Material Efficiency & Resource Conservation

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Resource Policy to Design Framework Requirements

Executive Summary

Summary report of Task 3 within the framework of the „Material Efficiency and Resource Conservation“ (MaRess) Project

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Contents

Figures

1 The Function and Goals of Resource Policy

Natural resources are the foundation of all economic activity. No economy can do without raw materials. The growth of the service economy has created new sources of value creation, but has not led to an absolute reduction of raw material consumption. The sales volume of raw materials has rapidly increased, creating a global network of supply relationships. Companies are becoming dependent on suppliers from sites around the world. These developments have enabled the continuous production of low priced products; concurrently, global market penetration and the volume of goods produced are rising. For the producers of natural resources the exploitation of sources of raw materials and global trade are often associated with a new prosperity.

The current utilization of resources, especially non-renewable ones, is, however, not sustainable. The extraction of metal ores, coal, oil, building materials and other materials often causes devastating environmental impacts. In addition to the increasing consumption of land and nature, transportation and processing of natural resources as well as the use of the resulting products is associated with large emissions of contaminants and greenhouse gases, as well as energy and water consumption. Finally, these material streams also produce enormous amounts of waste.

Current usage of resources is not only facing ecological limits. Economic limits are also becoming noticeable: for example, scarcities of certain metals which currently seem indispensable for use in information and communication technologies are clearly indicating the limits of natural resource reserves. Some other materials have adequate natural resource reserves, but have experienced rapidly rising prices due to skyrocketing demand, strong concentration of natural deposits in individual countries and in the hands of specific resource extraction companies, or their coupling with co-products in extraction. However, notable economic opportunities exist for an efficient use of natural resources: numerous studies demonstrate the considerable growth potential of resource-efficient products and recycling-technologies.

For this reason the Federal Government has stated the goal of doubling natural resource productivity: by 2020 every euro of value creation should be produced with half of the abiotic natural resources used in 1994. Insofar as efforts towards this goal lead to an absolute reduction of natural resource use, it would be associated with formidable environmental load reduction at every stage of the supply chain. The costs associated with the adjustment of products and processes would in many cases be compensated by reduced material consumption. As with energy use there are notable non-realised efficiency potentials in the utilization of natural resources.

Economic theory would suggest that companies have a strong incentive to exploit these efficiency potentials to gain competitive advantages. Scarcity of resources will be reflected in rising prices, triggering innovations for substituting or limiting the use of scarce materials. From this perspective resource policy should be limited to internalis-

ing harmful environmental effects into the price of resource use, while enabling market and pricing mechanisms to determine the optimal allocation of goods . The free market is viewed as the most efficient form of regulating the use of scarce resources.

However, research shows that this is not the case. Efficiency potentials have not been maximised, scarce resources not substituted. Moreover, resource extraction and the associated environmental damage (negative externalities) and final resource use are often geographically and temporally distinct. In many cases the necessary knowledge about environmental consequences, about possibilities of avoiding them as well as about appropriate and intelligent incentives are missing.

Sustainable resource use – material efficiency and resource conservation – faces a number of challenges. These include:

- **External effects**: It is possible to externalise the environmental damages from resource utilization, e.g. from resource extraction and environmentally damaging recycling practices. These costs are not born by the beneficiaries of resource use, but by the general public. The failure to internalise environmental costs is proof of market and policy failures.
- **Information deficits:** Company internal information deficits on potential savings as well as uncertainties about future market developments and natural resource prices contribute to the absence of innovations. Moreover, the widespread short-termism of economic actors in the form of reporting years and short production cycles suppresses planning for medium-term foreseeable scarcities for a number of metals and minerals. Furthermore, increasingly complex production chains and shorter product life cycles have led to information deficits on the composition of pre-products, the source of materials and conditions under which resource extraction takes place, and the whereabouts of end-of-life products. The lack of information of market actors is a further source of market failure.
- **Non-utilized innovation potentials:** Many sectors show underutilized innovation potentials for the development and diffusion of resource efficient products. This under-utilization is due, on the one hand, to the inherent incentive structures of innovations (unforeseeable risks, missing capital, spill-over-effects, missing infrastructure, etc.) and, on the other hand, to positive externalities: the benefits of innovations are realized by society as a whole. As a result, there are too few incentives for private actors, especially to induce far reaching system innovations.

The identified barriers allow one to deduce the following key areas for a resource policy.

1. A sustainable **environmentally sound utilization of resources**: requires the avoidance of negative externalities along the value-added chain. This includes the preservation of ecosystem functions and services which are particularly endangered by the extraction of natural resources or the improper disposal of end-of-life equipment. Reducing material intensity and preventing resource

losses by closing material cycles and establishing efficient recycling structures are further points of departure for reducing environmental impacts.

2. Security of supply: Medium-term scarcities are foreseeable for a multitude of natural resources. This includes several critical metals which are relevant for the production of technologies of the future. Even metals with adequate reserves have experienced rapidly rising or highly volatile prices on commodity markets. Resource policy, therefore, also aims to reduce natural resource use by exploiting efficiency potentials, thereby contributing to security of supply. Again the before mentioned closing of material cycles and optimization of recycling are important points of departure.
3. The competitiveness of domestic industries is to be secured in the future by stimulating **economic modernization effects**. These effects require political, legal and economic incentives towards a self-supporting development and the diffusion of green future technologies for material efficiency and resource conservation. These include the promotion of product innovations and more encompassing system innovations as well as support of the diffusion of innovations into the mass market. Overall, visions for sustainable resource consumption can be devised and realized through eco-innovations (Bringezu 2009). Material and resource efficiency innovation potentials exist that have not yet been fully realized.

There is no single policy tool that would be equally suited for all problem structures, goals, actor types, kinds of resources, etc. Instead a policy-mix is required that overcomes a variety of barriers, is mindful of separate innovation stages, and effectively addresses future global challenges. The suggested policy instruments can be grouped into the following categories:

- **Regulation**: States use regulatory measures to directly influence product design or production processes (e.g. in the form of prohibitions or product requirements). They aim at reducing or preventing negative environmental impacts or, where appropriate, to hold polluters responsible for environmental damage. Main disadvantages of this approach are the high information and legitimacy demands. Therefore, binding regulation needs to be linked with instruments of self-regulation (hybrid governance arrangements, Hey et al. 2007). The proposed instrument „Dynamic Standard Setting/Resource Top-Runner“ in MaRess Task 3 belongs to this group. A different form of regulation is the linking of reporting requirements for producers with market access for their products. Due to the complex nature of product life cycles and non-transparent supply chains, information on the natural resources found in products and their origin is often unavailable or only available in a limited form. Such information is, however, imperative for effective regulation. On the one hand, information generating instruments form a necessary basis for regulation (e.g.. material bans or substitution requirements) and, on the other hand, they can influence the behaviour of producers and consumers.

- **Economic incentives**: Taxes and duties can be used to induce short-term price changes for certain resources, thereby sending price signals to producers and consumers. Rising resource prices can induce innovation leading to positive economic developments in the medium-term. Fiscal tools can be used to make these incentives calculable and stable. They can help resource conserving innovations achieve higher demand and market penetration. Moreover, they serve as instruments for the internalization of negative externalities. MaRess Task 3 illustrates the effects of fiscal tools with the example of a building materials tax.
- Economic incentives can also be directly targeted at promoting innovation and the diffusion of innovations into the mass market. The state can use the entire spectrum of innovation policy tools, such as the direct support of R&D projects, the provision of risk capital or the promotion and funding of networks or clusters. In addition to supply side innovation policy it is also sensible to support the diffusion of innovation policy into the mass market. Export promotion is a potential instrument to support demand for innovate products. The MaRess Task 3, therefore, also studies the German export promotion initiatives in the area of recycling and efficiency technologies.
- **Private regulation** and the negotiation of standards: considering the limited (territorial) reach of state intervention contracts between state and private actors (so called covenants) present an opportunity to govern trans-boundary material streams and to involve a large number of actors along the product life cycle. The instrument aims at an improved assignment of responsibilities for materials used (material responsibility). Such an approach is introduced using the example of end-of-life vehicle recycling. The covenant is supposed to contribute to the closing of material cycles and to the avoidance of resource losses.

The aim of a resource policy is to design framework conditions for economic activity that provide incentives for efficient and sustainable, utilization of resources and that initiate search processes for more resource efficient technologies. Key areas of a resource policy are „avoiding negative environmental impacts“, „security of supply“, and „realizing competitive advantages“. Under increasingly globalized production chains and product life cycles, the conception of a role for the state necessarily goes beyond the national context and must acknowledge the framework requirements established by the single European market and international agreements. These include both challenges and opportunities. On the one hand many relevant policies, including environmental policy, but also trade, economic and innovation policy are Europeanized, making unilateral national action increasingly difficult. Moreover, the environmental impacts of resource use (such as those resulting from resource extraction and the disposal of end-of-life equipment) are primarily felt in jurisdictions outside those where the end products of the natural resources are consumed. On the other hand, internationalization provides an opportunity for innovations to create further international markets. If environmental concerns can be integrated into the mechanisms of world trade and the standardization of products and services, a potential for mutual amplification could de-

velop (Oberthür / Gehring 2006, Gehring 2007, Bleischwitz et al. 2009). Furthermore, environmental technologies that have demonstrated their technical and economic feasibility often experience high demand in important emerging economies (Walz 2010).

Accordingly, the MaRess Task 3 developed resource policy tools which aim to create dynamic framework requirements. The Task used a case study approach in which various modes of governance, policy and problem areas were examined in detail. Environmental, economic and innovation policy tools that use economic incentives, regulatory approaches, self-regulation and information based governance mechanisms were analyzed. The selected tools were subjected to a comprehensive impact assessment taking into consideration ecological, economic and social aspects as well as their legal and political feasibility. To conduct the impact assessment the tools were applied to concrete material streams and industries. The goal was to demonstrate the effectiveness and necessity of resource governance and provide exemplary an impact assessment.

2 An Overview of Suggestions for Resource Policy Tools to Design Framework Requirements

2.1 Resource Information and Certification Obligations in Supply Chains (RICOS) for the ICT Sector

Missing information on environmental impacts along global value-added chains is a central barrier to effective resource policy. To limit this problem a knowledge generating policy instrument named „Resource Information and Certification Obligations in Supply Chains“ (RICOS) is suggested and illustrated with the example of mobile telephones and the critical metals they contain. RICOS combines self-regulatory and knowledge generating approaches with legal instruments. The goal is knowledge generation and the limiting, or rather, reduction of environmental impacts that appear along global material streams, especially in developing countries. By providing basic information, RICOS also serves as point of departure for other tools.

The fulfilment of reporting obligations by producers is the precondition for gaining market access („No data no market“).Reporting requirements directly concern the materials used in products, as well as their environmental impacts. These responsibilities would start with resource extraction and, therefore, at the beginning of the supply chain. However, information would also be gathered on the share of recycled materials utilized. All resource related information would be presented in a product data sheet. In the case of Information and Communications Technology (ICT), the input of „critical metals“ is of particular importance due to their environmental impacts and scarcity.

The information obligations could be supplemented by obligations for substitution and certification. With help of the producers, it is to be determined for the various relevant

product groups whether the „especially problematic“ materials can be substituted by a less environmentally harmful material. Products that contain problematic materials for which substitutes exist would no longer gain market access. An agency would maintain a register of especially problematic materials. This register would be developed step-by-step on the basis of knowledge generated by the reporting requirements of producers. For those metals classified as especially problematic, but not substitutable, there would be an obligation to reduce their environmental impacts. The goal is to promote resource extraction with comparatively low environmental impacts and to continuously reduce such impacts. The effectiveness of the corresponding impact reduction measures is to be ensured through a certification system.

The application of RICOS for product and material streams must take place incrementally and in a dialogue with stakeholders. RICOS will further allow companies to a) take action on their own to provide solutions that might make regulation unnecessary, e.g. by voluntary substitution of certain materials, or b) to prepare for the requirements of the instrument.

2.2 Instruments for Product Input Regulation: The Example of Dynamic Standards / Resources Top Runner

This tool formulates a requirement for the use of secondary material in new ICT products. It contains a minimum input quota for recycled critical metals. The adherence to this standard is a precondition for market access and must be fashioned as a European ordinance. The aim of the regulation is to increase recycling rates as a means of reducing the use of primary materials for especially environmentally intensive metals such as gold, silver or platinum group metals. By creating incentives to introduce end-of-life equipment into the recycling process (generation of demand for secondary materials) it complements the provisions of waste legislation for electronic appliances (European Directive on Waste Electrical and Electronic Equipment (WEEE) and the German Electrical and Electronic Equipment Act). Furthermore, the approach more generally creates an incentive for steering global material intensity for valuable metals.

Concretely, producers must present a product data sheet for each product line that indicates the amount of specific materials used (cf., Chapter 2.1) . As it is not possible to determine whether a metal originates from recycled materials or natural ores, material streams along the production chain have so far not been traceable. In order to circumvent this problem certificates for recycled materials are to be distributed. For every model, producers must prove that they or their suppliers, have met requirements for secondary use of specific materials (ex. gold, palladium, indium, etc.). The certificates are distributed by accredited recycling companies and passed on along the production chain.

The standard can be determined using a top-runner-approach. In this approach the minimum quota is defined taking the best performers in a product category as benchmark. The level of recycled materials achieved in this group becomes a binding mini-

mum standard for all products of this product group. Such approaches have the advantage of initiating an efficiency race between producers, while doubtlessly proving the technical feasibility of the minimum standard. This approach has been demonstrated to be effective with energy using products, e.g. in the Japanese Top-Runner Program. However, an autonomous trend towards more efficient products that results from the expected operating costs and influences consumers’ purchasing decisions already existed in this case. Since such operating costs do not derive from the use of materials, incentives towards more material efficient products must be established exogenously (e.g. by announcing the intention of introducing a top-runner approach). The motivation for producers, then, is to exclude competitors from the market by setting benchmarks. The approach should be complemented with incentives for placing material responsibility at the intersection with the Waste Sector (e.g. standards for „Design for Recycling“).

2.3 Differentiated Value-Added Tax Rates for Promoting Resource Efficient Consumption

The aim of a transformation of the value-added tax (VAT) system oriented towards enhancing material efficiency and resource conservation criteria is to provide a signal that stimulates the demand for environmentally friendly products and services through price privileges in the short-term and, in the medium to long-term, aims at promoting innovation and market development. The intention is both a macroeconomic and consumer-level reorientation. This approach should generally produce incentives to make resource efficient and less environmentally damaging products and services relatively less costly, thereby also easing purchasing decisions for less wealthy consumers (e.g. organic products, energy efficient white goods, or energy consulting and energy-saving renovation).

Next to product and product group specific sectoral reductions or increases of VAT-rates, revisions of existing distortions and inconsistencies should contribute to a tax revenue neutral financing of VAT reductions in other areas in the sense of an ecological finance reform.

In the context of the German tax system, the project proposes a repeal of the VAT-waiver for international flights, a reduced VAT-rate for conventionally produced foods (at a reduced tax rate for organically produced foods) or alternatively a repeal of the reduced VAT-rates for resource intensive foods, such as meat and milk products, and the introduction of a reduced VAT-rate for inner-community and international rail traffic, as well as the introduction of a reduced VAT-rate for resource efficient and service intensive business (KOM(2008) 428).

On the European level, MaRess Task 3 proposes an expansion of the directive which allows the introduction of reduced VAT-rates for approved labelled products (such as the environmental label „ “Blauer Engel“ / “Resource Angel“),or for energy/water/material efficient household technological equipments (A++). How a re-

duced tax rate for secondary resources or products using secondary material can sensibly be achieved requires further discussion.

2.4 Introducing a Building Materials Tax to Increase Recource Efficiency in the Building Sector

A federal consumption tax on the extraction and import of primary building materials is proposed. A primary building materials tax is a fiscal policy tool which serves to increase state revenues. At the same time, it is a steering tax that, like the mineral oil tax, aims at creating an incentive to reduce the overall consumption. The tax revenues flow into the federal budget. They are not tied to a particular purpose and can be freely used. The tax would be applied to resource extracting companies which will pass on their increased burden along the supply chain. From the point of introduction the tax should amount to at least €2.00 per ton of extracted sand, gravel, rock, or limestone. As the primary building materials tax should send a clear signal for reduced physical consumption, a quantity tax will be used. For this reason a long-term tax increases with a progression of 5% per year should be planned to counter the immanent actual reduction of the quantity tax.

Outsourcing of the extraction and the subsequent production stages due to the materials tax are not to be expected. This could be further insured if a federal harmonization of the existing Länder and district specific regulations could be achieved. However, an increasing use of recycled and secondary resources in the construction sector can be expected. Outsourcing of operating sites is also unlikely due to high transportation costs. Simultaneously, a compensation for the extraction regions should be planned to internalize the environmental impact costs and achieve regional innovation potentials.

2.5 A Covenant for Closing Material Cycles in the Recycling of End-of-life Vehicles

End-of-life vehicles contain a number of materials whose recycling saves a substantial amount of resources in comparison with the primary route of acquisition, e.g. steel, copper, but also platinum group metals (PGM). The German end-of-life Vehicle Ordinance therefore mandates producers to achieve 85% recycling rates – and 95% by 2015. However, only about one-sixth of all vehicles are actually scrapped in Germany. Most vehicles are exported in advance as used cars and end up as waste in countries outside of the EU in which these recycling mandates no longer apply and where only the main mass stream (especially steel), if at all, is salvaged.

The central approach of the examined incentive mechanism is the negotiation of a legal contract – a covenant – between motor vehicle manufacturers and suppliers, recycling industries and relevant public administrations in exporting and importing countries. This covenant should determine long-term targets for increasing resource efficiency through high quality recycling of end-of-life vehicles. The contracting parties,

producers (or their associations), commit themselves to ambitious resource protection targets, while states guarantee stable and supportive framework requirements for the contract period. In contrast to voluntary agreements the covenant should in principle also be enforceable in a court of law, while at the same time the contract should contain possibilities for dispute settlement and sanctions if a contracting party does not fulfil its responsibilities. Germany could take the initiative for introducing such a covenant at the EU-level.

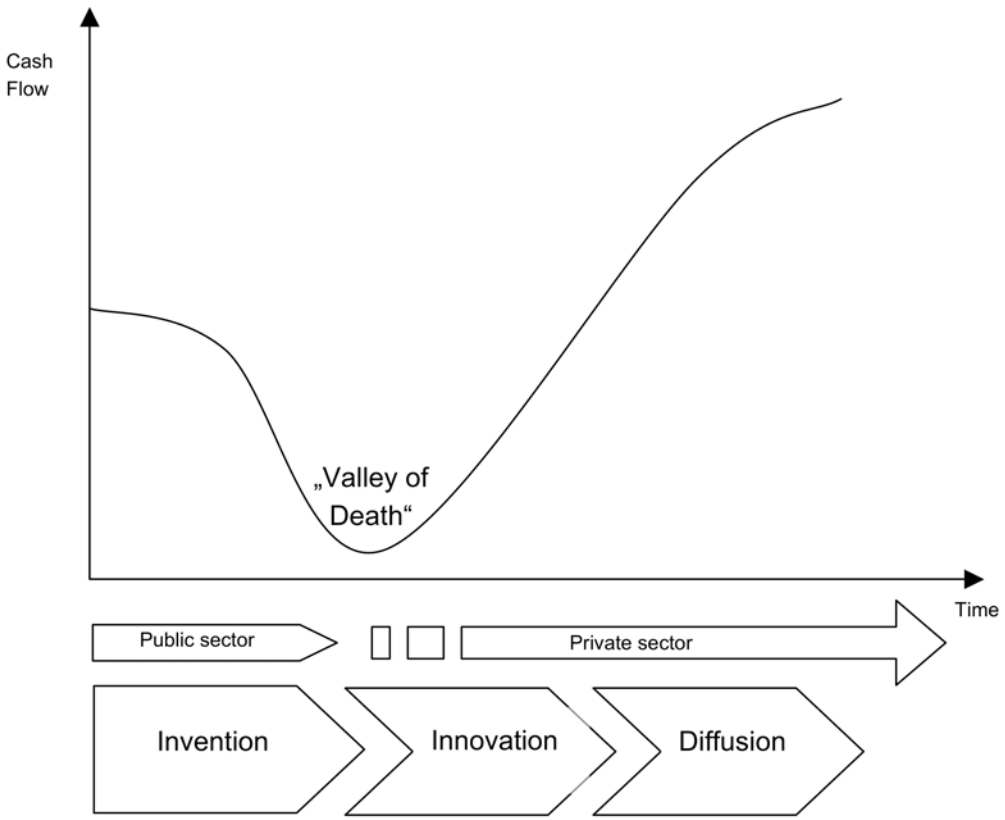
With such a covenant it would be possible to establish a framework for closing material cycles at the international level. The distribution of the resulting costs and benefits along the value-added chain could flexibly be determined in the contract. The expanded responsibility of producers for the physical and financial effects of their products at the end of their utilization phase would no longer be undermined by exports. This would above all create real incentives for introducing “design for recycling”.

2.6 Innovation Policy Tools: A Green Tech Fund for Lighthouse Projects

Innovation policy tools offer a means of supporting the introduction of resource efficient products and processes. Eco-innovations more generally and innovations for increasing resource efficiency in particular are impacted by a „double externality“: imitators profit as free riders from the innovative activities of other companies, preventing first-mover advantages from being realized (spill-over effects). Moreover, improvements of the quality of the environment not only benefit the innovator. They are a public good. Therefore, investments in eco-innovations fail to achieve, or rather, remain below economically desired levels. State interventions for the promotion of eco-innovations are, therefore, necessary to overcome this market failure.

An analysis of national support programs for innovation promotion found that resource efficiency has so far not been addressed as an independent issue area. Furthermore, it was shown that innovation policy tools are mainly aimed at the first of the three innovation phases (invention) in the form of direct project funding. The following phases of commercial launch and diffusion, on the other hand, do not receive much attention. This lack of support leads to financing gaps in the transition from public to private financing („valley of death“). Thus, many innovations are never realised (Fig. 1).

Fig. 1: Valley of Death



Source: Murphy / Edwards 2003

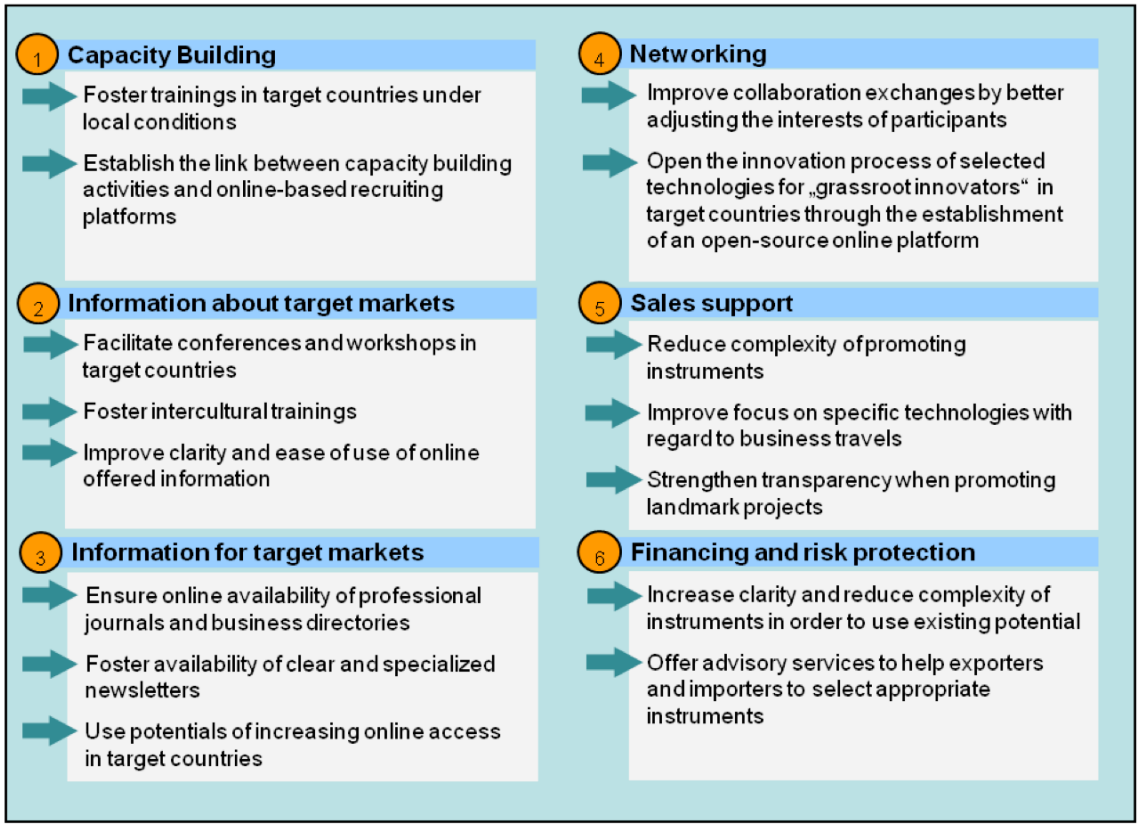
Therefore, in MaRess Task 3 tools were examined for bridging this „valley of death“. The short-term provision of risk capital by the state is of particular importance. A strengthened promotion of material efficiency could be achieved through the creation of a specific „Green Tech Fund“ for material efficiency innovations, but also through the establishment of material efficiency as a sustainability criterion in public technology funds.

A further tool for supporting the diffusion of material efficiency innovations is the promotion of so called lighthouse projects. The establishment of lighthouse projects using a national strategy similar to „transition management“ in the Netherlands (i.e. the planned transition to sustainable economy in several core areas-). Such projects would not least help to encourage emulation and promote acceptance. Points of departure already exist with the Hightech Strategy as well as the Masterplan Environmental Technologies. Further innovation policy tools could also be used, such as project financing, cluster-promotion, innovation workshops (Lemken et.al 2009) or incentives for research institutes.

2.7 Export Promotion of Recycling and Efficiency Technology

The export of recycling and waste disposal technologies offers substantial economic potentials for German companies. Achieving these potentials will require commensurate institutional framework requirements that effectively support German companies in their export activities. According to the work of the „Export Initiative Recycling and Efficiency Technology“ (RETech), five fields of action (capacity building, information about and for target countries, networking, marketing support as well as financing and risk hedging) involving different life cycle phases and tools were identified. These fields of action were among other things examined by conducting surveys of companies, associations as well as researchers concerning their acceptance and effectiveness. Overall the assessments and the discussions of tools for export promotion in the recycling and efficiency technology sector show that the instruments identified by the RETech-Initiative would be of great importance for making use of export opportunities and were generally viewed very positively. Nonetheless, weaknesses could also be identified from which a need for action could be deduced (cp. Fig. 2).

Fig. 2: An overview by field of action of the recommended actions for the further development of export promotion



Source: MaRess Task 3.2

- **1. Capacity Building**
  - Increase operations directly on site under local conditions
  - Link capacity building activities with online career platforms
- **2. Information about Target Countries**
  - Strengthen conferences and workshops directly in the target country
  - Strengthen intercultural training
  - Increase the ease of use and accessibility of online offerings
- **3. Information for Target Countries**
  - Make branch-leading, trade and information publications available online
  - Support the provision of accessible and specialized newsletters
  - Take advantage of increased internet use in target countries
- **4. Networking**
  - Increase the effectiveness of cooperation forums by comparing interests with expectations
  - Open the innovation processes of „grassroots innovators“ for select technologies in target countries through open-source online platforms
- **5. Marketing Support**
  - Reduce the complexity of grant opportunities
  - Support an increased focus on specific topic areas for business trips
  - Increase transparency for the support of lighthouse projects
- **6. Financing and Risk Hedging**
  - Support the ease-of-use of existing instruments by reducing complexity
  - Improve consulting services for the selection of appropriate tools for exporters and importers

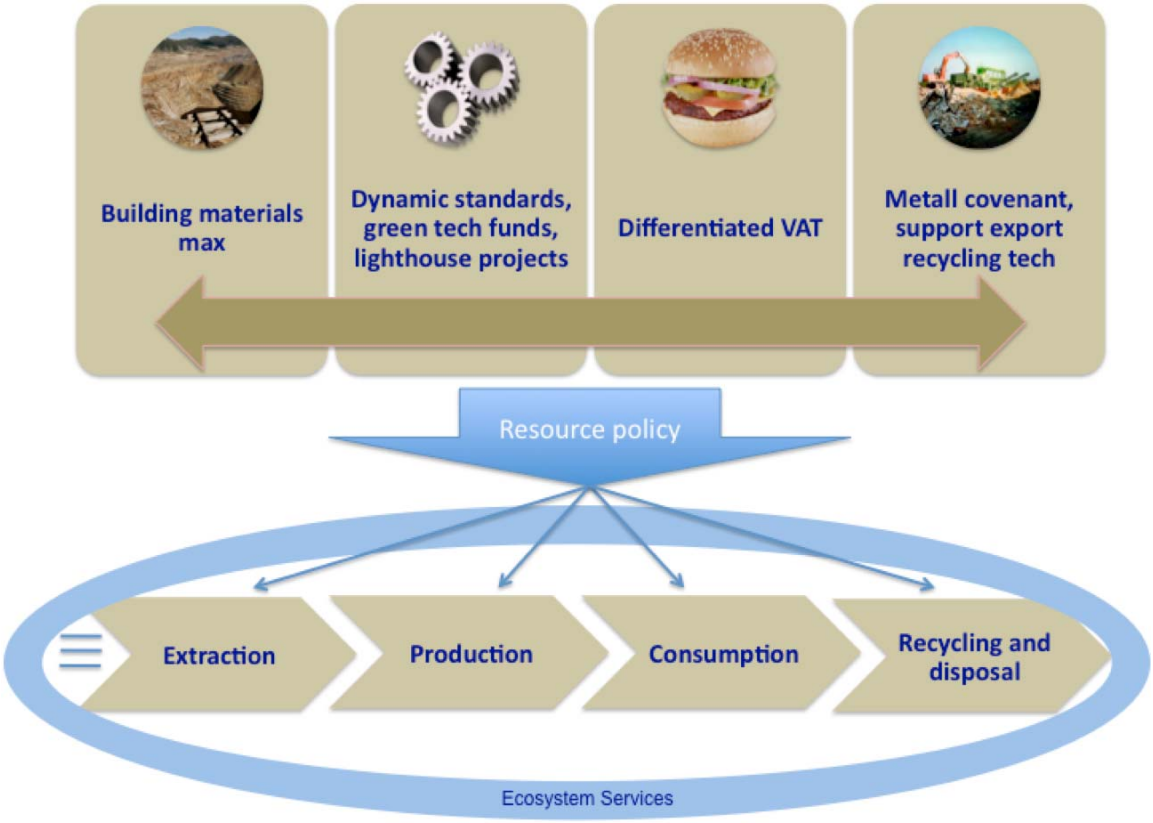
3 Summary

MaRess Task 3 examines the effectiveness of various steering mechanisms for a comprehensive resource policy. The point of departure is an analysis of the barriers and mechanisms of market failures with regard to sustainable resource utilization. The work is based on considerations on the configuration of a ‘resource policy’ field and about functions and key areas of a resource policy. This analysis concluded that a resource policy must especially aim towards environmentally friendly resource utilization, but also make contributions to security of supply and ecological modernization.

Based on these premises concrete options for a policy mix to enhance framework conditions were identified and analyzed in detail. The condensed version at hand outlined a policy mix for designing framework conditions based on regulation, economic incentives and a private law approach. The development of instruments was related to specific resources and sectors – the latter of which are to be understood as exemplary and served to demonstrate the technical, economic and institutional feasibility as well as to demonstrate the difficulties and limits of steering opportunities. Parallel to the work in MaRess Task 4 (Resource Policy at the Business Level), Task 12 (Consumer and Customer Oriented Resource Policy) and Task 7 (Policy Recommendations and Policy Papers), this work is to serve as a contribution to real developments in resource policy, thereby contributing to a sustainable resource utilization in Germany and Europe.

Fig. 3 illustrates the assignment of the tools developed in MaRess to stages of the value-added chain.

Fig. 3: Assignment of Resource Policy Tools in MaRess Task 3 to stages of the value-added chain



Source: MaRess Task 3.2

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