KEY MESSAGES

In many countries, Sustainable Materials Management (SMM) is increasingly recognised as a policy approach that can make a key contribution to green growth. The way economies use material resources determines to a significant extent what environmental pressures are being generated and SMM can help to better manage this linkage.

One of the key challenges of the SMM approach is to effectively address the environmental impacts that can occur along the life-cycle of materials, which frequently extends across political and geographic borders and involves a multitude of different economic actors.

The potential benefits of SMM for the economy, environment and employment are large. SMM approaches can help to improve competitiveness, contribute to addressing resource security concerns and create growth and jobs, in addition to making an important contribution to environmental protection and resource conservation.

The policy principles of SMM are the preservation of natural capital, the life-cycle perspective, the use of the full range of policy instruments and multi-stakeholder approach.

A broad array of policy instruments can be used to contribute to SMM, and the challenge is to find the right mix of policies along the different life-cycle phases of materials. Traditional policy approaches are often too narrow as they tend to focus on only one point in the life-cycle. Going to the full life-cycle requires taking into account the transboundary nature of material flows and the diversity of economic actors that intervene in materials management.

A key lesson for policy makers is that SMM will require greater coherence of policies across sectors and environmental media. Achieving this requires cooperation across different parts of government, which is not current practice. SMM policies will also require enhanced partnerships between economic actors as well as an international perspective and further efforts for capacity development.
The need for action

The size of the world economy is expected to double and world population to increase by one-third by 2030. With rising income and living standards, global consumption of fossil fuels, minerals, metals, timber and food crops is also increasing, generating pressures on natural resources and the environment. The total volume of material resources extracted or harvested worldwide reached nearly 60 billion metric tonnes (Gt)\(^1\) per year in 2007, a 65% increase from 1980 and an estimated 8 fold increase over the last century (Figure 1).

Going for green growth and establishing a resource efficient economy is therefore a major environmental, development and macroeconomic challenge today. In this context, putting in place policies that ensure sustainable materials management building on the principle of the 3Rs – Reduce, Reuse, Recycle - is crucial. Sustainable materials management can help both to improve the environment, by reducing the amount of resources that human economic activity requires as well as diminishing the associated environmental impacts, and to improve resource security and competitiveness.

Historically, governments have focused on managing waste as a means of managing the impact of materials on the environment. While much success has been achieved with waste management policies, research has shown that waste management is often not the key process, nor is it the most efficient and effective process, for controlling material flows in the industrial and economic systems.

**Figure 1. Global extraction of material resources, 1980-2007**


Economic theory suggests that market failures such as environmental externalities, i.e. an environmental cost that is not transmitted through market prices, are often best addressed through economic instruments such as taxes and charges. This approach achieves an efficient use of environmental resources by all economic actors at the lowest possible cost to the economy.

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However, economic instruments can be challenging to implement due to political and social resistance to their introduction and the difficulty to determine the exact cost of the externality.

As a result, policy makers have often created policies that address specific materials, products, life-cycle stages or environmental resources, leading to a highly fragmented policy landscape. For instance, despite the introduction of the EU’s Carbon Emissions Trading Scheme (ETS), climate change policy in EU Member States is supported by a broad range of other, additional policy instruments, such as feed-in tariffs for renewable energy, subsidies for better insulation of buildings and CO₂ emission standards for vehicles. While addressing complex environmental issues usually requires the use of a mix of different policy instruments, the inherent risk of a fragmented system is that it lacks integration and coordination between policies, leading to economic distortions and the potential shifting of the environmental burden from one media to the other or from one phase of the life-cycle to the next, instead of an economy-wide reduction of environmental impacts.

**Box 1. OECD Working Definition of Sustainable Materials Management**

Sustainable materials management (SMM) is defined as “…an approach to promote sustainable materials use, integrating actions targeted at reducing negative environmental impacts and preserving natural capital throughout the life-cycle of materials, taking into account economic efficiency and social equity.”

The OECD has been exploring this new, integrated approach to materials management since 2004 and has focused its attention on the policies and instruments that can help to achieve SMM and contribute to implement the OECD Council Recommendation on Resource Productivity adopted in 2008. Policy studies on target setting, policy principles and policy instruments for SMM, as well as case studies for selected materials have been published and an OECD Global Forum on SMM in

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2 The OECD working definition includes the following explanatory notes:

“**Materials**” include all those extracted or derived from natural resources, which may be either inorganic or organic substances, at all points throughout their life-cycles.

“**Life-cycle of materials**” includes all activities related to materials such as extraction, transportation, production, consumption, material/product reuse, recovery and disposal.

*An economically efficient outcome is achieved when net benefits to society as a whole are maximised.*

A variety of policy tools can support SMM, such as economic, regulatory and information instruments and partnerships.

**SMM may take place at different levels, including firm/sector and different government levels.**

**SMM may cover different geographical areas and time horizons.***


4 OECD (2011a), Policy Instruments for Sustainable Materials Management, Paris

OECD (2011b), Setting and Using Targets for Sustainable Materials Management – Opportunities and Challenges, Paris

OECD (2011c), Policy Principles for Sustainable Materials Management, Paris


October 2010 proposed concrete steps and measures to put SMM in practice as well as drawing the linkages to other policy areas.\(^5\)

Implementation of SMM policies and practices is a promising strategy for decoupling economic growth from natural resource consumption. Sustainable Materials Management therefore constitutes an important component of any green growth strategy. SMM policies will also indirectly reduce demand pressures on natural resources and therefore contribute to better resource security.

However, modern industrial supply chains often extend around the world, and SMM policies should ensure that environmental impacts are not merely shifted across international boundaries through mechanisms such as outsourcing. In this regard, SMM faces the double challenge of accounting for the full material impacts throughout the product life cycle, including mining, agriculture, and transportation, and of finding ways to influence the behavior of economic actors that operate in different jurisdictions.

Achievement of SMM is further complicated by the interdependence between material use and consumption of other natural resources, such as energy and water. Proposed policies must account for this interdependence to avoid unintended consequences. For example, many have proposed replacement of non-renewable materials such as petroleum derivatives with bio-based, renewable materials, yet these substitute materials may consume far greater amounts of water and other ecosystem services.\(^6\)

**The Benefits of SMM**

*Reduce life-cycle environmental impacts and improve policy coherence*

Sustainable management of materials helps to minimise environmental impacts by reducing the release of toxic substances to the environment and by limiting human exposure. It also helps to reduce pressures on resources by diminishing the quantities of materials that need to be extracted. Beyond this, SMM supports sustainable decision making by balancing the social, environmental, and economic considerations throughout the life cycle of a product or material, ensuring that negative impacts are not shifted from the production process to the consumption phase, or vice versa. SMM therefore encourages the consideration of the impacts of a suite of policies that affect a given target area, thereby promoting consideration and possible identification of policy incoherence where this may be the case.

For example, a range of waste policies are supporting waste minimisation, such as encouraging consumers to buy food and other products in larger containers that minimise the amount of packaging waste per unit of food. While this is a useful approach, the parallel issue of minimizing food waste also needs to be taken into account. Food can have a significantly larger environmental footprint than the packaging that is wrapped around it, as some life-cycle studies suggest. In a one

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\(^5\) See [www.oecd.org/environment/gfenv](http://www.oecd.org/environment/gfenv)

litre milk container, for instance, the milk can generate about five times as much CO2 as the packaging material that contains it. Hence, when consumers buy large containers and end-up throwing away perished food products, the environmental impact may in many cases be worse than if they had bought smaller packages leading to less food waste, but slightly more packaging waste (Figure 2)\(^7\).

**Figure 2. Energy consumption across the conventional milk production and consumption system**

![Graph showing energy consumption across the conventional milk production and consumption system](image)

N.B. White areas indicate maximum values for data points


Another example of a policy coherence issue relates to Green Procurement and the potential double counting of externalities. When introducing green procurement, explicit attention needs to be given to the extent of internalisation of environmental costs so as to avoid that green procurement criteria are used to address environmental impacts that have already been internalised through other policies, such as a tax or an emission standard.

**SMM can help to reduce dependency on raw materials**

Concerns about access to resources have gained importance on the political agenda, since the prices for many resources have been taking steep increases and producing countries have sometimes restricted the export of certain resources. Sustainable materials management can help to reduce

\(^7\) Foster C. et al. (2006), The environmental impacts of food production and consumption – A report to the Department for Environment, Food and Rural Affairs, Manchester Business School, Defra, London.
these pressures by increasing the amount of production that can be achieved with every unit of material and by returning material that has reached the end of its useful life to the economy through reuse or recycling, in other words, reducing total primary material consumption and improving resource productivity.

Box 2. Resource efficiency and resource productivity

Resource efficiency and resource productivity have been defined as follows by OECD in its publication “Measuring Material Flows and Resource Productivity, Volume I, The OECD Guide”, OECD 2008:

**Resource efficiency**: There is no commonly agreed upon definition of resource efficiency. It is understood to refer to the economic efficiency and the environmental effectiveness with which an economy or a production process is using natural resources. It is also understood to contain both a *quantitative* dimension (e.g. the quantity of output produced with a given input of natural resources) and a *qualitative* dimension (e.g. the environmental impacts per unit of output produced with a given natural resource input).

**Resource Productivity**: Resource productivity refers to the effectiveness with which an economy or a production process is using natural resources. It can be defined with respect to:

- the economic-physical efficiency, i.e. the money value added of outputs per mass unit of resource inputs used. This is also the focus when the aim is to decouple value added and resource consumption.

- the physical or technical efficiency, i.e. the amount of resources input required to produce a unit of output, both expressed in physical terms (e.g. iron ore inputs for crude steel production or raw material inputs for the production of a computer, a car, batteries). The focus is on maximising the output with a given set of inputs and a given technology or on minimising the inputs for a given output.

- the economic efficiency, i.e. the money value of outputs relative to the money value of inputs. The focus is on minimising resource input costs.

The concepts of resource productivity and resource efficiency are therefore largely identical in the way that they are used in this report.

Resource productivity has been improving throughout the OECD with a 42% increase between 1980 and 2008 (Figure 3). This can be at least partly attributed to a range of policies that OECD countries have put in place to improve resource efficiency and the recovery of materials from waste.
Figure 3. OECD material consumption versus GDP

Source: OECD material flow database, OECD Economic Outlook and World Bank.

Notes: OECD figures do not include: Chile, Czech Republic, Estonia, Hungary, Poland, Slovak Republic, Slovenia and Israel.

The OECD has established a set of environmental indicators which includes those used to illustrate resource productivity. Figure 3 illustrates the gradual decoupling of GDP and DMC over time, which is used as an indicator for resource productivity as OECD countries are producing an increasing amount of goods and services per unit of material mass input.

In Japan, which is one of the most resource efficient OECD economies, a set of SMM policy measures in line with the 3Rs, Reduce, Reuse, Recycle philosophy that supports the implementation of the “Fundamental Law for Establishment of a Sound Material Cycle Society”, has helped to increase the cyclical use rate of material. This rate compares recovered resources to total material input of the

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8 Domestic Material Consumption (DMC) is a variable used in material flow accounting. DMC measures the mass (weight) of the materials that are physically used in the consumption activities of the domestic economic system (i.e. the direct apparent consumption of materials, excluding indirect flows). In economy–wide material flow accounting DMC equals DMI minus exports, i.e. domestic extraction plus imports minus exports. Source: OECD (2008) Measuring material flows and resource productivity: The OECD Guide

9 It should be noted that domestic material consumption (DMC) does not take into account the hidden material flows linked to trade (also called indirect material flows) and unused extraction. If these were taken into account (but lack of data is preventing this for the moment at the OECD level) progress in resource productivity might show a different trend.
Japanese economy and has improved by 41% since 2000, reaching 14.1% in 2008. As a result of this and other efforts, Japanese material intensity\(^{10}\) was 37% below the OECD average in 2005.\(^{11}\)

**Improved competitiveness at no or low cost**

More sustainable and efficient management of materials also helps to improve competitiveness by reducing input costs. In the UK, potential input savings to firms from unexploited resource efficiency savings\(^{12}\) with a pay-back period of less than one year were estimated at GBP 23 billion in 2009, with about GBP 18 billion of waste reduction and better materials management. Further savings of about GBP 33 billion with a payback of more than a year would be available, again with the lion’s share (GBP 22 billion) in waste reduction and material management (DEFRA, 2011).\(^{13}\)

One global clothing firm identified that managing waste in its shoe manufacturing process cost it EUR 550 million per year. As part of a long-term programme of resource efficiency, streamlining of production and improved design of shoes reduced waste by up to 67%, energy use by 37% and solvent use by 80% along its supply chain.\(^{14}\)

**Contribute to growth and jobs**

Measures that help to increase the productivity of resources can generate innovation and new and additional economic activity in areas such as waste collection and treatment or recycling, potentially creating growth and jobs.

In the EU core environmental industries active in the fields of pollution management and control, waste collection and treatment, renewable energy and recycling have a combined turnover of over EUR 300 billion; provide nearly 3.5 million jobs, and have impressive global market shares of 30-40%. This sector is growing at annual rates of more than 8% in a global market predicted to reach four trillion euro by the middle of the decade and is offering many new and skilled green jobs.

More specifically, for the EU27 the number of jobs in the recycling industry is estimated at 1.8 million.\(^{15}\) The potential for additional jobs has been estimated by a recent study of Friends of the Earth that finds that across the EU27 up to 322,000 direct jobs could be created in recycling if recycling increased from 50% (embodied in current policies) to 70% for key materials. Including indirect and induced jobs, the total potential job creation would be about 550,000.\(^{16}\)

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\(^{10}\) Material intensity is domestic material consumption per unit of GDP.

\(^{11}\) OECD (2010), Environmental Performance Reviews: Japan 2010, Paris.

\(^{12}\) The DEFRA report defines resource efficiency as “any action or intervention that results in a reduction in overall material usage or greenhouse gas emissions that is either cost neutral or cost negative.” The study focuses on four key resources: water, energy, waste and materials.


\(^{14}\) Ibid.

\(^{15}\) Ernst and Young (2006), Eco Industry, Its Size, Employment, Perspectives and Barriers to Growth in an Enlarged EU, for DG Environment European Commission.

\(^{16}\) Friends of the Earth (2010), More jobs, less waste – Potential for job creation through higher rates of recycling in the UK and EU, London.
**SMM policy principles**

Work to develop practical guidance for policy makers who wish to improve the resource productivity of their economies and put in place sustainable materials management policies is currently ongoing at the OECD. This work has been carried-out through a number of reports, workshops and events, most recently a Global Forum on Sustainable Materials Management held in October 2010 in Mechelen, Belgium. These efforts have resulted in a number of policy papers and materials case studies. The following summarises the main conclusions of this work to date.

Recent OECD work suggests that four broad SMM Policy Principles should be used as guidance for the development of SMM policies wherever possible.18

**Principle 1 – Preserve natural capital**

Natural resources and healthy ecosystems are essential to all life and provide the natural capital on which humans depend. Sustainable materials management can contribute to the preservation of natural capital and is needed to foster long-term sustainability. Policy Principle 1 envisions leveraging the best available science, engineering, business and management practices to counter the trend toward incremental destruction and depletion of natural capital and its preservation now and for future generations. By modeling human use of materials as a system of material flows and environmental impacts, it is possible to outline broad strategies that would lead to the preservation of natural capital. Based on these strategies, policies and policy instruments specific to each country’s unique circumstances can be developed. Strategies for SMM Policy Principle 1 include:

- Improve information about material flows and environmental impacts;
- Increase resource productivity and resource efficiency (see Box 2);
- Reduce material throughput, particularly of high impact materials;
- Increase reuse/recycling of materials to preserve natural capital;
- Advance technologies for obtaining materials from natural resources that eliminate waste and toxics and support long-term ecosystem health (Eco-innovation).

**Principle 2 – Design and manage materials, products and processes for safety and sustainability from a life-cycle perspective**

It is at the design stage that decisions are made that determine impacts throughout the life-cycle. SMM Policy Principle 2 calls for maximising positive (and minimising negative) impacts to the environment and to human health and well-being through design. By managing for safety and sustainability at each life-cycle stage, efforts are made to ensure that risks are not shifted from one stage in the value chain, or from one geographical region, to another. Economic and social outcomes are optimised while natural capital is preserved and materials are sustainably managed.

SMM Policy Principle 2 also calls for increased cooperation between actors across the life-cycle so that all actors are aware of the impacts of their actions and decisions on other phases of the life-

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17 See [www.oecd.org/environment/gfenv](http://www.oecd.org/environment/gfenv)
cycle and can act accordingly. Three overarching material, product and process design strategies support SMM and they can be encouraged via government policies. They are:

- **Detoxification** – Detoxification supports SMM by eliminating the progressive build-up of chemicals and compounds produced by society that have harmful impacts on human health and environment, that cannot be properly or safely managed, or that are costly to manage from an economic or environmental standpoint. Detoxification is addressed through the application of green/sustainable chemistry and the process of chemical substitution.

- **Dematerialisation** supports SMM by reducing the throughput of materials, particularly those with high negative life-cycle impacts. Dematerialisation means doing more with less and refers to more efficient use of raw materials (resource efficiency) without decreasing the quality of the service they provide. In addition to resource efficiency, dematerialisation strategies also include material substitution and replacing products with services.

- **Design for value recovery** supports SMM by ensuring that products and materials are designed for reuse and recycling and that an effective model for recovery is in place (i.e. reverse logistics). Design for value recovery may be driven by product-related policies that promote for example extended producer responsibility (EPR) or “cradle-to-cradle” design. Cradle-to-cradle design strives to restore continuous cycles of materials with long-term positive effects on profitability, the environment and human health.
Box 3. Preserving natural capital – The example of wood fibres

A case study identifying opportunities for sustainable materials management of wood fibres (i.e., pulp and paper products) was carried out, as this is one of the sectors that have substantial opportunities to reduce energy use, greenhouse gas emissions and water use throughout the fibre product life-cycle. The report finds the following opportunities to reduce environmental impacts that are generated at different stages of the wood fibre life-cycle:

- Reductions in energy use on the order of 20 to 30% could be achieved in conventional pulp mills with existing technologies. Chemical and thermo-mechanical pulp mills offer the greatest potential for energy savings. Paper drying is the most energy-intensive process across the life-cycle, consuming 15 to 25% of total energy.

- Increased and more efficient use of biomass energy—considered to have zero net GHG emissions if sourced from sustainably managed forests—can further mitigate GHG emissions. Sustainable forest management practices and certification are essential to ensuring that biomass fuels remain carbon neutral.

- Chemical pulping can be roughly twice as water-intensive as mechanical pulping. Reductions in water use on the order of 25 to 50% are possible in conventional mills using technologies such as dry debarking, partial or full closure of certain water loops, washing system improvements and elemental chlorine-free (ECF) or enzymatic bleaching.

- At end-of-life, recycling paper products saves 7 to 19 GJ of energy per tonne of paper recycled and results in GHG emission reductions relative to the virgin manufacture of paper. Focusing on improving recovered paper collection efficiency, reducing the rates of contamination and developing new technologies and pulping processes can enable even greater efficiencies in the utilization of recovered paper.

- Although overall energy use is lower in recycling paper, GHG emissions from the manufacturing stage can be larger due to the fossil energy used in recycled mills compared to the low- or zero-carbon biomass energy used in virgin paper production. Even so, the GHG reductions from avoided fibre landfilling more than outweigh the additional GHG emissions from recycled paper manufacture and the overall GHG profile for recycling paper could be even more beneficial if biomass and other non-fossil fuel sources are used in the manufacture of recycled paper.

- Combustion facilities in OECD countries normally employ energy recovery systems, so fibre discards sent to these facilities can produce electricity for the grid, potentially displacing fossil electricity generation.

- Pulp and paper discards and residues that are sent to landfills generate GHG emissions in the form of methane and represent a significant portion of the GHG emissions associated with the pulp and paper life-cycle. Therefore, it is most important to divert paper which has high methane generation potential from disposal in landfills.

- Finally, across the entire life-cycle, source reduction of paper – in practices such as lightweighting packaging, double-sided printing and copying and paper re-use – offers a comprehensive approach to reducing the size of the environmental footprint.

**Principle 3 – Use the full diversity of policy instruments to stimulate and reinforce sustainable economic, environmental and social outcomes.**

To shift societies toward more sustainable materials management, governments can leverage a variety of policies and policy instruments including: regulations; economic incentives and disincentives; trade and innovation policies; information sharing; and, partnerships.

Each of these mechanisms has advantages and disadvantages and each can deliver benefits. However it is unlikely that any single mechanism is appropriate in all circumstances. Therefore, a multi-pronged approach, applying a diversity of policies and policy instruments, is more likely to influence all relevant players than a “one-size-fits-all” approach. Weaving these diverse policy mechanisms into combinations that reinforce each other can help to generate more effective, efficient and lasting outcomes. Integrated policies and policy instruments can successfully drive actors in the same direction and can accelerate progress -- sometimes generating synergies. Policymakers can also reinforce the use of these instruments by upgrading measures of success toward SMM objectives -- at both the systemic and organisational levels.

**Principle 4 – Engage all parts of society to take active, ethically-based responsibility for achieving sustainable outcomes.**

Material flows involve and affect many stakeholders throughout the supply chain and often across vast geographical areas. Because of the complexity of SMM, outcomes can be improved by inclusion and engagement of many players across the life-cycle of materials use in collaborative efforts to create collective solutions. Stakeholder engagement can also facilitate socially acceptable and equitable solutions by engaging those affected and allowing them to participate in designing of systemic solutions. SMM outcomes can be improved by systematic cultivation of:

- Multilateral stakeholder engagement, responsibility and collaboration;
- Open information flows;
- An ethical perspective.
Box 4. The example of critical metals in mobile phones – SMM policy recommendations

Another sustainable materials management case study focused on identifying opportunities for better management of critical metals in mobile phones, i.e. Beryllium, Antimony, Platinum and Palladium. This work illustrates the important insights that can be gained from the SMM approach. The policy recommendations that emerged from this case study, suggest that there is a range of different policy instruments that could be used at different stages of the life-cycle:

- In the processing of the four critical metals recycling can save significant amounts of energy. Public policy should promote the link between energy savings, improved economics and reduced GHG emissions. To improve recycling yields and reduce exposure to workers, policies to manage risk include raising awareness and setting standards.

- Some mobile phone material has been identified as problematic for recyclers and manufacturers are starting to phase these materials out (e.g. Beryllium and Antimony). Design for recycling and reduced toxicity are conceptually desirable and may be influenced by relevant product or materials related policies (such as US EPA’s Design for Environment (DFE) or well designed extended producer responsible (EPR) schemes) and collaboration between governments and industry.

- The collection of end-of-life mobile devices is a key challenge as collection rates are currently very low. In some countries Extended Producer Responsibility programs have contributed to rising product capture rates. Given their diminishing life span, a deposit system for these devices or innovative leasing arrangements may also be good mechanisms for raising collection rates.

- Since the technical lifespan of a mobile phone is about ten years, promoting extended mobile phone use through policy ultimately supports sustainable use of materials. Government procurement contracts could play a role by specifying product durability requirements; alternatively, standard government policy could extend electrical and electronic equipment usage periods.

- A mix of policies and programs is likely the most effective approach.

Source: OECD (2011), A Sustainable Materials Management Case Study – Critical Metals and Mobile Devices

Policy instruments for SMM

Due to the broad scope of SMM, it is helpful to adopt a conceptual framework that represents the sources of materials, their pathways through the environment, and their eventual sinks. When viewed from the systems perspective in Figure 1, policy frameworks can be classified in terms of their scope of application with regard to material flow cycles:

- **Natural resource policies** (e.g., Minerals and Metals Policy of Canada) address material flow cycles that link natural and industrial systems, including extraction, harvesting, and transport of raw materials as well as direct utilisation of natural resources (e.g., water, land).
- **Product life cycle policies** (e.g., E.U. Integrated Product Policy) address material flow cycles that link industrial systems and societal systems, including product development, transportation, energy production, supply chain operations, and waste recovery.

- **Waste management policies** (e.g., Japanese Fundamental Law for Establishing a Sound Material-Cycle Society) address the flows of waste materials into natural systems, including disposition or recycling of industrial and municipal wastes, as well as non-point source pollution control.

Effective SMM policies that take a whole of life-cycle perspective need to address each of these policy areas.

**Figure 4. Systems view of material flow cycles and policy frameworks**

Source: OECD (2011c), Policy Principles for Sustainable Materials Management, Paris

A review of policies contributing to SMM objectives in OECD countries identified a broad range of policies and policy targets that are currently in use and that address different stages of the material life-cycle (see annex 1 with a summary of SMM policies and sample SMM targets across the OECD). The policies in use range from those focusing on a single life-cycle stage (such as feed-in tariffs to promote the development of renewable energy generation, which reduces fossil fuel use and diminishes material extraction) to policies that cut across different stages of the life cycle (such as...
zero waste or detoxification policies). However, these policy instruments have not all been designed with the SMM principles in mind.

From this overview of SMM policy approaches, a pattern emerges that shows OECD countries are increasingly focusing their policies across the life-cycle, with a progressive shift away from an end-of-life focus. Policy instruments for SMM are also increasingly used within broader packages and programmes in order to address material use across the whole life-cycle. A classification of policy instruments on this basis is difficult, however, because of the breadth of policies which can reasonably be held to fall under the SMM definition.

Some of the key considerations when establishing and implementing SMM policy approaches include:

- The need for a variety of aligned programmes, policies, and initiatives to take into account both a comprehensive SMM policy as well as objectives of specific elements within that. Given SMM’s scope it will affect numerous ministries (e.g., environment, economy, finance, labour), industries, environmental media (e.g., air, water, land), which will likely require new partnerships and communication channels between previously independent groups.

- The need to understand the system in question to establish policy, select instruments or set targets. Understanding of the system includes factors such as: the time dimension (e.g., differences in product design cycles); the inter-relationship and opportunities between SMM targets and other activities and objectives (e.g., job creation linked to recycling infrastructure); as well as the aspects (e.g., design, waste, recycling) or impacts that should be addressed by the policy.

- The potential for systemic change, or in other words the capacity of SMM policy makers to “change the rules” through new policy. This is determined by policy makers’ authority, both in terms of jurisdictional control over policy implementation as well as their ability to monitor and enforce the policy. This is frequently complicated by market influence and material flows which often cross national borders. It is also important to understand who controls the strategic levers required (e.g., the availability of technological solutions) to affect the change desired.

Given these considerations, it is therefore interesting to see that the more comprehensive SMM policy approaches that are being developed and implemented in various OECD countries have not readily translated into “hard” policy. The complexity of the SMM issue, including its potential to bring into play a large number of different actors, as well as impacts which may take place in other countries, suggests that they are more easily addressed through innovative approaches or a combination of approaches which go beyond the traditional policy tools and which, in some cases, may not easily be categorised as “hard” or “soft.”
Key lessons for policy makers

Putting in place policies that promote sustainable materials management and improve resource productivity in the long term, necessitates:

- **Greater coherence of policies** relating to resource use and materials management. A key challenge will be to ensure the coherence of policies across sectors, materials and waste streams, i.e. to ensure that policies internalise externalities in a consistent manner across the board and avoid shifting environmental impacts across borders and from one phase of the life-cycle to the other. A specific example is that of Green Procurement, where explicit attention needs to be given to the extent of internalisation of environmental costs so as to avoid that green procurement criteria are used to address environmental impacts that have already been internalised through other policies, such as a tax or an emission standard.

- **Enhanced partnerships** with the private sector, research, and civil society. Governments need to provide the right incentives so that business and other parts of society can make effective contributions.

- **Inclusion of social and economic objectives**, as well as environmental ones in SMM policy making in order to stimulate and reinforce sustainable economic, environmental and social dimensions.

- **Engagement across departmental divides** as well as including key SMM targets within the wider financial and budget setting process.

- **Consideration of the full range of policy instruments and tools**. Conventional wisdom suggests that applying one policy to one addressee is the approach which is simplest to design, and most straightforward to implement. The sheer breadth of scope of SMM, which involves many different economic factors that are spread across borders, suggests that SMM action plans and programmes will need to have objectives affecting many sectors and hence, a need for more than one policy.

- **Establishment of “good” targets** has the potential to be effective in supporting SMM practices. “Good” targets are credible, supported by government and society, based on sound research, and set at an appropriate level based on the application of benefit-cost analysis. The main challenge for policy makers is to understand the attributes of effective target setting, which is complicated by the multi-national aspect and complexity created by the scope of SMM, and to incorporate these attributes into locally appropriate target-setting processes. Table 2 provides an overview of SMM targets that are being used across the OECD and beyond.
Table 1. Sample SMM targets in selected OECD and non-OECD countries and regions

<table>
<thead>
<tr>
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<th>Resource Extraction</th>
<th>Production</th>
<th>Resource productivity</th>
<th>Consumption</th>
<th>End of Life</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Japan</strong></td>
<td>Target for resource productivity with respect to earth and rock material</td>
<td>Programme looking at impact on land use (goals due out late 2009)</td>
<td>Targets set in the Fundamental Plan for Establishing a Sound Material-Cycle Society</td>
<td>Top Runner Programme provides incentives for reduced energy use from non-industrial sources through a label indicating energy performance</td>
<td>Targets set in the Fundamental Plan for Establishing a Sound Material-Cycle Society Programme looking at waste-related GHG emissions</td>
</tr>
<tr>
<td><strong>Netherlands</strong></td>
<td>Programme looking at impact on land use (goals due out late 2009)</td>
<td>Programme looking at pollution, GHG reduction and land use (goals due out late 2009)</td>
<td>Goals due out late 2009</td>
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</tr>
<tr>
<td><strong>Belgium</strong></td>
<td>General objective to minimise use of finite resources</td>
<td>General objective to increase number of Flemish companies producing in an eco-efficient way by 2009 (based on 2003 eco-efficiency rates)</td>
<td>General objective to optimise use of renewable resources</td>
<td>Increase sustainable consumption in retail and government sectors by 2015, based on 2008 levels</td>
<td>Extensive, quantifiable targets for household and industrial waste, building projects, end-of-life vehicles, tires, WEEE, batteries and oil</td>
</tr>
<tr>
<td>Belgian (Flanders)</td>
<td>General objective to increase number of Flemish companies producing in an eco-efficient way by 2009 (based on 2003 eco-efficiency rates)</td>
<td>General objective to optimise use of renewable resources</td>
<td>General objective to optimise use of renewable resources</td>
<td>Increase sustainable consumption in retail and government sectors by 2015, based on 2008 levels</td>
<td>Extensive, quantifiable targets for household and industrial waste, building projects, end-of-life vehicles, tires, WEEE, batteries and oil</td>
</tr>
<tr>
<td><strong>Finland</strong></td>
<td>Target looking at gravel and crushed stone used in earthworks</td>
<td>Material efficiency criteria and related programmes in development under the new waste management programme (targets due out in 2010)</td>
<td>Material efficiency criteria and related programmes in development under the new waste management programme (targets due out in 2010)</td>
<td>Material efficiency criteria and related programmes in development under the new waste management programme (targets due out in 2010)</td>
<td>Extensive, quantifiable targets for municipal waste, manure and building projects</td>
</tr>
<tr>
<td><strong>EU</strong></td>
<td>No specific targets, but there are restrictions on manufacturing, import and sales of zinc-manganese batteries and alkaline manganese batteries that contain over 5 ppm of mercury</td>
<td>Increase resource productivity at the same or greater rate than the 2.2% productivity improvement seen over the last 10 years.</td>
<td>Extensive, quantifiable targets for household and industrial waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chinese Taipei</strong></td>
<td>No specific targets, but there are restrictions on manufacturing, import and sales of zinc-manganese batteries and alkaline manganese batteries that contain over 5 ppm of mercury</td>
<td>No specific targets, but producers of special management wastes and hazardous end-of-life products must develop specific waste management plans</td>
<td>General objective to increase use of recyclable and reusable materials in production</td>
<td>General goal to increase alternative end-of-life waste treatment (thermal/caloric or composting) and reduce waste to landfill by 2012</td>
<td></td>
</tr>
<tr>
<td><strong>Mexico</strong></td>
<td>General objective to minimise use of finite resources</td>
<td>No specific targets, but producers of special management wastes and hazardous end-of-life products must develop specific waste management plans</td>
<td>General objective to increase use of recyclable and reusable materials in production</td>
<td>General goal to increase alternative end-of-life waste treatment (thermal/caloric or composting) and reduce waste to landfill by 2012</td>
<td></td>
</tr>
</tbody>
</table>

Note: This table is based on available data, however, there are likely to be additional targets and programmes addressing the various stages defined, as well as similar practices in other OECD countries. See additional detail and source information in the Annex 1 National SMM-Related Target Summary Tables.

- **A good understanding of the material basis of the economy**, of international and national flows of materials and their relation to productivity and environmental risks. Material Flow
Analysis (MFA), along with life-cycle analysis and other methodologies, contributes to that understanding.20

- **An international perspective** with a common vision and differentiated solutions at the local, regional and global levels. Resource rich and exporting countries, resource poor and import dependent countries, developing and industrialised countries all have different needs. Good practices and technologies need to be shared and taken up where they are most appropriate. OECD countries have a particular responsibility in generating and disseminating good practices and technologies.

### Challenges and the way forward

A major challenge of sustainable materials management is the sheer breadth of scope that is implied by the whole of life-cycle approach that is at the heart of SMM. For any given material or product an SMM approach will need to address a large number of economic actors that are active along the value chain in different sectors of the economy (e.g., miners, smelters, manufacturers, consumers, waste collectors and recyclers), as well as coordinating a number of different policy areas (e.g., agricultural, mining, product standards, fiscal, environmental). The geographic spread of actors and policies across different jurisdictions further adds to the complexity. Dealing with this situation requires a high level of coordination and cooperation between economic actors, different parts of government, as well as intergovernmental cooperation to deal with transboundary issues.

Furthermore, addressing the life cycle of products and materials is difficult to operationalise as a single policy, requiring the use of multiple instruments instead. If policies are developed with specific emphasis on some targeted material / product streams, the challenge becomes one of seeking to minimise distortions across product and material streams and the potential shifting of the environmental burden that this could induce.

A third challenge is linked to the significant need for detailed, good quality data that SMM policy making requires to avoid unintended effects. In order to effectively target policies, detailed information about the type and magnitude of environmental impacts along the material life-cycle is needed, such as is available from life-cycle assessments. This needs to be complemented with data about the costs of environmental damage through economic valuation and the application of cost benefit analysis.

SMM, therefore, requires both a high level of coordination between economic actors and different policy areas, as well as a significant amount of detailed data on environmental impacts and the valuation of these in economic terms as a basis for effective policy making.

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**What can governments do?**

The above calls for a range of actions from governments, including:

- Additional efforts to improve data and especially to translate life-cycle data on environmental impacts into economic costs.
- The prioritisation of material flows according to their environmental impact and the development of pilot projects that would allow to test new SMM based approaches, such as in the “Chain-oriented Waste Policy” that is currently experimented in The Netherlands.
- The development of innovative frameworks and processes to coordinate policies between a larger number of ministries.
- Facilitate cooperation of economic actors along the value chain (raw material producers, manufacturers, retailers, consumers, waste managers) in order to find joint solutions towards closing material cycles.
- Foster innovation and make available the necessary financial means to support technological and non-technological innovation towards SMM.
- The development of initiatives for international cooperation on specific high profile material and product streams.

**What can enterprises do?**

The transition to SMM will also require a new approach to doing business that integrates life cycle thinking in the way that enterprises operate. New business models need to be developed that focus on the establishment of green supply chains, on finding low impact substitutes for high-impact materials, goods and services, as well as on redesigning material and value cycles in more sustainable ways. Industrial entrepreneurs ought to become life cycle managers, who assess the impacts of materials usage and seek to minimise these impacts.

**How can the OECD assist governments in this task?**

The OECD can assist governments in this task by:

- identifying key policy gaps and coherence issues as well as the policy measures that an SMM approach would need to undertake to address these for specific materials and products through a number of case studies on priority materials;
- analysing the benefits and the costs of SMM approaches, including the economic and administrative costs of additional planning and consultation;
- gathering the experiences that are being made with SMM approaches in OECD and non-OECD countries in order to develop policy guidance for SMM with a particular focus on policy instruments and mixes, as well as the governance arrangements that are required for effective coordination of policies across sectors and at the international level.
Sustainable Materials Management
– Making Better Use of Resources
OECD 2012, Paris

is available at http://www.oecdbookshop.org

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