

designing an economy with built-in sustainability

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The modern market economy creates a perfect environment for expanding financial capital at the expense of the biosphere at an exponential rate.

Human numbers are four times the level of a century ago, and the world economy is seventeen times as large. ... Oceanic fisheries ... are being pushed to their limits and beyond, water tables are falling on every continent, rangelands are deteriorating from overgrazing, many remaining tropical forests are on the verge of being wiped out, and carbon dioxide concentrations in the atmosphere have reached the highest level in 160,000 years. If these trends continue, they could make the turning of the millenium seem trivial as a historic moment, for they may be triggering the largest extinction of life since a meteorite wiped out the dinosaurs some 65 million years ago.

As we look forward to the twenty-first century, it is clear that satisfying the projected needs of an ever larger world population with the economy we now have is simply not possible. ... We are entering a new century, then, with an economy that cannot take us where we want to go. The challenge is to design and build a new one that can sustain human progress without destroying ist support systems – and that offers a better life to all. - **Worldwatch Institute**, *State of the World 1999*, p. 4.

The capitalist market economy is unrivalled in its capability to generate material growth at the expense of the biosphere. The further it shakes off any social and ecological fetters under the fierce competitive pressure of global markets, the more strongly its interconnected positive feedback cycles amplify and reinforce each other. Money begets more money, the rich become richer, the poor become poorer, large corporations grow and merge into global giants that determine economic and social conditions instead of governments who are losing their grip.

A system centred on making money out of money, the capitalist market economy came into its own with the industrial revolution and has since increasingly come to control the human relationship with nature. Because of it, human demands on natural systems are no longer determined by human physiological needs but by the need to generate a return on capital. In such a system, corporations and economies grow rich by turning low-entropy natural resources into high-entropy waste. Part of the wealth they create this way is then invested to transform more natural assets into monetary value, and this cycle is repeated again and again. In this way, money/capital begets more and more money/capital, and the exponential growth of value creation translates into an exponential growth of the claims made on natural resources and life support systems.

Basically, importing low entropy (syntropy) and exporting high entropy is the process by which all self-organising systems create and maintain themselves. What, then, makes their man-made counterpart in the economic sphere such a ferocious, deadly competitor?

The difference at the level of self-organisation between organisms and ecosystems on the one hand and an industrial economy on the other, comes down to two essential points:

(1) Natural systems arise and have been extensively tested in co-evolution with other systems. The evolutionary process has knitted them into a network of sources and sinks, where every 'sink' for 'waste' is a source of food for other players, so that there is no way for noxious substances or poisons to accumulate in the biosphere. Their growth and replication is bounded by limiting factors like free energy or structural materials like nitrogen, sulphur, phosphorus or magnesium, which are

Syntropy and entropy

Entropy describes the inevitable fate of all existing things: degradation, decline, dissolution, death. A simple, everyday example of how entropy works is the way any concentrated energy form (like the heat contained in a cup of coffee) dissipates into a room over a period of time, becoming useless waste heat.

Syntropy is another word for low or negative entropy. In apparent contradiction to the second law of thermodynamics, islands of syntropy grow in an ocean of entropy through self-organisation of dynamic systems. Syntropy is the essence of life. Representing the temporary and localised suspension of entropy, it is at once created by life and enables life to flourish.

not in unlimited supply. Incidentally, this limited availability of resources is one of the basic conditions for evolution to work.

By contrast, the industrial economy is a linear once-through system with a tendency to deplete sources and to fill up and congest sinks. Its processes are untested by evolution and can obviously be sustained only for a few seconds of evolutionary time. In the short run, before its growth is checked by limiting factors, it behaves like a fire - it is characterised by unbounded self-reinforcement which will only be stopped by the exhaustion of its feed, the resources and life support systems of the planet.

(2) As a social system, industrial capitalism has gained an unbeatable competitive advantage by overlaying its physical process structure (exporting entropy, importing syntropy) with an abstract accounting structure which images the physical process symbolically and controls it by means of cultural conventions. In this accounting structure, earned syntropy turns into (monetary) income, and by the same token, money/capital is transformed into syntropy claims. Money which if invested turns into capital and generates a return or if made into a loan generates interest thus turns into a self-feeding generator of syntropy claims. In the short run it is a perpetual motion machine - so long as one disregards the pollution and exhaustion of its environment which is inseparably bound up with its functioning. As a concrete example, take the capital invested in the construction and maintenance of a coal mine. The investment results in generating many times the energy required in this process. The energy thus gained can be sold, i.e. be turned into money in the market. This extra money, combined with earnings from other enterprises, can be invested in another mine or an oil-field which, in its turn, will generate maybe five, maybe fifty times the energy used in the process, allowing the invested capital and the applied energy to grow continuously.

Economics is about using energy to convert useless matter into useful things. While the bottom line of a successful business enterprise is a *financial* surplus, the final result of the economics process and its interaction with the physical world is a decrease in syntropy and an increase in entropy, i.e. a loss of natural assets. In the capitalist market economy, that institution of money/capital with interest on money and returns on capital as its primary mission sits on top of and feeds the physical process turning natural assets into monetary value (*verwertung**) and, by the same token, into further claims for natural assets. This capital connection, the

* The German word *Verwertung* which does not translate well into English described the process perfectly (*verwert-ung*) by referring both to the value creation and the concomitant disappearance or destruction of the substance which is being turned into monetary value.

cultural construct of an unquestioned equivalence between capital and syntropy from which the system – pumped as it is from the symbolic level – derives its self organisational dynamics, is the heart of the capitalist market economy.

This capital/resources feedback loop turns into a hypercycle through being linked to human needs. The (human!) agents of the system who, from their own experience, know intimately the psychological profile of its customers have the capacity to invent a never-ending stream of new needs and wants. Moreover in a mature capitalist society there is a positive feedback loop connecting, on the one side, the gratification of essential human needs (for love, support and identity) with material *satisfiers* (impressive homes, cars, TV, clothes) and, on the other side, the deficits and needs that are created and sustained in the process. The cycle thus established displays classic features of addiction, maintaining and feeding on itself. The coldness of economic relationships creates an overwhelming craving for warmth - to which industry responds by offering an abundance of products promising to fulfil this need.

The modern market economy based on industrial capitalism thus creates a perfect environment for expanding real and financial capital at the expense of the biosphere at an exponential rate. Let me recapitulate the necessary conditions for this process:

- in the physical world: on the one side, a source of low entropy from fossil fuels and raw material deposits amassed during the Earth's history, and their systematic exploitation, and on the other side, available sinks in the shape of entropy-exporting process structures, or 'syntropy generators' in the biosphere such as vegetation, the water cycle and the carbon cycle.
- at the cultural level: the construct of an unquestioned equivalence between capital and syntropy from which the system - pumped as it is from the symbolic level - derives its self-organisational dynamics.
- at the level of human nature: needs that supply an inexhaustible resource for creating value, enabling inexorable growth of the stream of money/capital.

By activating a whole new set of imaginary* needs, the rising real incomes in the productive sector can be absorbed and redistributed and transformed into a

* The term *imaginary* was used by J.G. Schlosser (1739-99), a contemporary and brother-in-law of Goethe. The monetary philosophy of Schlosser is shown in greater detail in Binswanger (1991: 195). An even more appropriate term I should like to suggest is the word *notional* which denotes both the immaterial nature of the kinds of needs in question and articles like buttons, buckles, mirrors and ribbons – the 'instrument of vanity and waste' as David

constantly growing demand. Without the suction effect of that demand, production would soon come to a standstill. At the same time, value creation in the imaginary sector develops a momentum of its own. Unlike the satisfaction of physical needs, it is not limited by inevitable saturation. In the realm of imaginary needs, value creation without limits is a possibility, at least as long as the purchasing power so generated is balanced by the production of enough goods and services so that inflation does not strip it of its value. In developed industrial societies, purchasing power and production are pushing each other along.

A mechanism has thus been created that permits unlimited value creation in the imaginary or notional sphere - the sphere beyond basic needs. Imaginary needs, however, are not always satisfied with imaginary goods - quite the contrary: there is nothing imaginary about silk bed-linen, a fifth pair of shoes, or a holiday in the Caribbean. What is imaginary is their value - it is derived from fantasies, from symbolic meanings, from prestige. Anything that exceeds the basic human needs becomes an inexhaustible resource the system can explore, use, exploit and turn into monetary value. Whenever some need or want or any little part of it is gratified, value is created through the payment made for this gratification. And, most importantly, any value created by gratifying notional or imaginary needs has the astonishing power of buying real resources - without any limitation.

This brings us straight to the core problem of the capitalist system. Our essential, organic, absolute or physiological needs are limited. They are subject to the principle of marginal utility: when you are hungry, one loaf of bread represents great utility, the second loaf less, and by the tenth loaf, utility moves towards zero. The same applies to jumpers or woollen blankets when you are cold, and to a roof over your head for protection from rain and snow. This limitation does not apply to the imaginary (non-essential, psychological, relative) needs. People will always crave status symbols such as big cars, beautiful houses, classy dogs and horses or famous works of art, because an individual's underlying psychological ('imaginary') needs like a craving for security, recognition, love or identification can be fulfilled - or rather unfulfilled - in a million ways. Another way of

Landes called them – as offered by peddlers at the doorstep in pre- and early industrial times. By *imaginary* or *notional* I am referring to needs that go beyond subsistence. They are called *imaginary* or *notional* because they refer not to what human beings need for their survival but to what they would like beyond that, their wants. They are what humans desire, or require, to satisfy their feelings, their imagination, their social standing, their psychological or social deficits. One would call this a misfortune that was waiting to happen to humankind, with its ability to process symbols. This ability allows man to invest material objects like the cross, the car, palaces, clothes, golden cutlery or red roses with meanings like divine power, male potency, social standing, personal values, a secure living or love, representing an immaterial reality.

distinguishing between these two basic groups of needs is therefore to look at them as 'satisfiable/non-satisfiable' (Zinn 1995).

What this means is that the stuff from which the greater part of value creation in modern industrial societies is made can be reproduced at will. Provided the growth of the volume of money is carefully managed, the purchasing power resulting from this act of value creation in the imaginary sphere has the potential to grow beyond all limitations, all the time claiming its share of Nature's limited resources. And here we have it - the fatal flaw in the design of the capitalist market economy. Things are bound to go badly wrong when money - whether it derives from fulfilling real, physically limited needs or imaginary, endlessly expandable wants - is allowed to claim real *and* imaginary goods.

The only conclusion that can be inferred from all this is that a solid line needs to be drawn between the world of real, essential goods and that of imaginary, superfluous ones. Money is not able to distinguish between the real and the imaginary. It is sheer madness to give it equal access to both. An economic system that allows this is bound to make such inroads on the real resources and on the life support systems of the biosphere - both naturally limited on a limited planet - that they will inevitably run out.

To stop this growth threatening the basis of life, first we must be rid of this self-accelerating motor firmly locked to its own fuel pump. One way of

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achieving this is to set an upper limit to the means of exchange for the acquisition of real resources by creating a strictly limited budget (which will in the first place be directed towards the supply of basics). Money in its traditional sense (as the means of exchange, of storage and of creation of value which can be replicated without limits) would then be confined to the sphere of endlessly reproducible luxury needs. There would be no convertibility between the two sectors.

So, on the one hand, the amount of syntropy consumed by human needs would remain limited to a sustainable level, and on the other hand, there would be an incentive to make a more intelligent and efficient use of a given budget without increasing demands made on the real resources - something that is inevitable in a capitalist market economy.

One possibility of creating such a 'resource' budget would be to assign to every citizen a limited budget of CO₂ credits. Tying our consumption of natural resources and ecological services to a limited budget of CO₂ emissions builds an operational and verifiable concept of sustainability into the economy. Our use of resources and life support systems is then determined not by what we can set in motion by human labour, cleverness and capital, but by the budget set by our sustainable 'income' from natural assets.

Human economic activities depend very strongly on the deployment of energy for transforming existing matter into useful products. We could, therefore, in a rough approximation, take human energy use as a basis for outlining a 'legitimate' ecological space. As it is generated in all combustion processes, the greenhouse gas CO₂ is highly representative of energy consumption and, therefore, of industrial output. Logically, it therefore also roughly reflects the material flows, and the foreign substances and pollutants released during these processes, all of which put pressure on the natural systems. These kinds of pollution would be significantly reduced by a policy of limiting CO₂ emissions.

The principal argument for using CO₂ emissions as a standard for a sustainable economy is the fact that there is a high degree of consensus among scientists about the permissible global levels of CO₂ emissions that will not harm the planet's life support systems. These levels can be determined with some precision, and the IPCC (Intergovernmental Panel for Climate Control, a UN body), as well as the Enquiry Commission of the German Bundestag, have calculated that if global warming is to be prevented they must not exceed about 11 billion tonnes per year.

If we accept that long term sustainable development is possible only on a basis of fair distribution of wealth then, with a global population of six billion, our 11 billion tonne budget would allow two tonnes of CO₂ per person per year. The current per capita emissions of carbon dioxide in industrial countries stands at 11 to 13 tonnes. In the US this rises to 23 tonnes, while in most of the Southern countries it is much below two tonnes per year.

If we seriously want to make the sustainable use of natural resources and life support systems effective for the day-to-day and minute-to-minute behaviour of humans the obvious way of doing so is to use this quota in the way of an annual income, as a basis of consumer spending, making it effectively into a second means of payment that is tied to a real resource. Just as the consumer nowadays automatically pays VAT with any purchase, he or she would in future be charged

at the point of sale for all the carbon dioxide released during the manufacture of the goods or the provision of the services he or she is buying.

Carbon dioxide pollution charges could be assigned to the product like a value-added tax at each the stage in production or the chain of value creation. Let's use a fridge as an example. The manufacturer undertakes to pay for the carbon dioxide pollution he is charged by the sheet steel supplier, who passes on the charges for CO₂ pollution arising from the rolling mill, the steelworks, the mining and the transport of the iron-ore that he in his turn has been charged for. Other items on this bill would be the CO₂ costs of the insulating material, of the compressor, of glass and plastic parts. By the time the fridge appears on sale in the retailer's shop, its CO₂ cost will also contain a surcharge for transport from the factory to the point of sale, as well as for the retailer's overhead costs such as heating and lighting.

When the consumer pays the aggregated pollution cost out of her CO₂ budget, the credits are passed all the way back down the value chain to firms that have used CO₂ rights for manufacturing in the first place. It goes without saying that, as with Value Added Tax, most of these transactions would take place in the accounts of the companies involved, and that the process, like the VAT system, would be closely monitored by a public body.

All the technical conditions for the practical implementation of a CO₂ budget are in place. Naturally, the individual's budget would not be reduced overnight to 2 tonnes, from its present 12 tonnes per year. It would happen gradually, over thirty or forty years. Each individual budget could be stored on the magnetic strip of a charge card or on the chip of a smart card. Laser scanners in the supermarket or at the petrol stations would then read one bar code for the price and one for CO₂ content from the price label, and the card terminal would debit the card accordingly.

The obvious objection that a CO₂ quota would throw us back to the post-war period with its ration cards misses the point. A CO₂ quota is not an allocation of individual articles, but it constitutes a completely freely disposable budget, albeit limited in size. War-time vouchers and ration cards represented a quantity of a particular article, half a pound of butter, or a pair of shoes, or two gallons of petrol. They were part of a centralist command economy with all its clumsy bureaucratic workings, its built-in unfairness and its absurd consequence of never giving people what they really need. Such a system can function only in tandem with a black market to balance out the deficiencies in the allocation by matching supply and production to demand.

A budget based on CO₂ and resources has only one thing in common with the war-time ration coupons: both limit the amount of resources available. In every other way the CO₂ budget would be able to be used as if it was money, and like money it would have an impact on supply and demand in the market. It would also influence the allocation of resources, favouring the conservation of energy and raw materials, recycling, re-use, zero-emission cycles and renewable energies because these are the areas where people would concentrate their spending because they would be soft on their CO₂ budgets. A resource-based budget would ensure that after one or two decades there would be an abundant supply of goods and services which were not only produced with a minimum of resources but which also consumed a minimum in use.

As I said, a sustainable CO₂ budget could not be achieved overnight. Systems would need time to adjust but German emissions could shrink from twelve to two tonnes per head over a span of, say, 40 years, i.e. by a quarter tonne per year. Right from the start, it would have to be clear that in the year 2020 they would have shrunk to seven tonnes. This would create the certainty required to bring about long-term structural changes. Without such certainty it would be very difficult and often impossible for an individual to change his or her personal life-style, energy consumption, car use, eating habits, leisure time pursuits and holiday patterns.

The transition to a CO₂ economy is an emergency brake to stop the rapid course into self-destruction. It creates the material conditions which support and promote sustainable use of the life support systems - rather than penalising it as an unbounded capitalist market economy does.

A CO₂ budget would also set us on the road to greater distributive equity world-wide. The concept of a CO₂ economy determines the upper limits of individual consumption out of a fund of essential resources defined as a commons. By the same token, it makes available the 'environmental space' which the countries of the South need to achieve the level of economic development necessary to satisfy their basic needs. The claims of one half of humanity must be limited in order to preserve a living space for the other half. Rationing CO₂ would stop human beings appropriating resources they want but don't need and by doing so, excluding others and depriving them of their livelihoods.

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Lothar Mayer is chairman of the German Schumacher Society. He studied economics at university in the 1960s but acquired his hands-on experience of how economics shapes the life of people, peoples and the Earth as a conference interpreter for international organisations, corporations and professional associations. After fifteen years of ecological activism he turned to writing on the economy/ecology nexus in 1992, publishing the book *Ein System siegt sich zu Tode - Der Kapitalismus frißt seine Kinder*. His most recent book, from which this essay is adapted, is *Ausstieg aus dem Crash (Bailing out of the Crash)*. It appeared in 1999 and chapters in English can be downloaded from his website: www.Lothar-Mayer.de . His e-mail is LM@Lothar-Mayer.de

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