TOWARDS A EUROPEAN POLICY ON SUSTAINABLE MATERIALS MANAGEMENT

Discussion note for the interparliamentary conference on 3 and 4 October 2010

1. SITUATION: THE CHALLENGE

The European economy and society depend heavily on natural resources. The demand for organic and mineral resources has risen significantly as a result of global economic growth, which, in turn, results in considerable pressure in terms of availability, price and access. The extraction and processing of these raw materials often have an impact on biodiversity, violate the rights of indigenous peoples and result in the discharge of pollutants. After raw materials and materials have been incorporated in products or appliances they are discarded at the end of the lifecycle and enter the waste phase. At best they are re-used, recycled or recovered, but all too often they simply end up in a landfill resulting in a waste of material and energy content.

Europe also has a lot of natural resources (lime, sand, clay, gravel, biomass, and so on). These, however, are largely inadequate to supply the European economy with the necessary materials[1]. Often they are also difficult to access or their extraction is not economically feasible. Consequently the European economy remains highly dependent on the import of raw materials from other regions. But elsewhere in the world natural resources are also declining or are concentrated in regions that are often geopolitically unstable.

The EU is a global producer of certain *industrial minerals* although it continues to be a net importer for most of these. The EU, however, is highly dependent on the import of *metallic minerals* because its domestic production does not amount to more than c. 3% of global production. The EU is highly dependent on the import of "*high technological*" materials such as cobalt, platinum, rare earth metals and titanium. Although only very small quantities of these metals are often needed they have become increasingly important for the development of high-technological products in view of the growing number of applications.[2]

In the last decades there was a relative decoupling between global economic growth and the global use of resources[3]. Between 1980 and 2005 the global economy's raw material intensity dropped by

[1] Antonio Tajani, European Commissioner for Industry, recently published a report (MEMO/10/263) on the prospect of scarcity of 14 critical raw materials for the EU.

[2] MEMO/10/263 (see footnote 1)

[3] Calculations based on Giljum, S., Lutz, C., Jungnitz, A., Bruckner, M., Hinterberger, F. 2008. Global dimensions of European natural resource use. First results from the Global Resource Accounting Model (GRAM). SERI Working Paper 7, Sustainable Europe, Research Institute, Vienna.

25%. But the improvement in terms of eco-efficiency was insufficient to reduce the consumption of resources in absolute terms. In that same period Gross World Product doubled and raw material consumption rose by nearly 50%.

The European economy became very vulnerable due to its strong dependence on a number of critical raw materials. It is clear that our economy is heading towards a hard and shocking confrontation with sudden problems in terms of supply in a business-as-usual scenario. This does not only apply to different mineral resources but also to biomass. Renewable raw materials are scarcely used in the European industry, e.g., in the wood and chemical processing sectors, as a result of the limited available surface area for cultivation and in some cases due to potentially competing applications.

National and EU policy on renewable raw materials has a strong impact on industrial users. To this end the Commission will check the impact of the rise in demand for biomass on sectors that use biomass.[4] A UNECE-FAO study predicts a timber shortage of 448 million m³ by 2020 in the European Union. This means that if policy remains unchanged the EU will have to import more than half of its own timber production by then.[5]

The question thus rises how we can prevent a rapid depletion of our finite raw material supplies in a world with a growing world population and an economy that continuously grows. How we can use the available raw materials in the most judicious way possible in order to be able to respond maximally to the population's legitimate needs. How we can limit the environment impact to such an extent as we extract, process, produce, use and discard raw materials/materials/products in order not to exceed the capacity of ecosystems.

The answer to these challenges lies in a sustainable management of raw materials and materials and in a sustainable product policy. The design, production, use and processing phases of our products all have to focus on a more economical use of primary raw materials and energy and on the replacement of non-renewable raw materials with sustainably produced renewable raw materials. In addition the further development of a service-based society can ensure that more social needs are alleviated with the use of fewer products. This entails (repair) and re-use systems, the leasing or renting of products, the sale of services and so on.

2. EUROPE IS WELL PLACED TO TAKE THE LEAD

The European Union is well placed to play a pioneering role and show global leadership in the frame of sustainable materials management and in sustainable product policy.

[4] The Raw Materials Initiative – meeting our critical needs for growth and employment in Europe COM(2008)699 (Nov 2008)

[5] ENECE-FAO, Forest Products Annual Market Review, Geneva Timber and Forest Study Paper 22, 2007.

Firstly because Europe only has a limited amount of own raw materials and thus is (too) heavily dependent on supplies that are becoming increasingly scarce and which often have to be imported from geopolitically instable regions. A continuing big dependence of such supplies will weaken the European economy's position considerably and will result in a competitive disadvantage compared with continents or regions that do have their own supplies.

Secondly because the European economy still is the biggest economic market in the world economy. This means that Europe can set the tone for the rest of the world. European products norms also force foreign manufacturers to adapt their product design should they wish to export to Europe. As a result European policy has a broad impact.

Thirdly as one of the most prosperous regions worldwide the European Union has the moral obligation to develop those products and processes that can be generalised at global level and which can create and regenerate prosperity now and in the future, here and elsewhere. Our ecological footprint which we leave elsewhere in the world has also decreased as a result of the development of sustainable products and processes. Sustainable products in closed material cycles reduce our share in the environmental degradation and social disruption which is often associated with the extraction of raw materials and the export of waste flows in/to the rest of the world.

Fourthly, a sustainable materials policy is a necessary complement to European waste, energy and climate policy. Without a sustainable materials policy waste policy and energy and climate policy will generate suboptimal solutions. The European promotion of renewable energy thus results in the withdrawal of biomass flows from the recycling process (e.g., particle board industry, paper recycling, compost production), while these can, in effect, make a greater contribution to reducing CO2 emissions in the production phase or to increased carbon storage. Conversely the replacement of primary raw materials with secondary raw materials can save a lot of energy and CO2 in the production of new materials and thus result in an important contribution to European ambitions as regards the reduction of CO2 emissions[6]. Without a complementary materials and products policy European waste policy may possibly be deficient in terms of separating waste flows into high-quality secondary raw materials and in supplying these to the European recycling industry. Too many products or materials flows tend to escape the European market or are so polluted or mixed that they can only be recycled in sub-standard applications (downcycling) or that an energetic valorisation is necessary. Injudiciously introduced material recycling objectives in waste policy, on the other hand, can slow down the development of lighter and more fuel-efficient cars, which in turn can have an impact on sustainable product policy. This shows that only an integrated policy in terms of raw materials, materials, products, waste, energy and climate can prevent internal

[6] The extraction of metals from ores, for example, requires the use of a lot of primary energy, which contributes to greenhouse gas emissions whereas the re-melting of recovered metals requires considerably less energy. The Report on the Environmental Benefits of Recycling (Bureau of International Recycling (BIR), October 2008) shows that the recycling of certain metals in comparison with their primary extraction is much more CO2-friendly with a reduction of CO2 emissions which varies between 58% and 99%.

contradictions and ensure that the various policy areas can reinforce instead of oppose one another.

A well-considered raw materials, materials, and product policy is the missing complement in this frame. The subject is highly topical; in the frame of the Belgian EU Presidency (2010) the subject of sustainable materials management is one of the four priorities in terms of the environment. Mid-July 2010 the subject will be on the agenda of the informal meeting of Environment Ministers (in Ghent) and it is also the subject of this interparliamentary environment conference.

3. THE FIRST EUROPEAN ANSWERS ARE INSUFFICIENT

3.1. Policy answers: a first attempt

The European Union chose not to rest on its laurels. With the EU Raw Materials Initiative7 the EU (1) attempted to develop a strategy in order to arrive at fair, non-discriminatory access to international supplies, (2) to create a frame for the sustainable extraction of its own supplies and (3) to arrive at a more efficient use of materials and extensive recycling in the EU.

European waste policy – which is enshrined in the European Waste Framework Directive[8] and in several individual waste directives[9] - is largely based on the waste management hierarchy and the principle of extended producer responsibility. The waste management hierarchy prefers to prevent waste, then focuses on its re-use, above recycling and recovery. Waste disposal (landfill or incineration without or with limited energy yield) is only the last option. Through the introduction of (extended) producer responsibility and acceptance obligations the manufacturers of e.g., electric and electronic equipment, of vehicles, packaging or car tires are responsible for the environment-friendly management of their products once they are discarded and end up in the waste stage. Certain objectives in terms of re-use, recycling and recovery need to be achieved, possibly divided by materials group. The Waste Framework Directive also stipulates when priority waste flows (granulates, paper, glass, metal, tires and textile) can be qualified as "end waste" or "by-product', which in turn should facilitate their reinsertion in a production process.

Next to this the European Union also developed a Thematic Strategy on the Prevention and Recycling of Waste[10] and a Thematic Strategy on the Sustainable Use of Natural Resources[11] which are important for sustainable materials management policy.

The European Union is also trying to work towards an Integrated Product Policy[12] which attempts to minimise the environmental impact of products throughout their entire lifecycle. The European policy in this regard is based on five basic principles: (1) reflection on the lifecycle, (2) cooperation

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[7] EU Raw Materials Initiative — meeting our critical needs for growth and jobs in Europe. COM (2008) 699.

[8] Waste Framework Directive, 2008/98/EC.

[9] Like the ELV Directive (2000/53/EC), the Directive on Waste Electrical and Electronical Equipment (WEEE) (2002/96/EC) and the Packaging Directive (94/62/EC).

[10] EU Thematic Strategy on the Prevention and Recycling of Waste, COM (2005) 666.

[11] EU Thematic Strategy on the sustainable use of natural resources, COM (2005) 670.

[12] Integrated product policy, Building on environmental lifecycle thinking, Commission of the European Commission to the Council and the European Parliament, COM (2003) 302.

with the market, (3) the involvement of all stakeholders, (4) permanent improvement and (5) a diverse range of policy tools.

The European Commission has created a framework for setting out community regulations as regards the ecological design of energy-related products with the European Ecodesign Directive[13]. Energy-related products which fall under the implementation measures of this Directive will have to comply with certain regulations in order to be launched to market and/or be used. In order to assess when implementation measures need to be drawn up for certain products significant environment aspects and the improvement potential throughout the various stages of the lifecycle are, among others, taken into account. For each of these stages, among others, the predicted use of materials, energy and other resources is assessed as well as the expected production of waste and the potential for reuse, recycling and recovery of materials and/or energy. The specific requirements in terms of ecological design may take the form of requirements in term of a lower consumption of a given resource, such as limits for the use of this resource in the various stages of the product's lifecycle, where applicable (e.g., limits for the quantities of a given material which are incorporated in the product or minimum required quantities of recycled material).

Finally the European Union also wishes to arrive at a sustainable procurement policy for governments.

3.2. Policy answers: shortcomings

Up until now the outlined policy initiatives have contributed to increasing the European economy's eco-efficiency. They were not able to prevent the increase in absolute terms of raw material consumption. The effectiveness of this policy still leaves something to be desired. It is also obvious that "solutions-as-usual" are not sufficient.

The policy is lacking for several reasons:

- The Eco-Design Directive and Integrated Product Policy are hampered far too much by a voluntary and permissive approach. The elaboration of concrete standards is trapped in a Comitology, whereby representatives of the Member States and of the industry often drift towards the lowest common denominator of what is deemed feasible - also by the stragglers - in their ambition to arrive at a consensus. This does not result in a forerunner policy, which could serve as an incentive for the entire industry; nor does it stimulate innovation.
- The producer's responsibilities and acceptance obligations which are introduced in numerous waste directives are being undermined by the "pooling" of products in collective collection and processing systems, which are being set up by collective waste management organisations. The potential of "design for reuse" or of "design for recycling" of products of pioneers is thus not fully exploited.
- In spite of the acceptance obligation for several products it is impossible to close materials cycles because many discarded products are exported to countries outside of the EU,

[13] Directive 2009/125/EG of the European Parliament and the Council establishing a framework for the setting of ecodesign requirements for energy-related products.

sometimes as second-hand products. Often the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is violated with the export of electric and electronic equipment or discarded vehicles. In the frame of the IMPEL-TSF Project (EU Network for the Implementation and Enforcement of Environmental Law - cluster on Transfrontier Shipments of Waste) random checks were carried out on 10,481 road and port transports between October 2008 and May 2009 in 22 European Member States and four non-EU European countries. Nineteen percent of these transports violated the European Directives for transfrontier shipments of waste. 37% of these were illegal transports and 46% administrative offenses. Moreover Western waste is often processed in developing countries with little or no personal protective equipment or measures for controlling environmental pollution.

- Too many mixed waste flows, which are difficult to separate, or the presence of too many impurities means that opportunities are missed to recycle these materials again in fully closed cycles. In practice recycling often means downcycling in sub-standard applications. As a result the recycling objectives of the waste directives are achieved in a suboptimal manner. Next to this sorted recyclates are often exported abroad to be recycled in an inferior manner. European waste policy provides for a range of recyclates but these are often not suited or available to European manufacturers and processors of raw materials.
- Under European waste policy many recyclable materials are lost because of the lack of (ambitious) specific material recycling goals in the “recovery” objectives. As a result, e.g., in the case of plastics, manufacturers and processors often quickly opt for energetic valorisation meaning the material content of the materials is lost. This in spite of the fact that you can save more energy by recycling (process energy in the production of “virgin materials”) than you can reprocess in the frame of energy recovery. The choice for energetic valorisation in favour of material recovery is underscored by the fact that the European Waste Framework Directive opens the borders for the recovery of industrial waste. In view of the fact that incineration in conventional incinerators will probably be considered as “recovery” and of the current overcapacity of incinerators in the Netherlands and Germany incinerators may impose dumping tariffs thus hiving off recyclable flows from recycling (plastics, paper, cardboard and so on).
- Finally the European Energy and Climate Package – and more specifically the Directive on Renewable Energy (2009/28/EG) - results in a magnet effect on biomass flows in favour of energetic valorisation and to the disadvantage of material recovery (particle boards, paper and cardboard, compost, and so on).

4. RECOMMENDATIONS

In spite of the various efforts made European policy so far has not succeeded in directing material use within the Union in such a way that natural resources within and outside of the Union are saved and that the negative impact on air, water, climate and soil quality is reduced in such a way that public health is safeguarded and the capacity of ecosystems respected.

So far the emphasis in European policy was too much on the waste phase, whereby policy examined reactively - using an end-of-the-pipe approach – how waste problems could be managed. Attention only gradually shifted towards more process-integrated measures and finally to product design.

In order to limit the negative environment impact of material use in the frame of sustainable materials management and to maintain the natural material content throughout the lifecycles of products or services as much as possible, it will be necessary to focus more on sustainable materials extraction, ecological product design, eco-efficient production, sustainable consumption and waste management based on a lifecycle approach.

A more prudent and responsible use of the available raw materials, a better closure of material cycles and a replacement of finite raw materials with renewable raw materials requires the development of complimentary policy. The familiar instruments of European waste policy will have to be implemented better and broader and be completed with measures in the raw material extraction, design and production phases. The emphasis has to shift from waste policy to materials policy. The waste management hierarchy (prevention > reuse > material recycling > energy recovery > landfill) has to be completed with a material management hierarchy which indicates how materials have to be incorporated in design and production (prevention > reuse > recyclate/secondary raw materials > renewable primary raw materials > non-renewable primary raw materials) (see figure annex 1).

Based on this approach we have the following recommendations for European policy-makers:

4.1. Evaluation and adjustment of existing acceptance obligations and extension to other product categories

Existing acceptance obligations have to be evaluated and adjusted with a view to the introduction of ambitious material-specific recycling objectives, which include quantitative and qualitative requirements for the produced recyclates. In addition it is also necessary to investigate to which extent the levelling that takes place in the "pool" of collectively gathered products can be prevented. This is possible, among others, through the introduction of forms of "individual" acceptance obligations or by differentiating the disposal contribution to the collective waste management organisations in function of demountability and recyclability.

Specifically it is necessary to examine how the instrument of the acceptance obligation can signify a specific trigger for ecodesign (whereby material-efficient design is rewarded).

In order to prevent the collection of large appliances/products from taking precedence over that of smaller appliances collection goals can be introduced per sub group. In the case of discarded

products with valuable materials, which escape the European market before dismantling or processing guarantee systems may be considered to guarantee their return.

It should also be investigated for which other product categories - such as carpets, mattresses, furniture, textiles or building materials - it might be interesting to enforce the acceptance obligation and to impose specific collection objectives and norms in terms of prevention, reuse, recycling and useful applications.

4.2. Introduction of product norms that promote recycling

An important bottleneck continues to be the use of too many different types of materials that are difficult to separate or additives that complicate recycling. In the frame of the Eco-Design Directive or the Waste Directives for specific product categories product norms need to be created which result in products with a (more) limited number of components, of which the materials are easier to separate and whereby impurities are avoided, which are an obstacle for qualitative recycling ("upcycling") in the same or other high-quality applications.

In the case of new components in new products it is also possible to impose that these have to be manufactured using (a minimum share of) recyclates or renewable raw materials. In this way a market for qualitative recyclates is created, which prevents waste or recyclates from being applied outside of Europe. In non-OECD countries often only a limited share is recycled, meaning valuable residual fractions are lost. Moreover these recycling processes often offer much lower protection in terms of the environment and health than in Europe.

4.3. Introduction of certificates or guarantees of origin for recyclates and renewable raw materials

It is also recommended to investigate to which extent a market can be created within the European Union for secondary and renewable raw materials by imposing that material manufacturers/suppliers have to source a given percentage of the materials that they market from recyclates and/or renewable raw materials. It would be possible, by analogy with the guarantees of origin in terms of renewable electricity, to impose, for example, that the producers of recyclates and renewable raw materials issue "recycling certificates" or "guarantees of origin", which can be bought by material manufacturers to meet their objectives. The often suboptimal preferential application of biomass flows in the energy industry can be countered with minimal objectives in terms of renewable raw materials (and the associated guarantees of origin).

4.4. Prevent illegal leakage currents of waste to the Third World

Today many waste products do not end up in the regular recycling channels, meaning valuable secondary raw materials are often irrevocably lost. There are indications that a significant percentage of all EU waste shipments does not comply with regulations although the situation varies considerably in the Member States. A targeted examination of these shipments in 2006 revealed that more than 50% of all EU waste shipments does not comply with regulations and that there are irregularities for 43% of all shipments. This mainly applies to the export of discarded vehicles and electronic equipment, which leave Europe as reusable products but end up being

dismantled abroad. Moreover the Member States interpret the classification of waste for shipment in different ways which results in obstacles for the internal scrap market and thus in trade distortions. This is all the more regrettable because the physical transport of exported waste products and imported raw materials (from recycling outside of the EU according to less stringent conditions) result in considerable environmental leakage.[14]

Europe needs to thoroughly tackle the illegal export of waste by setting up a more effective control. To this end the Member States and the relevant departments need to work together more closely. A uniform definition is also necessary of which products are classified as waste and which products need to be considered as second-hand products. Europe needs to encourage R&D into standardised testing for verifying the residual operation of discarded electric and electronic appliances (e.g., Radio Frequency Identification (RFID) chips).

At international level Europe needs to advocate global standards in terms of waste collection and recycling aimed at reaching a high level of environment and public health protection and a minimum quality of secondary raw materials.

4.5. Clear definitions for "end waste" and "by-product" in the Waste Framework Directive

A correct and uniform interpretation of the notion of "end waste" and "by-product" in the frame of the European Waste Framework Directive in combination with adequate control should promote the environment-friendly recycling of secondary raw materials.

Since the introduction of the REACH Regulation[15] some industries prefer to not label potential 'secondary raw materials' as such but instead to label them as waste. In so doing these flows are no longer subject to the rules of the Regulation as waste is not covered under this Regulation.

4.6. A more judicious use of biomass in the energy sector

The increased demand for biomass for energy purposes leads to a degradation of biodiversity and food safety and results in a reduced availability of biomass for the wood-processing industry and for the recycling industry (particle board industry, paper and cardboard industry and so on).

The question rises whether we can produce/mobilise sufficient biomass and keep it in a closed cycle for food supply, energy supply and use as raw material in industry with the highest possible contribution to the preservation of biodiversity and to the limitation of climate change (carbon

[14] The Raw Materials Initiative – providing for our critical needs in terms of growth and employment in Europe COM(2008)699 (Nov 2008)

[15] REACH (Registration, Evaluation and Authorisation of CHemicals) is a system for registering, evaluating and authorising chemicals that are produced or imported in the EU. The Regulation (Regulation no. 1907/2006) dates from 18 December 2006, and became applicable on 1 June 2007.

sequestration) and the smallest possible impact on the environment (water use, soil erosion and so on). This requires the production/mobilisation of biomass within a clear sustainability framework.

Under Directive 2009/28/EG a number of sustainability criteria have been listed for biofuels and bioliquids[16]. Biofuels are increasingly popular since the Directive for the promotion of the use of energy from renewable sources (2009/28/EG). The objectives that have been set amount to a minimum share of 10% renewable energy in transport.

In the long term sustainability conditions will also have to become applicable to other (stationary) forms of bio energy and will not be limited to the one application of biomass into biofuels. This gives rise to indirect effects and shifts. Ultimately sustainability criteria should be applicable for all biomass-based products. This should be addressed at European - and preferably at global - level.[17]

In addition Europe has to work towards the development and use of second and third generation (delete fourth generation) biofuels and it should also impose high energy efficiencies for the use of biofuels in the energy sector in order to avoid the waste of biomass. The co-firing of biomass in coal plants with low energy efficiency also has to be excluded. Often the compensation for "green power" from co-firing helps maintain such climate-damaging plants from an economic point of view. Finally the energetic valorisation from biomass flows, which are eligible for use as raw material or for material recovery has to be excluded, especially if there is an effective demand for it.

4.7. Knowledge building, research and development

Europe has to focus on innovation in all the stages of the lifecycle in order to come closer to sustainable materials management and integrated product policy.

- Europe can establish an expertise centre on closing material cycles, whereby primary and secondary raw material flows in Europe are mapped, including the import and export flows and the leakage currents, as well as sustainable techniques in terms of mining, processing, production, use, collection, dismantling and recycling. Europe has to work on establishing best practices, manuals, knowledge exchange forums and support mechanisms.
- Europe has to stimulate R&D in terms of ecodesign, eco-efficient production processes, separation and recycling technologies, new application areas for recyclates and concepts of product services.

[16] Directive 2009/28/EG was published on 5 June 2009 and became applicable on 25 June 2010. From this date Member States have 1.5 years to transpose this directive into legislation. In practice the directive will thus become applicable from autumn 2010.

[17] On the occasion of the review of the Directive (2014) the remaining gaps in the sustainability frame need to be addressed thoroughly and preferably in the short term (before 2014). It is important that the Commission realises this in an open and transparent process, in which the stakeholders are involved.

- Europe has to encourage research into the consequences of the processing of nanoparticles and micro-electronics on the recyclability of materials and the health of employees in the recycling industry.
- Europe has to encourage R&D into the development of biomass for energy use, which does not compete with applications in the food industry or for the production of other raw materials.

4.8. Stimulation of product services systems

Product services systems ensure that products can be used several times by multiple users without them having to own the product in question. The development of a service economy will ensure that consumers no longer have to buy expensive equipment which they only need to use for a short period of time to meet their needs (e.g., copying services, car sharing, gardening, laundry and ironing services and so on). Thanks to lease and rental services manufacturers also remain the owners of their products so that they can be encouraged to develop economic products that are easy to repair, dismantle and recycle with a long lifecycle. This also results in a more efficient use of materials, products and energy to deal with these same needs. The European Union can encourage this by reducing VAT on services for the repair, lease or rental of products or by raising the guarantees that manufacturers have to give for the products that they market.

In a B2B environment leasing formulas (e.g., chemical leasing, floor covering and so on) can also give rise to win-win situations. On the one hand it can mean that the manufacturer can differentiate himself from the competition by offering a higher service level to the customer and thus can generate higher margins than from the mere sale of the product. On the other hand it is no longer in the manufacturer's interest to sell as many products as possible. Instead the aim should be to supply the best possible service with the fewest possible products or with a product that easy to reuse or recycle, in view of the fact that the manufacturer is the owner and will have to bear any potential costs for the product's final processing.

4.9. Encouraging a sustainable purchasing policy

The European Union can encourage all the governments to implement a sustainable procurement policy, in which priority is given in specifications for public procurement to products and services that tie in with sustainable materials management (products with a cradle to cradle certificate, secondary raw materials and so on).

Examples from the Netherlands indicate that the government can not only take into account ecological but also social criteria for the procurement policy for goods and services. The government can influence the supply side as well as citizens as users with a well-considered policy.

4.10. Stimulation of landfill mining (Enhanced Landfill Mining, ELFM)

Enhanced Landfill Mining (ELFM) is the integrated valorisation of materials and energy from landfills through the maximum recycling of materials and the conversion of the energy potential of the

recycling residue into renewable electricity and heat. EFLM can be seen as part of Enhanced Waste Management. EFLM can be applied for the mining of historic landfills – especially when these pose a threat to the environment – and as a strategy for the temporary storage of waste in anticipation of better material and energy recovery in the future. A valorisation as Waste-to-Product (WtP) or as Waste-to-Energy (WtE) will depend on the composition of waste flows and the available technologies in terms of energy production and material recovery. EFLM technology is continuously evolving[18] and requires attention for technological thresholds as well as for non-technical barriers (legislation that has not been adjusted, social acceptance of secondary raw materials). Technological breakthroughs among others are required in the field of new separation technologies (for complex, outdated, reacted, heterogeneous material flows) and gas plasma techniques (to generate electricity and heat from the resides that does not have to be converted into secondary raw material).

[18] EFRO project: 475 Knowledge valorisation – Clean Tech, Closing the Circle, a demonstration of Enhanced Landfill Mining (EFLM) in a 15 Mton landfill in Houthalen-Helchteren (by the consortium REMO Milieubeheer and Groep Machiels, VITO, KULeuven, UHasselt, LRM, OVAM)

Annex. The materials management hierarchy: mirrors the waste management hierarchy