EFFICIENT TECHNOLOGY IN AN INEFFICIENT ECONOMY

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1. SYNOPSIS

In Europe modest gains in technological energy effeciencies are more than offset by an increasing inefficiency of lifestyles and political systems aiming for economic growth.

2 ABSTRACT

The past two decades have revealed substantial potentials for reducing the use of energy by implementing more efficient *technology*, although only a small fraction has been implemented. In the long perspective, however, it is more important that the efficiency of the *economy* as a whole, interpreted as fulfillment of needs and wants with least possible energy, tends to decrease.

The paper defines some concepts around overall efficiency for different categories
of consumption: durable goods, non-durable goods, and services. Examples illustrate how efficiency options are ignored or even counteracted by the economic policy. A turn towards more consumption from the service sector results in higher efficiency only if it occurs in what is now the public service, and this is resisted politically. A promotion of longevity of goods could substantially increase energy efficiency, but will reduce GDP. Demand for more leisure is dominating over more income, which points towards reduction in energy consumption, but the trend is counteracted politically. Even cost effective options for more efficient electric technology seem unwelcome in a growth economy.

It is concluded that in general, overall energy efficiency in Europe is in conflict with a quest for economic growth, and that energy efficiency experts should face and tackle this problem.

3 INTRODUCTION

There is a general political agreement in Europe on the need for a more efficient use of energy. On ceremonious occasions, politicians even rank environmental sustainability higher than economic growth. In real life, however, things look different. In fact very few savings are achieved as compared to the immense potentials for doing well with less energy. For those working hard for more efficient use of energy, it is disappointing and discouraging to experience that the modest efficiency improvements achieved are confined to technology, and that these savings are more than eaten up by an ever increasing inefficiency in the economy due a focus on economic expansion. Economic growth is still given top priority, and energy efficiency, as well as environmental protection in general, is at best seen as an area for new economic activities and for international market shares.

The result is that no trends are seen towards the fifty percent reduction in energy consumption, found necessary by for instance the Brundtland commission (WCED 1987). Some options are suggested in the following for substantial reductions in the flow of energy through our economy.

4 THE EFFICIENCY CONCEPT

Basically efficiency of operating a system can be defined as the ratio of the desired consequences to the undesired consequences. In engineering this definition can typically take the narrow form of useful energy output to fuel energy input. In economics the efficiency has been expressed as the ratio of benefit to cost.

The cost or *undesired* consequences we will focus at in the following are the environmental problems which in many senses are also the ultimate cost. Environmental problems are all related to the flow of resources, whether minerals or energy, and whether renewable or non-renewable. The resource depletion, over-exploitation, and pollution are all consequences of this flow, here termed the *throughput* (Daly 1991). As the numerator, the ultimate *desired* consequences are related to *satisfaction* of some human needs and wants. With these concepts the overall efficiency equation will be:

Overall Efficiency = satisfaction / throughput (1)

If we look at the three categories of consumption, *durable goods, non-durable goods, and services*, this overall efficiency is composed differently. In the following we shall discuss the three consumption categories. In order to make each of the three categories physically more consistent, they are here defined slightly different than in traditional economic statistics.

4.1 Durable goods consumption

Durable goods are here defined as physical goods, the basic value of which lies in having a stock of them at disposal. This place clothes as durable goods, while standard statistic categorize them as non-durable goods. The stock of buildings in principle belongs to the category of durable goods if owned by the consumer, while housing is a purchased service, if the consumer rents a dwelling.

The stock of durable goods like furniture, clothes, washing machines, houses, etc, can provide some services, which again can yield some satisfaction. Here services are defined as the ultimate *quantifiable* benefits such as floor space at disposal, amount of laundries, body protection, available table area, etc. This definition of services is inspired by the way the concept is used in the energy conservation research. The satisfaction is the final benefit to human, usually *not quantifiable,* such as comfort and self esteem. In other words the satisfaction comes from the service which again comes from the stock, which finally is maintained by a certain flow of replacement and maintenance, - a certain throughput. Hence the efficiency equation (1) can be developed as follows, illustrating the fact that durable goods satisfy human needs in a rather indirect way:

Overall Efficiency = satisfaction/service * service/stock * stock/throughput (2)

This is an extension of the equation set up by Daly already in 1974 (Daly 1991), containing only the latter two factors.

The added first factor accounts for the fact, that people do not necessarily get twice as satisfied by getting disposal of two times as much floor space or by getting clothes washed twice as often. As a matter of fact, under almost all circumstances, there will be a diminishing marginal return, so the first efficiency factor is declining, when the service increases. One could term this factor the *satisfaction efficiency*, and it is closely related to the way people live. The diminishing marginal return of the services implies that for a nation or the earth as a whole the total average satisfaction efficiency can be increased through a more even distribution of the services.

The second factor deals with the rate of service acquired from the stock of durable goods. Examples are how many laundries a washing machine performs, how much time people spend in the rooms in a house, and how much a dress or a chair is used. Also here we will find a diminishing return, in the sense that the more goods a person possesses or have access to, the less will each item be utilized, among other things because only a limited time is available. An obvious way to increase this *utilization efficiency* is sharing the goods. This would mean breaking present trends, where family sizes are declining and more individual freedom by having your own car, sauna, etc. is stressed in advertisement, etc.

The third factor in the efficiency equation reflects the maintenance of the durable goods, including their replacement. Referring to Daly the ratio between the stock and the throughput can be termed the *maintenance efficiency*, and is roughly the average useful lifetime of the goods. This is not the same as the durability, since other factors can cause the goods to be discarded, as discussed later. Means to increase the maintenance efficiency, and hence to save resource throughput to produce the goods, are for instance to de-emphasize the fashion aspects and to increase the durability and repairability of the goods.

4.2 Non-durable goods consumption

These goods are linked more directly to satisfaction than the durable. Non-durable goods are here defined as goods, which only serve people when being consumed. Examples are food, beverages, tobacco, and energy in various forms. For these goods the efficiencies can be expressed as:

Overall Efficiency = satisfaction/service * service/throughput (3)

The interpretation of the first factor on the right side is explained above for equation (2) for durable goods.

The second factor is the utilization efficiency. As far as food, beverages, and tobacco is concerned, we will not go into details here but more or less assume that the utilization efficiency is equal to one, - that the throughput is equal to the

service. For these goods, however, the first factor in equation (2), the satisfaction efficiency, is a variable, but it will not be discussed here. Instead we will focus on energy where the utilization efficiency, or end-use efficiency, is a concept familiar to energy researchers.

The services obtained from throughput of the *non-durable* energy also require a stock of *durable* goods, such as houses, washing machines, and lamps, which are used to convert the energy into services. Cleaning of clothes can be provided by a washing machine *plus* the non-durable goods of electricity, water, and detergents. Increasing the utilization efficiency of these non-durables typically requires improvements in the durable goods, such as replacing a washing machine or retrofit insulating a house. This should not be confused with the utilization efficiency of the stock of durables, expressing how much the washing machine is used for instance, as described in the previous section.

4.3 Service consumption

In section 4.1 the term service has been defined in a general way as the ultimate quantifiable benefits people get from an activity. This definition still holds, but in this section *service consumption* refers to the concept as it appears as the *service sector* of the GDP statistics to account for what the consumers acquire *directly* as services in the form of child care, entertainment, education, shopping, etc. From the consumer's view point the efficiency equation concerning service consumption in this traditional sense is in principle very simple, as shown by the factor outside the parenthesis.

Overall Efficiency = satisfaction/service (* service/stock * stock/throughput) (4)

The two factors inside the parenthesis are for the consumer out of reach for improvement. But for the economy as a whole, including the institutions which provide the services consumed, the efficiency factors are similar to those in equations (2) and (3) for durable and non-durable goods.

For the consumer, the right mixture and the right level of service consumption are essential for a high degree of satisfaction. Certain situations in society can lead to over-consumption of some services, in the sense that people get more of it than they really want given that they had a free choice and were to pay the full price for the service. Some public services, for which the cost is paid via the taxes and hence separated from the benefits which an individual can enjoy from it, can lead to over-consumption. Other services, such as hiking in the mountains or chatting with friends, are not available in sufficient scale, due to the lack of one important "production factors", leisure time, even if people are willing to pay for it, as discussed later.

4.4 Cost and benefit

All parameters acting as denominators in the above efficiency equations, can basically be considered costs, which for high overall efficiency should be kept low. Most important is the final denominators, the throughput, and since GDP to a large extent reflects the throughput of an economy one senses a built-in conflict between overall efficiency and economic growth. The following section will illustrate this conflict.

5 ENVIRONMENTAL TRENDS IN MACRO ECONOMY

The first example demonstrates how the economic structure could move towards higher overall efficiency, but is hindered by a higher political priority to economic growth.

5.1 The myth of the harmless service sector

The prevailing opinion among economists, and hence among politicians, is that despite the environmental constraints, economic growth can continue, also in regions like Europe, because here the growth will naturally occur more and more in the service sector, which requires very little input of energy and other resources as compared to the manufacturing sector.

The Danish economist J. Jespersen came to a somewhat different result, however, when he analyzed the energy intensities of the economic sectors (Jespersen 1994). By means of input-output tables with 117 economic sectors, he was able to account for not only the *direct* use of energy in the service sector, but also the *indirect* energy consumption embodied in the inputs from other sectors, such as the manufacturing sectors.

As expected Jespersen finds that one million ECU worth of production from the service sector requires much less *direct* energy consumption than a similar value delivered by the manufacturing sector. But today's service sector is well

supplied by inputs from other economic sectors, and when the *indirect* energy consumption used to produce and deliver these inputs, is included in the analyses, the picture changes. In this case *private service*, including trade, hotels, and transport, is about as energy intensive as *manufacturing*, namely 6,9 TJ for each million ECU worth of service production against 8,4 TJ in manufacturing. Only what has typically been *public service*, such as education, health, administration, child care, and elderly care, is still significantly different with an intensity of only 3,1 TJ per million ECU, according to Jespersen's numbers from the year 1990. The difference in energy intensity between private and public services does not indicate that the public sector is more energy efficient in providing a certain service. Rather does it reflect that some types of services with a low energy intensity (and a high labor intensity) traditionally have been provided by the public sector, including education and children's care.

Calculations of energy consumption *per employed*, rather than per ECU as above, points in the same direction. For manufacturing and private service the energy consumed per employee is quite similar, while the public service requires only about one quarter of that.

5.2 Political dilemma about growth in service consumption

The conclusion of the above analyses is that given the present Danish economic structure, very little energy can be saved by turning the demand from the manufacturing sector to the private service sector. Significant gains in efficiency can be achieved only by switching the demand to the public sector, or, more precisely, to what has traditionally been public service. It is clear that this switch will not be brought about through market forces, but will require some determined political actions. Most politicians, however, are here caught in a dilemma or two.

Firstly, in the traditional political striving for economic growth it has in recent decades been considered essential to keep the public sector and thereby the taxes at a low level. For the sake of the environment, however, the public sector, or what has traditionally been the public sector, is precisely where the growth should occur, if at all, as described above.

Another dilemma about relying on growth in the typical public services is related to the longer perspective. These services are to a large extent person to person related, such as teaching, child care, health care, care for the ill, the old, and the handicapped. There is no doubt that today more service in these areas could be welcomed. But it raises the question to what extent the professional services, which contribute to the GDP, can be substituted for the non-professional service of being with family members and friends. It must reach a balance between the professional and the non-professional service. In any case, there is a limit to how much these person related, and hence employment intensive, professional public services can grow. Suppose a future growth of 3,5 % GDP per year should occur solely in this sector which is presently public, in 40 years it would have to *increase by a factor of 12-15*. Since it is impossible, for instance, to care for a child more than 24 hours a day, a switch to having all economic growth occurring in a more energy efficient service sector, can at best postpone the problems of a transition to a sustainable economy.

To summarize, in principle, it will be possible to increase the structural efficiency of the economy, but only by moving towards activities which have so far been public service. But this path is a blind alley for human as well as environmental reasons.

6 OPTIONS FOR LONGEVITY OF GOODS

The second example of inefficiencies in the economy relates to the lifetime of durable goods, here defined as the period in which the goods are still used for their original purpose. Three causes for discarding goods can be ranked in a hierarchy, namely *technological* obsolescence, *functional* obsolescence, and *psychological* obsolescence.

Technological obsolescence refers to the durability. When a refrigerator, a chair, a coat, etc is unable to fulfill its original task, - is worn out - then it must be discarded or repaired. Technological obsolescence sets the ultimate limit to the lifetime of durable goods, typically 20 years for a refrigerator, 100 years for a chair, and 10 years for a coat.

Functional obsolescence is related to the technological development. It refers to a situation where a new product does the task better than the existing product, for instance a more energy efficient refrigerator, an easier to maintain coat, a music system with better sound, etc. When this occurs, it will tend to make the life time of the product shorter than what the durability dictates. A typical example is the development in the computer sale.

Psychological obsolescence is probably the main cause for discarding durable goods in today's Europe or Western World in general. New fashion is not only a sales argument for clothing, but has spread to cars, furniture, refrigerators, etc. If a product is psychologically obsolete, its durability and functioning is irrelevant, since it will be discarded anyway.

6.1 Energy saving potentials from longevity

Today there are several political initiatives to *recycle* materials like metal, paper, glass, etc. and also to *reuse* components like bottles, plastic bags, timber, etc. The ultimate reuse of durable goods, however, is to use them over and over again, by ignoring the psychological and maybe the functional aspects, until reaching the ultimate limit, the durability. The consumption saved this way is hard to assess. If we include the potential for more durable and repairable goods, however, it is safe to assume that the actual lifetime could on the average be doubled for durable goods without any significant extra cost in production. The result would be a doubling of the maintenance efficiency, the last factor in equation (2), and hence a doubling of the overall efficiency of durable goods.

6.2 Consequences of longevity

The impact of for instance a doubling of lifetime for durable goods, would be a reduction of half in the consumption and hence in the production of these goods. If we define durable goods in the physical way done in section 4.1, it includes dwellings, and in Denmark these total durable goods account for about half of the private consumption alone. Doubling their lifetime, is estimated at least to save 25% of the total manufacturing and the associated energy consumption, without hampering the material welfare.

An environmental drawback of the longer lifetime is that for products which consume energy or other non-durable goods which affect the environment, the slower replacement rate will delay the introduction of new, cleaner technology, such as more energy efficient appliances, buses, and houses. In the transition until the high efficient version is implemented, there can be cases where an accelerated replacement to cleaner technologies can be justified from a rational environmental point of view. But it would be shortsighted to encourage a "buy and discard" attitude for specific items and for this limited period, when the opposite trend is needed in general.

Unfortunately, longevity is not encouraged by governments and businesses, and like for many other environmentally benign steps, the quest for growth in GDP is the basic barrier. It is still another dilemma for an environmentally conscious politician brought up with traditional views on economic development.

7 DEMAND FOR MORE LEISURE

Third example of the inefficiencies in the development deals with the value of leisure time. It is an important part of the Western culture, that work and business are highly valued elements in our behavior. From early childhood we have been brought up to feel bad and guilty about idleness. Weber has ascribed this work attitude to the emerging *Protestant ethics* (Weber 1972). Truly it has originated in the nations dominated by the faith of Protestantism, from a much more leisurely attitude prevailing before Protestantism emerged 500 years ago (Kjærgaard 1991). But there are indications that the cause and effect could be interchanged, because about that time many parts of Europe were on the verge of collapse due to *environmental problems* caused mainly by deforestation. The situation required more work and the upper class found it necessary to promote the attitude of work as a call, and this was then adapted as one of the pillars of the Protestantism. Later capitalism and its *industrialization* benefitted from the general appreciation of hard work. It became the driving force of the capitalistic industrialization and has provided the present high material standard of living. *But the persistency of this adoration of work now turns out also to become a serious barrier towards reaching an environmentally sustainable development.* It is interesting to notice that today the main argument in Northern Europe for increasing production is *not* the need for the products, but the need for employment, - the need for keeping people busy. The goods produced can in some cases be considered a wasteful and polluting byproduct. And yet, there seems to be some hope, if the politicians listen to the true wishes of people, as described in the following.

7.1 Trends in people's opinion

Since 1964 a number of surveys on the Danish people's preferences in time use have been carried out. One of the questions asked by the Danish National Institute for Social Research was: "If you had the choice between one extra hour of leisure a day (same income), and one extra hour's pay (same work time), which would you prefer?". The results from the three surveys showed for the whole working population that there has been a steady increase in preference for more leisure: from 44% in 1964 over 57% in 1975 to 70% in 1987. The preference for more pay was 28%, 30%, and 29% respectively, with the remaining undecided (Platz 1988; Körmendi 1990). In other words, rather than higher income and hence more consumption, 70% of the Danes wanted more leisure. This indicates a trend in values as suggested necessary for a sustainable development (Christensen and Nørgård 1976). But the system did not offer people this non-economic and environmentally benign service. It should be emphasized that this extra leisure would not lead to extra consumption,

since it was a choice between the two. It is striking that internationally very few such surveys have been conducted (Körmendi 1990).

Other survey results have roughly confirmed the trend described above, although the questions were phrased slightly different. After 1987, however, there has been a declining trend in preference for leisure (Schönemann-Paul et al 1992), which could be explained by political counteractions, as described later.

7.2 Leave of absence

The reaction from politicians to the above trends in people's preferences from opinion polls
has often been that they really don't trust that the polls reflects what people want. This could, of course, be true, but recently the economic saturation trend seems to be confirmed in actual behavior. In 1993 the Danish government introduced what is called a leave of absence scheme for everybody in the labor force.

The rationale behind the leave of absence scheme is that since 10 - 12% of the Danish labor force is unemployed and receives the unemployment benefits, it should be made possible for people who have jobs to voluntarily take some time off on leave and receive a pay comparable to those benefits. This would open up for jobs to unemployed, and give some distressed working people a welcomed break with a modest reduction in income. Three categories of leave were introduced, namely maternal leave (open for both fathers and mothers), educational leave, and sabbatical leave, with only 80% of the normal unemployment pay available to those choosing the latter.

Most interesting is a special system for utilizing the sabbatical leave, first organized among garbage collectors in the city of Aarhus in Denmark, who were facing a massive reduction in working force due to rationalization. Instead, most of the remaining colleagues decided to take one week sabbatical leave every fourth week, receiving 80% of the normal unemployment pay during that week and opening for jobs for the otherwise sacked. The system spread to other groups and has some similarities with work sharing programs established at the VW factory in Germany. Although those cases leave the workers with a higher pay per work hour they nevertheless confirm the preference for more leisure over more income, reported in the above described opinion polls. They even go beyond the polls by revealing a willingness to accept a *reduced* disposable income, though rather modest after tax.

7.3 Consequences of demand for more leisure

The leave of absence scheme might turn out to be one of the most important and most courageous Danish *environmental* laws, although it has never been associated with the environment. But the fact is that it cuts the Gordian knot linking full employment to more activity in the economy and hence more environmental deterioration. The leave of absence scheme might not be the ideal work sharing program, but it has broken the ice for redistribution of work.

As a matter of fact the redistribution of work through the leave of absence scheme has been so successful that the Danish government unfortunately has found it necessary to limit the option from 1995 in a way which makes the garbage collector model impossible. Basically, this is done out of fear that it would hamper the economic growth, one of the reasons being a shortage of labor when the recovery appears.

During the recent century workers have demanded and gradually achieved reduction in the hours of work per week, and nobody will probably dispute that this increase in leisure time has been a benefit along with the increase in income and consumption. It also seems quite natural that people's preferences move towards less materialistic improvements (Maslow 1970). But more leisure is not a benefit showing up in the GDP. Even when Daly and Cobb established an alternative to the GDP, an Index of Sustainable Economic Welfare, they hesitantly desist from including the value of leisure in this index with the remark "For now, at least, we omit the imputation for leisure because of the dubious calculations involved in it and *because it would outweigh all other components in a measure of welfare*" (my emphasis) (Daly and Cobb 1989). This importance was somehow confirmed in a recent study for Denmark's welfare indicator (Rørmose and Møllgaard 1995). Here leisure *was* included, and using the lost disposable income as the value of an hour of leisure. In this way the total value of leisure amounted to about the same as total consumption, but with very modest increase over the 1970-1990 period considered.

The only ways for the rich countries to avoid the environmental threat of a growing productivity are 1) to curb or reverse the productivity increase, 2) turn all productivity growth into leisure or 3) to send the surplus to the developing countries as an installment of old debt to them.

Satisfying people by providing more options for services which require leisure, equation (4) will increase efficiency of the overall economy. But it surely also places politicians in the dilemma between environment and economic growth.

8 DEMAND FOR ELECTRICITY SAVINGS

The last example presented here to illustrate the political resistance to energy efficiency, has to do with saving electricity through better technologies. It has become well known that energy demand in countries like the West European countries could be reduced to half or even one third with technologies which are already on the market or could be so in a few years (Goldemberg et al 1988, Nørgård and Viegand 1994). Particularly a more efficient end-use of *electricity* is found to be extremely *cost effective* as well, assuming that the new efficient technologies are introduced in the natural course of replacement. Acceleration of the replacement, as is often assumed in studies, can reduce the cost effectiveness considerably. It is found that in countries like the West European, saving about half the electricity can be achieved with technology already on the market and at a cost for the society around only 0,01 ECU per saved kWh (Nørgård 1989). Proceeding with more advanced, efficient technology will cost more, approximately 0,04 ECU per saved kWh. By comparison, the average cost of producing one kWh in one of Denmark's new coal fired power plants is also around 0,04 ECU. Considering the environmental gains from saving electricity instead of producing it, societies should not hesitate to pay much more for a saved kWh than from one produced.

8.1 Electricity savings might be too cheap

It is the experience of most people working in the field of electricity efficiency, that the enormous options for savings at a low price are not utilized at a rate to be expected. Many studies have investigated the obstacles to implementation of the electricity efficient end-use technologies. I will suggest a paradoxical one, namely that these savings are too cheap. When a society is geared towards economic growth, a more expensive solution to a problem will somehow get most attention, for instance by creating more jobs. This was a main argument for recently permitting the construction of two more new power plants in Denmark, after for a decade having largely ignored the options for more efficient electricity use. The Social Democratic Danish Government, the electric utility industry, and the labor union leaders, all seemed to agree, because the expensive solution of building new plants creates some temporary jobs. Also on a smaller economic scale, the attitude is that a new product, which performs better that the older one, but cost less, is often of little interest to industry.

9 THE DILEMMA BETWEEN GROWTH AND EFFICIENCY

Growth in the economy is often defended as necessary for solving the environmental problems, ignoring the reverse effect, that economic activity is the basic source of the environmental problems and that growth in these activities will tend to add to the problems.

9.1 Growth through inefficiency trends

In Danish we have an old sensible saying that "you should not cross the river to get water", meaning don't make life more troublesome than necessary, since the water at your own river bank is similar to that at the opposite side. As pointed out by the Danish economist Hvelplund, however, this is not a valid guideline for societies with economic growth as the dominating goal (Hvelplund 1980). If for example getting water from the river is part of the GDP in two countries, then the country which can convince its citizens to cross the river to get the water or in other ways behave similarly inefficiently, will have the largest GDP. As explained above there are plenty of examples where our present economic system chooses the inefficient solutions, as in the cases of building power plants instead of improving the efficiency in the use of electricity.

In general, the way economic growth can continue in a society where people's *economic* wants are already satisfied, is to provide this satisfaction in a more and more inefficient way. One model for that is to convince people to prefer beer, cookies, fruit and other products from remote regions, instead of their own region's similar products. Another model for inefficient satisfaction of people's needs is to use the wrong means. Most of the needs in Europe today are social and psychological in character, but they are excessively sought to be satisfied by material means. The result is that the satisfaction comes from *purchasing* the goods, rather than *possessing* them, and the consumer becomes *addicted* to the *flow* of goods, which at the same time is also the root of the environmental problem. The businesses acting as pushers have the full support, acknowledgement, and even subsidies of the growth oriented governments.

9.2 Sustainable lifestyles versus economic growth

Politicians in Denmark sometimes urge people to behave more consciously about the environment by adapting their lifestyles to sustainability. What the politicians don't specify is that *the basic element in such a sustainable lifestyle must be an everyday life with a reduced throughput of everything, including consumer goods in general.* To wear clothes longer before replacing them is one example. To travel less is another. To eat less meat and drink less bottled or canned beverages would also be an appropriate change. And so would a change towards working less hours and being less productive in the work as well as in leisure time. All this would save energy and resources, and hence be an extremely important step on an environmentally more sustainable path of development. But this is not the changes in lifestyles the politicians really want, because these changes will all lead to a lower GDP.

Rather than promoting a switch towards a truly more environmentally benign lifestyle, the politicians usually counteract such trends in lifestyles whenever they emerge, as discussed below.

9.3 Counteracting the demand for freedom

The examples of higher overall efficiency options in the economy described above, that is, the switch to more public service, to more leisure, to longer life times of durable goods, and more efficient electricity, all point toward less need to work, towards more freedom. The examples will also lead to a lower GDP, which has caused the government to take countermeasures.

The trend towards a general economic saturation, illustrated by the preferences for more leisure over more income, is most apparent in Denmark and other North European countries. It is obvious to associate this saturation not only with the high average standard of living already achieved in these countries, but also the rather high equity. One of the government actions to counter this trend, has therefore been very cautiously to increase inequities through tax reforms etc. More differentiated wages was also recommended to Denmark by OECD as a means to promote the economic growth (OECD 1983). The maintenance of a high unemployment instead of work sharing programs can also be seen as a growth promoting policy.

An obvious measure to counteract a saturation is advertisement, and by 1989 the Danish consumption of advertisement had in a couple of years grown 50% faster than consumption in general, reaching a level around 350 ECU/cap or 2% of the overall consumption (Danmarks Statistik 1992). In the 1980s advertisement was for the first time in Denmark allowed into TV. According to Vance Packard, a similar saturation situation in the 1950s in U.S.A. was successfully counteracted by a more aggressive advertisement, persuading consumers at a subconscious level (Packard 1957, Gaugler 1991). Liberation of the shopping hours and the introduction of electronic pay systems also worked towards increasing consumption.

9.4 Free market and efficiency

It is well known that the collective environmental problems we are all facing will require strong government regulations of the market economy. It is less recognized, however, that redirecting the economy toward a more efficient fulfilling of human needs also will require interference by government. Governments have to a large extent left the options to shape people's wants through advertisement, etc. to be controlled by the business capital, and there being directed towards selling still more consumer goods. The more free market, the less influence is left for the democratically elected governments.

The main virtue of a free market is that it has been able to provide *lower consumer prices*, which, however, we *don't really need* in today's over-consuming Europe unless we are willing to reduce working hours correspondingly. The main drawback of a free market is its resistance to democratic government control, which is so *badly needed*, because this over-consumption is threatening the common environment.

10. CONCLUDING REMARKS

Analyses indicate that there are no reasons to believe that a transition to an environmentally sustainable and globally responsible Europe necessarily implies any significant set back in *real* material standard of living, let alone in general quality of life for the Europeans. But the transition will require an almost revolutionary change in the economic thinking and acting, some would say back to real economy with an overall efficiency as the goal. The present trend in European economy is towards pursuing growth by turning more and more *uneconomical.*

For too long experts in the field of environment and energy efficiency have focussed on the technological potentials, but remained silent about the equally important need to reshape the economic system as a whole in order to reach an

environmentally sustainable development. In eager attempts to get the politicians to accept their wonderful efficiency technologies, they have been pretending that business could go on with the usual economic growth. It is high time to speak up for a responsible policy aimed at redesigning both the technology and economy for the future.

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