National Policies for Resource Efficiency and Waste Management – Structures, Impacts, and Deficits

B. Bahn-Walkowiak[1], N. von Gries[1] and C.H. Wilts[1]

[1]Wuppertal Institute for Climate, Environment, Energy, Wuppertal, Germany

Abstract. The Roadmap to a Resource Efficient Europe calls Europe to take decisive steps towards a transforming of the economy. This is however done without considering the fact that European Member States are using resources very differentially efficient to date. This paper explores the framework conditions, institutional and political factors effecting waste and resource management. It looks at the progress made to date in order to tackle the challenge and identifies barriers that hinder a more pronounced performance, in terms of a decisively improved resource efficiency. To this end, it conducts two in-depth evidence-based country analyses of ten selected countries representing different policy configurations and performances. In order to identify key factors for performance in resource efficiency and waste management and develop conclusions and policy recommendations, the issue is approached by looking at framework conditions, institutional and technical set-ups and incentive systems for resource and waste management, inter alia by referring to the drivers and barriers research (with a particular focus on barriers), policy diffusion research, and the transition management approach. The analysis of resource policy and waste management regimes and their specific characteristics in different EU Member States underlines that a country specific perspective is still necessary in order to understand why the EU as a whole does not use resources more efficiently. The analysis points to large unexploited potentials as regards innovation and particularly eco-innovation and related investments. The different institutional set-ups in the countries as well as the diversity in policy choices highlights a lack of ambitious goals and general uncertainty in a focused and targeted transformation to an improved resource and waste management. The paper develops conclusions and policy recommendations for environmental policy and planning and how the positive approaches could be channelled more effectively and flow in more radical leaps.

The paper was written as part of a 3-year project for the European Commission (POLFREE – Policy options for a Resource-efficient Economy) funded under Grant Agreement Grant Agreement no. 308371.

1 Introduction

A continuing high demand for resources, an inefficient use of them and large waste streams remain to be the prevailing patterns in Europe (Dittrich et al.

2012; Giljum et al. 2011). The Roadmap to a Resource Efficient Europe (EC 2011) requests European Member States to take decisive and consistent steps towards a reorientation and adjustment of resource use, consumption and production and waste management systems by 2020. Previous analyses have shown that the economic development and resource use connexion depends on a complex interplay between formal and informal institutions (North 1990), environmental policies (Ekins and Speck 2011; Bleischwitz, Welfens and Zhang 2009; Bruyn et al. 2009) and systems of innovation (EIO 2013; Kemp 2012; Vasseur and Kemp 2011). Specific analyses of resource efficiency policies and the related eco-innovation systems (EIO 2013; BIO IS 2012a; BIO IS 2012b; EC 2011) have, in addition, pointed to the importance of country-specific national governance patterns, structures and institutional developments. Further studies investigating, more specifically, market failures provide important insights regarding the incentive-barrier complexity (Meyer 2011; Ecorys 2011; Bleischwitz et al. 2009a; Bleischwitz et al. 2009b). An econometric strand of research explores, inter alia, relationships between material, energy and carbon productivities, and economic activity (Steinberger, Krausmann and Eisenmenger 2010; Steinberger and Krausmann 2011; Talmon-Gros 2014), while another one focuses on material flow indicators and country differences (Giljum et al. 2011; Steger and Bleischwitz 2011). The theoretical basis for systematically explaining inefficient resource use and the role of national policies and institutions is not yet well developed however.

In order to contribute to the understanding why resources being are being used inefficiently in Europe, this paper focuses on the interaction of policies and institutions as well as further inertia factors and incentive structures potentially counteracting important systemic or technological leaps and aims to identify levers for a better transition management and diffusion of successful policies (van den Bergh 2011; Tews 2006; Jänicke 2005; Geels 2004).

2 Methods and hypothesis

The hypothesis is that current resource and waste management systems are in a multi-directional process that form a "web of constraints" comprising a multitude of barriers such as information, adaptation and coordination deficits, market and policy failures and orientation deficits that cannot be addressed by single instruments but have to be met by a policy mix.

In order to cope with the amount of influencing factors, a systematic but pragmatic way was chosen in order to arrive at conclusions. Following this, in terms of barriers for resource efficiency and waste management the central question was specified as follows: What are hindering institutional and policy

factors for (a) a better resource efficiency performance and (b) for a movement of waste treatment up the waste hierarchy? Further areas of barriers are investigated in other parts of the projects, e.g. business barriers and others.

The method applied is an evidence-based qualitative country-comparative policy research of policy processes (politics), institutional structures and frameworks (polity) and evaluation criteria and dimensions (policy) in the policy areas resource and waste management and its interactions with neighbouring fields. While both may not be fully separated in technical terms, it is important to note that these two areas were chosen in order to embrace the two sides of resource use: the input-oriented side (resource policy) and the output-oriented side (waste policy), or, in other words the socio-metabolic and the circular economy approach.

The investigation approach for **resource policy** resulted in three pillars: the framework conditions (pillar 1) which is the geological starting position, the institutional set-up (pillar 2) such as programmes, responsibilities, coordination, and the economic incentive system (pillar 3), such as market-based instruments (taxes, direct financial support, direct consultancy), and side policies like economic recovery programmes, innovation policies, and the phasing out of environmentally harmful subsidies. The investigation approach for **waste policy** resulted in two pillars: the policy and institutional factors such as incentive and programmes (pillar 1) influencing the technical set-up, such as infrastructures (pillar 2). In the course of the country review, both pillars were analysed with regard to different dimensions and indicators, such as targets, regulatory framework, agencies and competencies, etc. Against this background, the two analyses conducted barrier analyses in form of case studies for waste and resource policy.

In this paper we compare countries on the basis of a rather simple evaluation framework consisting of 11 and 16 criteria. Further work in this direction is being recommended. In general, the knowledge base for resource policy has to be improved. There is, for example, a lack of relative and absolute data on eco-industries in terms of employment and contribution to value added; also in terms of a categorical division of the environmental effects of green innovation and other innovation are not transparent as well as in which way high labour and low resource costs favour the use of time-saving but resource-intensive innovations (e.g. food sector, transport sector) and thus contribute to decreasing life cycles and growing waste volumes. The role of national key sectors (which are often resource intensive sectors) and their contribution to path dependencies is widely not transparent at all. There is especially a need to create frameworks for the transition to a circular economy.

3 Results of the case studies

POLFREE uses the idea of a "web of constraints" as an analytical concept in order to explain why resources have been and are being used inefficiently. In this way it goes beyond the idea of physical, somehow moveable barriers and highlights the social context of technologies and resource usage: "In summary, the models on 'barriers to resource efficiency' tend to treat barriers in fairly concrete terms and to overcome the barrier typically involves a specific action that needs to be done. This may be true for some cases, but often barriers are part of a complex pattern of interaction (…), of cause-and-effects in a sector, in which reasonable actions of individual actors, unintentionally lead to unexpected outcomes. Also, underlying perspectives of relevant stakeholders - firms, consumers - are often kept exogenous to the study, a priori speaking of the subject being 'hindered' towards more resource efficiency. In the eyes of the stakeholder this may not be the case at all. As a consequence, the social context often tends to be treated in a somewhat mechanic way (identify obstacle, delete obstacle, subject will act more efficiently), which will not be as simple as that in practice" (Kemp and Dijk 2013).

Against this background, the results of the resource policy analysis will be briefly discussed.

3.1 Case study: Resource efficiency policies

3.1.1 Institutional set-up

The analysis reveals that only a relatively limited number of decided, concrete resource targets exist so far. As regards, national targets in RE programmes and strategies, there are no quantitative targets in the EU. Absolute reduction targets do not exist at all at national level but various relative consumption reduction targets were introduced. Some absolute reduction targets have been implemented at sectoral or regional level. Three countries formulate specific goals aiming at increasing resource productivity/ resource efficiency (Germany, Austria, Hungary). Austria stipulates an increase of resource productivity by factor 4 (2012) and factor 10 (2050), resource efficiency increase of 50% and decrease of 20% resource use (2020). Germany strives for a doubling of raw material productivity (1994-2020) while Hungary aims at minus 80% material intensity by 2050. The Netherlands has no official announcement on pursing resource efficiency or resource efficiency targets. From a barriers perspective, resource targets can serve the society and economy by removing orientation and information deficits. Furthermore, they can initiate or at least prepare a change in behaviour (BIO IS 2012b, p.27). It is thus possible to rank and differentiate targets along various criteria, such as

target lines, whether they are qualitative or quantitative, absolute reduction or efficiency targets, as regards the coverage of the included indicators, if they are part of a wider target system, concerning their stage of specification (as regards sectoral and further derived objectives), interim targets and milestones, and reporting duties. Due to their controllability and higher liability, quantitative targets are regarded as more effective than qualitative targets that often remain vague and tend to lead to inactivity. In addition, they can be operationalized and reviewed in contrast to possibly soft, qualitative visions of the future (Bahn-Walkowiak and Steger 2013).

The majority of the goals described in sustainability strategies or environmental programmes are formulated qualitatively. From today's perspective, the relatively advanced strategies of Germany and Austria can be assessed as pioneering, with Austria being the only country so far indicating figures and timelines and Germany seizing the roadmap ideas. The unclear responsibilities in both countries, however, would require greater efforts in terms of the horizontal and vertical policy coherence. The trade-offs are not resolved.

There is evidence of a growing movement to establish organisations in other countries, such as efficiency agencies, but they are very heterogeneous at European scale and "tend to focus narrowly on their area of jurisdiction, usually a single sector or resource type" (EC 2011, p.46). National strategies and their institutional embedding can reduce orientation and information deficits. However, a division of strategies into rather economically driven and rather ecologically driven policies has emerged at the European level (Öko-Institute and Leuphana University Lüneburg 2012) and was partly reproduced in other countries, such as Austria, Germany, Finland, Japan (DEFRA 2012). Securing access to raw materials and availability problems as well as the opportunities of eco-innovation of an energy transition that partly requires more demand for certain materials, but may entail conflicts of interests and trade-offs, not only at strategic level (Bleischwitz et al 2012). It is rather typical to share responsibilities for resource efficiency and raw materials though between the Ministries for Environment and Economy and introduce further laws for domestic material extraction.

3.1.2 Incentives

More and more policies aim to combine the dynamics of innovation with a targeted support for eco-technologies. Those policies are assumed to have advantages in achieving economic objectives and increasing resource efficiency, in terms of a broad definition (EIO 2013; COWI 2011), by being a fusion point of innovation and environmental policies. Incentive instruments and programmes are established, and yet focused, in the field of energy. According to Ecorys „instruments concerned with resources and aiming in particular at resource efficiency are not widespread and are poorly developed

in comparison to other areas, providing a significant opportunity for improvement and wider deployment“ (Ecorys 2011). Policies aiming to influence resource use, e.g. targets, market-based instruments, innovation and technology driving instruments, informational instruments and information transfer show a broad range of more than 127 different environmental protection and resource efficiency policies across the EU32 for SMEs, tailor-made for national needs. The EEA report (EC 2011) even reports 190 examples specified as good practices for resource efficiency.

A closer examination of the countries Austria, Germany, Hungary and the Netherlands concerning financial incentives and support programmes for resource efficiency shows parallels, both in terms of the measures implemented and the effects associated. In the area of direct financial incentives and support programs one can assume that the barriers for introduction are rather small. There are hardly any distributional conflicts and the cost of implementation, administration and evaluation lie with the public. Information deficits, adaptation deficits, initial capital deficits can be easily targeted. In particular, the specific combination of resource efficiency innovation and technology driving market incentive programs and information transfer in the form of targeted counselling proves to be quite effective. This is particularly well documented in the field of energy efficiency measures in the building sector. The assessments differ, however. Due to a combination of stricter building codes and regulation, higher efficiency standards for new construction and renovations with the EU Directive of 2002, certification schemes and national support programmes Nelson et al. find that the niche green buildings has already become mainstream (Nelson, Rakau and Dörrenberg 2010). BIO IS however finds barriers to energy efficiency in buildings not as a set of discrete problems, (...) but as „dynamic interplay of actors“ (BIO IS 2013, p.124) having reduced the potential energy efficiency gains in the last years. Support programmes and financial incentives reduce information deficits and cognitive barriers and encourage learning processes with good diffusion results. The overall picture is, however, inconsistent and regionally fragmented.

Concerning market-incentives it turns out that environmental taxes (NL 10%, HU 7%, DE 6%, AT 6%) and pollution/resource taxes (NL 2%, HU 0.3%, DE 0.1%, AT 0.1% of total taxation) are almost the same in three of the four countries. It is the Netherlands here who ranks first. In the general statistics 75% of the environmental tax revenues come from energy, 21% from transport, 4% rom resources and they altogether come up to 6% of the overall tax revenue.

From an economic perspective, taxes are usually second-best policies due to their inherent impreciseness (Söderholm 2011); from an environmental perspective, taxes are a step towards reflecting the full external and social costs of resource extraction and use. Concerning energy taxes, “pusher

strategies of pioneer countries" (which were the Scandinavian countries and the Netherlands at that time) came along with European Commission's proposal to introduce a common energy/carbon tax in the 1990s. Despite long-standing debate and the fact "that the environmental effectiveness of eco-taxes is widely recognised among scientists as well as policymakers and that these instruments have actively been promoted by many of the most influential international organisations such as the OECD, the UN and also by the EU for many years" a successful dissemination of resource taxes has failed. The analysis that this could be due to "high conflict potential due to their redistributive effects" and is therefore less likely to rapidly diffuse can still considered valid (Tews, Busch and Jörgens 2002, p.29). Resource taxes are confronted with a bundle of structural barriers: the market power of key sectors, the lack of information and cognitive barriers on various levels (industries, consumers, politics), split incentives in value chain, between companies, between different resources.

In general, environmental taxes and charges are overwhelmingly implemented selectively; they cannot be considered as large-scale instrument sending a clear-cut signal to consumers, except for the context of energy and petroleum. Mainly, single resources are addressed by rather low tax rates. Contribution to overall tax revenues is marginal. They are mainly below a 1% threshold of the overall tax revenue (EU = 0.3%). Potentials are not exploited; the tax shifting aim (major shift from taxation of labour towards environmental taxation) is not tackled at all.

3.1.3 Side policies

Eco-innovation efforts and output still have a niche role in the overall complex innovation policy. It is not transparent how specific sectors drive innovations via sector-specific modes and technological regimes, which innovations those are, how long or short innovation cycles are and which paths are determined like this. The last Sectoral Innovation Watch report is from 2008 (Europe Innova 2008). It understands eco-innovation as a subsector. In a broader sense, the technological progress path European countries follow is characterised by a constant output of new innovative products and services that do not distinguish between environmental and non-environmental innovations for the time being. This is drastically being reflected in the budgeting for eco-innovation in recovery, R&D efforts and innovation policies, pointing to a fundamental "Mislabelling of sustainability as purely environmental" (SD Commission UK 2011).

As the Green R&D (Research & Development) budgets are low compared to total government R&D budgets (Austria 4%, Germany 7.1%, Hungary 3.8%, Netherlands 2.8% of total R&D) although some countries show larger magnitudes Estonia 13.9%, Finland 12.5%, Japan 14.5%. The green R&D expenditures of businesses are unknown (there is no indicator). The green

elements in recovery programmes have a range of 13%-56% with a striking clustering of expenditures for transport and energy efficient buildings.

Another significant debate in the context of resource efficiency focuses on the reduction of subsidies contributing to pollution (Wilts 2014). Subsidies are often associated with environmental disadvantages; many of them are "resource-relevant" (Münch and Jacob). A useful definition widely used draws on the OECD term EHS as "a result of a government action that confers an advantage on consumers or producers, in order to supplement their income or lower their costs, but in doing so, discriminates against sound environmental practices" (OECD 2005). IEEP rightly indicates that the definition refers to "action" only. "In some cases non-action, e.g. not applying road pricing to cover costs of roads, not applying VAT on food or excise taxes on certain fuels, or not internalising externalities, leads to prices not reflecting environmental and social costs and hence creates implicit subsidies" (IEEP 2012, p.2).

There is a remarkable inter EU homogeneity of subsidies in resource-intensive sectors, for example in the transport sector (a key sector according to Roadmap but the only sector with no decoupling signs), such as commuter compensations, company cars privileges, no road pricing, tax cuts for agricultural vehicles, unfavourable taxation of competing modes of transport, etc.

There is altogether a low activity in the phasing out of national EHS (environmentally harmful subsidies); the countries inspected in depth show rudimentary or even no activities.

3.1.4 Assessment of resource efficiency efforts in four selected EU Member States

The following figures illustrate and summarise the results of the country review with regard to the dimensions: institutional set-up and incentives and side policies following the topics formulated within the chapter Transforming the economy in the EU Roadmap (EC 2011).

Following this, countries were assessed according to their fulfilment of the criteria indicated below. The assessment system ranges from 0 for a low fulfilment or low value to 4 for a high fulfilment or high value (0 = no activities; 1 = low degree of activities; 2 = moderate degree of activities; 3 = above-average degree of activities, 4 = high degree of activities). The results are represented in so-called network diagrams, where the degree of fulfilment corresponds to the visual representation in the form of a web, i.e. the larger the web, the better the various criteria are fulfilled. This visual presentation allows a comparative overview of the different policy areas and their characteristics. Methodologically, it has to be noted however that it is not an evaluation with precise quantified values, but an assignment of characteristics to particular criteria. This means, for example, that a measure based on an evaluation criterion (e.g. "Resource efficiency programmes") can of course

not be assigned to real effects but serves for assessing the and (current) priorities of countries and the variations between them.

Table 1: Assessment scheme of the institutional set-up, incentives and side policies criteria and scoring; Source: Authors' compilation.

Pillar	Criterion	Assessment	AT	DE	HU	NL
Institutional set-up	Resource efficiency programme (RP)	no 0 / stand-alone programme 1 / qualitative targets 2 / quantitative targets 3 / backed by measures 4	3	2	0	0
	Raw material initiative	no 0 / stand-alone programme 1 / qualitative targets 2 / quantitative targets 3 / backed by measures 4	2	2	0	1
	Coordination (institutions involved in policy formulation)	more than three 0 / three 1 / two institutions 2 / one institution 3 / integrated management 4	1	1	1	1
Incentives	Environmental taxes	no 0 / yes 1 / valuable effects 2 / considered successful 3 / more than one resource group 4	1	2	2	3
	Resource taxes	no 0 / yes 1 / valuable effects 2 / considered successful 3 / more than one resource group 4	0	0	0	0
	Direct financial support	no 0 / yes 1 / valuable effects 2 / considered successful 3 / more than one resource group 4	3	4	2	3
	Support for SMEs (consultancy)	no 0 / yes 1 / valuable effects 2 / considered successful 3 / more than one level 4	2	4	1	3
Side(effect) Policies	Economic recovery programmes - green elements	no 0 / yes 1 / valuable effects 2 / considered successful 3 / more than one level 4	2	2	1	2
	Innovation policies - green elements	no 0 / yes 1 / valuable effects 2 / considered successful 3 / more than one level 4	2	3	1	2
	Phasing out of environmentally-harmful sectoral subsidies (focus: meat)	0 = no activities; 1 = low degree of activities; 2 = moderate degree of activities; 3 = above-average degree of activities, 4 = high degree of activities	0	0	3	1
	Phasing out of environmentally-harmful sectoral subsidies (focus: cars)	0 = no activities; 1 = low degree of activities; 2 = moderate degree of activities; 3 = above-average degree of activities, 4 = high degree of activities	2	1	1	3

3.1.5 Governance patterns and policy preferences

Austria and Germany are the leaders in terms of the development of resource efficiency agendas/ action plans while having a focus in the field of financial incentives and support programmes for the industry. At the same time, aspects as the phasing out of EHS or shifting labour taxation to resource taxation are weakly or not at all pronounced. Both countries raise no resources taxes (apart from energy taxes and water charges). Other focal points in the field of innovation policy, which is good to very good pronounced, show a downtrend according to the Eco-Innovation Index for Austria and an uptrend for Germany. The socio-economic outcomes comprising exports of eco-industries, employment and turnover of eco-industries show a downtrend for both countries. Resource taxes are not charged by Hungary and the Netherlands, too, but the Netherlands has a leading performance as regards environmental taxes. With view to innovation and green components of innovation policies, activities are notable in Austria, Germany and the Netherlands but rather low in Hungary. The public R&D budgets for energy and the environment are highest in Germany and less than half of that in Hungary. As regards EHS, the Netherlands has developed first activities regarding the phasing out of EHS, such as tax

deductions for commuters. Hungary stands out with raising the standard VAT rate on meat. There are no such activities to be noted in Austria and Germany.

Overall, Hungary is ranging at a much lower efficiency (i.e. resource productivity) level, but, at the same time, shows a comparatively low per capita consumption of resources and an absolute decoupling in terms of the average annual growth rates in DMC (Domestic Material Consumption) and GDP (Gross Domestic Product) (2000-2009). This suggests that Hungary (still) has more frugal production and consumption patterns. The Netherlands also shows absolute decoupling and the lowest per-capita resource consumption of the country sample but it has hardly launched activities on the institutional side such as the development of resource efficiency action plans or the corresponding advisory institutions. For the Netherlands, all outcomes show improvements and also the Eco-Innovation Index shows an upward trend. This is true, moreover, for Hungary, where an upward trend in the Socio-economic outcomes of the Eco-Innovation Index is recorded, but not in the relative ranks of the composite index.

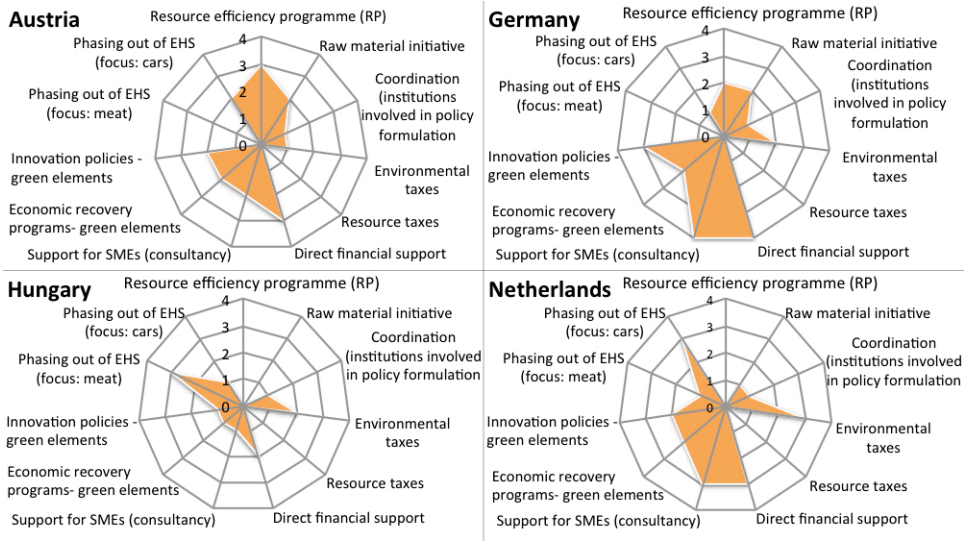

Fig. 1. Configurations of resource policies with respect to Roadmap requirements.

3.1.6 Preliminary conclusions

The present picture of resource policy (policies) (as of 31 May 2014) is that mainly single, (still) rather weak strategies (in the sense of enforcing competence) and a conglomerate of different sector-specific and/ or technology-driving instruments and policies and selective policies for innovation and green innovation meet a superiority of established socio-technical resource supply and consumption systems. Increasingly, individual instruments are quite effectively and successfully implemented (e.g.

governmental loan programmes for energy efficiency investments in buildings in Germany, UK). Successful instruments partly gain a relative diffusion as good practices (e.g. feed-in tariffs) and thus evolve stronger effects. This sometimes also relates to instruments that are considered less useful for environmental purposes (e.g. car scrappage scheme). Some former successful instruments lose their legitimacy in the wake of political changes at the national level or are successfully challenged by interest groups (e.g. ecological tax reform in Germany). Fedrigo-Fazio et al. (2014) investigate a number of policy mixes implemented with varying degrees of success. In most cases, a variety of instruments, a variety of resources and sectors is addressed and depicts fragmented approaches. Some of them show indeed impressing results: UK for aggregates, Sweden and Denmark for fossil fuels as examples for a sectoral approach, Japan on domestic material use as an example for a multi-sectoral approach. UK and Japan stand for an absolute decoupling of the resources addressed, Sweden and Denmark for a relative decoupling (Fedrigo-Fazio et al. 2014). Despite their relative success, those measures will probably not produce radical resource-efficiency improvements unless they obtain a significantly larger widespread at the European level.

A key feature of the framework conditions of economies is the fiscal system of nation states, where the EU competences are relatively low. The taxation systems of the Member States continue to set strong incentives towards a wastage of natural resources and a shortage of employment (Weizsäcker et al. 2009). The overall share of public revenues generated by resource taxes in Europe is extremely low (5% of overall environmental taxes) ((Eurostat/European Commission 2012) and very different among the European MS states; incentives for consumers and businesses to save resources are generally still moderate and often limited to informational tools (EC 2011). Environmental tax reforms implemented in some EU countries predominantly focus on energy sources and are on the decline again, particularly in former EU-15 (Ekins and Speck 2011). The European countries strongly compete regarding jobs and site-related factors for enterprises through varying their economic framework conditions.

Hence, the analysis points to largely unexploited potentials as regards innovation and particularly eco-innovation and related investments. The different institutional set-ups in the countries as well as the diversity in policy choices and preferences highlights a lack of ambitious goals and a general uncertainty what a focused and targeted transformation to an improved resource and waste management could mean. The role of the national key sectors (which are often resource intensive sectors) and their contribution to path dependencies is widely not transparent and needs further research.

3.2 Case study: Waste policies

According to the Roadmap to a Resource Efficient Europe (EC 2011), the EU should achieve a state where waste is managed as a resource by 2020. Waste prevention is at the top of the EU waste hierarchy, followed by reuse, recycling, other recovery (e.g. energy recovery) and disposal. This priority order aims at the reduction of environmental burdens as well as the conservation of natural resources.

All operation levels of the waste hierarchy can be influenced not only by direct and specific policies but also by indirectly influencing instruments and waste management system aspects. In the course of the country review, policy and institutional factors (pillar 1) and the technical set-up (pillar 2) were analysed with regard to different dimensions and indicators (table 3). These were chosen with a focus on bio-waste, end-of-life vehicles (ELVs) and municipal solid waste (MSW), which depict the broad character of waste policy (formed by the Waste framework directive, supplementary directives, Extended producer responsibility). Furthermore the chosen indicators cover all treatment operations of the waste hierarchy in order to highlight the indirect influence of technical infrastructures or policies addressing one waste management operation on other management operations. For instance, a policy promoting recycling e.g. through the setting of specific recycling targets can only be fully effective, if the waste management system is "ready" or "willing" to manage the potential waste flow for recycling (UNEP 2013). A lack of source separation in order to produce a high quality waste flow for the recycling or high capacities of waste incineration, which are dependent on a constant input flow, can considerably influence the effectiveness of the policy.

Following this, countries were assessed according to their fulfilment (e.g. national target is above or under the EU targets) or the value (e.g. low or high incineration capacity) of specific indicators. The classification system ranges from 0 for a low fulfilment or low value to 1 for a high fulfilment or high value (see table 3). Due to the consideration of different values and not only clear rateable indicators the results have to be interpreted as characteristics and not as a scoring (e.g. what is the appropriate incineration capacity?).

Table 2: Pillars, dimensions, indicators and assessment scheme for the analysis of waste policy; Source: Authors' compilation.

Pillar	Dimension	Indicator	Assessment
Institutional set-up and incentives / programmes	Targets	MSW Recycling target	1 if more ambitious than EU target / 0 if EU target
		ELV target	1 if more ambitious than EU target / 0 if EU target
	Regulatory framework	Existence of a waste prevention programme (WPP) in accordance with Art. 29 WFD	
		Number of waste management plans or concepts / Levels of target setting national/regional/local	
		Specific law for biogenic waste	
	Agencies and competences	Existence of an agency for environmental issues including waste issues	
	Policy instruments for waste management	Economic recovery programmes	1 if existent / 0 if not existent
		Waste charge systems	1 if exist 3 instruments / 0.5 if exist 2 instruments / 0 if exist 1 instrument
		EPR on ELV	1 if existent / 0 if not existent
		WPP instruments	1 if more than 50 % regulative and economic instruments / 0.5 if more than 25 % regulative and economic instruments / 0 if less than 25 % regulative and economic instruments
Technical set-up	Technical infrastructures	MSW incineration capacity	1 if above 0,8 quintile / 0,75 if above 0,6 quintile / 0,5 if above 0,4 quintile / 0,25 if above 0,2 quintile / 0 if no MSW incineration capacity
		Access separate bio-waste collection	1 if 100 % / 0.5 if partly implemented / 0 if not implemented

		ELV treated per authorized treatment facility (ATF)	1 if above 0,8 quintile / 0,75 if above 0,6 quintile / 0,5 if above 0,4 quintile / 0,25 if above 0,2 quintile / 0 if no ELV facility
	Outcomes	MSW Recycling rate	1 if above the EU targets / 0 if less than EU target
		MSW landfilling rate	1 if 0% / 0.5 if less than EU target 2009 / 0 if above EU target 2009
		ELV rates	1 if above the EU targets / 0 if less than EU target

The results of the country review (as of 31 May 2014) with regard to these indicators show that all countries have largely implemented the EU law in national legislation. All the considered countries established waste management plans and waste prevention programmes (except Estonia, but planned); the targets set are transposed in the national regulatory framework. Nevertheless, the recycling level of these countries differs enormously and waste prevention as well as reuse plays a minor role in all countries to date.

Especially waste management planning seems to be only weakly influenced by the European regulatory framework and varies significantly from country to country – with regard to contents, ambitions, targets or choice of policy instruments. For instance, the extent of the various waste prevention programmes varies widely, from very few pages (4-6 pages) to more comprehensive plans (75-80 pages) (EEA 2014). In addition, the shares of stringent policy instruments for waste prevention vary significantly between the different countries. Several initiatives have highlighted the enormous market potentials of waste prevention, reuse or closed loop recycling – raising the question why companies hesitate to realise these cost savings and market potentials. Some countries clearly see the need to sensitise the market actors, disseminate research results and lower transaction costs for data gathering – and thus focus on informative instruments. The underlying rationale in this case is the perception of unexploited market potentials. At the same time, other countries clearly follow a completely different approach and see the necessity for changed legal and market framework conditions in order to avoid that waste generation externalises social costs and that waste treatment is organised based on the lowest cost level and not from a view point of resource conservation and efficiency. For instance, Finland focuses on regulative and economic instruments (53 % of waste prevention instruments), while Sweden has chosen a set of instruments, which consist of 90 % informative and voluntary agreements.

Although the recycling grew in the period 2001-2010 by 29 million tonnes (EEA 2013) and data on recycling rates shows a shift of waste management up the waste hierarchy and depicts the clear increase of recycling, the results

differ from a MSW recycling rate in 2010 of 20 % in Estonia up to 63 % in Austria. The analysis of environmental outcomes indicates that - as long as waste management causes costs (instead of being a valuable "resource") - regulatory instruments seem to be more effective than economic instruments. For instance, Austria, which has a strong setting with regard to economic and regulatory instruments (e.g. a specific Ordinance on bio-waste, separate bio-waste collection), has the highest MSW recycling rate in comparison to the remaining countries, achieved the EU targets in the context of the ELV recycling and does not landfill any biodegradable MSW (see figures below).

In contrast, Spain has also a very strong use of economic instruments (see figures below), but further regulatory instruments are missing, for instance in order to set higher targets for MSW recycling or to establish a separate bio-waste collection. The MSW recycling results of Spain are with 33 % far behind the EU target and the disposal target is barely achieved.

A lack of proper treatment infrastructure and sufficient capacity for the municipal waste generated is a crucial barrier for environmentally sound waste management as shown in the example of Poland, which still landfills 84 % of biodegradable MSW. However, the example of Sweden highlights that even a well-established infrastructure bears risks: In Sweden the total amount of annually generated waste would not be enough to fill all incineration capacities. These capacities might be used to incinerate waste from non-municipal sources and by using imports. However, capacities far exceeding the amount of generated municipal waste indicate a potential competition between filling incineration capacities and achieving the 50% recycling target of the 2008 Waste Framework Directive, as well as the objectives of the EU's 7th Environmental Action Programme to further move towards a circular economy, to limit energy recovery to non-recyclable material and to reduce the generation of waste.

The following figures illustrate and summarise the results of the country review (exemplary four countries) with regard to the dimensions: targets, policy instruments for waste management, technical infrastructure and outcomes. The full results can be found on the POLFREE project page (Bahn-Walkowiak et al. 2014).

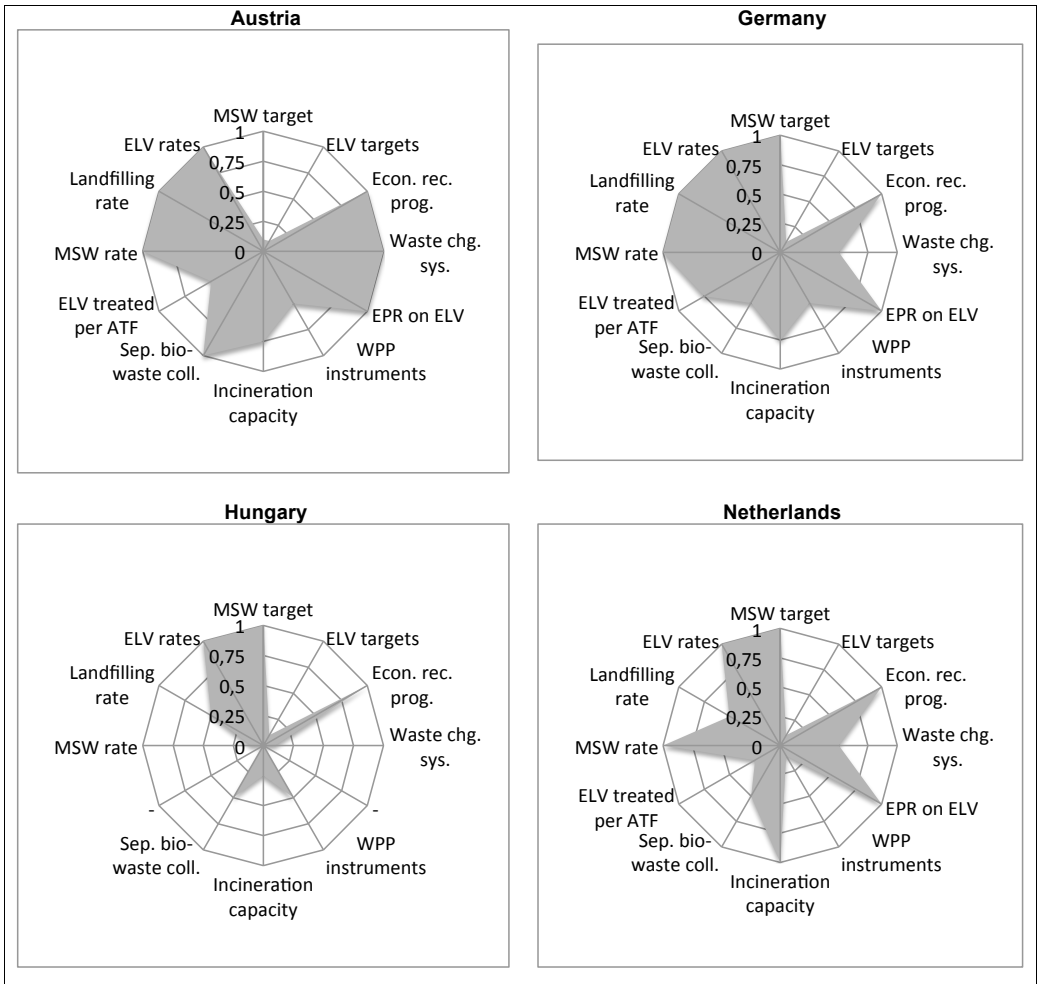

Fig. 2. Configurations of waste policies with respect to Roadmap requirements.

In the following table further results are shown. The grey fields highlight, whether the issue applies for the respective country. Otherwise, the fields were left blank.

Table 3: Waste Prevention Programmes, Waste Management Plans, and bio-waste regulation applied in selected countries; Source: Authors' compilation.

	Waste Prevention Programme			Waste Management Plan			Specific regulation on bio-waste		
	Stand-alone programme	Incorporated in WMP	WPP not in place, but planned	National	Regional / provincial	local	Ordinance	Strategy	Covered in WMP
Austria		■		■	■	■	■		
Germany	■				■	■	■		
Hungary		■		■	■	■		■	
Netherlands	■			■					■
Estonia			■	■		■			■
Finland		■		■	■			■	
Poland		■		■	■	■			■
Spain	■			■	■				■
Sweden	■			■		■			■
UK	■			■	■	■			■

Barriers within the waste management context

The empirical analysis of waste management regimes and their specific characteristics in different EU member states shows that with regard to a transition towards a circular economy, the implementation of EU legislation in national law is apparently not sufficient in order to automatically achieve a state where waste is managed as a resource – as required by the Waste Framework Directive (EC 2008). The effects on resource efficiency can differ enormously and are obviously dependent on the choice of additional national instruments and their comprehensiveness with regard to transposing the waste hierarchy into the waste management structure.

However, that does not allow us to conclude that if waste should be prevented, new framework conditions are needed for reuse and recycling. For instance, given the push of the promotion of electricity produced from renewable energy sources, the energy recovery from waste may detriment recycling in one country but it is an incentive to divert biodegradable waste from landfill in another country. In addition, also general detailed technical requirements will not necessarily have the same effects on resource efficiency in every country, not to mention the feasibility or significance from an ecological, economical and social point of view.

Especially the issue of waste incineration capacities highlights that policy approaches which do not consider every step of the waste hierarchy against the background of resource efficiency and life-cycle thinking in the respective context can lead to unwanted effects. For instance, a policy for diverting waste from landfill without the promotion of an alternative treatment and pathway up the waste hierarchy, which is environmental and economical appropriate in the specific context, can lead to treatment choices, which are either:

- per se ineffective (e.g. recycling focus on the less resource-intensive waste fractions, instead of the resource-intensive ones),
- induce unwanted pathways (e.g. investment in capital intensive incineration capacities without taking account of future shifts such as recycling) or
- have a completely counterproductive effect (e.g. illegal dumping).

The different waste management approaches in the countries as well as the diversity in policy choices highlights a lack of knowledge and uncertainty in the general transformation from waste to resource management. All in all, the lack of integrated environmental and economic assessments, which would allow identifying the best waste management practice in the respective context, can be seen as a powerful barrier to resource efficiency in the waste management sector. Hence, the lack of policies, which steer waste onto routes that save most natural and economic resources (which requires the consideration of the location-specific context) and targets that focus on material quality rather than weight, is becoming apparent.

4 Conclusions

Referring to the hypothesis it has become obvious that there are multiple barriers for more resource efficiency and better waste management found in geological and economic framework conditions, institutional and technical set ups, infrastructural and policy patterns, and the related incentives systems altogether forming a strong web of constraints. These are summarised as follows:

- Concerning resource policy, there are no absolute reduction targets, few limits for certain materials (phosphate, gravel), mainly non-binding efficiency targets without reporting duties contribute to orientation deficits and tend to lead to inactivity.
- A division of strategies in economically and ecologically driven policies is often mirrored in a division of responsibilities and institutional embedding that can induce conflicts of interests or competition of competences

- The share of resource taxes in EU MS is marginal, mainly below 1% threshold of the overall tax revenue (EU = 0.3%) only provides very weak incentives, assumed redistributive effects lead to reluctance.
- The tax shifting aim is not tackled at all due to the interaction of structural constraints, e.g. market power of key sectors such as construction, and system-related constraints such as the principle of unanimity in tax matters and the competition – taxes act as location factors.
- Support programmes and financial incentives successfully contribute to reducing information deficits and cognitive barriers and encourage learning effects and diffusion but are often driven by policy preferences of individual countries for specific measures where they can act as pioneers.
- The European regulatory framework for waste weakly influences national waste management planning and the institutional setting for pushing waste issues forward leading to a diversion of policy choices, which highlights uncertainty and knowledge deficits in the general transformation from waste to resource.
- The EU targets set for waste are transposed in the national regulatory frameworks but the outcomes show that the implementation of EU legislation in national law and the targets itself (weight based instead of considering material quality aspects) are not sufficient in order to manage waste as a resource.
- The aim of steering waste onto routes that save most natural and economic resources (waste hierarchy) is not tackled due to a lack of integrated environmental and economic assessments, monitoring and integrated planning with regard to potential detrimental effects on resource efficiency.

One may distinguish between systemic and structural barriers: Structure-related barriers can be assigned to a certain system and follow regularity while evolving specific attributable effects (e.g. lack of information, trade-offs between policy fields, lack of transparency, lack of coordination, etc.). System-related barriers relate to higher-level bureaucratic and political systems and processes which, although separated from the environment, touch a number of subordinate structures and subsystems in terms of their impacts (e.g. tax systems, web-bound infrastructures, rebounds, policy cycles, competition principle). Thus, a different amount of actors is involved in both cases, and one can also speak of a distinct strengths and persistence of the respective barriers. While system-related barriers affect several socio-technical systems and political levels in any case, the overcoming of structural constraints is, at least theoretically, conceivable within one socio-technical system. As a result, a change of system-related barriers would require much more effort, possibly a fundamental paradigm shift and it seems virtually

impossible that ground-breaking changes can be achieved through technological niche innovations.

When considering the transition approach not only as an analysis framework, but also as an instrument to support systemic innovations, the development, conservation and coordination of so-called innovation niches whose socio-technical variations have the potential to provoke a regime transformation can be interpreted as a new regulatory task. A crucial element of such a transition management process is the development of a shared vision in a participatory process of all relevant stakeholders. In order to make such a vision concrete and a working guidance reference, in particular, targets can play an important role. In this sense targets have a double function because they also allow for monitoring, evaluation and feedback loops as key element of an iterative transition management process. Although the European Commission has set the goal to turn Europe into a resource-efficient recycling society, the reality of waste management in the European Union is still far away from such closed loops or a circular economy as the country analysis showed. The challenges formulated in the EU Roadmap remain huge.

The web of constraints is thus strongly shaped by different interactively linked regimes, not at least with regard to innovation pathways. Large challenges lie in a more coherent treatment and more specifically directed guidance at European level and a synchronous coordination of stakeholder and industrial interests at national level. The transposition of the EU roadmap in national law and activities is in its infancy to varying degrees. The effects on resource efficiency therefore differ and are apparently dependent on the choice of national instruments and priorities with regard to resource-intensive sectors. However, that does not necessarily mean that new framework conditions are needed for resource management. Rather, it is about a much more consistent and coordinated use of existing structures, institutions and potentials. For this reason, one outcome of a follow-up process of the Roadmap could be to explicitly depart from a one-sided competition for the most successful economic and innovation performance (potentially resulting in a reproduction of established regimes) towards a qualitative oriented competition for environmentally relieving policies and eco-innovation, including the acknowledgement and, in a positive sense, integration of more modest life-styles and economies. Support and guidance are required as there are a lot of orientation deficits and ambiguities.

In this sense, Bringezu et al. pointed to the significance of policies and framework conditions: “In the course of economic development, T(otal)M(aterial)R(equirement)/capita[1] can be reduced in absolute terms. However, the limited cases of documented absolute decline of TMR/cap resulted each from political influence, either as specific measure to reduce a

[1] TMR/cap = Total Material Requirement / per capita

major component of TMR or as change of policy framework resulted in enormous technical improvements, which lead to certain increases of resource efficiency through at least partial abandonment of highly resource extractive industries. Nevertheless, policy may also exert a retarding influence on a structural change towards increased resource efficiency. Therefore, future dematerialization of economies may not be expected from business as usual under current conditions, but will require synergistic changes in policy and industry" (Bringezu et al. 2004, p.122).

References

Bahn-Walkowiak, B. and Steger, S., 2013, *Inputorientierte Ressourcenziele: Politische und rechtliche Ansätze*. Berlin, Environmental Policy Research Center (FFU) URL: http://www.ressourcenpolitik.de/ergebnisse/

Bahn-Walkowiak, B., von Gries, N., Wilts, H., Schefer, S., 2014, *Comparing trends and policies of key countries: Report about drivers for resource decoupling and the role of national policies*. Deliverable D1.3 within the POLFREE project. London, University College.

BIO Intelligence Service, 2012a, *Policies to encourage sustainable consumption*, Final report. Prepared for European Commission (DG ENV). Paris, BIO IS.

BIO Intelligence Service, 2012b, *Use of economic Instruments and waste management performances* - Final Report. Contract ENV.G.4/FRA/2008/0112. Paris, BIO IS.

BIO Intelligence Service, 2013, *Energy performance certificates in buildings and their impact on transaction prices and rents in selected EU countries*, Final Report. Prepared for European Commission (DG Energy). Paris, BIO IS.

Bleischwitz, R., Welfens, P., Zhang, Z.X., 2009, *Sustainable Growth and Resource Productivity Economic and Global Policy Issues*, Sheffield, Greenleaf Publisher.

Bleischwitz, R. et al., 2009a, Outline of a resource policy and its economic dimension. In: Bringezu, S. and Bleischwitz, R. (eds.) *Sustainable resource management. Trends, visions and policies for Europe and the World*, Greenleaf, Sheffield, pp. 216–296.

Bleischwitz, R., Jacob, K., Bahn-Walkowiak, B., Petrusche, T., Rennings, K., 2009b, Ressourcenpolitik zur Gestaltung der Rahmenbedingungen. Ressourceneffizienz Paper 3.1 (MaRess), Wuppertal, Wuppertal Inst. for Climate, Environment, Energy.

Bleischwitz, R., Bahn-Walkowiak, B., et al. 2012, *International resource politics : new challenges demanding new governance approaches for a green economy*. Berlin, Heinrich Böll Foundation.

Bringezu, S., Schütz, H., Steger, S., Baudisch, J., 2004, "International comparison of resource use and its relation to economic growth : The development of total material requirement, direct material inputs and hidden flows and the structure of TMR", *Ecological Economics*, 51 (2004), 97-124.

Bruyn, S.de, Markowska, A., de Jong, F., Blom, M., 2009, *Resource productivity, competitiveness and environmental policies*, CE Delft.

COWI, 2011, *Economic Analysis of Resource Efficiency Policies*. Commissioned by European Commission, DG Environment, Kongens Lyngby, Consultancy within Engineering, Environmental Science and Economics (COWI).

DEFRA, 2012, *A Review of National Resource Strategies and Research*. London, Department for Environment, Food and Rural Affairs (DEFRA). URL: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69526/pb13722-national-resource-strategies-review.pdf

Dittrich, M., Giljum, S., Lutter, S., Polzin, C., 2012, *Green economies around the world? Implications of resource use for development and the environment*, Vienna, Sustainable Europe Research Institute et al..

EC, 2008, Waste Framework Directive 2008/98/EC, Brussels.

EC, 2011, *Roadmap to a Resource Efficient Europe*, COM(2011) 571 final. Brussels, European Commission.

EIO (Eco-Innovation Observatory), 2013, *Europe in transition - Paving the way to a green economy through eco-innovation*. Funded by the European Commission, DG Environment. Brussels.

Ecorys, 2011, *The role of market-based instruments in achieving a resource efficient economy*. Framework contract: ENV.G.1/FRA/2006/0073 for DG Environment. Rotterdam.

EEA, 2013, *Managing municipal solid waste – a review of achievements in 32 European countries*. EEA Report No 2/2013, Copenhagen, European Environment Agency (EEA).

EEA, 2014, *Waste prevention in Europe — the status in 2013*. By Kjær Jørgensen, Birgitte and Wilts, Henning. EEA Report No 9/2014. Copenhagen, European Environment Agency (EEA).

Ekins, P. and Speck, S., 2011, *Environmental Tax Reform (ETR) - A Policy for Green Growth*, Oxford University Press.

Europe Innova, 2008, *Sectoral Innovation Watch. Synthesis Report*. Luxembourg, Office for Official Publications of the European Communities.

Eurostat / European Commission, 2012, *Taxation trends in the European Union, Data for the EU Member States, Iceland and Norway*. 2012 edition. Luxembourg, EC.

Fedrigo-Fazio, D., Mazza, L., ten Brink, P., Watkins, E., 2014, *Comparative analysis of policy mixes addressing natural resources. Learning from real world experiences* - DYNAMIX Deliverable 3.2, London/Brussels, Institute for European Environmental Policy (IEEP).

Geels, F.W., 2004, Understanding system innovations: a critical literature review and conceptual synthesis, in: Elzen, B., Geels, F.W., Green, K. (eds.) *System Innovation and the Transition to Sustainability: Theory, Evidence and Policy*. Cheltenham; Northampton, Edward Elgar.

Giljum, S., Lutz, C., Jungnitz, A., Bruckner, M., Hinterberger, F., 2011, European Resource Use and Resource Productivity in a Global Context, in: Ekins, P., Speck, S. (eds.) *Environmental Tax Reform (ETR): A Policy for Green Growth*. Oxford Univ. Press.

IEEP, 2012, *Study supporting the phasing out of environmentally harmful subsidies*. A report by the Institute for European Environmental Policy (IEEP), Institute for Environmental Studies - Vrije Universiteit (IVM), Ecologic Institute and VITO for the European Commission – DG Environment. Final Report. Brussels.

Jänicke, M., 2005, "Trend-Setters in Environmental Policy: the Character and Role of Pioneer Countries", *European Environment* 15 (2005), pp. 129-142, DOI: 10.1002/eet.375.
Kemp, R. and Dijk M., 2013, *Analytical Framework of Drivers and Barriers to Resource Efficiency,* Deliverable D1.1 within ENV.2012.6.3-2 - Policy Options for a Resource-Efficient Economy, Project within 7th Framework Programme of EU. London, UCL. URL: http://www.ucl.ac.uk/polfree/publications [Accessed 5 December 2014].
Kemp, R., 2012, "Ten themes for eco-innovation policies in Europe" *S.A.P.I.EN.S.,* Vol. 4, Issue 2, 23-42, 2012.
Meyer, B., 2011, *Macroeconomic Modelling of Sustainable Development and the Links between the Economy and the Environment*. Final Report, Brussels, European Commission.
Münch, L. and Jacob, K., 2014, *Ressourcenrelevante Subventionen – Ein Überblick*. PolRess-Kurzanalyse 6. Berlin, Research Center for Enviromental Policy (ffu). URL: http://www.ressourcenpolitik.de/ergebnisse/ [Accessed 5 December 2014]
Nelson, A.J., Rakau, O., Dörrenberg, P., 2010, *Green Buildings – A niche becomes mainstream*, RREEF Research. Frankfurt. URL: http://realestate.deutscheawm.com/content/_media/Research_Green_Buildings_A_niche_becomes_mainstream_4_10.pdf [Accessed 15 January 2014]
North, D. 1990, *Institutions, Institutional Change and Economic Performance*, Cambridge University Press.
OECD, 2005, *Environmentally Harmful Subsidies: Challenges for Reform*. Paris, OECD.
Öko-Institut e.V.; Leuphana Universität Lüneburg, 2012, *Entwicklung eines Regelungskonzepts für ein Ressourcenschutzrecht – Abschlussbericht*, Studie im Auftrag des Umweltbundesamtes, Lüneburg, Darmstadt.
SD Commission UK, 2011, *Governing for the Future - The opportunities for mainstreaming sustainable development*. London, Sustainable Development Commission.
Söderholm P., 2011, "Taxing virgin natural resources. Lessons from 1060 aggregates taxation in Europe", *Resources, Conservation and Recycling,* 55(11):911–922. doi:10.1016/j.resconrec.2011.05.011.
Steger, S., Bleischwitz, R., 2011, "Drivers for the use of materials across countries", *Journal of Cleaner Production* 19 (2011), pp. 816-826.
Steinberger, J.K. and Krausmann, F., 2011, "Material and Energy Productivity", *Environ. Sci. Techno*. dx.doi.org/10.1021/es1028537.
Steinberger, J.K., Krausmann, F., Eisenmenger, N., 2010, "Global patterns of materials use: A socioeconomic and geophysical analysis", *Ecological Economics* 69 (2010) 1148–1158.
Talmon-Gros, L., 2014, *Development Patterns of Material Productivity: Convergence or divergence?* Berlin, New York, Springer.
Tews, K., 2006, The Diffusion of Environmental Policy Innovations: Cornerstones of an Analytical Framework. In: Jänicke, M / Jacob, K (eds.) *Environmental Governance in Global Perspective. New Approaches to Ecological Modernisation*, pp. 97-122.
Tews, K., Busch, P.-O., Jörgens, H., 2002, *The Diffusion of New Environmental*

Policy Instruments, Free University Berlin, Environmental Policy Research Center (FFU).

UNEP, 2013, *Metal Recycling Opportunities, Limits, Infrastructure*, Nairobi, Kenya, International Resource Panel (IRP).

van den Bergh, Jeroen CJM, Truffer, B., Kallis, G., 2011, "Environmental innovation and societal transitions: Introduction and overview", *Environmental Innovation and Societal Transitions*, Vol. 1, Issue 1, pp. 1–23.

Vasseur, V. and Kemp, R., 2011, "The role of policy in the evolution of technological innovation systems for photovoltaic power in Germany and the Netherlands", *International Journal of Technology, Policy and Management*, 11(3-4): 307-327.

Weizsäcker, E.U., Hargroves, K., Smith, M.H., Desha, C., Stasinopolos, P., 2009, *Factor 5: Transforming the Global Economy through 80% Improvements in Resource Productivity*. London, Earthscan.

Wilts, H., 2014, *Nachhaltige Innovationsprozesse in der kommunalen Abfallwirtschaftspolitik – eine vergleichende Analyse zum Transition Management städtischer Infrastrukturen in deutschen Metropolregionen*. Dissertation at the TU Darmstadt, Institute IWAR. Darmstadt.