# Resource policies and the innovation dimension

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## Introduction

At a time of growing demand, better conservation of natural resources requires new innovative ways to use natural resources more efficiently and to reduce the burden of environmental impact from economic growth on a global scale. Innovation has contributed to a sharp increase in prosperity and well-being in developed as well as emerging countries. At the same time, market innovations on their own have not managed to affect the transition towards less resource use and to decrease the environmental impact of economic growth. This is mainly due to wrong market incentives and political instruments. Therefore, environmental policies should attempt to create new opportunities and abolish market and institutional barriers to guide innovation towards sustainability.

This ESDN case study describes the innovation concepts related to resource efficiency, also defined as eco-innovation, and identifies system innovation as the biggest challenge in the reforms towards a resource efficient and greener economy. At the end of this case study, some recommendations related to innovation are provided and should serve as a basis for discussions at the ESDN Conference 2011[1].

## Background on eco-innovation and resource policies

A demand for eco-innovation (or innovation towards sustainable development) has arisen because of the need to address today's pressing environmental challenges. The main challenge towards the transition to greener, cleaner and more equitable economic growth is to address the innovation issue not only from an economic, but also from a social and environmental dimension (Bleischwitz et al. 2009). Public strategies shaped towards reduction of resource use are currently focussing on concepts such as resource efficiency, dematerialization of economic growth by factor 5 or 10, absolute decoupling and eco-efficiency. Despite differences among these concepts, one common aim is to promote eco-innovation or environmental friendly innovations, which try to link economic and environmental developments. Mostly, the focus on eco-efficiency at the business sector is oriented towards technological improvements of production processes, in order to make them more resource and cost efficient. However, based on the literature, the potential of eco-innovation to drive eco-efficiency, and eventual sustainability in environmental or social terms, is questionable.

The change which is needed entails not only technological innovations, but also different types of systemic changes, such as industrial, societal or behavioural, regulatory market and framework conditions changes (Bleischwitz et al. 2009). A system change requires innovations which are being simultaneously implemented from different actors and at different levels, such as economy, policy and society. Therefore, innovation towards sustainable resource management requires innovation from a system perspective,

[1] We would like to thank Inge Lardinois, from the Dutch Ministry of Housing, Spatial Planning and the Environment for valuable inputs to this study. Ms Lardinois will also hold a "flashlight" presentation about the topic of this case study in one of the parallel working groups at the ESDN Conference 2011.

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integrating not only technological improvements and efficiency gains in an economic perspective, but also so called eco-efficiency or reduction of environmental burdens which contribute many positive aspects to quality of life (Del Rio et al. 2010).

## Definition of eco innovation

The general definition of innovation is neutral and concerns the content of change open in all directions (Rennings 2000). However, analysing innovation in the context of sustainable development adds the attribute of directing innovations towards reducing environmental burdens (ibid.). That means it becomes normative in its understanding.

Eco-innovation is defined in the "Sectoral Innovation Watch in Europe: Eco-innovation reports" as "the creation of a novel and competitively priced goods, processes, systems, services and procedures designed to satisfy human needs and provide a better quality of life for everyone with a whole life cycle minimal use of natural resources per unit of output and a minimal release of toxic substances" (Reid & Miedzinski 2008). Eco-innovation takes, therefore, a life-cycle approach and is understood as innovation that improves the environmental performance of production and consumption side (Kemp & Foxon 2007, OECD 2009a). When considering the impact of eco-innovation on resource efficiency, the most gains to be made on the production side are found in new technological solutions (Bleischwitz et al 2009). When eco-innovation is oriented towards sustainable development, its understanding becomes broader. In the literature, eco-innovation includes, aside from technological solutions, social elements involving change in consumption, behavioural patterns and life-style change.

## Types of eco-innovation

There are different types of innovation which lead to various outcomes. The barriers and the opportunities for innovation could be better identified once the type of innovation becomes clear. Following this clarification, different policy mixes could be better determined.

Innovation can be defined along following dimensions:

- *Product or process*: Based on the Schumpeter`s typology, innovation can be subdivided into product ("new good") or process ("new method of production") (Del Rio et al. 2010; Hellström 2007).
- *Incremental or radical*: The innovation can also be distinguished across the *newness of the offering*. The *incremental innovation* is based on a new technology or process which is marginally different from its predecessor. The *radical innovation* introduces new technologies and processes which are significantly different from the predecessor (Bleischwitz et al. 2009). It has been argued that an industry will face decreasing marginal returns on its incremental eco-innovation efforts, in terms of sustainability and financial improvements. Therefore, it is pertinent to regularly generate radical eco-innovation in order to push the technological system up to a new equilibrium (Murphy & Gouldson 2000).
- *Architectural (systemic) or component (modular)*: Component innovations take place when one or more modules integrated within a larger system are replaced, while the system itself stays intact. An architectural innovation, on the other hand, entails

changing the overall system design and also the way that its parts interact with each other (Hellström 2007).

## Eco-innovation and resource efficiency

The area of environmental innovation has been strongly influenced by eco-efficiency thinking: i.e. innovation in the way that firms improve the efficiency of their production processes, "in order to reduce environmental impacts as opposed to a production innovation, where environmental value is embodied in the firms output" (Hellström 2007: 150). It is important to understand the systemic nature of the "eco-efficiency" imperative of the World Business Council for Sustainable Development, in order to understand eco-innovation in term of products and processes (ibid.). However, eco-efficiency is focussed mostly on products and processes improvement and is less instructive in terms of product characteristics, on the basis of environmental norms. Therefore, eco-innovation based on the eco-efficiency concept represents mainly incremental processes and component innovations, but not radical and system innovation.

The routes eco-innovation is most likely to take today are based on *component innovation and incremental ones*, i.e. producing components in slightly different ways, moving from offering a product to a service, elimination of polluting product components, new clean replacement technologies etc. (Hellström 2007: 152). Most public strategies are focused on resource efficiency as a key strategy of eco-efficiency, and eco-innovation is also conceptualised in terms of component innovations rather than systemic or radical changes. However, the literature questions the potential of incremental innovation to "drive radical product or process innovation for global markets" (Hellström 2007). Incremental innovation, understood as the substitution of product and process with more environmental friendly ones, does still satisfy a certain existing demand. Coherently, such innovations conform to the existing model of consumption patterns and try to satisfy the current level of demand.

While radical component innovations introduce completely new product and processes, they also change and restructure the architecture of processes. The radical and architectural process innovations are the innovations that are least understood in the literature and also least applied in practice (Hellström 2007). These innovations aim to introduce completely new products and processes which positively impact the product quality and also change the demand side. Researchers have often expressed the need for radical, systemic technological changes to achieve demanding environmental sustainability goals (Nill & Kemp 2009; Hellström 2007)

As supported from an empirical study, eco-innovation based only on technological improvements for more resource efficiency seems to be biased away from the type of innovations which have the potential to realizing sustainable development (Huesemann 2003). Moreover, even when radical architectural innovation leads to improvement in the production process, the social system with its institutions, cultural settings, and life-style and consumption patterns will set limits to incremental or even radical technological development. The eco-innovations that are most likely to succeed in pushing the economy towards sustainable development will be those ones which include the social and

institutional dimension in the innovation of ecology and economy. The most applied incremental innovation on the other side seem to lock social practices into existing trajectories which then become increasingly more costly to break out (David 1985).

## Challenges towards system innovation and some recommendations for policies

For the challenge of leading to system changes, some initial recommendations are made below and will be discussed at the ESDN Conference 2011:

1. *A shared long term vision*

By sharing perspectives about long-term goals, short term agendas can be derived for both business and policy makers. One example of such a vision is 'Vision 2050' developed by the World Business Council for Sustainable Development (WBCSD): 'In 2050, around 9 billion people live well, and within the limits of the planet'. This vision can motivate the various actors (companies, universities, technological institutions, NGOs) to commit and contribute to a new agenda that paves the way to a transition to a resource-efficient economy. On the EU level, the Europe 2020 strategy has the objective to induce smart, inclusive and sustainable growth. Setting the vision might affect to find new solutions to technological improvement, and may also change social trajectories which would lead to the achievement of these visions.

2. *Research Agenda*

A shared long term vision can help to make a clear link between the research agenda and the effort for sustainability. Harnessing the complementary expertise of academia, industry and government is essential. Evidently, the knowledge agenda needs to address key areas of technological change, such as new materials, bio-mimicry, and artificial photosynthesis. However, technical knowledge is not enough to power the transition to a resource efficient Europe. Radical architectural innovations and system changes require involvement of various disciplines, knowledge dissemination, and the inducement of social innovation, market innovation, institutional innovation and new business models. The EU also needs to generate synergy between national and European R&D-programs (FP7/FP8) and the upcoming Eco-innovation action plan.

3. *Stimulating frontrunners*

System changes require that innovative newcomers in the market are successful enough to challenge business-as-usual attitudes of players with vested interests. A top-runners approach is probably the best reward for frontrunners, such as Green Public Procurement (GPP). Frontrunners can also be supported by being given special opportunities, such as locating their company close to main ports and having access to other deliverers in the chain, to knowledge centers and other frontrunners. Moreover, it is important to frame the *radical innovation niches* as constituting attractive investment opportunities for venture capitalists. The private investor may note that unlike incremental process improvements, these innovations might form the basis of a totally new business. The public sector investor, on the other hand, may see in these innovations an "opportunity for a socially desirable production of positive long term environmental externalities and a platform for renewing national industry" (Hellström 2007).

*4. Market-based instruments*

The economic rationale for using market-based instruments lies in their ability to correct market failures in a cost-effective way. Market failure refers to a situation in which markets are either entirely lacking (e.g. environmental assets having the nature of public goods), or do not sufficiently account for the "true" or social costs of economic activity. Public intervention is then justified to correct these failures.

*5. Consumer incentives*

Influencing the demand side through adequate policies is essential to boost market penetration of clean technologies and green business practices. Better information through labeling, phasing out of unsustainable products, and creating financial incentives are examples.

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