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"Approaching and Measuring Sustainability"

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Content of the Schmidt-Bleeks' paper:

"Approaching and Measuring Sustainability"

APPROACHING AND MEASURING SUSTAINABILITY

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Without dematerialization,
neither sustainability
nor long-term growth
can be expected

APPROACHING SUSTAINABILITY

Where We Stand

The principle of sustainable development has now been widely adopted. It has also become international consensus that sustainable solutions require that ecological, social and economic development be made mutually supportive at the front-end of the cycle when the goals and policies of society are being set, not at the tail-end after society has already incurred the damage costs of unsustainable development. However, in the political arena and in business one still notices serious shortcomings in applying this principle.

Political reasons for this shortcoming include the lack of experience among those responsible for policies in scrutinizing their intentions with respect to the requirement of satisfying *all* dimensions of sustainability. While it is common procedure for example to review all intended ordinances and laws with regard to their financial and legal implications before they are promulgated, this is not the case as regards their impact upon attaining sustainability. Thus, recent changes in fiscal and social policies in Germany and France - considered to be of basic importance for economic long-term growth - were designed without regard to their ecological impact. The lack of operational indicators for designing durable policies and monitoring their consequences is evident.

Time horizons of environmental changes are usually much longer than those for planning and executing actions within our economic and the political framework. And environmental disasters may occur or develop in far away places. What does a change in the direction of the gulf stream for instance mean to a middle-European compared to the threat of losing her or his job?

On the ***socio-scientific*** side, no consensus on *key social goals* exists today. True, politicians and the World Bank talk about eradicating hunger. True, the western world is deeply troubled by child labour and child soldiering. True, the World Health Organisation has specific goals for the health of all people. But these are goals and concerns for the less privileged and are not on the mind of people in "developed" countries when discussing social achievement goals for their own future. Basic needs are no longer the issue here. Advanced technology and safe conveniences in housing, mobility, shopping, leisure-time, advanced education and safe working conditions with commensurate income and comfortable early retirement are among the issues discussed here.

So, while it may be rather unrealistic to expect that globally harmonized social goals can be agreed upon in the foreseeable future, it would seem feasible to reach understanding of some key social targets on the national or regional level.

The EU is currently attempting to develop a minimum set of key social indicators for the Member countries. For instance, in March 2000 the Lisbon European Council formulated strategic social goals to be reached by 2010: The percentage of people employed should increase from 61% in 2000 to 70% by 2010 and the employment level for women should rise from 51% to 60% during the same period of time [1].

With respect to the ***root* causes for *human-induced environmental changes*** it is only recent that international agreement emerges on the key importance of the *resource productivity* of *all* goods and *all* services [2]. However, it is still preferred practice to select certain human generated effects on specific parts of the environment (such as climatic change, waldsterben or water pollution) as pilot indicators for the presumed *overall* influence of technology on the ecosystem. Would the elimination of all man-made CO^2 emission mean sustainability? Of course not! It is unavoidable that such selected indicators often reflect regional and frequently political priorities. And their relative weight tends to change with time (e. g. from mercury to lead to asbestos to PCB's to CFC's to CO2). Controlling the output side of the economy is still prevalent. Apart from the fact that the economy pays a heavy price for this shifting approach, it does not lead to ecological sustainability for theoretical as well as practical reasons [3].

Five Dilemmas

- There is overwhelming evidence and wide agreement in a number of large industrial countries that the public budgetary situation is unsustainable in view of known future social, economic and ecological needs [4]. The same can be said for lesser economic players in Europe and elsewhere [5]. Heavy overspending since many years, subsidies to the tune of more than 100 billion Euros per annum in Germany alone, demographic developments, shifting the medium age of the population inexorably upward while the total population decreases, a declining labour force that continues to be taxed for supplying the overwhelming part of the public budget needs, and increasing costs for unemployment, public health as well as for combating mounting environmental problems are some of the major reasons for this dilemma.

- One of the major stumbling blocks for progress toward sustainability today is the growing realization that it is <u>not</u> sufficient to adjust the economic and fiscal framework in isolated steps as has been the practice hitherto. It is becoming more and more evident that only *profound* (paradigmatic) policy changes will open the road to sustainability – if taken in a systemic manner. Such an undertaking, however, seems risky for politicians who depend upon winning elections every 4 or 5 years. This is plainly visible in Germany and France today even when only relatively minor fiscal adjustments are being attempted. While the public is aware of the need to change the framework for doing tomorrow's business, citizens have apparently little faith left in their leaders to bring about such change in fair, honest and reliable ways.

- The root cause for the growing ***ecological problems*** is the excessive use of natural resources, including energy carriers, land and water [6]. Today's resource productivity of

1 European Council, 2000, cipher 5

2 F. Schmidt-Bleek, "Toward Universal Ecology Disturbance Measures", Regulatory, Toxicology And Pharmacology, Vol 18, No. 3., Acadmic Press Inc., Dezember 1993 (The Wuppertal Position Paper, Mid-1992, in a translated form).

3 F. Schmidt-Bleek, "Wieviel Umwelt braucht der Mensch – MIPS, das Mass fuer oekologisches Wirtschaften", Basel, Berlin, Boston, 1983 (English in www.factor10-institute.org under the title "The Fossil Makers)

4 See, for instance, Report (in German) by the Future Council of the state of Northrhine-Westfalia, March 2004, Dusseldorf. To be published in English in 2004

5 See, for instance, H. Wohlmeyer (Austria): "Strategische Steuerreform und nachhaltige Naturbewirtschaftung", to be published, h.wohlmeyer@pvg.at

6 Schmidt-Bleek and Coworkers,: The unfolding of the Factor 10- and MIPS- story *(in English)* at the Wuppertal Institute, Special Issue of the Fresenius Environmental Bulletin, Birkhaeuser, August

technology requires roughly 30 tons of non-renewable nature on the average for every ton of product - and 5 to 15 times that much water. A dismal performance. But ITC (Information and Communication Technology) consumes even ten times more non-renewable resources on a ton per ton basis. Since all services require the availability of increasingly complicated and closely interlinked technology - even when rendered from person to person – delivering modern services is extremely resource intensive, too. On the average, every European consumes 70 tons of non-renewable natural resources per annum (while the average Vietnamese consumes between 3 and 4 tons). The massive replacement of human labour by machines and ITC [7] in all parts of the economy contributes to this situation.

- Prices govern economic choices. Today, prices of natural resources are distorted through tax systems, perverse subsidies, historical cost-free extraction- and use rights and other politically motivated priorities [8]. As a consequence the market is in disarray and leads to massive misallocation of natural resources. The market dis-functions as regards preserving life-sustaining environmental services while it stutters along within the economic framework conditions of yesteryear [9].

- More than two planets earth would be needed for providing the natural resources necessary to allow a western life style for the whole world. On the one hand such a development would eventually push the price of natural resources upwards and thus slow down their use. This is already noticeable to some degree as regards the prices of certain metals and scrap iron. For a while, some rich and powerful countries may still continue to subsidize (and/or fight wars for) the exploitation and use of energy carriers, water and other resources. On the other hand, it seems very likely that price hikes due to scarcity would be felt far too late to stop and reverse ecological destruction. It is furthermore quite unlikely that resource prices would climb in tune with their "*ecological rucksack"* [10], that is to say in tune with their respective resource intensity.

Approaching Sustainability

Governments

The overhead on incomes and salaries
must be lowered dramatically
before the reduction of unemployment
to socially acceptable levels
can be achieved In Germany
and other industrialised countries.

Many politicians, economist, business leader and TV business analyst extol the virtues of increasing consumption in order to generate growth in terms of GDP. Frequently, this is portrayed also to be *the* way to generate new employment. However, since hardly any price of good and service reflect their respective ecological rucksack at this time, growth through increasing consumption leads to expanding resource use and thus steers the economy away from ecological sustainability.

1993.

7 ICT = Information and communication technology

8 Schmidt-Bleek, "Das MIPS-Konzept – Faktor 10" Droemer, Munich 1998. Franz Lehner and F. Schmidt-Bleek, "Die Wachstumsmaschine – Der oekonomische Charm der Oekologie", Droemer, Munich 2000

9 See Recommendations and Statements of the International Factor 10 Club, www.factor10-institute.org .

10 The Ecological Rucksack has been introduced by Schmidt-Bleek in 1993 and is defined as the sum total inputs of natural resources needed to produce a good in kg minus the weight (mass) of the good in kg.

According to a recent report to the government of Northrhine-Westphalia [11] by its *Future Council*, the existing tax and levy-system in Germany pushes the economy in the wrong direction. The Council recommended lowering expenses foreseen in the present budget by *at least* 15% in order to regain the freedom for financing urgent new needs.

The existing levy and tax system, so the Council argued, distributes the various burdens of wealth production inefficiently and it is unjust. The overall current cost-structure in the manufacturing sector is approximately 70% for labour, 25 % for capital and 5 % for energy. On the other hand, studies in the USA, Japan and Germany have shown that the added value in industry is affected to the same extent by a one percent increase in energy input as by increasing the inputs of capital and labour one percent each. In other words, labour is too expensive when considering its contribution to productivity whereas energy is - relatively speaking - under-priced.

Under such conditions it is entirely rational when jobs are being eliminated, in particular because the expenditures for the social security system depend almost entirely on labour. The labour market becomes de-coupled from growth with the consequence of decreasing tax revenues while social expenditures rise at the same time. It is thus necessary to adjust the optimal input of natural resources for wealth creation. The economically rational mix for the input of labour, capital and material/energy must be shifted toward more work while reducing the input of natural resources.

It is no surprise therefore that a pervasive unemployment problem exists in traditional industrialized countries. In Germany, unemployment has increased continuously since the early 1960ies in a step-like fashion [12]. Officially it hovers now around 10% and emerges as the main cause for the lack of adequate funds for paying pensions in the future as well as adequate public services like education and public health. It appears as if the negotiations between unions and management for salary adjustments need very much to be guided by sustainability considerations in the future.

> Growth without dematerialization is unsustainable . The rate of dematerialization must be more than twice that of growth measured in GDP.

The findings of the *Future Council* strengthen the arguments of earlier publications [13] [14] [15] [16].

The absolute total yearly material flow (TMF) through most European countries - including the ecological rucksack of all materials - has been more or less steady since the early 90ies in spite of a noticeable trend toward higher resource productivity in terms of GDP/TMF. In Germany for instance, resource productivity increased by 21.8% from 1994 to 2001, while the GDP rose by 11.9%.

I should like to remind the reader that much of the existing environmental legislation has created a situation that is in fact akin to a planned economy. It causes non-marked driven world wide expenditures by hundreds of billions of Euro every year. Moreover, such a legislative approach cannot lead to sustainability because it is basically not precautionary, because only "rich" countries can afford the ensuing costs and it does not reward saving of natural resources. Altogether this

11 Report "NRW 2015 – Ressourcen nutzen, Regionen staerken", (in German) by the Future Council of the state of Northrhine-Westfalia (NRW), March 2004, Dusseldorf. To be published in English in 2004 Northrhine-Westfalia includes the most densely industrialized part of Germany, the Ruhr District. With 18 Million inhabitants, NRW is one of the bigger "countries" of the EU.

12 F. Schmidt-Bleek, "Das MIPS-Konzept – Faktor 10" Knaur, Muenchen, 1998, Page 203

13 F. Schmidt-Bleek, "Wieviel Umwelt braucht der Mensch – MIPS, das Mass fuer oekologisches Wirtschaften", Birkhaeuser, Basel, 1993 (English under the title "The Fossil Makers" in www.factor10-institute.org), translated into Japanese, Chinese, and Finnish

14 Recommendations and Statements by the International Factor 10 Club since 1994 (see in www.factor10-institute.org)

15 F. Schmidt-Bleek, with M. Lettenmeier and C. Nettersheim, "Der Oekologische Rucksack – Wirtschaften fuer eine Zukunft mit Zukunft", Hirzel, Stuttgart, 2004

16 Yannis Paleocrassas, "Fiscal Reform – Resource Productivity and Employment", Chapter II in F. Schmidt-Bleek et al "The International Factor 10 Club's Report of 1999, Institut fuer Arbeit und Technik, Gelsenkirchen, 1999-10

approach may even increase overall resource use because it requires much investment in hardware, energy for running equipment and for re-cycling as well as for transporting wastes. It would seem worth analysing the resource flows put in motion by environment protection legislation since 1972 in the EU.

In 2001 President Bush has made it clear that the USA is not willing any longer to follow the path of ordering emission restrictions. He withdrew his country from the Kyoto Protocol. Unfortunately no positive action followed from the White House to improve the dismal ecological performance of the United States. Increasing the costs of resources before their use would put the cost of environmental protection squarely into the allocation mechanism of the market and it would reward superior ecological performance throughout the value added and consumption chain.

In some European countries "eco-taxes" have been imposed, for instance on gasoline in Germany. So far these taxes or levies are far too timid for either stabilizing the fiscal disarray or stopping the trend toward un-sustainability. The word "eco-tax" is often perceived by the public to hide its suspected real intent: Imposing additional taxes under the pretext of protecting the environment. I am quite certain that no German government will attempt again to impose resource taxes under the label "eco". When predicting this development in 1995, a very prominent green in Germany got very angry. It seemed as if the word "eco" in conjunction with "taxes" was vital for her self-respect. Perhaps one should call a future tax-shift from labour to natural resources a ***"job-creation-tax"***. The public could then observe the results itself.

When shifting taxation to natural resources, energy carriers, land–use, water, wood, copper, aluminium, silver, gold, sand, gravel and limestone could be among the attractive choices. Resource taxes can and should be imposed in socially responsible ways and should also consider the possibility of theft of high priced resources and the smuggling of expensive materials. Water, energy, and land-use being subject to routine consumption/use monitoring procedures already may be interesting initial choices for tax shifts. If exemptions from payment are necessary for protecting certain parts of the economy from short-term unacceptable economic consequences, exemptions should be strictly short-lived except those that were extended to individuals or families for reasons of social justice.

The present situation is a vicious circle: The governments' playing field on which to decide on precautionary expenditures and policies for the future is not only tilted, it becomes progressively smaller. And this situation will prevail until the government changes the relative price signals to the market for labour and natural resources.

Additionally, governments must lower subsidies noticeably, in particular those subsidies that encourage the consumption of natural resources. Since governments procure some 20% of final goods and services in most countries, giving strong preference to dematerialised goods and services would be a powerful signal to manufacturing and trade for offering dematerialised solutions.

Existing standards and norms need be reviewed, too, since hardly any of them were formulated with a view to the resource consumption they generate. This is particularly evident in the building sector, for traffic regulation and for food safety and packaging norms.

Only government can correct the currently unsustainable situation in a binding way. It could also smoothen transition by offering training to SME's [17] for designing dematerialised goods and services. Corrective legal action should be considered in the fiscal, R&D and educational system, in adjusting norms, standards and in other areas. As regards the increase of market prices for goods and services in exchange for lowering the cost of labour, governments may face protracted international negotiations for defending non-tariff barriers to trade.

17 SME = small and medium sized enterprises

However, such reforms should stabilize public finances, create new jobs in a far more sustainable environ, boost innovation, support long-term success on the world market, and enable government to harness market forces in support of a more rapid transition to an energy and resource efficient service economy.

A recent article illustrated the potential macro-economic gains in Germany under condition that *all currently profitable* dematerialization measures would be undertaken and further, that financial gains would not be negotiated away by increasing the income of labour in tune with traditional practices [18]. Wage increases during the period of dematerialization were assumed to be those expected without the deliberate increase of resource productivity. Among the most interesting results of the study were these: some 760 000 new jobs would be created, the GNP would rise by close to the 10 % and the government income would increase by ca. 20 billion Euro.

What is urgently needed now is a similarly exhaustive modeling effort to clarify the consequences of shifting the current overhead on labor/income to natural resources.

Based on such results one could conceive a *step-by-step* plan for approaching ecologically and economically sustainable conditions. *First*, such dematerialization efforts would be launched that are already profitable under existing economic boundary conditions. Governments could simultaneously begin to re-orient their procurement procedures, giving increasingly preference to dematerialized products and services. Subsidies deleterious to saving resources would begin to be withdrawn. *After some 2 – 3 years*, fiscal reforms would commence in a carefully planned manner, previously shared and discussed with the public. Features protecting the sick and the poor would demand special attention. *3 or 4 Years later,* all measures aiming at "Factor 10" would become fully operational, including the adjustment of norms, standards and practices and revoking special privileges of all kinds that provoke un-necessary resource and energy consumption. Among those to be eliminated could be the right to levy-free lifting of resources from nature, including minerals, sand, gravel, fish, and plants.

In my mind, all governments have – sooner or later - little choice but following the path of action outlined here for assuring a future with a future for generations to come. Experience tells us that necessary reforms, introduced in a timely manner, can save much money and yield advantages compared to those who did not act in time. I would expect this to be the case for the export of innovative and dematerialised goods, infrastructures and service systems.

Enterprises

The aim of eco-design is to provide
"service-delivery-machines" that consume
as little natural resources as possible
from cradle to cradle
while providing as many units
of extractable value as possible
for the longest possible period of time.

Only few firms are seriously engaged in pursuing truly long term strategies at this time by giving appropriate weight to all sustainability dimensions before making decisions. Often such firms are global players.

In June 2001 a meeting was held in Tokyo, organized by NIKKEI, with the aim of convincing industry to take the lead in guiding the economy to a more sustainable future [19]. Representatives of global enterprises and opinion leaders agreed on a statement that reads in part: **"***We, the participants, recognize that the present environmental destruction and resource depletion of the earth is undermining our economy and our future***"……** *"We agree on the need for fundamental*

18 Hartmut Fischer, Karl Lichtblau, Bernd Meyer and Janina Scheelhaase, "Wachstum und Beschaeftigungsimpulse rentabler Materialeinsparungen", Wirtschaftsdienst, Issue 4, April 2004. This study was financed by the Aachen Foundation Kathy Beys.

19 "The Tokyo Statement", see www.factro10-institute.org

changes in our present economic systems, corporate activities, and lifestyles. Participating business and opinion leaders agree on the need for systemic change. This depends on corporations taking the leading role in changing the present trends, including the encouragement of governments to change the economic framework and incentive structures." While the Japanese Government decided in 2001 to make Factor 10 [20] part of the strategic national planning, no comparable move has come to my attention from other countries.

In 2001 the Factor 10 Institute together with The Natural Step organization from Sweden, the Zero Emission Forum of the United Nations University in Tokyo, The United Nations Environment Program in Paris, The Dutch Sustainable Technology Program, the Thai Environment Ministry, and subsequently the German "Green Manufacturers Association" (B.A.U.M., Hamburg with some 600 members), supported financially by the Aachener Foundation Kathy Beys, undertook an intensive effort to convince industry to shoulder the responsibility of convincing governments to begin restructuring the economy. This effort failed because of Lack of interest in industry. (see "Alliance for Global Eco-Structuring – AGES, Carnoules Appeal under www.factor10-institute.org).

> "In our mind, one decisive part of reaching sustainability can be described with "more value on the market for less natural resources" and "solutions instead of products" "(Carnoules Appeal 2001).

The Sustainable Asset Management group in Zuerich (SAM) has analysed several hundred stock-exchange-listed companies world-wide with respect to their respective CO^2 emission. Results were compared with their performance on the stock market. It was found that those with relatively low emissions out-performed others by a considerable margin. The instrument developed by SAM for this comparison has been named the *Dow Jones Sustainability Index-DJSI.* While the results obtained by SAM are an encouraging message because they tend to show an important commercial awareness for environmental problems, the factual basis of the SAM-analysis would seem too narrow to allow comparison as regards *sustainability* concerns in the private sector. It is no big surprise for instance that Swiss Re was found to be a top performer because Insurers, banks, as well as real estate agencies are not known to be big emitters of pollutants themselves. Their customers, however, may well be among important polluters and heavy consumers of resources. Since no harmonized criteria for selecting customers exist among insurance companies, banks, and real estate agencies, there is as yet no defensible basis to believe that DJSI can serve as a reliable yardstick for genuinely sustainable performance among enterprises. Nevertheless, SAM has made an important novel contribution toward approaching sustainability in that it has begun establishing a measurable connection between environmental protection and market performance.

Hundreds of practical examples from industry have been recorded in Europe, Japan and in the USA that demonstrate that dramatically dematerialised technology and service systems can technically be achieved without loss of end-use satisfaction. However, marketing of such solutions remains frequently unsatisfactory because the public has as yet little notion of the interconnection between the resource intensity of gadgets and environmental problems. For instance, one single internet bank transfer typically causes as much non-renewable resource consumption as the production of 4 aluminium beer cans. When considering "to overcome the digital divide", some caution would therefore seem in order. And German electric current is 6 times more resource intensive than Finnish electricity, which means for instance that while the use of one-way plates, forks and cups may be the ecological solution in Germany but not so in Finland [21].

Today, very few people are systematically informed about the key importance of resource productivity and the concept of dematerialisation. Standard school texts regularly fail to treat

20 The minimum dematerialization goal postulated by Schmidt-Bleek in 1992
21 F. Schmidt-Bleek, with M. Lettenmeier and C. Nettersheim, "Der Oekologische Rucksack – Wirtschaften fuer eine Zukunft mit Zukunft", Hirzel, Stuttgart, 2004

resource productivity as an important economic performance parameter. And so far the mass media have not focused on this issue in depth, preferring to continue emphasising the effects of selected pollutants on the environment rather than the economic and political causes for the non-sustainability of our present wealth generation system.

Most people cling to ways of doing business "comme d'habitude", be that in manufacturing, trading or consuming. Changing habits is often inconvenient, time consuming, sometimes expensive and perceived to be risky. We in the west are, so the saying goes, still close to the bottom of the learning curve. Perhaps this is so because we like to learn by experience. Our Japanese friends are different in this respect. And yet, the apparently deep-seated conservative attitude of most actors on the market today hides the fact that change is an integral part of consumption: At least 6 major new technologies were not even available to the public at that time (e.g. fax, internet, mobile telephone).

One question remains puzzling: Why is it that enterprises operating under market-economic conditions rarely exhaust the potential to save resources – and thus money - during manufacturing and in the design of their products and services? I have given already one answer: today's cost pressure can best be relieved by throwing people out of work or by moving production to a low-wage country. This may well become an even more troublesome issue after the 10 candidate countries have joint the EU in May 2004.

Beyond this, however, book keeping in industry does not normally include reporting the flow of natural resources in weight units. And since prices of raw materials, goods and services almost never reflect their respective resource intensity (their "ecological rucksack" [22]), manufacturers, traders and institutions rarely have real knowledge of the true resource consumption they generate. Most cannot therefore assess their saving potential for natural resources either.

Fairness demands mentioning that some companies, in particular global players such as Cannon and Panasonic have begun reporting yearly changes in social and economic matters as well as in resource flows under their control.

Communities

"Agenda 21" has caught the imagination of thousands of communities around the world. It would be impossible to even begin to list all projects presently under way.

Here I will report only one such story. Haellefors is located in the middle of lakes and forests, some 300 km west of Stockholm in Sweden. One would think that only hunters may take some interest in this part of the world. But there is a rather well known and lovely spa close by called Loka Brunn. And there is a mayor who refused to give up hope when the traditional iron business came to a halt. Instead there is a large saw-dust pelleting operation now and a number of other future oriented businesses. The squirrelly major acquired the Swedish pavilion of the Seville World Exhibition and installed a cooking school for some 600 students from around the world at the edge of town where visitors can find a truly remarkable herbal garden. Every child in Haellefors is invited at the age of two to join cost-free learning/playing centres with music and art education. And a few years ago the city decided to establish a "Formens Hus", a large design centre based on the concept of MIPS/Factor 10. The building is under roof now and the interior is being completed by a well-known architect from Stockholm. The close-by university of Orebroe is about to establish a teaching program in the Formens Hus and a famous art school in New York will become a partner. Several Baltic universities will also cooperate with this institution. Regular teaching programs involving dematerialisation issue are in the planning stage (see www.hellefors.se).

22 F. Schmidt-Bl;eek, "Das MIPS Konzept – Faktor 10", Muenchen, 1998

Resource Use

Production Sector

I have already mentioned that the average resource intensity of western industrial products today is about 30 kg of natural resources input per kg product. I have also pointed out that for ICT the figure are typically 10 to 20 times higher. These results are obtained when counting the resource input from "cradle to finished product" and refer to *non-renewable* natural resources only. The overall consumption of *water* tends to be in the hundreds of kg/kg product.

Since no services are rendered anymore in modern society without the support of a multitude of interlinked products and infrastructures, the resource consumption of services can be very high also. Withdrawing cash from an automatic bank teller for instance, while saving labour, is an altogether resource intensive affair. It is a typical case of replacing labour by natural resource investment for the sake of profit maximization under economic boundary conditions of a bygone era.

A number of training methods have been worked out for industry, in particular for SME's, small and medium enterprises, to reduce resource consumption [23]. Help is also available in this respect from such institutions as the Efficiency Agency and the Energy Agency of Northrhine-Westfalia, the Wuppertal Institute in Germany, the University of Graz in Austria and the International Factor 10 Innovation Network (see www.factor10-institute.org). A new publication of the Wuppertal Institute details the calculation of the resource intensity of goods and services [24]. Information on rucksack factors for raw materials are available from www.aachen-foundation.de.

When computing the overall resource intensity of products one regularly observes that it is their design and their specific resource consumption during use that far outweigh the resource inputs during manufacturing. This contrasts considerably with much existing environmental regulation that continues to focus on the performance of manufacturers. It also puts into question the enormous efforts made and costs incurred when reducing industrial emissions excessively and increasing re-cycling rates by regulation (e.g. the "green point") rather than rendering wastes of all sort valuable materials by adjusting the price structure of labour and natural resources in line with the proposals of this paper.

Population and Consumption

There are at least three major reasons why the consumption of natural resources is still rising steeply on our planet, moving us further and further away from sustainable conditions.

First, the global population is still increasing. Best estimates indicate that 30 to 40 % more people will be alive and live longer by the end of the present century than at its beginning.

Second, the economically emerging countries are still far less resource intensive on a *per capita* basis than the average OECD country (factor 5 to 30 less). Simultaneously many show very high economic growth rates. Western life style, beamed into most households world-wide by relentless advertisement on TV, is the desired future of a large majority of people, particularly in very poor countries. Anybody who has observed the change in density of mopeds during the last few years in countries like Vietnam or Indonesia can testify to a fast materialization of life style along the western examples.

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23 See, for instance publications by the Austrian Chamber of Commerce (Wirtschaftskammer/WIFI) No 270 and 303.

24 M. Ritthof et. al., "Calculating MIPS – Resource productivity of products and services", Wuppertal Special N0. 27.

Thirdly, the trend toward living as "singles" in traditionally industrialized countries is pervasive. In cities like Cologne or Stockholm, households of "singles" are said to have reached more than 50 % of the population. Estimates indicate that the resource consumption of singles in Europe exceed that of freshly born children in African countries typically by a factor of 50 to 100.

It is considerations such as these, together with the need to dematerialise the global economy by at least a factor 2 even at present overall resource consumption that has lead me to postulate the "Factor 10" as a minimum requirement for approaching ecological sustainability in 1992 [25].

SevenStrategic Goals
For Reaching Sustainability

I consider the following 8 goals of strategic importance for reaching sustainability:

- Defending and respecting the needs and dignity of *all* people
- Increasing the well-being of *all* human beings
- Assuring justice and free speech for all
- Rewarding self-responsibility and entrepreneurship
- Treating nature and all its life with respect
- Maximizing resource productivity (land, material, energy) in wealth creation
- Avoiding all wastes, not only over-use of nature
- Minimizing the handling and emission of dangerous substances

Competences For Tomorrow

The following key-competences should be taught as early as possible to children in all countries so that they can effectively contribute toward approaching sustainability:

Social Competence
The capacity to respect the dignity and needs of all live on earth
Competence to learn
The ability to perform independent studies and evaluate results by one-self
Systems competence
The capacity to discern and take into consideration interdependencies, time sequences and limitations when creating new options
Innovation competence
The ability to convert experience and knowledge into novel solutions
Communication competence
The ability to present and communicate even complex issues in generally understandable terms – even in a foreign language
The ability to participate actively in constructive dialogues
Economic competence
The ability to increase wealth through market forces, respecting ecological, economic and social needs
Decision competence
The ability to give fair consideration to ecological, social, cultural and economic consequence before reaching a decision
Productivity competence
The ability to meet needs and develop capacities with the least possible waste and the ability to generate utility in the most cost effective fashion with the least amount of natural resources, capital and labour

25 F. Schmidt-Bleek.: "Eco-Restructuring The Economies Of The Former COMECON Countries", Fresenius Environm. Bull.1, 1992 and many subsequent oublications and books.

Summarizing the Need for New Policies

As we have noted, there are several reasons why a dramatic dematerialization of western economies is unavoidable:

- The *root cause* for the growing *ecological crisis* is the massive and frequently indiscriminate use of natural resources, including energy carriers, land and water [26]. At the present time, worldwide use of natural resources increases dramatically.

- On the average, more than 30 tons of non-renewable natural resources are invested today for every ton of goods, with increasing tendency. The intensity of water use is about ten times higher. In order to approach ecological sustainability, the resource productivity has to be increased by at least a Factor 10, compared to today. This would even apply if sufficient natural resources would be available on planet earth because the present consumption of natural resources causes already catastrophic ecological consequences [27].

- More than two planets earth would need be available for providing the natural resources necessary to allow globalisation of the present western life style.

- Current environmental policies cannot lead to sustainability because they essentially address the output-side of the economy, they do not adequately focus on lowering resource consumption (in fact, they often spawn additional resource investments), they are basically non-precautionary and they cause enormous non-market-driven costs that most countries cannot afford.

- At this time in history, a number of reasons call for serious re-orientation of the current economic framework in western countries. Among these reasons are:

- The current public budget situation in leading countries is unsustainable with respect to meeting known future social and economic needs [28].

- The present taxation system is altogether economically wrong and unfair [29]. Whereas labour costs are relatively high on account of considerable overheads, prices of natural resources are kept low by not being taxed in tune with their contribution to the economic output, by perverse subsidies, by traditional cost-free extraction- and use rights and other politically motivated priorities [30]. As a consequence, the market causes a massive misallocation of natural resources.

It is evident that only *profound* and *systemic* policy changes will secure the future and open the road to sustainability. It is no longer possible to continue introducing partial solutions to individual problems when they

26 Schmidt-Bleek and Coworkers,: The unfolding of the Factor 10- and MIPS- story *(in English)* at the Wuppertal Institute, Special Issue of the Fresenius Environmental Bulletin, Birkhaeuser, August 1993.

27 F. Schmidt-Bleek, "Wieviel Umwelt braucht der Mensch – MIPS, das Mass fuer oekologisches Wirtschaften", Birkhaeuser, 1993. A Chinese translations is on the market. The Finnish version is in its second, and the Japanese version is in its 4th edition. An English translation is available on this Web Site under the title "The Fossil Makers".

28 See, for instance, Report (in German) by the Future Council of the state of Northrhine-Westfalia, March 2004, Dusseldorf. To be published in English in 2004

29 Report of the Future Council of the German stateof Northrhine Westfalia, March 2004

30 F. Schmidt-Bleek, "Das MIPS-Konzept – Faktor 10" Droemer, Munich 1998, and Franz Lehner and F. Schmidt-Bleek, "Die Wachstumsmaschine – Der oekonomische Charm der Oekologie", Droemer, Munich 2000

arise. Sustainable solutions require the simultaneous and even-handed consideration of economic, social and ecological consequences of every impending decision.

Failure to drastically dematerialize the economy in leading countries would yield dramatic consequences:

- Neither economic, social or ecological sustainability could be reached;
- In the long run, economic growth would no longer be possible;
- Unemployment would persist on a high level in industrialized countries;
- The unstable budgetary situation in industrialized countries and its unwanted social and economic consequences would continue;
- The export power would diminish over time;
- The destruction of life supporting environmental services would continue;
- Current non-market based and costly environmental policies would persist and cause an ever increasing financial burden on society in technical and administrative terms;
- Costly repair of environmental damages would increase;

While the basic concept of Factor 10 seems straight-forward and the advantages of its implementation appear to be plentiful and self evident, potential economic "side-effects" have not as yet been sufficiently elaborated, including the identity of potential winners and losers [31].

Moreover, it is far from obvious how to incorporate the concept of dramatic dematerialization into the political and economic reality of today. The possibilities of unilateral national moves are limited because all national economies operate today in a complex network of international interests and contractual obligations. The necessary changes would obviously require courageous and farsighted political leadership.

Democratic process demands that voters - most of them recipients of subsidies and enjoying special privileges of one sort or another within the present system - would agree to a new set of parameters, accepting shifting focuses and priorities, be ready to abandon and change the safety of successful decision making procedures of yesteryear, and having to establish a new network of business partners. Perhaps the most serious barrier to change would be the ensuing initial uncertainty about how to establish proper budgets, how to make profits and what to consume.

In earlier times natural catastrophes and wars lost and wars won left little choice but to take such risks. Fortunately, times have changed in some parts of the world. In the future we will have to learn how to adjust to paradigmatically new realities on the basis of reason and dialogue. Are we ready for that? Do we have the right leaders for that in industry and politics?

Japan has already incorporated the concept of dematerialization (Factor 8 to 10) into the framework of its strategic economic planning.

Outlook

Neither social nor economic nor environmental pressures are as yet sufficient to force political leaders – and the vast majority of business leaders as well - to take the risk of replacing *"business as usual"* by changing their priorities in the direction of preserving our planet earth as a secure place to live for generations to come.
Current concern with international terrorism and globalisation deflect the debate. Wars for securing resources and power (e.g. the Falkland "Conflict" and the US "counter terror" invasion of Iraq and of Russia in the Caucasus region) are far more costly than setting the development of resource-saving developments in motion. The material input into the 2003 war in Iraq alone would

31 The Aachen Foundation finances at present a large modeling effort at Osnabrueck University to elucidate such "side- effects".

have sufficed to build housing for 1 billion people. If as much money would be spent today on generating economically sensible sustainability options and feeding the hungry as is being spent for arms and on exploring the chances for men to live on another planet, we would not need worrying too much about losing the viability of the only planet we will ever have.
And yet there is hope. When I compare the number of people who participate today constructively in the debate on sustainability with the few in the early 90ies and when I compare the level of care in enterprises then and now, I feel encouraged. I wish that scientists would concentrate more on systemic solutions for our dilemmas and use their influence for convincing politicians to act more for the benefit of future generations. This applies particularly to my colleagues trained in economic matters and who have the privilege to advise governments, politicians and international organisations.

MEASURING SUSTAINABILITY

What cannot be measured, cannot be managed

OECD, 1998

At the beginning of this article I noted that it has become international consensus that sustainable solutions require the simultaneous and even-handed consideration of ecological, social as well as economic expectations and needs. In other words, unless a suitable mix of inter-connectible indicators is applied to guide policies in accordance with the above-mentioned strategic goals, approaching sustainability will continue to be a rather elusive undertaking. And in view of the fact that all human commerce depends and happens on a single common planet, such sets of indices should be internationally acknowledged and – to the extent possible – they should be internationally harmonised.

Here follow my suggestions for the properties of useful indicators:

General Requirements for Indicators

- They should be few in numbers to be useful in decision making
- They should be compatible with striving for a sustainable economy
- They should reflect *key targets* for social, ecological and economic development
- They should apply to the needs of all people and be valid for all products and services
- They must be measurable or calculable
- They should be based on «cradle to the grave» (life-cycle-wide) analyses
- Their application should be cost-effective and yield reproducible, timely and directionally safe answers
- They should be applicable to all levels: locally, regionally and globally

Indicators
For Preserving The Services of the Environment

The enormous dislodging and use of natural resources, comprising natural materials and land, has been widely accepted as a *root cause* for human-induced *environmental changes* [32]. The material

32 The use of energy as such is environmentally of little consequence. It is the overall material intensity of the energy at the point of use - and the material consequences of its use - that count most.

input per unit extractable value or service, MIPS, and the land-use per unit extractable value or service, FIPS, are consequently used as basic indicators for a first life-cycle-wide evaluation of the ecological impact potential of goods and services. On the macro level, the indicator TMF the total yearly material flow, has already been introduced into the German and European statistics [33].

Raw materials are assigned a "rucksack factor" (or MI-factor) that is the total amount of natural material displaced in kg to produce one kg of raw material. "Rucksack factors" are intensity factors and could be looked upon as a new kind of material property that should be taken into account when designing and constructing goods. Typical "rucksack factors" in terms of non-renewable natural material are: Bamboo 1.01, Plastics 3-8, iron 7, steel 8 - 20, aluminium 85, copper 500, and gold 500 000. Many can be found in the internet under **www.wupperinst.org/projekte/mipsonline**.

The Aachen Foundation Kathy Beys has agreed in November 2003 to collect all available MI-factors in the future and put them on its web site. With MI-factors, the composite rucksacks of complex products can be computed, so long as the compositions of the product - as well as the quantities of wastes during its production - are known. Having the rucksacks of goods in hand, the rucksacks of services generated with these goods can also be calculated.

Virtually all prices quoted for goods on the market are *"prices at the point of sale"*. Such prices rarely allow end-users to asses the real value of goods since the overall costs per unit extractable value (such as for driving a car for 1 km or for cleaning 5 kg of cloth with a washing machine) cannot be deduced. I have therefore suggested to replace the present pricing system with COPS, the *Cost Per unit Service* [34]. The price of services such as using a taxi or obtaining a haircut are traditionally given in COPS. For me it is difficult to imagine a functioning service economy without stating the prices for goods *and* services in terms of COPS.

Other indicators for the protection of the ecosphere are included in the attached table.

Indicators For Social Cohesion

During the deliberations of the above-mentioned *"Future Council NRW",* some social goals were identified. They include the availability of all-day *"family centres"* where sick and working parents would find help, including the care for children starting with 3 years of age. Basic skills in reading and handling numbers would be taught as well as the foundation of at least one foreign language (including German for kids with a migration background). A related target is increasing the birth rate of women from 1.3 to 1.9 in Germany. In order to improve the *"life-time economy"* of young people, high school should be finished at 17 and university education by the age of 23 (present figures are considerably higher, particularly in Germany). The performance of Social services would be shifted on a voluntary basis to those who have left active employment.

Other indicators for social cohesion are included in the attached table.

Indicators For A Stable Economy

Most economic experts, politicians and the public media seem to be content to continue using GDP (or GNP) as an all-embracing *measure for economic growth* and they frequently seem to imply that GDP also is indicative of the welfare of people. However, this index cannot possibly measure the quality of life of people since it does not give information on average income, social justice

33 F. Schmidt-Bleek introduced these measures in 1992 and has since published many books and papers on their use and computation. Among his former co-workers at the Wuppertal Institut, Stefan Bringezu, Fritz Hinterberger, Christa Liedtke, Joachim Spangenberg and Hartmut Stiller (and and their co-workers) have published many treaties in this area since 1993.

34 F. Schmidt-Bleek, "Wieviel Umwelt braucht der Mensch – MIPS, das Mass fuer oekologisches Wirtschaften", Birkhaeuser, Basel, 1993

conditions, the breakdown of environmental services, cultural achievements, institutional appropriateness, democratic conditions and other factors contributing to human well being and survival on this planet,.

> In my view, the continued failure to seriously consider factors other than increasing money flows and optimising average financial gains is at the heart of the non-sustainability of present human activities. GNP and GDP are measures that are open-ended, that is, no limits of (the presently resource-intensive) growth are considered. From a scientific point of view this is not a justifiable assumption because the planet earth is a limited system and the only natural resource base we have. This is why the MIPS/Factor 10 concept demands replacing current resource use largely by innovation *("Replace the use of mass and space with brain")*.
>
> However, since satisfying most human needs requires at least *some* resource input (material, energy, space), dematerialisation is essentially a mechanism for gaining time in finding truly sustainable conditions for human survival. Increasing world population and growing individual resource consumption shorten the time available for necessary change.

There have been noticeable efforts to expand GDP to include social and ecological requirements[35]. However, it seems to me that the interdependences and interactions of various non-linear complex systems cannot adequately be captured by a single indicator. Instead, small sets of '*key (or headline) indicators"* should be agreed to for the three dimensions of sustainability, together with a set of coherent "*interlinkage indicators"*.

The following table contains such sets without claim to completeness or best choices.

35 Wouter van Dieren, Ed., "Taking Nature into Account", Copernicus, 1995

Possible Headline and Interlinkage Indicators
For Approaching Sustainability [36]

Headline Indicators

Economy

The economic dimension refers to the system of production and consumption (including finance) and refers to the market based and to the unpaid economy.

Objective	*Indicator(s)*
sufficient supply and goods and services	GDP/capita[37]
efficient wealth creation	total factor productivity
economic system's evolution and competitiveness	net investment, R&D expenditures, accumulated public and private debt

Social System

The social or human dimension refers to the development and well-being of individuals.

Objective	*Indicator(s)*
social cohesion, social security	UNDP Human Poverty Index HPI 2
access to education	Education expenditure per capita [38]
identity, self-realisation	unemployment rate [39]
security	crime rate, corruption rate

Ecosphere

The environmental dimension refers to the bio-geosphere of the planet earth.

Objective	*Indicator(s)*
protect eco-systems' functions and evolution	percentage of protected reserves
enhance (genetic, species, and ecosystems) biodiversity	average size of protected reserves (research on interconnections needed)
reduce anthropogenic resource throughput and degradation of land and sea	TMC per capita including "ecological rucksacks" [40], land use intensity per capita, energy use per capita (research needed for the land use part)

36 This listing is derived from a statement made during a meeting of 16 European experts in sustainability research. The meeting took place at the Factor 10 Institute in Carnoules, France, from 1-4 May, 2003, in the course of the preparation process for a research proposal on "Governance for Sustainable Development (GoSD)" for the 6th Framework Programme of the European Commission (see www.seri.at). The objectives and indicators listed in this statement reflect a *European* perspective on sustainable development. The Statement represents the state of the art in integrated sustainability indicator development; as the state of the art is necessarily incomplete and work in progress, the definition of some of the indicators may be improved in the future debate, while for other objectives indicators have not yet been developed at all.

37 As explained in the text, GDP must not be misinterpreted as an overall indicator for human well-being.

38 One could think about replacing a flow indicator like investment by a state indicator like percentage of population with at least 2nd grade school degree. However, such an indicator would reflect the results of past investment, but not current policies.

39 While employment is central to identity and self-realisation, the indicator does not cover these objectives exhaustively.

40 The authors recognize that data quality and availability of unused and indirect material flows necessary to calculate total material consumption TMC (including rucksacks) is significantly less than those for direct

Inter-linkage Indicators

By considering the driving forces in the different systems, a number of objectives and indicators for the inter-linkages between the three traditional dimensions of sustainable development (economic, social, environmental) can been derived:

The objectives and indicators suggested for the **economic-environmental** inter-linkage are:

Objective	*Indicator(s)*
minimise the burden for the environment: improve resource productivity (mass, energy and area)	MIPS per basket of products and services; TMC/GDP; land use productivity in FIPS (land-use in m^2 per unit output); energy [41]
minimise damage for the economy: reduce costs related to environmental degradation (damage costs, compliance costs, administrative costs, avoidance costs…)	damage costs/GDP, compliance costs/GDP, avoidance costs/GDP
minimise the impacts on health and environment: minimize outputs of known (eco-)toxics	(research on qualitative indicators needed)

The objectives and indicators derived for the **socio-environmental** inter-linkage are:

Objective	*Indicator(s)*
equitable access to food, drinking water and natural resources	(indicator must be country- or region-specific)
provide healthy and secure shelter	Proposals include “homes judged unfit to live in” and " % of the population living in sub-standard housing”
re-adjust the demand for resource consumption, environmental impact of household consumption	MIPS (including rucksacks) of consumption basket resource consumption and actors’ matrices for construction and housing, mobility and nutrition
provide and secure environmental quality for the health of human beings	years of life expectancy lost by environmental health problems

The objectives and indicators suggested for the **socio-economic** inter-linkage are:

Objective	*Indicator(s)*
enhance the distributional justice (equity principle)	Gini coefficient
efforts (paid and unpaid) should be devoted fairly to generate sustainable incomes	labour force participation, gender distribution of unpaid work

material flows. However, they regard the inclusion of these flows as particularly relevant for sustainability-related analyses and urge for the improvement of data quality and availability.

41 According to the MIPS/Factor 10 concept, energy inputs into human activities should be stated in material terms (kg input/kg output) on a life-cycle-wide basis. Only in this fashion does it become apparent that the “environmental quality” of electricity and of renewable (solar) depend very much on the technology applied. For instance, the German electricity mix is 6 times more resource intensive than the Finnish one, and electricity coming from photo voltaic cells shows about the same material intensity as electricity produced by burning hard coal. Nuclear energy, too, is very resource intensive and can - depending upon the waste disposal technology applied - show a far greater MIPS (life-cycle-wide material input per unit electricity extracted) than any coal-fired power plant.

provide opportunities for paid labour to all willing and able to work	unemployment rate
increase knowledge intensity	see Human Development Report of UNDP : to be defined
refocus innovation and adapt its speed to societal demands	to be defined