

*

Taking non-monetisable impacts (NMIs) into account in an eco-development strategy¹

Hélène Connor, Ph.D.

HELIO International

Helene.connor@helio-international.org

As long as the sustainability of economic development remained unquestioned, neoclassical economic theory seemed to offer a reasonably accurate representation of the world for economists to use. When, however, it became obvious that what this traditional outlook on the world considered as 'external' was in fact 'essential' to the production of wealth and to human existence, a new model of the world and of its economic processes was required. So far, however, unquantifiable and therefore unmonetisable elements have been considered of too little significance to be studied and integrated. This paper shows that this is no longer true, it attempts a typology of these elements and identifies ways of dealing with them, using the energy sector as an example.

Introduction: why we need to deal with non-monetisable impacts

The acknowledgement of the need for a new style of economic development, for an 'eco-development' as defined by Ignacy Sachs, dates back to the late sixties, but the economic profession has been slow in reacting and in operationalising the new concept. Various attempts to better represent the world in economic analyses and methods to internalise externalities have thus appeared only lately in the mainstream of economics.

Efforts to implement Pareto efficiency in resource allocation, what O'Connor refers to as 'narrow internalisation'², reached limited results as social and environmental externalities mostly defy monetisation, quantification and even sometimes identification. A second set of problems is inherent to the fact that the market is not apt to lead to the enforcement of the Polluter Pays Principle³, when it, itself, harbours distortions of all kinds, only allows one signal -production prices-, and therefore

ignores non-monetisable goods and bads⁴, even when a life-cycle approach is adopted⁵.

Thirdly, in addition, internalisation procedures have been confronted in the past decade with the emergence of global threats to the environment and to human survival which are fully in the realm of hence unknown impacts which would require an early implementation of the Precautionary Principle -as reiterated at the 1992 Rio Earth Summit- and a different approach altogether. Over the last half of the XXth century, human activity has come to cover the whole earth : there are more and more people everywhere and no real frontier left. Humankind seemingly has all it will ever have to play with and hoping for possible technological or resources discoveries is just that: a hope. As Herman Daly⁶ puts it : "From empty-world economics to full-world economics : Recognizing an historical turning point in economic development".

All the social, economic or environmental costs and benefits of development, should be included at some point in the decision-making process. Private costs are born by the promoter, but external costs have to be taken into account, "internalised" somehow, instead of remaining as "externalities" imposed on parties alien to the decision, or to society at large.

So far two main approaches coexist for the valuation of external costs. The first one, the avoidance method, takes into consideration the cost of pollution prevention and control, i.e. antipollution devices and services (an ex-ante view), the other one, sometimes called the resources method, counts the actual cost of damages to people and to the environment (an ex-post view).

The avoidance method has the advantage of showing what it costs to avoid the pollution, but the disadvantage that this amount may be more than what society thinks it is worth. The resource method has the exact opposite advantage and disadvantage; it shows what society is prepared to pay, but this may be less than the pollution costs.

These measurement procedures are also fraught with various difficulties, even for damages which are easy to identify, as they are submitted to subjective evaluation and to space and time constraints which do not fit into traditional accounting books, nor in official national statistics. Some quantification, monetisation and standardisation efforts are nevertheless being attempted, in particular for the external costs of the energy sector by the European Union's large ExternE Project⁷ .

The search for life-cycle costs of various products or technologies and the gradual enforcement of the Polluter Pays Principle (PPP) has led to the identification of externalities and to the evaluation of those costs which are the most readily quantifiable and monetisable. Such knowledge has already

contributed to more enlightened policies and investments. Furthermore, some countries have established various eco-taxes⁸ and charges, in particular on effluents and wastes, with the goal of raising revenues. This will contribute to changing attitudes towards the environment. There remain, however, a number of methodological and measurement difficulties to overcome before arriving at accurate and widely accepted estimates.

In the present paper, we propose to push further the investigation of damage costs through suggesting ways of taking non-monetisable impacts (NMIs) into account. Our thesis is that NMIs are more important and pervasive than analysts first thought them to be, that their specificity deserves specific attention and that over time they will increase in number and importance.

First, before suggesting how to deal with NMIs, we will identify and define some NMIs, distinguishing between several categories, according to their degree of knowledgeability, i.e. to our ability to identify and quantify them with some precision.

Then, in a second step, we will focus on the methodologies, both conventional and new, that could be used to evaluate NMIs. This effort would reinforce the application of the PP and of the PPP and, therefore, the sustainability of development.

Thirdly, we will see how the study of NMIs can help us to select energy sources and technologies appropriate for sustainable development.

What are non-monetisable impacts (NMIs) ?

NMIs are social, economic, environmental and other impacts which are theoretically identifiable at some point, now or in the future, but are neither readily quantifiable or even apparent, nor therefore accurately monetisable, even if an attempt to do so arbitrarily is sometimes made. The distinctions illustrated in Table 1 show that amongst all externalities, some are monetised even though they are, under our definition, deemed non-monetisable (e.g. human life). Once quantified however, these externalities are considered "internalisable", contrary to NMIs or here "remaining external impacts".

These NMIs are not monetisable for a variety of reasons. Some are too complex to be evaluated as there is too much uncertainty surrounding the occurrence and/or the point of impact. We still lack information and the existing data are often of dubious quality, or not consistent enough to allow comparisons.

Contrary to monetisable externalities which exhibit a fair degree of certainty and predictability and can be made to fit into

a legitimate market or semi-market setting, NMIs exist because the very logic of nature is at odds with the logic of the market which, comparatively, operates in a simplistic, mechanistic and materialistic manner. Hence we contend here that NMIs are not just an extreme case of externalities, they are a separate category altogether.

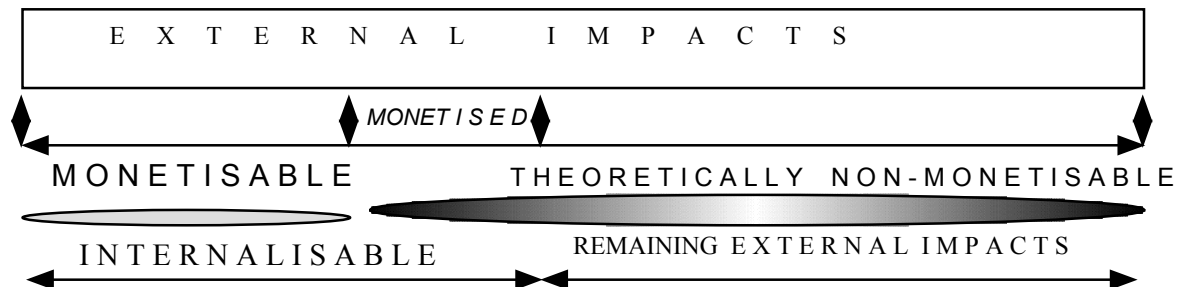


Table 1. CATEGORIES OF EXTERNALITIES

Indeed, in trying to assess these types of non-market-able impacts, we meet some irreducible obstacles to their identification and quantification as René Passet has stressed⁹:

- the irreversibility of some damage makes it impossible for the original equilibrium to be restored even in the long-term (dam reservoirs, for instance, change ecosystems and can modify local way of life indefinitely). There is no way to assess an adequate compensation, valid for all times for such costs.

- the effect of synergies between pollutants is still generally ignored and variable in different environments. Data are almost inexistent.

- the existence of thresholds, ill-defined or totally unpredictable, can condemn entire ecosystems. Thresholds which can be defined are not transportable as every milieu has different levels of resistance and resilience. Often thresholds have a way of revealing themselves only when it is too late to preserve even the statu quo.

- the phenomenon of amplification, with the build-up and concentration of pollutants along the food-chain. The fact that man is at the end of this food-chain make this phenomenon

particularly threatening for humankind (impact on the immune system, allergies).

- other yet-to-be-discovered, understood or explained, biological mechanisms of interaction between living organisms of different species and their environment.

These NMIs need to be dealt with, prevented or compensated for, using an approach different from the traditional assessment and compensation techniques.

Finally, there are, amongst identifiable and measurable impacts that can be quantified in some way, some which can be considered as not monetisable for ethical reasons. It is questionable, for instance, whether life or death should be deemed translatable into money terms especially in an ex ante situation, i.e. before a decision¹⁰ is taken that will possibly or almost certainly cause the loss of life. As an example, the present conflict between the Northern economists of the Intergovernmental Panel on Climate Change (IPCC) and Southern analysts¹¹ reveals a deep perception gap with moral overtones.

Obviously this type of ethical outcry will not stop insurance companies, nor cost-benefit analysts from quantifying the "invaluable", but it stresses also appropriately one more obstacle this time to global governance : the impossibility of using the assumption of an homogeneous "manageability" of spaceship Earth.

It is obvious that, the more the globe becomes "one world", the more it reveals its complexity and the importance of hitherto neglected sources of value. With increased knowledge, therefore, we can expect a further increase in the awareness of non-monetisable aspects of human and economic development.

Categories and identification of non-monetisable impacts (NMIs)

We consider here mostly negative externalities because we assume that most, if not all, the positive impacts are somehow already taken into account in the price and/or in the investment decision that triggered the impact and cannot compensate for the negative externalities. These impacts have been listed and combined in categories as logically as possible to allow a clear differentiation of all types of NMIs. See Table 2 illustrating a tentative typology of non-monetisable impacts by level of knowledgeability. Some NMIs, however, can fit into several slots according to the degree of damage inflicted and to whether or not they can be reversed to the previous state.

Let us explain now how we can proceed to categorise some NMIs according to their respective level of knowledgeability. We can distinguish first, among identifiable impacts, those which are observable immediately and appear in a way that permits us to link them directly to their cause. Others, not measurable immediately, will reveal themselves after a period of latency, which can be of long duration, even though the triggering event may have been very short, as a single accident. In this category of NMIs can be found several deadly diseases.

The impacts identifiable, but not observable immediately may be so, because not all of them are tangible, i.e. physically apprehended. The intangible NMIs can be visible, like a pall of brown air on the horizon, or simply felt, like the loss of esthetic value, the change of taste in some food or feared like the disappearance of some ethnic groups (altruistic value) or the possibility of a nuclear accident. The perception of most intangibles can be considered subjective and their valuation will differ with persons and regions.

Impacts can be reversible or irreversible, according to the type of burdens and to their strength and spread as well. Irreversibility has been classified into weak and strong forms¹². The best example of strong irreversibility is, of course, the disappearance of species, other cases may be the damming of rivers when it requires flooding and changes the whole watershed, turning rivers into lakes. By comparison some run-of-the-river hydroelectric dams can be installed reasonably harmlessly and removed without the same irreversible changes.

Irreversibility also occurs when a threshold of tolerance is transgressed, knowingly or unknowingly. At some point, the resource or the service provided is irreversibly damaged and no longer available. Irreversible damages are by definition impossible to compensate¹³, non-monetisable, since no amount of money can bring back the earlier state of affairs.

External costs are sometimes predictable with some accuracy when the state of environmental knowledge is adequate, i.e. allowing NMIs to be known in advance and forecast. Other impacts that cannot be predicted at the moment, may become known and undergo analysis, so that at a later time this improvement in the information market will make them wholly predictable.

We know very little for instance about threshold values and the degree of tolerance manifested by different milieus. It took scientists a long time to realise for instance that radiation is cumulative and harmful even at low doses, and that various polluting substances interact in multiple ways in the atmosphere and in water tables for instance. These synergies, however, are still poorly understood and little studied. We cannot forecast their exact impacts on human health or on the environment as these

effects are sometimes counter-intuitive. This is why these NMIs can be considered unpredictable and un-preventable.

Some identifiable, tangible and predictable NMIs can be recognised as insurable risks. They are the only category of impacts seen on Table 2 likely to ever be compensated appropriately through negotiations, even when they are irreversible. Some impacts may also be recognised as giving right to compensation on an ad hoc basis.

For policy purposes, it is useful to recast NMIs shown in Table 2 in terms of spatio-temporal categories. Table 3 reflects the categories adopted by the ExternE Project and distinguishes between local, regional and global impacts according both to their time of appearance and to the span of time they are likely to last : a year or so (short term), over one or two generations (medium term) or longer (long term). This classification may help define the urgency of the threat and the level of responsibility at which it should be treated.

Table 3. SPATIO-TEMPORAL TYPOLOGY OF NON-MONETISABLE IMPACTS

TIME LINE	LOCAL PROBLEMS	REGIONAL ISSUES	GLOBAL THREATS
SHORT TERM <1 an	Floods Wells contamination Harvests destruction	Famines Soils acidification Underground water tables contamination Ecological refugees	Nuclear Proliferation Climate perturbation Ozone layer fading
MEDIUM TERM	Erosion Populations up-rooting Epidemics Forests degradation	Habitat destruction Resources wars Routine or accidental radioactive emissions Unsustainable development	Climate change Increased background radioactivity Resources exhaustion Nuclear accident
LONG TERM >2 generations	Excess concentration	Desertification Radioactive pollution (+wastes)	Extinction of species Change of climate Nuclear winter

Externalities can occur in a fairly subtle manner and only become known or noticeable when they are too serious and widespread to still be readily manageable. This is why some of the major environmental problems we have encountered so far became noticed only when they were already threatening the earth global mechanisms: acidification of soil and water, high atmosphere ozone depletion and untractable climate change.

One serious flaw to our approach to improving knowledge which may explain the way we have overlooked some early warnings also has to do with the way scientific research is structured, as has been exposed by Mark Jaccard¹⁴ : “Most scientists report cases in which they reject the null hypothesis at a certain level of confidence (95%). However, they generally fail to apply the equally important concept of statistical power to interpreting cases where they fail to reject the null hypothesis.” Unfortunately they are therefore more likely to reject the consideration of existing impacts than to consider possible illusory impacts. This may render research funds cost-effective in the short term, but somewhat unprepared to deal with NMIs.

In other words, our knowledge of NMIs -and therefore the attention given to them by policy-makers- is, in a first instance, closely dependent on the keenness of attention paid by researchers.

Evaluation and Internalisation of NMIs

Since NMIs cannot be valued in any market, how can they be taken into account? The typology of Table 2 and the spatio-temporal delineation of Table 3 can help devise a framework to deal with NMIs. We can now distinguish NMIs in terms of the time and energy needed to reverse the damage, single out the broad-ranging damaging NMIs to be avoided at all costs (those which are irreversible) and the NMIs which fate and the present state of knowledge leave un-preventable.

To evaluate them at least in a qualitative manner, we can distinguish two different approaches, the first one technical, building on existing measurement methods, the other one, more social and institutional. As the method of internalisation is likely to be closely associated with the method of evaluation, we will deal with both exercises at the same time.

Table 4 lists some impacts on the environment, on health and safety, on the energy system, on the economy and on the political sphere. Such a matrix need not be filled with numerary or quantity indicators, but using alternative qualitative types of valuation, some of which are reviewed below. In this table, we make a distinction between the technical approach currently used for lesser impacts and the institutional approach which is definitely needed for larger or more subtle impacts and everywhere there is a possibility of conflict. In most cases, both approaches can be considered complementary.

The Technical Approach¹⁵ .

The methods used for the evaluation and internalisation of monetisable impacts can sometimes be transposed to assess NMIs. The whole process is even more subjective than for quantifiable impacts, and therefore a consensus on internalisation policies will be difficult to achieve. Nevertheless the attempt deserves to be made if, otherwise, such impacts would be occulted and therefore remain totally absent from the decision-making process.

The multi-criteria analysis of costs and advantages could be used for some types of NMIs. In comparing options, NMIs can be also compared up to a point and some decision can emerge in favour of the least uncertain, or of the least threatening technology, without requiring actual quantification of the impacts.

Delphi consultations, i.e. getting the point of view of experts in the field of the NMI being considered, would yield useful information for action as well as on the choice of instruments to be used to deal with the problem.

There are also the threshold or acceptance methods. Once it has been established that a certain type or level of impacts leads to irreversible damages unacceptable in a certain environment, this verdict can act as a veto.

To give an example, Sørensen¹⁶ has developed a ranking system which does not necessarily require quantification. He has elected to list impacts one by one, rank them on a scale of acceptance, stipulating that an energy technology with one "fundamentally unacceptable" judgement on one of its economic, environmental or social impacts would be excluded automatically from the planning process. This veto power awarded to every single type of damages allows an equitable treatment of all impacts, whether monetised or not.

Another approach uses case studies to help track down some NMIs and it is used in particular to assess the impacts of energy decisions on the economy¹⁷. Case studies can investigate all aspects of a question and signal the presence of NMIs without necessarily having the constraint of giving precise and quantified assessments. Lessons learnt in other times and places can be usefully analysed to prevent, or better manage, unwanted impacts.

The above-mentioned methods can contribute to shrinking the share of shadow around the NMI (the SSS approach on Table 5) in the short term, assuming that we are in a business-as-usual situation, i.e. that the NMI is not of a threatening nature and will not trigger major changes. If it carries the potential of some threat, a precautionary premium should be included

prominently in any consideration of the importance of this NMI according to the precautionary principle.

The ecological science is still young and large spans of ignorance are regularly exposed : the assessment of the likely impacts of technology should therefore also include a reasonable margin of contingency - a precautionary premium - which in extreme cases can translate into a ban.

To deal with the long term threat, the SSS approach would require not only the measures taken to cope in the short and medium term, but also increased research funding to investigate the case. The precautionary approach would impose not just a premium, but require also the setting-up of collaborative structures and a threshold which could ban the harmful activity, as soon as it is suspected that it may have complex and far-reaching adverse repercussions.

The Institutional Approach.

Used alongside the SSS (technical) approach, the institutional approach calls upon refinements of the decision-making framework and has a better potential of going to the roots of the problem -which is more often than not a past decision. As mentioned earlier, NMIs appear mostly because nature and the market operate according to different rules. The market is somewhat observable, but natural phenomena are far less understood and need to be spoken for.

Since nature cannot talk and has not yet been acknowledged as a juridic entity in the way institutions and corporations have been, it is the people who benefit from her presence or from her services who can represent it for the present and for future generations (option value). These disinterested¹⁸ persons could control the process and take decisions in a consensual manner : the way ancient tribes, remote from proprietary civilisations, deal with their own affairs. Democratic elections could bring such people to power if they cared to seek power.

Experiences in Scandinavia and North America have shown that one of the best ways to identify and deal with possible problems is to involve all stakeholders very early in the decision-making process and to keep the statu quo as a possible option. In stakeholder collaboratives, possible NMIs are brought to light and dealt with by the very people likely to be saddled with them. This approach where all interests are represented and well-informed (right of access to information and equivalent expertise) usually improves the quality and the chances of success of a decision taken by consensus. NMIs are therefore automatically internalised.

The organisation and the holding of a referendum can also bypass formal quantification and deal with particularly important NMIs. Referenda have been held for instance in the past on nuclear issues in most countries using nuclear power, and now on solar planning (The Canton of Geneva's Solar Initiative in Switzerland).

Other institutional arrangements are voluntary agreements into which industrialists enter freely. They are deemed preferable to taxes and regulation. They orchestrate a simultaneous effort of all competing industries to diminish the polluting burdens they impose on the environment. Voluntary agreements are a way of internalising externalities by trying not to create them in the first place. This formula started in Canada with the chemical industry in the mid-eighties and has been quite successful, or so it seems. It is very popular in some OECD countries where some governments tend to shy away from intervening in business activities.

To conclude on these two approaches, we should stress that both the technical and institutional approaches to dealing with NMIs remain anthropocentric and "presentist", as we decide not only for ourselves *hic et nunc*, but for nature and for future generations as well even if the *statu quo* situation prevails.

Among the various ways of dealing with NMIs, institutional solutions¹⁹, and in particular the setting-up of collaboratives, are more commendable and logical than the justification by the traditional "invisible hand" of the market ; they represent a definite progress replicable at every level of decision-making and they have the power of enlisting government decision-makers. As an added benefit, it is an approach that can be implemented immediately or at least in the medium term and it is already operational in several countries at different levels of responsibility (Principle of Subsidiarity).

By improving the decision-making process, the establishment of collaboratives may also be the only way suited to internalise NMIs as it holds the potential of dealing with nature or with society on their own terms, as distinct entities, instead of trying to make them fit into the logic of the market.

Counting on NMIs to test sustainability and select viable technologies: the case of energy

Now that we have suggested how to identify and integrate NMIs into policy-making, let us see how this approach could work in real cases, for instance in the design of a sustainable energy strategy.

Energy sources and technologies damaging to the environment will remain in use for years to come, despite the

increasing importance of renewable energies. Their external costs which are fairly well-known are often taken care of somehow and even sometimes compensated for. Some, however, remain unidentifiable and/or unmonetisable and are listed in Table 6 by level of knowledgeability.

These NMIs appear in Table 7 by source of energy or end-use with an indication of their timescale (impacts in the short, medium or long term) and spatial range (local, regional or global) in order to introduce the policy recommendations listed in the fifth column under "minimisation of NMIs". In some cases, the only viable decision for sustainable development is to stop the damage at the source and institute a ban. We see thus how taking NMIs into account can constitute a preliminary selection of sources and of technologies.

Starting with fossil fuels, the main energy source affected by the 60-80% CO₂ reduction recommended by scientists, minimisation of any impact would require a radical revision of our ways of managing and using energy going far beyond presently discussed improvements in energy efficiency. A ban on the burning of the most damaging fossil fuels (coal and oil) would therefore be in order. Their past, present and future contribution to other environmental and health damage justify extreme caution. They are used intensively all over the world and most of the time are subsidised at one stage or another of their cycle. These declared or hidden government supports should have to be explicitly transferred to the implementation of appropriate renewable substitutes.

Nuclear energy has the widest array of NMIs as :

- a) its fuel cycle is particularly long and complex,
- b) it is a heavy technology requiring huge bulky installations and machinery, all damaging to the environment and most of them also emitting greenhouse gases,
- c) this is an unforgiving technology with the greatest uncertainties and risks (reflected in the spread of nuclear psychosis),
- d) it is so far the only technology whose proponents are so little trusted that it has had to be submitted to several national referenda.

Its impacts have an unlimited timescale by human standards and their range is all-encompassing. In countries like France its overcapacity prevents the emergence of renewable energy and this crowding-out has created a lack of diversity in the system which is itself a NMI, and could have far-reaching impacts.²⁰

Dealing with such NMIs requires and justifies the creation of a number of sophisticated new institutions: collaboratives, extensive public concertation with adequate intervenor funding

for counter-expertise, and taking great care in preventing the same people from being judge and party to the debate.

Massive renewable power production sites, hydro or solar, can be construed as also having non-monetised impacts, which are the costs of centralised structures generally. Their timescale can extend over one or two generations, but the impacts remain local. These can be dealt with by the fragmentation of the project in smaller units, or using different devices.

Transportation is still massively fossil-fueled and this is the major environmental problem created in this sector. In the rush to find alternatives to road transport, environmental impacts may end up being underestimated. A more intensive use of waterways in some developed and populated countries could prove disastrous. The status quo is nevertheless now unbearable in most countries, as well as in third-world megacities.

Impacts are seldom monetised to their actual costs, even in countries where gasoline is highly taxed, because nobody knows yet the final cost of climate change. At one time local, these impacts are therefore now understood as being global with an immediate effect, that may last for a very long time.

Solutions are expected to come more from local governments struggling with everyday problems, than from national administrations, even though both will have to be attuned in order to yield tangible positive results.

Transportation of power and energy fuels is more insidious. Even though transmission lines and gas mains are part of everyday life and decor, as well as a multitude of electric devices and appliances, no one seems concerned by the level of stress created by the magnetic fields and the fluxes of negative ions. Anything invisible tends to remain unnoticed, unmeasured, non-monetised. They nevertheless contribute to the increasing amount of risks people are taking or stresses they are suffering, knowingly or not, when they benefit from technical progress.

If, however, we accept one of the apparent conclusions of the ExternE Project that externalities are generally dwarfed by costs routinely included - with the exception of the impacts of global warming which the analysts decided not to include given their wide range - our main recommendations for further research on the identification and treatment of non-monetisable impacts would be :

- to refine the ways of dealing with NMIs using in particular the institutional approaches,
- to improve the understanding of the mechanisms of global externalities and in particular of climate change and its regional variations as undertaken by the Intergovernmental Panel on Climate Change (IPCC).

In the meantime, taking non-monetisable impacts of energy into account requires the measures mentioned above in order to

fully respect the Precautionary Principle and the Polluter Pays Principle, i.e. :

- a ban of nuclear energy and of any other "unforgiving" technology,
- the speedy elimination of the burning of fossil fuels,
- the creation of institutions and other mechanisms enforcing energy efficiency policies and promoting clean and, wherever possible, renewable forms of energy.

Such measures and mechanisms should therefore be explicitly implied in the assumptions of sustainable development strategies. They are part of the 'price' to pay for sustainability.

Conclusion on NMIs and sustainable development

It will be noticed from this study that NMIs constitute some of the worst and most real threats to human survival, whether it be the impacts of the thinning of the ozone layer, the rapid degradation of water sources everywhere, or global changes in climate. These impacts can usually be traced to energy use or production and they all are :

- environmental in nature, but with deep social and economic consequences as well,
- only recently "discovered" (in the past ten to fifteen years) and "caused" (in the last hundred years or so),
- still contested in powerful quarters,
- going to leave everybody worse-off,
- ultimately non-monetisable : there is no market to buy a new climate, a new ozone layer or to compensate for the change of direction of the Gulf Stream.

Any sensible energy planner has therefore no other recourse than to adopt the institutional, proactive, strategic approach described here to deal with NMIs "upstream" i.e. "during the early planning and design stages of the project cycle"²¹, and to call upon citizens' collaboratives to :

- require the provision of improved local and global environmental knowledge,
- downsize drastically the use of unsustainable energy,
- weigh the cost of inaction in all possible domains,
- systematically foster energy and materials efficiency and develop renewable energies allowing the design and implementation of sustainable energy strategies.

This is the price of sustainability and only such practices have a chance to prevent NMIs from excessive "damage overruns" and from one day blowing monetised impacts into oblivion.

REFERENCES

- 1 The preliminary research for this paper was funded through a contract awarded by the European Union Directorate General on Research and Technology to a team of universities and research institutions, including Roskilde University IMFUFA, for the realisation of the project "Long-term Integration of Renewables in European Energy Strategies", 1995-1996.
- 2 O'Connor, M. (1997) 'The internalization of environmental costs: implementing the Polluter pays principle in the European Union', in O'Connor, M. and Faucheux, S., Decision-making and the Environment, published in Int. J. Environment and Pollution, Vol.7. No 3.
- 3 The Polluter Pays Principle (PPP) adopted in 1972 by countries of the Organisation for Economic Cooperation and Development (OECD) states that the polluter should be charged for the damages created by his activities. The main objective of the generalisation of the PPP was to insure fairness between countries, some having more stringent pollution regulations than others, which created a commercial handicap for their nationals compared to producers in countries without such controls.
- 4 For more extensive discussion, see O'Connor, M. ,'Environmental Valuation from the Point of View of Sustainability', in Sustainability and Global Environmental Policy, chapter 8., Holland, A. (1997) 'The foundations of environmental decision-making', in Int. J. Environment and Pollution, Vol. 7. No 4, and Faucheux, S., Muir, E. and O'Connor, M., 'Neoclassical Natural Capital Theory and 'Weak' Indicators for Sustainability,' Cahiers du C3ED n° 96-05, Novembre 1996.
- 5 OECD/IEA (1993), Life-cycle Analysis of Energy Systems, Methods and Experience, Proceedings OECD/IEA Expert Workshop, 21-22 May 1992, Paris.
- 6 Robert Goodland, Herman Daly, Salah El Serafy and Bernd von Droste (1992), Environmentally Sustainable Economic Development : Building on Brundtland, UNESCO.
- 7 European Commission Directorate-General XII (1994), Externalities of Fuel Cycles "Externe" Project, Economic Valuation, Volume n°9.
- 8 None of these countries, however, are actually dedicating the product of these receipts to the restoration or the protection of the environment. most economists will argue that earmarking is inappropriate.
- 9 René Passet (1979), L'économique et le vivant, Petite Bibliothèque Payot, p. 53. See also Funtowicz, S.O., Ravetz, J.R. 'The worth of a songbird: ecological economics as a post-normal science', in Ecological Economics 10 (1994) 197-207.
- 10 Let us say, however, that not putting an explicit value on a "statistical life" does not mean that this value is not imposed implicitly. By building nuclear plants or road infrastructure to a certain level of safety, the governments already put a de facto value on life, even if they did not say so.
- 11 "The willingness-to-pay methodology - how much people are willing to pay for a better environment - used by this group of (Northern) economists resulted in 15 lives in the poor South being equated to one live (valued at \$1.5 million) in the rich North". Quote taken from the article by Chakravarthi Raghavan, "Southern lives are cheaper, say climate change economists", in Third World Resurgence, N°64, 1996 .
- 12 Dieter Birnbacher (1994), La responsabilité envers les générations futures, pp. 60-62, Presses Universitaires de France.
- 13 Even when successful, negotiations between the winners and the losers remain keyed to the present and do not take into account the wishes or the condition of future generations. It is also unlikely that all the losers and winners will be included.
- 14 Mark Jaccard, 'Abatement Cost and Energy Resource Planning : Revealing Social Preferences' in OECD (1992), op. cit. p. 279.
- 15 Sometimes called the SSS approach as it "Shrinks the Share of Shadow", i.e. it improves the state of knowledge in a relative manner.
- 16 Bent Sørensen, 'What is Life-Cycle Analysis', in OECD (1992), op. cit. p. 49.
- 17 Hélène Connor-Lajambe, 'Societal Impacts of Utility Overinvestment: the Case of the James Bay Hydroelectric Project', in Utilities Policy, Vol. 1, n° 1.
- 18 J. Rawls has suggested that people could decide for future generations if they themselves were "covered by a veil of ignorance" of their own position in society. Theory of Justice, Harvard University Press, Cambridge, Mass. 1971.
- 19 As an example to better integrate policies, during its last Meeting of Environment Ministers, the Organisation for Economic Cooperation and Development

considered creating a consultative body made-up of environmental non-governmental organisations alongside the business, industry and trade unions advisory committees, BIAC and TUAC. See also the institutional changes suggested in the OECD Progress Report on Environment-Economy Policy Integration, pp. 47-49, November 1995.

20 For instance if generic defects are detected in a system that provides an important proportion of the energy budget.

21 Robert Goodland & George Ledec, 'Neoclassical Economics and Principles of Sustainable Development', in Ecological Modelling, 38 (1987), p. 22.

2

3

4

5