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Towards a Resource Policy – unleashing productivity dynamics and balancing international distortions

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Abstract

The paper outlines a resource policy that seeks to enhance resource productivity. Main focus is the European Union. A rational for policies stems from a demand to increase sluggish material productivity growth as well as from indications on environmental damages occurring along material flows at an international scale. Increasing Total Material Requirements associated with imports in the EU indicate a burden shifting into countries outside the EU, i.e. a case for international policy approaches. In general, it is both the environmental and the innovation perspective that legitimate policies. The paper develops guidelines for policies and a transition management towards resource-efficient economies. It furthermore develops three instruments: a tax on construction minerals, an ecologically differentiated VAT tax, and an international covenant for metals and an international convention for sustainable resource management. Further reference is made to a proposal for an international convention for sustainable resource management. The paper finally reflects these incentives against weaknesses and ongoing discussions of climate policy and the International Resource Panel.

JEL-Code:

Keywords: resource productivity, eco-innovation, economic instruments, policy mix.

1. Introduction

In the aftermath of the financial crisis, the markets for raw materials have started to surge again. Many prices are now almost back at the levels where they had been before late 2008. Three recent events illustrate the need for international economics to take a comprehensive look at markets for minerals, energy, and their use in societies worldwide:

- Both, the oil disaster in the Gulf of Mexico that has occurred in early 2010 and the nuclear disaster of Fukushima in March 2011, will have a long-lasting impact on energy strategies. The foreseeable shift towards e-mobility and renewable energies however has a concomitant towards using *more* minerals, including critical metals such as gallium, indium and neodymium whose supply raises some concern (Bringezu/Bleischwitz 2010; Graedel 2011).

- The UNEP's International Resource Panel[1] has released its report on decoupling natural resource use and environmental impacts from GDP growth (UNEP 2010) that indicates moderate progress and underlines the need for stronger incentives.

- The European Commission (2010) has released its long-awaited second report on the criticality of minerals in June 2010 naming some fourteen minerals as „critical", i.e. that the risks for supply shortage and environmental issues as well as their impacts on the economy are higher compared with most of the other raw materials. Though at least some these minerals (Antimony, Beryllium, Cobalt, Fluorspar, Gallium, Germanium, Indium Graphite, Magnesium, Niobium, Platinum Group Metals, Rare earths, Tantalum, Tungsten) are not well-known outside the expert community, the fact that they are essential for steel production and many future technologies make a strong case for economic analysis.

Resource productivity can be seen as a core strategy for addressing the need to decouple the use of natural resources from GDP and to innovate along the material value chains (Blei-schwitz 2010). However recent research discusses shortcomings of any such strategy. Steinberger / Krausmann / Eisenmenger (2010) refer to striking differences between the material groups and income as main driver for material productivity; in a related paper Steinberger and Krausmann (2011) conclude on the inappropriateness of resource productivity towards any decoupling and the necessity to formulate limits to growth. De Bruyn et al. (2009) claim that traditional environmental policy is of greater relevance than resource productivity that is supposed to increase anyway.

Against this background the main purpose of the paper is a critical appraisal of the discussion and the outline of a resource policy that takes remaining uncertainties into account. The main scope of our paper is the European Union; however countries outside the EU may also draw useful lessons. The following chapters briefly summarize recent trends of material and resource productivity (chapter 2) and prices (chapter 3), before turning the policy dimension (chapter 4).

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[1] http://www.uneptie.org/scp/rpanel/

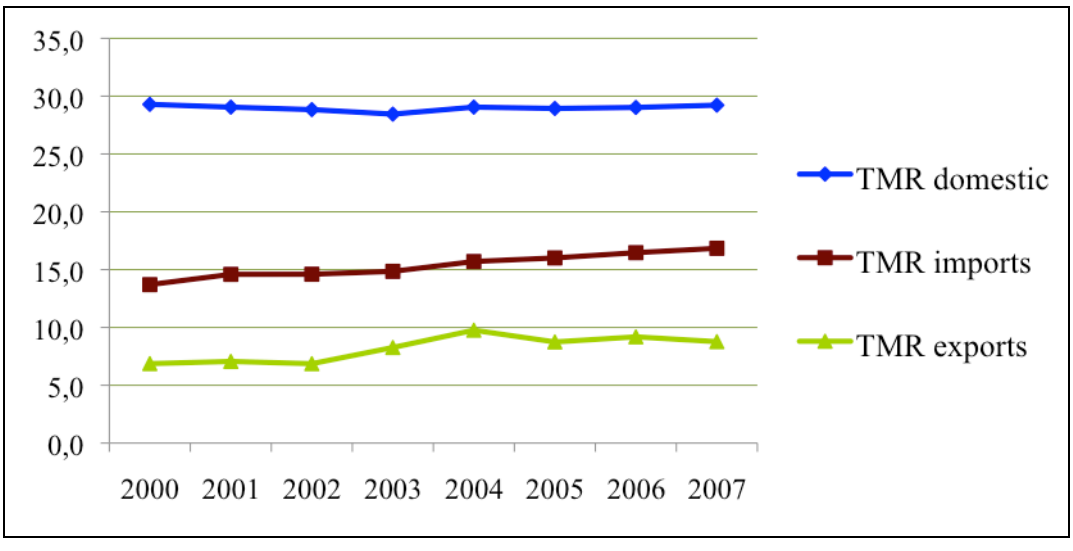
2. International Trends of Material and Resource Productivity

As a general trend, material productivity[2] (GDP generated per ton of DMC) in Europe has improved – economies have been creating 24 % more value per ton of materials consumption in 2007 compared to the year 2000. The EU Eco-Innovation Observatory (EIO 2011) reveals that the average annual increase in the EU has been 3,2 % (measured against PPP) or 2,2 %/a (measured against GDP). The EU's material productivity is lower than Japan but similar to the USA.

It is interesting to note that the gap in material productivity between the EU's new member states and old member states has not changed significantly between 2000 and 2007. In 2007 material productivity in the EU-12 was only 45% of the average for the EU-15. With the exception of Malta, material productivity in the new member states was well below the EU-27 average. Some member states have witnessed very low increases or even a decrease in material productivity (Sweden, Austria, Denmark, Portugal, Lithuania, Slovenia, Estonia). In total, it was very wide spread within the EU itself, with an order of magnitude difference (factor 17) between the Netherlands (ahead of Japan) and Bulgaria and Romania. The conclusion is that income is by far not sufficient as explanatory factor, and more country-specific driving factors are to be analysed.

A second interesting observation relates to the more comprehensive indicator Total Material Requirements (TMR) that includes hidden flows of imports and 'ecological rucksacks'. The updated data for the EU show an almost stagnating trend between 2000 and 2007, and increasing TMR associated with imports (Figure 1). This indicates the need to assess the environmental impacts associated with resource use with great care and to address in particular the international dimension.

Figure 1: TMR in the EU-27 2000 – 2007



Source: Own compilation made by Helmut Schütz WI 2010.

[2] We use the term material productivity if the denominator is DMC or DMI and resource productivity for the more inclusive measurement approaches with TMR or TMC and for general purposes. See OECD (2008) and EIO 2011) for more information on measurement and indicators, and Bringezu / Bleischwitz (2009) for a general discussion.

Despite continuous improvements, growth in the productivity of material resources in the EU has been significantly slower than growth in the productivity of labour and, to a lower degree, energy productivity. Over the period 1970-2007 productivity of labour increased by 144% in the EU-15, while productivity of materials grew by 94% and productivity of energy increased by 73% (2009). In the EU-12, where a much shorter time series is available, productivity of materials increased by less than 30% between 1992 and 2007, whereas productivity of energy and labour grew hand in hand increasing by 85%. This surely also reflects also a shift in energy fuels from coal to gas as well as shifts in imports.

According to the induced-investments theory of John Hicks (see e.g. Popp 2002), a main driving force can be seen in the relative pricing of these three inputs and the prevailing tax regimes, which have made labour costs continuously more expensive over the long time compared to materials (de Bruyn et al. 2009: 13). This has enhanced a business focus on managing labour costs. In contrast, the prices on commodity markets are much more volatile, with long periods of low prices (such as 1980 – 2000), surrounded by peaks, which make any rational expectation much more difficult. A long-term prices trend for commodities is quite difficult to conclude – Bretschger et al. (2010: 52) question the common belief in a long-term decline of commodity prices, and refer to quite different price levels during economic history. Notwithstanding the strengths and weaknesses of the induced-investments theory and empirical observations, one should conclude that understanding price effects deserves more attention as a key to spurring innovation.

Driving forces for such uneven patterns of use and relatively slow productivity dynamics are key topics of international economics in general but less elaborated for minerals. Some general explanatory factors are the stages of development – in particular the intensity of use during early industrialisation – and income. However, our EU analysis demonstrates that major differences also occur across countries with similar levels of industrialization and income. Driving forces for material and resource productivity thus have to be analysed from a perspective that takes into account relevant socio-economic variables of economies and their innovation systems. According to Steger and Bleischwitz (2011) this includes:

- Construction activities such as new dwellings completed, road construction, share of construction in GDP;
- Structure of the energy system (a high share of coal and lignite correlates with higher resource intensity, efforts to increase energy efficiency correlate with resource productivity; see also Wardal 2011);
- Imports and international trade: tentative evidence suggests a positive correlation between high imports and material *intensity* for industrialized countries. The reason probably lies in global production chains, where raw materials and intermediate goods are imported, transformed into finished products domestically and also traded globally, i.e. most industrialized countries utilize the international division of labour as net importers of natural resources.[3] By contrast, there is a

[3] Test statistic for EU-15, 1980-2000: an increase in the import share by 1% would raise the DMC per capita by 0.225%; see also on trade and natural resources: Dittrich 2009.

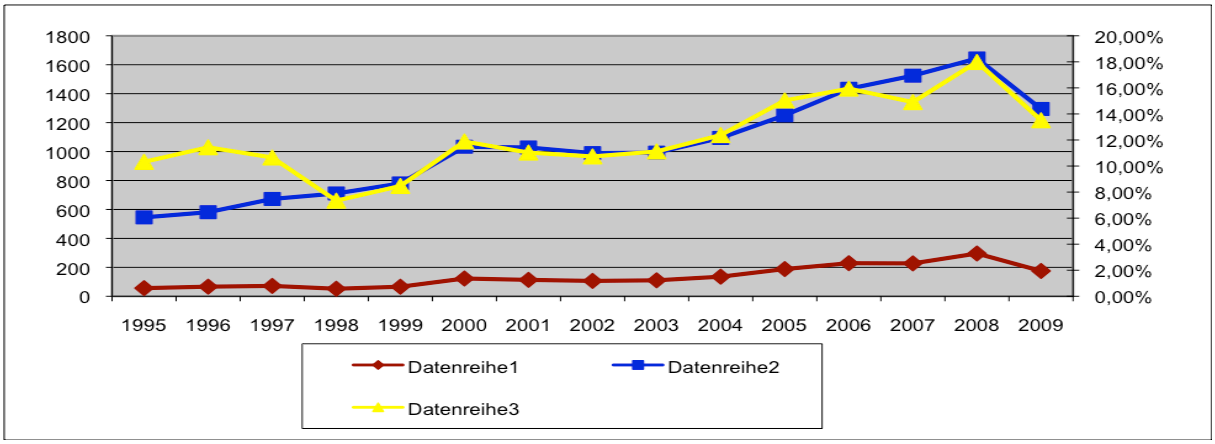
positive correlation between high imports and material *productivity* for many less industrialized countries, which is probably due to the competitive pressure on inefficient and resource-intensive industries in those countries.

2. Resource Productivity, Prices and Innovation

Price trends and an analysis about their impact on innovation patterns certainly deserve more attention. Here, traditional resource economics often falls short of looking at life-cycle costs of materials for industries and economies. However raw material import costs may serve as a useful entry point into a more comprehensive analysis.

Importing costs for raw materials is a key macro-economic variable for competitiveness; for the EU, the value based share of the top-ten raw material imports in total imports grew between 1998 and 2008 from around 8% up to 18% (Figure 2).[4] It should be noted however that due to the recession that followed the financial crisis this share has declined to 13.1% (2009).

Figure 2: Importing Costs of Raw Materials into the EU (Top Ten, value based share)



Source: Eurostat statistics, own compilation, WI 2010.

Recent data provided by Eurobarometer (2011) confirms earlier evidence provided by the German Federal Statistical Office that the costs of materials account for around 40 – 45 % of the gross production value of manufacturing companies in the EU and Germany. This includes all purchased material inputs such as raw materials *and* intermediate goods and is hence much more comprehensive on the relevance of life cycle costs. This data is based upon a questionnaire to industry managers and is thus relevant for industries but may be less reliable when added up to an aggregated figure for whole economies.

The current and expected high prices for commodities are seen as the most important driver for investments into resource efficiency according to the Eurobarometer survey. However this seems to be more a future perspective. Some 55 % of the European entrepreneurs have not yet introduced any kind of eco-innovation in terms of material efficiency during the last 24 months. What effects have been stated about those material reduction innovation and investments efforts? They lowered the amount of the total ma-

[4] Based on Eurostat and 10 minerals, but no semi-final goods; the share actually is higher than the analysis of de Bruyn et al. (2009) suggests.

terial use for the majority of the entrepreneurs between 5 to 39 %! In some seldom cases, material reductions of 40 or even 60 % could be realized! This disparity confirms earlier analysis by Rennings and Rammer (2009)[5]. It demonstrates a gap between prevailing awareness, trends and potential benefits. For the purpose of our paper it also indicate promising returns for a governance aiming at dissemination of those best practices.

The vast majority of related innovation can currently be characterized as process innovation (EIO 2011), a strategy that offers affordable risks for companies compared to product innovation or system innovation. Such process innovation becomes visible in material efficiency when companies accomplish strategies such as ‚zero losses', ‚design to costs', or ‚remanufacturing'. At an international scale however, an advanced process innovation of closing the loops in international value chains remains a challenge especially when end-of-life stages of consumer goods are considered. Thus, these challenges combined with challenges to develop more radical innovations including "*material flow innovation*" in that area (Bleischwitz 2010) underline a need for policies.

The overall macroeconomic situation – characterized by an excess of public debts – increases the vulnerability of economies against higher commodity prices in the future. This should in principle encourage resource savings because such strategy lowers risks of inflation caused by importing fuels and commodities, and it may favour resource taxation within countries.

4. Resource Policies

The general motivation for resource policies is mainly twofold: Firstly, to address the risks associated with environmental damages that occur throughout the whole life-cycle of using resources at an international scale (negative externalities) and, secondly, to address the opportunities stemming from potential eco-innovation if material purchasing costs can be reduced and turned into new processes, new products and system innovation (positive externalities). As expressed above, such eco-innovation can also utilize material flow innovation.

Following contemporary analysis of market failures and barriers, however, such attempts are unlikely to be harnessed by markets and business alone (Bergek et al. 2008: Bleischwitz et al. 2009: 228ff.; Nelson 2002). A number of market failures and barriers need to be removed in order to minimize risks and unleash the eco-innovation opportunities towards a green economy. The following categories seem especially relevant with regard to increasing resource productivity at an international scale:

1. Negative externalities: in line with environmental considerations (see above), the existing practices of unsustainable extraction, low environmental standards at production sites for resource-intensive goods and recycling facilities as well as landfilling options will have to be taken into account;

[5] Innovation panel as of 2005, survey data from 2002 – 2004 based upon 6,600 German firms.

2. Positive Externalities: the current incentives to invest in eco-innovative products and systems (i.e. beyond process innovations) are relatively poor. They are faced with the double externality problem of public costs and benefits.

3. Information deficits at the business level on options to save material purchasing costs and their cost/benefit ratio.[6]

4. Fundamental knowledge gaps on raw material price trends, anthropogenic stocks and asymmetrical information on new green products and systems.

5. Orientation deficits resulting from missing targets and objectives as well as from path dependencies for most capital goods and infrastructures.

Policy analysis can turn these market failures and barriers into guidelines that will facilitate the formulation of efficient resource policies. Following the five categories above, suitable guidelines may look as follows (Figure 3):

1. Market order – getting the framework conditions right by establishing the polluter pays principle and the precautionary principle at an international scale and by establishing a competition policy in favour of eco-innovation.

2. Provision – by establishing international open access data sources on resource productivity (including the ecological dimension of resources and trends).

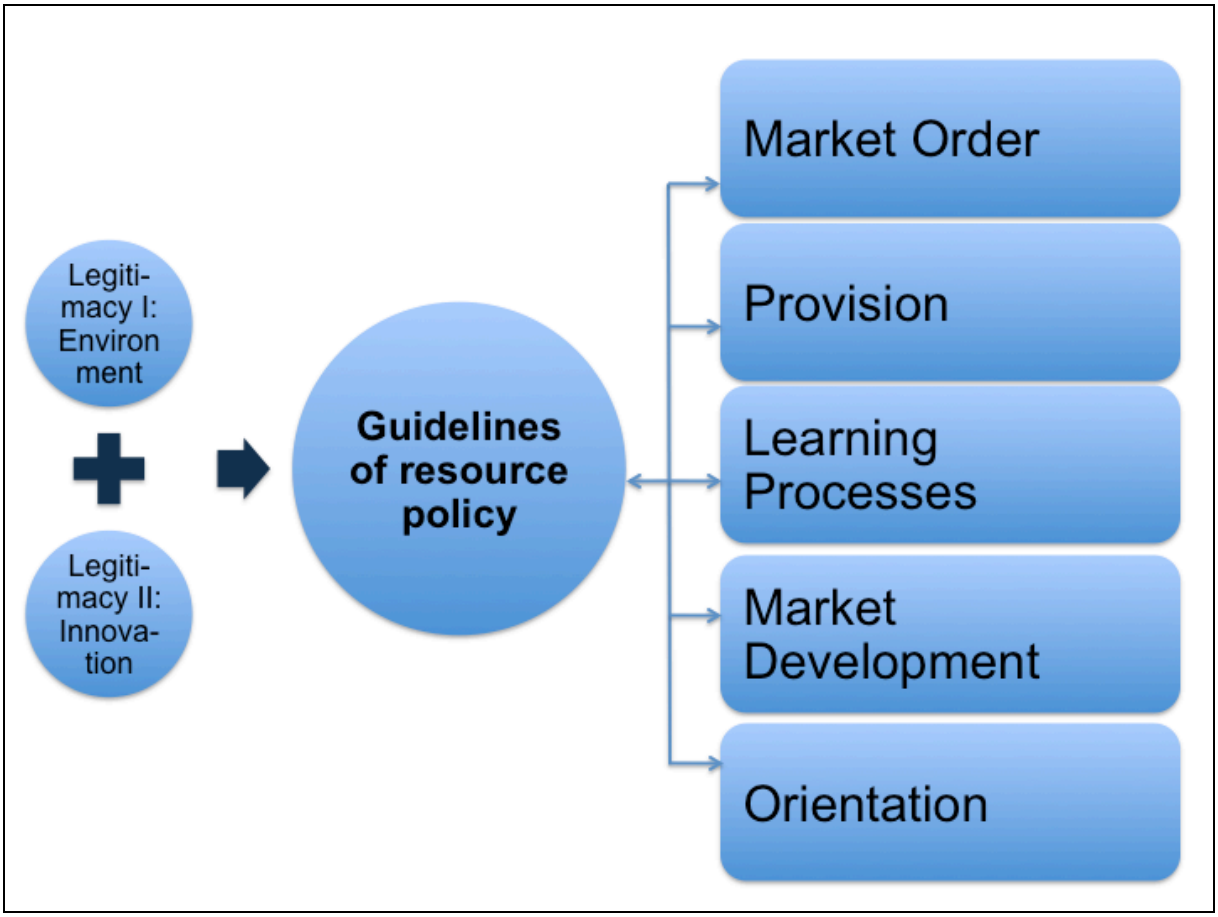
3. Learning processes – facilitate attention and learning through e.g. benchmarking processes, reporting guidelines and diffusion of best practices.

4. Market development – a sustainable industrial policy that ramps up new and radical eco-innovation and supports the transformation of resource-intensive sectors into new business models as well as international recycling.

5. Orientation – going beyond usual business cycles and even beyond the 2020 perspective will help to develop system innovation and to align resource productivity with the needs of a low carbon society that uses 80 – 90 % less carbon compared to today's level.

[6] See the experience made in UK (OakdeneHollins/DEFRA 2011) and in the German DEMEA programme.

Figure 3: Legitimacy and Guidelines for a Resource Policy



Source: Own compilation, WI 2010.

Setting Targets – Developing Visions

Such guidelines can also serve as useful tools when targets and objectives are to be formulated. A challenge compared to e.g. climate policy is that the concept of ‚carrying capacity' will be difficult to apply. The carrying capacity concept allows setting targets derived from (a) a maximum level of tolerable impacts such as the 2º C maximum temperature increase target and (b) a maximum budget of tolerable emissions leading to the target of 80 – 95 % reduction of net carbon emissions by 2050. In the area of resource policy however the environmental science is by far weaker and does not yet allow fixing a maximum amount of resources that can be used in the future. What can be said with high confidence is that the future use of primary materials in industrialized countries and regions such as the EU ought to be reduced compared to today's levels. Such a target, despite the lack of precision, which may be seen,[7] can serve functions of orientation for market participants and planners. With regard to indicators, the Total Material Requirements are a more inclusive approach compared to other indicators such as Direct Material Inputs or Raw Materials per se – but research on such indicators is under way.[8]

7 Bringezu (2009: 168) suggests a long-term reduction by 80 %.

8 See e.g. the EU projects MATISSE, CALCAS, Sustainability A-Test, Measuring Eco-Innovation, the newly established Eco-Innovation Observatory and UNEP (2010).

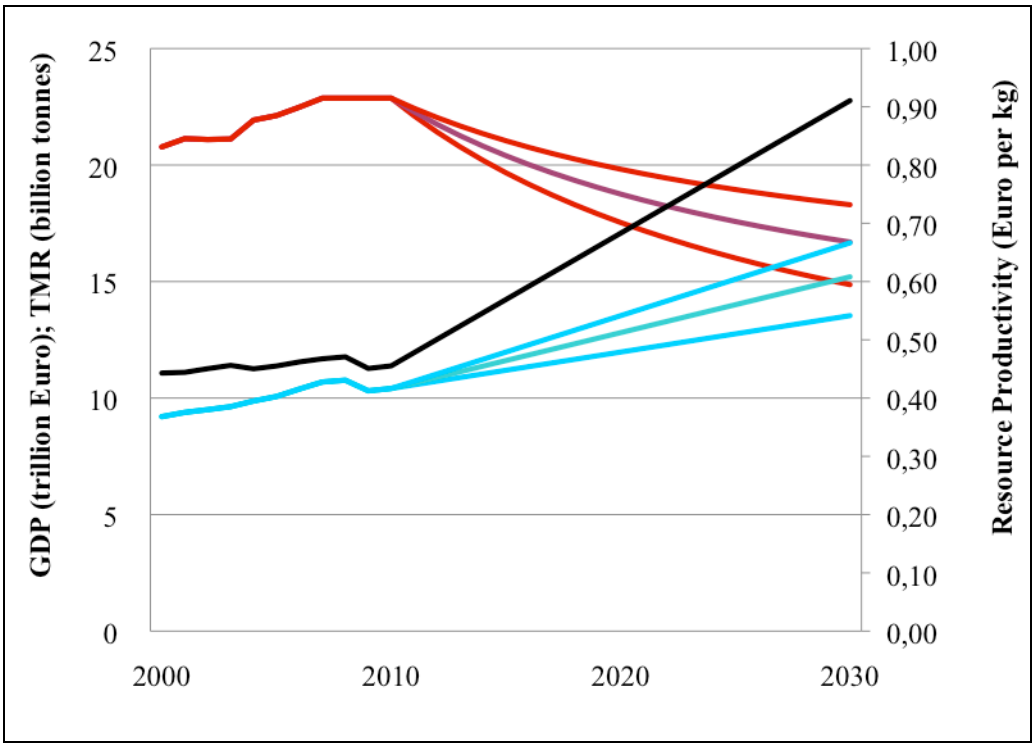
In line with research on transition management (Grin / Rotmans / Schot 2010), visions about sustainable futures can stimulate far-reaching innovation. With regard to the overarching issue of increasing resource productivity, Bringezu (2009) outlines four visions on

- Resource efficient and recycling based industries
- Steady stocks societies
- Solarized infrastructures
- The balanced bio-economy.

Such visions also capture the dimensions of climate change and land use that are not only important but also likely to put constraints on the future availability of biomass and related agricultural goods and renewable resources. In terms of innovation, such visions lead into explorations of carbon recycling and industrial photosynthesis (mineral-based systems) that clearly go beyond today's options of recycling and bio-based products. For sure, this will add to the world market potentials for material efficiency that is estimated to triple by 2020 (Roland Berger 2009).

As a suitable target, a doubling of resource productivity from 2010 to 2030 could be envisaged (Figure 4). #source# The timeframe reflects the need to get started and to go beyond current business cycles. The dynamics of doubling clearly goes beyond prevailing trends of material productivity increases, i.e. it will require additional action and suitable policies.

Figure 4: A Scenario to double resource productivity by 2030



Red line indicates TMR paths, blue line different GDP growth paths, the black line the GDP/TMR ratio.
Source: Own compilation, Schütz / Bringezu WI 2010.

Why a policy mix – priority instruments

The complexity of addressing the different barriers and drivers associated with sustainable resource management, the likelihood of trade-offs among different goals, and the different actors involved are not in favour of one single instrument, but rather suggest a policy mix. In line with recent economic analysis (Aghion et al. 2009; Bretschger et al. 2010; Pelikan / Wegner 2003; Welfens 2009: 517) and our proposed guidelines (Figure 3), our paper calls for a step-by-step approach to address market failures and to gradually improve the framework conditions for eco-innovation and to enhance the ensuing capacities.

The three instruments described below follow a strategic approach that has been outlined elsewhere (Bleischwitz et al. 2009) and have been analysed in-depth within a German large-scale research project called MaRess[9]. The policy mix captures the eco-innovation perspective of reducing material costs thru disseminating process innovation among businesses, encouraging product innovation and developing lead markets for more radical innovation as well as the international dimension (Figure 5). It does not address fossil fuels and the CO_2 dimension because that is regulated in climate policy; however we will conclude on synergies and trade offs.

[9] Each instrument has undergone an impact analysis according to a common analytical framework; the respective studies (written by Bettina Bahn-Walkowiak, Henning Wilts and myself) are available in German at: http://ressourcen.wupperinst.org/?id=271. English executive summaries are available at: http://ressourcen.wupperinst.org/en/downloads/executive_summaries_of_the_wps/index.html

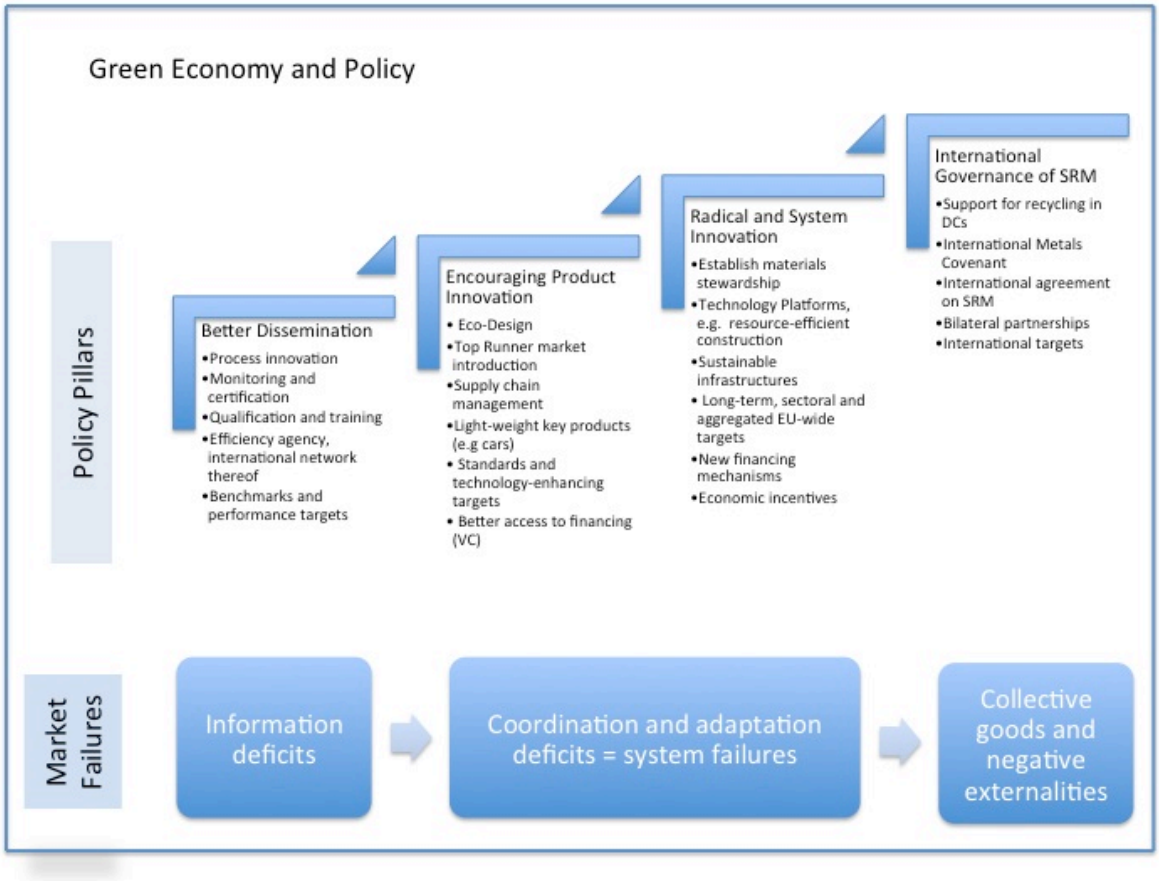
The following selected instruments can be seen as a priority towards such a resource policy:

- Taxation of construction minerals: they have been less decoupled from GDP growth than any other material group between 1980 – 2010 in the OECD (UNEP 2011: 12);

- A differentiated VAT system should bring more economic incentives into the consumption patterns;

- An international metals covenant addressing the international distortions that jeopardize ecosystems, human health and raw materials security alike; in this context, iron, steel and aluminium may deserve special attention as priority materials (UNEP 2010: 75) however our approach also underlines the interdependencies of metal markets (Crowson 2010).

Figure 5: Market Failures and Suitable Instruments for a Resource Policy



Source: Own Compilation, WI 2011.

A Europe-wide minimum taxation of construction minerals

In addition to the poor performance on decoupling, the rationale for taxing construction minerals stems from their material intensity: it is the most relevant area of any economy with regard to resource productivity, the current recycling rates are low (ranging from roughly 5 % to 25 %), and it has impacts on the environment such as the 45 % share of heavy freight transportation (Bleischwitz/Bahn-Walkowiak 2008). A tax can be seen as a response to the need for economic incentives in that area and as a step towards a more inclusive taxation of resources in general. Practical experiences with the effect of taxes on aggregates have been gained in some EU member states (in particular in the UK, Sweden, Italy and the Czech Republic), which all levy taxes or charges for sand, gravel and crushed rock (EEA 2008). Drawing on the European Council Directive restructuring the Community framework for the taxation of energy products and electricity (CEC 2003) that was set up in order to harmonise the market conditions our proposal lays the foundation for further expansion and harmonisation of environmental incentives, hence reducing market distortions and the competition that occurs because of different environmental regulations within Europe.

We propose a directive on the structuring of the Community framework for the taxation of construction materials that is applicable to primary aggregates (i.e. sand, gravel and crushed rock) and comprises all European member states. The tax/charge base should be tonnes produced, that is, extracted and purchased (used extraction). The minimum levels could start from €1.5 – 2 per tonne and stepwise increase by e.g. 5 % / a. Based on

current production and under the assumption of a low elasticity of demand, this will lead to revenues in countries such as Spain, France and Germany in the order of 800.000 Mill. € each. Tentative scenario results for Germany (Meyer et al. 2011) indicate a reduction of Total Material Requirements in this sector by more than 10 % while the negative impacts are negligible.

The directive should also allow for mechanisms such as border tax adjustments for aggre- gates imported into the EU, as it could otherwise distort the price mechanism in some local markets. In addition, existing regional schemes such as a stronger differentiation according to the environmental value of extraction sites or land use patterns ought to be integrated.

Politically, the revenues generated could be earmarked and support a resource-efficiency programmes, in particular one addressing the downstream construction perspective (EIO 2011b).

An ecologically differentiated VAT

The rationale of the VAT is that VAT is a large source of revenues in all countries (aprox. 20 % on average in the OECD). It is also an excise tax charged on the end users, since all upstream services are entitled to the deduction of the input tax, provided they have been charged in commercial transactions. Thus it is mainly paid by consumers mainly and allows for a differentiation that targets different lifestyles.

In 2008, the European Commission presented a proposal for a Council Directive amending the VAT Directive 2006/112/EC as regards reduced rates of VAT, which states: "Similarly, the appropriateness of allowing the application of a reduced rate to energy saving materials and to other environmentally beneficial products or services (notably energy saving and energy efficiency related services such as inspections, energy audits and energy performance certifications) is currently being examined by the Commission in accordance with the request formulated by the European Council in March 2008. "This may also apply to the possible elimination of reduced tax rates on polluting products, such as pesticides (COM (2008) 428, see also COM (2007) 380 in a similar wording).

Besides environmental effects, social issues are frequently raised in discussions on reduced VAT rates (Albrecht 2006). The distributional effects of a differentiated VAT are - especially in the public debate - particularly sensitive and shall therefore be briefly discussed here. One criticism is that other than the income tax the VAT is not based on the financial capacity of the taxpayer. Households with a low income would therefore have to bear a proportionately heavier burden through the VAT than households with a high income.

In light of contemporary analysis (IVM 2008), the following section presents a proposal for advancement of the current VAT system:

Repeal of the tax exemption of international flights

In e.g. Germany, the VAT exemption for international flights entails a loss of 1.56 billion euros for the federal and state governments. A possible alternative could be to constitute a staggered ticket tax, e.g. as raised in France, England or the Netherlands (FÖS 2008: 5). The future inclusion of aviation in the EU emissions trading has to be taken into account though.

Repeal of the reduced VAT rate for milk and meat products

In e.g. Germany, the appeal of the VAT reduced rate of these two product groups would lead to additional tax revenues of 5.1 billion €, roughly an equivalent to the current market size for organic products. As a general appeal of the reduced tax rate on food stuff would likely run into opposition in business, government and consumer communities, a normal VAT rate on the most resource-intensive food could be an alternative. These include mainly meat and dairy products. Calculations of IVM (2008) have shown that an increase in VAT for conventional meat and dairy products to the standard rate in all Member States would result in a consumption decrease of 2-7% for meat (1-3 million tonnes) and 2-5% for dairy products (3-6.5 million tonnes) (IVM, 2008, 117). Taking into account possible shifts in organic products and conventional foods this would result in a CO2 reduction of 12-21 million tonnes of CO2 per year. Alternatively, it could be a useful measure to support the organically produced milk and meat products with a VAT reduction.

Introduction of a reduced VAT rate on energy and material efficient white ware (A++)

Household appliances are usually taxed at the standard rate all over Europe. Under the assumption that the introduction of a reduced VAT rate for Class A+ appliances would lead to an increase of a 15% IVM (2008, 58) estimate that 3.4 million tonnes of CO_2 could be saved EU-wide, for refrigerators, freezers and washing machines alone. In the future, the criterion of resource efficiency / material efficiency can be incorporated into legislation of Integrated Product Policy and the Eco-Design Directive.

There are many other possibilities of utilizing the VAT for a resource policy such as a differentiation according to the resource-intensity of key sectors or according to teir service intensity and maintenance of goods. However our proposals are of such character that they offer multiple synergies with other environmental policies and can be implemented rather easily. This also means that more far-reaching options such as to include more products do exist but will require a better information base.

An International Metal Covenant

End of life vehicles (ELV) are a good case to illustrate the business perspective for action: they contain a variety of materials, including steel and copper but also PGM. A high-level recycling could save considerable amounts of resources in comparison to the primary production route. Accordingly, the ELV directive states that manufacturers have to ensure recycling rates of 85%, and this rate will have to be increased up to 95% in 2015. However, most vehicles are exported as pre-used vehicles and end up as waste in coun-

tries outside of the EU, where these recycling targets are of no relevance. Usually - if at all - only the main mass flows (particularly steel) are recovered. Such poor management of resources causes a massive material leakage for the EU.

In principle, there should be an economic interest to increasing the recycling rates of these materials: the automotive industry could reduce its dependence on the volatile commodity markets and strengthen their security of supply (e.g. for copper). The recycling industry has developed techniques and infrastructures to recycle ELV profitably, but needs a sufficient amount of available input. In the destination countries of exports illegal waste activities cause significant environmental burdens. At the same time, the development of functioning recycling infrastructures could stimulate local economies while transferring existing schemes of the shadow economy into a legal frame. Despite such common interests, the prevailing policy instruments and incentives are clearly not sufficient to stimulate transactions and to generate the necessary investments that are deemed necessary to put this into action.

Against this background one may start with the negotiation of a legal contract based on private law (a covenant) between suppliers and automotive manufacturers, recycling industry and the relevant public authorities in the export and destination countries. Such a covenant should set long-term goals to increase the resource productivity by high quality recycling of old cars (wrecks). It should define the responsibilities of different actors in terms of operation, implementation, and evaluation. The contractual parties, be it industrial enterprises or their associations, shall commit themselves to ambitious targets for resource protection. In return, the states shall guarantee stable and supportive regulatory framework conditions for the duration of the contract. In distinction to voluntary agreements, the covenant and its compliance should possibly be brought up to a court. However for an effective implementation it should also provide effective dispute resolution and sanctions if contractors fail to meet their obligations. Germany, the biggest car manufacturer and recycling market, could take the initiative for such a covenant within the EU.

Such a covenant does have the potential to establish a framework towards closing material cycles for consumer goods more effectively at an international level. The distribution of the existing costs and benefits along the value chain could be regulated in such contract in a flexible way in order to overcome existing prisoner's dilemmas. New partnerships between industry sectors and public bodies may contribute to the reduction of transaction costs for obtaining information and simultaneously increase the state's regulatory capacity and the industry's acceptance for such arrangements. The extended producer's responsibilities for the physical and financial effects of their products at the end of the use phase – name it material stewardship (ICMM 2007) – would be no longer undermined by exports. This would put real incentives to reinforce design for recycling and solve existing conflicts with other environmental goals, such as the use of plastic for lightweight construction to reduce fuel consumption. But the instrument also shows some practical and legal issues and risks that must be weighed against these potential benefits.

Such an international covenant between selected states and industry sectors is a new area for international law and economics. The theoretical starting point for our considerations of an international covenant is the thesis that especially knowledge problems and transaction costs are responsible for the open loops in international material cycles with end-of-life products. On the one hand market failures exist on recycling markets because of the asymmetrical distribution of information hindering efficient contracts. On the other hand the state has insufficient information to correct market failures for an optimal result by direct regulation. Instruments of direct regulation (prohibitions, standards, etc.) have been very effective in the past and mainly prevented local pollution. Sustainability as a goal of social development increasingly seems to be too complex to be achieved in this way. In particular the uncertainty of sustainable development and the associated principle of precaution overwhelm capacity and capabilities of the political environmental actors to motivate businesses to behaviour "beyond compliance".

To start with automotive recycling appears potentially interesting for such a covenant: it offers high specific investments in recycling infrastructures, complex coordination processes in the international process with high uncertainty about the evolution of the framework, in combination with a lucrative market with a manageable number of key players and the potential for material efficiency and resource conservation as well as a large number of target countries for the export of used cars, which could be incorporated into a single treaty.

An International Convention for Sustainable Resource Management

In the long run, sound reasons advocate for new legal mechanisms for international resource policy by an international convention on sustainable resource management (Bleischwitz et al. 2009: 286ff.):

- Existing initiatives and boards are not legally binding; they are based on voluntary participation and uncertain continuity,
- Competitive advantages through material efficiency are thwarted by destructive exploitation, environmental dumping and ‘sleazy waste disposal’
- The pressures from problems and therefore the potential for conflicts are growing.

With a view to resource-rich developing countries that usually perform poor regarding increases of resource productivity, such convention should provide legal support for the establishment and management of national and regional raw material funds. In essence, such funds should include rules that ensure that yields of activities from extraction and the use of natural resources are reinvested (i) for better macro-economic resource governance and (ii) in the development of sustainable production and consumption structures downstream.

An international convention should also be designed as a platform under international law for bilateral programmes and arrangements. In this context, cooperatively stipulated ‘road maps for sustainable resource management’ between G8 and BRIC countries

are of special interest. In addition, a legal framework for the realisation of sectoral agreements with material-intensive industries under the roof of such a convention is imaginable. Economic instruments, e.g. the international harmonization of resource taxation and user fees on international goods that are currently not taxed (such as aviation, maritime shipping, international harbours) or resource certificates are also interesting options.

Such a convention, however, will probably be established in a stepwise manner and, in particular, only develop incentives for resource conservation and the legally new area of material stewardship in cooperation with industry. Thus, it is imaginable that initially only information exchange will be undertaken. Furthermore, an international convention is only a means towards global and sustainable resource management. Alternatively, an existing international organisation could take responsibility for information exchange and creating a database, or existing initiatives could be effectively strengthened and implemented.

A short reflection on these instruments

Our suggested resource policy will make a difference to the prevailing ways of treating construction minerals and metals. Together with approaches that are more short term – e.g. a technology platform, a trust funds for eco-entrepreneurship, lighthouse projects – it will spur innovation along material value chains in the EU and internationally. It will in particular strengthen the relationship with emerging economies. It needs to be stressed however that such policy does not exclude a special treatment of single substances or selected critical matals if it is deemed to be necessary.

In regards to the stalemate in climate policy, our approach may offer advantages of spurring eco-innovation, in particular for material-intensive industries and their product applications downstream. The international metal covenant is a good example of how this may be taken as starting point for sectoral agreements internationally. At the same time, instruments such as energy taxation, the eco-design directive, and emissions trading can either be extended to cover aspects of resource efficiency or are likely to have synergies anyway. However, the fixation towards CO_2 ought to be broadened, and certainly a long-term innovation approach should be stressed (Aghion et al. 2009, Rene Kemp in this special issue). Early results from the German MaRess project (see Bernd Meyer in this special issue) seem to confirm the opportunities of such strategy yielding macro-economic benefits as well.

Another reflection should address land use, agricultural goods and biomass. So far, our proposals have not yet been specific on how biomass should be addressed. In terms of environmental priority, the availability of arable land for sustainable supply of agricultural goods and biotic materials is of utmost importance (UNEP 2010: 75). Related areas such as the expansion of cropland at the expense of life-supporting ecosystems and the destruction of forests are clearly issues, which need to be addressed. For sure, any total shift from non-renewable to renewable resources is not an option. Our VAT proposal targets the problematic of food patterns though, and existing biofuel certification in the EU can also be seen as a starting point towards more comprehensive resource policies in light of the visions mentioned.

5. Conclusions

The empirical survey underlines the well-known trend of decoupling the use of natural resources from GDP and ensuing gains of material productivity and resource productivity. The trend towards increasing Total Material Requirements associated with imports in the EU indicates a burden shifting into countries outside the EU, i.e. a case for international policy approaches.

The paper outlines a rational for such resource policy and develops guidelines for a transition management towards resource-efficient green economies. However this won't be enough to remove the lock-in barriers and market failures that effectively hinder markets for resource efficiency to flourish. The paper thus develops a strategic approach with grasping the 'low hanging fruits' of material efficiency at the business level first, strenghtened by pillars to disseminate process innovation, to develop lead markets, to transform sectors and to establish new infrastructures. In addition, the paper supports the target of doubling resource productivity by 2030. It furthermore proposes economic instruments such as a tax on construction minerals and an ecologically differentiated VAT. The international markets can be addressed via an international covenant for metals and an international convention for sustainable resource management. For sure, such instruments won't be introduced in short term, but may well become a topic at the forthcoming Rio+20 Earth Summit in 2012. [10]

After all, more research is needed to understand the dynamics of drivers and barriers as well as the interaction with international economics, and to develop a policy mix that leads to an absolute decoupling of economic growth from using natural resources. Here, a transition management perspective seems appropriate to tackle the different levels of activities and the time dimension.

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[10] www.unep.org/greeneconomy/

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