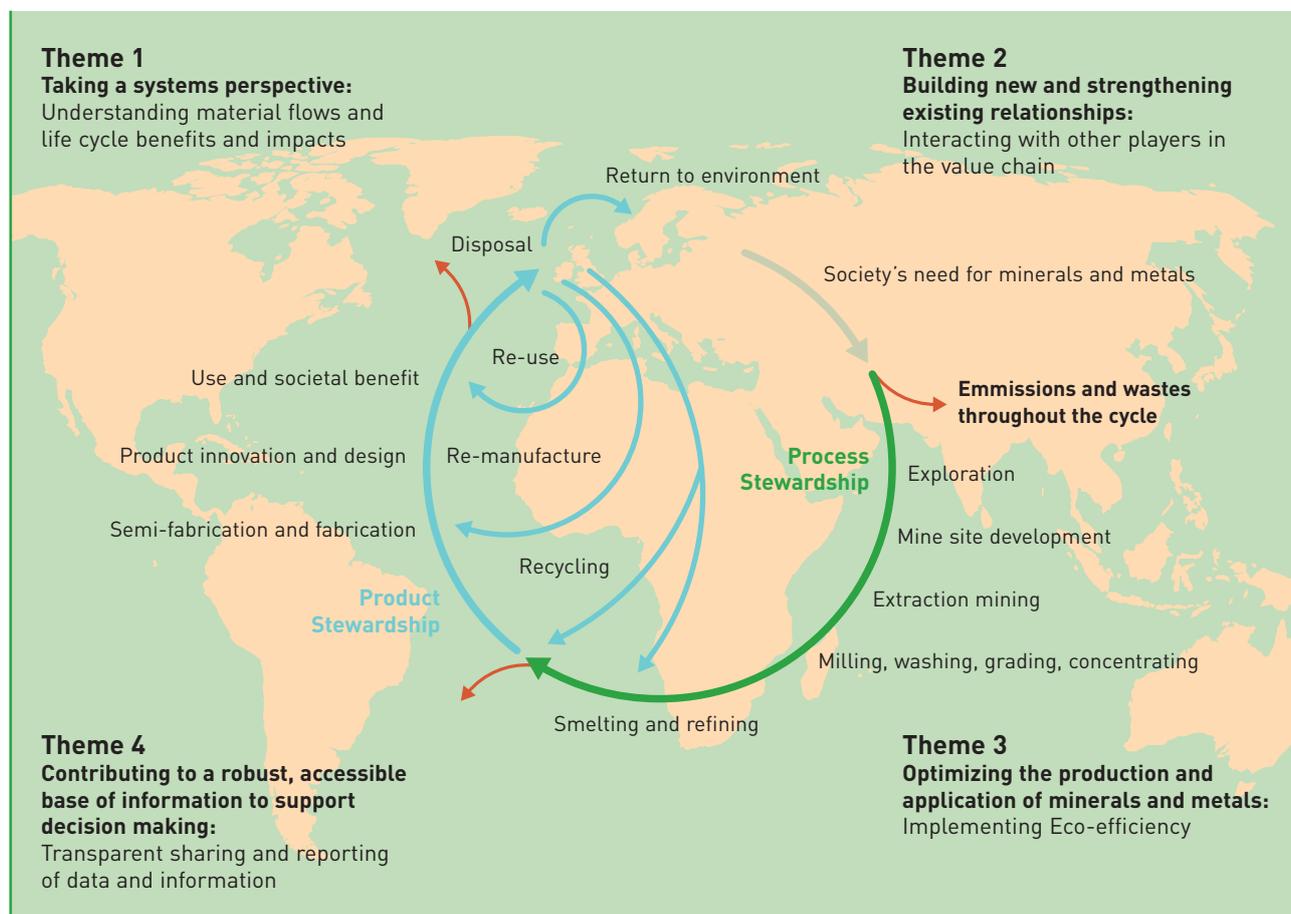
# 2. Introduction and Definitions

Progress toward sustainable development requires a strong focus on accessing and harvesting natural resources with minimal social and environmental impacts and positive economic benefit to society.

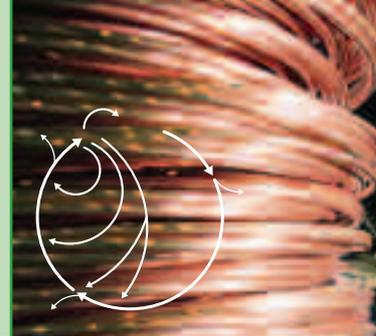
Once those resources are in use in the economy, maximizing their contribution to sustainable development requires concentrating on the appropriate application of the materials and coordinated stewardship activities (to ensure wise use and recovery where appropriate).

Sustainable development policy frameworks in the EU and other jurisdictions recognize this need and there are a number of initiatives underway that focus not only on the sustainability of the upstream natural resource base but also on the life cycle of the materials and products created from these resources.

Figure 1: Themes and activities in materials stewardship



Adapted from: 'the minerals cycle' in Breaking New Ground – the Mining Minerals and Sustainable Development Final Report, Earthscan Publications, 2002



## 2.1 Materials Stewardship

Materials stewardship is the concept ICMM has developed to embody the range of activities required to ensure the optimal and appropriate use of minerals and metals in society. It is a key element of the metals and mining industry contribution to sustainable development and it encompasses the four themes outlined in Figure 1:

- **Theme 1** Taking a systems perspective
- **Theme 2** Building new and strengthening existing relationships
- **Theme 3** Optimizing the production and application of minerals and metals
- **Theme 4** Contributing to a robust, accessible base of information to support decision making.

Materials stewardship includes activities and actions to improve both the upstream processes that support the production of the material, and the product(s) that it goes into. As can be seen from Figure 1 materials stewardship includes both process- and product-related activities throughout the life cycle including recycling<sup>1</sup>. Materials stewardship is seen by ICMM as a significant and emerging concept and it is actively being promoted to its members, and other actors in the minerals and metals value chain.

## 2.2 Eco-efficiency

The Business Council for Sustainable Development (now the World Business Council for Sustainable Development – WBCSD) originally introduced *Eco-efficiency* as a concept at the Rio Earth Summit (UNCED) in 1992. Eco-efficiency has been defined in a number of ways; the most widely quoted being the WBCSD's, which states that it is reached by:

*'the delivery of competitively-priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the Earth's estimated carrying capacity.'*<sup>2</sup>

A key feature of eco-efficiency is that it harnesses the business concept of creating value and links it to environmental performance. According to the

<sup>1</sup> Adapted from *Breaking New Ground – the Mining Minerals and Sustainable Development Final Report*. Earthscan Publications, 2002.  
<sup>2</sup> WBCSD. [www.wbcsd.ch](http://www.wbcsd.ch)

### Materials stewardship along the value chain

#### In Design...

HalSall Associates Ltd provides structural and cladding engineering services for new construction and renovations. They look for sustainable building solutions and technologies in many aspects of their work. This has included designing super efficient building envelopes, undertaking life cycle analysis of building materials, reusing of structural steel, and the reclamation and re-use of demolished concrete, selecting wood products from managed forests, creating thermal mass systems for storing energy, integrating green roofs and utilizing supplementary cementing materials. For example, on the west face of a new building their team choose titanium cladding materials to more effectively capture and reflect the changing sunlight. It also reclaimed steel from a recent demolition and used it in a building frame (5% of the frame's total steel content was reclaimed).

Source: HalSall Associates Ltd

#### and at end of life...

Mitsubishi Materials Corporation (MMC) operates three household appliance recycling plants, which they built jointly with household appliance manufacturers. At these plants, MMC disassembles and sorts used electrical appliances from homes and offices (air conditioners, refrigerators, TV sets, and washing machines) as well as used items of office equipment (e.g. personal computers). The materials are then processed at the appropriate facilities, including MMC's cement plants, non-ferrous metals smelting plants, and other facilities in its operations group, and the resources are efficiently recovered for re-use. According to MMC this is another example of their efforts to contribute to creating a 'recycling-oriented society'. In 2003 1.2 million pieces of equipment were disassembled.

Source: MMC

### Eco-efficiency in practice

Falconbridge (now Xstrata) Canadian Electrolytic Zinc (CEZ) refinery efforts have demonstrated that re-evaluating a product's development from an eco-efficiency perspective can often lead to innovative and profitable solutions. As an example, in 2005, the neighbouring plants of CEZ refinery and Eka Chemicals Magog, owned by Falconbridge, shared a prestigious prize for an innovative partnership that has enabled the refinery to reduce its greenhouse gas emissions by 30%. Eka generates hydrogen as a by-product of its sodium chlorate manufacturing process and the CEZ refinery uses the neighbouring plant's waste hydrogen to heat its boilers. To date, over 30 million cubic metres of hydrogen from Eka have been 'recycled,' allowing the CEZ refinery to reduce its fossil fuel consumption by more than 10 million cubic metres, a savings of nearly \$830,000 and 19,000 tonnes of greenhouse gases.

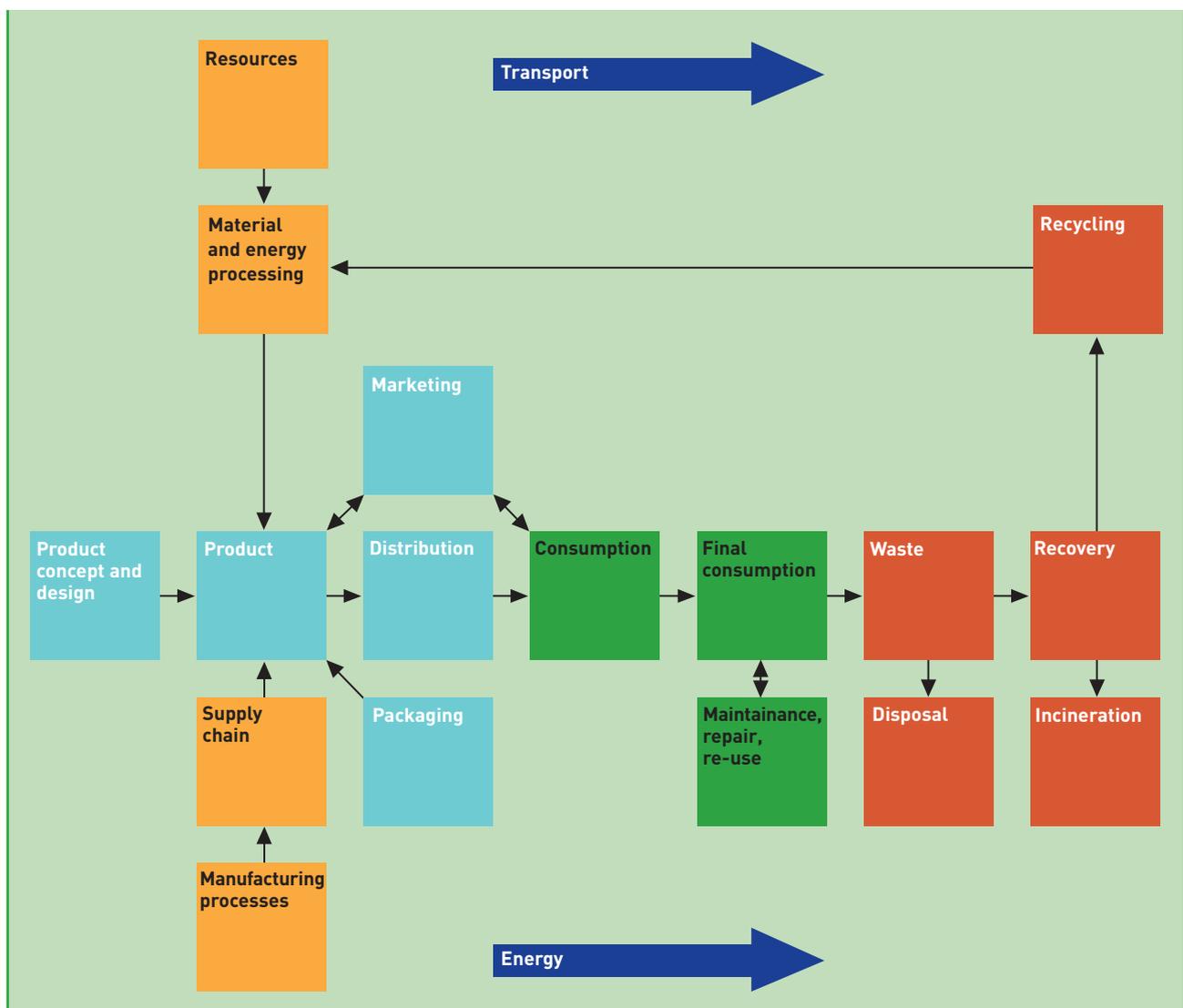
Source: Falconbridge Limited Sustainable Development Report 2005 'Sustainable Values'

WBCSD, businesses embrace eco-efficiency because it focuses on opportunities and helps identify performance improvements and therefore it is linked to competitiveness. In practice, it is achieved through a variety of strategies such as improving material and energy efficiency of products, reducing environmental and human health related risks of industrial processes, designing products which 'fit' into ecological cycles and can be easily disassembled and

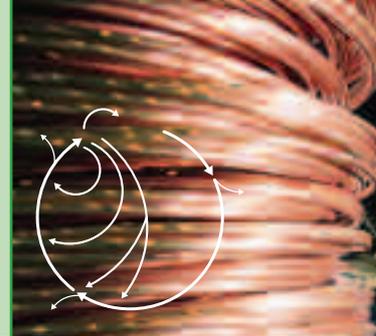
recycled, and extending the durability, service life and functionality of products.

In the last ten years eco-efficiency has been actively promoted by the WBCSD, a variety of national governments, and multi-lateral organizations such as the OECD and the United Nations Environment Programme, as one of the primary contributions industry can make to sustainable development.

**Figure 2: Product system scope**



Adapted from: European Commission



## 2.3 Product Policy

In the European Union and a variety of other jurisdictions around the world, governments are making product systems a focal point for policy and program development. The objective of 'product policy' is to improve the resource efficiency and reduce the environmental impact of goods and services throughout the life cycle. This objective is being achieved through a variety of mechanisms including market instruments, mandatory extended producer responsibility initiatives, voluntary programs which promote design for environment or green design and waste management initiatives. The general thrust is to first look at an entire product system from raw material extraction through to the end-of-life and then look for ways to influence or work with key actors to improve the system. Figure 2 shows the full scope of a product system with different colours illustrating some of the main life cycle stages (e.g. upstream resources and manufacturing processes, product design and production, use, end-of-life, and associated energy and transportation activities).

The European Union's effort to develop an Integrated Product Policy (IPP) framework is an illustrative example of government activity on products. The objective of taking a more integrated perspective on the wide range of policies related to products is to minimize environmental impacts of products across their life cycle (raw material production through to end-of-life). In addition to examining impacts across the life cycle, a product focus to environmental policy also recognizes that improving the environmental performance of product systems involves many different actors such as material suppliers, designers, manufacturers, marketing people, retailers, consumers and the recycling industry. Product policy efforts, such as IPP, are attempting to stimulate actions within each of these phases as well as the actors to improve their environmental performance.

With so many different products and actors there can not be one simple policy approach and a variety of tools – both voluntary and mandatory – are being used to achieve performance improvements. These include measures such as economic instruments, substance restrictions, voluntary agreements, environmental labelling and product design guidelines.

### Product policies

**Building on environmental policies that govern emissions from manufacturing facilities, product policies govern the design, use and disposal of products.**

The EuP Directive (Environmentally-friendly design of Energy-using Products) will lead to the setting of requirements on product lifetime, waste generation, energy consumption and other environmentally relevant product characteristics (via implementing measures for specific products). Its requirements are intended to ensure action during product design, because during design costs are committed and pollution caused during each life cycle stage is determined. Other product policies focus primarily on products at their end-of-life.

#### Japan

*Law Concerning the Recycling of End-of-Life Vehicles (2005)* requires automobile manufacturers and importers to collect and recycle discarded vehicles and to collect CFCs, air bags and shredder residues for proper disposal (financed by a fee charged to purchasers of new cars). Japan also has enacted a 'Fundamental Law for Establishing a Sound Material-Cycle Society For the purpose of this Law' to promote a society where the consumption of natural resources is minimized and the environmental load is reduced as much as possible by: restraining products from becoming wastes; promoting appropriate recycling of products when they have become recyclable resources; and securing appropriate disposal of the recyclable resources not recycled.

#### European Union

The Directive on End-of-Life Vehicles calls on manufacturers to design more easily recyclable vehicles and sets targets for re-use and recovery (95% by an average weight per vehicle and year by 2015), for re-use and recycling (85% by an average weight per vehicle and year by 2015) and hazardous substance use (vehicles put on the market after 1 July 2003 may not contain lead, mercury, cadmium or hexavalent chromium unless exempted). Directives on waste electrical and electronic equipment set comparable targets for re-use, recovery, recycling and elimination of hazardous substances by 2006. Given the global nature of markets for vehicles and electronics, these directives have impacted manufacturers in North and South America, as well as Asia and Europe.

### 3. Significance and Interrelationships

The significance of materials stewardship, eco-efficiency and product policy have never been higher. The business and environmental drivers for these types of approaches have been well documented. Key drivers include population growth and its impacts on resource availability and use, the need to decouple economic growth from environmental impacts, climate change, and increasing concerns about the impacts of the dissipative use of chemicals on human health and natural ecosystems. These drivers are complemented by a growing understanding of the business benefits of a shift to materials stewardship, eco-efficiency and product policy.

Specific reasons these three approaches are needed are to:

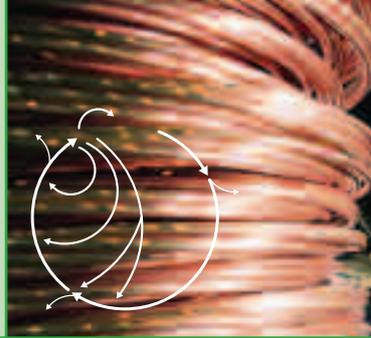
- Increase resource conservation. This applies not only to the materials themselves but also to the energy required to produce them. Taking a product systems perspective will help identify opportunities to conserve resources.
- Ensure the identification, management and reduction or elimination of risks. Governments are increasingly concerned with the human health and ecological impacts of materials and are developing strategies to evaluate hazards and reduce or remove risks where needed.
- Put into practice more sustainable forms of production and consumption. All three concepts place an emphasis on the design of products to ensure the appropriate use and recovery of materials.
- Develop platforms of understanding and knowledge that will enable further innovation in the use and application of materials. Pursuing these approaches requires new relationships, broader information sets, and in some cases, new business models. Materials stewardship, eco-efficiency and product policy initiatives are platforms to develop experience that will lead to creative and more sustainable innovation.

At the conceptual level the relationship between these three concepts is as follows. Materials stewardship is a broad strategy that encompasses eco-efficiency and product policy. Specifically, optimizing the production and application of minerals and metals is supported by integrating eco-efficiency into all stages of the material life cycle. Companies pursuing materials stewardship strive to improve their eco-efficiency performance both at the process level (e.g. activities related to the upstream exploration, mining, refining and smelting of minerals and metals) and at the product level (e.g. activities related to the distribution, application, and ultimate fate of minerals and metals as they move through the economy).

#### Collaboration to promote stewardship: Australia's Leading Practice for Sustainable Development Program

**The Australian Department of Industry Tourism and Resources in conjunction with a wide range of stakeholders has produced a stewardship handbook to 'encourage mine and marketing managers, as well as customers, to apply the principles of stewardship and play a critical role in continuously improving the mining industry's sustainable development performance.'** Created with the cooperation of the Minerals Council of Australia, the handbook contains considerable guidance and a number of case studies on stewardship implementation.

Source: Australian Department of Industry, Tourism and Resources



**Effective materials stewardship will be defined by the actions of various players throughout the life cycle**

Examples of specific activities that contribute to materials stewardship and eco-efficiency include<sup>3</sup>:

- Developing eco-efficiency performance measures to guide continual improvement of mining operations. Examples of indicators include<sup>4</sup>:

**Total energy consumed within the mining operations boundary**  
**Unit of production (e.g., per ton of mineral/metal)**

**Total GHG emissions leaving the operations**  
**Unit of production (e.g., per ton of mineral/metal)**

- Developing relationships with users of minerals and metals to support applications that improve product performance (e.g. by extending durability).
- Working with various stakeholders involved in product design and end-of-life recovery to ensure appropriate recovery and recycling of the materials.
- Cooperating with policy makers and other stakeholders to design effective policies and programs to support eco-design and material recovery.

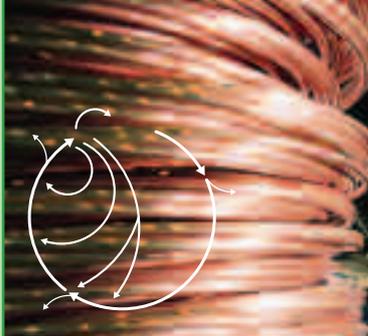
Materials stewardship and eco-efficiency are key components of an overall shift to more sustainable forms of production and consumption. Therefore, these industry-led initiatives share common objectives with government-led product policies. Some key areas of common interest include:

- Taking a life cycle perspective to ensure key impacts are identified and minimized without creating trade-offs in other parts of the system;
- Supporting the establishment of value chain relationships to identify opportunities, manage risks and determine responsibilities; and
- Creating the information base needed to support decision-making on material selection, product design and end-of-life management options.

As governments move to implement policies and programs aimed at improving sustainability of product systems they can work collaboratively with the minerals and metals industry to support materials stewardship and eco-efficiency. In turn, materials stewardship and eco-efficiency offer governments a business focused approach to improving product systems that will achieve not only environmental improvement but also improve the competitiveness of industry. Both approaches emphasize the need to identify and eliminate or manage risks associated with certain uses and applications of mineral and metals, but equally important, the approaches focus on maximizing the beneficial and sustainable applications of these materials.

<sup>3</sup> For many other examples see *Maximizing Value*.

<sup>4</sup> National Round Table on Environment and Economy. *Eco-efficiency Indicators Workbook 2001*.



**Once resources are transformed into materials they should be managed to maximize utility and minimize losses**

## 4. Specific Areas of Collaboration/Emphasis

### 4.1 Understanding

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A key step in identifying opportunities to support materials stewardship, eco-efficiency and government product policy objectives will be to develop a common understanding among key stakeholders on the objectives, benefits and synergies between these approaches. Awareness raising sessions, information exchanges and focused workshops can help identify key challenges and opportunities for improving product systems. These efforts should be focused on not only building awareness of risks and opportunities but also on identifying key areas for collaboration between governments, the minerals and metals industry and other stakeholders along the minerals and metals value chain (see relationships below).

### 4.2 Information

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Central to materials stewardship, eco-efficiency and product policy is a comprehensive information base on product systems. The metals and mining industry is actively developing life cycle information on its key materials. Similarly other actors along the value chain of key product systems (e.g., vehicles, buildings, and electronics) have developed, or are beginning to develop, information on all or part of the product life cycle. In Japan, North America, Europe and a number of other jurisdictions, governments are involved in developing life cycle data on key materials and products, as well as the associated energy supply options, transportation and end-of-life management systems. As ICMM members pursue materials stewardship there will be more and more opportunities to work collaboratively with policy makers to ensure credible information is developed on minerals and metals and the product systems they go into.

### 4.3 Innovation

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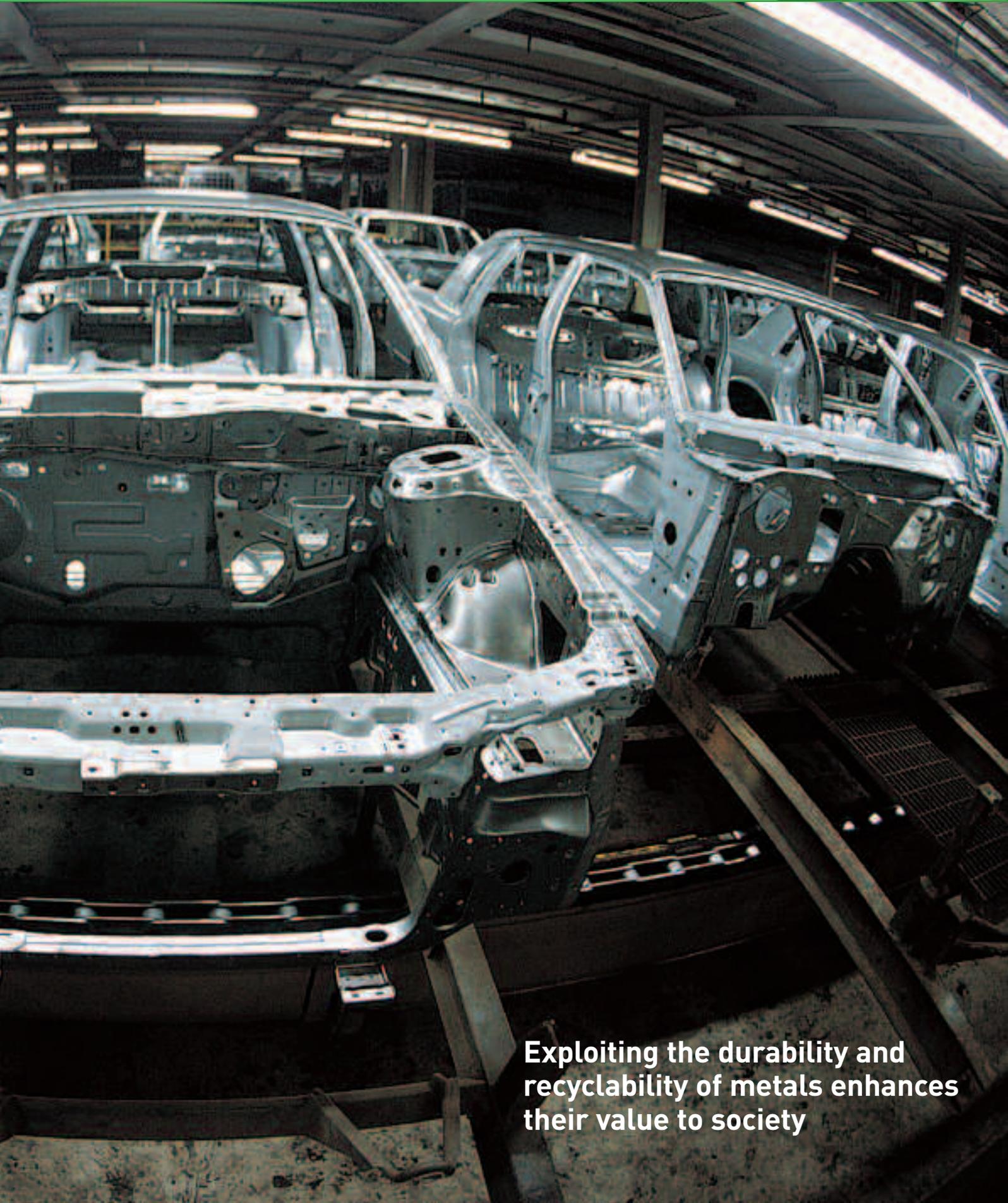
Minerals and metals provide valuable benefits to many product systems. Improving thermal conductivity and energy efficiency, extending the durability of products and enabling re-use or ongoing recycling of product components are inherent performance attributes of minerals and metals that support the development of more sustainable products. Manufacturers will be seeking innovative solutions as they strive to create products with high technical and environmental performance. Governments can also play a role in supporting needed innovations although experience in some jurisdictions has shown that actions need

to be carefully thought out. There is potential for governments to work with industry and other stakeholders to develop market mechanisms and product policies that encourage the reduction of impacts along the product system and ensure resource recovery and re-use. For example, the directive 'Environmentally-friendly design of Energy using Products' (EuP) covers energy-using products such as electrical and electronic devices and heating equipment. The implementing measures for this directive will set requirements for 'eco-design' – intended to stimulate innovation during product design that minimizes impacts throughout the product life cycle, instead of focusing on one environmental performance attribute that unintentionally creates an overall negative result (for example eliminating mercury from lamps may lead to increased energy consumption, which on balance may have a negative impact on the environment). There are many research and development projects that could be explored that would advance the use of minerals and metals to support product policy objectives.

### 4.4 Relationships

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Achieving the above will require collaborative relationships along the value chain of minerals and metals. Collaboration of actors from across the value chain enables technologies and applications which may not arise when industries work in isolation. Governments can play a key role in fostering these collaborations. ICMM members have clearly stated that this is a key component of materials stewardship and governments pursuing product policy increasingly understand that strong, trusting relationships are critical for successful policy and program development. Building these relationships is a challenging task given the different commercial interests of the actors in the value chain and the historical relationship between industry and government agencies responsible for environmental protection.



**Exploiting the durability and recyclability of metals enhances their value to society**

# 5. ICMM Activity

The complexity of materials stewardship, both in terms of the players involved, and the data and information requirements, means that it is an approach that will be more fully implemented over the mid to long term. As noted in (the guidance document) *Maximizing Value*, 'Materials stewardship is an evolving concept that will ultimately be defined and implemented through the actions of various players associated with the life cycle or value chain of specific minerals and metals'. Therefore a critical success factor in moving forward will be the recognition of other players in the minerals and metals value chain of their shared responsibility in implementing materials stewardship. While product policy approaches underway in many jurisdictions may support materials stewardship and eco-efficiency it is important for the minerals and metals industry to work with other stakeholders to consider how these policies can most effectively be informed and designed.

For its part ICMM has been taking a number of actions to encourage companies to improve eco-efficiency and adopt materials stewardship. A key example is the guidance document *Maximizing Value* which outlines a significant number of activities under each of the themes in Figure 1 that will support the objective of reducing the impacts of products across the life cycle. These activities range from developing life cycle datasets for key commodities, to fostering partnerships with mineral and metals users, to improving the eco-efficiency of mining operations.

To formalize its commitment ICMM has also adopted a Materials Stewardship Policy. The policy and associated initiatives will help member companies implement materials stewardship in their own organizations as well as reach out to other stakeholders and key actors in the minerals and metals value chain. The policy has six core elements which are:

## 1. Guidance for Implementing Materials Stewardship

Develop specific guidance for corporate members in understanding and implementing effective strategies to improve the stewardship of the minerals and metals they produce.

## 2. Education

Develop a range of initiatives and activities for introducing a materials stewardship culture into the businesses of ICMM corporate members. These may include training programs on materials stewardship, targeting key audiences within companies.

## 3. Materials Stewardship Indicators

Develop clear reporting guidelines for materials stewardship including indicators for product stewardship to ensure accountability, improved reputation for the sector and increased value for minerals and metals. There is a need to examine the potential for integration within existing reporting and environmental management systems.

## 4. Outreach Strategy

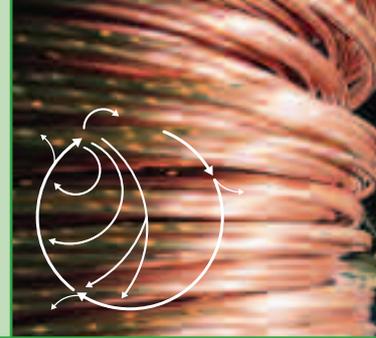
Build awareness, credibility and participation in materials stewardship for minerals and metals beyond ICMM membership. Target specific metal use sectors and build cross-commodity alliances to work on demonstrating and communicating the capacity of the minerals and metals sector towards materials stewardship. Encourage mineral and metals users to provide complementary capacity including identification of the role of governments and national authorities in stewardship activity (e.g. facilitating collection and sorting of recoverable metals in municipal solid waste).

## 5. Commodity Specific Materials Stewardship Plans

Encourage the development of commodity-specific materials stewardship plans in conjunction with commodity associations. These plans, and cooperative approaches to their implementation, may streamline and broaden corporate approaches to materials stewardship.

## 6. Demonstrate Complementary Responsibility

Develop engagement programs with downstream manufacturers, users and recyclers. This will include the establishment of a Materials Stewardship Round Table (MSRT) as a key mechanism for advancing materials stewardship along the value chain. The MSRT will explore common issues such as metrics, eco-efficiency, best practices and communication.



The policy will be supported by a range of initiatives such as the above mentioned Round Table. Another initiative underway is on eco-efficiency. ICMM is developing an Eco-efficiency Action Plan that calls for activity in a number of areas including:

#### Setting the appropriate boundaries of responsibility for materials

This will help companies identify and communicate where they have:

- Direct control – e.g. improving eco-efficiency of mining operations – managing water, energy, material use, emissions etc...
- Influence and no control – e.g. working with product designers to ensure appropriate application of a material that will extend the life, or enhance the recyclability, of a product.
- No influence and no control (but may want to influence in the future) – e.g. where a company has no control of who purchases their material and what application it goes into.

#### Developing internal performance measures

The objective is to develop a core set of eco-efficiency indicators that can be used to measure and drive eco-efficiency improvements. This work will build on current member company activity and the GRI Mining and Metals Sector Supplement.

#### Developing product eco-efficiency measures

Product eco-efficiency relates to the applications of minerals and metals in products and their ultimate fate in the economy and the environment.

Developing measures of product eco-efficiency will require (in most cases) collaboration with other actors in the value chain who have more direct control over either the design or the end-of-life fate of products. The work will be linked to ICMM member company Product Stewardship activities which include developing life cycle inventories, providing information on appropriate use of materials, developing environmental communications on the benefits of materials and highlighting potential risks. Given the range of minerals and metals and the thousands of potential applications, action on product eco-efficiency will require prioritizing opportunities for developing product eco-efficiency indicators in conjunction with downstream sectors with a demonstrated interest in improving eco-efficiency (e.g. building and construction and transportation).

#### Communications

This includes:

- Internal communications on the tangible business value from pursuing eco-efficiency and practical guidance on implementation;
- External communications on mining and metal industry efforts and to support the development of product eco-efficiency; and
- Communication with policy makers (e.g. those engaged in key initiatives related to discussion on sustainability, resources and products) to identify where emerging approaches can be supported or where more information on industry activities is required.

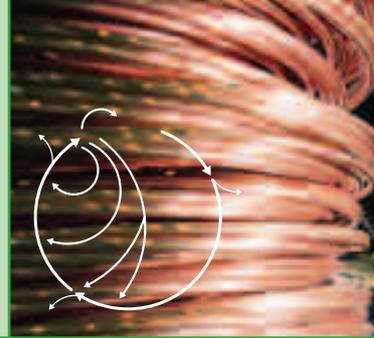
The implementation of the Materials Stewardship Policy and the Eco-efficiency Action Plan will provide ICMM members with a challenging set of activities over the coming years.

## 6. Summary

The focus of this paper has been on the implications materials stewardship, eco-efficiency and product policies have for metals and mining companies, and how the pursuit of materials stewardship can be leveraged to ensure that policy efforts maximize the value of materials to society and minimize any potential risks. Though terms may differ, government product policies and industries striving for better environmental practices via eco-efficiency and materials stewardship have a common goal – to use resources effectively in order to strengthen environmental and economic performance. A key opportunity that materials stewardship and eco-efficiency efforts of industry offer government is a business oriented approach to improving product systems, which will support societal objectives such as resource conservation. Pursuing materials stewardship and eco-efficiency will also enhance the environmental performance of companies and support the competitiveness of industry as markets increasingly recognize the value of materials that contribute to sustainable development.

There is however much work to be done. Advancing optimal ways to use mineral and metal resources requires actions at stages throughout the life cycle from raw material extraction, to product manufacturing, to end-of-life management. Effectively identifying the right actions and responsible actors will require greater collaboration between experts from each of these stages. It is clear from the definitions given here that both government and industry recognize this, and that their goals and strategies are converging. The challenge now is to facilitate the interaction, learning and actions needed to advance these common goals. Keys to success will be the development of cooperative partnerships, sharing of environmental performance and risk information, and developing a greater understanding of how minerals and metals can support sustainable production and consumption.

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The views expressed in this publication do not necessarily reflect those of ICMM.

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## ICMM – The International Council on Mining and Metals

The International Council on Mining and Metals (ICMM) is the industry's peak CEO-led organization. It comprises the leading international mining and metals companies as well as regional, national and commodity associations. ICMM's vision is a respected leadership group that is recognized as a key contributor to sustainable development, in a mining and metals industry whose activities and products are widely regarded as essential for society.

Our library at [www.goodpracticemining.com](http://www.goodpracticemining.com) has case studies and other examples of leading practices.

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