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## **A Solution Named Dematerialization**

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*The bailout of the financial crisis must be paralleled  
by the prevention of the ultimate ecological breakdown,  
which has some of the same root causes.*

Report to the EU Parliament on Eco-Innovation <sup>2</sup>

*We have the means and the know-how,  
and we still have the time,  
to avoid the fate of the people  
who once inhabited the Easter Island*

*Dematerialization is  
not the only condition  
for reaching sustainability,  
but without it,  
there is no future with future.*

### **Summary**

There are two main reasons why traditional environmental policies have to be improved:-

1. The climatic change is real and stands out as a strong signal for the fact that traditional environmental and economic policies have failed to prevent major environmental breakdowns;-
2. The environmental crisis has largely the same roots as the financial

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<sup>2</sup> Wuppertal Institut, „Eco-Innovation – Putting The EU On The Path Of A Resource And Energy Efficient Economy“, Report on eco-innovation to the European Parliament, April 2009

catastrophe: Market failures due to systems incompetence; lack of valid indicators, of early warning systems, and of precautionary policies; short term profit maximization; marketing „poisonous products“; and prices that do not tell the truth.

There are two main reasons why *dematerialization* is unavoidable:-

1. There are not enough resources (material, water, land surface) on planet earth for expanding the western life-style to 8 or 9 billion people;-
2. The resource intensity of the western life-style is the physical *root cause* for significant losses in eco-system functions and services with consequences such as climatic change, pervasive water shortages, desertification, erosion, and loss of species.

There are two main reasons why governments must act for approaching sustainability:-

1. Only governments can adjust economic frameworks in order to render sustainable production and consumption profitable;-
2. Governments are responsible for international cooperation.

### ***Today***

Recently, the world has witnessed how market failures and foresight incompetence impaired the stability of the global financial system and with it the entire economy. The German minister of finance, Per Steinbrück, noted in late fall of 2008: „*When the financial market burns, the fire must be extinguished, even if it was deliberately set*“.

Insufficient accounting methods and incomplete early warning systems, missing competence in systems analysis and unwillingness to implement precautionary policies, short-term profit maximization, “toxic products” (Stiglitz) and wrong prices of products and services were among the key causing factors. As one consequence, even the CEOs of leading financial institutions have called for a framework of rules

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capable of avoiding a similar disaster in the future. As another, thousands of billions of Euros and Dollars were committed by governments at great speed with the aim to limit the damage caused by the self-inflicted failure of just one sector of industry.

At the same time, not many people seem to perceive the *ecological crisis* to be on the same level as a collapsing financial market in terms of threatening life styles, security and achievements. This is rather peculiar, because climatic change is just as much on the mind of the public, its potentially destructive consequences are accepted as real. Every day, the media give accounts of people suffering painful results from insufficient environmental protection around the world.

Perhaps the reason for this asymmetry in the perception of significance is the fact that while national governments are held responsible for high unemployment and stagnating or declining expendable income in their countries, significant ecological problems are perceived to be far away, created by other countries, and are only amenable through international negotiations. Also, most people are convinced that solving environmental problems invariably implies shouldering additional net costs. On the other hand, civil society in many countries is willingly making substantial efforts to “*help the environment*” by such activities as recycling products, reviving stranded whales, using public transportation, and saving energy at home.

Environmental protection policies cause indeed “*additional*” costs, because they are *not* imbedded in the market pricing structure. Commonly they are added at public expense “*at the end of the pipe*” - long after society has made the technical and economic decisions that caused them.

Still today, environmental protection policies and environmental economics focus on the emission of residuals from the economic process into the natural environment, and their mitigation, instead on precautionary measures. Through microeconomic partial analysis, individual emission problems (like forest dieback and climatic change) are analyzed, monetary valuations of environmental damages are attempted and policy decisions are made with the aim to reduce emissions such that the marginal costs of the emissions („*externalities*“) become equal to the marginal benefits from the activities that produce them.

From a scientific point of view, this is *not* a satisfactory approach to environmental protection because it is fundamentally impossible to know, analyze, and quantify impacts of millions of chemically different emissions, effluents and ever changing waste products upon many millions of different targets in the ecosphere.

In order to move toward sustainability, a precautionary systems' approach is required that functions as an integral part of the market economic process.

### ***What Causes the Environmental Crisis?***

Protecting the environment means protecting the *functions and services of the ecosystem*<sup>3</sup>. These functions and services are essential for all life on earth. They include for instance the availability of liquid water, clean air, a multitude of different elements and materials, as well as edible plants and animals, the propagative power of seeds and sperms, the formation and maintenance of productive soil, a rich biodiversity, a moderate range of temperatures on the surface of the earth, and the protection against radiation from outer space.

Functions and services of the ecosystem cannot be generated by technology on any noticeable scale, they are indivisible and cost-free available to all humans around the globe. If they could be traded on the market, they would carry an infinitely high price.

Functions and services of the ecosystem are vulnerable to human economic activities. Already today, consequences thereof can be observed, e.g. water shortages, desertification, climatic change, extinction of species, spread of old and new diseases, increasing floods and hurricanes<sup>4</sup>.

The *physical root cause* for destructing life-sustaining functions and services of the ecosystem is the wasteful consumption of natural resources<sup>5</sup>. No material and no

<sup>3</sup> In literature also referred to as "eco-system services" and "services of nature".

<sup>4</sup> See, for instance, the Wiegandt Series „Courage for Sustainability“ Haus Printers, London, 2008/2009; and the IPCC (Intergovernmental Panel on Climate Change) Climate Report 2007; the UNDP (United Nations Development Programme) Report 2007 on Climate Change and Poverty; the UNEP (United Nations Environment Programme) Report 2007 „Global Environmental Outlook GEO-4“, and the EEA (European Environment Agency) Report 2007.

<sup>5</sup> Natural *resources* encompass all naturally available non-renewable (abiotic) and biotic raw materials (minerals, gravel, fossil and nuclear energy carriers, plants, wild animals), air, water, and space (land use *for human settlements, infrastructures, industry, mineral extraction, agriculture and forestry*).

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water can be moved or extracted from their natural location, and no natural surface can be altered by technology, without imposing changes on the functions and services of the ecosystem<sup>6</sup>.

The more humans interfere with the natural ecosphere, the more intensive and frequent they move and excavate natural materials from their natural location, the more natural surfaces are denatured or sealed, the more the habituated functions and services of the ecosystem will weaken, change, and disappear.

And also: The more material is extracted for feeding the industrial metabolism, the larger will be the discharge from the technosphere.

On the material side, one can give an approximate account of this situation by defining the environmental impact potential of goods as "*the life-cycle-wide mass input required per unit of value (or service) generated when putting this good to use: MIPS*"<sup>7</sup>. For instance, a European mid-sized car requires about 0.4 kg of natural material per km, based on a total lifetime of 250 000 km.

Of course, the environmental impact potential of a product or an emission *also* depends on its specific eco-toxic nature. This should therefore be considered - to the extent that it is known - when making an assessment. For instance, the climate changing potential of 1 ton of methane (CH<sub>4</sub>) is much larger than that of one ton of CO<sub>2</sub>. This is the reason why the beef raised by mankind contributes more to climate change than the emissions of all cars taken together.

While serious destruction of eco-system services can be – and has already been – caused by a minority of the world population, *all* inhabitants of the earth have to suffer the consequences.

### ***New Products, New Systems***

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<sup>6</sup> F. Schmidt-Bleek, "Wieviel Umwelt braucht der Mensch? MIPS, das Mass für ökologisches Wirtschaften, Birkhäuser, Basel, Boston, Berlin, 1993. Finish, Japanese and Chinese editions. English version under [www.factor10-institute.org](http://www.factor10-institute.org).

<sup>7</sup> Complete Special Issue of the *Fresenius Environmental Bulletin*, Birkhäuser, Basel, Boston, Berlin, August 1993 (In English), covering essential details of Schmidt-Bleek's dematerialization-concept (Factor 10/MIPS).

The fundamental *technical* requirement for moving towards a sustainable economy is to *dematerialize*<sup>8</sup> the generation of welfare, including the provision of energy. Today, more than 90% of the resources lifted from nature on average are turned into waste before goods reach the market<sup>9</sup>.

In the European Union, eco-innovation is now defined as “*the creation of novel and competitively priced goods, processes, systems, services, and procedures that can satisfy human needs and bring quality of life to all people with a life-cycle-wide minimal use of natural resources (material, including energy carriers, and surface area) per unit output, and a minimal release of toxic substances*” (A. Reid, M. Miedzinski, (2008), EUROPE INNOVA, Final Report for the EU Sectoral Innovation Watch Panel on Eco-Innovation, [www.europe-innova.org](http://www.europe-innova.org)).

A vast range of technical options exists for achieving radical dematerialization without compromising end-use satisfaction, but systematic eco-innovation remains largely unimplemented because of lacking economic incentives.

In addition to concerns about diminishing eco-systemic stability through resource consumption, an emerging global resource scarcity is increasingly driving technological change. Globalizing the current patterns of Western consumption and resource use is *not* possible because of insufficient availability of natural material resources, water and land surface on planet earth.

### **Targets**

In 1992, Schmidt-Bleek suggested as a target for *sustainable* ecological conditions a reduction of 50% of the global extraction of non-renewable resources, including fossil energy carriers<sup>10</sup>. Since at that time some 80 % of the natural resources were required by only 20% of the world population, he suggested “*Factor 10*” as a rough average target for dematerializing technically advanced countries in order to make

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<sup>8</sup> Schmidt-Bleek received the highly priced Takeda World Environment Award in 2001 for pioneering his Factor10/MIPS dematerialization concept.

<sup>9</sup> F. Schmidt-Bleek, „The Earth: Natural Resources and Human Intervention“, Haus Publishers, London, 2008; Chinese Edition: „Resource Productivity“, Chinese National Center for Productivity, 2009; Italian Edition in preparation.

<sup>10</sup> F. Schmidt-Bleek; „Materials Flows and Eco-Restructuring“, Fresenius Environmental Bulletin 7, 1992

environmental space available for the poorer countries, while moving the world economy toward more stable ecological conditions.

In June 2009, Hinterberger and Bringezu presented in Berlin the newest data on global resource use <sup>11</sup>. According to their research, the global excavation of non-renewable natural material, used and unused, was between 100 and 110 billion tons in the year 2000, not counting erosion caused by agricultural practices, which amounted to some 40 billion tons. The “unused” excavation – the “ecological rucksack” of excavation not acquiring any commercial value – typically makes up some 50% of the total excavation.

Taking the target of 50 % suggested earlier for excavation as a global limit, applying the equity criterion and extrapolating to some 9 billion people world-wide in 2050, a target value of 5 – 6 annual tons per capita results <sup>12</sup>. This corresponds well with the 6 tons/year suggested by Schmidt-Bleek in 2008 <sup>13</sup>. A “6 Ton Society” has therefore been recently called for as a target for the year 2050, suggesting a worldwide maximum yearly *per capita* use of 6 tons of non-renewable natural resources <sup>14</sup>.

Considerable research on defining more reliable targets for sustainable resource use is required, keeping in mind that “zero MIPS” is impossible. It is also clear that dematerialization is *not* the only requirement for approaching sustainability. For instance, the adjustment of western life styles with the aim of creating a less hectic and a less profit-oriented society is just an important condition. However, in view of the dramatic worsening of the environmental stability, radical dematerialization should commence immediately as an indispensable step for protecting the life-sustaining functions and services of the ecosystem

### ***The Economic Mismatch***

11 F. Hinterberger, “The Limits of Resource Use”, and S. Bringezu, “Targets for Global Resource Consumption”, Proceedings, “Factor X: Policy, Strategies and Instruments Towards a Sustainable Resource Use”, German Environment Protection Agency (to be available at the World Resources Forum Davos, 2009 in September, 2009).

12 Stefan Bringezu, R. Bleischwitz, Ed: “Sustainable Resource Management. Trends, Visions and Policies for Europe and the World”, Greenleaf Publishers, Sheffield, UK, 2009

13 F. Schmidt-Bleek , Editorial: „Factor 10: The Future Of Stuff“, Sustainability, Science, Practice, & Policy <http://ejournal.nbii.org>

14 H. Lehmann and F. Schmidt-Bleek, „The 6 Ton Society“, Proceedings, “Factor X: Policy, Strategies and Instruments, Towards a Sustainable Resource Use”, German Environment Protection Agency (to be available at the World Resources Forum Davos, 2009 in September, 2009).

Some of the causes for the financial crisis were recalled above: Foresight incompetence, insufficient accounting methods, incomplete early warning systems, missing competence in systems analysis and unwillingness to implement precautionary policies, short-term profit maximization, emission of toxic products and wrong prices of products and services.

These are some of the important contributing factors for the growing environmental crisis, too. The current market process itself is thus prominently responsible for the continuing destruction of eco-system services. But while the stability of the financial system can most likely be restored eventually, at least in theory, this is not true for lost eco-system functions and services.

Given the similarities between the drivers for the financial disaster and the ecological crisis, there is a window of opportunity for a systemic structural change that is crucial to both developments. For protecting the eco-system services, adjustments to the present economic framework have been proposed by Herman Daly<sup>15</sup> and more recently by the Lindau Group<sup>16 17</sup>.

Most importantly, the human economy must be constrained to function *within* the limits of the environment and its resources and in such a way that it works with the grain of, rather than against, natural laws and processes. This argues for a strong conception of sustainability, whereby the economy respects and adapts to ecological imperatives, rather than seeking to substitute manufactured for natural capital.

Among many options, the price structure on the market prominently needs adjustment. In Europe, taxes and levies increase the cost of labor roughly to twice the level of actual income. Releasing coworkers into unemployment is often believed to be the most effective way to cut costs of production. Natural resources, on the other hand, are wasted. In Germany, SMU's could spend 20% less on resources and still make the

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15 H. E. Daly: "Beyond Growth: the Economics of Sustainable Development", Beacon Press, Boston, 1996

16 See [www.Worldresourcesforum.org](http://www.Worldresourcesforum.org);

17 P. Ekins, et. al.: „Reducing Resource Consumption. A Proposal for Global Resource and Environmental Policy“, gws Discussion Paper 2009/5, ISSN 1867-7290, [meyer@gws-os.de](mailto:meyer@gws-os.de); and Bernd Meyer, „Costing the Earth? Perspectives on Sustainable Development“, Haus Publishers, London, 2009.

same profit<sup>18</sup>. Actual eco-innovation is far from producing the level of dematerialization that is technically feasible. Governments should carefully correct this mismatch, for instance by a cost-neutral shift of taxation and levies to resources – for the benefit of improving its international competitive performance, and for protecting the life-supporting functions and services of the ecosphere<sup>19</sup>.

### ***Smoothing The Way to Sustainability***

In order to improve the chances for moving successfully toward sustainable economic conditions, a 10 Year International Development Project is suggested, encompassing the following components:

- Bringing national and international economic frameworks into tune with the laws of nature.
- Creating without delay “Risk Management Units” with high systems competence, advising heads of national governments, and international organization.
- Creating, within two years, publicly accessible, “*Material Agencies*” that create, collect, validate, update, and distribute information and data on the national, regional and world-wide availability and use of natural resources (material, water, and land), on all levels of the economy (e.g. for noticing *rebound* effects), as well as the material intensity of goods, services, and systems. Such agencies would also interpret available information, and issue policy oriented reports on resource management. It would also be responsible for developing, harmonizing, and observing the application of key indicators, and for developing curricula and offering educational and training programs.

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18 Hartmut Fischer et. al., “Wachstum und Beschäftigungsimpulse rentabler Materialeinsparungen”, Wirtschaftsdienst, 4, April 2004. The „Factor 10 Innovation Network“ has had similar experiences with several hundred companies.

19 B. Meyer, „Costing the Earth? Perspectives on Sustainable Development“, Haus Publishers, London, 2009.

- Promoting and supporting radical eco-innovation in goods, processes, systems, services, and procedures, and in particular creating technological options by 2020 that would allow decoupling energy needs from fossil use and nuclear power. In this context one should remember that dematerializing life styles lowers the demand for energy.
- Promoting and supporting the development of synthetic materials that can support eco-innovation, including the replacement of scarce natural materials such as lithium-ion batteries, tantalum in small electronic devices, Antimon, Gallium, and Indium.
- Expanding significantly the development of materials, goods, and systems that mimic nature, not only in their function but also in terms of their energy and material needs.

The total costs of this project are estimated at about 150 billion Euro. This corresponds roughly to the amount of public funds invested in the development of nuclear power, and it represents but a fraction of the current financial commitment for correcting the financial crisis.

Among the potential added benefits of radically dematerializing the economy are these: Slowing down or even stopping climate change; reducing the loss of forests, species and soil; lessening of global migration pressures; reducing global hunger and material poverty; reducing economic dependence on resource-rich countries; avoiding conflicts resulting from regional scarcity of water, land, and other resources; and lessening the probability of ecological surprises in the future.