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FUTURE
Beyond Climatic Change

F. Schmidt-Bleek [1]

[1] Colleagues and the press call Schmidt-Bleek "The father of dematerialization". In 2001 he received the Takeda Global Environment Award, "The Japanese Nobel Price for Environment", together with E. U. von Weiszsäcker. The present communication is based on Schmidt-Bleek's newest book entitled: "Nutzen wir die Erde richtig?"(Are we using the earth wisely?), Fischer, 2006 (Chinese version available), as well as other books published by him since 1993.

FUTURE
BEYOND CLIMATIC CHANGE

F. Schmidt-Bleek

Summary

Climatic change is commonly thought to be *the* ecological problem. But even if we had solved this crisis, the systemic mismatch between our economic performance and the stability of the carrier system earth would still remain.

For improving decisively the chances of human survival on our planet, the world-wide generation of welfare must be achieved by 2050 with a *per capita* ecological footprint of 1.8 ha, a *per capita* consumption of 5 – 6 yearly tons of non-renewable material resources, and an emission of CO_2 *not* exceeding 2 tons per year and person. These goals imply a manifold dematerialization in the western world, but will allow reasonable growth in many poorer countries. These goals should be independently reviewed, and where need be adjusted and refined in the light of growing experience and a changing world population.

Considerable practical experience has shown that the chances for achieving these goals are reasonable from a technical point of view - without jeopardizing end use satisfaction. However, the economic framework of today, fiscal policies, the price structure for labor and natural resources, perverse subsidies, the distribution of wealth and health, as well as the wide variation of access to food and education, are *not* supporting at this time a promising future with a future.

Coherent key indicators for social, institutional and in particular economic progress toward a more sustainable future have not as yet been agreed to.

This paper describes a systems-based approach for framing the ecological dimension of sustainability.

Worries [2]

In Germany and other industrialized countries, uncertainty grows among industrial leaders about how to position their enterprises in view of the mounting ecological consequences created by the traditional system of production, distribution and consumption. Are life styles changing, such as indicated by the fast growing preferences for "bio"-products? The debate about climate change has suddenly and un-expectably taken on a high pitch, resulting in previously unknown intense pressure to lower CO_2 emission [3]. There is rising concern about the reliable supply of accustomed raw materials - in addition to the potential ecological consequences of their use. How steeply will the prices of energy carriers and raw materials climb, pushed on by world wide uncontrolled speculation and in particular by mounting demands of some 3 billion people in emerging countries like China, India, and Brazil? In addition to climatic change, should one anticipate other ecological problems

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[2] This section is based on a discussion at the Wuppertal Institute on 25. October 2007. Present were: Dr. Meyer, Professor of Economics, Univ. Osnabrück; Klaus Wiegandt, former CEO of METRO and Editor of the Fischer book series "Courage for Sustainability"; Dr. Christa Liedtke, and Dr. Jola Welfens from the Wuppertal Institure; and the author of this contribution.

[3] Mojib Latif, "Bringen wir das Klima aus dem Takt?" (Are we disturbing the climatic rhythm?", Fischer, 2006

and in which part of the world [4]? The global population is still growing by some 80 million people every year, the equivalent of the whole German population [5]. Poverty, hunger, health problems and lack of education among billions of people persist, and are even getting worse. The old economic paradigm and its yardsticks for measuring success seem to become brittle. But how could the economy be reshaped while keeping a robust, profitable and market-oriented system? [6] And what will be the costs and benefits? Who will be the losers and the winners? Could Germany, can Europe go the necessary changes alone? Should they carry the banner of ecological sanity into the future?

Consumers in industrialized countries, too, begin to pay closer attention to environmental problems [7]. They begin to understand that serious adjustments of their life styles are imminent, in particular their energy consumption. Uneasiness is growing about being increasingly exposed to previously unknown catastrophic events like storms and floods, lack of rain or too much of it, forest fires, water shortages and health problems, and by rising costs of food, energy and insurance.

The current public debate about the origin of environmental problems, and options for their solution, are frequently perceived as confusing and sometimes driven more by special interests and easy quick-fix-solutions, rather than by true care of political and industrial leaders for a save future for humankind. Why are the power plants given free rights to emit CO_2 and the "little man" has to accept inconveniences and often pay for change? It's the Chinese that cause all these problems and the people in Africa with all their babies, isn't it? What if saving gasoline, turning off stand-by features and lowering the thermostats do not stop climatic changes – or are indeed *not* the end of the environmental problems? Are we going to be poorer tomorrow, are the pension plans reliable? And what about the unemployment? There seem to be many more questions than answers.

Klaus Wiegandt, former CEO of METRO, and chairperson of his "Forum für Verantwortung" [8] has financed the publication of 12 books under the common title "Mut zur Nachhaltigkeit" ("Courage for Sustainability"), written by well known experts in easy to understand language, and published by Fischer in Frankfurt, 2006/2007. The principal purpose of this series is to provide the backdrop for a vigorous public debate on the causes and dangers of environmental change, and offering options for reaching harmony between humankind and nature. The first English translations will be available in 2008.

In this position paper I present the outline of a rational systems approach for improving the chances for a long-term human existence on earth. Since 1989 I worked on this basically simple idea: *First,* we must create our wealth and wellbeing with far less natural resources than hitherto the case, on the average we must *dematerialize* our western economy by at least a *factor 10*. *Second*, technically this is achievable through systems innovation without losing end use satisfaction. *Third* we must organize a cost-neutral shift of overheads, charges and taxes from income to natural resources, in order to (1) Internalize the costs of using nature, (2) Stimulate eco-innovation (3) Give incentives to producers for dematerializing goods and services, (4) Create a price structure on the market that rewards purchasing and using eco-efficient goods and services, and (5) make labor less costly and thus create new jobs. *Fourth*, we must use any other reasonable and

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[4] Stefan Rahmsdorf. Katherine Richardson, "Wie bedroht sind die Ozeane?" (How much are the oceans threatened?), Fischer 2007

[5] Rainer Münzer, Albert F. Reiterer, "Wie schnell wächst die Zahle der Menschen?" (How fast does the global population grow?), Fischer 2007

[6] Bernd Meyer, "Wie muss die Wirtschaft umgebaut werden? Perspektiven einer nachhaltigen Entwicklung", (How must we rebuild our economy? Perspectives of a sustainable development), Fischer, December 2007

[7] Jill Jäger, "Was verträgt die Erde noch?" (How much can the earth endure?), Fischer, 2006

[8] *"Forum for Responsibility"*

cost-effective option available in order to lessen the use of natural resources, including through education [9], elimination of perverse subsidies [10], review of norms and standards, and on occasion new control legislation.

In brief, we need to add a new dimension to the traditional environmental protection: Rather than just fighting one symptom of our impact on the ecosphere after another, we must get to the root cause of our problems. We must understand the currently fundamental mismatch between generating welfare for people and the stability of the carrier system earth. And then we must design solutions for a more sustainable future of human life on earth.

This paper addresses primarily the ecological dimension of sustainability. It stresses the fundamental importance of the resource consumption and the use of land for meeting the needs of people.

While dematerialization is one of the fundamental environmental requirements for moving toward sustainability, there are other issues that need be considered, too. They include: Changing the way decisions are made in government and industry, adjusting the framework conditions of the economy for meeting new challenges, getting accustomed to a different kind of consumption, and changing policy for improving social cohesion.

It is high noon for governments and enterprises to understand and incorporate sustainability into an integrated, long-term and systemic precautionary policy concept and into responsible actions.

It is high noon for looking *beyond GNP, beyond short-term corporate balance sheets and beyond the casino indicator called stock market*. Time is running out for patchwork debates and patchwork solutions aimed at relieving symptoms instead of curing the root cause for our failure in creating long lasting wellbeing and happiness for people.

The services of nature and their sensitivity

Humans would not have appeared and survived on planet earth without the services of nature. These services are the essential support for all life on earth. They include, for instance, the availability of liquid water and clean air, edible plants and animals, the propagative power of seeds and sperms, and a multitude of different elements and materials. They include the formation and maintenance of productive soil, a rich biodiversity, fitting climatic conditions with appropriate temperature ranges, all linked to the water and carbon cycles, and they also include the protection from dangerous radiation from outer space.

In the solar system and far beyond, only the earth can be home to humans.

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

Services of nature undergo *slow* evolutionary changes as a natural process. It is well known that temperature ranges on the earth and species have changed over time. However, ever since humans walk the planet, the average temperature was around + 20 degree Centigrade,

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[9] The Wuppertal Institute translates the Wiegandt-Fischer Series of books –mentioned above - into educational material (contact J. Welfens or Christa Liedtke, www.wupperinst.org)

[10] Norman Meyers with Jennifer Kent, “Perverse Subsidies”, IISD, 1998, ISBN 1-895536-09-x

which means that in most parts water is a liquid – and not ice or vapor. The biosphere on earth can only function with liquid water [11].

Services of nature are vulnerable to human economic activities. The *root cause* for these changes imposed by humankind is the indiscriminate technical use of nature. Humans with their impatient attitude, and with the help of their technical power, have imposed rapid changes on natural dynamic equilibria and thus on the services of nature. One of the problems with this is that it is not possible to predict the kind, the size and the location of the resulting changes because of the non-linear complexity of nature.

Already today, consequences thereof can be observed, e.g. increasing water shortages, desertification, soil erosion, declining ground water tables, overgrazing, deforestation through fires in the US and Europe, tropical deforestation, massive extinction of species, over fishing, climatic changes, and increasingly catastrophic events like hurricanes and floods.

> *Protecting the environment means safeguarding the continued services of nature that support human life.*

The earth has limits

The planet earth is a closed, a limited system as regards materials and surface areas. Unlimited material growth is therefore not possible, and neither is continuous growth of the human population. Only energy is available with practically no limits in the form of solar radiation and its derivatives, as well as geothermal energy from within the earth. While solar radiation is the driving force for the earth's biosphere, humankind has so far failed to seriously utilize this *"naturally nature-friendly"* source for technical activities. Rather, we lift huge carbonaceous masses from the earth and put them on fire.

To top this scientifically and ecologically foolish approach, a *"triple-loss"* strategy has been pursued in the Ruhr Area of Germany - and in other parts of the world as well: Coal is removed from deep inside the earth, a practice that is still subsidized today. While coal was important for producing steel and fuel for the industrialization of Germany, and for fighting two self-provoked world wars, some of the consequences are these: CO_2 was (and still is) emitted with the well publicized consequences. Some 70'000 hectares of land have subsided by an average of 6 meters or so and continue to sack due to collapsing tunnels - with high ensuing costs for restoring buildings, infrastructures, the bed of the Rhine river and a harbor.

In order to prevent water from flooding the densely populated area that has subsided, enormous quantities of water are pumped continuously, costing labor, capital, material and electricity. Sometimes in the distant future, the quantity of electricity used for this process will surpass the energy gained from mining coal. The subsidy for using coal may thus continue *"ad infinitum"*.

Many examples like this can be found around the world, demonstrating that thinking ahead in systemic ways is not always applied. For instance, virtually no secondary water supply systems were installed in hundreds of millions of buildings around the world during the past 60 years, in order to make use of rainwater for flushing toilets, for irrigating parks, etc. Singapore imports almost all water from Malaysia, and yet the government has steadfastly refused to require appropriate use of the abundant rainfall this country receives.

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[11] Wolfram Mauser, "Wie lange reicht die Ressource Wasser?" (How long will the resource water last?), Fischer, 2007

Ecological Rucksacks and Factor 10

The *„ecological rucksack"* of a product is the total amount of natural material input (MI) – from cradle to the point of sale - for manufacturing a product or making it otherwise available, minus the weight of the product itself [12]. The ecological Rucksack of our artifacts is in most cases *much* heavier than the products themselves. In addition, the lifetime of our products is often deliberately limited, so as to make room for replacements in saturated markets. In other words, the heavy investment of nature is not utilized intelligently. Cars for instance are considered to be quite old after running 250'000 kilometers. Aircrafts, on the other hand, while 1000 times more complex, are used for 1000 times more kilometers (of course with exchanging vital parts in between).

On the average, Europeans consume some 45 *tons* of non-renewable resources per person every year, plus 5 *tons* of biomass, plus more than 1000 tons of water (for drinking water we need only 1.5 tons yearly and in addition we need some 15 tons for hygienic purposes). The Fins consume 100 tons of natural material yearly, the US Americans 85, the Japanese 40, and the Chinese somewhat less with quickly growing tendency.

Typically, less than 5 % of the material resources taken from nature end up in products. The rest becomes waste on the way. More than 30 tons of nature is used to create one ton of car, and for many other machines the ratio is similar. The rucksacks of Information and Communication Technology [ICT] is ten times heavier. The costs to nature for one bank order per internet is equal to that of producing four aluminum cans for beer.

It takes 1000 liter (one ton) of water to produce one kg of bread, and 30 - 40 tons (40 cubic meters) of water for the production of 1 kg of raw cotton in some cotton exporting countries. In addition, many of the products we use have very big appetites for material and energy once they are put to work. Note: There is no service provided in the technosphere without utilizing goods and infrastructures. That means that the rucksacks of services are very heavy, too.

In sum: The *ecological rucksack* of our products, including agricultural products, is enormous. In other words, the resource productivity of our economy is dismally low. Many published practical examples demonstrate, however, that this is not necessary from an engineerings' and consumers' points of view [13].

> *The technical key for improving the protection of the services of nature is to increase dramatically the production and consumption of dematerialized goods and services.*

Eija Koski of Finland has composed a little story to illustrate the real weight of things we use:

> *Mirjas Heavy Morning*
> *Mirja wakes up and puts on her 12.5 kg heavy wristwatch. She slips into her 30 kg heavy jeans, brews her coffee with the 52 kg weighing coffee machine and enjoys the*

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12 F. Schmidt-Bleek, "Der ökologische Rucksack", Hirzel 2004

13 There is a wealth of literature, citing many practical examples and giving practical advice on how to dematerialize existing products and design new ones with increased resource efficiency with much less input of natural resources from cradle to grave. See for example www.Wupperinst.org, www.factor-10.institute.org, www.aachen-foundation.org

refreshing drink from her 1.5 kg heavy mug. After putting on her 3.5 kg weighing jogging shoes she gets on the way to the office on her 400 kg heavy bicycle. Once there, she turns on her computer that weighs several tons and puts in her first call with the help of her telephone weighing 25 kg.
Mirja's day has begun as usual. Except this time it started with ecological rucksacks.

Many experts now agree that at least a *tenfold* improvement of the resource productivity of present-day artifacts is economically [14] and ecologically [15] necessary.

> *The principal eco-economic worries as regards natural materials have little to do with their growing scarcity ("reduced natural capital"), but rather are related to the consequences of their use* [16].

As we have already seen, it is the translocation and extraction of natural resources for feeding the metabolism of the technosphere, and it is their return to the "cradle" in chemically and mechanically modified forms, which are the causes for altering the life-sustaining ecological services. Climatic change is but one typical example. It also demonstrates why the market as now constituted cannot protect us from our ultimately suicidal form of welfare generation.

In the early 90ies of last century, Factor 10 in western countries would have left a factor 2 - 5 in environmental space for developing countries to expand their use of nature on a *per capita* basis. Practical experience in industry indicates that Factor 10 and more can be achieved without jeopardizing end-use satisfaction [17] [18] [19].

A tenfold improvement of the overall resource productivity of the economy will not only preserve natural resources for future generations, it will reduce emissions, effluents and wastes accordingly. And moreover it would have as a "side-effect" a ca. three- to fivefold *decrease* in energy demand [20].

> *A substantial part of our current energy problems could be reduced by dematerializing the economy.*

Dioxins = Sand?

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[14] B. Meyer, "Wie muss die Wirtschaft umgebaut werden? Perspektiven einer nachhaltigen Entwicklung", (How must we rebuild our economy? Perspectives of a sustainable development), Fischer, December 2007

[15] F. Schmidt-Bleek,: "Toward Universal Ecology Disturbance Measures", Regulatory, Toxicology And Pharmacology, Vol. 18, No. 3., Academic Press Inc., December 1993 (Translation of the Wuppertal Position Paper No 1, Mid-1992).

[16] F. Hinterberger and M. Welfens,"Stoffpolitik und oekologischer Strukturwandel", Wirtschaftsdienst 8, 1994

[17] C. Fussler et. al.: "Driving Eco-Innovation", Pitman, 1995

[18] F. Schmidt-Bleek,: "Der Ökologische Rucksack", Hirzel 2004

[19] Ernst Ulrich von Weizsäcker has claimed in a successful book (1995) that "Faktor 4" would suffice, well after Factor 10 had been published, based on a concept developed years before and detailed further at his institute since 1992. He did not consult us and he never justified his choice of factor 4, except to say that it was less shocking to industry than Factor 10.

[20] F. Schmidt-Bleek, "Wieviel Umwelt braucht der Mensch?, MIPS, das Mass für ökologisches Wirtschaften" Birkhäuser, 1993.

The question has been raised before: Does it really makes sense to use mass when comparing the environmental impact potential of goods, processes and services? After all, a ton of dioxin is much more toxic than a ton of sand. Why then accept the "rucksack" or MIPS (see below) as serious measures?

One should distinguish between toxic potentials of chemicals for humans and their environmental impact potential. Dioxins for instance, asbestos, mercury or cadmium – to name just a few that attracted wide attention as "environmental chemicals" – while toxic to humans, have never been a threat to the services of nature. Sand, blown by wind onto grasslands in large quantity, on the other hand, can have serious environmental consequences. Paracelsus, the grandfather of all toxicologists, stated already in the 16th century that *"dosis facit venum"* - the dose makes toxicity.

In order to protect the services of nature in a *precautionary* mode, we need reliable guidance *before* making decisions on procedures, products, processes, systems, infrastructure, and services with a view to their ecological disturbance potential.

Of course, where we have information about the eco-toxicity of specific materials, it obviously must be taken into account. Obvious cases are pesticides, CFC's, Methane, N_2O, and CO_2.

However, in most cases, we have precious little information of this sort because it is scientifically *not* possible to observe, simulate or elucidate, let alone quantify, *all* possible effects *of even one single* chemical on the millions of different targets in the environment. This applies also to CO_2. There are several hundred thousand chemically different emissions and effluents emanating from the technosphere. In addition, many billions of products with ever changing chemical composition are discarded every day as waste. This means that our chances to judge in a *precautionary* sense the ecological disturbance potential due to the eco-toxicity of emissions, effluents and wastes are by definition insufficient and can be seriously flawed. These circumstances are not very helpful either when performing standard "Life-Cycle-Analysis", when attempting to establish cost-benefit analyses, or when design environmental protection strategies for getting closer to sustainability.

Since traditional *"environmental economics"* was, and still is, essentially based on the presumption that emissions, effluents, and wastes are the determining factors for defining the environmental impact potential of human activities, it should perhaps not be too surprising that the advice of economists to governments for approaching sustainability has not been as helpful as one may have wished. Even the recent "*Stern Report*" [21], brilliant as it is and helpful because of its economic insights, is not a reliable basis for approaching sustainability.

In fact, over the last 40 years, OECD countries could only agree on the overall environmental impact potential for a few chemicals, based on their eco-toxic nature. One of the reasons for this is that information on environmental properties of chemicals can be quite contradictory in itself, and cultural differences in judging their importance do exist.[22]

> *Let me repeat: Where reliable information exists on the eco-toxic nature of material, it must be taken into account before making decisions, as well as in strategies*

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[21] Nicholas Stern, "The economics of climate change" The Economic Print Edition, 2006. Compare "research eu", European Commission, No 52, June 2007, Interview with Professor Stern

[22] The author of this paper was prominently involved in developing, and he was later responsible for applying the German Chemicals Act as regards environmental protection. He is often called the father of this legal instrument. He was also involved in developing the EU Directives in this area and he was responsible for developing the testing guidelines for chemicals as head of the OECD Chemicals Division.

designed to improve an existing situation. But whatever measure are taken, they shall not increase the overall use of material input.

There is no reasonable doubt that trans-locating materials from their natural setting and extracting resources for the purpose of feeding the material metabolism of economies, cause changes in natural dynamic equilibria. The same is true when a natural surface with its biological components is denuded, plowed under or sealed. Again, we know not many details as regards the intricate web of causes and effects. But it is clear that the more we disturb natural systems, the more pronounced must be their cumulative reaction. And *all* human activities demand the use of mass, energy and surface area. As these technical encroachments of the earth happen billions of time every day around the globe, and as they are growing in strength and number, a growing shift of *environmental services* is bound to ensue [23].

Neither assessing the ecological disturbance potential of procedures, products, processes, systems, infrastructure, and services by their eco-toxicity, nor by their mass intensity and space needs can be entirely satisfactory from a scientific point of view. Such measures, however, should not be expected as scientifically satisfactory any more than the price is a scientifically accurate measure of the economic value of a product or a service. And the prices of things move the world. And at this moment, hardly any merchandise is traded at a price that includes its ecological impact potential.

The price of procedures, products, processes, infrastructure, and services is the world-wide basis for making choices in production and consumption. As long as these prices do not contain the costs of "damage" imposed on nature, production and consumption cannot be sustainable.

The main purpose of protecting the services of nature is making sure that economic priorities, primarily driven by the price of things and profit margins, must be balanced with an effective measure reflecting their "price to the environment". And while all procedures, products, processes, systems, infrastructure, and services require mass and space, only limited numbers of them involve the same chemicals, or cause the same toxic effects upon the environment.

The physical root cause for the mismatch of our current wealth production and the maintenance of the life-sustaining services of nature, is the production and consumption of enormously resource intensive industrial goods, infrastructures and services.

Dematerialization, therefore, is a necessary pre-requisite for approaching sustainability. But it is not the only one. Improving responsible human behavior and guarding social cohesion are others.

Indicators – making progress toward goals transparent

Statistical indicators are facts-based instruments that simplify the presentation of complex interlinkages. Indicators serve to facilitate, support, steer and monitor developments for reaching desired goals. They can strengthen citizens' capacity to influence goals and activities for approaching sustainability through debate and consensus building, and increase the accountability of public and private policies [24]. Mass media frequently utilize

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[23] F. Schmidt-Bleek, "Wieviel Umwelt braucht der Mensch ?, MIPS, das Mass für ökologisches Wirtschaften" Birkhäuser, 1993. Available in Japanese, Chinese and Finnish editions. English version can be downloaded from www.factor10-institute.org

[24] Istanbul Declaration, June 2007, of the EU, OECD, Org. of Islamic Conference, UN, UNDP, and the World Bank.

indicators as effective *"short-hand"* instruments for informing the public about developments.

Indicators must be readily measurable, easy to apply, and cost efficient in their use. To the extent possible, sustainability indicators should be in line with the usual standards of National Economic Accounting (System of National Accounts; SNA). It seems rather likely, however, that for moving toward *ecological* sustainability, new kinds of data and information must be routinely collected, validated and made (publicly) available.

"Key Indicators" chosen for the various dimensions of sustainable development, and for their interconnecting linkages, must be few in numbers and directionally true, lest they will fail to serve their primary purposes: Namely (1) To guide economic and social policies toward sustainable conditions within the guard rails of the ecosphere, (2) Allowing to assess the distance from strategic goals, and (3) Permitting to compare the ecological performance of economic entities, as well as the environmental impact potential of goods, infrastructures and services.

While nations retain differences in history, culture, in social and in economic developments, all nations must live within the means of *one* planet earth. This implies that indicators for social, institutional and economic developments may vary from country to country. Of course, comparing the economic, or social (or any other) performance among different nations requires the application of identical yardsticks. Environmental indicators, to be certain, *must* be harmonized on a worldwide level for guarding the life-sustaining services of the one and only planet we all share.

As regards moving the economy forward into a sustainable future, the widely used progress indicator GDP is *not* as such a useful tool. It is *not meant* for comparing the *real* wealth of nations. GDP does *not* take into consideration the damages imposed upon the environment by economic activities. Neither does it reflect the wellbeing of people. The Nobel Prize winner Simon Kuznetz, one of the main originators of GDP, stated at its inception more than 60 years ago: *"The welfare of a nation can scarcely be inferred from a measure of national income….Distinction must be kept in mind between quantity and quality of growth, between costs and returns, between the short and the long run. Goals for more growth should specify more growth of what and for what"*. In spite of this, the mass media's use of GDP continues to convey the impression that its upward trend is a *positive* signal for a nation and its future.

Among the many who share the view that GDP must *not* be misused as an apparent measure for welfare, are Hans-Gert Pöttering, the President of the European Parliament, and Jose Manuel Baroso, President of the European Commission. (Conference "Beyond GDP", on 19-20 November 2007 in Brussels). In my opinion, the continuous and unreflective use of GDP has in fact been – and continues to be - a barrier toward making the necessary adjustments of the economic framework for gaining a more reliable future for humankind.

A number of international organizations continue the 30 year old search for more adequate methods and (sets of) indicators for measuring human welfare, and how they can be integrated into public decision making [25] (OECD, Worldbank, WWF, Club of Rome among others). The Policy Department of the European Parliament has proposed to distinguish four different approaches [26].

Because all human activities require the use of natural materials and surface of land, *"interlinkage"* or *"decoupling"* indicators would seem to be unavoidable, constructs that link economic, as well as social and institutional developments to their specific

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[25] W.van Dieren, Ed,: "Taking Nature into Account", Copernicus, 1995

[26] http://www.beyond-gdp.eu

consumption of nature. As explained already in this paper, "decoupling" means the *absolute reduction* of the use of nature for meeting specific human needs.

As regards *ecological* sustainability indicators, two widely applied instruments were independently developed since the early 90ies of last century. One concentrates on the use of land, and the other is mainly concerned with the material productivity for creating welfare and wellbeing. Both are steeped in the knowledge that planet earth has limited resources to offer. They complement each other well and should find application as an integrated approach.

Mathis Wackernagel has developed the *"Ecological Footprint"* concept [27]. The *Footprint "measures humanity's demand on the biosphere in terms of the area of biologically productive land and sea required to provide the resources we use and to absorb our waste. The footprint of a country or region includes all the cropland, grazing land, forest, and fishing grounds required to produce the food, fibre and timber it consumes and to absorb the wastes it emits."*

The "footprint" is an easy to understand picture, showing the *area* that a person, a country or a region "occupies", one of the limited assets available for human development on planet earth.

Having been responsible during 15 years for developing and applying legal instruments for environmental protection, the author of this paper realized in the late 80ies that "*cleaning up*" the economy and protecting the environment from "*dangerous*" chemicals, wastes and emissions *on its output side* cannot by definition constitute a *precautionary* policy. Furthermore, this approach is so cost-intensive, that only rich countries can ultimately afford it. In 1989, the chief economic advisor to president Gorbatchev, Stash Shatalin, told the author: *"My country will first introduce the market economy. Once we are rich as you are, we will worry about the environment – just as you have done"*. George W. Bush, to be sure, is president of the richest market economy. Nevertheless, he claims that setting limits for the emission of CO_2 is too expensive for his country.

Perhaps more to the point than enormous costs:

> *Symptom-oriented policies and measures that concentrate case by case on the reduction of destructive impacts by individual substances or developments cannot constitute a valid policy for improving the basic disharmony between the economy and nature.*

From this insight, the "Factor10/MIPS" [28] [29] concept was developed, taking the input of natural materials [30] into the technosphere as a starting point for estimating the impact potential of welfare creation on the environment [31].

The total mass requirement, TMR, is the sum total of the life-cycle-wide material input into the industrial metabolisms of a country (or of any other defined economic entity) [32]. On

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[27] info@footprintnetwork.org

[28] F. Schmidt-Bleek,: "Wieviel Umwelt braucht der Mensch – MIPS, das Mass für oekologisches Wirtschaften", Birkhäuser, 1993. Chinese, Japanese and Finish Translations have been published. English version available in www.factor10-institute,org.

[29] Declarations and reports published by the Interntional Factor 10 Club starting in 1994. See www.factor10-institute.org .

[30] Non-renewable materials - including energy carriers, biomass, translocated materials, water and air.

[31] F. Schmidt-Bleek and co-workers, Special issue of the Fresenius Environmental Bulletin, No 8, 1993

the *macro-level*, GDP divided by TMR [33] [34] [35], could be considered as a *decoupling* indicator for the environmental impact potential of an economic entity. In order to achieve a Factor 10 within 30 years, the material productivity would have to increase (the TMR lowered) by 7.7 % per annum, within 50 years by 4.6%, and within 100 years by yearly 2.3 % [36]

In order to move toward a more sustainable civil society, all its goods, infrastructures and services must be designed, manufactured, transported, stored, used and discarded with the smallest possible amount of material (as well as land surface) consumption. The same holds for the generation, transportation, storage and application of energy.

For this to be achieved in practice, appropriate indicators must be available on the micro-level (the level of individual products and services). A first step in this direction was to define the "*ecological rucksack*" of a product as described already. Rucksacks can be taken as the environmental equivalent to the market price of a product (from cradle to the point of sale). However, neither the rucksack nor the market price of a product indicate the *"full costs"* for extracting value or obtaining service from a good, because using a product usually requires the input of additional money and resources.

For this reason, MIPS, the *life-cycle-wide* Material Input Pro unit deliverable Service (extractable value) from a product was developed [37]. When achieving a decrease in MIPS for a technology-derived service (e. g. transporting a person one kilometer by car), one has a direct measure for the potential to decouple this service from the consumption of nature. One can also compare the environmental impact potential of diverse products directly with those that have an equivalent functional purpose. For instance, one can compare cars from different companies with each other or one can compare the environmental quality of bicycles, cars, trains, and airplanes [38], [39]. When doing so, the widely held opinion on the superior ecological quality of cars propelled alternatively by electricity or liquid fuel, becomes rather less convincing. The reason for this can be comprehended when comparing the rucksack of a hybrid car with that of a "normal" automobile: 20 kg more copper in a car amounts to the investment of 10 tons more nature.

Most importantly, however, one can use MIPS to *design* and *manufacture* life-cycle-wide dematerialized technical solutions for meeting specific needs of people. MIPS could also be used as a universal *label* for indicating the material efficiency of goods and services.

In my opinion, it would behoove a service oriented society well to indicate prices for goods to potential customers at the point of sale in terms of COPS, the life-cycle-wide costs per unit service.

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[32] S. Bringezu, "Ressourcennutzung in Wirtschaftsräumen", Springer, 2000

[33] S. Bringezu,:"Erdlandung", Hirzel, 2004

[34] A. Aadrianse, et al.: "Resource Flows, The Mterial Basis of Industrial Economies", World Resources Institute, Wuppertal Institute, Netherlands Ministry of Housing, Japan National Institute for Environmental Studies, Washington, D. C., 1997

[35] : http://epp.eurostat.ec.europa.eu: Estat-environment@ec.europa.eu

[36] Numbers provided by Dr. Jola Welfens, Wuppertal Institut

[37] F. Schmidt-Bleek,:"Das MIPS Konzept – Faktor 10", Droemer, 1998

[38] M. Ritthoff et. al., "Calculating MIPS, Resource Productivity of Products and Services", 2002, www.wupperinst.org

[39] There will be a new Finish report available soon, in which MIPS for common technical modes of transport are compared. Contact: m.l@iki.fi.

The *resource productivity* for obtaining a service by using a product (a "service delivery machine") is represented by the inverse of MIPS, namely S/MI. MIPS can be lowered – the resource productivity S/MI improved - by technical means, for instance by lowering MI through design or by increasing S by improving the longevity of the product, or both at the same time. But consumers can also increase the resource productivity by keeping a product longer in use. For example, if a hotel guest uses the provided towels for three days instead of for one day only, she or he has increased the resource productivity for this service by a factor 3. Such improvements cannot only be accomplished by a split second decision, they also save money. In this case the saving goes to the hotel management.

Walter Stahel has proposed to use the indicator Euro/Kg in order to gain a first and readily computable indication for the resource efficiency of products [40]. With this indicator, the trend of the price change of a product vs. the change in resource consumption can give a rough first indication of a dematerialization trend. If the MI from cradle to the point of sale [41] is used for computing kg, this indicator becomes considerably more reliable.

What is now sorely needed in my opinion, is a very high level –"*Heiligendamm-type*" – impetus by the G8 nations, perhaps together with China and other major economic actors, to move the completion of harmonized key indicators for approaching sustainability forward. Once available and agreed to, such indicators should be routinely used by governments and enterprises for reporting on their achievements or otherwise.

Based on available information, the worldwide per capita consumption of non-renewable material resources should be reduced to 5 – 6 tons by 2050, including the rucksacks of the materials involved. Included in this target is the quantity of fossil energy carriers, which amounts to .54 tons of carbon per annum, once the target of 2 yearly tons per capita CO_2 emission from technical sources has been reached. These goals should be independently reviewed, and when needed be adjusted and refined in the light of growing experience and a changing world population.

The *footprint concept* has shown that *per capita* a space of 1.8 hectare on a global scale (1.8 gha) is available. At this time, however, the world-wide average footprint per person amounts to 2,2 gha, - an obvious ecological overshoot that would only be tolerable, if more than 2,5 planets earth would be available.

As stated before, the footstep and the dematerialization concepts should be incorporated into one coherent set of indicators for approaching ecological sustainability. The reader may be reminded at this point again that the *"environmental guardrails"* form the limits within which economies and social systems must be accommodated.

The new technology

Practical experience in industry has in many cases shown that dematerialization can be achieved by factors 2 to 4 with state of the art technology and with investments that can

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[40] Walter R. Stahel, :"The Performance Economy", Palgrave-macmillan, 2006

[41] MI from cradle to point of sale = ecological rucksack plus the own weight of the product.

regularly be retired within a few years [42]. Dematerializing *existing* products is the obvious first step for approaching sustainability by technical changes.

The main technical steps are:

- Exchanging materials with high rucksack factors (MIF) for those with lesser "environmental weight". For instance replacing copper (MIF=500) or aluminum (MIF=85) with PVC (MIF=8) in window constructions;
- Adapting capacity to real needs. For instance, using small cars and buses instead of large ones, or leasing vehicles or goods by demand only;
- Increasing the longevity and the length of use of products;
- Developing new technical systems' solutions for satisfying needs.

The biggest gains in saving resources are reachable through taking a systems' approach. For instance, Stephan Wrage has re-invented the use of wind for propelling cargo ships over the oceans by means of "SkySails" [43]. Through the use of a (now available) special enzymes, washing temperatures for textiles can be lowered to room temperature. Beyond that, however, the application of self-cleaning surfaces (micro-technology, lotus effects) can eliminate cleaning needs altogether, saving billions of tons of water and large quantities of detergents and energy worldwide.

> *"Eco-Innovation means 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, and surface area) per unit output, and a minimal release of toxic substances."*
>
> EU Eco-Innovation Panel

In Germany, three prizes for excellence in innovating resource efficient solutions exist: Private: www.Aachener-stiftung.de, State of Northrhine Westfalia: www.efanrw.de Federal: simon@materialeffizienz.de .

As an ANNEX to this paper I have listed the properties relating to the eco-efficiency of products. When considering the dematerialization of services, "low-MIPS" products (and where possible "low-MIPS" infrastructures) should be employed.

Lowering CO_2 emissions or dematerializing cars?

We have already noticed that it is *in*sufficient to compare the gasoline consumption of a car with that of a competing product, because the fuel consumption is only part of the life-cycle-wide MI for using a car. Typically, the fuel consumption is in the 15 to 20% range of MI. If one takes the needed infrastructure into consideration, the contribution of the fuel to the overall mass input for using a car falls below 2%.

Reducing the fuel consumption of a car from 5 liters to 4 pro 100 km is equal to a 20% saving in fuel. Since the fuel consumption contributes 20% of the total amount of mass consumed for using a car, the actual saving of natural material amounts to 4%, not counting the infrastructure. Is this worth the huge technical and financial effort, the

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[42] F. Schmidt-Bleek et. al, "Ökodesign", Austrian Chamber of Commerce, WIFI 303, 1998; and "Der ökologische Rucksack", Hirzel, 2004

[43] "Turn wind into profit", www.skysails.de

pervasive advertising and mass media campaigns that have been launched recently for using less fuel? When considering that the fuel consumption of cars is but a contribution to the overall CO_2 emission from the technosphere - albeit a noticeable one - the 4% mentioned above becomes even less significant. Beyond this, even though CO_2 is an important part, it is *not* the only technical emission resulting in climatic changes. For instance, the emission of N_2O resulting from fertilizing fields is similarly significant for climatic changes as is CO_2, and the methane emissions from billions of cows raised for beef production is considerably higher. This reduces the significance of fuel saving still more.

As regards limiting the speed of cars to 130 km per hrs on super highways, the above numbers indicate that gains with respect to fighting climatic changes would not be significant. However, there may be other arguments that can support such a limit, like safety, for instance. It would be interesting to see a fair assessment, using MIPS, of all statistically known facts, and consider also the additional costs in money and resources for the enforcement of various options.

„Biodiesel"?

George Monbiots reports: [44] Road transport in the UK consumes annually close to 40 million tons of petrol products. The total waste cooking oil in UK amounts to about 100'000 tons yearly, sufficient to meet one 380th of the actual fuel demand. Of course, conversion of other waste products into sources of useful energy should not be neglected.

The most productive oil crop that can be grown in the UK is rape. The average yield is between 3 and 3.5 tons per hectare. One ton of rapeseed yields 41,5 kg of biodiesel. So, every hectare of arable land could provide 1.45 tons of transport fuel. This means that running UK's cars, buses and lorries on biodiesel would require 25.9 million hectares. However, there are only 5.7 million hectares of arable land available in the UK. The EU target of 20 % biofuel consumption by 2020 would therefore require the use of almost all of the cropland available in the UK for rape production.

"Biofuel for cars, or food for people, that is the question"!

In addition, the rucksack of biofuel from rapeseed is considerable: The land is prepared and seeded mechanically, transportation needs for harvesting, to the mills and for other purposes, material and energy input into the production of seeds, of oil and thence biodiesel, utilizing less than 10 % of the biomass produced, and an erosion rate some 15 times higher than the natural loss of soil, make up an ecological rucksack *far* bigger than that of fuels derived from fossil energy carriers.

Just three more points should be made for indicating how short-sighted and non-systemic the technical use of planted biomass can be: In 2005, the Friends of the Earth showed in a report, how palm oil production - in part used for biodiesel - is threatening the survival of the Orang Utan in Malaysia [45]. According to the Wall Street Journal (November 2007), the price of maize in Illinois, USA, has risen by 40%, and that of soy beans by 75%, compared to 2006, because of rising demand for biofuels. And as already indicated above, according to Nobel Prize Laureate Crutzen from Mainz, the actual climate change potential of N_2O, which stems from the decomposition of nitrogen containing fertilizers – used also to push rape and other crop production -, is equal to that of technical CO_2 emissions.

And then there is this question: Is civil society really ready to support the continued use of transportation modes from a bygone era with huge agricultural subsidies?

On the average, biomass makes up about 10% of the total material use in industrialized countries today. The earlier dreams of some well intended people, and in particular

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[44] G. Monbiots,: "Heat", Penguin, 2006

[45] Friends of the Earth et. al., ; "The Oil for Ape Scandal: How Palm Oil is Threatening Orange-Utan Survival", September 2005

economists, to replace all non-renewables with biomass („strong sustainability“) will remain technically impossible and ecologically questionable for a very, very long time, if it ever comes true. One can only hope that in the future, single-minded ecologists will no longer be successful in shaming policy makers into scientifically senseless, mono-linear, and purely symptom-oriented solutions without systemic justification. Using the indicators indicated above, defensible proposals for systemic change can and should be elaborated for moving toward ecological sustainability.

Of course the huge hullabaloo about CO_2 emissions and the billions of Euro spent in lowering car emissions seem justified, because they are related to climatic change. And who could deny the potentially disastrous consequences of the man-made change in climatic conditions?

> *What I am trying to communicate is that the current efforts of reducing CO_2 are not imbedded in a systemic strategy to protect the services of nature, namely an overall far lesser consumption of nature, including materials, land surface, water and even oxygen and nitrogen gases, for the services we need and want to enjoy. What we witness is yet another single-minded effort to fight one more symptom resulting from the basic mismatch between our economy and nature. In order to reduce a specific emission, an unknown quantity of nature and money is being invested in technologies toward this one goal, with largely non-considered and unknown ecological consequences. Systemically, this is not different from fighting the emissions of cadmium, asbestos or SO_2. The "chemical of the week" has been replaced by the "chemical of the century".*

Instead of offering incentives for inventing transportation technology that can fulfill the statistically well-known needs at much less costs to the environment, the public and private decision makers are apparently satisfied with the chances to generate new fuels and new machines for propelling vehicles with essentially the same characteristics as today (e.g. size, weight, power). Carmakers even offer rebates to consumers in the name of protecting the environment for getting rid of their "old" cars and buying new ones with less fuel consumption. In other words, they are advising consumers to throw away investments of natural resources and pay for the consumption of more for the sake of emitting less of the *"chemical of the century"*.

I am prepared to show that inner city mobility by cars could be dematerialized by a factor 20 or more while meeting the statistically known demand.

> *Meeting present demand with "ecologized" old technology can be a stop-gap measure on occasion. However, this approach cannot lead to a future with a future. What is needed, is fulfilling wants of people for services with the smallest possible quantity of nature, from cradle to grave.*
>
> *Note: If all fossil related CO_2 emissions were stopped tomorrow, neither climatic changes nor the continued growth of other pervasive consequences of the parasitic nature of our economy would be eliminated.*
>
> *Only strategies aiming at eradicating the economic and technical root causes of our ecological predicaments, are suited for enhancing the chances for human survival on earth.*

What is most discouraging to me about the current public debate on climate change, is the fact that neither Al Gore nor any government has as yet given any indication for having understood that sustainability is *not* reachable without adjusting the framework conditions of our economy, and in particular the price structure for goods and services. Eco-intelligent production and consumption must be profitable, there will hardly be sustainability otherwise. And since *only* governments are empowered to achieve such changes, the current debate and the measures taken, cannot lead us to a sustainable solution of our problems with sustainability.

The rich and the poor

Damages to services of nature can be inflicted by every human being. But it is the "modern", the powerful and rich countries that exhibit the greatest hunger for raw materials, energy, and land to underpin their prosperity, their economic and their military power. This is not a phenomenon of modern times only. But ever since the industrial revolution, the trend to subjugate nature has accelerated enormously. The citizens of early-industrialized countries are therefore the greatest beneficiaries in terms of building healthy, safe and convenient lives at the expense of ecological stability. But the other people around the globe have to *"co-suffer"* the consequences, without the same benefits.

For many centuries we in the west have profoundly ignored the wisdom that a parasite can only survive *„so long as it does not kill its host"* [46]. We were convinced that our science, our technology, and in particular our economic genius, could create limitless material wealth for all, and growth could be made to last forever. To fulfill the dream of mastering the earth, everybody could remove and use resources at will and turn it into money. Materials were trans-located in ever growing quantities and surfaces were sealed wherever it seemed convenient.

Though the *ecological footprint* of humankind is already beyond the ecological level of risk, only 20% of the world population receives the benefits promised by the West's economic model and the advertising industry. Some, like the Chinese, Indians and Brazilians are working hard and successfully to catch up. They, too, want a place in man-made heaven. But more and more people are left behind in growing poverty, "co-suffering" the ecological consequences caused by the rich. "Factor 10" is an attempt to correct this situation.

> *If all people on earth were to partake in the western way of life, more than two additional planets earth would be required as resource base* [47]

Environmental protection – today and tomorrow

Traditional environment protection began some 40 years ago as an add-on to the economy. It first responded to the occurrence of individual acute problems, particularly problems arising from toxic substances that escaped to the environment, or were deliberately introduced into the environment for various reasons (e. g. pesticides).

Consequently, *„environmental technology"* is for the most part a sophisticated clean-up system, a kind of barrier for „dangerous substances" between our economy and nature. The old environmental policies have developed into a jungle of legislation, into staggering costs for cleaning up emissions and contaminated soil, into enforced recycling of worthless waste. And it has created an army of bureaucrats.

While this approach has helped to clean up the air and improved water quality, it is by definition *not precautionary* in nature and it can contribute very little for promoting *sustainable conditions*.

What the world needs now is a policy focusing on protecting the very basis of life. This does *not* mean replacing the first approach to environmental protection, it means enlarging

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[46] Of course, the planet earth will not "die" if we continue our economic pursuits unchanged. As indicated before, the life-sustaining services of nature will change and fade away. *"The final irony would still be hers"* –namely that of the earth (Auel).

[47] Umweltbundesamt Berlin, "Nachhaltiges Deutschland" Erich Schmidt-Verlag, 1997.

its scope. To become operational, the new phase has to move its attention and intervention forward to the input side of economic activities, so that preventive actions can be taken before the processes of production and consumption starts [48]. The net cost for this undertaking promises to be *far more* moderate to society than the 1st phase of environmental protection.

Whereas the focus of the 1st phase was dealing with selected symptoms, the 2nd phase will be governed by a *systems approach*, aiming at eradicating the *root cause* for the current incompatibility of the human economy with the laws of nature. Without taking this task very seriously, the chances that the children of our children and theirs can continue to enjoy a worthwhile life may be in question.

Get the prices right!

The question arises, what was and continues to be the driving force behind developing technologies that consume more natural resources than is needed for meeting human wants?

Traditionally, the economic assumption has been that there exists no limit to natural resources and that where a scarcity arose, technology could fill the gap. Material growth, in other words, seemed possible without end.

What began thousands of years ago as a struggle for freedom from hard labor by inventing more and more sophisticated machines, has turned into socially unacceptable unemployment in industrialized countries. What has started as a fight by humankind to free itself from the "*hardships of nature"* ten thousand years ago, has turned into the *"ecological overshoot"*, the destruction of the life sustaining services of nature and the increasingly violent game of nature in destroying technical achievements.

While labor contributes 10 times less to productivity than energy, it is taxed 15 times higher, including overheads, in Germany as an example. In other words, the price of labor is too high compared to that of resources: An unfortunate invitation to throw people out of work and continue wasting nature.

> *As long as eco-conscious production and consumption is not profitable, sustainability will not be reached.*

In Germany, some 20% of the resource input costs in the manufacturing sector could be lowered without negatively affecting the output. That is equivalent to more than 170 billion Euros per year in a country that can claim to be export champion even without having much in terms of domestic natural resources. And on top of saving resources, it seem likely that more than one million new jobs could be created when going in the direction of profitable dematerialization [49] [50].

> *The economic root cause for the continued destruction of the life-sustaining services of nature is the relatively low prices of natural resources that do not include the harmful consequences of their use.*

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[48] Recommendation of the International Factor 10 Club, 1994 - 1997. See www.Factor10-institute.org

[49] B. Meyer, "Wie muss die Wirtschaft umgebaut werden? Perspektiven einer nachhaltigen Entwicklung", (How must we rebuild our economy? Perspectives of a sustainable development), Fischer, December 2007

[50] Hartmut Fischer et. al., "Wachstum und Beschäftigungsimpulse rentabler Materialeinsparungen", Wirtschaftsdienst, Issue 4, April 2004.

We are facing now a serious dilemma: On the one hand we *cannot* afford to lessen our efforts in eliminating the specific causes responsible for climatic change. In fact, we should eliminate 50 - 80% of the CO_2 emitted from technical sources as quickly as possible in order to avoid the scientifically predicted consequences of not doing so.

On the other hand, we have to begin *without delay* eliminating the *root cause* for the potentially deadly mismatch between our economic activities and the stability of nature. As discussed before, this is unavoidable for reducing already known and future consequences of excessive use of resources like, for instance, sinking water tables, lowering photosynthesis through sealing surface areas, erosion, decreasing water flow in rivers, and the expansion of desserts.

> *I will now propose a strategy which I believe gives us a chance to satisfy the need of reducing CO2 emissions and simultaneously the need to lower the overall resource consumption: This strategy consists of shifting current taxes* [51] *and overheads on income to the carbon contained in all fossil energy carriers.*

In all countries, *energy carriers* make up a considerable part of the total material fluxes through the economy. Additionally (e. g. for social equity reasons), one could shift private payments for retirement, health insurance, and basic insurance also into the carbon tax. In this case, the private payments for receiving potential benefit would have to be taken over by the authority receiving the carbon tax.

The total amounts and the sources of present levies and taxes on income are known, and so are all payments for social security as well. Since the total consumption of fossilized carbon is also known, and since importers and domestic providers of fossilized energy carriers are relatively few, differentiated, balanced and socially just switchover operations of payments should be feasible.

Representatives of the nuclear power industry like to point out that electricity from their installations is free of CO_2 emissions. *First*, this is not a completely honest statement, because all the energy that was needed for innovating nuclear power, for producing nuclear fuels, as well as the energy needed for constructing considerable parts of their plants, for their maintenance and repair, and for the distribution system of electricity, was and continues to be derived from fossil energy carriers. And *second*, and more importantly, the *resource productivity* of electricity from nuclear power plants is roughly equivalent to that of electricity produced in power plants burning hard coal [52] (not counting the resource needs for nuclear waste disposal, which can be huge).

For avoiding ecologically unjustifiable advantages of nuclear power, present taxes, levies and other payments could be shifted onto taxing the electricity output of nuclear plants as well, equivalent in magnitude to the taxes imposed on the carbon consumption of coal fired power plants with comparable production capacity.

Other taxes on resources, like land occupying tax, taxes on the extraction of water, taxes on metals and the likes could then be phased in later.

Several points are worth recounting here: (1) To some degree the details of switching over taxes and other expenditures to the use of natural resources will reflect national and regional needs and conditions. However, to the extent possible they should be internationally harmonized, at least among EU member states, in order to avoid non-tariff barriers to trade. (2) The tax rate should reflect the rucksack of the resources involved and/or known eco-toxicities. (3) The switchover should be cost-neutral. (4) For a number of reasons, the word *"Eco-tax"* does not evoke very positive responses in civil society.

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[51] On the 25th of October 2007, the French President, Nicolas Sarkozy, signaled his support for a carbon tax in return for cutting social charges (Financial Times, 26.10.07).

[52] F. Schmidt-Bleek, "Wieviel Umwelt braucht der Mensch?", Birkhäuser, 1993

Perhaps a more agreeable description for the switched-over funds would be *"resource-taxation"*.

> *The term "eco-tax" has gained a questionable reputation. For many citizens, this term implies new taxes for enlarging the coffers of government without transparent aims.*

There is a host of additional policy options that can support the saving of natural resources: e.g. Allowing only subsidies (including agricultural subsidies), that contribute to the saving of natural resources; the review and adjustment of technical norms and standards causing unnecessarily high use of nature (particularly in the building and food and beverage industry); demanding proof of feasible resource saving before approving plans for building, re-building and repairing constructions and infrastructures; reviewing the freedom of moving and investing capital world-wide at will; changing the short term planning of industrial management; and considering the environmental implications of personal property rights etc. ("Carnoules potentials" [53]).

Considering the complexity of modern economies, it would seem realistic to expect that a mixture of measures and instruments will be developed and applied for increasing the resource productivity of civil society. In the Annex to this paper I list serious challenges and instruments to meet them.

Choices

Sustainability is indivisible
Because the services of nature
And her destructive powers
Are shared by all

Humankind would seem to have two major choices at this stage: Either we continue business as usual and spend whatever money we have to fight the mounting ecological consequences of our wealth-generating machine. Since this fight will also require increasing quantities of natural resources, we will create a classical spiraling up effect towards a frightening future. Forecasts of the insurance business can serve as a rough guide for what is likely to come in the foreseeable future. Of all we know, the point of no return will be upon us during the first half of this century.

The *second choice* we have is to accept that systemic problems demand systems solutions, solutions that can prevent future problems, solutions that are directed at eliminating the root causes of today's disharmony between the human economy and the ecosphere, solutions that are germane to all products, processes, services, systems and procedures, now and in the future.

This *second choice* demands that we accept the failure of our current economic ways that cannot lead us to sustainable conditions, and that we therefore also accept the need to make adjustments. We must get beyond accepting GDP as *the* measure of success and we must question the societal value of news from the stock exchange. We must adjust our wealth and prosperity-generating machine to operate within the guardrails of the laws of nature.

As discussed before, infinite *material* growth of the technosphere on earth is *not* possible without risking the survival of humans on this planet. And infinite growth of GDP and stock market indices are, from an natural science point of view, either misleading or have little substance, or both.

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53 F. Schmidt-Bleek, „Nutzen wir die Ede richtig?", Fischer, 2006.

Infinite material growth of the technosphere is not possible without risking the survival of humans on planet earth.

It is astounding to note the claim of some governments that they are seriously working at this time toward ecological or any other sustainability. My observations tell me that this is simply untrue. They continue fighting symptoms as before, instead of making systemic adjustments to the economic framework. For instance, in order to create new jobs, they support increasing consumption and exports. Increasing production and consumption of material intensive goods and services, however, means higher subsidies by nature and less stability of its services. As regards ecological problems, *"advanced"* governments fight hard for lowering the emission of CO_2. Little do they seem to know or care that even if all CO_2 caused by the oxidation of fossil carbon would be eliminated, sustainable conditions would still not have been reached. As discussed before, these fights for correcting symptoms cannot serve as blueprints for approaching sustainability.

Sustainability is not attainable without governments making the necessary framework adjustments in order to get the price structure on the market right.

And beyond adjusting economic and fiscal conditions in their own country, governments must forge international harmonization of the approaches toward sustainability. The summit at Heiligendamm in 2007 was a remarkable example of what must happen. It must become the most prominent task of international politics to de-couple economic performance from the use of natural resources as quickly and as thoroughly as possible.

Europe's historic mission

The EU problem
Is the absence of a clear
Social and political message.
Harald Tribune, 24. Oct. 2007

It is high time to stop inflicting harm on ourselves and on people in other parts of the world by selfishly overusing the resources of the earth. The time has come to share the riches of our common planet fairly among all people. The time has come to stop fighting temporary phenomena like terrorism with resource intensive restrictions of personal freedom and wars like that in Iraq, that has already cost the resource equivalence of building shelter for one billion people. And only by dematerializing the economy can we become free of coercion by unfriendly countries whose' power rests with our stubborn dependence upon outdated technologies.

It seems to me that it is Europe's historical chance and responsibility to construct an eco-social market economy and demonstrate to the rest of the world that happiness and prosperity for human beings can be achieved far into the future in co-evolution with nature. Europe may be the only region of the world where the necessary experiences, both shameful and brilliant, have sprung from its history and where the human and technical genius exists to lead humankind toward a more sustainable future.

The question is: Will we have the courage to dare inventing a new era without precedence ?[54]

I close with the poetic wisdom of Jean Auel, who wrote the following lines in her book "The Plains of Passage" some 25 years ago:

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[54] This question was the incentive for Klaus Wiegandt, a former CEO of a global enterprise, to finance a series of 12 books on the subject of sustainability and bring their content among people by having their content translated into educational material. His ground-breaking efforts are supported by the ASKO foundation and the European Academy of Ötzenhausen.

Unspoiled, undamaged, ruled by her own natural law,
And subject only to her own will –
And the great void whence she sprang -,
The great Mother Erath took pleasure in creating and sustaining life
In all its prolific diversity.
But pillage by a plundering dominion, raped of her resources,
Despoiled by unchecked pollution,
And befouled by excess and corruption,
Her fecund ability to create and sustain could be undone.
Though rendered sterile by destructive subjugation,
Her great productive fertility exhausted,
The final irony would still be hers.

ANNEX I

INSTRUMENTS FOR DRIVING THE MOVE TOWARD SUSTAINABILITY

A MARKET USE	*Such as:* Shift of taxes and charges on income to natural resources („resource taxes"); Eco-taxes and charges; user charges; deposit-refund systems; targeted subsidies; removal of perverse subsidies.
B MARKET CREATION	*Such as:* Property rights; research support; tradable permits; tradable rights; „green" programs; environmental investment funds; seed funds and investments; incentives; purchasing priorities.
C COMMAND and CONTROL	*Such as*: Standards; norms; bans; permits; quotas; zoning; liability systems; legal redress; special legislation.
D PRIVATE and PUBLIC SECTOR ENGAGEMENT	*Such as:* Public participation; decentralization; information disclosure and provision; educational and training programs; eco-labeling; voluntary agreements; public/private partnership; indicators; sustainability goals.
E GOVERNMENT PROVISIONS	Such as: Infrastructures; basic services;(eco)-industrial zones; protected areas; protected recreational facilities; eco-system rehabilitations.
F INTERNATIIONAL AGREEMENTS	Such as: Kyoto Protocol, Montreal Agreement

ANNEX II

KEY CHALLENGES FOR MOVING TOWARD SUSTAINABILITY

FACTS	CHALLENGES	INSTRUMENTS
1. **Climatic changes have begun.**	**By 2050 or earlier** **Reach worldwide 2 annual tons per capita emission of CO_2 from technical sources (= .54 tons of Carbon)**	**A., B., C., D., E., F.**
2. **Western life styles destroy the life-sustaining services of nature. Globalizing these life styles would require several planets earth as a resource base. Raw material prices are rising sharply.**	**By 2050 or earlier** **Reach worldwide 5 – 6 annual tons (gto) of non-renewable material resource consumption (including rucksacks) per capita, and 1.8 ha per capita (1.8 gha) footprints, based on world population in 2000.**	**A., B., C., D.**
3. **Current economic framework conditions favor waste of resources and unemployment.**	**By 2015 or earlier** **"Get the prices right".**	**Primarily A., Shifting taxes and charges from income to natural resources.** **B., C., D., E., and F must also be considered.**
4. **Knowledge on**	**By 2008** **Establish strong**	**B.**

macro-economic consequences of far-reaching fiscal and other reforms is currently insufficient.	**interdisciplinary research program to investigate the macro-economic consequences of change.**	
5.	**Start 2008**	**D. , F. , D.**
With the possible exception of climatic changes, civil society is not sufficiently aware of the ecological overshoot by "modern" life-styles	**Inform civil society and establish broad educational programs on all levels on the reasons for the current disharmony between the economy and the ecosphere, about its consequences, and about options to get things right.**	
6.	**By 2011 or earlier**	**D.**
Practical sustainability targets and key indicators have not as yet been set and agreed to.	**Agree on short and long-term ecological and other sustainability goals and key indicators. Harmonize environmental targets and indicators internationally.**	
7.	**By 2008**	**C**
So far governments have failed to give strong signals to the market by procuring dematerialized goods, infrastructures and services.	**Make responsible purchasing of dematerialized goods, infrastructures, and services mandatory for all public authorities. Give preference to import goods from countries with small footprints.**	
8.	**By 2011**	**D.**

Relevant data and information for practical steps toward sustainable production and consumption are not readily available to SME's and the public.	**Establish publicly accessible registry that collects and validates information and data on dematerialization and ecological food steps.**	
Perverse subsidies are still abundant, that counteract efforts to reach sustainability.	Review all subsidies and eliminate or adjust those, that lead to increasing imports, exports, extraction, production, or consumption of natural resources	A.
Water shortage, erosion, forest destruction, and desertification have reached critical levels and are on the rise in many parts of the world.	Seek international agreements for improvement. Impose custom duties for imports where necessary. Refund to poor countries under condition that ecological improvements are demonstrably undertaken.	A., F.
Yearly reports by governments and enterprises should contain statistical information on the total resource requirement, and on the resource productivity of individual goods, infrastructures, and services	Design basic report format, using key indicators as a basis	C.
Present short-term profit and reporting policies in the	De-celerate expansion of production and	C

industrial sector are counterproductive to approaching sustainability	consumption. Cap salaries of CEOs to 35/1 (highest/lowest in company). Pay boni only at end of contract.	
The content of most advertisement is obstructing the needs for approaching sustainability	Impose tax on advertisement and use revenue for publishing supplementary information; increase price for paper used for advertisement.	A

Eexperiences with the privatization of essential services and forms of life show, that social injustices and ecologically questionable practices can ensue.	Official statistics, water resources, biodiversity, seeds, all froms of life, mineral reserves, and other public goods must not be privatized.	**C.**
Development aid with the potential to counteract sustainability is still being offered.	Instead of supporting yet another huge dam project (e.g. Worldbank in Laos), every effort should be made to support decentralizing power production, saving energy, and dematerializing infrastructures, goods and services.	**C.**
Currently, the international flows of capital are essentially out of the control by any democratically legitimized government.	Make government control of international capital flows mandatory.	**C.**
Standards, norms and security regulations that require excessive use of natural resources are common.	Review all nationally applied/enforced norms, standards and security regulations as regards their resource intensity. Eliminate or adjust all that show excessive resource demand.	**C.**
Professional skills and competences for a more	Develop scenarios for future needs of skills and key competences	**B., D.**

sustainable future have not as yet been systematically identified.		
Governmental and private decision making is not sufficiently responsive to the complex needs of approaching sustainability	It must become mandatory that governments consider the impacts on all dimensions of sustainability before reaching a decision.	**D. A.**
Geo-engineering projects are currently researched and considered by certain countries.	Geo-engineering projects with the potential to impact other countries must be controlled by the Security Council of the United Nations.	**F.**

ANNEX III
Properties of products that need be considered for sustainability

* Indicates that MIPS capture this property.

MANUFACTURING
* material intensity (materials, processes)
* energy intensity (materials, processes)
* renewable resource inputs
* useful material outputs
* waste intensity
* refusal rate
* transport intensity
* packaging intensity
hazardous materials

USE, CONSUMPTION
* material throughput
* energy input
* weight
* self control, self optimization
* multi-functionality
* potential for subsequent (different) uses
* potential for joint (e.g. several families) uses
size
area coverage
dispersive hazardous material outputs
* ***longevity***
  * *availability of spare parts for extended time period*
* *surface properties*
  * *anti-corrosivity*
  * *repairability, exchangeability of parts*
  * *structure and ease to dis-assemble*
  * *robustness, reliability*
  * *likelihood of material fatigue*
  * *adaptability to technical progress*

AFTER FIRST USE
* *low MIPS collecting and sorting potentials*
* *re-usability*
* *usability for different purposes*
* *re-manufacturing potential for same use*
* *material composition and complexity (ease of re-cycling for chemical/metallurgical reasons)*
* *re-cycling potential of parts and materials for same or other uses*

DISPOSAL
* combustion potential (usable energy outputs)
potential for composting
impact on environment after disposal

CV
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