Workshop:
Strengthening the role of R&D in boosting eco-innovation and eco-efficiency

DG Research, Environment Directorate[1]

Brussels, 13th November 2009

Background paper and guidance for the panel discussions

This paper is intended to provide some limited information on current and past activities in the field of eco-innovation and eco-efficiency and will also introduce some "food for thought", in form of opinions and possible lines of action. It is not meant to represent an official position of the Commission, nor is it meant to be exhaustive in the described topics.

"We have to create the conditions where the transition to a low-carbon economy is a source of competitive advantage for our businesses, a source of jobs for our workers and a source of hope for future generations." "We will invest in new sources of sustainable growth, in smart green growth."

President Barroso to the European Parliament, 15.09.2009

I. Introduction

To foster eco-innovation in Europe, a strong political commitment is needed, accompanied by multiple actions across research, innovation and environmental policies. It's beyond the purpose of this paper to discuss the issue on the governance of the eco-innovation process at European level. Our aim is to focus on the "research pillar" of eco-innovation.

The objective of this workshop is to discuss with the help of experts the elements for an eco-innovation research agenda. In particular, it is necessary to better understand what kind of research actions could result in a real added value at European scale. It is also important to receive some feedback on how the work DG RTD is doing in this field is perceived by different stakeholders and what their view is about the content of next calls that will be published under the current Framework Programme.

The title of this workshop contains the reference to two different concepts that are considered correlated: eco-innovation and eco-efficiency. There is not always a bi-directional link between the two. An improvement in eco-efficiency is not necessarily linked to innovation dynamics. However, the contrary should always be true: an innovation should always result in an improvement of eco-efficiency (or at least not in its deterioration). Whilst this is often claimed, there is not yet an agreed and practical way to measure if an innovation (or any kind of new or improved process/product/service) is really an ECO-innovation. How to do that? How to measure eco-efficiency in a consistent but still feasible and harmonised way?

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II. What is intended for eco-innovation?

Even if eco-innovation is a new concept, there are already different definitions. The one used for this background paper has been formulated in the MEI research project (Measuring Eco-Innovation)[2], where eco-innovation is defined as "the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life-cycle, in a reduction of environmental risks, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives".

It is beyond the intention of this paper to provide the best definition of eco-innovation. It was decided to adopt the MEI one because of the boundaries it sets.

Eco-innovation is neither sector nor technology specific. Eco-innovation can take place in any economic activity, not only in the eco-business sectors, and it is not limited to environmentally motivated innovations, but includes "unintended environmental innovations". The definition of eco-innovation is close to the one of environmental technologies, defined as "all technologies which use is less environmentally harmful than relevant alternatives"[3], but eco-innovation is not only about technologies, and includes also new organizational methods, products, services and system innovation. Organisational methods are closely linked to education and training.

III. The European policy context for eco-innovation

Different policy initiatives at EU level address eco-innovation in the areas of research, innovation and environmental policies. These policy fields are interlinked even though each one intervenes on eco-innovation from a different perspective and involving different actors.

Policy actions in the field of eco-innovation are aimed at building capacities and setting the framework conditions, identify and support the S&T drivers of innovation, ensuring a market for eco-innovations and setting environmental regulations and mechanisms able to stimulate an innovative response of the economic system. In some cases the boundaries are only theoretical or administrative and a single policy could combine both research and innovation tools. Related to this, the need to better streamline the existing programmes and funding schemes to ensure a better coordination and efficacy of the existing actions promoting eco-innovation has been recently acknowledged by the Commission[4].

Eco-innovation can provide tools and solutions to achieve the objectives and targets set by many environmental policies, like those in the field of mitigation and adaptation to climate change, waste prevention, reuse and recycle - including the eco-design of new products and services - just to mention some.

Eco-innovation and eco-efficiency are both themes which recently attracted high interest in the EU policy debate. Eco-innovation could ensure an economic development which is environmentally sustainable and is closely connected to the objectives of green growth; as a

[2] Mei was a research project funded under the 6th Research Framework Programme (FP6). For more information please visit the project website at http://www.merit.unu.edu/MEI/

[3] Stimulating Technologies for Sustainable Development: An Environmental Technologies Action Plan for the European Union, COM(2004) 38

[4] Making public support for innovation in the EU more effective: Lessons learned from a public consultation for action at Community level, SEC(2009)1197

consequence, there is a growing pressure/call for specific actions to foster the eco-innovation processes. For instance, the need to promote a European eco-efficient economy is a key topic of the Swedish Presidency and the contribution eco-innovation could provide in restructuring and greening the economy in the context of the economic crisis has been recognized also in the context of the EU Recovery Plan[5] and within similar initiatives inside and outside Europe.

The last Environment Council meeting[6] (Luxembourg, 21 October 2009) recognised "the urgency of turning the current multiple crises into an opportunity by shifting to an eco-efficient economy, i.e. a safe and sustainable low carbon, resource-efficient economy, based on sustainable production in all sectors and underpinned by more sustainable life-styles focusing inter alia on the housing, transport and food sectors" and "invited the Commission to:

- identify concrete measures and develop guidelines, with a view to mainstreaming eco-efficiency in the new Lisbon strategy post-2010 and providing strategic orientation to all relevant EU policies including the future environmental action programme, drawing inter alia on experiences from the implementation of the economic recovery plans and their effects on jobs, growth, competitiveness, social cohesion and the environment, also taking into account specific conditions in different Member States, as well as the importance of better regulation principles, including reduction of administrative burdens,
- present an integrated strategy for the promotion of eco-innovation, as called for by the Council in June 2007, and, in that context, looks forward to an action plan on eco-innovation as soon as possible in 2010, and, the forthcoming European Innovation Plan to create a competitive and harmonised internal market in that area."

The European policy context for eco-innovation is also currently changing. After the European elections of June 2009, a new European Parliament is in place and after the ratification of the Lisbon Treaty, a new Commission is expected to become operational soon. In addition, some of the main policy frameworks addressing eco-innovation will probably be revised, according to the agenda of the new Commission; in particular:

- The Lisbon Agenda was set forth in 2000 to make the EU the most competitive economy in the world and its review is scheduled for Spring 2010;
- The review of the EU Sustainable Development Strategy is scheduled for Spring 2010;
- The Innovation Policy is in a phase of comprehensive review[7]; this will lead to the proposal for a new European Innovation Plan scheduled for Spring 2010. In order to prepare such a plan, the Directorate General of Enterprise and Industry of the Commission is assessing the achievements of current Community innovation policies. Based on this assessment, possible policy orientations for the medium- and long term will be identified to be developed in the forthcoming European Innovation Plan. It is expected that the future EU Innovation Plan will be linked to EU political priorities and the post 2010 Lisbon agenda and will be based on a global economic, environmental and social context. A public consultation[8] has been launched on the key topics of debate for the future Innovation policy. However, no specific questions address the contribution and the role of eco-innovation;

[5] A European Economic Recovery Plan, COM(2008) 800

[6] Council Conclusions "Towards Sustainability: Eco-Efficient Economy in the context of the post 2010 Lisbon Agenda and the EU Sustainable Development Strategy", 2968th ENVIRONMENT Council meeting, Luxembourg, 21 October 2009

[7] "Reviewing Community innovation policy in a changing world" COM(2009)442

[8] http://ec.europa.eu/enterprise/policies/innovation/policy/future-policy/index_en.htm

- The Environmental Technologies Action Plan (ETAP) was set up in 2004 as a complement to the EC regulatory approaches. It is a tool to implement the EU Sustainable Development Strategy in line with the Lisbon strategy. ETAP fosters initiatives on environmental technologies and eco-innovation. It promotes research, development and deployment, mobilises funds, helps to drive demand and to remove barriers to market developments. After five years of activity, it is now time to assess how far ETAP activities contributed to the achievements of its goals. DG Environment plans to launch a broad consultation on the future of ETAP that will provide elements to the new Commission who will decide about the next steps.

This non exhaustive list gives an idea of the reasons why it is believed that this is the right time to think about what role Environment research could play to promote eco-innovation in Europe and how to maximise the potential added value, using at best the relatively limited available financial resources.

IV. What is the role of EU R&D in this complex context?

In general, public support to R&D is needed to address the market failure related to the process of knowledge creation and diffusion. Given the risks associated with the expenditures for research and development ('sunk costs') and the knowledge spillovers, the expenses for research and development fall short of the socially optimal level. In addition to that, eco-innovation is considered to underlie a double externality, since environmental quality is a public good.

In DG RTD vision, every innovation should be an eco-innovation, meaning that every new or improved process, products or service that enters the market should - in comparison to relevant alternatives - maximize its potential in terms of resource-efficiency and pollution prevention overall its life-cycle of production and consumption. To foster this process, European funded research can help identifying the most promising alternatives and getting them closer to the market, supporting early-stage eco-efficient processes, enabling technological advancements and supporting the networking among the actors in the research and innovation communities.

In the FP6 and FP7 the support of eco-innovation was mainly tackled through the Cooperation Specific Program for Environment (including Climate Change) Theme, with the funding of research in the area of Environmental technologies. However, eco-innovation is indirectly addressed by most of the other Themes (e.g. Energy, Food, Agriculture and Fisheries, and Biotechnology, Nanosciences, Nanotechnologies, Materials and new Production Technologies). It was estimated that a total of €1,4 billion has been dedicated to Environmental technologies through the 6th Framework Programme since 2002. As the 7th Framework Programme is concerned, up to €10 billion representing 30% of the budget for the Cooperation Programme will address R&D funding for environmental technologies in the time frame 2007-2013.

The research areas included under Environmental Technology (Activity 6.3 of the Environment Theme) are subdivided under three groups, and two of them are particularly relevant for eco-innovation. The first includes research on environmental technologies for observation, simulation, prevention, mitigation, adaptation, remediation and restoration of the natural and man-made environment (Sub-activity 6.3.1). This is a broad area where, inter alia, the projects financed so far fall under the following categories: technologies promoting

sustainability in buildings, resilience technologies, water supply, wastewater treatment and sanitation technologies, membrane separation technologies, waste treatment technologies and waste management solutions, air pollution treatment and soil remediation. The second area includes technology assessment, verification and testing (Sub-activity 6.3.3). Under this sub-activity, several topics/projects have been financed for instance supporting the development of the European Environmental Technologies Verification and Testing System, Life Cycle Assessment, Life Cycle Impact Assessment, risk-based management of chemicals and products and intelligent testing strategies.

Fostering eco-innovation requires a strong commitment and support to address methodological challenges and to further develop and diffuse life-cycle thinking tools in all relevant research fields. The life cycle perspective helps decision makers in business and government to take into account all the resources consumed and environmental impacts associated with the supply, use and end of life of goods and services. This provides a fair basis for products comparisons, to effectively identify options for improvements, to monitor progress in environmental performance and to communicate them. For this reason, the Environment Directorate of DG RTD is promoting the inclusion of life-cycle analysis and sustainability assessment in other research themes, namely with Joint Calls in the field of sustainable biorefineries, nano products and components, electric cars, hydrogen production and fuel cells, and energy efficient buildings. These joint calls are for DG RTD also an internal laboratory where a more cross-sectoral research is being implemented. It is believed that this is particularly needed to foster eco-innovation, especially in areas where a more systematic problem-solving approach is needed.

Besides the diffusion of the eco-innovation concept in European research, there is the need to prioritize actions and to identify areas or sectors that require a more focused support in the context of the European Research Area, in cooperation with industry and Member States, to avoid fragmentation and to favour the scaling-up.

As for the collaboration with relevant industries, the setting up of the European Technology Platforms (ETPs) was intended to be a step in the direction of a closer interaction between DG Research and industrial private research programmes. Since 2004, 36 European Technology Platforms have been established to bring together industry stakeholders and to define research priorities. ETPs are industry-led forums involving industries, research centres, users, NGOs and other stakeholders. Their aim is to identify and implement long-term visions and strategic research agendas in key technological domains requiring strong cooperation between research actors. The most relevant for eco-innovation are the ones on Hydrogen and Fuel Cells, Water Supply and Sanitation, Construction, Chemistry, Photovoltaic, Wind, Forest Based Sector and Steel. The Platforms have a different organisation and developed a dialogue with the Commission concerning research needs that could be deepened and further developed. ETPs have mobilized research actors at national level and lead to 5 Joint Technology Initiatives (JTIs). JTIs are long-term Public-Private Partnerships and will support large-scale multinational research activities in areas of major interest to European industrial competitiveness and issues of high societal relevance. In particular, two of the Joint technology Initiatives adopted so far are fully dedicated to green technologies: “Clean Sky”, with 800 million € EC contribution and “Hydrogen and fuel cells”, with 450 million € EC contribution. While it may be a non-sense to set up a Technology Platform on eco-innovation, it is difficult to address this horizontally because each Directorate tends to privilege the dialogue with a limited number of Platforms of reference.

EU research on eco-innovation should complement national research programs. Related to this, in the Environment Theme 2010 Work Programme it has been opened a specific call for an ERA-Net on eco-innovation. ERA-Nets are among the measures aimed at structuring the European research Area. It is expected that this ERA-Net will set the basis for a multi-annual program that will promote the exchange of information and best practices among Member States and regions across Europe concerning the inclusion of eco-innovation in national and regional research programs. The Era-Net could develop a framework supporting - already at the programme drafting stage - a better technology transfer and take-up of eco-innovation from the research shelves to the market. The ERA-Net could pave the way for a close collaboration between the EU and Member States and could develop to an ERA-Net +.

The research agenda for eco-innovation should also have an international dimension. A comprehensive set of cooperation activities on environmental research are annually defined for major cooperation countries and regions. The existing channels for international cooperation on research with the US, Japan and BRICs countries should be further oriented to the specific needs of the promotion of eco-innovation, based on mutual interests.

Questions to provide guidance for the panel discussion (Session I):

1. *Eco-innovation encompasses a broad area including technologies, processes, products, services, products. Is it correct to think in these terms? Should eco-innovation be approached differently?*
2. *What should be the first three priorities of an European eco-innovation research agenda?*
3. *What are the research gaps to address in the eco-innovation area that can be covered by the Environment Theme?*
4. *Should our priority be to "boost eco-innovation" in sectors where EU companies can become (or currently are) leaders, or rather in sectors where the total environmental gains could be maximised?*
5. *How to strengthen the collaboration between EU Research actions and the Technology Platforms to achieve more eco-innovative and eco-efficient results?*
6. *What activities and research areas could be covered by the forthcoming ERA-Net on eco-innovation?*

V. Measuring eco-innovation and eco-efficiency in Europe

The knowledge base for eco-innovation is generally poor. There's a lack of measures for eco-innovation. Permanent statistics do not exist in this field, and several methodological gaps need to be addressed in order to design appropriate indicators. One reason is that eco-innovation is not an official sector.

In FP6 the Environment Directorate of DG Research funded two specific projects on measuring eco-innovation. ECODRIVE (Measuring ECO-innovation: ecological and economic performance and DeRIVEd indicators)[9] analysed the problem of how to move from measuring economic and environmental improvements at a micro-level (technologies goods and services) towards performance measurement at meso-level. MEI (Measuring Eco-Innovation)[10] elaborated a conceptual clarification of eco-innovation (developing a typology)

[9] http://www.eco-innovation.eu/
[10] http://www.merit.unu.edu/MEI/

based on an understanding of innovation dynamics. It identified and discussed the main methodological challenges in developing indicators and statistics on eco-innovation and how these may be overcome. The MEI project also proposed a number of possible indicators for measuring relevant aspects of eco-innovation, taking into account data availability issues, and contributed to identify some research needs for addressing the methodological challenges in developing eco-innovation indicators.

As for eco-efficiency, this concept was developed by the World Business Council for sustainable Development (WBCSD) in 1992 and has become widely recognized thereafter. It brings together the economic and environmental dimensions, which are necessary for economic prosperity to increase with a more efficient use of resources and lower emissions. Approaches to implementing the concept and measuring performance have varied widely, both for micro and macro measures of eco-efficiency. Extensive further data generation and research and development are required to make a set of eco-efficiency indicators fully operational.

According to the outcomes of the ECODRIVE project "*There is a connection, but not a direct one, between eco-innovation and eco-efficiency. Both concepts relate to sustainability measurement but in a different way: eco-efficiency offering a static measurement, possibly in a comparative static way, while eco-innovation gives a dynamic view. The static measurement of economic and environmental performance in one period can be caught in the eco-efficiency score of that period: the impacts on environmental impacts and the economic welfare of that period can be expressed as a ratio, for example as GDP per unit of environmental impact, comparable to value added per unit of environmental impact as advocated by the World Business Council on Sustainable Development*".

In this paper eco-efficiency is therefore defined as:

$$\frac{\text{Economic value}}{\text{Unit of environmental impact}}$$

This ratio is also known as environmental productivity. If the eco-efficiency for a certain system increases it means that it is effectively decoupling its economic performance from the respective environmental impacts. This is one of the ultimate goals of a Sustainable Society[11].

VI. Why measures for eco-innovation and eco-efficiency are needed?

The benefits of developing sound measures of eco-innovation are multiple. In general indicators can support the European Union's political decision-making process and help communicate to citizens about what the EU is doing. The monitoring of progress towards a greater eco-efficiency, and the comparison of the performance of countries, regions, clusters, firms, processes, products and services also require a range of appropriate indicators.

Indicators are needed to inform policy makers. Measures can in fact be used to assess and monitor the impact of environmental policies and they could be able to identify the role of eco-innovation in reaching targets and objectives set by policies. Indicators of eco-innovation could pave the way for future policy targets in the field of eco-innovation and eco-efficiency.

[11] What is really needed is an absolute decoupling. The simple arithmetic for the macro level shows that the percentage improvement in eco-efficiency should be higher than that of economic growth to arrive at an effective increase in environmental quality, however measured.

Targets are needed to create a narrative for the goals of the EU policy and to monitor the impact of policies. An important role of indicators is also that of raising awareness of eco-innovation among stakeholders, for instance among companies, sectors and states.

Four different types of measures can be used to quantify eco-innovation. Each measure has its own disadvantages and is subject to a particular kind of bias. Input indicators (e.g. environmental R&D expenses) are very relevant since they measure the European eco-innovative capacity (of a sector or a nation) and evaluate the presence of preconditions necessary to create a context favourable to develop eco-innovations. As for output indicators (e.g. patents) or indicators for eco-innovative activities or performance, this category is well suited to monitor the real outcomes of eco-innovation and of their contribution and diffusion overall the society and economy. Two different kinds of "indirect indicators" can be considered: (a) indicators of eco- efficiency across the economy (or specific to some sectors) reflecting the transformation occurring into the economy, where eco-innovation could be one among multiple causes; (b) indicators of diffusion of eco-innovation on the markets: share on the markets of specific products target as eco-innovation. These indicators only monitor the final stage of the eco-innovation cycle, but the commercialisation of innovation is of great importance and could complement input data on environmental R&D.

An overall macro- measure of eco-innovation could help understanding and benchmarking how and to what extent the innovation dynamics contribute to the decoupling of economic growth from environmental degradation. More detailed eco-innovation data on activities, actors and markets related to eco-innovations can draw the attention to specific trends in product and process categories and may help identifying drivers and barriers for eco-innovation.

As for Indicators of eco-efficiency, they should be developed in order to monitor micro-level dynamics (at company level), meso-level transformations (at sector level) and macro-level trends and transitions in relation to eco-efficiency performance. Micro-level indicators should consider environmental impacts in a life-cycle perspective and macro-level indicators should also take into account the impact of the import and export of goods. However, the links between the different levels (micro-meso-macro) are not straightforward and there is not yet a consistent and harmonised way to make these links.

A specific aspect on which the Environment Directorate of DG Research has already been working in the past is how to measure the denominator of the eco-efficiency ratio. In particular the work done has focused on the improvement of the Life Cycle Assessment method and its consistent inclusion into relevant EU policies (whenever appropriate). Some important work is in progress on Environmental Input/Output tables and on sustainability indicators in a wider sense[12].

[12] EXIOPOL is an FP7 project aiming at setting up an environmentally extended (EE) Input-Output (I-O) framework allowing the estimation of environmental impacts and external costs of different economic sector activities, final consumption activities and resource consumption for countries in the EU (http://www.feem-project.net/exiopol/index.php), On sustainability indicators, INDI-LINK devoted to the assessment of interlinkages between different priorities of the EU SDS. Based on experiences gained in a large number of past and ongoing research projects in the field of integrated assessments, INDI-LINK provided a review and comparative analysis of analytical frameworks, methods and tools to assess interlinkages between the different SD dimensions, in order to develop a solid conceptual framework for interlinkage assessment (http://www.indi-link.net/index.php?option=com_frontpage&Itemid=1).

There is clear evidence that more research is needed in the "measuring" field. Related to this, there is an overall agreement about the importance to improve the level of collaboration within different Commission services in order not to disperse resources. Synergies and collaboration among existing initiatives are needed, as well as a general agreement on which are the best data to be used in the numerator and denominator of the eco-efficiency ratio. This would be a preliminary step towards performing more joint activities aimed at filling those indicators with consistent data.

VII. An overview of current initiatives on the measurement of eco-innovation and eco-efficiency in Europe.

Activities on eco-innovation measurement

DG Enterprise has recently funded a study on eco-industries in Europe[13], focusing on the size and competiveness and emerging trends of this industry composed by a variety of branches and activities. Previous studies on eco-industries were funded by DG Environment and conducted by Ernst&Young (2006)[14] and Ecotec (2002)[15]. National studies have been carried out in particular for Germany[16]. EUROSTAT has recently published a Data Collection Handbook on the Environmental Goods and Services Sector that provides guidance for the collection of regular statistics on a voluntary basis by Member States[17].

There are currently some relevant initiatives on measuring eco-innovation in place. OECD is extensively working on the collection and analysis of the data related to the patents of environmental technologies. Besides that, OECD is also developing an eco-innovation toolkit for business which is intended to support companies in the measurement and analysis of their sustainability performance[18].

The 2008 Community Innovation Survey (CIS2008) included a special module on eco-innovation, which in 2010 will produce important information about the nature of eco-innovation and its determinants. A limitation remains that, even if the module could provide some specific indicators for eco-innovation (share of eco-innovation on total innovation, scoreboard of eco-innovative companies), these indicators are the result of a self-estimation from companies, and therefore they are not fully "objective". The module is however more intended to provide measures to understand the determinants of eco-innovation rather than to ground the basis for sound indicators. Moreover, this module is not going to be repeated in the future.

Technopolis (2008)[19] analysed eco-innovation patterns of industries across Europe as part of the Europe INNOVA Sectoral Innovation Watch project. An Eco-innovation Observatory has been set up under the Europe-INNOVA initiative. Its activities will start at the end of the year and should produce an annual report on Eco-innovation in the EU, based on the existing sources of data.

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[13] Ecorys et al. (2009), Study on the Competitiveness of the EU eco-industry (Within the Framework Contract of Sectoral Competitiveness Studies – ENTR/06/054)

[14] Ernst&Young (2006), European Commission DG Environment - Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU

[15] ECOTEC (2002); Analysis of the EU Eco-Industries, their Employment and Export Potential

[16] Roland Berger Strategy Consultants (2009)

[17] Eurostat (2009), The Environmental Goods and Services Sector - A Data Collection Handbook

[18] http://www.oecd.org/document/37/0,3343,en_2649_34173_40695077_1_1_1_1,00.html

[19] Technopolis (2008), Eco-Innovation - Final report for sectoral innovation watch.

Activities on eco-efficiency measurement

The Commission, through an agreement among the "Group of 4" - Joint Research Centre, DG Environment, Eurostat and European Environment Agency - has recently established three Data Centres on Resources, Products and Waste. These Data Centres will provide the necessary information to support the implementation and monitoring of the above policy areas.

The JRC IES will develop by 2010 life cycle based environmental indicators for the three data centres through the following main tasks[20]:

- the provision of the three sets of decoupling indicators set out in the Thematic Strategy on Natural Resources, namely the overall EU eco-efficiency indicator, the resource productivity and the resource specific impact indicators;
- the provision of products environmental impact indicators, covering the most relevant product groups consumed or used in the EU;
- the provision of waste environmental indicators, covering the most relevant waste types generated and treated in the EU.

These indicators will be based on a consistent framework. A number of life cycle based approaches, such as process LCA, Environmental Input/Output LCA and other hybrid methods are currently under evaluation in order to define which is the most suitable to build up consistent and scientifically robust indicators. The methodological frame and the underlying data for the characterisation of the environmental impact indicators will build on the requirements of the International Life Cycle Data System (ILCD) handbook[21], in particular the available life cycle inventory data sets and impact assessment methods and factors. Sub-indicators will provide information on the carbon footprint as well as the ecological footprint.

OECD, UNCSD, Eurostat and the European Environment Agency (EEA) are working on indicators to describe the performance of national or regional economies with regard to eco-efficiency. The Wuppertal Institute - and in particular the Research Group on Material Flows and Resource Management - works on the development of policy relevant indicators in the field of resource efficiency and contributed to the official reporting of the EU on material flows, resource use and efficiency through EurostatT and the EEA.

This is a non-exhaustive list of initiatives summarizing some of the ongoing initiatives in the field of eco-innovation and eco-efficiency indicators. These activities will all contribute to a better understanding and monitoring of these phenomenon and processes, however, several methodological issues and uncertainties exist and need to be addressed. In particular there's the need to better understand the link of innovation dynamics with the economic and environmental performance of the economic system, for instance examining the link between eco-innovation and eco-efficiency, focusing on the meso-dimension of eco-innovation.

Macro-indicators of eco-efficiency cannot be independent for the two existing frameworks of indicators relating to structural indicators (Lisbon Strategy) and Sustainable Development Indicators[22]. Both frameworks include to some extent indicators related to production patterns

[20] For further information you may visit the JRC website at http://lct.jrc.ec.europa.eu/indicators

[21] http://lct.jrc.ec.europa.eu/eplca/deliverables/international-reference-life-cycle-data-system-ilcd-handbook

[22] Eurostat (2009), Sustainable Development Indicators versus Structural Indicators. Some thoughts from JRC Econometric unit, Doc. SDI/WG/72 (2009)

and Innovation and Research, even though no specific indicators on eco-innovation and eco-efficiency are reflected there. To avoid further confusion and overlaps it will be of relevance to study how to integrate macro indicators on eco-innovation and eco-efficiency in these frameworks.

Questions to provide guidance for the panel discussion (Session II):

7. *What are the methodological issues not yet covered by current activities that need to be addressed for building eco-innovation indicators?*
8. *What are the best output indicators for eco-innovation?*
9. *What indicators are most suitable as policy targets on eco-innovation?*
10. *What are the methodological issues not yet covered by current activities that need to be addressed for building eco-efficiency indicators?*
11. *Which kind of data should populate the denominator of the eco-efficiency indicator? Where to obtain them?*