The social formation of capitalism, fossil energy, and oil-imperialism

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1 Introduction: The Societal Relation to Nature

The economy has a monetary and value dimension (value of the gross national product, of world trade, of FDI, of financial flows etc. and its dynamics), it has a material basis with regard to production and consumption, transportation and distribution. The economy is also an element of social communication. Thus, economic globalisation is a globalised and globalising process of monetary and value processes, of transformations of matter and energy, particularly of fossil energy-sources into labour-energy, and last not least of social relations and contradictions. Transnational corporations are a good example of this complex societal relation. They have established commodity chains all across the world. Therefore, it is possible for them to locate production processes which are labour intensive in places where labour is cheap, or environmentally harmful processes in those places where environmental laws and regulations are lagging behind more developed standards. The decisions in the first place consider values and prices, profit margins and returns on capital invested. But they have due to the material dimension of economic processes an important impact on nature. Moreover, they have the potential to reshape social relations.

Consumption also has environmental effects because of the globalisation of the western way of life. The "westernisation" of the world follows a model of consumption which intensively builds on a high degree of mobility, on the establishment of the "spatial fix" of a huge and thus nature consuming infrastructure. The natural environment more and more is supplemented by a "built environment". The effects on natural reproduction on the local, the national and on the global level mostly are negative. Global transportation is responsible for the consumption of big amounts of fossil energy and thus for an increase of CO_2-emissions and for the aggravating climate crises. Preventive measures are so difficult because they have to address the structures and processes of globalisation, the monetary and value dimension as well as the material and energetic transformations and processes of social communication.

At the first glance it seems as if services and finance do not exert negative effects on the environment. However, the assumption of a "virtual economy" of bits and bytes is bullshit (in the sense of Frankfurt 2005) and nothing but a grand illusion. Financial markets exert financial repression on the real economy, enforce the debt-service of financial claims of creditors (banks and funds), which are only affordable in the case of high real growth rates. Therefore, finance

exerts indirectly a high pressure on the consumption of energy as well as of material resources. Due to the financial instabilities and crises, so visible during the last decades, the financial sphere is apt of jeopardizing social stability, of pushing large strata of the population into informality and poverty, and even the World Bank admits that these nuisances are highly responsible for ecological degradation in large parts of the world.

The environment in synchronic terms includes the energy system, climate, biodiversity, soils, water, woods, deserts, ice sheets, etc. and diachronically the evolution of nature. Therefore, it is necessary to analyse the impact of human (above all: economic) activities on all these dimensions of the comprehensive environment. The complexity of nature and the positive and negative feed-back mechanisms between the dimensions of the environment only partly are known. Therefore, environmental policy has to be performed in the shadow of a high degree of insecurity. Human activities, particularly the economic ones and their effects on the natural processes are the central elements of the so called man-nature relationship (societal relation of man to nature), which also includes feed back mechanisms on the totality of the social, political and economic system. Only a *holistic endeavour* of integrating environmental aspects into discourses of political economy, political science, sociology, cultural studies etc. enables a coherent understanding of the environmental problems and can give advice for the elaboration of adequate political responses to the challenges of the ongoing ecological crisis. Moreover, the exploitation of natural resources and their degradation due to a growing quantity of pollutants results in a man-made artificial scarcity (or shortage) so that conflicts on the access to natural resources are coming up. The environment more and more is transformed into a contested object of human greed. The societal relation of man to nature therefore also includes environmental conflicts and even wars on resources. The reason is the contradiction between the necessity of certain resources for human survival and for the working of the modern economy and the scarcity which is becoming the main characteristics of many resources: of land, of fresh water and above all of oil.

2 The fossil energy regime and the wealth of nations

In order to better understand the indispensable dependence of modern capitalist societies on fossil fuel and particularly on oil it makes sense to briefly consider the advantages of fossil fuels for capitalist accumulation. In general terms the Energy Return on Energy Input (EROEI) is very high. For, the entropy of this energy source is very low, the energy concentration very high so that it is energetically possible, to produce a high surplus. Fossil energy is a thick energy source, whereas solar flows may be described as a thin form of energy. Therefore it seems so as if fossil energies are the origin of and responsible for the

creation of surplus value in a capitalist system. However this is not the case. A physical surplus and economic surplus value are so different as use values and exchange values, as the physical barrel of oil and the futures quotation of that barrel at the Chicago stock exchange.

The misunderstanding of physical and value processes induce some ecologists to reproach Marx with a certain negligence of the "value of nature" in the process of value-production (e.g. Immler 1984; Bunker 1985, Deléage 1989). But this rebuke only is relevant insofar as the labour process is concerned. Of course, nature is as important as labour in processing matter and energy into needed use values. In the course of the process from input to output man and nature work together; they are both equally important. But as a process of exchange value production it is only labour which creates value and surplus value. The reason which mostly is misunderstood by the critics of the Marxian concept of nature, is the following one: nature is wonderfully productive – the evolution of species in the history of the planet and their tremendous diversity and variety show it. But nature is not *value-productive* because it produces no commodities to be sold on the market. There is no market in nature. The market is a social and economic construct. The most beautiful bird or a very old tree in a tropical rain forest or the iron ore in a mine are no commodities; they only are changed into commodities by a process of valorisation (*Inwertsetzung; mise-en-valeur*). It is labour which performs the metamorphosis of nature into commodity. But it is not labour as such, *labour sans phrase*, but labour power spent under the social condition of value and surplus value-production (Altvater 1992: 250ff; similarly Burkett 1996: 64).

Because of the low entropy and the high energy intensity of fossil fuels they are apt to enormously help increase the production of use values in a given time period (and thus of labour productivity). This is a general characteristic of any production system in human history. But only since the product produced is sold as a commodity against money and those producing the commodity are getting wages which are claims that cannot buy back the whole product, and since those who control the reproduction process compare the surplus with the capital outlays the economic surplus appears in the social form of surplus value.

From the viewpoint of energy analysis the production process may look very different as compared with the viewpoint of commodity- and value-analysis. Juan Martinez-Alier mentions with regard to the different perspectives: "The productivity of agriculture has not increased, but decreased, from the point of view of energy analysis" (Martinez-Alier 1987: 3); but in terms of commodity-production in agriculture and in terms of return on invested capital the productivity has increased. Therefore it is possible for Dutch agricultural producers to compete with Mexican producers of horticultural products such as

eggplants on the North-American market (Maya 2005). They simply do not take the full costs of fossil energy inputs into account.

In history the transition to industrial systems and to the predominant use of fossil energies is much more dramatic than that which transformed societies of hunters and gatherers into a social order of sedentary agricultural systems. It is a revolutionary break in the history of the societal relation of human beings to nature because it is no longer the *flow* of solar radiation which serves as the main energy supply for the system of production and the satisfaction of human needs, but the use of the mineralised *stocks* of energy in the crust of the earth. The greatest expansion of human demand for natural resources followed the Industrial Revolution during the latter half of the 18th and the first half of the 19th centuries. One of the main advantages of fossil (and to a minor extent nuclear) energies for capitalist accumulation in comparison with other energies is the congruence of their physical properties with the socioeconomic and political logics of capitalist development:

Firstly, the patterns of space and place change. The location of energy resources is no longer the main reason for the location of manufactures or industries. For, it is simple to transport energy resources to any place in the world. The fossil energy system spreads itself far and wide by creating logistical networks which today cover the globe. It is so to say "*autopoetic*", for it allows the transport of energy to remote places of the Earth and thus draws them into the fossil system. Energy supply therefore is only one factor amongst many others in decisions about where production is to take place. The availability of local sources of energy has only a minor impact on the competition for locations of manufactures and industries in the global space.

Secondly, and in contrast to solar radiation, which changes its intensity between day and night and with the rhythms of the seasons, fossil energies can be used 24 hours a day and 365 days a year with constant intensity. They allow the organisation of production processes independently of social time schedules, biological and other natural rhythms. The time regime of modernity follows the logics of profitability and that of the optimisation of shareholder value. The reason is that fossil energies can be stored and consumed without reference to natural time patterns, and only in accordance with the timetable which will optimise profits. "Time is money" (Benjamin Franklin) therefore appears not as a crazy statement but as an adequate norm for human behaviour in "modern times". Moreover, fossil energies allow the extreme *acceleration* of processes, i.e. the "*compression* of time and space" (Harvey 1999; Altvater and Mahnkopf 1996/ 2004). In other words: they allow an increase in productivity, i.e. the production of more commodities within a given time span or the reduction of the time span for the production of the same amount of products. Since time and space are the

coordinates of nature in which we live, their compression is a serious neglect of the natural conditions of work and life.

Thirdly, fossil energies can be used very flexibly with regard to the quantities of energy consumed or the temporal distribution and spatial location of consumption. The development of electricity networks and of the electro-motor, the illumination of whole cities at night, the inventions of the gasoline and diesel-motor are decisive steps for an increasingly flexible use of energy-inputs, for the mobilisation and acceleration of economic processes and for an individualisation of social life which never before in human history existed.

Now, managerial decisions can follow the logics of profitability for capitalist firms without needing to take into account energy restrictions or spatial and temporal constraints. Therefore, accumulation and growth must be understood as increasingly independent from natural conditions and their limitations. These advantages of fossil energy for the capitalist system make them indispensable. The congruence of capitalism, fossilism, rationalism and industrialism is perfect. Fossil energy would not have played the decisive role which it has done since the industrial revolution without the social formation of capitalism and its all-encompassing dynamics. Four forces since then drove the highly dynamic development: (1) the "European rationality of world domination" (as Max Weber called it), (2) the "great transformation" to a disembedded market-economy – the theme of Karl Polanyi, (3) the dynamics of money in the social form of capital (as Marx analysed it) and (4) the use of fossil energies which became the fulfilment of a (by Nicolas Georgescu-Roegen) so called "promethean revolution", comparable to the Neolithic revolution several thousand years ago, when mankind discovered how systematically to transform solar energy into crops etc. by establishing sedentary agricultural systems.

This *ensemble* of aspects of the fossil energy regime gives us not only an impression of the ingredients of its dynamics, but also of the width of approaches of social sciences which must be applied in order to understand the functional mechanisms of the fossil energy regime, of the formation of social relations based on the massive use of fossil energy and of a fossil culture, most visible in the dominance of automobiles in modern societies.

Without a continuous supply and massive use of fossil energies modern capitalism would be locked into the boundaries of biotic energies (wind, water, bio-masses, the power of muscles etc.). Although capitalist social forms had already put down some weak roots in ancient societies (in Europe as well as in Latin America and Asia), these could not flourish because of an insufficient technological basis and because of the lack of fossil energy. The entropy of energy sources was too high as to allow considerable surplus production.

Therefore growth was limited, and in fact the average growth rate was nearly zero before the industrial revolution of late 18th century which propelled growth rates to more than 2 per Cent annually until the end of the 20th century (Maddison 2001).

World population also has increased faster than ever before. In pre-capitalist and pre-industrial times economic growth was dependent on population growth which, in turn, depended – this was the rationale behind Malthus' theory – on the supply of goods and services for subsistence and reproduction. But since the industrial revolution economic growth became independent on population growth due to an enormous productivity increase and the concomitant increase of the production of relative surplus value. Therefore, contrary to Malthus predictions and according to the optimistic massage of Adam Smith and David Ricardo per capita incomes also increased with the widening and deepening of the division of labour. Angus Maddison in an OECD study showed that in the first millennium after Christ, from 0 to 1000 AD, world population grew at an average annual rate of 0,02% from 230,8 million to 268,3 million. Between 1000 to 1820 the number increased to 1041,1 million. GDP per capita followed a similar trend: in the first millennium from 0 to 1000 AD there was a slight decrease from an average of $444 to $435 per person per year (in the 1990 equivalent dollar standard which Maddison uses[1]). Between 1000 AD to 1820 an increase to $667 per capita took place. It is interesting to note that in the first millennium the income divergences between Western Europe, Japan, Latin America, Eastern Europe, Africa and Asia were very small.

From the second half of the 18th century average growth rates increased remarkably. This growth, however, has been extremely uneven over time and in space, and has failed to reduce the inequalities between peoples and regions in a globalizing world. This is also evident in the numbers provided by Maddison. Average world per capita income increased from 1820 to 1998, i.e. in only 178 years from $667 to $5709 (in Maddison's 1990 international dollar standard). The distribution of incomes in the same period became more uneven. In 1998 average per capita income in Western Europe was $17921, in North America (USA, Canada etc.) it was $26146 dollars, in Asia (excluding Japan) it was $2936 and in Africa $1368 (Maddison 2001: 28).

[1] Maddison, of course, is aware of the methodological problems measuring monetary flows over 2000 years in 1990 dollar-denomination. Therefore the interpretation must be more careful than usual. Although the numbers are not fully reliable, the trend found out is plausible.

3 Entropy and life conditions

In view of these numbers the question comes up: is growth possible for ever, is growth "triumphant" (Easterlin 1998)? The answer has to be "No", because nothing on earth grows eternally without any limits. The limits of growth belong to the life conditions, to the laws of evolution on the planet Earth, and they are a direct consequence of the limits of fossil resources which are fuelling the growth-engine. Although the accumulation of capital and growth are nearly entirely powered by fossil energy (and thus dependent on an isolated system of finite resources) human and natural life in general is almost entirely dependent on solar radiation (i.e. on the influx of solar energy into an open system). Daylight, the warming of the atmosphere, of the waters and the soils, the growth of living beings, the provision of food, etc. are the result of solar radiation and only to a small extent that of the use of fossil energy consumption. The satisfaction of primary human needs only is possible by using energy in the form of organic foods (containing proteins, fats, carbohydrates, vitamins, and minerals; water) and in a transformed manner as clothing and shelter - not to speak about the availability of oxygen.

The consumption of fossil energy has repercussions on the man-nature-relation. The increase of entropy and the associated irreversibility of all processes make up history. Since capital is following a logics of reversibility and circularity (capital is "selfreferential"), the natural and the capitalist time-and-space-regime are not compatible. Capital has to appropriate the surplus and invest this surplus again into the production process, which at the end will again result in the appropriation of a growing surplus. The compulsion to aim a surplus is inescapable, if production processes have been financed with credits and debt service has to be paid. The performance indicators of capital indicate very clearly the circularity and reversibility of the flow of capital within the relationship between results and outlay. Profitability, marginal efficiency of capital, return on capital, profitability, shareholder value and other indicators clearly demonstrate that the rationality is based on a Weberian rationalist comparison between the means i.e. investment and objectives, i.e. profit.

In contrast, natural processes of transformation of matter and energy as well as the natural growth process of living beings like plants and animals are characterised by irreversibility. This follows ultimately from the law of entropy. At the end of the process there is something qualitatively new (in the rationality of reversibility the quality remains the same, whereas the quantity of the same quality must grow). This qualitatively new product cannot be reproduced with the same energy or matter, thus the stocks of energy and matter are used until their depletion, unless new energy and new matter are supplied from outside the planet Earth.

Each production process is joint production. In the understanding of Herman Daly there is not only the straightforward process from inputs to outputs, but also the production of throughput (Daly 1991). It is a natural law that it is impossible to transform 100% of energy- and matter-input into products designed for the satisfaction of human needs. In the interpretation of Ilya Prigogine an increase of entropy is the inevitable expression of a transformation of matter and energy in the process of natural - and we may add - social evolution, i.e. no evolution without entropy-increase (Prigogine/ Stenger 1986). Therefore, we "enjoy our lives" (Nicholas Gorgescu-Roegen 1971) by simultaneously increasing entropy and worsening life conditions on Earth. Marx was full aware of this double-sided power of satisfaction of our needs and of destruction of the natural environment unfettered by capital accumulation: "all progress increasing the fertility of the soil for a given time is a progress towards ruining the more long-lasting sources of that fertility. The more country proceeds from large-scale industry as a background of its development..., the more rapid is this process of destruction. Capitalist production, therefore, only develops the techniques and the degree of combination of the social process of production by simultaneously undermining the original sources of all wealth - the soil and the worker." (*Capital*, vol. I, p. 638)

The increase of entropy decisively depends on the energy regime. The Neolithic revolution changed it by developing devices to capture thin solar energy and to transform it into concentrated useful energy for man. The development of agriculture resulted in an increase of food production, and moreover in a greater reliability of food supplies. The surplus produced by the farmers – in the terminology of the "Physiocrats" of the 18th century the sole "productive class" - made it possible that "unproductive classes" of artisans, clerks and rulers could be fed. But the agricultural system capturing solar energy flows for the transformation into economically valuable process-energy nearly completely disappeared in consequence of the industrial and fossil revolution. Eric Hobsbawm in his "Age of Extremes" speaks of the "only revolution" in the course of the 20th century, that in the second half of the century, the first time in human history the number of peoples living on the countryside and working as farmers in agriculture (as "harvesters of solar energy") is lower than the number of persons working in urban manufactures and services.

In the analyses of Fourastié or Colin Clark and Jan Tinbergen the transition from primary (agricultural) to secondary (industrial) and tertiary (services) has been interprted not as a revolution but as a sequence of modernisation steps. But the transition from an agricultural to an industrial societal relation to nature is a radical change, a revolution. Capitalist systems are based on the consumption of the limited fossil stocks of energy. Firstly, they will run out and secondly their

combustion is producing such an amount of harmful emissions that the living conditions on earth are deteriorating. In the terms of thermodynamic economics the transition to capitalist industrial systems based on fossil fuels creates the globalised planet Earth and moreover the planet is treated as a closed and isolated system. For, solar radiation from outside (and likewise the irradiation of heat into the outer space) are substituted by fossil energy sources from inside the crust of the Earth. However, life on Earth remains dependent on the radiation of the sun. Between life conditions (open system) and economic conditions (isolated system) on Earth a "firewall" has been constructed. Today, and possibly forever, it is impossible to power the machine of capitalist accumulation and growth with thin solar radiation-energy. It simply has not the advantages mentioned above, i.e. the potential of time and space compression, which thick fossil energy offers. Conversely, the fossil energy regime of the capitalist economy has an extremely destructive effect on life on Earth which is "powered" nearly completely by solar radiation. The degradation of nature, e.g. the greenhouse effect, ozone layer depletion, loss of biodiversity, desertification, disappearance of tropical rain forests etc. is unquestionable. The advantages of the fossil energy regime have a price: the disadvantages of ecological destruction and of the necessity to find a solution to the limits of their availability.

4 Limits of Resources and their oligarchical distribution

In capitalist calculation ecological limits of production and accumulation are recognised only when they increase the costs of economic processes and exert pressures on the rate of profit. Calculations of the German Institute for Economic Research have shown that the annual costs of climate change will be the equivalent of about $2000bn from the middle of the century on (Kemfert 2004). The hurricanes of autumn 2005 already caused damages of about 200 bn US$. "External effects" of production and consumption on society and nature are irrelevant for capitalist rational choices so long as they remain "external" to the calculations of single firms. But this is the case only so long as the "carrying capacity" and the capacities of recreation of nature and social systems are sufficient as to bear the polluting emissions of the economic process. Otherwise they become part of the "general conditions of production", increase the costs of production, affect negatively profitability and accumulation up to a crisis of the capitalist system. (This is the theme of James O'Connor, David Harvey and others.) The attempts to internalize these costs, e.g. by emission trading, do not offer a real solution. As it is possible to substitute artificial paper money for natural gold[2] it is not possible to substitute certificates and bonds to be traded on a special stock exchange for an increase of temperature of the atmosphere.

[2] Gold is a telling example for the abstraction of economics from natural boundaries. Gold is, by its very nature, a limited resource, although socially and economically it functions as money. Since capitalist

On the input side, in the case of oil it also is impossible to neglect natural properties and boundaries of the resource; bits and bytes cannot substitute for oil. The stocks of oil are limited, and oil is running out over the next few decades. Although the supply of oil is limited, the demand for oil will increase in spite of the attempts to save energy, to increase the efficiency of its use, to improve the energy mix and to make more use of renewable resources. This is for two interconnected reasons. First, the crucial role of global financial markets with its high real interest rates and rates of return-claims, enforce high real growth rates of GNP. Under the prevailing patterns of technology deployment, growth only can be achieved by an intensive use of fossil energy. Thus the operation of global financial markets has an impact on the oil market. It only can be mentioned here that there are also two other pressures exerted by the financial system on quantities and prices of supply on world oil markets. One arises from speculation on futures markets; much of the increases of the oil price in the years after 2004 is due to financial speculation. The other is due to the fact that rich oil producers of the Gulf region have heavily invested their "petro-dollars" into financial assets so that their income in the meanwhile is as dependent on returns on invested capitals and interest flows as on oil rents.

The second reason stems from the globalization of Western production and consumption patterns which are extremely energy-intensive. Newly industrialising countries crowd into markets and add to the already insatiable demand of the OECD countries, above all of the USA.

In all parts of the world, including huge countries like China and India, there is a continuing shift from agriculture (which is more dependent on renewable, solar energy than industrial systems) into industry, and a movement of population from the countryside to urban agglomerations. These trends are powerfully accelerated by the rules of the game as implemented by international organisations such as the IMF and the World Bank, with their structural adjustment plans, or the WTO which exerts pressure on all member countries to increase competitiveness in global competition. Economic mechanisms, supported by political pressures transplant the limits of energy supply into the working of the global accumulation process. The limits of resources on the background of increasing demand are responsible for higher conflictuality between political and economic actors.

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accumulation is ignoring natural boundaries and money is a social construct, the function of money has been de-coupled from the natural form of limited gold and ascribed to paper-money or electronic bits and bytes. Money in a nature-form nearly completely disappeared. Attempts to revive gold as the natural form of money, as Jaques Rueff tried to do under de Gaulle in the 1960s, is a ridiculous and anachronistic undertaking.

Under “normal” conditions capitalist accumulation relied on the production of relative surplus value, on productivity increases, powered by fossil fuel. Under the conditions of energy shortage and increasing energy prices accumulation of capital more and more takes the form of a process of dispossession (Harvey; de Angelis) of the less powerful by the more powerful private corporations and national states. The “oil security” of different countries and alliances is competitive and conflict-prone. The transformation of natural riches (matter and energy) into the wealth of nations is not possible for all peoples in the world. The “wealth of nations” is a “positional”, an oligarchical or club-good for the minority belonging to the club of the global oligarchs. “The others” are poor nations and within nations the poor people who cannot afford to pay the oil-bill, fill the gas-tank or pay for electricity and therefore are enforced to switch to other heating energies, from wood by cutting the remaining forests until collected industrial waste from nearby factories. Many poor peoples in Latin America living from 1 to 2 US$ per day are cut off the normal energy supply. They have no alternative as to look for non-fossil energy provision. This is the situation of poor people in the USA which Hugo Chavez exploits by offering cheap Venezuelan oil for the peoples in need.

5 Peakoil and climate damage

The main limiting factor of accumulation is the exhaustion of non-renewable fossil energy-resources within a reasonable time-span. Of course, the capitalist crisis is the consequence of internal socio-economic contradictions. “External limits” of the availability of resources have the potential to aggravate “normal” capitalist crises. Nobody knows exactly when oil and gas fields will be dry and empty, but it is certain that this will happen not in centuries but in a few years or decades from now. Oil production probably is peaking soon, Deffeyes writes around thanksgiving day 2005. Moreover, the exploitation of known reserves becomes more expensive since pressure and viscosity and other physical properties of oil fields deteriorate in the course of the extraction. Drilling is becoming complicated, especially in off-shore areas or in the case of unconventional oil-fields. The peak of oil production was already predicted by Marion King Hubbert in the 1950s, when everybody believed in an abundance of oil. He has foreseen that the US-American oil production will peak at the beginning of the 1970s, and exactly this happened. Since then the USA switched from an oil exporting into an oil importing country. Until the beginning of the 1980s global oil discoveries were larger than oil consumption. Since then consumption exceeds discoveries, so that the reach of oil reserves inevitably is shrinking.

The peak, however, only is partly an objective fact. It is dependent on extraction-technologies and on the knowledge about and the evaluation of

reserves. The first factor is emphasised by neoclassical economists: Do invest capital into the exploration of oil fields and into oil logistics and refinement - and the supply of oil can be increased in pace with the growing demand. The second factor, the evaluation of known and presumable reserves is highly dependent on interests of all parties involved in oil markets: producers, consumers, brokers and dealers. Therefore the estimates of world reserves are substantially different, reaching from 1149 bn barrels (BP in 2003) to 780 bn barrels (ASPO). The data published by the International Energy Agency are based on information provided by private oil companies. These data are biased by the strategies deployed by the companies concerned. The case of Shell in 2004 is telling. The company had to reduce their published highly overvalued reserve figures by 3,9 bn barrels, i.e. by more than 20 percent due to the requirements of stock market supervision. A major reason of this "error" and its corrections is "creative book-keeping". The company blew the reserves out for their annual report, in order to facelift the financial performance and to boost the market value, the quotation of the company (and with it the salaries of top managers). OPEC countries for their part are interested in high reserve-figures because of two reasons: First, they increase their estimate of reserves in order to get a higher OPEC quota in oil production. Typically, during the late 1980s "six of the 11 OPEC nations increased their reserve figures by colossal amounts, ranging from 42 to 197 percent, they did so only to boost their export quotas." (Campbell/ Laherrere 1998; available under http://www.dieoff.org/page140.htm). The Iraq reported in 1983 (during the war against Iran) an increase of reserves of 11 bn barrels although there was no verifiable discovery of new fields. Also Kuwait notified an increase of its reserves in 1985 of 50% without any proof. The second reason for reports of high reserves is the intention to influence the consumers of oil. High reserves of oil producing countries signal that also in the future there will be no shortage of oil and therefore the search of alternatives (of renewable energies) is a not necessary expense. On the other hand the reserves may be underestimated in order to increase the hidden reserves of an oil company or to inflate the oil-price in order to make the exploration of unconventional oil (deep sea-oil; oil-sand; polar oil, heavy oil) and high investment into new infrastructure (pipelines, tankers, refineries etc.) profitable. The uncertainty about the real amount of reserves therefore is remarkably high, as the comparison between the reserve figures of BP and ASPO perspicuously show. But it is absolutely certain that the reserve stocks are declining, although the Saudi oil minister Ali al-Naimi at an industry conference in Johannesburg September 2005 informed the world, that the country would soon almost double its "proven" reserve base and add 200 billion barrels to its current reserves estimate of 264 billion barrels. Sceptics however suggest that Saudi Arabia is running out of oil (http://www.energybulletin.net/9314.html).

At the end of the fossil energy regime conflicts are becoming sharper, on the input side with regard to access to oil resources as well as on the output side with regard to environmental consequences of petrol-combustion. Each nation, constrained by the logics of industrial and post-industrial capitalism, needs to have access to the common good of fossil fuel reserves. But under the conditions of scarcity (better: shortage) the global commons of oil reserves is (as we have already seen) transformed into a "positional", oligarchical or "club" good. Either its distribution can be left to market forces and the processes of price formation, so that those oil consumers which do not afford to pay for the oil invoices are prevented from access. Or it could be organized in a democratic, solidary rationing of oil reserves - a perspective which in these times is not realistic. The third mode of distributing oil resources is that of the exercise of political power and military violence. It is rather likely that the first and the third mode and a mixture between both will rule the "Great Game", the battle over control of scarce oil resources in the coming future. These are the forces at play in the new "petrostrategy", in the arising oil- and greenhouse-imperialism, in which geo-economics and geopolitics are combined.

6 Petrol imperialism

The highly developed countries, particularly the United States, rely on both, on market power in the play of free trade and on military power in conflicts about oil-resources and in defending the country against coming climate conflicts. The combination of market forces and (military) power is central in the ideologies of American neo-conservatives – the neo-liberal glorification of a free market in a "geo-economy" and a "geo-political" recourse to military power. The invisible hand of the market must be completed by the visible fist of the American army, in the cynical words of Thomas Friedman. This is only at the first glance a contradictory position, considered more closely, it refers to a long tradition of "oil-empire". American wealth, power and supremacy are founded on "cheap and abundant oil flows" (Klare 2004) from the 19th century and the Rockefeller-Baku-connection until the present days.

"Oil security" is one of the priorities of US-American politics (Cheney report 2001; Klare 2004) and of other powerful oil consuming countries. It refers to several dimensions: first, to a strategic control of oil territories; secondly, to the strategic control of oil logistics (pipe lines, routes of oil tank-ships, secure refineries and storage); thirdly, it aims to influence the formation of the oil-price by controlling supply and demand on markets; and fourthly, it aims to determine the currency in which the price of oil is invoiced. When we consider

the many strands in a complex strategy of oil security or "oil imperialism", the formula of "blood for oil" seems much too simple. Yet it is essentially correct.

Firstly. The strategic control over oil regions can be secured either by means of diplomacy and the establishment of friendly relations as in the Gulf region, or by means of subversion as in some Latin American and African countries, or by using massive military power as in Iraq and to a lesser extent also in Central Asia and perhaps against Iran and Venezuela. The war waged on Iraq seems to be an irrational undertaking, because a military occupation imposed on a country against the resistance of a hostile population is extremely expensive and, in ways which are difficult to estimate, may well involve a demoralising impact on hegemony of the global superpower. Nevertheless, the USA after 2001 are well prepared to control the oil-regions; they dispose on more than 700 military bases in all parts of the world, many of them aiming at controlling the Caucasus Region, Central Asia, the Gulf and parts of Africa. The USA also hold military bases in many Latin American countries, from Columbia and Ecuador to Paraguay, trying to militarily encircle and politically isolate Venezuela, even by threatening with an invasion of the country and by trying to control Columbian and Ecuadorian pipeline-systems and Bolivian water reserves and the stocks of hydrocarbons.

Secondly. The strategic control of oil logistics is expensive too, although to a lesser extent. It requires the collaboration of many governments in countries traversed by pipelines, and of countries with coasts where the routes of tankers are passing. Central Asia has been labelled "*Pipelineistan*", that is the group of states in the region which provides transit for the Caspian oil. Based as it is on authoritarian and corrupt regimes, US dominance over these states is however precarious, and faces challenge, not only by "terrorists", but by considerable parts of the population. The crucial role of pipelines became evident in the course of the conflict between Russia and the Ukrain in 2005/06 about the transit of gas from Siberia to Western Europe and on the occasion of the planned construction of a direct pipeline from Russia to Germany through the Baltic Sea without crossing neighbouring Baltic countries or Poland. In Latin America the governments of Venezuela, Brasil, Argentina and Bolivia try to establish a continental pipeline system with the intention of intensifying Latin American integration by providing common infrastructure and not by creating an open market from Alaska to Fireland (Free Trade Area of the Americas) as it was intended primarily by the USA. Networks of gas and oil pipelines are gaining importance together with the globalisation of the fossil energy regime and the increasing scarcity of oil, and to a lesser extent of gas.

Thirdly. An influence on the supply of oil can only be exercised effectively by influencing OPEC. In the near future the great bulk of oil originates from OPEC-

countries of the Middle-East because the oil fields of other Non-OPEC-countries are expected to be depleted earlier. ASPO estimates that 2010 more than 50% of world oil production come from OPEC countries in the Middle East. Diplomatic pressure on single oil producers, or by enforcing oil exploration in parts of the world which so far have not fully become incorporated into the US-dominated global oil-empire may also help increase the oil supply. It is however doubtful whether this remedy has a long lasting impact, simply because also middle-eastern oil production is going to peak. The occupation of Iraq, and the establishment of a US-dependent and therefore only formally sovereign government, allow the USA to exert some influence on OPEC decisions since Iraq is a member country and can be used as a vehicle of US oil-interests. Diplomatic pressure on oil producers (particularly swing producers like Saudi Arabia), to get them to increase their exports is a very common practice of rich oil consuming countries and not only of the USA.

Fourthly. In the 1970s the US dollar fell sharply against other currencies and the inflation rate in the USA increased. One of the main reasons were the expenses for the war against the Vietnamese people and the loss of competitiveness vis-à-vis other countries such as Germany and later Japan. Faced with this situation, the oil exporting countries had only one choice in order to compensate for the losses of the real value of the US$ as the oil currency. What they were able to do was to exploit the opportunity of the Israeli-Arab Yom Kippur war of October 1973 to increase the oil price. The jump from less than 2 US$ per barrel to more than 11 US$ per barrel has been experienced in oil importing countries as a severe “shock”. But one choice was not available to oil producers: another currency, apart from the US dollar, in which oil could be priced. More than thirty years later, however, the situation fundamentally changed. One of the reasons is the “financialisation” of oil trading on futures markets, another is the concentration of oil quotations at the Chicago stock exchange. The most important change however is the Iranian challenge to establish an Iranian oil bourse, for trading oil in alternative currencies especially in Euro (Clark 2005). By making this step Iran places the petro-euro as an oil transaction currency in a competitive position with the petro-dollar.

The main economic and political actors in North America and Europe are not pleased by the Iranian initiative. Although some peoples doubt the seriousness and effectiveness of the Iranian initiative, because it always is possible to change Euro for US$ and vice versa on liberalised currency markets, so that the currency in which oil is invoiced does not matter very much, it is sure that the US$ will loose part of the seignorage-advantages as the only oil currency. Under the petro-dollar regime it is possible to import valuable oil for valueless paper. Insofar as it represents a claim on parts of the real global GNP it is as valuable as the quantity of use values to be purchased. The petro-dollars therefore circulate

between oil exporters and other countries in the world, and large amounts are stocked in form of currency reserves. The option of switching from US$ to Euro could become attractive for those countries, particularly Japan and China, much of whose huge official reserves consist of US financial assets. Again we have to consider the close connectedness of financial and oil markets. According to the WestLB (Westdeutsche Landesbank) at the end of 2004 Japan held reserves totalling $845 bn, China $610 bn, Taiwan 242 bn, South Korea 193 bn, Russia 125 bn, OPEC 133 bn, Singapore 113 bn. Hongkong $124 bn US$ (FAZ 23-2-05). These huge stocks of currency reserves are a direct consequence of financial instability, they serve as a kind of insurance against speculative attacks. This is the lesson learned in the financial crises of the 1990s.

At the end of the day however the issued dollars return to the USA, presented by external creditors. They claim the service in real terms or the exchange into other currencies. The USA which since the 1970 have become a structural importing country must reduce the import surplus and stimulate exports. This is only possible by an increase of the savings rate and a decrease in consumption expenditure, military expenses included. The dissolution of US$-reserves and the change into other currencies is a blow to the seignorage position of an imperial power.

But there is also the possibility of a devaluation of the US dollar in consequence of the growing twin deficit and the enormous increases of unproductive military spending of the US-government. In order to avoid a loss of value of their reserves the strategy of these countries will be to change their reserves into alternative currencies, above all into the Euro. They must do it slowly in order to avoid turbulences on currency markets. Senior officials of the People's Bank of China and of the Bank of South Korea have in fact declared their intention to increase the share of the Euro in its reserves and thus to reduce the engagement in US-Dollars. However, the share of the Euro in the reserves of the Asian central banks today is less than 10%, so that the momentum of the movement into the Euro should not be overstated (Solans 2004: 12) – so long as the shift from US$-invoicing of the oil bill to the Euro is no serious option. In June 2003 the OPEC decided to continue to invoice in US dollars, although some governments already considered to switch into the Euro, above all Venezuela and the Iraq before the war and the Iran in recent times in order to become more independent on the USA. But the domination of all the other dimensions of "oil governance" by the USA makes sure that no change of the oil currency in the near future is going to take place although since 2001 "OPEC exposure to dollar reduced sharply" (FT 23-2-05). The loss of value of the US dollar vis-à-vis the Euro and the huge twin deficits being run by the US economy (on trade and the federal budget) are factors which make the Euro as an oil currency more attractive for oil exporters.

The Iranian initiative to establish an oil bourse on a euro-basis must be interpreted on the background of the mentioned developments: oil is becoming scarce and more expensive, the Middle East in the near future will change to the most important oil supplier of the world, the western world has nearly completely lost the credibility in the Muslim world and therefore cannot expect popular support in the region, the competition among oil consumers also is sharpening. The Iranian oil bourse therefore is a realistic and highly conflict-prone undertaking. For, in this case the USA as an import-country of oil are obliged to pay in a currency which they cannot "produce". They have either to reduce oil imports – an announcement of President Bush in his state of the union in january 2006, which he failed to more exactly qualify - or to earn the euros by an increase of exports or an increase of foreign debt. Both alternatives have detrimental effects on the world economy as a whole, particularly on the European economies which are highly dependent on an export surplus. The change of the oil currency therefore includes structural changes of the global economic system. It is not likely that these changes happen without serious and turbulent conflicts between the main actors, the oil producing countries as well as the oil consuming countries. On the horizon of the disputes on energy security, i.e. on oil, there hovers the possibility of deep tensions between North America and Europe. Oil imperialism obviously includes conflict dimensions which have the potential to undermine any peaceful co-existence between the peoples of the world.

This statement is underlined by the output-side of the fossil energy regime. The German "*Umweltbundesamt*", the state agency responsible for environmental research, has issued a warning that climate change obviously occurs much faster than presumed and that therefore the pressure on immediate action, i.e. a considerable reduction of greenhouse-gas-emissions is increasing. One of the worst scenarios of climate change, paradoxically, has been presented in a study commissioned by the Pentagon and carried out by Peter Schwartz and Doug Randall (2003) of the Global Business Network. Since global warming does not have equal effects in all parts of the world, the regions of the world may be affected differently, and thus will experience different patterns of climate change. Some regions may well be hit by colder periods in the near future because of the changing pattern of global air and water circulation. The study follows the assumption of the IPCC that the average global temperature is likely to increase by up to 5.8^0 C by 2100. As this temperature rise will cause a melting of the Greenland ice sheet, the Gulf Stream may change its direction due to the lower density and salination of waters in the North Atlantic. This process is expected to be very rapid. The resulting collapse of the *thermohaline circulation* in the North Atlantic will involve "disrupting the temperate climate of Europe …. Ocean circulation patterns change, bringing less warm water north and causing

an immediate shift in the weather in Northern Europe and eastern North America…." (Schwartz and Randall 2003: 9). Europe would be severely affected by such an abrupt climate change; "…Over time though, conflicts over land and water use are likely to become more severe – and more violent. As states become increasingly desperate, the pressure for action will grow." (Ibid.: 16)

Even if climate change turns out to be less dramatic as this analysis suggests, and does not occur as suddenly as assumed in the Pentagon scenario, it is obvious how conflict-prone the use of fossil energies actually is – both on the "input side" of energy provision at the beginning of the energy-chain and on the "output side" of green house gas emissions at the end of the energy-chain. The future conflicts very likely will have to do with access to resources and with the strategies undertaken to insulate nation states against the effects of climate change, especially against migration flows. This also is the conclusion in the recommendations of Schwartz and Randall. They do not recommend the signature of the Kyoto-protocol, but technical solutions on a planetary scale for the warming of the cooler areas in the Northern hemisphere.

7 A "solar revolution": the transition to a renewable energy regime

It is unlikely that new reserves of oil explored can hold pace with the growing demand for oil. China and India alone are responsible for three quarters of the rise in oil demand in 2004. This situation will not change, and therefore the supply-curve after "peakoil" is declining whereas the demand curve is increasing. The oil price is going up and becoming an obstacle for many oil consuming countries to afford paying the oil bill.

There seems in fact to be only one realistic alternative to oil imperialism – namely a shift from oil dependence to renewable energy sources, to the radiation energy of the sun (and its secondary derivatives such as photovoltaic, eolic, water, biotic energies etc.), or to volcanic and geothermal energy. The Neolithic revolution is an important example which shows that it is possible to extremely increase the productivity of labour and of resources on the basis of the solar energy-regime. Therefore, a similar increase after the transition to a "solar society" cannot be excluded. On the one hand the shift to non-fossil and to renewable energy is a response to energy scarcity. This was already the Brazilian experience after the first oil price shock of 1973 when it started the "pro-alcool"-program of the production of ethanol out of sugar cane. President Lula of Brazil has offered technological experience in the production of ethanol to other governments in Latin America in order to face the recent energy crisis. In the volcanic regions of Central America and the Andes it also is possible to tap volcanic and geothermal energy. The transition to renewable energy requires appropriate technologies, but above all appropriate social institutions

which have to be developed in the course of a social learning process in order to realise the necessary transformation and to overcome the above mentioned "firewall" which separates the (closed) fossil regime from the (open) life energies provided by the sun. This radical transition from fossil to renewable energies can be understood as a "solar revolution". Such a revolution must aim not just at a simple seizure of power but must include radical transformation in patterns of production and consumption, of life and work, of gender relations, of the societal relation of mankind to nature. It is a holistic endeavour, a revolution, which cannot be carried out in a short period of time but in the long run.

Literature

Altvater, Elmar (1992): Der Preis des Wohlstands oder Umweltplünderung und neue Welt(un)ordnung, (Westfälisches Dampfboot) Münster

Altvater, Elmar (2004): Inflationäre Deflation oder die Dominanz der globalen Finanzmärkte, in: *Prokla - Zeitschrift für kritische Sozialwissenschaft*, No 134, März 2004

Altvater, Elmar/ Mahnkopf, Birgit (2002): Globalisierung der Unsicherheit – Arbeit im Schatten, schmutziges Geld und informelle Politik, (Westfälisches Dampfboot 2002) Münster

Brzezinski, Zbigniew (1997): Die einzige Weltmacht, (Beltz Quadriga) Weinheim und Berlin

Campbell, Colin/Laherrère, Jean H. (1998): The Ende of Cheap Oil, in: Scientific American, March 1998 (http://dieoff.org/page140.htm)

Cheney-Report (2001): National Energy Policy – Reliable, Affordable, and Environmentally Sound Energy for America's Future. Report of the National Energy Development Group, The Vice President, Washington D.C. (http://www.whitehouse.gov/energy/National-Energy-Policy.pdf)

Clark, William (2005): Petrodollar Warfare: Dollars, Euros and the Upcoming Iranian Oil Bourse, in: Media Monitors Network, archived 9 August 2005: http://www.energybulletin.net/7707.html (download 5 February 2006)

Crafts, Nicholas (2000): Globalization and Growth in the Twentieth Century, IMF Working Paper WP/00/44, Washington D.C.

Deffeyes, Kenneth S. (2005): Beyond Oil. The View from Hubbert's Peak, (Hill and Wang) New York

Easterlin, Richard A. (1998): Growth Triumphant. The Twenty-first Century in Historical perspective, Ann Arbor 1998

ERP (2003): Economic Report of the President together with The Annual Report of the Council of Economic Advisors, (United States Government Printing Office) Washington D.C.

Frankfurt, Harry G. (2005): On Bullshit, (Princeton University Press) Princeton

Georgescu-Roegen, Nicholas (1971): *The Entropy Law and the Economic Process*, Cambridge (Mass.)/ London (Harvard University Press)

Giesenfeld

Global Challenges Network, ed. (2003): Ölwechsel! – Das Ende des Erdölzeitalters und die Weichenstellung für die Zukunft, (dtv) München

Hardt, Michael/Negri, Antonio (2002): Empire. Die neue Weltordnung, (Campus) Frankfurt/New York

Harvey, David (2003): The 'New' Imperialism: Accumulation by Dispossession, in: Panitch, Leo/ Leys, Colin (ed): The New Imperial Challenge, Socialist Register 2004, (Merlin Press/ Fernwood Publishing/ Monthly Review Press) London: 63-87

Heinberg, Richard (2004): The party's over. Das Ende der Ölvorräte und die Zukunft der industrialisierten Welt, (Riemann, One Earth Spirit) München

Hirsch-Report (2005): Hirsch, Robert L./Bezdek, Roger/Wending, Robert: Peaking of World Oil Production: Impacts, Mitigation, & Risk Management, February 2005: http://www.projectcensored.org/newsflash/The_Hirsch_Report_Proj_Cens.pdf

IMF (2005): World Economic Outlook April 2005 – Globalization and External Imbalances, (International Monetary Fund) Washington D.C.

Klare, Michael (2004): Blood and Oil. The Dangers and Consequences of America's Growing Dependency on Imported Petroleum, New York (Metropolitan Books)

Krauthammer, Charles (1991): The Unipolar Moment, in: Foreign Affairs, 70: 1, 1991, 23-33

Kutter, Karin (2004): Ölreserven und Ölinteressen. Wie glaubwürdig sind die Angaben zu den weltweiten Ölreserven?, in: PROKLA 131 – Zeitschrift für kritische Sozialwissenschaft, 34. Jahrg., Heft 4, Dezember 2004: 643-649

Luttwak, Edward (1994): *Weltwirtschaftskrieg. Export als Waffe - aus Partnern werden Gegner*, Reinbek bei Hamburg (Rowohlt)

Maddison, Angus (2001): The World Economy. A Millenial Perspective, Development Centre Studies OECD, Paris 2001

MEW 23, 24, 25: Marx, Karl (1970): Das Kapital, 3 Bände, Marx-Engels-Werke, Band 23, 24, 25. (Dietz Verlag) Berlin

Mommer, Bernard (2002): Global Oil and the Nation State, (Oxford University Press) Oxford

Mouffe, Chantal (2005): Towards a multipolar world order, in: Chaloupek, Günther u.a., Hrsg.: Sysiphus als Optimist. Versuche zur zeitgenössischen politischen Ökonomie. In memoriam Egon Matzner, (VSA) Hamburg: 404-411

NSS (2002): The National Security Strategy of the United States of America, September 2002 (http://www.whitehouse.gov/nsc/nss.pdf)

Ohmae, Kenichi (1990*): The Borderless World: Power and Strategy in the Interlinked Economy*, London (Collins)

Ohmae, Kenichi /Henzler, H./Gluck, F. (1992): "Stuttgarter Erklärung" zur weltwirtschaftlichen Interdependenz, in: K. Ohmae (Hg.), *Die neue Logik der Weltwirtschaft*, Hamburg (Hoffmann und Campe): 337ff

Scheer, Herrmann (1999): Solare Weltwirtschaft. Strategien für die ökologische Moderne, (Kunstmann) München

Scheer, Herrmann (2005): Energieautonomie, (Kunstmann) München

Schwarz, Peter /Randall, Doug (2003): An Abrupt Climate Change Scenario and Its Implications for United States Security, Pentagon. Internet: www.ems.org/climate/pentagon_climatechange.pdf.