

## Discussion Document

### Innovation Partnership: Non-Energy Raw Materials for a Modern Society

#### 1. 2020 target

- Europe needs to make a significant step ahead by 2020 to ensure a secure supply and achieve efficient and sustainable management of **non-energy materials in Europe**. The proposed partnership will contribute to the mid and long term raw **material supply security**, to **increase resource efficiency** in the EU, to the development of new **European based recycling activities** (largely SME-based).
- Europe has to extract better, to recycle more, to find alternatives/substitutions for critical and environmentally/energy demanding raw materials and to be more resource efficient. Demonstrating ten innovative **pilot plants** for raw materials **extraction and processing and recycling, finding substitutes** for at least three key applications of critical raw materials underpin this partnership. In addition, **studies** with an integrated systemic approach and raw material **dialogue at international level** will round this initiative off.

#### 2. Strategic objective and link to societal challenges

- In line with the **Europe 2020** the partnership aims to achieve smart, sustainable and inclusive growth. The issues of sustainable supply of raw materials will be addressed by the French Presidency at the G20 summit in 2011. The roadmaps for **Industrial Policy** and **Resource Efficiency** clearly recognize that the trends in the global economy mean that environment and economy cannot be treated separately. This is also in line with the three pillars of the Raw Materials Initiative adopted by the Commission. Accordingly, the major social challenges are mentioned below.
- **Demographic growth and supply security:** Following the observed **demographic trends** global populations will increase to 9 billion by 2050, resource demands may start to outstrip the capacity to supply some of them in economic, environmental and social sound conditions. Moreover, this problem is compounded by the fact that many countries adopted policies reserving their resources for their own use. An important part of this demand could be covered through secondary materials from recycled waste – one of the EU most abundant domestic resources. Eco-design of product could also contribute to reduce the demand for specific raw materials and facilitate the recycling of key materials. Although further increases in recycling are expected to contribute in meeting the expected growth in demand, a further increase in global production of primary raw materials will be necessary.
- **Challenges from the new technologies** The **urbanisation** of emerging economies and the increased demand for new **technologies**, including environmental technology sector will put increased pressure on the demand for raw materials of our European society and elsewhere. Solar panel systems, hybrid cars, energy efficient buildings, flat screens, mobile phones, computers and other IT devices and KET but also medical instruments and means of transport will require increasing input of crucial raw materials. With the rapidly evolving emerging technologies the demand is expected by 2030 to be increased in some cases by the factor of eight (indium and germanium) or even 20 (gallium).

- **Being more resource efficient in the use of current resources:** The European Union has put in place efforts to increase the recycling of valuable resources from different types of waste. Despite the encouraging progresses achieved in some sectors still a massive amount of resources is not recycled. Recycling in most cases produces materials at much lower environmental impact than many primary materials. New efforts are needed to improve the collection/sorting systems in order to ensure high level quality of recyclates and recovery of key raw materials.

**Conceive products to be reused, dismantled or recycled:** Develop and foster adoption of highly advanced clean, safe and cost-effective production technologies (improvement of responsible consumers' behaviour, see flagship initiative - resource efficient Europe). Products should be conceived and (indirectly) managed "from cradle to cradle".

**Finding substitutes to critical materials:** Diversification and enlargement of the origin of the materials for the European industries to reduce Europe's dependency. Continuing dedicated research actions in order to find substitutes and viable alternatives for at least three critical raw materials. Synergy in research can be sought with international cooperation, where appropriate.

**Extracting more efficiently:** Develop and demonstrate highly innovative solutions for deep, intelligent, safe, cost-effective, zero-waste mining are examples of technologies that need to be further developed in Europe in order to exploit better the resources available within and outside the borders of the EU. In addition, the use of Earth observation and other space technologies like the satellite positioning systems GALILEO and EGNOS will be essential.
- **The EU can not miss these technological evolutions** which represent a huge opportunity for skilled jobs. The high-technology areas of safe and environmental sound deep mining and undersea mining and as well as sophisticated recycling and ecodesign creates smart jobs much of it with SMEs. The EU has to ensure a sustainable management of materials and the supply of raw materials from inside its borders and from the outside. It has to be recognised that the situation is particularly vulnerable in some cases with an import dependency of 100 %. This Innovation Partnership will strengthen the overall non-energy raw materials import strategy of the EU, for critical raw materials in particular; guarantee the EU a safe position at the world resources markets; and will bring skills, jobs and production capacities back to the EU.
- **A dialogue at international level** with industrialised and developing countries on managing materials and resources within a global systemic approach should be launched. This approach should consider the economic, social and environmental challenges. The EU leadership in Earth observation and the extension of the European satellite positioning system EGNOS to the whole Mediterranean sea and to Africa provide tools in this respect, especially as work is already advanced with some partners, such as Africa. The Partnership could contribute to move towards an European resource efficient society and the development of a new EU leadership in that field.

### 3. Policy framework in the domain of the Partnership

The Partnership is set up in the context of the **Raw Materials Initiative** adopted by the Commission in 2008 and fully endorsed on different occasions in the **Council** (in May and December 2009 as well as May 2010) who asked for swift action including in the area of Research and Innovation. A new Communication on Raw Materials is foreseen by the end of 2010.

It is also coherent with the European Sustainable Consumption and Production Policies (SCP), eco-design, eco-label, green public procurement (GPP), waste policies, the concept of waste hierarchy, the new waste framework Directive and the Thematic Strategy on waste and natural resources. The EU 2020 strategy highlighted among others, two important Flagships "**An industrial policy for the globalisation era**" and "**Resource efficient Europe**". According to the EU 2020 objectives:

- The EC framework for a modern industrial policy addresses all elements of the increasingly international value chain from access to raw materials to after-sales service.
- There is an aim to increase investment in the EU's existing natural assets and to promote technologies and production methods that reduce natural resource use and combat climate change.

The European 7<sup>th</sup> Framework programme for Research and Technological Development (FP7) represents the main policy and budgetary framework to support dedicated research and innovation actions.

At international level, the crucial role of raw materials was highlighted at the occasion of G 8 meeting in Heiligendamm<sup>1</sup>. The need for international discussions on raw materials has also been stressed by the United Nations<sup>2</sup>. The EU-US Transatlantic Economic Council (TEC) has agreed on promoting innovation partnerships in the area of developing substitutions to critical rare materials such as rare earths. The OECD has recently included the issue of raw materials as one of its major policy issues. The UE Ministers of the Environment have also recently confirmed the need to move towards a "sustainable management of materials"<sup>3</sup>. At the 18th session of the United Nations Commission on Sustainable Development (CSD) in May 2010, the need of new initiative to boost sustainable consumption and production was also highlighted.

#### **4. Existing tools, measures and initiatives**

**Tools:** **European Technology Platforms** (ETP) such as *SMR, Artemis, Manufuture, SusChem, Forest-Based Industries, ECTP, EURO* and *EuMaT*; **Public Private Partnerships** such as *Factories of the Future on enabling manufacturing technologies; Energy-efficient Buildings, Green Cars; Eco-labelling, Eco-design and Green Public Procurement*; **European and joint national research** within FP7 with dedicated calls for research for the substitution of critical raw materials and an *ERA-NET on industrial handling of raw materials, TIC*; *GMES (Global Monitoring for Environment and Security) and its environmental information services, with European component and global component (in particular Africa); GALILEO and EGNOS applications and extension to Africa and Middle East.*

**Measures:** The Waste Framework Directive, the Waste Shipment Regulation, the Birds and Habitat Directive and other regulations give the legal framework for implementation in MS. Competitiveness and Innovation Framework Programme (CIP).

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<sup>1</sup> The G 8 has put forward recommendations underlining the need for sustainability and transparency in the area of raw materials exploration and exploitation.

<sup>2</sup> World Investment Report 2007.

<sup>3</sup> [www.eutrio.be/pressrelease/necessity-using-materials-sustainable-way](http://www.eutrio.be/pressrelease/necessity-using-materials-sustainable-way)

*Initiatives:* i) Raw Materials Initiative, ii) Lead Market Initiative on recycling, and bio-based products iii) Initiative on sustainable consumption and production, iv) PRO INNO Europe<sup>®</sup>, v) EU-AU Partnership and *Thematic Strategies* of i) Waste Prevention and Recycling, ii) Sustainable Use of Natural Resources.

## 5. Bottlenecks to be overcome

- **Lack of suitable technologies to optimize the management of materials within an integrated approach:** Although the EU has a long tradition in managing materials, a boosted integrated systemic approach needs to be developed and set in place on the basis of industrial priorities and sustainability considerations. There is a need to develop new technologies with an interdisciplinary approach for materials identification, extraction, optimized management, processing, transformation, their use for the production of goods that will have to be managed at their end-of-life (EoL). This should involve the whole value chain.

Appropriate new technologies are needed in all aspects of the supply chain (from identification to extraction to EoL) in particular for those raw materials, including semi products used in small quantities in a product or requiring significant energy, land use, toxic substances, etc. for their extraction/processing. Interdisciplinary research regarding the economic efficiency and the optimised treatment of process slags, effluents, etc. and end-of-life product collection, pre-treatment processes and optimisation of the interfaces between several steps and stakeholders involved along the value chain are not well connected.

- **Lack of possibilities to substitute critical materials.** There is still a limited freedom in choosing the materials to use. For many of the critical raw materials, substitution is currently difficult to achieve without deterioration in the quality or performance of the products, or is not economically viable. New materials technologies and related processing enable today the development of "materials by design" starting from the required properties and taking into account availability, cost, sustainability and safety concerns. Dedicated research is needed and this should be turned into industrial innovation as soon as possible. More complex modelling, novel technologies (e.g. nanotechnology & industrial biotechnology) and multiple disciplines will play a paramount role to overcome this bottleneck.
- **Insufficient recycling and the loss of raw materials in the value chain:** Energy efficient and environmentally sound techniques for the recycling of various materials notably non-ferrous metals (e.g. rare earth metals, lithium) and industrial minerals from waste deposits are not well developed. Also, the integrated use of diversified resources for the sustainable manufacturing needs more process technology development (e.g. catalysis). Moreover, the bulk raw materials used in infrastructure are hardly ever recycled but often downgraded. The ongoing evaluation on the Thematic Strategy on waste prevention and recycling is showing that results are quite limited in terms of prevention and very different between MS in terms of recycling. In-depth data collection concerning selected relevant products and transparency of Life Cycle Analysis (LCA) are missing. An optimization of interfaces in the recycling chain is crucial.
- **Lost economic opportunities:** More and more sorted waste is exported to be recycled outside the EU and where it is dismantled under poor environmental and social conditions. This is the case for instance for electric and electronic end-of-waste, life consumer goods,

old cars, and plastics, paper and cardboard. This is due notably to the to insufficient measures to facilitate the use of secondary raw materials and to support the competitiveness of the recycling industry. In addition, it seems that illegal shipment of waste has increased in the recent years. The exact environmental consequences of these exports are difficult to assess, but it represents a missed opportunity for European industries and related jobs. Recycling markets are largely SME based. The growth potential is significant – in France alone the sector reports some 2000 new jobs annually. To this one could add future specialist jobs in manufacturing and use of recycled materials.

- **Inadequate support for SME:** SME face not only shortage of appropriate financing of innovative projects but have also difficulties to patenting their solutions which put them in disadvantage with bigger companies. They are also particular affected by the lack of knowledge about deposits and transparency of the policies related to minerals policy and permitting. Niche solutions along the entire value chain of raw materials are often provided by SME as first business implementation achievements. The raw materials production (cradle to cradle) in the EU should be facilitated for the investment with governments and citizens' support.
- **Lack of sufficiently harmonised minerals policy between Member States:** Minerals Policies and land use planning are a matter of national and regional competence. Sharing experiences as provided with the recent report on "exchanging of best practice in land use planning, permitting and geological knowledge base" and with the exchanges of information on the implementation of the Mining Waste Directive need to be further reinforced. It is essential to ensure a complete implementation of existing European legislation (e.g. mining waste directive) to avoid unnecessary risks and unsafe mining operations.
- **The lack of effective structures for networking and cooperation to develop a knowledge based approach:** To develop the currently hidden European primary and secondary raw material resources having a complete, coherent and reliable knowledge base is a cornerstone. The vast majority of the earth surface is largely unexplored as 71% is covered by sea. Major basic statistics are not available at the EU level in relation to deposits, exploration, real extraction and recycling potential. No quantitative intelligence on likely future needs for raw materials is in place on a pan-European level. Geological Surveys provide useful data. However, their major area of operation is at national level. The lack of effective structures for networking and cooperation does not allow maximising the potential benefits of economies of scale nor the development of joint projects (e.g. mapping in 3 dimensions) at European level. There is a need to make projection at EU level of the future demand of raw materials and to confront it to the various potential supply sources including recycling and EU geological reserves.  
The move to operations of the EU Earth monitoring programme GMES has the potential to overcome most of these bottlenecks, possibly with an adaptation or extension of its environmental information services.
- **Need for standardisation and certification schemes and systems** to be developed in cooperation with industry, Geological Surveys and MS to ensure a high quality of the raw materials extraction and processing, including improved control of waste management, treatment and shipment of waste. Currently, national geological surveys use different nomenclature and different definitions which limits pan-European assessments and references.

- **Lack of Demand of secondary raw materials.** There is a large variation in incentives offered by Member States through public procurement for recycled material. Also private sector initiatives should be boosted. NGOs are deemed to play an important role in the actions addressing this issue.

## **6. Building-blocks for implementing the Partnership**

**WP1 – Developing new innovative technologies and solutions for sustainable raw materials supply.** Innovative approaches shall address all aspects of the value chain including efficient resource processing. It addresses economic, safe and environmentally friendly extraction and processing of primary raw materials as well as the safe and environmental friendly extraction of mining waste heaps and recycling of secondary raw materials in order to improve the quality and quantity of recyclates. This shall be demonstrated on 10 new pilot plants along the value chain reflecting extraction of different types of raw materials, and processing and collection and recycling processes, in different regions and three demonstration biorefinery plants. Business orientated implementation of those pilot plants to be designed in close cooperation with stakeholders including companies from different sectors. Design, set-up and continuity performance of those pilot plants shall be ensured by the stakeholder consortium to consist of academia, industry and NGO's aimed also to promote skills and experience (trainee on the job). Particular accent will be set on the competitiveness of the proposed solutions in order to ensure their durability in the globalised context.

**WP2 – Developing new innovative technologies and solutions for the substitution of critical materials.** Substitution is particularly adequate for dissipative use segments of critical raw materials, since here hardly any recycling opportunities exist. Substitution becomes very powerful where a potentially scarce and critical raw material could be substituted by an abundant one or through alternative process design not requiring such materials.. This Partnership shall tackle substitution for at least three key applications of critical raw materials or groups thereof, with reference to the priority list identified and published by the European Commission<sup>4</sup>. As an example, one can mention Rare Earths, Platinum Group Metals and Gallium or Indium. Impact studies and analyses should also be carried out. Appropriate synergy will be searched in international cooperation, for instance with the US (e.g. DoE) and Japan (e.g. MEXT and METI).

**WP3 - Improving Europe's raw materials knowledge and infrastructure base.** To develop the currently hidden European primary and secondary raw material resources having a complete, coherent and reliable knowledge base is a cornerstone. Major basic statistics must be available at the EU level in relation to deposits, exploration or real extraction and recycling potentials. Projections of future demand of raw materials should be developed according to different scenario The economic and environmental consequences of the various scenarios should be assessed. The EU Earth monitoring programme GMES can contribute to discovering hidden resources, mapping them and monitoring the performance. It would enhance monitoring for security and environmental purpose and complement the Maritime Policy (e.g. maritime spatial planning).

Collaboration between Geological Surveys and other research organisations aiming to improve the European geological knowledge base should be promoted. Primary resources should be

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<sup>4</sup> [http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/report-b\\_en.pdf](http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/report-b_en.pdf)

mapped in 3 Dimensions . It will build on the OneGeology-Europe standards and the marine component will be integrated within the European Marine Observation and Data Network<sup>5</sup>. Furthermore, Geological Surveys shall contribute their experienced knowledge to i) improve standardisation and certification and ii) technical and technological matters.

Data on resources are of additional benefit to the society in particular in terms of land use planning and environmental monitoring. An information platform shall be established to assess the conflicts of deposits with other land uses. GMES will provide parts of the needed satellite data for such services, e.g. for ground stability monitoring.

**WP4 – Improving the regulatory framework via promotion of excellence and promoting recycling through public procurement and private initiatives.** Enhanced cooperation between MS authorities aiming at streamlining the procedures (e.g. minerals policies, including mining law, land use planning and permitting processes and Pan-European infrastructure, inspection of mining facilities) and promoting stories of success (e.g. closing raw materials loops, collecting schemes for raw materials). Determining which recycled products would benefit from a more enlightened public procurement policy and disseminating the results to national governments and public authorities. Develop and ensure high standards for the implementation of the technological approaches with the involvement of citizens to increase acceptability of new technologies. Facilitate the use or application in final products and highlight novel properties of final products through standards. Improve standardisation and certification mechanisms (e.g. in the area of control of illegal waste shipments) without creating extra costs and supported by exchange of success stories in MS.

**WP5 –International cooperation.** A dialogue at international level on managing materials and resources in the industrialized world and in a sustainable way should be launched. Other world's economies should be involved in this approach within a global systemic approach, as the challenge is for all Nations. More operationally, European expertise in data collection from Geological Surveys, advanced technologies and skills for economic efficient mining and minerals processing, measures to protect the environment and rehabilitate abandoned mining sites shall be put to the advantage of a better cooperation between the EU and African countries in particular by helping the implementation of the **African Mining Vision 2050**. Support and monitoring of actions could be promoted in the GMES framework, where an initiative "GMES and Africa" is already in place and provides an ideal framework. Optimization of mining operations including protection of the environment, as well as of the transport of materials after extraction, can be improved via using accurate geopositioning systems like EGNOS and GALILEO. Research projects on substitutes to critical raw materials and networking with Geological Surveys of industrialised countries such as USA and Japan will be reinforced. Exchanges of experiences on new ways of designing products in order to increase recycling and improve the efficiency on use on raw materials.

*A close interaction between the WP is needed in order to accelerate the economic opportunities in particular for SMEs.*

## **7. Stakeholders to be involved in the Partnership**

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<sup>5</sup> Marine Knowledge 2020; Commission Communication to be adopted 8 September 2010

Member States through Public authorities including Ministries of economy, research and environment and research agencies; and stakeholders related to the exploration, mining and mineral processing and waste management including industry, research organisations, universities, geological services, NGOs and organizations representing the civil society.

The partnership will benefit from an ERA-NET on Raw materials in preparation which will gather MS Public authorities and the ETP for Sustainable Mineral Resources representing a large part of the European stakeholders in the area as well as from the stakeholders involved in the waste and SCP policies.

**Commission services:** ENTR, MARE, RTD, ENV, JRC, DEV, RELEX and TRADE, could also involve REGIO, EMPL, MARKT.

## **8. Lead Commissioner(s) and DGs involved**

VP Tajani will be the leading commissioner in association with Janez Potočnik for what concerns waste and SCP aspects and Máire Geoghegan-Quinn on research aspects. Preparatory work is led by DG ENTR (D/1, G/3), ENV (C1 and C2) and DG RTD (G/2, G/3) with involvement of the DG's MARE, TRADE, and RELEX, MARKT.

## **9. Governance of the Partnership**

The Partnership will be steered by a High-Level Steering Group that will meet one to two times a year and underpinned by an Expert Group which shall meet twice as often as the steering group. Possible members for the High-Level Steering Group: Vice President Commissioner for Industry and Entrepreneurship (chair), and Commissioner for the Environment and Commissioner for Research and Innovation will be associated; 6 Ministers in total (2 for each of the domains Industry/Economy, Environment and Research); 10 CEO's of major European Industries (mining and materials producers including chemical, and mechanical engineering and waste management industries) EIB and EIF high-level representative; NGO high-level representative (e.g. EEB, EITI); 5 high-level representative of research organisations (e.g. coordinator of ERA-NET, Director General of EuroGeoSurvey, Director-General of the European Space Agency). 2 MEP's.

The High-Level Steering Group will prepare a multi-annual roadmap 2011-2020. The High-Level Steering Group will be supported by an Expert Group that will prepare the Partnership meetings and coordinate the milestone details among the stakeholders.

A broader Stakeholders' Forum will be called to meet once a year to assess the work done by the Partnership and to provide inputs for the continuation of the activities. With ERA-NET and ETP-SMR, the SCP and waste consultations groups the EU has already set up the right fora to provide continuity among stakeholders and the steering group.

## **10. Financing the Partnership**

Financial support to research via the EU Framework Programme(s) is decided with separate acts. Under NMP theme within the **FP7** which foresees an overall budget of € 50521 million for the period of 2007-2013 €, calls for proposals are expected with regard to: i) networking at MS level ii) developing new technologies for clean intelligent mining activities, iii) eco-design

for new products and eco-efficient and cost-effective method of production and iv) finding substitutes for some critical raw materials. SMEs are also supported via the research for the benefit of SMEs programme<sup>6</sup> of the FP7.

The timeframe 2014 to 2020 would be covered by **FP8** which could address some of the specific milestones expressed below.

SME orientated **CIP** foresees an overall budget of € 3621 million for the period of 2007 to 2013. Within its framework on eco-innovation support the next call for proposals could be used to promote the demonstration pilot plants.

Environmental information services on land and oceans available through GMES could directly contribute (or be extended to this aim) to part of the Partnership's geological knowledge base.

**ESFRI** could continue developing the European Geological Survey infrastructure towards a pan-European research and innovation infrastructure.

Up to €45 million will be allocated to large **multidisciplinary marine research projects** in the framework of the cross-thematic approach recommended by the "European Strategy for Marine and Maritime Research" (COM (2008) 534).

Networking can be supported by **COST** while exploring Europe's resources shall be co-funded in the GMES framework. In addition, the partnership needs to be funded also by MS (e.g. ERA-NET members) and Industry (e.g. research and fellowship programmes).

**ENRTP**. The 2010 EC Annual Action Programme foresees € 1 million to support the Secretariat of the UN CBD in implementing CBD COP 10 decisions and a further € 1 million to support the implementation of the CBD Work Programme on Protected Areas with a focus on marine protected areas.

The dedicated funding to nature and biodiversity from **LIFE+** foresees about € 836 million for the period of 2007-2013.

## **11. Milestones to track the implementation of the Partnership**

### **Short term: (2010-2011)**

- Implementation of high-level steering group and its related expert group with first deliverables of action plans on i) research and innovation actions under FP7 and subsequent as well as e.g. CIP, National research programmes; ii) creating the raw materials knowledge base of Europe. Action plans need to be defined in an open Stakeholder process including European Geological Surveys, Industry, Research Organisations, NGO's and MS.
- Preparatory work regarding specifications for the 10 pilot plants (on extraction and recycling).
- Planning the research actions on finding substitutes for critical raw materials and raw materials extraction, processing and recycling.

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<sup>6</sup> [http://cordis.europa.eu/fp7/capacities/research-sme\\_en.html](http://cordis.europa.eu/fp7/capacities/research-sme_en.html)

- Identification of concrete legislation and standardisation targets needed to be implemented.
- Launching a first approach on defining possible EU concrete actions for extraction recycling and resource efficiency of raw material management.
- Establish the international cooperation on raw materials on a regular basis with close neighbours (Barents Region), industrialised countries via TEC and TCP (e.g. US and Japan) and regions of high potential (e.g. EU-AU partnership).
- Establish a progress report on the Thematic Strategy on Waste Prevention and Recycling by end 2010. On the basis of this detailed assessment, new actions will be proposed to improve the implementation of the EU waste policies.
- Suggestions on possible research areas for the next EU Framework programme.

### **Medium term: (2011-2013)**

- The key actors and infrastructure for feeding the raw materials knowledge base of Europe in place.
- First elements of the raw materials knowledge base are in place notably through the GMES initial operations and the GMES and Africa initiative.
- Launching dedicated FP7 research actions targeting basic concepts and technological elements for new production plants in extraction and processing and for collection, recycling of raw materials and actions for finding substitutes and viable alternatives for at least three to critical raw materials.
- Ensuring long term implementation by continuous dedicated research actions, supporting innovation and fostering industrial take-up in order to bring into industrial praxis the substitutes and viable alternatives for at least three to critical raw materials.
- Collaboration of public authorities and the private sector to promote and develop guidance for innovative raw materials production and secondary raw material collection and recycling technologies.

### **Long term: (2014-2020)**

- Complete raw materials knowledge base of Europe created and permanently updated including a deliverable of a European 3-D map of the distribution of raw materials resources, projection of future demand of raw materials according various scenarios, economic and environmental impacts of the scenarios.
- Demonstrating **ten innovative pilot plants** for raw materials **extraction, processing and recycling**.
- Industrially viable alternatives for at least three substitutes to critical raw materials (or groups thereof) addressed also via research projects.
- Initiatives including legislation and standardisation promoting the uptake of innovative solutions in place.