

Huber, Joseph

**Working Paper**

## Key Environmental Innovations

Nota di Lavoro, No. 33.2005

**Provided in Cooperation with:**

Fondazione Eni Enrico Mattei (FEEM)

*Suggested Citation:* Huber, Joseph (2005) : Key Environmental Innovations, Nota di Lavoro, No. 33.2005, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<https://hdl.handle.net/10419/73907>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

## **Key Environmental Innovations**

Joseph Huber

NOTA DI LAVORO 33.2005

**MARCH 2005**

CCMP – Climate Change Modelling and Policy
--

Joseph Huber, *Martin-Luther-University*

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:  
<http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm>

Social Science Research Network Electronic Paper Collection:  
<http://ssrn.com/abstract=677901>

The opinions expressed in this paper do not necessarily reflect the position of  
Fondazione Eni Enrico Mattei  
Corso Magenta, 63, 20123 Milano (I), web site: [www.feem.it](http://www.feem.it), e-mail: [working.papers@feem.it](mailto:working.papers@feem.it)

# Key Environmental Innovations

## Summary

This paper is based on empirical research on a taxonomy of technological environmental innovations. It draws on a databank with over 500 examples of new technologies (materials, products, processes and practices) which come with benign environmental effects. The approaches applied to interpreting the datasets are innovation life cycle analysis, and product chain analysis. Main results include the following:

1. Innovations merely aimed at eco-efficiency do in most cases not represent significant contributions to improving the properties of the industrial metabolism. This can better be achieved by technologies that fulfill the criteria of eco-consistency (metabolic consistency), also called eco-effectiveness.

2. Ecological pressure of a technology is basically determined by its conceptual make-up and design. Most promising thus are technologies in earlier rather than later stages of their life cycle (i.e. during R&D and customisation in growing numbers), because it is during the stages *before* reaching the inflection point and maturity in a learning curve where technological environmental innovations can best contribute to improving ecological consistency of the industrial metabolism while at the same time delivering their maximum increase in efficiency as well.

3. Moreover, environmental action needs to focus on early steps in the vertical manufacturing chain rather than on those in the end. Most of the ecological pressure of a technology is normally not caused end-of-chain in use or consumption, but in the more basic steps of the manufacturing chain (with the exception of products the use of which consumes energy, e.g. vehicles, appliances).

There are conclusions to be drawn for refocusing attention from downstream to upstream in life cycles and product chains, and for a shift of emphasis in environmental policy from regulation to innovation. Ambitious environmental standards, though, continue to be an important regulative precondition of ecologically benign technological innovation.

**Keywords:** Technological innovation, Environmental innovation, Life cycle analysis, Sustainability strategies, Environmental policy

**JEL Classification:** O33, Q00

*The author is the chair of economic and environmental sociology at Martin-Luther-University, Halle an der Saale, Germany. Main fields of research and teaching are modernisation processes in general, and ecological modernisation in particular.*

*Address for correspondence:*

Joseph Huber

Martin-Luther-University

Emil-Abderhalden-Str. 7

Halle an der Saale

06099 Berlin Germany

Phone: +49 0 345 5524251

Fax +49 0 345 5527150

E-mail [huber@soziologie.uni-halle.de](mailto:huber@soziologie.uni-halle.de)

## 1. Technological Environmental Innovations (TEIs) and Metabolic Consistency

Environmental innovation includes any kind of innovations – technical, economic, legal, institutional, organisational, behavioural – that lead to an improvement of ecological quality, regardless of any additional advantage or motive (Klemmer et al. 1999 25, also Hemmelskamp/Rennings/Leone 2000).

This paper just deals with technological environmental innovations (TEIs). A technology is a body of knowledge, especially know-how, but also includes some theoretical know-why as well as know-what-for (also Freeman 1987 235, Kemp 1997 pp7). As far as know-how is concerned, a technology is a method of applying a specific knowledge base for achieving a specified operative purpose by special operative means such as tools (instruments, materials, machinery, plant equipment, infrastructures) and practices. Products – as much as production processes and services – are specific instrumental manifestations, or apparatus-like implementations of a technology. Products, processes and services tend to be marketable, commercialised applications of a technology.

In order to qualify as a TEI for entry into the database of this study, technological innovations had to meet one or several aspects of the environmental innovation strategies as listed in Table 1.

*Table 1 Selected concepts of technological environmental innovation according to the realm of innovation where they most apply*

<b>Approach</b>	<b>Realm</b>	Energy incl. vehicles propulsion, heating	Raw materials. Natural resources	Agriculture	Chemistry, Chemicals	Materials processing and reprocessing	End-products: Building, vehicles, utility goods	Emissions control, waste processing
Industrial symbiosis. Zero-emission processes. Circulatory economy		x	x	x	x	x	x	x
Sustainable resource management		x	x	x	x	x	x	
Cleaner technologies		x	x	x	x	x	x	
Benign substitution					x	x	x	
Product design for environment					x	x	x	
Bionics					x	x	x	
Add-on purification technology								x

Another, and perhaps more coherent way of deciding whether a technological innovation qualifies as an environmental innovation, is to determine whether a new technology or product contributes to significantly increasing eco-efficiency and/or improving ecological or

metabolic consistency. These terms are closely linked to the sustainability discourse and to the concept of industrial metabolism (Ayres 1996), or industrial ecology respectively. Criticism of the shortcomings of the previous sustainability discourse has been a key element in the more recent discourse on ecological modernisation (Andersen/Massa 2000, Mol/ Sonnenfeld 2000), and within this context it was the starting point of the concept of ecological or metabolic consistency (Huber 2004, 2000), sometimes also referred to as eco-effectiveness (Braungart/McDonough 2002 103–117).

Metabolic consistency focuses on the structural, qualitative side of technology, not just input-output-quantities within basically given structures. Ecological consistency is about how to embed the industrial metabolism within nature's metabolism by introducing new technosystems, regimes and practices, thus changing technological structures and the metabolic qualities of products and processes, rather than mere quantity of turnover within old structures. E.g., energy demand on giga and tera levels may not be an ecological problem as such if the energy were based on clean fuels such as hydrogen, or represented fuelless energy from solar, wind, hydro and geothermal sources. Whereas an efficiency approach primarily appeals to green savings commissioners, a consistency approach calls for green inventors and investors.

In terms of various lines of ecological discourse, TEIs can thus be characterised as being the operative tool-set of technological regimes aimed at ecological modernisation, i.e. structural change towards benign or at least strain-relieving effects on resources, sinks, ecosystems and the biosphere. TEIs eliminate, or reduce, or help to control environmental hazard (risk). TEIs create metabolic consistency and optimise eco-efficiency. TEIs can be add-on as well as integrated, although integrated solutions are in almost any case preferable from an ecological point of view.

## **2. Collection of TEIs and database**

The criteria of TEIs and its systematics emerged in the course of long-standing empirical research, which has from 2001 to 2004 also been carried out in connection with the Key Environmental Innovations group of the German Federal Research Ministry's Initiative on Sustainability and Innovation. An explorative databank has been created which now numbers 305 datasets, with a total of more than 500 examples of TEIs.

Corresponding to the approaches of innovation life cycle analysis and product chain analysis, the datasets include information on a technology (products, materials, processes, practices), its structural impact, the life cycle stage of development and diffusion, on rival like technologies, competitiveness and adoptability, as well as ecological properties and environmental improvements which have been achieved or can be expected.

The databank has been fed by a continuous survey of innovations as they were reported in articles in a number of specialised journals and newsletters (among these MIT Technology Review, The Economist and The Economist Quarterly, VDI Nachrichten) from the beginning of 2000 through to March 2003.

### **3. Some examples and trends of TEIs**

Typical examples and trends of TEIs include the following. They all represent innovative regime shifts from mature conventional technologies to new ones that are metabolically more consistent, and normally also much more efficient than previous like technologies:

- Replacement of fossil fuels with clean-burn hydrogen, the use of which does not require additional end-of-pipe purification of emissions
- Substitution of clean electrochemical fuel cells for pollutant furnaces and combustion engines in manifold applications, from power stations to vehicle propulsion
- Clean coal, notably in zero-emission central power plants on the basis of IGCC technology (integrated gasifier combined cycle) and CO<sub>2</sub> sequestration. The purpose of these power plants is to produce hydrogen by steam reformation as much as to generate electricity.
- Fuelless energy such as photovoltaics and further regenerative energies which make use of sun radiation, geothermal flows, or wind and water currents
- Decentral micropower, i.e. new sources of electricity generation that are leading towards distributed power generation (which includes a certain number of large central stations). Over-centralised power generation and one-way distribution will thus be replaced by an integrated two-way-flow grid management.
- Transgenic biochemistry which makes use of enzymes and microorganisms especially designed and bred for various production tasks, thus replacing the conventional high-temperature high-pressure chemistry that poses a heavy burden on the environment and human health
- Substitution of high-hazard chemicals for more benign low-impact substances and new specialty chemicals which are, among other things, biodegradable, non-persistent, non-accumulative and non-toxic
- Biofeedstocks replacing petrol as a raw material to a certain extent
- New materials which are simultaneously ultra-light and ultra-strong, saving larger volumes of conventional materials and energy
- Micromachines and nanotechnology which relieve pressure on resources and sinks compared to larger conventional machines and chemical production
- Substituting sonar, photonic and microfluidic analyses for cumbersome conventional methods involving many hazardous ingredients, and thus considerably improving quality and performance of production
- Circular production processes in which water, auxiliary substances, metals, bulk minerals and fibres are recycled at an optimum rate
- Last but not least, overcoming the ecologically devastating practices of today's over-intensified and inappropriately chemicalised agriculture by introducing sound ecological

practices in combination with high-tech precision farming and, again, modern biotechnology which makes use of transgenic organisms.

Since biotechnology is a sensitive issue, it may deserve a brief comment: genetic engineering in agriculture, as well as transgenic biotechnology in chemistry, nanotechnology, materials processing, waste management, pharmacology and medicine, has to be considered as an important field of TEIs, full in the knowledge that such an assessment will certainly remain controversial for another one or two decades to come. As tends to be the case with true key innovations of major structural importance, people's sense of security is undermined. Conservative opposition and risk aversion are strong. It takes time to replace uncertain expectations with realistic experience. Not all feelings of uneasiness are unfounded, but in most cases it has turned out that in fact they were. Almost all transgenic innovations seem to spur efficiency, and most of the examples represented in the database are environmentally benign in that they allow to substitute, e.g., for conventional high-temperature high-pressure processes, hazardous chemicals, resources input and emissions output. Biotechnologies improve on productivity and product quality. In comparison to these advantages, fears of particular disadvantages are dwarfed, or are untenable in face of the facts. But not all applications – such as pesticide-resistant crops – can be said to be metabolically consistent. Some are not, or not yet.

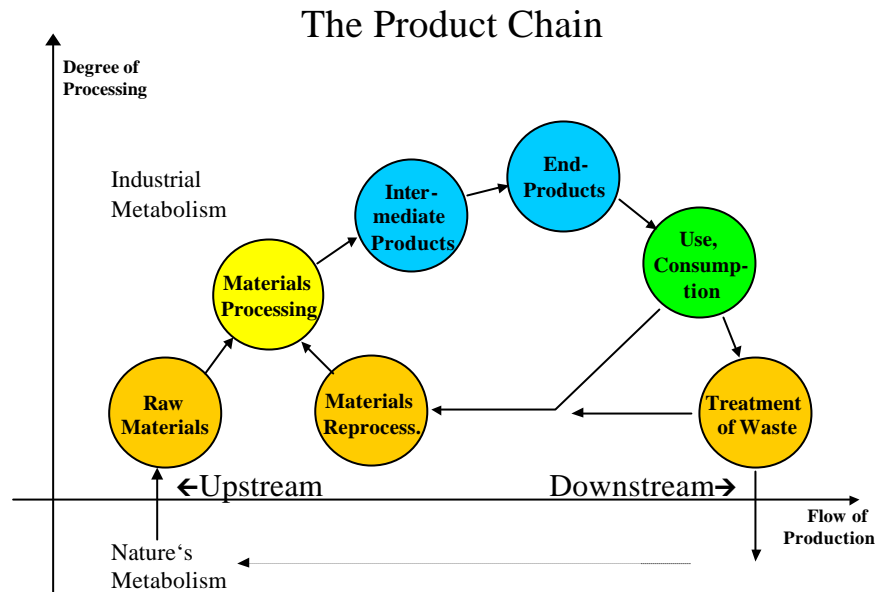
#### **4. TEIs tend to be upstream the product chain and upstream a technology's life cycle**

In terms of integrated solutions versus add-on measures, 85% of TEIs in the database represent integrated solutions, 15% environmental add-on technology. This is hardly surprising, serving to confirm what was to be expected. Of the 85% integrated solutions, 49% can be said to be driven mainly by ecological motives so that these are TEIs by prime intention, whereas in 36% of the examples ecological motives, though these may also be considered, cannot be said to be the main reason behind that innovation.

The central finding which emerges from the present investigation is that most TEIs, and also the most important TEIs in terms of structural impact, tend to be upstream in the manufacturing chain, and upstream the learning curve in the life cycle of a technology or product. The upstream tendency of TEIs is all the more true if we consider energy technology to be upstream in any production function in that it is a primary basic input component at each step in the manufacturing chain.

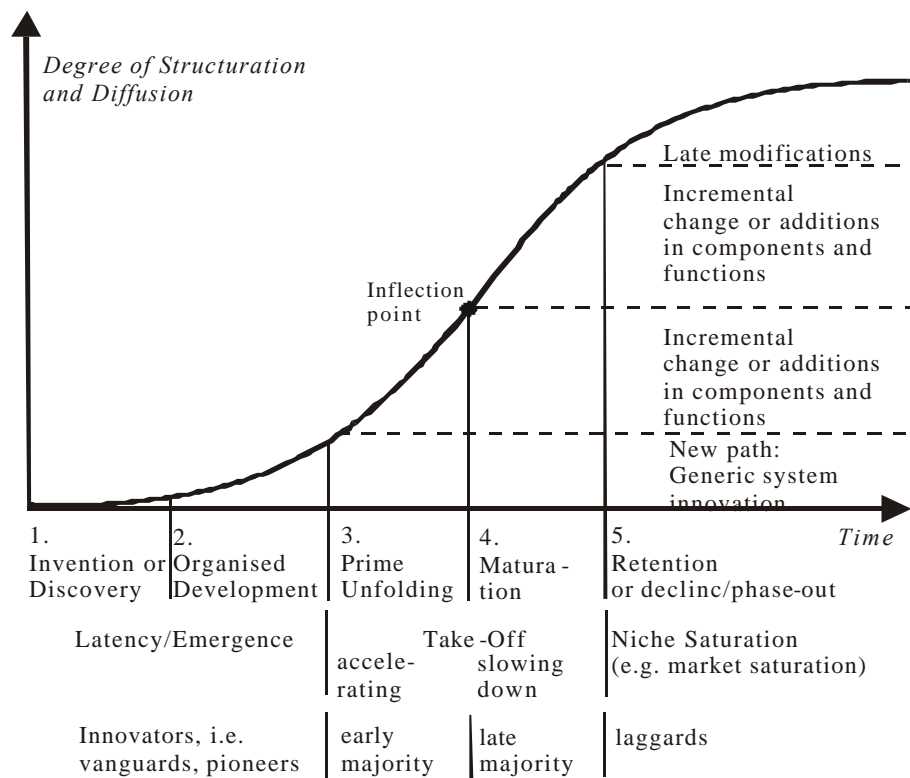
In the environmental literature, the term 'life cycle analysis' is often used interchangeably with 'product chain analysis' or 'eco-balances' that try to gauge the environmental impact of a product from first input by extraction of raw materials to last output by being definitely phased out as waste. What they represent more precisely, however, is analysis of the vertical manufacturing chain or product chain as shown in Figure 1. By contrast, another meaning of

Figure 1 The product chain



life cycle analysis refers to an innovation life cycle or technology life cycle as shown in Figure 2, i.e. the evolutive existence of a technology or product species.

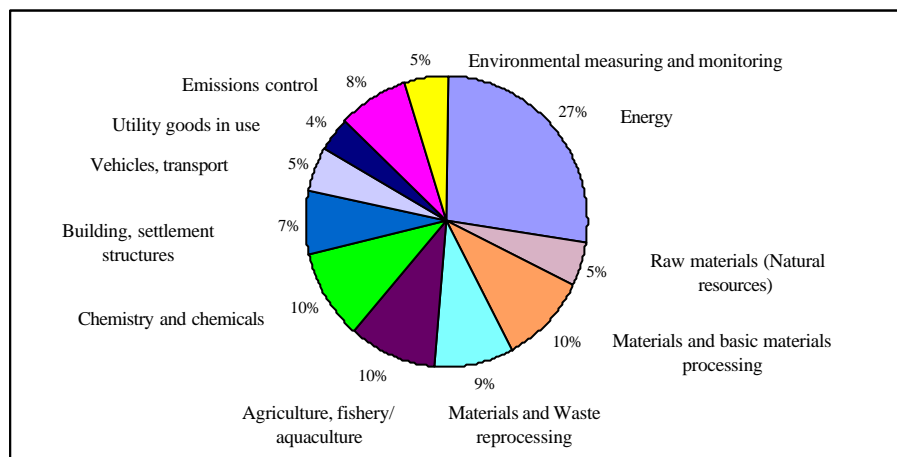
Figure 2 The innovation life cycle





As can be seen in Figure 3, more than a quarter of the datasets (27%) relate to energy, including vehicle propulsion and energy design of buildings (not however innovations related to energy demand of appliances). The number of TEIs in the realm of energy is matched only by 24% of technologies relating to the extraction, processing and reprocessing of materials, which accounts for 34% if agriculture is included, and 44% if TEIs in the realm the chemical industry, 52% if emissions control is added to this.

Figure 3 TEIs according to realm of innovation ( $n = 298$ )



We can try to specifically ascribe energy technologies and emissions control to the sectors where they actually occur within the vertical manufacturing chain. We can thus make a distinction between end-products on the one hand, and intermediate products, and primary or base products, both representing pre-products, on the other hand. We can furthermore distinguish user or consumer behaviour (practices) from producer practices (behaviour and regime rules). We again exclude TEIs regarding off-site measuring and monitoring. This results in the categories of (a) primary or base production and materials, (b) materials processing and intermediate productions, (c) final productions and products, and (d) user behaviour or consumer practices as shown in Table 2.

In this way the upstream concentration of TEIs emerges even more markedly. Primary productions and base products represent the biggest slice with 44%, materials processing and intermediate products 27%, making up 71% of the TEIs in primary and intermediate productions. Final productions and end-products represent 25%. Most of this relates to building and vehicles rather than office and household appliances and consumer goods. By contrast, innovative practices regarding consumption and private user behaviour (such as soft driving, car-sharing, leasing instead of buying, avoiding overheating of rooms, etc.) at 4% do not count for much. Even if this figure were doubled or tripled, the finding and its message would basically remain the same: TEIs are upstream rather than downstream in the manufacturing chain.

As a rule of thumb one can say the more products and production processes are placed chain-upwards, the more important the potential of their environmental impact is. This is particularly the case with regard to the difference between all of the steps of extracting and successively (re)processing materials, which regularly cause large environmental impact, and the final assembly or finishing of final products, which causes comparatively less impact. In the same sense it can be said that it is the processes of production rather than the use of products which cause environmental impact.

Table 2 *TEIs (products, processes, practices) according to chain position*

<b>Primary productions or base products</b>		
e.g. raw materials, primary fuels, power stations, agriculture, forestry, base materials (steel, cement, pulping, tanning, ...), secondary raw materials from recycling, also incl. related add-on-purification technology		44 %
<b>Materials processing and intermediate products</b>		
e.g. metal and surface working paper making, wood processing, furniture, textiles manuf., production of cycleware, dyeing/coating, food processing, etc., including related energy technology (e.g. industrial furnaces, stoves, burners), also incl. related add-on-purification technology	Pre-products and pre-producer practices	27 %
	71 %	
<b>Final productions, end-products</b>		
Buildings, vehicles, utility and consumer goods, including related energy technology (e.g. car propulsion, house heating, electr. demand of appliances), also incl. related add-on-purification technology, and producer practices		25 %
<b>User behaviour, consumer practices</b>		4 %
n = 288		100 %

There is, however, an important exception: long-lived complex energy apparatus such as motors in cars, jet engines, power plants, heating systems and electric appliances which consume large quantities of fuel. Food, feed and fuels have a metabolic rate of almost 100%. This makes a big difference to use-materials which by and large keep their physical structure when used. If there are important, unresolved environmental problems to be found in the use of final products, they indeed have in most cases to do with the fuels and the energy apparatus involved in using those products.

As regards the innovation life cycle stage of TEIs, as summarised in Table 3, 3% are just an idea on paper, 10% are in an early stage of research and laboratory demonstration, 26% in a more advanced stage of development, i.e. 36% in the development stage. 35% then are at market launch or shortly thereafter, or otherwise being introduced to regular practice. 16% are in experiencing growing adoption, though this does not always represent an impressive take-off. The remaining 10% represent mature technologies in a rather late stage of structuration and diffusion.

Table 3 *TEIs according to stage of life cycle*

Idea, concept on paper	3 %
Early stage of research and laboratory demonstration	10 %
Advanced stage of development	26 %
About market launch or introduction, or shortly thereafter	35 %
Experiencing growing adoption	16 %
Mature stage	10 %
	n = 289
	100 %

The distribution in Table 3 was to be expected. Ideas and early experiments are normally not communicated to a broader public, just as technologies in a late stage of their life cycle are normally not subject to public attention since nothing particular is occurring any more. It is nonetheless important to have this documented empirically, because it confirms one of the basic recommendations that can be drawn from life cycle analysis: true progress which includes structural change, particularly regarding a change in the ecological consistency of the industrial metabolism, requires a change in path; i.e. it requires the development and implementation of new technologies rather than the modification of mature systems already in place.

It is important here to understand that with technologies, as with living organisms, the key features of a novel thing and its life course are determined upstream rather than downstream, i.e. with regard to an organism, in its genetic code and in its early days of growth, experiencing and learning; and similarly with regard to technologies, in their conceptualisation and design, in the early stages of research and development, i.e. the early stages of structuration and diffusion. What remains to be determined during later stages, consists of incremental changes and modifications of minor importance, after the point of inflection of a learning curve has been passed. Most of the environmental pressure which is caused by producing and using a certain kind of product or technology is determined right at the beginning with the conceptualisation and design of that product or technology. Once in place, there is not much left which one can do about it, aside from some improvements in later new-generation variants of that product, some percentage points of materials and energy savings in the factory, and a few percentage points by being a good consumer.

As is shown in Table 4, most TEIs do indeed bring about change in ecological consistency. In about a quarter of the TEIs, there are significant efficiency increases without a change in metabolic properties. Typical examples of this include reuse of parts and recycling of materials, e.g. of solvents or sulphuric acid, or increased fuel-efficiency in internal-combustion engines. Three quarters, however, involve some consistency change.

The biggest share, at 41%, is that of examples where there are both consistency improvements and efficiency increases, e.g. latest-generation solar cells, fuel cells of any kind, and many biotech applications of where there is simultaneously less or no environmental pressure and higher yield. The percentage of such double-surplus-TEIs is nevertheless lower than was hy-

pothetically supposed, whereas the number of cases in which there is less inconsistency rather than really benign improvements are more than was expected.

*Table 4    TEIs according to ecological consistency and efficiency*

Consistency improvement without efficiency change, or efficiency unclear, or even slightly decreased	16 %
Consistency change in the sense of lesser degree of inconsistency without efficiency change, or efficiency unclear, or even slightly decreased	8 %
Consistency change in the sense of lesser degree of inconsistency combined with increase in efficiency	12 %
Both consistency improvement and efficiency increase	41 %
Mere efficiency increase without actual change in ecological consistency	23 %
	n = 281      100 %

Typical examples of lesser degree of inconsistency without efficiency change include exhaust catalysts, transmutation of nuclear waste, GM crops tolerant of agrochemicals, or HCFC-22 (chlorodifluoromethane) as a halocarbon replacements for conventional CFCs.

Replacement with SF<sub>6</sub> then is an example of lesser degree of inconsistency combined with some efficiency increase, because on eco-balance SF<sub>6</sub> helps to save CO<sub>2</sub> emissions. Further examples in this category tend to be incremental process innovations which help to reduce hazardous auxiliaries or materials-content while simultaneously increasing output.

An example of benign consistency improvements without efficiency changes are hydrogen-fuelled internal-combustion engines. Previous generations of solar cells and wind power, though clearly clean and metabolically consistent, even came with less efficiency than conventional like technologies.

## **5. Conclusions: Paradigm shift from downstream to upstream the product chain and technology life cycles**

The central message from the above findings concerns a paradigm shift from downstream to upstream in the vertical product chain and in technology life cycles. I would like to mention four aspects of such an upstreaming of environmental action and policies.

First, if environmentally significant technological innovations are to be found chain-upwards rather than chain-downwards, then priorities would need to be refocused onto those industrial operations where large environmental impact actually occurs – in energy, raw materials, agriculture, chemistry and base industries, partly also in building and vehicles.

Second, the key actor groups that have to be mobilised are technology developers, product designers and producers rather than users and consumers. With a focus on products and production, one would not be spending too much time with user behaviour and consumer demand.

New technologies do not occur by way of demand pull. Important environmental innovations originate on the supply side. They are science-driven and technology-pushed, induced by ideas and interests, one of which may be solving environmental problems – though further selective impulses from the side of regulation, government and user demand certainly come in later on.

The fact that most environmental impacts are determined and caused upstream in the life cycle and upstream in the product chain puts final consumption in a somewhat paradoxical role. This ecological paradox of consumption is as follows: On the one hand, expectations of high and still rising levels of affluence are indeed among the main driving forces behind the ongoing growth of industrial production and the large volumes of turnover of the industrial metabolism; on the other hand, however, the immediate contribution of consumer behaviour to the industrial metabolism is rather low, about 5–15% to gauge it generously. This is because most of the environmental pressure, the big ecological footprints or materials rucksacks of consumer society, occur during the different steps upstream in the product chain, and are determined by the basic principles of a technology and the physical design of a product, in the early stages of their life cycle. In contrast, consumption in service businesses and private households entails final steps downstream in the product chain. Approaches such as ‘sustainable consumption’ or ‘sustainable household’ can, in the end indeed, not be particularly effective in changing the industrial metabolism.

Third, in upstreaming environmental activities, chain management by key manufacturers and trade businesses has a particular role to play. It is the manufacturers of complex end-products such as buildings, vehicles, appliances, and also large retailers such as mail order firms, who are in the position to effectively implement supply chain management. This is none of a user’s nor of a government’s business.

Final demand may be decisive with regard to the diffusion of innovations. Demand itself, however, cannot innovate, it cannot ‘buy into existence’ things which do not exist, i.e. things which are not on the market yet – with one exception, which is the demand by key manufacturers and large trade businesses, because they have, or can have if they wish so, a decisive influence on suppliers along the product chain, and a defining influence on the design and re-design of products.

Fourth, as far as government is concerned, upstreaming environmental policy would induce a shift of emphasis from regulation to innovation. Environmental policy, much more than has hitherto been the case, would have to become a policy of technology development, or will have to cooperate systematically with technological R&D policy. In consequence there would have to be a shift in the pattern of environmental policy from bureaucratic procedural control to co-ordination of national innovation networks, European at the EU level, including suitable and well balanced financial support by granting regular research funds and seed money, as

well as providing venture capital and introductory aids in appropriate ways. What has to stay, though, is to set strict environmental performance standards (Ashford 1985, Kemp 1997 pp.317, Hemmelskamp/Rennings/Leone 2000). This remains by far the most effective controls instrument for environment and innovation alike (which is not astonishing given the fact that environmental standards are, or immediately translate into, technical standards).

In face of the discussed findings on TEIs one could go as far as to say: environmental awareness and will-building, regulation by law and environmental authorities, green marketing, and even green business management remain ultimately pointless in the absence of a prior strategy of technological environmental *upstream* innovation to give a common focus to environmental policies.

## References

- Andersen, Mikael Skou / Massa, Ilmo (Eds) (2000) Ecological Modernization, *Journal of Environmental Policy and Planning*, Special issue, Vol. 2, Issue 4, Wiley & Sons.
- Ashford, Nicholas A. / Ayers, C. / Stone, R.F. (1985) Using Regulation to Change the Markets for Innovation, *Harvard Environmental Law Review* 9, 419–466.
- Ayres, Robert U. / Ayres, Leslie W. (1996) Industrial Ecology. Towards Closing the Materials Cycle, Cheltenham: Edward Elgar.
- Braungart, Michael / McDonough, William (2002) Cradle to Cradle. Remaking the way we make things, New York: North Point Press.
- Freeman, Christopher (1987) Technology Policy and Economic Performance, London: Pinter.
- Hemmelskamp, Jens / Rennings, Klaus / Leone, Fabio (Eds) (2000) Innovation-Oriented Environmental Regulation, Heidelberg: Physica Verlag.
- Huber, Joseph (2004) New Technologies and Environmental Innovation, Cheltenham: Edward Elgar.
- Huber, Joseph (2000) Towards Industrial Ecology. Sustainable Development as a Concept of Ecological Modernization, in: Andersen/Massa (Eds) 269–285.
- Kemp, René (1997) Environmental Policy and Technical Change. A Comparison of the Technological Impact of Policy Instruments, Cheltenham: Edward Elgar.
- Klemmer, Paul / Lehr, Ulrike / Löbke, Klaus (1999) Environmental Innovation. Incentives and Barriers, Berlin: Analytica.
- Mol, Arthur P.J. / Sonnenfeld, D.A. (2000) Ecological modernisation around the world. An introduction, *Environmental Politics*, 9 (1) 3–14.

# NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

## Fondazione Eni Enrico Mattei Working Paper Series

Our Note di Lavoro are available on the Internet at the following addresses:

<http://www.feem.it/Feem/Pub/Publications/WPapers/default.html>

<http://www.ssrn.com/link/feem.html>

<http://www.repec.org>

## NOTE DI LAVORO PUBLISHED IN 2004

IEM	1.2004	Anil MARKANDYA, Suzette PEDROSO and Alexander GOLUB: <u>Empirical Analysis of National Income and So2 Emissions in Selected European Countries</u>
ETA	2.2004	Masahisa FUJITA and Shlomo WEBER: <u>Strategic Immigration Policies and Welfare in Heterogeneous Countries</u>
PRA	3.2004	Adolfo DI CARLUCCIO, Giovanni FERRI, Cecilia FRALE and Ottavio RICCHI: <u>Do Privatizations Boost Household Shareholding? Evidence from Italy</u>
ETA	4.2004	Victor GINSBURGH and Shlomo WEBER: <u>Languages Disenfranchisement in the European Union</u>
ETA	5.2004	Romano PIRAS: <u>Growth, Congestion of Public Goods, and Second-Best Optimal Policy</u>
CCMP	6.2004	Herman R.J. VOLLEBERGH: <u>Lessons from the Polder: Is Dutch CO2-Taxation Optimal</u>
PRA	7.2004	Sandro BRUSCO, Giuseppe LOPOMO and S. VISWANATHAN (lxv): <u>Merger Mechanisms</u>
PRA	8.2004	Wolfgang AUSENNEGG, Pegaret PICHLER and Alex STOMPER (lxv): <u>IPO Pricing with Bookbuilding, and a When-Issued Market</u>
PRA	9.2004	Pegaret PICHLER and Alex STOMPER (lxv): <u>Primary Market Design: Direct Mechanisms and Markets</u>
PRA	10.2004	Florian ENGLMAIER, Pablo GUILLEN, Loreto LLORENTE, Sander ONDERSTAL and Rupert SAUSGRUBER (lxv): <u>The Chopstick Auction: A Study of the Exposure Problem in Multi-Unit Auctions</u>
PRA	11.2004	Bjarne BRENDSTRUP and Harry J. PAARSCH (lxv): <u>Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders</u>
PRA	12.2004	Ohad KADAN (lxv): <u>Equilibrium in the Two Player, k-Double Auction with Affiliated Private Values</u>
PRA	13.2004	Maarten C.W. JANSSEN (lxv): <u>Auctions as Coordination Devices</u>
PRA	14.2004	Gadi FIBICH, Arie GAVIOUS and Aner SELA (lxv): <u>All-Pay Auctions with Weakly Risk-Averse Buyers</u>
PRA	15.2004	Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER (lxv): <u>Competition and Cooperation in Divisible Good Auctions: An Experimental Examination</u>
PRA	16.2004	Marta STRYSZOWSKA (lxv): <u>Late and Multiple Bidding in Competing Second Price Internet Auctions</u>
CCMP	17.2004	Slim Ben YOUSSEF: <u>R&amp;D in Cleaner Technology and International Trade</u>
NRM	18.2004	Angelo ANTOCI, Simone BORGHESI and Paolo RUSSU (lxvi): <u>Biodiversity and Economic Growth: Stabilization Versus Preservation of the Ecological Dynamics</u>
SIEV	19.2004	Anna ALBERINI, Paolo ROSATO, Alberto LONGO and Valentina ZANATTA: <u>Information and Willingness to Pay in a Contingent Valuation Study: The Value of S. Erasmo in the Lagoon of Venice</u>
NRM	20.2004	Guido CANDELA and Roberto CELLINI (lxvii): <u>Investment in Tourism Market: A Dynamic Model of Differentiated Oligopoly</u>
NRM	21.2004	Jacqueline M. HAMILTON (lxvii): <u>Climate and the Destination Choice of German Tourists</u>
NRM	22.2004	Javier Rey-MAQUIEIRA PALMER, Javier LOZANO IBÁÑEZ and Carlos Mario GÓMEZ GÓMEZ (lxvii): <u>Land, Environmental Externalities and Tourism Development</u>
NRM	23.2004	Pius ODUNGA and Henk FOLMER (lxvii): <u>Profiling Tourists for Balanced Utilization of Tourism-Based Resources in Kenya</u>
NRM	24.2004	Jean-Jacques NOWAK, Mondher SAHLI and Pasquale M. SGRO (lxvii): <u>Tourism, Trade and Domestic Welfare</u>
NRM	25.2004	Riaz SHAREEF (lxvii): <u>Country Risk Ratings of Small Island Tourism Economies</u>
NRM	26.2004	Juan Luis EUGENIO-MARTÍN, Noelia MARTÍN MORALES and Riccardo SCARPA (lxvii): <u>Tourism and Economic Growth in Latin American Countries: A Panel Data Approach</u>
NRM	27.2004	Raúl Hernández MARTÍN (lxvii): <u>Impact of Tourism Consumption on GDP. The Role of Imports</u>
CSRM	28.2004	Nicoletta FERRO: <u>Cross-Country Ethical Dilemmas in Business: A Descriptive Framework</u>
NRM	29.2004	Marian WEBER (lxvi): <u>Assessing the Effectiveness of Tradable Landuse Rights for Biodiversity Conservation: an Application to Canada's Boreal Mixedwood Forest</u>
NRM	30.2004	Trond BJORN DAL, Phoebe KOUNDOURI and Sean PASCOE (lxvi): <u>Output Substitution in Multi-Species Trawl Fisheries: Implications for Quota Setting</u>
CCMP	31.2004	Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI: <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part I: Sectoral Analysis of Climate Impacts in Italy</u>
CCMP	32.2004	Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI: <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part II: Individual Perception of Climate Extremes in Italy</u>
CTN	33.2004	Wilson PEREZ: <u>Divide and Conquer: Noisy Communication in Networks, Power, and Wealth Distribution</u>
KTHC	34.2004	Gianmarco I.P. OTTAVIANO and Giovanni PERI (lxviii): <u>The Economic Value of Cultural Diversity: Evidence from US Cities</u>
KTHC	35.2004	Linda CHAIB (lxviii): <u>Immigration and Local Urban Participatory Democracy: A Boston-Paris Comparison</u>

KTHC	36.2004	<i>Franca ECKERT COEN and Claudio ROSSI (Ixviii): <u>Foreigners, Immigrants, Host Cities: The Policies of Multi-Ethnicity in Rome. Reading Governance in a Local Context</u></i>
KTHC	37.2004	<i>Kristine CRANE (Ixviii): <u>Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari</u></i>
KTHC	38.2004	<i>Kiflemariam HAMDE (Ixviii): <u>Mind in Africa, Body in Europe: The Struggle for Maintaining and Transforming Cultural Identity - A Note from the Experience of Eritrean Immigrants in Stockholm</u></i>
ETA	39.2004	<i>Alberto CAVALIERE: <u>Price Competition with Information Disparities in a Vertically Differentiated Duopoly</u></i>
PRA	40.2004	<i>Andrea BIGANO and Stef PROOST: <u>The Opening of the European Electricity Market and Environmental Policy: Does the Degree of Competition Matter?</u></i>
CCMP	41.2004	<i>Micheal FINUS (Ixix): <u>International Cooperation to Resolve International Pollution Problems</u></i>
KTHC	42.2004	<i>Francesco CRESPI: <u>Notes on the Determinants of Innovation: A Multi-Perspective Analysis</u></i>
CTN	43.2004	<i>Sergio CURRARINI and Marco MARINI: <u>Coalition Formation in Games without Synergies</u></i>
CTN	44.2004	<i>Marc ESCRIHUELA-VILLAR: <u>Cartel Sustainability and Cartel Stability</u></i>
NRM	45.2004	<i>Sebastian BERVOETS and Nicolas GRAVEL (Ixvi): <u>Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach</u></i>
NRM	46.2004	<i>Signe ANTHON and Bo JELLES MARK THORSEN (Ixvi): <u>Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits</u></i>
NRM	47.2004	<i>John MBURU (Ixvi): <u>Wildlife Conservation and Management in Kenya: Towards a Co-management Approach</u></i>
NRM	48.2004	<i>Ekin BIROL, Ágnes GYÓVAI and Melinda SMALE (Ixvi): <u>Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transition al Economy</u></i>
CCMP	49.2004	<i>Gernot KLEPPER and Sonja PETERSON: <u>The EU Emissions Trading Scheme. Allowance Prices, Trade Flows, Competitiveness Effects</u></i>
GG	50.2004	<i>Scott BARRETT and Michael HOEL: <u>Optimal Disease Eradication</u></i>
CTN	51.2004	<i>Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG: <u>Simple Priorities and Core Stability in Hedonic Games</u></i>
SIEV	52.2004	<i>Francesco RICCI: <u>Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory</u></i>
SIEV	53.2004	<i>Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON: <u>Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?</u></i>
NRM	54.2004	<i>Ingo BRÄUER and Rainer MARGGRAF (Ixvi): <u>Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams</u></i>
NRM	55.2004	<i>Timo GOESCHL and Tun LIN (Ixvi): <u>Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices</u></i>
NRM	56.2004	<i>Tom DEDEURWAERDERE (Ixvi): <u>Bioprospection: From the Economics of Contracts to Reflexive Governance</u></i>
CCMP	57.2004	<i>Katrin REHDANZ and David MADDISON: <u>The Amenity Value of Climate to German Households</u></i>
CCMP	58.2004	<i>Koen SMEKENS and Bob VAN DER ZWAAN: <u>Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios</u></i>
NRM	59.2004	<i>Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA (Ixvii): <u>Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management</u></i>
NRM	60.2004	<i>Timo GOESCHL and Danilo CAMARGO IGLIORI (Ixvi): <u>Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon</u></i>
CCMP	61.2004	<i>Barbara BUCHNER and Carlo CARRARO: <u>Economic and Environmental Effectiveness of a Technology-based Climate Protocol</u></i>
NRM	62.2004	<i>Elissaios PAPYRAKIS and Reyer GERLAGH: <u>Resource-Abundance and Economic Growth in the U.S.</u></i>
NRM	63.2004	<i>Györgyi BELA, György PATAKI, Melinda SMALE and Mariann HAJDÚ (Ixvi): <u>Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis</u></i>
NRM	64.2004	<i>E.C.M. RUIJGROK and E.E.M. NILLESEN (Ixvi): <u>The Socio-Economic Value of Natural Riverbanks in the Netherlands</u></i>
NRM	65.2004	<i>E.C.M. RUIJGROK (Ixvi): <u>Reducing Acidification: The Benefits of Increased Nature Quality. Investigating the Possibilities of the Contingent Valuation Method</u></i>
ETA	66.2004	<i>Giannis VARDAS and Anastasios XEPAPADEAS: <u>Uncertainty Aversion, Robust Control and Asset Holdings</u></i>
GG	67.2004	<i>Anastasios XEPAPADEAS and Constadina PASSA: <u>Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach</u></i>
GG	68.2004	<i>Michael FINUS: <u>Modesty Pays: Sometimes!</u></i>
NRM	69.2004	<i>Trond BJØRNDAL and Ana BRASÃO: <u>The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications</u></i>
CTN	70.2004	<i>Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT: <u>On Coalition Formation with Heterogeneous Agents</u></i>
IEM	71.2004	<i>Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA: <u>Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants</u></i>
IEM	72.2004	<i>Alessandro LANZA, Matteo MANERA and Michael MCALEER: <u>Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns</u></i>
SIEV	73.2004	<i>Margarita GENIUS and Elisabetta STRAZZERA: <u>The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests</u></i>



CCMP	74.2004	<i>Rob DELLINK and Ekko van IERLAND</i> : <u>Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment</u>
ETA	75.2004	<i>Rosella LEVAGGI and Michele MORETTO</i> : <u>Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach</u>
CTN	76.2004	<i>Salvador BARBERÀ and Matthew O. JACKSON</i> (lxx): <u>On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union</u>
CTN	77.2004	<i>Àlex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERÀ and Fernando VEGA-REDONDO</i> (lxx): <u>Optimal Information Transmission in Organizations: Search and Congestion</u>
CTN	78.2004	<i>Francis BLOCH and Armando GOMES</i> (lxx): <u>Contracting with Externalities and Outside Options</u>
CTN	79.2004	<i>Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE</i> (lxx): <u>Merger Performance under Uncertain Efficiency Gains</u>
CTN	80.2004	<i>Francis BLOCH and Matthew O. JACKSON</i> (lxx): <u>The Formation of Networks with Transfers among Players</u>
CTN	81.2004	<i>Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO</i> (lxx): <u>Bicameralism and Government Formation</u>
CTN	82.2004	<i>Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Amnon RAPOPORT</i> (lxx): <u>Potential Maximization and Coalition Government Formation</u>
CTN	83.2004	<i>Kfir ELIAZ, Debraj RAY and Ronny RAZIN</i> (lxx): <u>Group Decision-Making in the Shadow of Disagreement</u>
CTN	84.2004	<i>Sanjeev GOYAL, Marco van der LEIJ and José Luis MORAGA-GONZÁLEZ</i> (lxx): <u>Economics: An Emerging Small World?</u>
CTN	85.2004	<i>Edward CARTWRIGHT</i> (lxx): <u>Learning to Play Approximate Nash Equilibria in Games with Many Players</u>
IEM	86.2004	<i>Finn R. FØRSUND and Michael HOEL</i> : <u>Properties of a Non-Competitive Electricity Market Dominated by Hydroelectric Power</u>
KTHC	87.2004	<i>Elissaios PAPYRAKIS and Reyer GERLAGH</i> : <u>Natural Resources, Investment and Long-Term Income</u>
CCMP	88.2004	<i>Marzio GALEOTTI and Claudia KEMFERT</i> : <u>Interactions between Climate and Trade Policies: A Survey</u>
IEM	89.2004	<i>A. MARKANDYA, S. PEDROSO and D. STREIMIKIENE</i> : <u>Energy Efficiency in Transition Economies: Is There Convergence Towards the EU Average?</u>
GG	90.2004	<i>Rolf GOLOMBEK and Michael HOEL</i> : <u>Climate Agreements and Technology Policy</u>
PRA	91.2004	<i>Sergei IZMALKOV</i> (lxxv): <u>Multi-Unit Open Ascending Price Efficient Auction</u>
KTHC	92.2004	<i>Gianmarco I.P. OTTAVIANO and Giovanni PERI</i> : <u>Cities and Cultures</u>
KTHC	93.2004	<i>Massimo DEL GATTO</i> : <u>Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus devolution</u>
CCMP	94.2004	<i>Pierre-André JOUVET, Philippe MICHEL and Gilles ROTILLON</i> : <u>Equilibrium with a Market of Permits</u>
CCMP	95.2004	<i>Bob van der ZWAAN and Reyer GERLAGH</i> : <u>Climate Uncertainty and the Necessity to Transform Global Energy Supply</u>
CCMP	96.2004	<i>Francesco BOSELLO, Marco LAZZARIN, Roberto ROSON and Richard S.J. TOL</i> : <u>Economy-Wide Estimates of the Implications of Climate Change: Sea Level Rise</u>
CTN	97.2004	<i>Gustavo BERGANTIÑOS and Juan J. VIDAL-PUGA</i> : <u>Defining Rules in Cost Spanning Tree Problems Through the Canonical Form</u>
CTN	98.2004	<i>Siddhartha BANDYOPADHYAY and Mandar OAK</i> : <u>Party Formation and Coalitional Bargaining in a Model of Proportional Representation</u>
GG	99.2004	<i>Hans-Peter WEIKARD, Michael FINUS and Juan-Carlos ALTAMIRANO-CABRERA</i> : <u>The Impact of Surplus Sharing on the Stability of International Climate Agreements</u>
SIEV	100.2004	<i>Chiara M. TRAVISI and Peter NIJKAMP</i> : <u>Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents</u>
SIEV	101.2004	<i>Chiara M. TRAVISI, Raymond J. G. M. FLORAX and Peter NIJKAMP</i> : <u>A Meta-Analysis of the Willingness to Pay for Reductions in Pesticide Risk Exposure</u>
NRM	102.2004	<i>Valentina BOSETTI and David TOMBERLIN</i> : <u>Real Options Analysis of Fishing Fleet Dynamics: A Test</u>
CCMP	103.2004	<i>Alessandra GORIA e Gretel GAMBARELLI</i> : <u>Economic Evaluation of Climate Change Impacts and Adaptability in Italy</u>
PRA	104.2004	<i>Massimo FLORIO and Mara GRASSEN</i> : <u>The Missing Shock: The Macroeconomic Impact of British Privatisation</u>
PRA	105.2004	<i>John BENNETT, Saul ESTRIN, James MAW and Giovanni URG</i> : <u>Privatisation Methods and Economic Growth in Transition Economies</u>
PRA	106.2004	<i>Kira BÖRNER</i> : <u>The Political Economy of Privatization: Why Do Governments Want Reforms?</u>
PRA	107.2004	<i>Pehr-Johan NORBÄCK and Lars PERSSON</i> : <u>Privatization and Restructuring in Concentrated Markets</u>
SIEV	108.2004	<i>Angela GRANZOTTO, Fabio PRANOVI, Simone LIBRALATO, Patrizia TORRICELLI and Danilo MAINARDI</i> : <u>Comparison between Artisanal Fishery and Manila Clam Harvesting in the Venice Lagoon by Using Ecosystem Indicators: An Ecological Economics Perspective</u>
CTN	109.2004	<i>Somdeb LAHIRI</i> : <u>The Cooperative Theory of Two Sided Matching Problems: A Re-examination of Some Results</u>
NRM	110.2004	<i>Giuseppe DI VITA</i> : <u>Natural Resources Dynamics: Another Look</u>
SIEV	111.2004	<i>Anna ALBERINI, Alistair HUNT and Anil MARKANDYA</i> : <u>Willingness to Pay to Reduce Mortality Risks: Evidence from a Three-Country Contingent Valuation Study</u>
KTHC	112.2004	<i>Valeria PAPPONETTI and Dino PINELLI</i> : <u>Scientific Advice to Public Policy-Making</u>
SIEV	113.2004	<i>Paulo A.L.D. NUNES and Laura ONOFRI</i> : <u>The Economics of Warm Glow: A Note on Consumer's Behavior and Public Policy Implications</u>
IEM	114.2004	<i>Patrick CAYRADE</i> : <u>Investments in Gas Pipelines and Liquefied Natural Gas Infrastructure What is the Impact on the Security of Supply?</u>
IEM	115.2004	<i>Valeria COSTANTINI and Francesco GRACCEVA</i> : <u>Oil Security. Short- and Long-Term Policies</u>

ITEM	116.2004	<i>Valeria COSTANTINI and Francesco GRACCEVA: <u>Social Costs of Energy Disruptions</u></i>
ITEM	117.2004	<i>Christian EGENHOFER, Kyriakos GIALOGLOU, Giacomo LUCIANI, Maroeska BOOTS, Martin SCHEEPERS, Valeria COSTANTINI, Francesco GRACCEVA, Anil MARKANDYA and Giorgio VICINI: <u>Market-Based Options for Security of Energy Supply</u></i>
ITEM	118.2004	<i>David FISK: <u>Transport Energy Security. The Unseen Risk?</u></i>
ITEM	119.2004	<i>Giacomo LUCIANI: <u>Security of Supply for Natural Gas Markets. What is it and What is it not?</u></i>
ITEM	120.2004	<i>L.J. de VRIES and R.A. HAKVOORT: <u>The Question of Generation Adequacy in Liberalised Electricity Markets</u></i>
KTHC	121.2004	<i>Alberto PETRUCCI: <u>Asset Accumulation, Fertility Choice and Nondegenerate Dynamics in a Small Open Economy</u></i>
NRM	122.2004	<i>Carlo GIUPPONI, Jaroslav MYSLAK and Anita FASSIO: <u>An Integrated Assessment Framework for Water Resources Management: A DSS Tool and a Pilot Study Application</u></i>
NRM	123.2004	<i>Margaretha BREIL, Anita FASSIO, Carlo GIUPPONI and Paolo ROSATO: <u>Evaluation of Urban Improvement on the Islands of the Venice Lagoon: A Spatially-Distributed Hedonic-Hierarchical Approach</u></i>
ETA	124.2004	<i>Paul MENSINK: <u>Instant Efficient Pollution Abatement Under Non-Linear Taxation and Asymmetric Information: The Differential Tax Revisited</u></i>
NRM	125.2004	<i>Mauro FABIANO, Gabriella CAMARSA, Rosanna DURSI, Roberta IVALDI, Valentina MARIN and Francesca PALMISANI: <u>Integrated Environmental Study for Beach Management: A Methodological Approach</u></i>
PRA	126.2004	<i>Irena GROSFELD and Iraj HASHI: <u>The Emergence of Large Shareholders in Mass Privatized Firms: Evidence from Poland and the Czech Republic</u></i>
CCMP	127.2004	<i>Maria BERRITTELLA, Andrea BIGANO, Roberto ROSON and Richard S.J. TOL: <u>A General Equilibrium Analysis of Climate Change Impacts on Tourism</u></i>
CCMP	128.2004	<i>Reyer GERLAGH: <u>A Climate-Change Policy Induced Shift from Innovations in Energy Production to Energy Savings</u></i>
NRM	129.2004	<i>Elissaios PAPYRAKIS and Reyer GERLAGH: <u>Natural Resources, Innovation, and Growth</u></i>
PRA	130.2004	<i>Bernardo BORTOLOTTI and Mara FACCIO: <u>Reluctant Privatization</u></i>
SIEV	131.2004	<i>Riccardo SCARPA and Mara THIENE: <u>Destination Choice Models for Rock Climbing in the Northeast Alps: A Latent-Class Approach Based on Intensity of Participation</u></i>
SIEV	132.2004	<i>Riccardo SCARPA Kenneth G. WILLIS and Melinda ACUTT: <u>Comparing Individual-Specific Benefit Estimates for Public Goods: Finite Versus Continuous Mixing in Logit Models</u></i>
ITEM	133.2004	<i>Santiago J. RUBIO: <u>On Capturing Oil Rents with a National Excise Tax Revisited</u></i>
ETA	134.2004	<i>Ascensión ANDINA DÍAZ: <u>Political Competition when Media Create Candidates' Charisma</u></i>
SIEV	135.2004	<i>Anna ALBERINI: <u>Robustness of VSL Values from Contingent Valuation Surveys</u></i>
CCMP	136.2004	<i>Gernot KLEPPER and Sonja PETERSON: <u>Marginal Abatement Cost Curves in General Equilibrium: The Influence of World Energy Prices</u></i>
ETA	137.2004	<i>Herbert DAWID, Christophe DEISSENBERG and Pavel ŠEVČIK: <u>Cheap Talk, Gullibility, and Welfare in an Environmental Taxation Game</u></i>
CCMP	138.2004	<i>ZhongXiang ZHANG: <u>The World Bank's Prototype Carbon Fund and China</u></i>
CCMP	139.2004	<i>Reyer GERLAGH and Marjan W. HOFKES: <u>Time Profile of Climate Change Stabilization Policy</u></i>
NRM	140.2004	<i>Chiara D'ALPAOS and Michele MORETTO: <u>The Value of Flexibility in the Italian Water Service Sector: A Real Option Analysis</u></i>
PRA	141.2004	<i>Patrick BAJARI, Stephanie HOUGHTON and Steven TADELIS (lxxi): <u>Bidding for Incomplete Contracts</u></i>
PRA	142.2004	<i>Susan ATHEY, Jonathan LEVIN and Enrique SEIRA (lxxi): <u>Comparing Open and Sealed Bid Auctions: Theory and Evidence from Timber Auctions</u></i>
PRA	143.2004	<i>David GOLDREICH (lxxi): <u>Behavioral Biases of Dealers in U.S. Treasury Auctions</u></i>
PRA	144.2004	<i>Roberto BURGUET (lxxi): <u>Optimal Procurement Auction for a Buyer with Downward Sloping Demand: More Simple Economics</u></i>
PRA	145.2004	<i>Ali HORTACSU and Samita SAREEN (lxxi): <u>Order Flow and the Formation of Dealer Bids: An Analysis of Information and Strategic Behavior in the Government of Canada Securities Auctions</u></i>
PRA	146.2004	<i>Victor GINSBURGH, Patrick LEGROS and Nicolas SAHUGUET (lxxi): <u>How to Win Twice at an Auction. On the Incidence of Commissions in Auction Markets</u></i>
PRA	147.2004	<i>Claudio MEZZETTI, Aleksandar PEKEČ and Ilia TSETLIN (lxxi): <u>Sequential vs. Single-Round Uniform-Price Auctions</u></i>
PRA	148.2004	<i>John ASKER and Estelle CANTILLON (lxxi): <u>Equilibrium of Scoring Auctions</u></i>
PRA	149.2004	<i>Philip A. HAILE, Han HONG and Matthew SHUM (lxxi): <u>Nonparametric Tests for Common Values in First-Price Sealed-Bid Auctions</u></i>
PRA	150.2004	<i>François DEGEORGE, François DERRIEN and Kent L. WOMACK (lxxi): <u>Quid Pro Quo in IPOs: Why Bookbuilding is Dominating Auctions</u></i>
CCMP	151.2004	<i>Barbara BUCHNER and Silvia DALL'OLIO: <u>Russia: The Long Road to Ratification. Internal Institution and Pressure Groups in the Kyoto Protocol's Adoption Process</u></i>
CCMP	152.2004	<i>Carlo CARRARO and Marzio GALEOTTI: <u>Does Endogenous Technical Change Make a Difference in Climate Policy Analysis? A Robustness Exercise with the FEEM-RICE Model</u></i>
PRA	153.2004	<i>Alejandro M. MANELLI and Daniel R. VINCENT (lxxi): <u>Multidimensional Mechanism Design: Revenue Maximization and the Multiple-Good Monopoly</u></i>
ETA	154.2004	<i>Nicola ACOCELLA, Giovanni Di BARTOLOMEO and Wilfried PAUWELS: <u>Is there any Scope for Corporatism in Stabilization Policies?</u></i>
CTN	155.2004	<i>Johan EYCKMANS and Michael FINUS: <u>An Almost Ideal Sharing Scheme for Coalition Games with Externalities</u></i>
CCMP	156.2004	<i>Cesare DOSI and Michele MORETTO: <u>Environmental Innovation, War of Attrition and Investment Grants</u></i>

CCMP	157.2004	<i>Valentina BOSETTI, Marzio GALEOTTI and Alessandro LANZA: <u>How Consistent are Alternative Short-Term Climate Policies with Long-Term Goals?</u></i>
ETA	158.2004	<i>Y. Hossein FARZIN and Ken-Ichi AKAO: <u>Non-pecuniary Value of Employment and Individual Labor Supply</u></i>
ETA	159.2004	<i>William BROCK and Anastasios XEPAPADEAS: <u>Spatial Analysis: Development of Descriptive and Normative Methods with Applications to Economic-Ecological Modelling</u></i>
KTHC	160.2004	<i>Alberto PETRUCCI: <u>On the Incidence of a Tax on PureRent with Infinite Horizons</u></i>
IEM	161.2004	<i>Xavier LABANDEIRA, José M. LABEAGA and Miguel RODRÍGUEZ: <u>Microsimulating the Effects of Household Energy Price Changes in Spain</u></i>

#### NOTE DI LAVORO PUBLISHED IN 2005

CCMP	1.2005	<i>Stéphane HALLEGATTE: <u>Accounting for Extreme Events in the Economic Assessment of Climate Change</u></i>
CCMP	2.2005	<i>Qiang WU and Paulo Augusto NUNES: <u>Application of Technological Control Measures on Vehicle Pollution: A Cost-Benefit Analysis in China</u></i>
CCMP	3.2005	<i>Andrea BIGANO, Jacqueline M. HAMILTON, Maren LAU, Richard S.J. TOL and Yuan ZHOU: <u>A Global Database of Domestic and International Tourist Numbers at National and Subnational Level</u></i>
CCMP	4.2005	<i>Andrea BIGANO, Jacqueline M. HAMILTON and Richard S.J. TOL: <u>The Impact of Climate on Holiday Destination Choice</u></i>
ETA	5.2005	<i>Hubert KEMPF: <u>Is Inequality Harmful for the Environment in a Growing Economy?</u></i>
CCMP	6.2005	<i>Valentina BOSETTI, Carlo CARRARO and Marzio GALEOTTI: <u>The Dynamics of Carbon and Energy Intensity in a Model of Endogenous Technical Change</u></i>
IEM	7.2005	<i>David CALEF and Robert GOBLE: <u>The Allure of Technology: How France and California Promoted Electric Vehicles to Reduce Urban Air Pollution</u></i>
ETA	8.2005	<i>Lorenzo PELLEGRINI and Reyer GERLAGH: <u>An Empirical Contribution to the Debate on Corruption Democracy and Environmental Policy</u></i>
CCMP	9.2005	<i>Angelo ANTOCI: <u>Environmental Resources Depletion and Interplay Between Negative and Positive Externalities in a Growth Model</u></i>
CTN	10.2005	<i>Frédéric DEROLAN: <u>Cost-Reducing Alliances and Local Spillovers</u></i>
NRM	11.2005	<i>Francesco SINDICO: <u>The GMO Dispute before the WTO: Legal Implications for the Trade and Environment Debate</u></i>
KTHC	12.2005	<i>Carla MASSIDDA: <u>Estimating the New Keynesian Phillips Curve for Italian Manufacturing Sectors</u></i>
KTHC	13.2005	<i>Michele MORETTO and Gianpaolo ROSSINI: <u>Start-up Entry Strategies: Employer vs. Nonemployer firms</u></i>
PRCG	14.2005	<i>Clara GRAZIANO and Annalisa LUPORINI: <u>Ownership Concentration, Monitoring and Optimal Board Structure</u></i>
CSRM	15.2005	<i>Parashar KULKARNI: <u>Use of Ecolabels in Promoting Exports from Developing Countries to Developed Countries: Lessons from the Indian LeatherFootwear Industry</u></i>
KTHC	16.2005	<i>Adriana DI LIBERTO, Roberto MURA and Francesco PIGLIARU: <u>How to Measure the Unobservable: A Panel Technique for the Analysis of TFP Convergence</u></i>
KTHC	17.2005	<i>Alireza NAGHAVI: <u>Asymmetric Labor Markets, Southern Wages, and the Location of Firms</u></i>
KTHC	18.2005	<i>Alireza NAGHAVI: <u>Strategic Intellectual Property Rights Policy and North-South Technology Transfer</u></i>
KTHC	19.2005	<i>Mombert HOPPE: <u>Technology Transfer Through Trade</u></i>
PRCG	20.2005	<i>Roberto ROSON: <u>Platform Competition with Endogenous Multihoming</u></i>
CCMP	21.2005	<i>Barbara BUCHNER and Carlo CARRARO: <u>Regional and Sub-Global Climate Blocs. A Game Theoretic Perspective on Bottom-up Climate Regimes</u></i>
IEM	22.2005	<i>Fausto CAVALLARO: <u>An Integrated Multi-Criteria System to Assess Sustainable Energy Options: An Application of the Promethee Method</u></i>
CTN	23.2005	<i>Michael FINUS, Pierre v. MOUCHE and Bianca RUNDSHAGEN: <u>Uniqueness of Coalitional Equilibria</u></i>
IEM	24.2005	<i>Wietze LISE: <u>Decomposition of CO2 Emissions over 1980–2003 in Turkey</u></i>
CTN	25.2005	<i>Somdeb LAHIRI: <u>The Core of Directed Network Problems with Quotas</u></i>
SIEV	26.2005	<i>Susanne MENZEL and Riccardo SCARPA: <u>Protection Motivation Theory and Contingent Valuation: Perceived Realism, Threat and WTP Estimates for Biodiversity Protection</u></i>
NRM	27.2005	<i>Massimiliano MAZZANTI and Anna MONTINI: <u>The Determinants of Residential Water Demand Empirical Evidence for a Panel of Italian Municipalities</u></i>
CCMP	28.2005	<i>Laurent GILOTTE and Michel de LARA: <u>Precautionary Effect and Variations of the Value of Information</u></i>
NRM	29.2005	<i>Paul SARFO-MENSAH: <u>Exportation of Timber in Ghana: The Menace of Illegal Logging Operations</u></i>
CCMP	30.2005	<i>Andrea BIGANO, Alessandra GORIA, Jacqueline HAMILTON and Richard S.J. TOL: <u>The Effect of Climate Change and Extreme Weather Events on Tourism</u></i>
NRM	31.2005	<i>Maria Angeles GARCIA-VALIÑAS: <u>Decentralization and Environment: An Application to Water Policies</u></i>
NRM	32.2005	<i>Chiara D.ALPAOS, Cesare DOSI and Michele MORETTO: <u>Concession Length and Investment Timing Flexibility</u></i>
CCMP	33.2005	<i>Joseph HUBER: <u>Key Environmental Innovations</u></i>

(lxv) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications” organised by Fondazione Eni Enrico Mattei and sponsored by the EU, Milan, September 25-27, 2003

(lxvi) This paper has been presented at the 4th BioEcon Workshop on “Economic Analysis of Policies for Biodiversity Conservation” organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL), Venice, August 28-29, 2003

(lxvii) This paper has been presented at the international conference on “Tourism and Sustainable Economic Development – Macro and Micro Economic Issues” jointly organised by CRENoS (Università di Cagliari e Sassari, Italy) and Fondazione Eni Enrico Mattei, and supported by the World Bank, Sardinia, September 19-20, 2003

(lxviii) This paper was presented at the ENGIME Workshop on “Governance and Policies in Multicultural Cities”, Rome, June 5-6, 2003

(lxix) This paper was presented at the Fourth EEP Plenary Workshop and EEP Conference “The Future of Climate Policy”, Cagliari, Italy, 27-28 March 2003

(lxx) This paper was presented at the 9<sup>th</sup> Coalition Theory Workshop on "Collective Decisions and Institutional Design" organised by the Universitat Autònoma de Barcelona and held in Barcelona, Spain, January 30-31, 2004

(lxxi) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by Fondazione Eni Enrico Mattei and Consip and sponsored by the EU, Rome, September 23-25, 2004

**2004 SERIES**

<b>CCMP</b>	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti )
<b>GG</b>	<i>Global Governance</i> (Editor: Carlo Carraro)
<b>SIEV</b>	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Anna Alberini)
<b>NRM</b>	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
<b>KTHC</b>	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
<b>IEM</b>	<i>International Energy Markets</i> (Editor: Anil Markandya)
<b>CSRM</b>	<i>Corporate Social Responsibility and Sustainable Management</i> (Editor: Sabina Ratti)
<b>PRA</b>	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
<b>ETA</b>	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
<b>CTN</b>	<i>Coalition Theory Network</i>

**2005 SERIES**

<b>CCMP</b>	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti )
<b>SIEV</b>	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Anna Alberini)
<b>NRM</b>	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
<b>KTHC</b>	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
<b>IEM</b>	<i>International Energy Markets</i> (Editor: Anil Markandya)
<b>CSRM</b>	<i>Corporate Social Responsibility and Sustainable Management</i> (Editor: Sabina Ratti)
<b>PRCG</b>	<i>Privatisation Regulation Corporate Governance</i> (Editor: Bernardo Bortolotti)
<b>ETA</b>	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
<b>CTN</b>	<i>Coalition Theory Network</i>