

# THE SOCIAL AND NATURAL ENVIRONMENT OF FOSSIL CAPITALISM

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The ‘westernization’ of the world has led to a pattern of production and consumption which builds intensively on the nearly limitless availability of matter and energy, sophisticated technology, and the existence of natural ‘sinks’ in which solids, liquids and gas-emissions can be dumped. The effects on the local, national and global natural environment are mostly negative. Global transportation is responsible for the consumption of large quantities of fossil energy and thus for an increase of CO<sub>2</sub>-emissions, thus aggravating the climate crisis. Labour-intensive production processes are located where labour is cheap, and environmentally harmful processes where environmental laws and regulations are least exacting, and so least expensive.

At first glance it seems as if services and finance do not exert negative effects on the environment. However, the idea that we now live in a ‘virtual economy’ of bits and bytes, and that economic growth is being decoupled from energy consumption, is nothing but ‘a myth’ (or as Harry Frankfurt says, ‘bullshit’).<sup>1</sup> Financial markets exert pressure on the real economy, enforcing the payment by borrowers of the financial claims of creditors (banks and funds) – payments that are only affordable if real growth rates remain high. This pressure has been seen as an efficient lever for securing increasing competitiveness, just as the absence of this pressure in formerly socialist countries has been seen as one of the main causes of their economic failure. Therefore finance indirectly enforces growth and, concomitantly, a rising consumption of energy as well as of material resources (although increasing efficiency in the use of matter and energy may partially offset this pressure). The financial instabilities and crises of recent decades have also jeopardized social stability, pushing large strata of the populations in the worse affected countries into precarious life conditions and poverty. Even the World Bank admits that these effects are responsible for ecological degradation in large parts of the world.

The reason for capitalism's high economic impact on the environment is to be found in its double character. It has a value dimension (the monetary value of the gross national product, of world trade, of FDI, of financial flows, etc.) but is also a system of material and energy flows in production and consumption, transportation and distribution. Economic decisions concerning production first consider values and prices, profit margins and monetary returns, on capital invested. In this sphere the ruling principle is only the economic rationality of profit-maximizing decision-makers. But the decisions they take have important impacts on nature, due to the material and energy dimension of economic processes.

Under capitalist conditions the environment is more and more transformed into a contested object of human greed. The exploitation of natural resources, and their degradation by a growing quantity of pollutants, results in a man-made scarcity, leading to conflicts over access to them. Access to nature (to resources and sinks) is uneven and unequal and the societal relation of man to nature therefore is conflict-prone. The 'ecological footprints' of people in different countries and regions of the world are of very different sizes, reflecting severe inequalities of incomes and wealth.<sup>2</sup> Ecological injustices therefore can only usefully be discussed if social class contradictions and the production of inequality in the course of capital accumulation are taken into account.

The environment includes the energy system, climate, biodiversity, soils, water, woods, deserts, ice sheets, etc. – i.e. the different spheres of the planet Earth and their historical evolution. The complexity of nature, and the positive and negative feed-back mechanisms between the different dimensions of the environment in space and time, are only partly known. Therefore environmental policy has to be made in the shadow of a high degree of uncertainty. This is why one of the basic principles of environmental policy is that of *precaution*.<sup>3</sup> The effects of human activities, particularly economic activities, on natural processes, and the feed-back mechanisms within the totality of the social, political and economic systems, constitute the so-called societal relation of man to nature. Only a *holistic* attempt to integrate environmental aspects into discourses of political economy, political science, sociology, cultural studies etc. can make possible a coherent understanding of environmental problems and yield adequate political responses to the challenges of the ongoing ecological crisis.

## NATURAL RICHES AND THE ECONOMIC WEALTH OF NATIONS

At the centre of the analysis of capitalism's relation to nature is its inherent and unavoidable dependence on fossil fuels, and particularly on oil.<sup>4</sup> To understand this properly we must first briefly consider the advantages of fossil fuels for capitalist accumulation. In general terms petroleum's Energy Return on Energy Input (EROEI) is very high. Only a small amount of energy needs to be invested in order to harvest much greater amounts of energy, because the entropy of petroleum is very low and its energy concentration is very high, yielding a high energy surplus. Compared with the flows of solar energy, fossil energy is a 'thick' energy source, to the point where fossil energy can easily come to seem responsible for the surplus value produced in a capitalist system. However this is not the case. A physical surplus and an economic surplus value are as different as use values and exchange values, or as the physical barrel of oil ('wet oil') and the futures price of that barrel on the Chicago stock exchange ('paper oil'). Again, we encounter the decisive importance of the double character of capitalist exchange relations.

An important *caveat* has to be introduced here. Solar energy of course has the highest EROEI, because solar energy flows, which power all processes of life on earth (plants, animals and human beings), come in the form of solar radiation (light and heat) without the need for any energy input by living beings on earth. However, energy inputs *are* required for the transformation of solar radiation into useful energy for humankind. The role of agriculture is a telling example. Energy – i.e. the efforts of the farmer and his family and workers, the energy of animals, etc. – is invested to obtain a higher return from the energy contained in plants and livestock (this is why the EROEI in a pre-fossil economy and society is never infinite).

In a fossil energy regime the EROEI is high in recently developed oil-fields, and then decreases because in most cases the energy input grows and the energy output decreases, until further exploitation becomes irrational, in terms of both energy and later also economics. Then the energy source is transformed into an energy sink, 'and the oil will simply remain in the ground. It is for these reasons that the world will never technically run out of oil; rather, it will ultimately become simply too energy-intensive to extract low-quality or geographically inaccessible oil'.<sup>5</sup> What has been said about a single oilfield can be said about oil-extraction in general. The EROEI decreases in step with the exhaustion of global oil reserves. The implications of this are obvious. Oil production not only reaches a peak and then declines (the so-called 'Hubbert-curve');<sup>6</sup> equally important is the fact that the

amount of energy that has to be invested in the extraction of a declining output must grow. Although irrational in terms of energy, it may still seem economically rational because of the calculation in value terms. The energy invested (e.g. water power) may be cheaper than the energy return (e.g. in the form of non-conventional oil), although calculated in calories the reverse is true.

By confusing physical and value processes some ecologists accuse Marx of systematically underestimating the 'value of nature' in the process of value-production.<sup>7</sup> But the rebuke is only relevant insofar as the labour process is concerned. Of course, nature is as important as labour in converting matter and energy into use. Nature is remarkably productive – the evolution of species in the history of the planet, and their tremendous diversity and variety, prove it – but it is not *value-productive*, because it produces no commodities to be sold on the market. There is no market in nature. The market and commodities are social and economic constructs, not a natural heritage, even if neoliberal economists assume otherwise. It is labour which turns nature into commodities. This is why resource-rich countries very often remain poor, and why resource-poor countries very often become wealthy, because they have the capacity to transform natural riches into economic wealth by dominating the process of capitalist valorization.

From the viewpoint of energy analysis the production process may look very different from the way it looks from the viewpoint of commodity- and value-analysis. Juan Martínez-Alier says in this regard: 'The productivity of agriculture has not increased, but decreased, from the point of view of energy analysis',<sup>8</sup> but in terms of commodity-production in agriculture, and in terms of return on invested capital, its 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. They simply do not take the full inputs of fossil energy into account, so that productivity in value-terms seems to be high, while productivity in energy-terms is low or even negative.

The transition to industrial systems and to the predominant use of fossil energies was much more dramatic than that which transformed societies of hunters and gatherers into a social order of sedentary agricultural systems. It was a revolutionary break in the history of the societal relation of human beings to nature because it was no longer the *flow* of solar radiation which served 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 contained in the crust of the earth.

The greatest expansion of human demand for natural resources followed the Industrial Revolution in the latter half of the eighteenth century, and the first half of the nineteenth. One of the main advantages of fossil energy for capitalist accumulation is the *congruence* of its physical properties with the socioeconomic and political logics of capitalist development.<sup>9</sup> In comparison with other energy sources fossil energy fulfils almost perfectly the requirements of the capitalist process of accumulation. It fits into capitalism's societal relation to nature.

First, fossil energy allows the transformation of pre-capitalist patterns of space and place into capitalist ones. The local availability of energy resources is no longer the main reason for the location of manufacturing or other industries. It is simple to transport energy resources anywhere in the world, giving rise to logistical networks which today cover the globe. Energy supply therefore becomes only one factor among 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 the location of investment in global space.

Second, in contrast to solar radiation, which changes its intensity between day and night and with the rhythms of the seasons, fossil energy can be used 24 hours a day and 365 days a year with constant intensity, allowing the organization of production processes independently of social time schedules, biological and other natural rhythms. Fossil energies can be stored and then consumed without reference to natural time patterns, in accordance only with the time regime of modernity and a timetable that optimizes profits. Benjamin Franklin's famous statement 'time is money' could therefore seem not crazy but as an appropriate norm of human behaviour in 'modern times'. Moreover, fossil energy allows for the extreme *acceleration* of processes, the '*compression* of time and space'.<sup>10</sup> In other words, it allows for an increase in productivity, reducing the time needed for the production of a given amount of products.

Third, fossil energy can be used very flexibly in production, consumption and transportation, and in the use of time and space. The development of electricity networks and the electric motor, the illumination of whole cities at night and the invention of the internal combustion engine, were decisive steps in an increasingly flexible use of energy-inputs, in the mobilization and acceleration of economic processes and in a degree of individualization of social life never before experienced in human history. Now, managerial decisions could follow the logic of profitability without needing to take energy restrictions or spatial and temporal constraints into account. Accumulation and economic growth, i.e. the 'wealth of nations', became increasingly inde-

pendent of natural conditions and their limitations. These advantages of fossil energy for the capitalist system make it unique and indispensable. The congruence of capitalism, fossil energy, rationalism and industrialism is perfect.

An ensemble of four forces has subsequently driven the whole set of dynamic developments: (1) the 'European rationality of world domination' and its translation into technical devices and organizational expertise;<sup>11</sup> (2) the 'great transformation' to a disembedded market-economy – the theme of Karl Polanyi;<sup>12</sup> (3) the dynamics of money in the social form of capital, which Marx analyzed in *Capital*;<sup>13</sup> and (4) the use of fossil energy. Together these forces have produced what Georgescu-Roegen called a 'Promethean revolution',<sup>14</sup> comparable to the Neolithic revolution of several thousand years ago, when humankind discovered how to transform solar energy systematically into crops and animal products, by establishing sedentary agricultural systems.

This *ensemble* of dimensions of the fossil energy regime gives an impression of the ingredients of its dynamics and the range of social scientific approaches which must be applied in order to understand the mechanisms involved in the transformation of natural riches into economic wealth. Without the continuous supply and massive use of fossil energy modern capitalism would be locked into the boundaries of biotic energy (wind, water, bio-mass, muscle-power, etc.). Although something like capitalist social forms occasionally could be found in ancient societies (in Latin America and Asia as well as in Europe), they could not grow and flourish without fossil energy. The entropy of the available energy sources was too high, and the EROEI too low, to allow significant surplus production. Therefore growth was limited, and in fact the average annual growth rate was close to zero before the industrial revolution of late eighteenth century.

But in the course of the industrial revolution economic growth rates jumped from 0.2 per cent to more than 2 per cent a year until the end of the twentieth century; world population also increased faster than ever before.<sup>15</sup> 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 after the industrial revolution economic growth became independent of population growth, due to an enormous increase in productivity and a concomitant increase in the production of relative surplus value. Therefore, contrary to Malthus' predictions, but in accordance with the optimistic message of Adam Smith and David Ricardo, per capita incomes also increased, with the widening and deepening of the division of labour by means of expanding markets and the establishment of free trade. It is inter-

esting to note that in the first millennium the income divergences between Western Europe, Japan, Latin America, Eastern Europe, Africa and Asia were very small. In the course of the fossil-industrial revolution, however, things changed completely. The gap between rich and poor nations widened and inequality became the name of the game. From the second half of the eighteenth century average growth rates increased remarkably, but this failed to reduce the inequalities between peoples and regions in a globalizing world; on the contrary, inequalities increased.<sup>16</sup>

### ENTROPY AND LIFE CONDITIONS

In view of these numbers the question arises: is growth possible for ever? Is growth ‘triumphant’?<sup>17</sup> The answer has to be ‘no’, because nothing on earth grows eternally without any limits, and this also applies to the capitalist economy. The time will come when ‘the party’s over’.<sup>18</sup> The limits of growth are among the conditions of life and the laws of evolution on planet Earth, and are a direct consequence of the limits of the resources – and especially fossil resources – which fuel growth. Although the accumulation of capital and growth are almost wholly powered by fossil energy (and thus dependent on an *isolated* system, with 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 and evolution of living beings, the provision of food, are the result of solar radiation and only to a minor extent of the use of fossil energy. The satisfaction of primary human needs is only possible by using energy in the form of organic foods (containing proteins, fats, carbohydrates, vitamins and minerals, water), and other organic materials transformed into clothing and shelter – not to mention our dependence on oxygen.

Nicholas Georgescu-Roegen points out that humanity in principle only disposes on ‘two resources of wealth’:

first the finite stock of mineral resources in the earth’s crust which within certain limits we can decumulate into a flow almost at will, and second, a flow of solar radiation the rate of which is not subject to our control. In terms of low entropy, the stock of mineral resources is only a very small fraction of the solar energy received by the globe within a single year. More precisely, the highest estimate of terrestrial energy resources does not exceed the amount of free energy received from the sun during *four days!* In addition, the flow of the sun’s radiation will continue with the same intensity (practically) for a long time to come. For these reasons and because

the low entropy received from the sun cannot be converted into matter in bulk, it is not the sun's finite stock of energy that sets a limit to how long the human species may survive. Instead, it is the meager stock of the earth's resources that constitutes the crucial scarcity....<sup>19</sup>

The consumption of fossil energy has repercussions on the man-nature-relation. History consists of the increase of entropy and the associated irreversibility of all processes, whereas capital operates on a logic of reversibility and circularity. Capital has to appropriate the surplus and invest it again in the production process, to secure the appropriation of a growing surplus – a surplus which must be produced, since the production process has been financed with credits, and debt must be serviced. The performance indicators of capital very clearly exhibit the circularity and reversibility of the flow of capital. Capital outlays 'return', and the returns must be greater than the investment. Profitability, the marginal efficiency of capital, the return on capital, shareholder value and other terms clearly demonstrate that the Weberian instrumental rationality, based on a comparison of means (i.e. investment) and objectives (i.e. profit), animates capitalism. In contrast, natural processes of transformation of matter and energy are characterized by irreversibility, as well as the natural growth process of living beings like plants and animals; all living beings are aging. This follows ultimately from the law of entropy.

Every production process also has two aspects: producing not only the desired outputs, but also (mostly negative) side effects. It is a natural law that it is impossible to transform 100 per cent 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. there is no evolution without increased entropy.<sup>20</sup> In 'enjoying our lives' we simultaneously increase entropy and worsen life conditions on earth.<sup>21</sup> Marx was fully aware of this double-sidedness of the satisfaction of human needs and of the destruction of the natural environment:

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 a 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.<sup>22</sup>

The degree of entropy depends decisively on the energy regime. The Neolithic revolution raised it by developing devices to capture solar energy and transform it into concentrated energy, useful for humans. This was the revolutionary achievement of agriculture. The development of agriculture resulted in an increase in food production, and greater reliability of food supplies. The surplus produced by farmers – whom the physiocrats of the eighteenth century saw as the sole ‘productive class’ – made it possible to feed ‘unproductive classes’ of artisans, clerks and rulers. But the agricultural system based on capturing solar energy flows disappeared almost completely as a result of the industrial and fossil revolutions. Eric Hobsbawm in his *Age of Extremes* suggested that the second half of the twentieth century was the first time in human history when the number of people living on the countryside and working as farmers in agriculture (as ‘harvesters of solar energy’) was lower than the number working in urban manufactures and services.<sup>23</sup>

In the transition from an agricultural to an industrial society the congruence of capitalism, rationalism, industrialism and fossil energy becomes central. But the key role of fossil energy in this congruence makes it an obstacle to further development. First, it will eventually run out; and second, its combustion produces so much harmful emission that living conditions on earth are deteriorating. In terms of thermodynamic economics, the transition to a capitalist industrial system means that the planet is treated as a *closed* and even *isolated* system. For solar radiation from outside (and likewise the irradiation of heat into the outer space) is replaced by fossil energy sources taken from inside the crust of the Earth. But life on Earth remains dependent on the sun’s radiation. Between life conditions (*open system*) and economic conditions (*isolated system*) on earth a ‘firewall’ has been socially and politically constructed. Today, and possibly for ever, it is impossible to power the machine of capitalist accumulation and growth with ‘thin’ solar radiation–energy. It simply lacks the advantages mentioned above, i.e. the potential of time and space compression, which ‘thick’ fossil energy offers. And meanwhile the fossil energy regime of the capitalist economy has an extremely destructive effect on all the forms of life on earth which are ‘powered’ almost completely by solar radiation. The degradation of nature – i.e. the greenhouse effect, ozone layer depletion, loss of biodiversity, desertification, the disappearance of tropical rain forests etc. – is unquestionable. The price of the advantages of the fossil energy regime is ecological destruction and the necessity of finding a solution to the limits of fossil energy’s availability.

## PEAK OIL AND CLIMATE CHANGE

Of all the forms of fossil energy oil is the one which has above all been key to capitalist development over the last hundred years. The peak, and thus the limits, of oil production have a major effect on the capitalist accumulation process, because the above-mentioned congruence is over. The 'external limits' of resources aggravate 'normal' capitalist crises – and oil production will peak soon, as the geologist Marion King Hubbert already predicted in the 1950s, when everybody believed in an abundance of oil. He foresaw that US oil production would peak at the beginning of the 1970s, which is exactly what happened. After that the USA switched from being an oil-exporting to an oil-importing country.

Until the beginning of the 1980s global oil discoveries were larger than oil consumption. Since then, however, consumption has exceeded discoveries, so that oil reserves are shrinking. The stocks of oil are limited, and supplies will likely run out in four decades.<sup>24</sup> Oil production is peaking. Some geologists say that it already happened.<sup>25</sup> Others are more cautious and predict the peaking of oil production in the course of the next decade. Then the first half of the global reserves will have been used up. Down to 2004 the accumulated global consumption of oil was about 944 billion barrels. For the consumption of the second half less time will be needed, because the demand for oil will increase in spite of attempts to save energy, to increase the efficiency of its use, to improve the energy mix and to make more use of renewable resources.<sup>26</sup>

This is for two interconnected reasons. First, the crucial role of global financial markets, with their high real interest rates and claims on rates of return, enforce high real growth rates of GNP. Under the prevailing patterns of technology deployment, such high growth rates 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.<sup>27</sup> The second reason stems from the globalization of Western production and consumption patterns, which are extremely energy-intensive. Newly-industrializing countries crowd into markets and add to the already insatiable demand of the OECD countries, above all of the USA, which consume nearly one fourth of global oil production (20 million barrels per day out of a total of about 80 million barrels in 2006).

However, peak oil is not the whole story. The exploitation of known reserves becomes more expensive over time because pressure, viscosity and other physical and chemical properties of oil fields deteriorate in the course of extraction. Water must be pumped in, in order to sustain the pressure necessary for bringing oil to the surface. Drilling is becoming increasingly

complicated, especially in off-shore areas and unconventional oil-fields, but also in 'old' oilfields. Moreover, peak oil is only partly an objective fact.<sup>28</sup> It is dependent on extraction-technologies and knowledge about, and the evaluation of, oil reserves. The first factor is emphasized by neoclassical economists: investment in the exploration of oil fields and oil logistics and refinement can help to increase the supply of oil in pace with growing demand. This is also the line of argument of the International Energy Agency, which says that about US\$3 trillion must be invested in exploration, drilling, pipelines and refineries in order to increase oil production from about 80 to 120 million barrels per day. The second factor influencing the reserve calculations is the exploration of non-conventional oil and gas, such as heavy oils, deepwater oil and gas, polar oil and gas, etc., and the costs of extraction in relation to the market price of crude oil.<sup>29</sup>

A third factor is the evaluation of known and presumable reserves. This is highly dependent on the interests of all the parties involved in oil markets – producers, consumers, brokers and dealers. Therefore the estimates of world reserves vary substantially, ranging from 1,149 billion barrels (BP's 2003 estimate) to 750 billion barrels (estimate of the Association for the Study of Peak Oil, or 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. Shell in 2004 is an exemplary, though extreme, case. The company was obliged to reduce its highly overvalued published reserve figure by 3.9 billion barrels, i.e. by more than 20 per cent, to meet the requirements of the stock market supervisors. A major reason for this 'error' and its correction was 'creative book-keeping'. The company had exaggerated the reserves for its annual report, in order to boost its market value (and with it, the salaries of its top managers).

OPEC countries for their part are interested in high reserve figures for two reasons: First, they increase their estimate of reserves in order to get a higher OPEC production quota. Typically, during the late 1980s 'six of the 11 OPEC nations increased their reserve figures by colossal amounts, ranging from 42 to 197 per cent, simply to boost their export quotas'.<sup>30</sup> Iraq reported in 1983 (during the war against Iran) an increase of reserves of 11 billion barrels, although there was no verifiable discovery of new fields. In 1985 Kuwait notified an increase of 50 per cent in its reserves, without any proof, and did so again in 2006. The second reason for reports of high reserves is to influence oil consumers. High reserves in oil-producing countries signal that in the future there will be no shortage of oil, and that therefore the search for alternatives (i.e. for renewable energy) is an unnecessary expense. On the other hand the reserves may be *underestimated* in order to increase the hid-

den reserves of an oil company, or to push up the oil-price in order to make it profitable to explore non-conventional oil (deep sea-oil; oil-sand; polar oil, heavy oil) and to invest in costly new infrastructure (pipelines, tankers, refineries, etc.).

Uncertainty about the real amount of reserves is therefore remarkably high, as the difference cited above between the figures given by BP and ASPO clearly shows. But what is absolutely certain is that the reserves are declining, even though at an industry conference in Johannesburg in September 2005 the Saudi oil minister Ali al-Naimi informed the world that his country would soon almost double its 'proven' reserve base and add 200 billion barrels to its current reserves estimate of 264 billion barrels. Sceptics suggest, in contrast, that Saudi Arabia already is running out of oil because the country is approaching the peak or has already passed it. Moreover, the costs of extraction are increasing, even in the largest Saudi Arabian Ghawar oil-field.<sup>31</sup> The Saudi estimate is very likely flawed, simply because the higher the reserves, the higher the market power of the oil producer.<sup>32</sup>

The effects of the emissions of greenhouse gases in the course of oil consumption are also highly contested. In capitalist calculations the ecological limits of production and accumulation are recognized only as an increase in the costs of production and distribution, and as a pressure on the rate of return. Calculations by the German Institute for Economic Research (DIW) suggest that the annual costs of climate change will be about \$2,000 billion from the middle of the century onwards.<sup>33</sup> The hurricanes of autumn 2005 already caused damage valued at about US\$200 billion, not counting the human cost or their destructive effects on the social fabric.<sup>34</sup> The effects of production and consumption on society and nature are irrelevant for capitalist decision-making, 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 recuperative capacity of nature and social systems are sufficient to withstand the pollution caused. Otherwise these effects become part of the 'general conditions of production', increase the costs of production, and have a negative effect on profitability and accumulation, until a crisis finally breaks out.<sup>35</sup>

Attempts to internalize these costs, e.g. by emissions trading, do not offer a real solution. Emissions certificates, or the 'clean development mechanism', are designed as financial instruments which serve the financial industry, not the environment.<sup>36</sup> It is possible to substitute artificial paper money for natural gold,<sup>37</sup> but it is not possible to substitute certificates and bonds, traded on a special stock exchange, for an increase of CO<sub>2</sub> particles in the atmosphere, or for a rise in average temperatures. Here again the two forms of oil as a

commodity are evident: as a use value, with the natural characteristics of satisfying human needs and violating the natural environment, and as exchange value, with a monetary form. The first form of oil ('wet oil') is the object of geopolitical calculations, mostly undertaken by neo-conservative think tanks and politicians. The second form ('paper oil') is left to regulation by the market mechanism, cheered on by neo-liberal think tanks and politicians. As we approach the end of the fossil energy regime conflicts are becoming sharper, both on the input side, over access to oil resources, as well as on the output side, over the environmental consequences of petrol-combustion.

Climate change is evidently occurring much faster than had been assumed, so that pressure for immediate action, i.e. for a considerable reduction of greenhouse-gas emissions, is increasing. One of the worst scenarios of climate change has been presented, paradoxically, in a study commissioned by the Pentagon and carried out by Peter Schwartz and Doug Randall of the Global Business Network.<sup>38</sup> Different regions of the world will experience different patterns of climate change. Some may well be hit in the near future by colder periods, because of the changing pattern of global air and water circulation. The study adopts the view taken by the International Panel of Climate Change (IPCC) that average global temperature is likely to increase by up to 5.8° C by 2100. Since this increase in temperature will melt the Greenland ice sheet, the Gulf Stream may change its direction due to lower density and salination in the waters of the North Atlantic. This process is expected to be very rapid, '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...'.<sup>39</sup> Over time, Europe would be severely affected as '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'.<sup>40</sup>

Even if climate change is less dramatic than this analysis suggests, and does not occur as suddenly as assumed in the Pentagon scenario, and even if new technologies are developed for improving energy efficiency, for capturing and storing carbon gas in the deep oceans or in the underground of dry oil fields, and even if there is 'abiogenetic' oil in the soil.<sup>41</sup> This does not gainsay how conflict-prone the use of fossil energies will very likely remain – both on the 'input side' of energy provision at the beginning of the energy-chain, and on the 'output side' of greenhouse gas emissions at the end of it.

## OLIGARCHIC ENERGY RESOURCE DISTRIBUTION AND PETRO-IMPERIALISM

Every nation, constrained by the logics of industrial and post-industrial capitalism, needs to have access to the common good of fossil fuel reserves.<sup>42</sup> But the transformation of natural riches (matter and energy) into the wealth of nations is not possible for all peoples. The 'wealth of nations' is a 'positional', an 'oligarchic' or 'club' good for the minority who belong to the club of global oligarchs.<sup>43</sup> The 'others' are more or less excluded from access to it.

How does the social process of exclusion work? When the distribution of the positional good, of oil under conditions of shortage, is left to market forces and the processes of price formation, some oil consumers cannot afford to pay for it. This is the market economy form of dispossession. It is fully compatible with the institutional order and the belief system of a 'free market society'. Another mode of distributing oil resources is the exercise of political power and military violence to achieve dispossession by force. Most likely a mixture of these two modes will rule the 'Great Game', the battle for the control of scarce oil resources in the twenty-first century. These are the forces at play in the new 'petro-strategy', the emerging oil- and greenhouse-imperialism, in which geo-economics and geopolitics are combined. It is not very likely that fossil resources will be distributed through a democratic, solidaristic rationing of oil reserves.<sup>44</sup>

As we have seen, the dynamics of modern capitalism are due to productivity increases, powered by fossil fuel. The production of relative surplus value is the key to increased profits, positive interest rates and – in the peaks of the business cycle – even rising wages. Under conditions of energy shortage and increasing energy prices the accumulation of capital falls back on absolute surplus value production; accumulation increasingly takes the form of processes of dispossession of the less powerful by more powerful private corporations and national states.<sup>45</sup> The 'oil security' of countries and alliances is competitive and conflict-prone, and leads to a decline in human security. Less powerful peoples and classes are excluded from crucial decisions about the development of the world, and are hit by a growing proportion of the negative external effects of growth. Their living conditions deteriorate as the natural environment undergoes a progressive deterioration.

The highly developed countries, particularly the United States, rely on both market power and military power in conflicts over oil-resources, and for the defence of the country in the conflicts which can be anticipated to arise from climate change. The neo-liberal glorification of a free market in a global 'geo-economy' and the 'geo-political' recourse to national military

power are central axiom of the ideologies of American neo-conservatives. In the cynical words of Thomas Friedman, the invisible hand of the market must be supported by the visible fist of the American army. This, however, only reflects a long tradition of US 'oil-empire' strategy: American wealth, power and supremacy have been founded on 'cheap and abundant oil flows', and on the Rockefeller-Baku-connection, from the nineteenth century to the present.<sup>46</sup>

'Oil security' is one of the priorities of the US and other powerful oil-consuming countries or blocs, such as the EU.<sup>47</sup> It represents nothing else than a political attempt to ensure that the previously mentioned congruence between social form, economic dynamics, rationality and energy provision, on which the capitalist system depends, is maintained. 'Oil security' has several dimensions: first, the strategic control of oil territories; second, the strategic control of oil logistics (pipe lines, the routes of oil tankers, refineries and storage facilities); third, influencing the price of oil by controlling supply and demand on markets; and fourth, determining 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.

Strategic control over oil regions can be secured either by means of diplomacy, and the establishment of friendly inter-state 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 in the future against Iran and Venezuela. The tradition is long. Adam Smith already distinguished between having diplomatic relations with 'civilized' nations and the use of military power against 'barbaric' nations (today the latter are apt to be called an 'axis of the evil').<sup>48</sup> The strategic objective of military interventions by 'civilized' against 'non-civilized' nations today is represented as a civilizing mission, as in the former Yugoslavia, in Afghanistan and Iraq, and elsewhere. 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 serious weakening of the hegemony of the global superpower.<sup>49</sup> Nevertheless, since 2001 the USA has been well prepared to control the oil regions; it disposes of more than 700 military bases in all parts of the world, many of them aimed at controlling the Caucasus, Central Asia, the Gulf and parts of Africa.<sup>50</sup>

The strategic control of oil logistics is also expensive, but less so. It requires the collaboration of many governments in countries traversed by pipelines,

and of countries with coasts which oil tankers pass close by. Central Asia has been labelled '*Pipelineistan*'; that is, the group of states in the region through which the Caspian oil passes. Based as it is on authoritarian and corrupt regimes, US dominance over these states is, however, precarious, and faces challenges not only by 'terrorists' but also by considerable sections of the populations concerned. The crucial role of pipelines became evident in the course of the conflict between Russia and the Ukraine in 2005/06 over the transport of gas from Siberia to Western Europe, and in connection with the planned construction of a pipeline from Russia to Germany that would go through the Baltic Sea without crossing any of the neighbouring Baltic countries or Poland (the North European Gas Pipeline). In Latin America the governments of Venezuela, Brazil, Argentina and Bolivia are trying to establish a continental pipeline system with the aim of intensifying Latin American integration by providing a common infrastructure, rather than creating an open market from Alaska to Tierra del Fuego as the USA, especially, intended with the Free Trade Area of the Americas. Networks of gas and oil pipelines are gaining in importance as the fossil energy regime becomes globalized and oil and, to a lesser extent, gas grow scarcer.

Influence over the supply of oil can only be exercised effectively by influencing OPEC. In the near future the great bulk of oil will come from the OPEC countries of the Middle East, because the oil fields of other, non-OPEC oil producing-countries are expected to deplete sooner. ASPO estimates that by 2010 more than 50 per cent of the world's oil production will come from OPEC countries in the Middle East. Putting diplomatic pressure on individual oil producers, such as the pressure put on Saudi Arabia by the USA, and pushing ahead with oil exploration in parts of the world which have not yet been fully incorporated into the US-dominated global oil-empire, may help to increase the oil supply. The occupation of Iraq, and the establishment of a US-dependent and therefore only formally sovereign Iraqi government, allows the USA to exert some influence on OPEC decisions, since Iraq is a member country and can be used as a vehicle for US oil interests. It is, however, doubtful whether these measures can have a long-lasting impact, simply because Middle-Eastern oil production is also approaching its peak.

A further significant dimension in the struggle for oil is that of finance. The collapse of the Bretton Woods system of fixed exchange rates in the early 1970s reflected the way the US dollar was weakened vis á vis other currencies both by the loss of the competitive advantage the US had enjoyed for some two decades after the Second World War and by the cost of the war against the Vietnamese people. Faced with this situation, the oil-exporting

countries had only one chance to compensate for the losses they incurred due to the decline of the US dollar as the currency in which oil contracts were denominated: they seized the opportunity of the Israeli–Arab Yom Kippur war of October 1973 to increase the oil price. The jump from less than \$2 to more than \$11 per barrel was experienced in oil-importing countries as a severe ‘shock’. At that time an option that was not available to oil producers was invoicing their oil in a currency other than the US dollar. More than thirty years later, however, the situation has fundamentally changed. One of the reasons is the ‘financialization’ of oil trading on future markets, and the concentration of oil quotations on the Chicago and London stock exchanges. The role of ‘paper oil’ in the formation of oil prices is increasing, since financial innovations on globalized and liberalized financial markets allow it. The price of oil is now determined not only by ‘wet oil’ but also by ‘paper oil’. It is in this context that the Iranian threat to establish an Iranian oil exchange, trading in alternative currencies, especially in the Euro, putting the ‘petro-euro’ in competition with the ‘petro-dollar’, may be especially significant.<sup>51</sup>

So long as the big export surplus countries continue keeping their reserves in US dollars it is unimportant whether oil is priced in US dollars or euros or any other currency. However, at the end of the day the issued dollars return to the USA, presented by external creditors. Their claims must be met in real terms (by exports of US goods and services) or by the sale to them of real assets in the USA, or there will be an exchange of foreign claims into other currencies or gold. The USA, which since the 1970s has become a structurally importing country, would then have to reduce its imports and stimulate exports. This is only possible by means of an increase in the domestic savings rate and a decrease in domestic consumption, military expenditures included. A switch of other countries’ reserves out of US dollars into other currencies would thus be a blow to the seignorage position of the imperial power.

The days of the congruence of capitalism and the energy regime perfectly based on the use of oil, gas and coal are, or soon will be, over. It is unlikely that new discoveries of oil reserves can keep pace with growing demand. The oil price is going up and is already becoming an obstacle to growth for many oil-consuming countries.<sup>52</sup> On the other hand, for oil-producing countries, their natural riches frequently become a curse because of the thirst for oil of powerful oil-importing countries, leading to geopolitical tensions and vulnerability. ‘Global resource warfare’ is not just the consequence of oil-shortage and climate effects but is mainly caused by attempts to secure the prerequisites for the systemic congruence between growth and accumulation of capital.<sup>53</sup>

## A 'SOLAR REVOLUTION': THE TRANSITION TO A RENEWABLE ENERGY REGIME

There seems in fact to be only one realistic alternative to oil imperialism – a shift from dependence on oil to a dependence on renewable energy sources, on the radiation energy released by the sun (and its derivatives such as photovoltaic, eolic, water, wave and biotic energy, etc.), or on volcanic and geothermal energy. The Neolithic revolution shows that it is possible to bring about a remarkable increase in the productivity of labour and resources on the basis of solar energy, and a similar increase in productivity after the transition from the fossil regime to a 'solar society' cannot be excluded. Technical and social progress will not end with the fossil energy regime, but it will have to be directed into new non-fossil, and non-capitalist, trajectories.

At present any shift to non-fossil renewable energy is a response to energy scarcity and therefore a temporary and sometimes an emergency solution. The Brazilian experience after the first oil price shock of 1973 is an example: the military government of the time initiated a 'pro-alcool' programme for the production of ethanol from sugar cane. About 35 years later Brazil's democratic president Lula da Silva has offered technological expertise in the production of ethanol to other governments in Latin America, in order to help 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. But these alternative energies build upon the technology of fossil capitalism and on capitalism's social form, its temporal and spatial structures, and thus only impart a very limited impulse to human development.

The transition to renewable energy requires appropriate technologies, but requires even more appropriate social institutions and economic forms. A system based on renewable energy also needs a certain congruence of social form, technology, economic regulation and the energy used, which in this case can be understood as involving a '*solar revolution*'. Such a revolution must involve a radical transformation of the patterns of production and consumption, life and work, gender relations and the spatial and temporal organization of social life. Capitalist crises are not restricted to the energy crisis, and social movements with comprehensive perspectives and projects are emerging aimed at realizing new social forms such as a 'solidary economy' and reviving old cooperative forms of a 'moral economy'. The social basis of a society based on renewable energies is spreading. It must be more radical than anything aspired to, let alone achieved, by the socialist revolutions of the twentieth century – a holistic endeavour, which can only be carried out over an extended period of time. The reason is obvious. Capitalism was the most

dynamic social system in the history of mankind because of the congruence of social forms and mechanisms, rationality and energy provision. A society based on renewable instead of fossil energy sources must develop adequate technologies and above all social forms beyond capitalism. The relation of society to nature cannot remain the same when the fuel driving capitalist dynamics is running out.

## NOTES

I am grateful for useful comments on earlier versions of the text by Birgit Mahnkopf, Achim Brunnengräber, Ursula Huws and others, and for linguistic corrections by Patricia Margerison.

- 1 Andrew McKillop, 'The Myth of Decoupling', in Andrew McKillop with Sheila Newman, ed., *The Final Energy Crisis*, Copenhagen, London: Pluto Press, 2005, pp. 197-216; Harry G. Frankfurt, *On Bullshit*, Princeton: Princeton University Press, 2005.
- 2 J.B. Opschoor, *Environment, Economics and Sustainable Development*, Groningen: Wolters Noordhoff Publishers, 1992; Wuppertal Institut für Klima, Umwelt, Energie, *Zukunftsfähiges Deutschland. Ein Beitrag zu einer global nachhaltigen Entwicklung*, Basel: Birkhäuser, 1995.
- 3 For a discussion of the many aspects of the precautionary principle see Poul Harremoës, David Gee and Malcolm MacGarvin, *Late Lessons from Early Warnings: The Precautionary Principle 1896-2000*, Environmental Issue Report Number 22, Copenhagen: European Environment Agency, 2002.
- 4 In a more elaborated paper it would be necessary to differentiate between coal, oil and gas. Their role in the history of capital accumulation is quite different. In this article fossil fuel mostly refers to petroleum, and the analysis of coal and gas is excluded.
- 5 William R. Clark, *Petrodollar Warfare. Oil, Iraq and the Future of the Dollar*, Gabriola Island: New Society Publishers, 2005, p. 79.
- 6 Kenneth S. Deffeyes, *Beyond Oil. The View from Hubbert's Peak*, New York: Hill and Wang, 2005; Colin J. Campbell, 'The Assessment and Importance of Oil Depletion', in McKillop, *The Final Energy Crisis*, pp. 29-55.
- 7 E.g. Stehen Bunker, *Underdeveloping the Amazon*, Chicago: University of Illinois Press, 1985; see also the interesting debate on the 'value of nature' in Hans Immler/Wolfdietrich Schmied-Kowarzik, *Marx und die Naturfrage – Ein Wissenschaftsstreit*, Hamburg: VSA, 1994.
- 8 Joan Martinez-Alier, *Ecological Economics. Energy, Environment and Society*, Oxford: Basil Blackwell, 1987, p. 3.
- 9 I do not deal with nuclear energy because of space limitations. But nuclear energy is no alternative to fossil energy. First, it is also running out (in about four decades) and second, the negative external effects (from nuclear accidents like that of Chernobyl to the disposal of nuclear waste) are so significant that its use is ecologically irrational and ethically unjustifiable.

- 10 David Harvey, *Justice, Nature & the Geography of Difference*, Oxford: Blackwell, 1996; Elmar Altvater and Birgit Mahnkopf, *Grenzen der Globalisierung. Politik, Ökonomie und Ökologie in der Weltgesellschaft*, Fourth Edition, Münster: Westfälisches Dampfboot, 2004. Since time and space are the coordinates of nature in which we live, however, their compression involves breaking with the natural conditions of work and life, of the 'external' environment as well as of the 'internal' environment – i.e. of human health.
- 11 Max Weber, *Wirtschaft und Gesellschaft*, Studienausgabe, Tübingen: J.C.B. Mohr Paul Siebeck, (1921) 1976, p. 534.
- 12 Karl Polanyi, *The Great Transformation: The Political and Economic Origins of Our Time*, New York: Viking Press (1944) 1957.
- 13 Karl Marx, *Das Kapital*, 3 Bände, in *Marx-Engels-Werke*, Bände 23–25, Berlin: Dietz Verlag, 1970.
- 14 Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process*, Cambridge: Harvard University Press, 1971.
- 15 Angus Maddison, *The World Economy. A Millennial Perspective*, Paris: OECD Development Centre Studies, 2001. Maddison showed that in the first millennium after Christ, from 0 to 1000 AD, world population grew at an average annual rate of 0.02 per cent 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 there was a slight decrease, from an average of \$444 to \$435 a year per capita (in 1990 dollars). Between 1000 and 1820 AD there was an increase to \$667 per capita.
- 16 *Ibid.*, p. 28.
- 17 Richard A. Easterlin, *Growth Triumphant. The Twenty-first Century in Historical Perspective*, Ann Arbor: Michigan University Press, 1998.
- 18 Richard Heinberg, *The Party's Over*, Gabriola Island: New Society Publishers, 2003.
- 19 Georgescu-Roegen, *The Entropy Law*, p. 303.
- 20 Ilya Prigogine and Isabelle Stenger, *Dialog mit der Natur*, München: Piper, 1986.
- 21 See Georgescu-Roegen, *The Entropy Law*, p. 288.
- 22 Karl Marx, *Capital*, Volume 1, Penguin Books: Harmondsworth, 1976, p. 638–9.
- 23 Eric Hobsbawm, *Age of Extremes. The Short Twentieth Century 1914-1991*, London: Michael Joseph, 1994, chapter 10.
- 24 There is no consensus among analysts about oil availability and the extent of reserves. The oil industry (BP) estimates that there are still 1150 bn barrels of secure reserves in the ground whereas the Association for the Study of Peak Oil only calculates ca 750 bn barrels. But even on the basis of the former estimate, and without taking into account increasing demand, BP itself estimates that the (static) reserves will only last another 41 years, or not quite the time of two generations. See BP Statistical Review of World Energy, June 2005; and for overviews, Deffeyes, *Beyond Oil*, Seppo Korpela, *Oil Depletion in the United States and the World*, A working paper for a talk to Ohio Petroleum Marketers Association at their annual meeting in Columbus, Ohio, 1 May 2002, available

- at <http://www.peakoil.com> and Korpela, 'Prediction of World Peak Oil Production', in McKillop, *The Final Energy Crisis*, pp. 11-28.
- 25 See Deffeyes, *Beyond Oil* and his updated prediction based on new data that the peak of global oil production was passed on 16 December 2005: <http://www.princeton.edu/hubbert/current-events-06-02.html>.
  - 26 In a two-paged advertisement in the *Financial Times*, 26 July 2005, Chevron writes: 'It took us 125 years to use the first trillion barrels of oil. We'll use the next trillion in 30'.
  - 27 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 future markets; much of the increase in oil prices in the years since 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.
  - 28 Off-shore drilling has the disadvantage of high extraction costs but it has the 'advantage' of insulating oil-drilling from the peoples concerned about it and thus of avoiding conflicts. On the Nigerian case see David Hallowes and Mark Butler, *Whose Energy Future? Big Oil Against People in Africa. groundWork Report 2005*, Pietermaritzburg: groundWork, 2005.
  - 29 Colin Campbell and Jean H. Laherrère, 'The End of Cheap Oil', *Scientific American*, March, 1998, pp. 44.
  - 30 Ibid.
  - 31 André Salem, 'Wundersame Ölvermehrung', *Internationale Politik*, February, 2006, pp. 44-49.
  - 32 Colin Campbell, 'The Assessment and Importance of Oil Depletion', in McKillop, *The Final Energy Crisis*, pp. 38; see also: <http://www.energybulletin.net/9314.html>.
  - 33 Claudia Kemfert, 'Die ökonomischen Kosten des Klimawandels', *DIW-Wochenbericht*, 42, 2004.
  - 34 In the cases of the Tsunamis around Christmas 2004 and the devastating hurricane in New Orleans the rescue work of help organizations, of governments and international organizations was in some ways even more destructive than the natural disaster, as Naomi Klein convincingly has pointed out: 'The Rise of Disaster Capitalism', *The Nation*, 2 May 2005.
  - 35 This is the theme of James O'Connor, *Natural Causes. Essays in Ecological Marxism*, London: Guilford Press, 1998.
  - 36 For a good discussion of the implications of the clean development mechanism in Africa, see Megan Lindow, 'A New Source of African Finance', in Patrick Bond and Rehana Dada, eds., *Trouble in the Air. Global Warming and the Privatised Atmosphere*, Durban: TNI/Centre for Civil Society, 2005, pp. 54-63.
  - 37 Gold is a telling example of 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 accumulation ignores natural boundaries and money is a social construct, the function of money has been de-coupled from the natural form of gold and ascribed to paper-money or

electronic bits and bytes. Money in a nature-form has 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, are a ridiculous and anachronistic undertaking.

- 38 Peter Schwarz and Doug Randall, *An Abrupt Climate Change Scenario and Its Implications for United States Security*, Washington: Pentagon, 2003, available at <http://www.ems.org>.
- 39 Ibid., p. 9.
- 40 Ibid., p. 16.
- 41 There are arguments against the peak oil thesis based on the hypothesis of an abiogenic, volcanic origin of oil. If there are massive oil reserves deep in the crust and mantle of the earth then the world's oil supply may extend far into the future. The hypothesis is rather old; it can be traced back to the writings of Alexander von Humboldt in the early 19th century. It was developed during the cold war in the former Soviet Union and is coming up again towards the end of the (biogenic) fossil energy regime. However, the hypothesis is not proved by geo-science and is heavily criticized for fostering complacency about the existing fossil energy regime. Even if there are abiogenic oil reserves it has to be calculated whether the EROEI is positive in the case of oil drilling at depths of 5000 meters and more (for a good overview on the controversy on the biogenic or abiogenic origin of oil see the Wikipedia entry, 'Abiogenic Petroleum Origin', <http://en.wikipedia.org>).
- 42 Comparable to other natural resources, oil can be understood as a global public good because it came into being over hundreds of million years by natural processes and not with the help of human activities. Today the global commons, the natural riches, are transformed into private wealth by means of the assignment of property rights, the transformation of resources and goods into commodities which are sold against money on global markets. The private appropriation of commons is the other side of an expropriation or dispossession of peoples. This double sided process of valorization ('Inwertsetzung'), of transforming commons into private goods in history is only possible by the exercise of political power and therefore in history this process has always been pushed by the state. In most cases it also has triggered resistance.
- 43 Roy Harrod, 'The Possibility of Economic Satiety – Use of Economic Growth for Improving the Quality of Education and Leisure', in Committee for Economic Development, *Problems of United States Economic Development*, Volume 1, New York: Committee for Economic Development, 1958, pp. 207-13; Fred Hirsch, *Die sozialen Grenzen des Wachstums*, Reinbek: Rowohlt, 1978.
- 44 A fourth form is that of charity, which President Chavez practised in winter 2005/2006. He seized the opportunity of energy shortages in the USA by offering cheap and subsidised Venezuelan oil for US citizens in need of otherwise unaffordable energy supply. Poor people who cannot afford to pay the oil-bill, to fill the gas-tank or to pay for electricity also are forced to switch to other heating energies, from wood by cutting the remaining forests or from industrial waste collected from nearby factories. Many poor people have no alternative

- except to look for non-fossil energy provision or to 'steal' energy by tapping electricity lines.
- 45 David Harvey, 'The "New" Imperialism: Accumulation by Dispossession', in *Socialist Register 2004*; David Harvey, *The New Imperialism*, Oxford: Oxford University Press, 2003; Massimo de Angelis, 'Separating the Doing and the Deed: Capital and the Continuous Character of Enclosures', *Historical Materialism*, 12(2), 2004.
  - 46 Michael Klare, *Blood and Oil. The Dangers and Consequences of America's Growing Dependency on Imported Petroleum*, New York: Metropolitan Books, 2004. For the Friedman quip, and others in this vein, see the opening paragraph of Leo Panitch and Sam Gindin's essay, 'Global Capitalism and American Empire' in the *Socialist Register 2004*.
  - 47 Ibid.; Cheney-Report: National Energy Policy Development Group, *National Energy Policy – Reliable, Affordable, and Environmentally Sound Energy for America's Future*, Washington: US Government Printing Office, 2001. For an overview on Europe, see Frank Umbach, 'Europas nächster Kalter Krieg', *Internationale Politik*, February, 2006.
  - 48 Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, edited by E. Cannan, Ann Arbor: The University of Chicago Press, 1976, fifth book.
  - 49 It is not possible to calculate rationally and exactly the costs of a war. It only is possible to estimate the dimensions of costs in monetary terms. Joseph Stiglitz and Linda Bilmes come to the conclusion that the costs of the Iraq war and the occupation, assuming it lasts no longer than 2010, will reach up to 2200 billion US\$ (*Süddeutsche Zeitung*, 5 April 2006).
  - 50 Chalmers Johnston, *Der Selbstmord der amerikanischen Demokratie*, München: Goldmann, 2004.
  - 51 See William R. Clark, *Petrodollar Warfare: Oil, Iraq and the Future of the Dollar*, Gabriola Island: New Society Publishers, 2005.
  - 52 Andrew Simms quoted in Hallowes and Butler, *Whose Energy Future?*, p. 44.
  - 53 See Clark, *Petrodollar Warfare*, p. 93; Andy Stern begins his book *Who Won the Oil Wars?* with the sentence: 'Since the birth of the modern oil industry in the middle of the 19th century, the pursuit of oil has brought out three characteristics in mankind: greed, corruption and belligerence'. Stern, *Who Won the Oil Wars? Why Governments Wage Wars for Oil Rights*, London: Collins & Brown, 2005, p. 7.