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# Working for World Ecological Sustainability

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The relationship of humankind to its environment, that is, the way one affects the other and the way the environment enables humankind to live, is the subject of human ecology, still called "political ecology" (man being a political animal).

Demographics, followed by economics, are the shaping forces in this relationship. Since the dawn of history, economic progress and the artificialisation of human's surroundings appeared to be the instruments which would irreversibly emancipate human beings from the limits imposed by their environment's "load capacity". In the second half of the 20th century, after the long boom which followed the Second World War, the march towards emancipation from this load capacity reached its limits. Economic progress itself would seem to be a crisis factor in regard to sustainability. Does that mean that, where the long-term future is concerned, "environment" and "development" must be considered as opposites? This paper is intended to supply a qualified answer to this question, which poses a formidable challenge to an institution, the OECD, whose "D" stands for "development".

In fact, the creation of the OECD when the Second World War had ended went in step with the institution of a new "model of development", one which was to bring the OECD countries thirty glorious years of economic growth.

The model marked the apogee of a "technological paradigm", namely the search for maximum work efficiency gains, thanks to the Scientific Organisation of Labour. Above all, it expressed a new way of viewing labour itself. Its cost (wages) was now seen primarily as the basic income of the mass consumer and hence as the key element in determining outlets for industrial production [1]. The regulation of these wages, and thereby of effective demand, changed the conditions governing how capitalism operated - a turning-point which the anthropologist Karl Polanyi called "the Great Transformation".

The "Great Transformation" of 1930-1940, according to Polanyi, expressed "the revolt of Society against the dogma of the market's self-regulating power", a power which during the Depression had shown its ability to destroy "the machine, the earth and labour". The solution could lie only in placing the laws of the market within a wider system of social constraints: habits, regulations, laws and conventions. Capitalism so reorganised would operate as much by "civic spirit" as by "self-interest".

Nobody these days disputes the reality of the "Golden Age" that followed the Great Transformation, but nobody would dare claim going back to it. Globalisation of the world economy has crippled the effectiveness of national regulations; and, above all, the technological paradigm which attached top priority to raising labour productivity seems well and truly responsible for the particularly nature-fouling character of this model of development. It is as though, to quote Adam Smith's trinity, there had been a systematic attempt to economise labour by amassing capital and exhausting the Earth, and as though the Great Change of the mid-20th century, in failing to transcend a civic spirit anchored in the Nation-State, had (at least during the "thirty glorious" years 1945-1975) been able to save only the Machine and Labour - by intensifying the plunder of the Earth.

We shall begin by a very short review of the age-old history of the environment-development relationship, up until the crisis of the economic model that saw the founding of the OECD. Economic globalisation, as we well know, played a decisive (though not exclusive) role in this crisis, and any way out of the crisis must deal with this problem. In a

second Section, we shall distinguish between two concepts, "local ecological crisis" and "global ecological crisis" along with its diplomatic repercussions. The third Section will treat the contribution of economic thinking to the management of local ecological crises. The fourth concerns the first lessons to be drawn from global crises. The fifth will explore the global crisis presenting the most danger for the 21st century, and currently the subject of internal divisions within the OECD, namely the greenhouse effect.

At the end of this journey, we shall have gained some inkling of the new technological paradigm, the new civic sensibility and the new modes of regulation that should enable the world to experience a new phase of prolonged growth compatible with environmental constraints: the New Great Transformation opening the way towards "sustainable development".

### I - A SHORT HISTORY OF HUMAN ECOLOGY

If we are to guess what the long-term future holds, our only guide is study of the long march of history.

Long ago, the "viability" of human groups depended almost entirely on the natural environment. Human ecology differed very little from that of other living species: a predator-prey system converging towards eco-demographic equilibrium, no doubt cyclical (Lokta-Volterra equations). The population grew as far as the load capacity of its hunting-grounds permitted, then ran into a "scarcity crisis". The human difference lay almost certainly in an ability to see ahead and, by population displacements, to adjust to changes in the environment, whether they resulted from very slow climate fluctuations (like the glaciation cycle), or from human pressure itself.

With the Neolithic revolution, begun 10 000 years ago and ending in our time, humans learnt how to "domesticate" nature by selecting seeds and raising animals. The subsequent artificial leap in the load capacity of the environment allowed, and indeed demanded, social specialisation differentiating the leaders of what must already be called an "economy" and those who followed their orders [2]. The specialisation was itself expressed by the appearance of towns, writing and History. From then on, ecological crises of scarcity (the collision of demographics with environmental load capacity) were compounded by crises stemming from faulty proportions in the social distribution of the wealth produced.

The most spectacular (and instructive for us) example of this kind of crisis was the "great bi-secular fluctuation" at the end of the European Middle Ages. The excessive pressure of the nobles and their wars on the peasantry produced an over-exploitation of communal property by the peasants, general penury and vulnerability to the Great Plague, which exterminated over half of the European population. Europe recovered thanks to the agricultural revolution of mixing farming and husbandry - a revolution within the Neolithic revolution - which entailed sweeping changes in technical productivity and in the legal system of land use. This agricultural revolution of the modern age in turn allowed the industrial revolution to gather strength.

From the start of the modern age (16th-18th centuries), ecological crises seemed completely subordinate to economics, and the latter's twin aspect. As rational organisation of production, it embodied the promise of final deliverance from scarcity. But, as a politico-social system founded on private interest regulated by the market (spreading around the world with a violence that makes today's "globalisation" look like a footnote), it showed itself to be a scourge even more implacable than the weather. The major calamities that have followed one another since the 16th century ("destruction of the West Indies" by colonisation, ravaging of Africa by the slave trade, the Irish famine, etc.) could no longer be blamed on the human overloading of ecosystems, but on the overloading of the masses by certain social groups.

The Great Slump of the 1930s marked the paroxysm of this "autonomisation" of these market forces capable of

devastating society. The "Great Transformation" studied by K. Polanyi signalled the rebellion of world society against this power of destruction. The Second World War would lead to a "domestication" of economics, expressed in the creation of the OECD, among other things, and the birth of the concept of "economic development".

Many economists dubbed this post-war development model "Fordism". It rested on three pillars:

- ▶ Scientific organisation of labour (Taylorism), designed by engineers, relying on automation and mass production, and characterised by impressive gains in apparent labour productivity.
- ▶ Distribution of productivity gains to the workers, granting them access to mass consumption and, via the sustaining of effective demand, guaranteeing full employment.
- ▶ A thicket of labour agreements and social legislation, combined with a strong welfare-State system, ensured that mass production and mass consumption would run in tandem. This mode of regulation buttressed by the State was given legitimacy by a new civic consciousness that paid attention to "social issues".

For thirty years, this model seemed to have banished not only economic crises but also the ecological crises arising from either insufficient land or labour productivity or from unsatisfactory product distribution. In the 1970s, it nonetheless ran into trouble, following a new spate of globalisation (which shook the "third pillar") and the exhaustion of the Taylorist model of labour organisation (which eroded the "first pillar"). The OECD countries, faced with this dual crisis, have diverged for twenty years. Some look for a solution rather in the free play of market forces; others seek rather a degree of continuity with the "organised capitalism" of the post-war period. The divergence is reflected in stronger or weaker commitment where the new ecological problems are concerned.

Alongside the economic crisis, a quite novel form of ecological crisis - the crisis of abundance - was making itself known. It was the tainted legacy of the post-war economic miracles. In the OECD area, technical progress had at last made it possible to feed humankind, but at the price of a dangerous impoverishment of biodiversity and landscape variety. Town-dwellers, crowded into megacities, had discovered traffic jams and pollution as the cost of their mobility. Morbidity and mortality were increasingly being related by epidemiology to, not under-consumption, but excessive consumption of certain things. More generally, the industrial model was threatened by a new scarcity of natural resources - not so much, as the Club of Rome had feared, in terms of raw materials as in terms of the planetary ecosystem's capacity to recycle wastes. The artificialisation of the living world brought dramatic "industrial illnesses" (blood contamination, mad cow disease) in its wake. The cutting-edge of artificialisation, the cyber-world, developed its own pathologies (computer viruses, the "millennium bug"). In the Third World, which had never experienced Fordism but was familiar with uncontrolled industrialisation, all the historical forms of ecological crisis (scarcity, distribution, abundance) were superimposed.

At the approach of the 21st century, ecological crisis is thus palpable at the very core of the economic system. It is a hydra-headed crisis, similar in seriousness to the Great Plague but vastly more ramified. It is no wonder that it feeds irrational fantasies. Regaining control over the economy, at a level which embraces not only market forces but also techno-science, that is the crucial challenge facing a "New Great Transformation".

## II - LOCAL CRISES AND GLOBAL CRISES

Ecological crises, in addition to their variety, as has just been seen, are characterised by human ability to deal with them. An initial distinction needs to be made between "local" and "global" crises.

Every modern ecological crisis is rooted in a malfunctioning of the socio-economic system or, more precisely, in an inability to keep the system in good running order given the inherited environment. By "socio-economic system" we mean the economic system adopted by a given society. The governance of this society usually depends on compromises that have been institutionalised in a national framework, "diffracted" into local bodies. "World society" exists only as a myth, ethically useful but for the moment largely inoperative.

Practically speaking, we are hit by ecological crises whose victims nearly all belong to the organised society whose operation is itself the source of the crises. We may term these "local" crises. Then we have crises whose effects are felt all round the world, even though they originate in malfunctioning located in particular societies whose members are rarely their main victims. These we shall term "global" crises.

Where a local crisis is concerned, the society involved theoretically possesses the means for controlling, for "regulating" it. These means are a matter of morals, civic spirit, the law or market organisation. "Victim" groups have ways of exerting pressure on the groups "responsible": demonstrations, press campaigns, the ballot-box. Examples are local pollution of a city's water or atmosphere by a particular factory, industrial epidemics induced by insufficient nation-wide policing and regulation (use of asbestos), traffic snarls and pollution caused by an inadequate public transport network.

At the other extreme, the depletion of the ozone layer above territories in the Southern hemisphere, the drift of the greenhouse effect and its dramatic consequences for the Indian Ocean rim countries, depend to a very large extent on the industrial economic model adopted tens of years ago by the OECD countries. There is no democratic mechanism by which the potential victim societies can shield themselves. Only action followed by diplomatic agreements can oblige the societies responsible to alter their practice, if they are willing to do so.

The distinction is too crude, however. Some local crises are "transborder" by nature. Closeness to the border means that the effects are felt in the neighbouring country, or the place of pollution is actually the border (pollution of the Rhine). Diplomatically negotiated methods of regulation had urgently to be devised. The Convention on Long-Range Transboundary Air Pollution (against acid rain) was a recent example - destined for ever broader enlargement, as the Chernobyl "transboundary" accident makes clear.

Some kinds of local crises are so common that, by spreading and generalizing, they end up creating a global problem. Deforestation, for example, which is locally dangerous (it depletes soils and induces irreversible erosion) contributes globally to the greenhouse effect. The industrialisation of local agriculture leads to a breakdown of global biodiversity. In this case, international diplomacy can take advantage of local mobilisation to make the general interest prevail - providing that modes of economic regulation do not generate pernicious effects of the "everyone loses" kind.

It is in this field that the OECD bears a special responsibility. Further on, we shall examine its prime role in solving the most serious global problem threatening the 21st century, namely the greenhouse effect. Even now, however, its influence in international trade negotiations endows it with particular responsibilities concerning the ability of local societies to deal with their own crises. Ecological crises spread transborder not only through air and water but also through traded goods.

There is luckily a border which economic liberalism has never dared to cross: the health frontier. All sovereign states have stubbornly clung to their right to protect themselves against dangerous or spoiled goods. This legitimate protectionism is not contrary to the GATT or WTO principle of "national treatment". If it is forbidden to import an article, it is because the domestic production or consumption of that article would also be forbidden. The compartmentalisation of the world meat market in response to foot-and-mouth disease is one example.

Foot-and-mouth disease is a case of a naturally-originating crisis affecting livestock farming. But modern ecological crises are born of technology. When a crisis occurs, national self-interest becomes legitimate once more, as we saw in the European Union with the mad cow crisis. In order to prevent such crises, the "precautionary principle" was recently imposed, i.e. the obligation laid upon a State to prohibit or defer the introduction of a process whose harmlessness is dubious. Doubt not being certainty, the precautionary principle can give rise to situations of "questionable legitimacy" where production is authorised but may in the end be boycotted by the consumer population, owing to the risks it represents. It is futile to retort that these risks are exaggerated. A society has a perfect right to accept death in war and at the same time refuse the slightest risk posed by the genetic or hormone treatment of what it eats. Only democracy can decide, however enlightened it may be by independent investigations.

This means that no society should be able to force on another society articles produced by manufacturing processes that this other society would not itself allow. It is the "Do not do unto others as they would not be done by" principle.

The OECD would send a strong message for preventing ecological crises at the most strictly local level and stopping their spread, were it to campaign within international trade regulation fora for an expansion of the "national treatment of products" principle into a "national treatment of products and production processes" principle.

The "Do not do unto others as they would not be done by" principle should naturally be coupled with a "Do not do unto others as you would not be done by" rule. I am here referring to problems of "international environmental justice". In the most developed countries, a century and a half of citizen mobilisation has imposed social and environmental standards. There is a strong temptation for transnational firms to ignore these standards when they are operating (producing or selling) in emerging economies. True, the laxity of these countries' legislation often supplies the "comparative advantage" that enables them to industrialise. It would nonetheless be difficult to prove (and it would be terribly damning for the OECD economic model) that this "take-off" absolutely requires huge deviations from currently employed standards. Once techniques are the same and guarantee comparable productivity, standards should also be [3]].

The OECD recently stirred an international citizen's movement against a draft Multilateral Agreement on Investment, which seemed to violate the first principle. Indeed, a multinational firm would have had the right to sue, before an International Court of Trade, and obtain compensation from a democracy that decided to introduce new regulations for protecting the environment. Such a compensation principle would systematically rule out any future environmental taxation. The OECD's code of professional ethics for multinational enterprises received much less publicity; yet it is a good illustration of the second principle. It recommends that these firms, when they delocate, should at least observe the standards of their country of origin. The OECD, as an institution and as a group of countries, would greatly enhance its world legitimacy by promoting the code and having it incorporated in the WTO corpus.

### III - ON THE REGULATION OF LOCAL ECOLOGICAL CRISES

The most frequently quoted "tools" for solving latent or declared ecological crises are divided into two families, the "regulatory" (laws, standards) and the "economic" (taxes, permit markets). There is a third type, consisting of self-restriction agreements, good conduct codes, etc.

This third type is, in fact, the first in all forms of human conduct. Women and men (including economic agents), before observing laws, conform to implied social norms (what is called "civic sense" or "civility") and together work out practical arrangements, including the place where they settle, in face-to-face negotiations. As Fernand Braudel or Pierre Bourdieu might say, "society" exists on the one hand in its "habitat" - the material environment which it has already given itself - and on the other in a mentally-integrated system of norms and habits. The "New Great Change" which will enable humankind to adopt an ecologically sustainable development model will first require a cultural revolution in which certain former practices are "delegitimised", stigmatised by consumers, neighbours, the press,

competitors and lastly by governments. Concurrently, better practices, codes of good behaviour, self-limitation agreements and negotiated standards will come into being in civil society, well before the law makes them mandatory or price-signals make them attractive [4].

As to the environment, the physical space in which economic activity takes place and which is constantly remodelled by it, it has been the primary concern of policy since Neolithic times and Sumeria. Governance is above all the production of a collective good, the "habitat", and the regulation of access to it (beginning with the irrigation system). The spontaneous activity of civil society - merely choosing where to live - automatically creates a physical environment: urban aggregations, grouping of industries. The art of placing together industries the wastes of some of which are the raw materials of the others (energy co-generation, use of water, etc.) is starting to be called "industrial ecology". This could be said to form a new type of "Marshall-style industrial districts" where the factors in favour of juxtaposition are not only the social division of labour but also the "social" division of by-products and joint productions. Local authorities will certainly be required to channel what are still groping attempts, by a new kind of town planning whose goal will no longer be to enlarge cities but to restructure them by the installation of diverse networks (public transport, telematics loops, etc.), and better thought-out zoning schemes.

In "real-life ecology", however, most private activities contribute to damaging the environment. This makes it necessary to introduce explicit forms of regulation, a responsibility that also falls to the political sphere. What are the justifying reasons?

In economic language, the local environment may be termed a "collective asset", at once freely accessible and "non-rival", in the sense that its use by certain agents does not impinge on the ability of other agents to make use of it...at least up to a certain point, which is what ecologists correctly call its "load capacity". Public regulation of the environment always aims at obliging or persuading agents not to abuse this load capacity, and if possible to increase it. This indeed is the crucial element in the "New Great Transformation", whereas the aim of the one described by Polanyi was better to distribute wildly increasing output. Another New Great Transformation guideline will be to redirect technological progress so as to increase the sustainable load capacity of our environment. This, according to the World Commission on Environment and Development (Brundtland), was the true definition of sustainable development: "Development that meets the needs of the present, and as an over-riding priority those of the world's poor, without compromising the ability of future generations to meet their own needs."

Why should the quest for private satisfaction run counter to such collective goals, in contrast with the faith of the fathers of liberalism? It is largely a consequence of the properties of collective assets ("the tragedy of commons"). Once, as a result of joint use, exploitation of the environment approaches the load capacity threshold, collective satisfaction - for the community of potential users - wanes. For each individual agent, on the other hand, the pressure he exercises on the unrestricted and cost-free environment represents a virtual rent, that is, a surplus of satisfaction and profit in comparison with what he would be prepared to pay if the environment stopped being unrestricted. This is the contradiction that needs in principle to be regulated.

To this end, the public authorities have an arsenal of possible policies at their disposal. A first distinction may be made between:

- ▶ Regulatory instruments: bans (to prohibit uses that do too much damage to the environment) and norms (to ration legitimate uses within a sustainable "envelope").
- ▶ Economic instruments: environmental taxes (or rather pollution taxes) and tradeable quotas.

Another distinction may be added to the list, that between "goals policies" and "instrument policies".

A goals policy regulates the impact of practices on the environment. It determines the lawful (sustainable) envelope for users, then:

- ▶ Either it lays down an "intensity" limit for each potential user. This technique is a powerful industrial policy tool when it generates economies of scale but, by an agglomeration effect, a host of users can exceed the sustainable threshold, even though they are all within the permitted norms.
- ▶ Or it "allocates" the total volume allowed in the shape of quotas or permits, granted to private users, which are then freely tradeable, as after an agrarian reform. This method, the one chosen in Kyoto for dealing with the greenhouse effect, gives maximum power to the government authorities, which plan both overall use and (at least to begin with) each party's share.

Instrument policies, on the other hand, go no further than prohibiting or setting a direction. "Prohibiting" does not mean eliminating. Everything depends on the severity of the penalty. A fine, after all, is only the extreme form of a pollution tax. While the effect of a pollution tax is to induce agents to adopt increasingly efficient practices, there is no saying in advance whether the tax is high enough.

From the user's standpoint, quotas and pollution taxes amount to the same thing. You pay once in one case and continuously in the other. It is like the difference between buying land and renting it. The two instruments, which allow the user to choose his/her techniques and extent of use, are particularly appropriate where large numbers of different sorts of users threaten the environment.

But just what do they pay for? The OECD has adopted the Polluter-Pays Principle, without too much delving into its signification. Is it a question of paying for:

- ▶ The cost of repairing the environment? This should be called a fee.
- ▶ Damage caused to third parties? This should be called compensation.
- ▶ The price deterring polluters, by confiscating their virtual rent, from damaging the environment? This should properly be called a pollution tax.

In the world of the standard general equilibrium theory, the three definitions would be interchangeable. In the real world, this is not at all so. Why? Precisely because the environment is a collective asset, sometimes international and always inter-generational (all the agents concerned are not simultaneously present on the market); it is, moreover, subjective (what is the price of noise, the pain of illnesses, of the loss of beauty?). The guiding principle should therefore be the third definition (a deterrent tax) configured by an assessment derived from the second one (damage caused). Naturally, government revenues accruing from pollution taxes or the initial auctioning of quotas can serve for "repairing" but this is not always possible. Whatever the case, these revenues, apart from the "primary dividend" provided by the instruments (protecting the environment), offer a "secondary dividend" in the shape of funds for other policies, e.g. lowering the cost of labour as part of a jobs policy.

This leads us to the social aspect of the New Great Transformation. In the 21st century, a dense system of ecological regulations will most probably develop. What will be its redistributive effect? It will surely not be neutral; and it will be fairly complex.

The least well-off are hardly in a position to create pollution, and their satisfaction will come mainly from a healthy

environment. They will be the chief beneficiaries of a general shift towards sustainable development. The wealthiest will have their virtual rent somewhat amputated but at a high income level where its marginal utility is smallest. The short-term losers could be the "middle poor", those for whom restrictions on an open and cost-free use of the environment will push the dream of the "Fordist" consumer model for all even further away - even though they may well be unaware of its unsustainable and health-endangering character.

This "U-curve" will require New Deal-style social reforms to be combined with the new ecological policies. If they are not, these policies will not seem justified. The same remark applies to global crises and international relations.

#### IV - GLOBAL CRISES: FIRST LESSONS

The first international agreements - the Washington convention forbidding international trade in endangered species, and especially the Montreal protocol for protecting the ozone layer - are by now textbook examples. The scenario is always the same.

1. Specialists, with a world view, ring the alarm bells on a subject that is at first disputed.
- 2.
3. Public opinion in a few developed countries becomes convinced and takes fright.
- 4.
5. Consensus, and sometimes an international agreement, is achieved among the OECD countries.
- 6.
7. At this stage, emerging economy governments realise that they will be prevented from doing what the predecessor countries had been doing for over a century. They protest, and demand waivers and compensations, even if their own people will be the first to benefit from the agreement.
- 8.

To break this deadlock (because the emerging countries have the power of obstruction, suicidal though it be), there are three indispensable requirements:

- ▶ The agreement put forward by the OECD countries must clearly and effectively respond to the global threat, with the OECD assuming more than its fair share of the burden.
- ▶ The results of the agreement, in terms of protecting the planet, must not only be positive but they must be popularised among the people in the least developed countries and the emerging economies; NGOs in the South have a vital role to play in this.
- ▶ The agreement must have a redistributive function that will hasten the transition towards sustainable development in the two last groups of country.

Let us take the example of one of these agreements, that on biodiversity, which the United States rejected at the Rio Conference but later accepted.

Unknown genetic biodiversity is for the most part that of wild plants and traditional peasant varieties. It acts something like a planetary immune system reservoir, as distinct from the super-selected varieties of modern agriculture. It provides raw material for the pharmaceutical industry and biological engineering. By definition, this raw material is located essentially in the developing countries. The user industries, on the other hand, are located in the OECD area. It is the classical set-up for North-South disputes.

The OECD's snap reaction is to say that biodiversity is naturally free but that selection of useful genes must be covered by patents - a position which the South countries find unacceptable. The agreement negotiated in Rio provides on the contrary that the North must pay royalties to the biodiversity source countries and offer the results of its research to the South countries at favourable prices.

The agreement was crippled by the WTO agreement on intellectual property rights which has stalled its implementation. Since then, private control over useful genes has grown. What is worse, the agro-food industry is marketing on a large scale genetically modified organisms whose effect on the human system, and on ecosystems, has not even been tested over the period of a generation, whereas natural biodiversity no longer presents any danger to humankind from the food angle. For generations human beings have selected danger-free peasant varieties and do not feed on wild biodiversity [5]. Industry practice contravenes the precautionary principle which Europe, chastened by the completely unpredictable phenomenon of mad cow disease, holds particularly dear where food is concerned. Today's rules of international trade, by not allowing for any compartmentalising of risks variously accepted by different publics, breach the "Do not do unto others as they would not be done by" principle.

The present dynamics of unregulated technological progress therefore open on to a serious crisis, within the OECD, and between the OECD and the peasant communities of the South. For the moment, luckily, the risks are still virtual, and there has not yet been a bad accident arising from a genetically modified variety imposed on the whole world by the agro-food industry [6]. Let us hope that the OECD will be wise enough to propose and impose upon itself sound rules before any such accident happens.

Its responsibility is on the line also in a global crisis whose imminence is now recognised: the greenhouse effect.

### **V - CASE OF THE GREENHOUSE EFFECT**

Of all the global economic crises looming over the first half of the 21st century, the climatic perturbations caused by the rise in the greenhouse effect is the one that poses the greatest challenge to the model of economic development. The core of human activity is involved - agro-industry through the methane cycle, and energy through the carbon dioxide cycle.

#### **a) The situation**

Since Arrhenius at the end of the 19th century, scientists have known that certain molecules imprison in the atmosphere the infra-red radiation emitted by the Earth (radiative forcing). Only in the late 20th century, however, was the concentration, as a result of human activity, of these gases in the atmosphere put in relation with an observed warming of the planet, first as a strong presumption (IPCC 1990), and then as a near-certainty (IPCC 1995).

The greenhouse gases (GHGs) are water vapour (whose radiative forcing does not vary appreciably), CFCs (already covered by the Montreal Protocol) and, especially, carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>).

Methane is associated particularly with paddy fields and grazing animals. Forty times more dangerous than carbon dioxide, it has only a short life-span in the atmosphere, which means that the methane problem can be settled at any time by strong measures. The carbon dioxide emitted into the atmosphere, on the other hand, is up there for a century, which is to say practically forever. For this reason the different greenhouse gases are measured in "CO<sub>2</sub> equivalent" [7].

Carbon dioxide is for the most part produced by the burning of fossil fuel reserves (coal, oil and gas in descending order of CO<sub>2</sub> emitted per energy produced) and, to a lesser extent, by the burning of wood for energy. The latter can be offset by matching growth of the standing bio-mass, which acts as a "carbon sink". There are other reasons for deforestation, however - uncontrolled logging, clearing for farming purposes (suspended within the OECD but widely practised in the Third World for lack of agrarian reform). Fossil energy may be replaced by nuclear energy, which entails ecological hazards of similar magnitude, to the point where major OECD countries have stopped developing it, in practice (the United States) or in law (Germany).

It is for these reasons that the French General Commissariat for Planning (CGP, 1998) rightly concludes that, "Economic growth is circumscribed by a triangle: climate risk, nuclear risk and land use conflicts."

To beat this challenge, humankind has two trump cards to play. First, the global ecosystem automatically fixes about half of the human carbon released into the atmosphere. This "sustainable envelope", matched against a human population that stabilises at 9 billion in the 21st century, would allow a flow of some 600 kg of carbon per person per annum. Attaining this "frontier of sustainability" (in flow) would mean stabilising CO<sub>2</sub> concentrations in the atmosphere (its stock) only at the level it will then have reached, and would not produce a return to pre-industrial concentrations. Ideally, in order to reduce carbon dioxide concentrations to a level which would stabilise temperatures, a target of reduction in GHG production by a factor of three, and not by a factor of two, would have to be assigned. In any case, the flow must be reduced as quickly as possible, to prevent concentrations reaching too high a level before subsiding.

The second trump card is the reversal of the historic trend towards lower energy efficiency. The first agricultural and industrial revolutions had, by "lengthening the production detour", caused an ever faster decline in human labour per product unit, at the cost of a rise in the quantity of energy per unit. Then, in the 1960s, the ratio between GDP and energy consumed became stable. The oil price "shocks" triggered an unexpected turnabout - an "uncoupling" of the rise in the economic output of the industrialised countries and the rise in their energy consumption (which became much less steep or stopped altogether). With progress in technology, energy intensity (quantity of energy in national product) described an "inverted V" curve, first rising then falling (at a present rate of 1 or 2 per cent in Europe).

Human's technological hopes all rest on this gamble: that this result can be generalised. If humankind can manage, at the level of production and especially of the structures of consumption, to achieve a boost in energy efficiency as spectacular as the rise in labour productivity, it has a hope of providing all future generations with an acceptable degree of material comfort without irremediably upsetting the world's climate [\[8\]](#). But the risks are very great.

### **b) Consequences**

Current IPCC estimates forecast, on the basis of the present rate of anthropically-generated GHG releases, a doubling in the 21st century of CO<sub>2</sub> concentrations, leading to an average temperature rise of 2 degrees Celsius and a rise in sea-level (by surface dilatation) of 20-30 centimetres.

Experience with financial instability suggests that it is often a bad idea to make provision only for forecast averages. The IPCC does not predict the worst-case scenarios - melting of continental ice-sheets, escape of methane from the Siberian permafrost - for the next century. This does not mean that they are excluded. The consequences of even the mid-range (+2°) scenario are dramatic enough. Climate zones would be displaced by several hundreds of kilometres; the great overpopulated deltas and the low-lying islands would be submerged. The geophysical changes would affect ecosystems even more seriously, and have a crucial impact on human ecology. The climatic shifts would probably be too rapid to allow an organised transmigration of flora and the associated fauna. Above all, hostility to international mass migration would thwart the natural form of adjustment practised by early humans when faced with the slow climatic cycles of prehistoric times.

If no preventive remedy is found, this form of adjustment will be inevitable, and it will be the main cause of wars and crises in the 21st century. Preventive strategies themselves have a geo-strategic and economic dimension which lies and will continue to lie at the heart of negotiations on climate change.

### **c) The geo-strategic nexus**

All countries are not in the same boat, as regards either the costs of a prevention strategy or its benefits.

On the plus side: Countries are not all equally threatened by the greenhouse effect. Europe protects its deltas (Rhine-Meuse, Po); the Mississippi delta is sparsely populated. All the great unprotected and heavily populated deltas are located in the least developed countries (typical example: Bangladesh) or the emerging economies. All the Small Island States (grouped in the AOSIS) are in this situation. These countries also have the largest proportions of rural inhabitants and the largest share of agriculture in their GNP.

The South countries are the first to be threatened by the drift of the greenhouse effect, and it is their populations which stand most to gain from a "precautionary policy". The OECD countries, on the other hand, do not have much to fear, at least according to the scenarios of 1990. Since then, the aggravation of temperate zone storms awakened the attention of scientists and insurers. The OECD could be a major victim of "world tropicalisation". If a link were established between the intensification of the El Niño-La Niña phenomena and the observed warming of the surface waters of the Pacific (something which is not yet proven), the "cost" to the OECD area of the greenhouse effect could be very substantial indeed.

As to the costs of prevention policy, the dissymmetries are even more striking. Humanity cannot do without rice-fields or livestock, or even without some kind of land-clearing. "Basic needs" entail an incompressible production of anthropic GHGs, which in any case fits inside the "sustainable envelope" of 600 kg of carbon per head per annum (currently 60 kg in Bangladesh). The least developed countries have practically no leeway for reduction, except through agrarian reform and improvement in plant-energy efficiency. Conversely, industrial pollution is very largely concentrated in the OECD countries which consequently all greatly exceed the sustainable envelope amounts - five metric tons per head in the United States, and two metric tons on average in the European Union and Japan.

It would be wrong, however, to think that greenhouse geopolitics pit a South interested in having a prevention policy at barely any cost to itself against a North deriving dubious benefits from preventing the greenhouse effect and having huge costs to pay out. Such a caricature applies only to a contest between the United States and Bangladesh or the Fiji Islands.

For one thing, in the South, the emerging economies are coming close to the threshold of sustainability and consider it normal to cross it for as long as the industrialised countries which preceded them have done. For another, within the OECD itself, serious differences surfaced in 1990 between the Europeans, the most determined advocates of precautionary policies, and the United States which were not so convinced, with the other countries wavering between the two extremes. The same divergence was apparent during the preparation of the fourth Conference of Parties (COP-4) in Buenos Aires, between the European Union and the other OECD countries (the JUSCANZ in COP-4 parlance: Japan, USA, Canada, Australia, New Zealand). There is a double explanation for this friction.

As regards benefits: Europe feels vulnerable, if not to its own greenhouse crisis, at least to that of its African and West and Central Asian neighbours. The JUSCANZ countries view themselves on the contrary as "large island States" having little to fear from a rise in sea-levels or migration pressures and (except for Japan) possessing plentiful amounts of space and natural resources.

As regards costs: Europe already has technical systems that are two to three times as energy- and GHG-efficient as those of the United States. Any restraints imposed on the whole OECD area would work in its favour. Furthermore, its model of social regulation accords considerable importance to compromise goals dictated by the general interest. America's faith in free enterprise has, on the contrary, resulted in an energy-voracious model, in terms of both production and consumption.

### **d) Negotiation: the state of play**

Command over climate risk will involve decades of bickering and compromise. A "certain idea of the ultimate goal" already governs the first stepping-stones in all negotiations, however.

In 1990, the United States expressed scepticism as to the reality of the greenhouse effect; it took an optimistic view of any disadvantages it might have to endure; and was adamant about any effort it might have to make. The best the World Research Institute would do was to suggest a "percentage" dividing of the burden, in other words, conservation of historically acquired shares of rights to pollute the atmosphere.

The Third World found this position unacceptable. A protest movement, launched by the Centre for Science and Environment in New Delhi, soon joined by the Group of 77 and UNCTAD, retorted by postulating a principle of equality - each country would ultimately have a right to pollute which would be sustainable and proportionate to its population. At the same time, the theorists who were the artisans of this position, A. Agarwal and M. Grubb, proposed a flexibility mechanism: countries that did not use all of their quota could sell the remainder to those which exceeded it. A general pollution tax would be levied on all countries exceeding the sum of their quotas, allocated or purchased.

The New York Framework Convention (1992), solemnly signed at the Rio UNCED, endorsed a compromise suggested by Europe: only the "Annex I Group" (in effect, the OECD countries and the industrialised ex-Socialist countries) would initially constrain themselves to make efforts at limitation, the others being invited to temper the increase in their GHGs. According to interpretation, it was possible to understand or refuse to understand a planned return by the year 2000 to the levels of 1990. As to instruments, Europe considered proposing a general environmental tax, but was incapable of imposing it on itself. A decade was wasted with little to show for it [\[9\]](#).

Then the new certainties acquired by the IPCC and the intervening climatic accidents altered the "climate" of the negotiations. At the COP-3 (Kyoto, 1997), the American delegation let itself be persuaded by Europe to accept quantified reduction targets - unevenly distributed among Annex I Group countries according to considerations that were more diplomatic than scientific - for the time-frame 2010. [\[10\]](#) It set two conditions: commitment by the newly industrialising Third World countries to make abatement efforts, and economic flexibility mechanisms, all based on the idea of purchasing abatements where their marginal cost was lowest: a QELRO (quantified emission limitation and reduction objectives) quotas market and "joint implementation" among Annex I parties, a "clean development mechanism" in the Third World.

At the time of writing, the Kyoto Protocol has been ratified by only the most typical of the AOSIS countries, the Fiji Islands. The COP-4 in Buenos Aires had only one purpose, which was to clarify this compromise. It failed to do so.

### **d) Hopes for a world compromise**

As things now stand, negotiations are stalemated. Europe refuses to accept flexibility for quantitative objectives that are already too low; the United States will not accept binding objectives unless the Third World agrees to commitments; the Third World will not agree to commitments if it is denied the same right to development as that enjoyed by the North.

The only thread on which to pull to unravel this tangle is a solemn recognition, prior to any negotiation, of the equal right of all human beings of all generations over the atmosphere. A declaration of this kind would be in conformity with the values that oversaw the foundation of the OECD, after the end of the Second World War. In practical terms, it would mean that, in the final analysis, all the people in the world would have a roughly equal right to "the common envelope of sustainable use of the atmosphere", i.e. about 600 kg per person if the aim is to stabilise CO<sub>2</sub> concentrations, less if the aim is to reduce them.

Were this to happen, a compromise - founded on a principle of reduction objectives converging towards this final target allocation - between the Third World (including the emerging economies) and the OECD (including the JUSCANZ countries) should be attainable. The compromise would have to take into account the energy intensity "inverted V" curve. While the industrialised countries, whose improvement in energy efficiency outstrips their growth, would immediately have to embark on a downward per capita pollution path towards the target, the emerging economies would be entitled to let their pollution mount slightly higher than the sustainability threshold (but well beyond their present emissions - an imaginable figure would be 1 000 kg per head of population per year); beyond that, quantified reduction objectives would become mandatory.

The first major compromise would therefore be to couple recognition of an egalitarian target level with mandatory entry into Annex I for all countries exceeding the target level by more than a certain amount.

At the same time, it would be understood that this threshold beyond which abatement is compulsory would act as a mid-course convergence target for Annex I countries, with 2030 as time-frame, for example. After this date and this threshold, all countries would be required to abate their per capita emission levels in parallel, at a rate to be set at about that time in accordance with the then state of knowledge.

A compromise along these lines reflects the spirit of the "historic" compromises that have marked the close of the century, such as the solution to the conflict in Ireland. The idea is to make commitments now for problems which will become apparent only in the long run, at a time when the benefits of action will appear more clearly than they do today.

What instruments should be associated with this goals policy? From the moment that these goals clearly set humankind on a path for overall quantified reductions in GHG emissions leading to an egalitarian right over the atmosphere, every economic "mechanism" inducing respect for this path becomes licit.

User responsabilisation, dissemination of "best practices", self-restriction agreements by manufacturers, energy consumption norms for machines and appliances, will, as in the case of local crises, be the surest way of translating awareness into wise behaviour, shaped by a budding "planet-wide civic consciousness". The problem is that norms, agreements and even the sense of responsibility suffer from a lack of uniformity. They determine intermediate goals without offering an incentive to go further. They thus create an impression of disappointment when a new, sterner, norm has to be imposed. They do not enable effort to be concentrated where it is the most effective.

Economic instruments, on the other hand, motivate a permanent quest for increased efficiency. It is true that they are ineffectual when they are not associated with trading practices, as in the case of slash-and-burn cultivation. But the great mass of atmospheric pollution comes from trade-related economic practices aiming for profit maximisation and virtual rents. Any rise in the costs weighing on a factor's use therefore encourages the search for techniques to husband it.

In the current negotiations, two traditions confront one another: environmental taxes (which should more properly be called pollution taxes) and tradeable permits. As we have seen, tradeable permits, after being introduced into the

greenhouse debate by A. Agarwal and M. Grubb, are today preferred by the United States, which sees them as genuine market mechanisms that can possibly remove the need for government-style agencies. The Europeans for their part regard trade in QELRO quotas as a means for dodging domestic efforts. What is worse, trades might concern phoney reductions - either the "seller" might not implement the agreed abatement of emissions, or the abatement might owe more to economic recession, which it is hoped will be short-lived, than to a sincere effort to increase energy efficiency. A crisis-ridden Russia could, for example, sell QELRO quotas that were not matched by any change in its productive system. Worse yet, indebted Third World countries might be tempted to sacrifice their chances of future development. This could create a sort of "atmospheric serfdom", over and above the servicing of high-interest debts. One may see why the European Union is tempted to set quantitative caps on the use of "economic flexibilities".

Even granting the legitimacy of the European reservations (supported by international NGOs), their implications need to be qualified. As has been said, once all countries agree to an overall scheme for reduction, there is nothing shocking about seeking reduction where it is least expensive, especially if it is associated with an increase in labour productivity. Funding efficient stoves in the Sahel, for example, (whether it be by buying Sahel quotas, by "joint implementation" operations, or "clean development" mechanisms [11]) would not only be friendly to the atmosphere, it would also ease the toil of the women whose necessary wood-gathering chore is ruining the savannah.

Moreover, where the buyer is concerned, tradeable permits are nothing else than a capitalised pollution tax. This is quite obvious if it is supposed that only one-year pollution permits may be sold; they would take exactly the same form as an annual tax matched to the amount of emissions produced. Of course, it is important to be sure that the quota is actually be paid for. This remark raises the question of the rules of competition on the quota market. Since a quota is merely a capitalised pollution tax, a State which handed out free quotas to its business firms would in effect be subsidising them. Such a practice would in all likelihood be contestable before the World Trade Organisation.

In fact, a quota market requires not less government than a pollution tax but more. With a pollution tax, each State goes only as far as to set a direction and a more or less powerful incentive to reduce emissions. But with quotas, an international States treaty must first determine each State's initial allocation - the reduction obligations map. Then a supra-national agency must oversee the sincerity of transactions, i.e. the effective reduction. Lastly, this agency would probably have to regulate quota prices so as to prevent a buyer with unlimited credit from cornering the market and dispensing with domestic reduction, or an indebted seller from pawning away its future development potential. The quota price, like any market mechanism, serves only two purposes.

- ▶ To send a price signal to both buyer and seller, conferring "worth" for both parties on the economising effort associated with the object of their transaction - here the interest they have in air pollution abatement, regardless of the degree of development already achieved.
- ▶ To transfer from buyer to seller the financial means for re-producing the object of the transaction - here a more industrialised and polluting country would be financing the "clean development" of a less developed one.

In short, the international permit market supervisory agency should set a floor-price for transactions, in line with broadly established practice in the world's three dominant economic entities (United States, EU, Japan) once agriculture is involved. The reader will surely want to reflect upon the deeper reasons for this parallel.

If this were to happen, the difference between European demands and American preferences would dissipate. A floor-price is, after all, the mirror counterpart of a ceiling quantity. The Agency could, for the four-year exercise 2008-2012, fix a floor-price so calculated that 80 per cent of reduction efforts in the domestic space of countries already parties to Annex I would cost them less than the floor-price [12]. The most "prodigal" countries, those where the marginal cost per carbon tonne avoided is the lowest (United States), would centre their efforts on improving

domestic technologies. The most expensive 20 per cent of reduction efforts, involving more particularly countries that have reached the technological frontiers of clean development, could be sought in countries not having these technologies - and would be a way for these countries to acquire them.

### CONCLUSION

At the Kyoto Conference, the world's people chose to give their preference to objectives quantified by country or group of countries (the EU). This primary strategy cannot now be altered. It can, however, be perfected:

- ▶ by setting it in a very long-term prospect of convergence in the allocation of pollution permits, respecting the equal rights of all human beings from generation to generation;
- ▶ by reserving the choice of instruments (regulations, pollution taxes or permit markets) for national or continental subsidiarity;
- ▶ by laying down rules for fair competition in addition to the different national instruments;
- ▶ by stabilising price ratios in intra- or international flexibility mechanisms.

Over and above this example, the main lines of the New Great Transformation are coming into focus:

- ▶ A new "global civic consciousness" that recognises the egalitarian right of all humans of all generations to a healthy environment.
- ▶ International diplomatic arrangements that establish common rules (against global ecological crises) and limit, by rules on free trade, the pernicious effects of competition, so as to enable national (or continental) societies to handle their local crises.

These new methods of regulation (rules, pollution taxes, quotas) will raise the cost of using the environment in a way that will favour the technologies that economise this use.

- ▶ Applied research, spurred by corporate economic interest, stimulated by aid measures and encouraged by the pooling of best practices, will turn towards pollution and energy use savings.
- ▶ Income from pollution taxes and quota auctions will enable the taxation weighing upon labour costs to be lightened, enabling the use of this factor to be "de-intensified" (reduction in work-time, development of low labour productivity-gaining services), and setting in motion a return to full employment.

The economic instruments, framed by norms that are consonant with an ethic of human rights and responsibility towards future generations, can influence the trajectory of technological progress in accordance with a new paradigm - the search for maximum energy and environmental efficiency. From then on the possibility will emerge of a new period of prolonged development, ecologically viable for the whole world: sustainable development.

[1] Whence the name "Fordism", in honour of Henry Ford I's famous observation that the working-class was America's most populous class, and that it should become a well-off class if American industry wished to sell its huge output.

[2] *Economics, ecology and domestication* hark back to two linguistic roots (one Greek and the other Latin) both meaning the same thing: the domain around the house.

[3] [[The notion of comparability needs to be fairly flexible. It is not a question of fixing a world-wide pay standard for the same hour's work, while overlooking differences in productivity. Such uniformity is not applied in either the social nor the environmental fields within the European Union, or even among the regions of the same country. It is easy, however, to compare social legislation in the presently less productive countries with the social legislation obtaining in the past in the countries which are now the most highly productive. It has to be admitted that in the mid-20th century, humany OECD countries tolerated child labour when there was heavy work to be done in the fields. It would be inadmissible in international trade, however, for countries which launch satellites and have computer industries to condone social standards which were already out of date in Europe before the invention of the electric motor!

What is all-important is the existence of a neutral supra-national referee (which could be the International Labour Office and the Commission on Sustainable Development working to the UN Secretary-General). The decisions handed down would then be applicable by the WTO.

[4] Case studies do not invalidate the idea the "first-mover", the economic agent who acts in advance of future norms, can thereby obtain a competitive advantage even though the corresponding equipment is very expensive at the beginning. An environment-friendly initiative of this kind usually goes hand in hand with a technical renewal that increases productivity. Secondly, the "civic-consciousness" of his production methods gives his product the advantage of respectability. Lastly, when the implied norm propagates and becomes law or an official standard, the accumulated experience acts as an entrance barrier. This consideration tempers the need for explicit binding rules - in any case, where social pressure is sufficiently strong.

[5] Land-clearing does however put the human race in contact with wild reservoirs of microbes, and this can be a cause of new epidemics.

[6] Let us again remember the precedent of bovine spongiform encephalopathy (mad cow disease), apparently due to the mutation of a prion, innocuous to humans for centuries for as long as it remained in sheep, but which jumped the species barrier as the result of new livestock industry practices.

[7] In France, CO<sub>2</sub> emissions are also measured by the carbon atoms in the gas. In other countries, they are measured by the molecular mass (3.66 times greater) of CO<sub>2</sub>. We shall use the French system.

[8] At the height of Fordism, between 1950 and 1970, the quantity of direct labour per product unit was divided by three in France. Such a rate, kept up over forty years and applied to energy efficiency, would be more than enough to fall within the sustainable CO<sub>2</sub> envelope, without reliance on nuclear energy. See Goldemberg *et al.*

[9] From 1990 to 1996, world emissions grew by 17 %, those of the United States by 9 %, Japan's by 11 %. The EU countries almost stabilised theirs (France +1,6 %, Italy +3 %, United Kingdom - 0.4 %, Germany - 8 %). The emerging economies posted spectacular increases (China +33 %, India +44 %, Korea +75 %). Yet China and India which together contain nearly half of the human race still do not much influence the world total, which is growing five times more slowly.

[10] With 1990 as base year, the idea was to reduce emissions of six GHGs by 2010, on a four-yearly sliding average, by a CO<sub>2</sub> equivalent of - 8 % for the EU, - 7 % for the United States, - 6 % for Japan, - 5.2 % for the Annex I Group.

[11] As said before, these are mechanisms by which one country finances the reduction of pollution in another country and "credits itself" with the reduction obtained.

[12] The Commission of the European Union is considering a pollution tax of \$ 10 per barrel of oil equivalent, which it feels is enough to return to a sustainable level in Europe. This being a ceiling price for QELRO quotas, the floor-price could be something like \$ 8 per boe.