

STRUCTURAL ECONOMIC CHANGE AND THE BIO-ENVIRONMENT

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Introduction To the questions for this meeting, which were well formulated by Dr. Vlavianos-Arvanitis, one more could be added. How could structural change in the economy contribute to relieving the burden on the environment? What political conditions must be established to make possible the "greening" of technology, the economy and of Greece?

Undoubtedly, industrial, and particularly urbanized, society is still on a collision course with nature. The United Nations Conference on the Environment and Development, UNCED, the so-called Earth Summit which took place in Rio de Janeiro in 1992, included this conflict on its Agenda 21. Two conventions were signed by more than 160 countries: the Convention on Climate Change and the Convention on Biological Diversity. However, what conclusions were reached regarding the economy? The world economy is still expanding. If the structures of the economy remain unchanged, it is quite certain that additional resources will be required and additional pollution will be generated.

This issue constitutes the subject of this presentation. The seriousness of the present environmental crisis is crucial. Most people admit the existence of a crisis, but fail to recognize how serious the environmental problems are. According to a simple theory proposed at a recent conference in Berlin, there are two ways of approaching such problems. One is through the emotions, the other through rational thinking, which would probably be preferred by most scientists. Considering these two possible approaches, certain stages can be distinguished, through which a society and an economy must proceed. These are:

- awareness of the problem;
- discussion of values;
- knowledge of the environment;
- as a consequence: new lifestyles.

From a more comprehensive point of view, not only scientific knowledge about the problems, but also a new policy in economic and technological areas needs to be developed. This could include the introduction of taxes on certain resources, emission charges and the development of clean technology. These reforms would ideally result in what may be defined as an ecological modernization of society.

Environment and Development: The International Dimension

Seen from a global perspective, the split between North and South and East and West has resulted in very different stages of understanding, in the perception of problems as well as their solutions. Not everyone has realized that a new lifestyle is necessary. Not everyone has perceived the ecological modernization of industrial society as essential, now. On the other hand, the majority of people, nations and governments would like to move from a low income to a high income level. This is considered as modernization and development.

Unfortunately, in most cases reaching a higher income bracket has also meant moving from an area of low environmental impact to one of high environmental impact. Figure 1 depicts what is probably the future of the world as a whole.

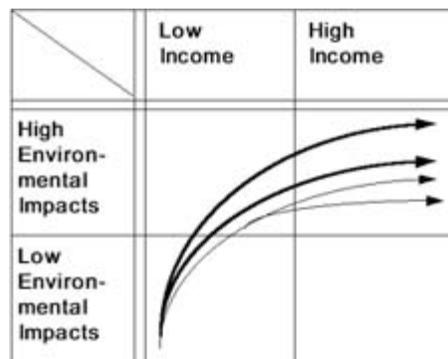


Figure 1: Economic-Ecological Transformation

What, however, are the chances of reaching a turning point for this world, from a high impact level to a low one again? A pessimistic answer to this question is that the problem has to do with modern man himself, who is so demanding of resources and creates so much pollution, compared to pre-modern man. Many changes will have to take place before the goal set out above can be achieved. Unfortunately, most of the trends in modern society are still in the wrong direction. Table 1 shows that the world energy consumption trends from 1970 until the present are all adverse. This is also true of another important input, natural resources; the use of these, with one exception, is still increasing. These trends of intensified energy and resource consumption are not sustainable in the long run.

Energy	1970	1980	1986
	(mil. metric tons)		
Coal	2,134.3	2,728.0	3,196.3
Oil	2,275.0	2,982.4	2,786.8
Lignite	790.8	1,004.0	1,224.7
Gas	580.7	807.6	923.9
Total	5,780.8	7,522.0	8,131.7

Source: UN Industrial Statistic Yearbook

Metal	Human Activity	Natural Activity	Ratio of Human to Natural Activity
	(thousand metric tons)		
Lead	2,000	6	333
Zinc	840	36	23
Copper	260	19	14
Vanadium	210	65	3
Nickel	98	28	4
Chromium	94	58	2
Arsenic	78	21	4
Antimony	38	1	38
Selenium	14	3	5
Cadmium	6	0.3	20

Source: James N. Galloway et al., 1982

One of the problems is that nature itself is not always friendly. Although there are some harmful emissions from nature, as shown in Table 2, at the same time it is clear that human activity has had a much greater effect than natural activity. In terms of ratios, even in the very lowest case, that of chromium emissions, man-made emissions are twice as high as natural ones. In all other cases the ratio is much wider.

An additional example is a study by the World Resources Institute in Washington to calculate the net emissions of carbon dioxide in the various countries of the world are. These consist of the gross emissions from industry, transport and households on the one hand, and regenerative accumulation through nature on the other. Comparing net figures leads to the conclusion that although industrialized countries have high emissions per capita, so do some developing economies. It is an even more disturbing reality that some low income countries, particularly countries where forests are being burnt down, have comparatively high net emissions per capita. If the countries of the world had to be rated according to a per capita criterion, then the highest rate of CO₂ emission per person is met in neither the United States nor the

former Soviet Union, as would be expected. It is found in one of the poorest countries of the world, Laos, followed by three of the major energy and oil producing countries.

How can this situation be explained? In Laos particularly it is due to the burning of forests, and high emissions of methane from agriculture, particularly rice production. It also originates from the emissions of animals. It is these factors which make such a poor country a leader, from this point of view. They also indicate that implementing a climate convention is a very complicated issue. Fortunately, some preliminary answers exist.

Sustainable Development

This topic is being debated internationally, as well as nationally. Since about 1987 when the World Commission on Environment and Development presented its report, and particularly since the Conference on Environment and Development in Rio de Janeiro, the concept of sustainable development (or sustainability) of industrial societies has become a high priority topic. The Brundtland Report, accepted throughout the world and discussed in many countries in seminars and universities, has had an important impact by introducing the concept of sustainability:

"a process of change in which the exploitation of resources, the direction of investments, the orientation of ecological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations."

With regard to these new concepts, please allow me to quote a German philosopher and countryman. Arthur Schopenhauer once defined a law of happiness as: "To be happy and to remain happy you have two options, first, decrease your expectations, and second, increase your efforts." Regarding sustainable development a third suggestion could be made and that is: "Let us decrease our expectations and increase our efforts at the same time."

Now why should society's expectations be decreased? This has to do with the possible definition of the concept of sustainability. So far there are at least two definitions. One is a weak one, while the other is strong. The weak definition goes like this:

As long as man-made and human capital increase in the world we need not worry about the decrease in natural capital; as long as there is a balance between what people construct, what they do with regard to infrastructure, intelligence and education, we need not worry what happens to nature.

The strong definition says:

We have to keep nature intact, we can rely only on renewable resources and we have to stop the exploitation of non-renewable resources.

The consequences of the weak definition are clear: more houses and structures will be built and people will have more Ph.Ds, but nature will have gone. There is a warning attached to the new concept. It is essential to be careful of what is meant by sustainable development.

A personal interpretation of what is needed for a sustainable world, is that there are at least three strategic elements in a policy towards sustainable development. The first element has to do with the market; what can be expected from the market? The other two have to do with politics; what should be expected from politics?

1. Free Market

With regard to the first, the market; there are three different pathways. One is to increase income in order to de-link or de-couple polluting activities such as energy production, cement production, freight, transport and other polluting activities, from the increase in GNP. The second course is that there is no de-linking of polluting activities from GNP at all. In between those two extremes there is a third position, where at least a certain transformation has taken place, and where the polluting activities have been somewhat reduced. It must be added that the market cannot remain as it is because there are some incentives that are still going in the wrong direction; incentives are needed that point in the right direction. That, of course, means introducing politics into the picture.

2. Environmental Policy

There is a need for a strict environmental policy. This is not something new, but it was fairly new only 20 years ago when the first United Nations Conference on Environment and Development was held in Stockholm, in 1972. At that time, there were only 12 countries in the world which had some kind of environmental policy. When the second conference took place in Rio de Janeiro, in 1992, there were 127 countries in the world that had established some kind of environmental policy. This is a move in the right direction. The question is whether the type of

environmental policy established is the best one. Here many of the experts in the field have their doubts. Characterizing the policy established so far, the conclusion is that it is predominantly curative, re-active; it is not yet preventative, pro-active. This has to do not only with the goals but also with the instruments used in environmental policy, and these so far have mainly been state regulations, norms and standards. Not enough use has been made of market instruments, of charges on emissions and taxes on precious resources. This is probably going to be the future of environmental policy, which could then be labeled "preventative policy". There are three major answers for the creation of an effective environmental policy:

- Freedom of information. There is a need not only for better laws, but for improved monitoring, which has to be public. It could well be that the government has to be forced to give the information which it has to the public. If that is not the case, what can be done?
- Good organization at grass root level. People must organize themselves where they find a problem. Non-Governmental Organizations (NGOs) have become very important. This is mostly because they are in opposition to the Governmental Organizations (GOs), but there are some cases where cooperation between NGOs and GOs has led to excellent results. It depends upon who has the best information and who can best convince the public, industry, private households that something must change.
- International legislation. With regard to the "modern Flying Dutchmen", the ships which cruise around the world with waste to be dumped somewhere abroad and not at home; first of all there is a law, the Basle Convention, signed in 1989, prohibiting this transport of toxic waste. However, is the administration strong enough to prohibit illegal exports and imports?

An economist's answer to this is that if there are exports of waste and imports of wasted resources, it has to do with wrong prices. "Get the prices right", and then there does not need to have as much waste as at present. Wasting the environment is still very cheap because the environment has no price. That is why the environment must be priced.

3. Expectations from Environmental Policy: Quality instead of Quantity.

The third point has to do with a more traditional field, economic policy. Economic policy in most countries of the world is still very much quantity-orientated. Quantitative growth of the economy is still the major aim, where what needs to be looked for is quality of life. Quality instead of quantity, is something which should be considered more in the future. Again, this means using different instruments, and additional ones, in this traditional field of policy making.

Technological and Socio-Economical Innovations

How far is the current world away from such a definition of sustainability? Some opinion believes that the world is already following this path and that further explanation is not necessary. But a more constructive approach is that there are a number of possible technological and socio-economic innovations which would provide the potential for making progress in a different direction from the present situation. It is already possible to introduce technologically new methods in order to increase energy efficiency by a factor of 2, possibly even 3. Resource consumption can be reduced drastically, and water saved, etc. Unfortunately, the socio-economic questions indicating the need for institutional change, are not so well addressed. For example, proposals have been made to provide a profit motive for reuse and recycling, and to investigate leasing systems instead of selling systems. If the automobile industry were not allowed to sell cars but could only lease them and had to take them back after use, there would be a revolution in the automobile world.

However, there are alternative ways, such as the revision of tax systems. A current debate in Europe is about introducing a CO₂ emission charge and an energy tax. Other ways of institutional improvement could be named. In the legal sense, liability is one major category. Those who produce and construct things should be liable for the effects those products and technologies have on the environment. Labeling of products is another way through which consumers become better informed. Trading mission certificates is yet another possibility. Some action has already been taken, which has had a certain impact on the present and will have more, for the future. Two statistics from Germany are quoted in Table 3. According to these data, industrial and governmental investment in environmental protection has more than doubled within 12 years and is still on the increase. The structure of such investments, however, differs from one country to another.

In Germany, the priorities in industry during this period had mainly to do with anti-air pollution activity and not primarily with waste disposal. This has now changed. Waste recycling, including the so-called Dual System, has attracted a great deal of attention from industry and the public. In practice, privatization has taken place in what had previously mainly been the domain of the public sector.

However, even though all these changes have been carried out and considerable amounts of money have been spent, the environment is still suffering. One estimate of what is still happening to the environment can be made by calculating the damage to the environment in monetary terms. The environmental agency in Berlin has calculated that more than 200 billion DM's worth of damage to the environment occurs every year. The environmental damage to the Acropolis can be calculated exactly, but to calculate damage to human health and forests is more difficult. Methodologically speaking, these are very complicated questions.

Exit from the Dilemma: De-linking GNP from Polluting Activities

If, according to calculations, it is true that the net impact on the environment is still high, what are possible ways out of the dilemma? Research has been carried out into the following question; how can the industrialized world be analyzed, from the point of view of de-linking polluting industries from the growth of GNP?

Table 3a: Environmental Protection Investments, Manufacturing Sector, Federal Republic of Germany

Year	Total Investments		Waste Disposal		Water Pollution Control		Noise Abatement		Air Pollution Control	
	Current	1980	Current	1980	Current	1980	Current	1980	Current	1980
	Prices	Prices	Prices	Prices	Prices	Prices	Prices	Prices	Prices	Prices
in Millions of DM										
1975	2,480	3,090	170	210	900	1,110	200	240	1,210	1,530
1976	2,390	2,830	200	230	820	960	220	260	1,150	1,380
1977	2,250	2,560	200	230	740	850	210	230	1,100	1,250
1978	2,150	2,370	170	180	680	750	200	220	1,100	1,220
1979	2,080	2,190	160	160	760	800	200	210	960	1,020
1980	2,650	2,650	210	210	910	910	240	240	1,290	1,290
1981	2,940	2,810	250	240	950	910	210	200	1,530	1,460
1982	3,560	3,250	390	360	1,130	1,030	230	210	1,810	1,650
1983	3,690	3,270	290	260	1,100	990	230	200	2,070	1,820
1984	3,500	3,100	270	240	1,040	920	230	190	1,960	1,750
1985	5,620	4,940	330	280	1,060	910	260	220	3,970	3,530
1986	7,339		426		1,158		248		5,507	
Average Annual Change										
1975/84	+3.9	-0.0	+5.3	+1.5	+1.6	-2.1	+1.6	-2.6	+5.5	+1.5
1975/79	-4.3	-8.2	-1.5	-6.6	-4.1	-7.9	0.0	-3.3	-5.6	-9.6
1979/84	+11.0	+7.2	+11.0	+8.4	+6.5	+2.8	+2.8	-2.0	+15.3	+11.4

Source: IIES research project: Data for 1986 from Statistical Yearbook 1989, p. 587

Table 3b: Environmental Protection Investments, Government Sector, Federal Republic of Germany

Year	Total Investments		Waste Disposal		Water Pollution Control		Noise Abatement		Air Pollution Control	
	Current	1980	Current	1980	Current	1980	Current	1980	Current	1980
	Prices	Prices	Prices	Prices	Prices	Prices	Prices	Prices	Prices	Prices
in Millions of DM										
1975	4,740	6,410	300	390	4,430	6,010	0	0	10	10
1976	5,270	6,950	290	360	4,970	6,580	0	0	10	10
1977	4,860	6,190	310	370	4,530	5,800	10	10	10	10
1978	5,860	7,020	330	370	5,450	6,560	70	80	10	10
1979	6,940	7,640	390	420	6,440	7,100	110	120	0	0
1980	8,060	8,060	470	470	7,430	7,430	150	150	10	10
1981	7,390	7,150	520	500	6,700	6,480	160	160	10	10
1982	6,500	6,300	570	540	5,740	5,580	180	170	10	10
1983	6,030	5,810	510	470	5,330	5,160	170	170	20	10
1984	5,900	5,590	450	410	5,300	5,050	130	120	20	10
1985	6,750	6,350	550	490	5,950	5,630	230	210	20	20
Average Annual Change in %										
1975/84	+2.5	-1.5	+4.6	+0.6	+2.0	-1.9	*	*	*	*
1975/80	+11.2	+4.7	+9.4	+3.8	+10.9	+4.3	*	*	*	*
1980/84	-7.5	-8.7	-1.1	-3.4	-8.1	-9.2	-3.5	-5.4	*	*

* = Statement incomplete

Source: IIES research project

Table 3c: Total Expenditures for Environmental Protection, Federal Republic of Germany

Year	Industry		Government		Industry and Government	
	Current Prices	1980 Prices	Current Prices	1980 Prices	Current Prices	1980 Prices
In Millions of DM						
1975	5,680	7,140	7,740	10,200	13,420	17,340
1976	6,000	7,190	8,850	10,940	14,550	18,130
1977	6,180	7,180	8,410	10,340	14,590	17,520
1978	6,390	7,200	9,780	11,470	16,170	18,670
1979	6,740	7,190	11,350	12,380	18,090	19,570
1980	7,810	7,810	12,750	12,750	20,560	20,560
1981	8,860	8,160	12,510	11,940	21,370	20,100
1982	10,110	8,820	11,890	11,130	22,000	19,950
1983	10,620	9,070	11,640	10,720	22,260	19,800
1984	10,890	9,090	11,830	10,630	22,720	19,750
1985	13,550	11,170	13,180	11,690	26,730	22,860
1986	15,570	13,030	14,520	12,860	30,090	25,890
1987	16,940	14,160	15,310	13,280	32,250	27,440
Average Annual Change in %						
1975/84	+7.5	+2.7	+4.8	+0.5	+6.0	+1.4
1975/80	+6.6	+1.8	+10.5	+4.6	+8.9	+3.5
1980/84	+8.7	+3.9	-1.9	-4.4	+2.5	-1.0

Source: IIES research project

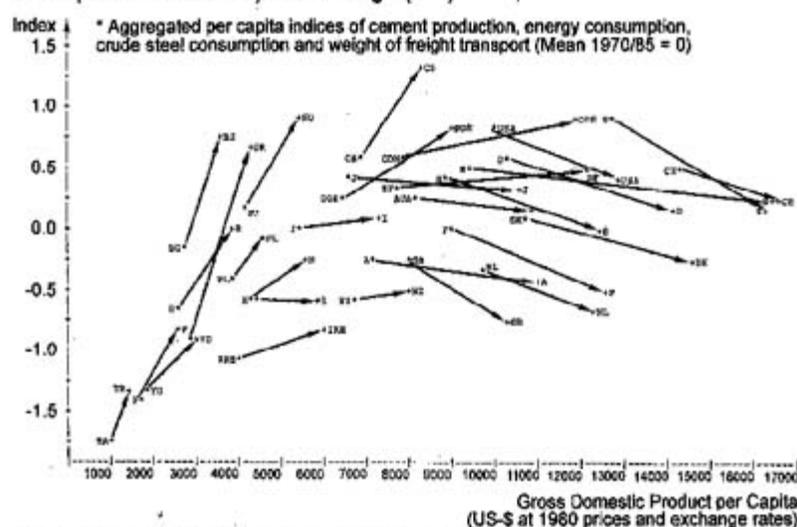
Data for 1986 and 1987 from Statistical Yearbook 1989, p. 586

As depicted in Figure 2, results show at least three groups of countries. In the first group the de-linking of polluting industries from the growth of income has taken place, resulting in some relief for the environment. It has been induced by structural change in the economy.

Unfortunately, there is a group, including Greece, where no such delinking has taken place. In this group the impact has in fact been increasing over time. Thirdly, there is a middle group where there has been a relative de-linking. To take a positive example, in Sweden the growth rate of GNP has been de-linked from the growth rate of energy consumption, steel consumption, cement consumption and also from the weight of freight transport. All these industries, which by themselves are resource consuming and polluting, were de-linked from the growth of the economy. However, the growth of the Swedish economy has not been very great over a period of 15 years. Japan is believed to be the most successful example of industrialization in the last 2 years. Here the growth rate of GNP has been very high, and at the same time some de-linking has occurred, particularly in the energy sector. Japan could be cited as a relatively successful country with regard to structural change. In Germany the situation is similar. It is not a totally positive, but at least a relatively positive example, representative of the middle of the three groups.

Next comes the group of countries that are not yet de-linking these activities from the overall growth of the economy. Czechoslovakia is one of the ex-amples here; it is an old industrial nation in which the efficiency of energy consumption, cement and steel production is very low.

Index of Structural Environmental Impacts per Capita and Economic Performance Level (1970=* / 1985=+) and Change (--->)



Source: Jänicke, Mönch, Ranneberg, Simonis, 1991

Figure 2: Index of Structural Environmental Impacts per Capita and Economic Performance Level (1970=* / 1985=+) and Change (--->)

The situation in Greece is presented in Figure 3. Over a period of 20 years, most of the activities, starting with energy production, cement and

steel production, fertilizers, paper and pesticide production as well as transport, have all been on the increase. They have been far above the growth rate of income. Since all these activities are bad for the environment, structural change in the Greek economy is still very much needed.

Progress has to be made in transforming the structure of the economy, because that transformation will bring a gratis effect, ecologically speaking; it will benefit the environment and reduce the burden on it.

The Role of the Government

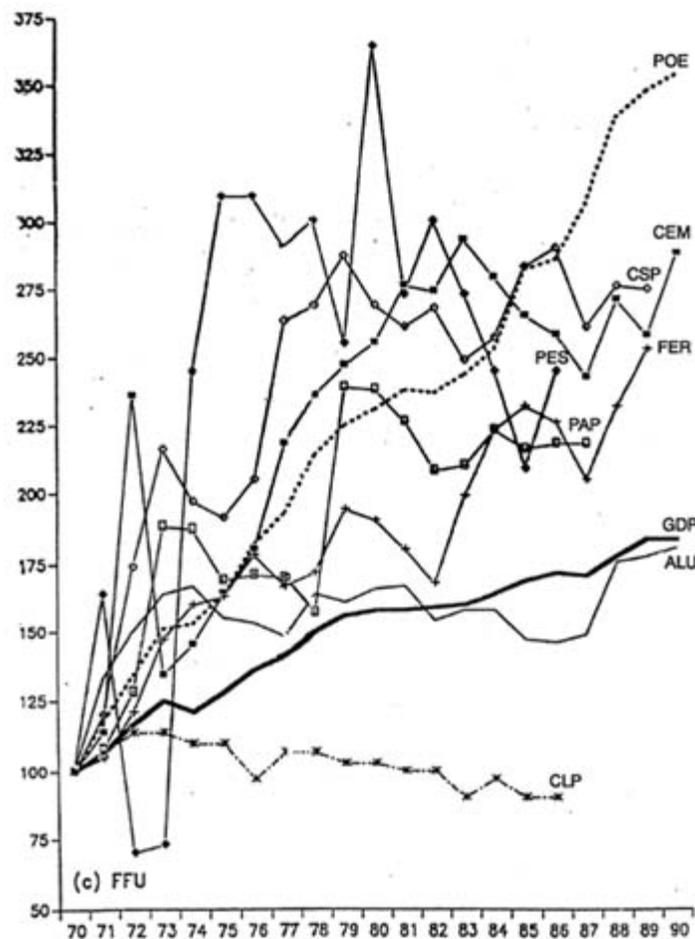
Having examined what industry itself is doing, the next question concerns the role of government. It is possible for governments to act spontaneously. A well formulated environmental policy is necessary. It must be on all levels, not only the national, but also the global one. These two levels have to be supported by what is happening at the local level. A bottom-up approach as well as a top-down approach is necessary.

However, what could be a danger for the future is what is sometimes called "ecological dictatorship". This is a kind of regime imposed because of society's inability to introduce the necessary changes quickly enough.

Whatever the approach, three steps must be differentiated in any effective environmental policy structure. First, the principles have to be clear. For ex-ample, the 'polluter pays' principle is well known, and most countries now agree to it. Recently, the question of compensation schemes was put on the agenda. If Brazil saves part of its forests, Europe should compensate it for the services the tropical rain forests provide for the Earth's climate. The basic message is that a precautionary or preventive approach should be established and that there is a need to be serious about institutions. Here, monetary institutions, fiscal and evaluation institutions are all-important, not only for policy formulation but also for policy implementation.

With regard to measures and instruments, the discussion has so far been about standards or technical norms. Only recently has discussion started about introducing taxes on certain polluting activities. Discussion has also commenced on the introduction of certificates that could be traded on the market.

Here is a presentation of what is considered necessary for the future. According to a simple theory, environmental problems are related to three trends. Firstly, pollution is accumulating over time. Unfortunately, knowledge of, and technical expertise about this problem has started only at a later stage than the pollution, and this also has to increase over time. Another unfortunate situation is that public awareness of the problem begins only at a later stage than the other two. If this theory is relevant, then these conclusions are also important; namely that more has to be done to handle the problem technically, and move on to what was earlier called 'clean-up technology, cleaner technology and clean product'. All this is important, but probably not enough. The second issue is to take all the necessary steps to increase the awareness among the population that something needs to be done.



GDP = Gross Domestic Product **POE** = Production of Energy **CEM** = Cement Production **CSP** = Crude Steel Production **FER** = Fertilizer Production **PAP** = Paper Production **ALU** = Aluminum Production **CLP** = Chlorine Production **PES** = Pesticides **FRT** = Weight of Freight Transport

Figure 3: Structural Change in Greece

One of the roles of a scientist is to provide some kind of relevant indicators. Addressing global climate change for instance, the need to consider a CO₂ emission plan for the world as a whole must be emphasized. This plan was particularly supported by a commission of the German parliament. Taking CO₂ as a global problem, the commission decided that the industrialized countries need to decrease their CO₂ emissions, from 1987 to 2050, by 80%. This is a challenge which needs a response, and comes close to what may be called a new industrial revolution.

However, humanity is already on the move. One step forward was the so-called 30% Club, on anti-acid rain strategy. It was included in a convention signed in Helsinki in 1985 on sulfur dioxide and, later on, nitrogen oxide. The convention was signed in 1988 but came into existence only in 1991. Other agreements include CFCs, the Vienna Convention in 1985, with the respective Montreal Protocol in 1987, the Helsinki Declaration and the London Declaration of 1990, and finally the Copenhagen Conference in 1992, which further tightened the Montreal Protocol.

The latest step was taken at the United Nations Conference on the Environment and Development in Rio de Janeiro in 1992, where the climate and bio-diversity conventions were signed. The issue now is how to bring about a protocol on implementing CO₂ reductions. This is planned to take place in Bonn in 1995.

In addition to CO₂ and CFCs, there are other pollutants, such as methane emissions, which contribute to climate change. These emissions have to be addressed as a parallel to the question of how to stabilize tropical forests. One suggestion is to introduce a climate fund for the world as a whole. With regard to financial aid and institutional aspects, an energy tax could be introduced, not only in the European Union countries but also in the United States and Japan.

However, all these are open questions leading to the final challenge: the future agenda on sustainability. In order to put together some of the essentials that are needed, the following should be mentioned:

- the improvement of environmental information and education;
- the need to become clear on indicators which are important;
- the undertaking of environmental policy research.

Strategic research regarding certain economic sectors will be needed. What has been well researched so far is the energy sector. What is not so well understood is the chemical sector. A great deal of discussion is taking place on how to restructure the transport system; everybody who has to walk or drive through cities like Athens knows that change is needed. Although this is related to the perception and the structures within which urbanization takes place, it also has to do with international trade.

It is not only through norms, but particularly through education and new instruments that these goals may be achieved. Equally important is the awareness by industry and government that behavioral change is necessary. There is still a discrepancy between what is already known and what is really done. Education is basic at all levels, and for these very good reasons, Dr. Vlavianos-Arvanitis is proposing a major step forward on how to integrate the B.I.O ideas into all levels of education.

The conclusion is that these three elements, structural change of the economy, preventive environmental policy, and ecologically oriented economic policy, are all necessary ingredients in any effort towards sustainable development. The latter in itself is probably not sufficient, so this presentation ends by proposing that a fourth element is possibly needed, defined as sustainable ideas, sustainable principles and sustainable philosophy. As was suggested earlier, let us make oikos strategic on the local, national and also global, level. To quote Dr. Vlavianos-Arvanitis, "let us make bios fundamental, fundamental in our hearts, fundamental in our minds and fundamental in our actions."

Professor Udo Simonis is a research professor in environmental policy at the Science Centre Berlin and former member of the German Advisory Council on Global Environment Change. He studied economics at the University of Mainz and the University of Freiburg, and received a Ph.D. from the University of Kiel. His previous positions include Personal Advisor to the President of Zambia, Research Fellow at the University of Tokyo, Professor of Economics at the Technical University of Berlin, Visiting Professor at the Chinese University of Hong Kong and Director of the International Institute for Environment and Society at the Science Centre Berlin. Professor Simonis is the Chairman of the Association of German Scientists and a member of the Advisory Committee of the Development and Peace Foundation.