Beyond GDP
Measuring progress, true wealth, and the well-being of nations
International Conference, 19 & 20 November 2007, Brussels

http://www.beyond-gdp.eu

Name of the indicator/method:

Environmentally Sustainable National Income (eSNI):
Asymmetric entries and other ways to improve information about economic growth.

Summary prepared by (name; institution):

Dr Roefie Hueting
Roelofsstraat 6
The Hague, the Netherlands
www.sni-hueting.info

Updated: October, 2011 (original: October 2007)

Abstract

All economic action is directed to the satisfaction of wants, or in other words: to welfare. Welfare is defined as the satisfaction of wants derived from our dealings with scarce goods. It is a category of personal experience and not measurable in cardinal units. Therefore we have to make do with indicators that *are* measurable in cardinal units and that are arguably influencing welfare. The cardinal indicator and the ordinal welfare have, of course, to develop in the same direction.

Economic growth is generally defined as increase of national income (NI) (or GDP) as a measure of production. However, according to the subject matter of economics economic growth can mean nothing other than increase in welfare. Welfare is dependent on more factors than solely production. It is also dependent on employment, income distribution, labour conditions, leisure time and the scarce possible uses of the non-human-made physical surroundings: the environmental functions. These objectives or ends are often conflicting. Therefore welfare can increase with decreasing production.

The narrow minded, theoretically wrong definition of economic growth is especially threatening the current and future availability of environmental functions, the most fundamental scarce and consequently economic goods at the disposal of humanity. These fall outside the market and outside the measurement of NI. Correct information is decisive for the coming into being of the preferences of individuals and institutions and consequently for the decision making process. Therefore it is of the utmost importance to correct the current misleading information. In the paper five relatively simple ways are discussed to correct the wrong information about growth.

The concept of environmental functions is defined as the possible uses of the non-human-made physical surroundings on which humanity is entirely dependent.

Keywords: environmental function; economic growth; environmentally sustainable national income; employment; asymmetric entries.

1. Environmental sustainability

The notion of environmental sustainability has a long intellectual history, going back to the concept of a 'stationary' or 'steady state' economy employed by nineteenth-century economists. This concept denotes a state of dynamic equilibrium between production and natural resources. J.S. Mill (1876) wrote that he sincerely hoped that people would be content to be stationary, for the sake of posterity, long before necessity compels them to it. This pronouncement can be interpreted as being based on considerations of intergenerational equity. In the context of sustainable national income this means that it is investigated under which conditions the *possibilities* to use our non-human-made physical surroundings can be passed on to future generations undamaged. In the twentieth century the notion of sustainability has been extended to encompass other aspects of the environmental issue, such as the relation with the living world (nature) and pollution; see IUCN [1].

In the process, the principle of preferences for intergenerational equity has always remained a core element of the concept. This implied a state of *dynamic equilibrium* with the available natural resources and with the living world, and abatement of pollution, to the extent of its significance for future generations. Uncompensated exportation of anthropogenic environmental risks to future generations was rejected as inadmissible. To establish an appropriate maximum environmental burden to meet these preferences was seen as a task for natural scientists. In other words, sustainability was taken to mean that the environmental capital - defined as the possible uses, or functions, of the environment and natural resources - provided by nature and capable of being scientifically established, should remain intact; see Kapp [2], Daly [3], Hueting [4], and Goodland [5].

Using Boulding's [6] terminology, this implies a dynamic equilibrium, in which (ceteris paribus) the functions of environment and natural resources remain available. Measures taken to allow for the permanent availability of functions should be derived from scientifically based presuppositions. Whether these measures are sufficient can of course only be evaluated after the event, again using natural science. So in this view environmental sustainability is an objective concept to the extent that natural science is objective. Whether or not individuals and institutions want to attain environmental sustainability depends on their preferences which are evidently subjective.[1] The equilibrium is dynamic because both geological processes and human activities are continuously changing the state of our planet.

In the report Our Common Future [7], also known as the Brundtland report, the concept of sustainability was clearly linked to the issue of intergenerational equity. In Our Common Future this was phrased as follows: 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. Many countries have by now subscribed to sustainable development as defined in the Brundtland report. However, the report is according to Hueting [8] a matter of conflicting goals, because it is pleading for both sustainability and production growth; see Section 6.

2. The concept of environmental functions

In the theoretical basis for the calculation of environmentally sustainable national income (eSNI), the environment is defined as the non-human-made physical surroundings: water, air, soil, plant and animal species and the life support functions (including ecosystems) of our planet, on which humanity is entirely dependent whether producing, consuming, breathing or

[1] Because they reflect the feelings of subjects.

recreating. It is true that our observable surroundings are largely human-built. However, houses, roads, machines and farm crops are the result of two complementary factors: labour, that is technology, and elements of the physical surroundings as here intended.

The possible uses, or functions, of our physical surroundings (the environment), on which all human life depends, have come into being largely via processes proceeding at a geological or evolutionary pace. For the life support systems it is unfeasible ever completely to be replaced by technology, as is shown by Goodland [5]. It is thanks to these life support systems, which are under threat of disruption, that indispensable (or vital) environmental functions remain available.

Life support systems are understood to mean the processes that maintain the conditions necessary for life on earth. This comes down to maintaining equilibria within narrow margins. The processes may be of a biological or physico-chemical nature, or a combination thereof. Examples of biological processes include the carbon and nutrient cycles, involving the extraction of such substances as carbon dioxide, water and minerals from the abiotic environment during creation of biomass, and the return of these substances to the abiotic environment during decomposition of the biomass. Examples of physico-chemical processes include the water cycle and regulation of the thickness of the stratospheric ozone layer. These examples show that there is interaction between the processes, whereby equilibrium may be disturbed. The water cycle, for example, may be disturbed by large-scale deforestation. Climate change is a disturbance of the carbon cycle.

In our physical surroundings, a great number of possible uses can be distinguished, which are essential for production, consumption, breathing, et cetera, and thus for human existence. These are called environmental functions, or in short: functions; see Hueting [9] [4]. As long as the use of a function does not hamper the use of an other or the same function, so as long as environmental functions are not scarce, an insufficiency of labour, that is intellect or technology, is the sole factor limiting production growth, as measured in standard NI. As soon as one use of a function is at the expense of another or the same function (by excessive use), though, or threatens to be so in the future, a second limiting factor is introduced. This competition of functions leads to partial or complete loss of function. An example of excessive use of one and the same function, leading to its loss, is overfishing resulting in decreased availability of the function ‘water to accommodate fish species’; then the catch of some species decreases or species become extinct.

A distinction is made between three kinds of competition of functions: spatial, quantitative and qualitative. When spatial and quantitative competition occurs, the amount of space and the amount of matter respectively are deficient in respect to the existing or future needs for them. In qualitative competition, overburdening the function 'waste dumping medium' by chemical, physical or biological agents has caused partial or total loss of other possible uses of the environment, such as the function 'drinking water' or 'air for physiological functioning of humans, plants and animals (breathing)'.

Worldwide severe competition exists between use of space for production of food, production of bio fuels, natural ecosystems and the survival of species, road building, building of houses, traffic and possibilities for children to play and discover their surroundings. In many regions of the world the quantity of ground and surface water is insufficient to meet the needs for both raining on agricultural crops and industrial processes and drinking water and the survival of species. Qualitative competition includes pollution, disturbance of ecosystem by exotics and phenomena such as climate change.

When using the concept of function, the only thing that matters in the context of sustainability is that vital functions remain available. As for renewable resources, functions remain available as long as their regenerative capacity remains intact. Regeneration in relation to current use of 'non-renewable' resources such as crude oil and copper that are formed by slow geological processes is close to zero. Regeneration then takes the form of developing substitutes. The possibilities for this are hopeful; see Brown et al. [10] and Reijnders [11]. So, economically speaking, there seems to be no essential difference between the two.

3. Valuation of environmental functions, an impossibility leading to assumptions

The emergence of competition between functions marks a juncture at which functions start to fall short of meeting existing wants. Competing functions are by definition scarce and consequently economic goods, indeed the most fundamental economic goods humanity disposes of. In a situation of severe competition between functions, in which we live today, labour is not only reducing scarcity, and thus causing a positive effect on our satisfaction of wants, or welfare; but it is also increasing scarcity, thus causing a negative effect on welfare. The same holds for consumption. So today production not only adds value (viz. goods for consumption) but also nullifies value (by damaging environmental functions).

The availability of functions, or, in terms of the System of National Accounts (SNA), their volume, decreases from ‘infinite’ (abundant with respect to existing wants) to finite, that is falling short with respect to existing wants. As a result, the shadow price of environmental functions rises, and with it their value, defined as price times quantity, from zero to an ever-higher positive value. *This rise in value reflects a rise in costs*. To determine the extent of the loss of function, we must know the value of the function. Since environmental functions are collective goods that are not traded on the market, supply and demand curves have to be constructed. Without data on *both* preferences (demand) *and* opportunity costs (supply), determination of value is impossible. For, if a good is not wanted or if its acquisition requires no sacrifice, the economic value of that good equals zero and no problem of choice arises. It then is obviously not scarce, has by definition no economic aspect and falls consequently outside economics.

The estimated costs of measures necessary to restore functions, that rise progressively per unit of function restored, can be seen as a supply curve, because it supplies the function. We call this the cost-effectiveness curve or the elimination cost curve, because it refers to measures that eliminate the pressure on the environment. Except in the case of irreparable damage, the elimination costs can always be estimated, so this curve can always be constructed. The measures include technical measures, direct shifts to environmentally benign production and consumption, development of alternatives for depletable resources such as oil and cupper, and family planning. The necessary pace of substitution of non-renewables is dealt with in Hueting and De Boer [12].

Preferences for environmental functions (demand), on the contrary, can only partially be determined, since these can be expressed only partially via the market, while willingness to pay techniques cannot yield reliable data precisely for vital functions. Hueting [13] [14] and Hueting and De Boer [12] mention quite a few reasons for this statement. Thus much of the damage resulting from the loss of functions will take place in the future. No financial damage or compensation expenditures, as revealed preferences, can therefore arise in the present. Choosing a discount rate boils down to making an assumption about preferences and therefore does not resolve the problem; see Hueting [15]. Another example is that we cannot base ourselves on observed individual behaviour, given the working of the prisoners’ dilemma.

Therefore, it is not possible to construct a complete demand curve. Expenditure on compensation for loss of function and restoration of physical damage resulting from loss of function, however, constitute revealed preferences for the availability of functions, so that some impression of these preferences can be obtained. One example is the additional measures for the production of drinking water as a result of the loss of the function 'drinking water' because of pollution (overuse of the function 'water as dumping ground for waste'). Another example is the restoration of damage caused by flooding due to excessively cutting forests etc. (overuse of the function 'provider of wood' etc.) that consequently are losing their function 'regulation of the water flow'.

Because individual preferences can be measured only partially, shadow prices for environmental functions, which are determined by the intersection of the first derivatives of the constructed curves for demand and supply (see Figure 1), cannot be determined. Consequently, these shadow prices – and the value of environmental functions - remain unknown. This means that the *correct prices for the human-made goods* that are produced and consumed at the expense of environmental functions remain *equally unknowable*.

However, to provide the necessary information, assumptions can be made about the relative preferences for environmental functions and produced goods. *One* of the possible assumptions is that the economic agents, individuals and institutions, have a dominant preference for an environmentally sustainable development. This assumption is legitimate since governments and institutions all over the world have stated support for environmental sustainability. Furthermore Hueting [16], referring to the ecological risks by production growth, postulates: "Man derives part of the meaning of existence from the company of others. These others include in any case his children and grandchildren. The prospect of a safer future is therefore a normal human need, and dimming of this prospect has a negative effect on welfare." *Another* possible assumption is that the economy is currently on an optimal path that is described by the changes in the standard NI. So *both the SNI and the standard NI are fictitious* in the context of what is at issue in economic theory and statistics, namely to provide indicators of the effect of our actions on our welfare. This holds true apart from the fact that measuring NI has smaller uncertainty margins than measuring eSNI.

When assuming dominant preferences for sustainability, the unknown demand curves must be replaced by physical standards for sustainable use of the physical environment. The standards are scientifically determined and in this sense objective. They must, of course, be distinguished clearly from the subjective preferences for whether or not they should be attained. Examples are: the man-made rate of extinction of species should not exceed the rate at which new species come into being, for safeguarding the many functions of ecosystems; the emission of greenhouse gases has to be reduced by 70 to 80 % in order to let life support systems restore the climate; the rate of erosion of topsoil may not exceed the rate of formation of such soil due to weathering, for safeguarding the function: 'soil for raising crops'.

From an economic perspective, sustainability standards approximate demand curves that are vertical in the relevant area of a diagram that has the availability of functions measured in physical units on the *x*-axis and the demand for functions and their opportunity costs on the *y*-axis. The shadow price for environmental functions – and their value – based upon the assumed preferences for sustainability then follows from the intersection of the vertical line and the marginal cost-effectiveness curve. In this manner the distance to sustainability, denoted in physical units on the *x*-axis, is translated into monetary units. See Figure 1, taken from Hueting [4], which shows the relationship between economy and ecology. Of course, bridging the gap requires a transition period.

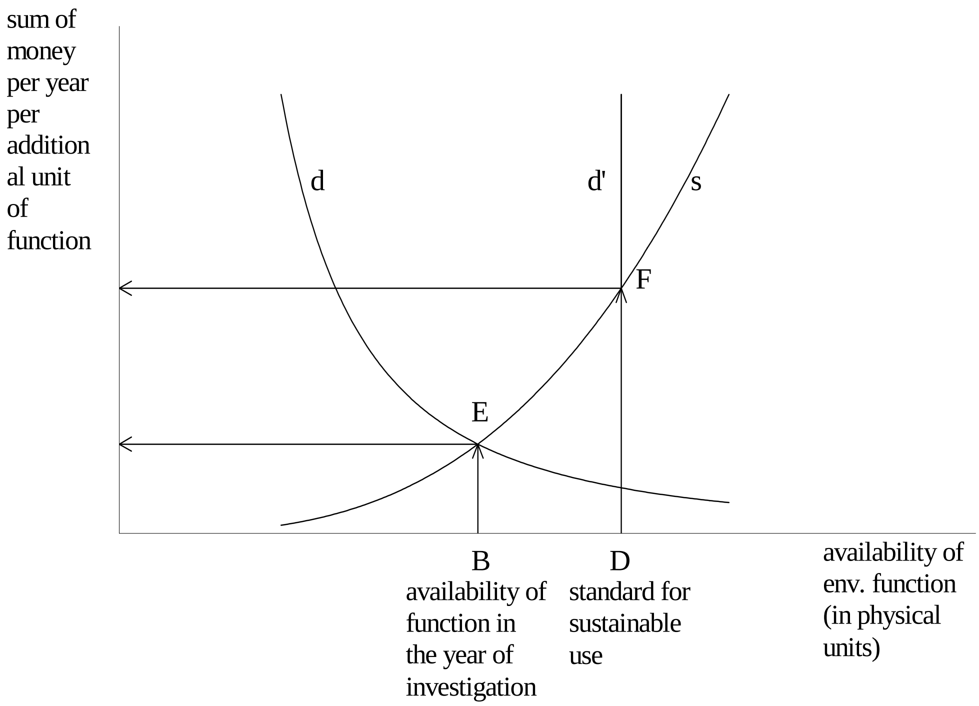

Figure 1, *taken from Hueting [4]. Translation of costs in physical units into costs in monetary units: s=supply curve or marginal elimination cost curve; d=incomplete demand curve or marginal benefit curve based on individual preferences revealed from expenditures on compensation of functions, and so on; d' = 'demand curve' based on assumed preferences for sustainability; BD = distance that must be bridged in order to arrive at sustainable use of environmental functions; area BEFD=total costs of the loss functions, expressed in money; the arrows indicate the way in which the loss of environmental functions recorded in physical units is translated into monetary units. The availability of the function (B) does not need to coincide with the level following from intersection point (E).*

The greater the distance between the present economy and the desired more environmentally benign economy that has to be bridged, the higher the costs of the required set of elimination measures are, as Figure 1 shows. These measures, consisting of technical means to reduce the use of the environment, direct shifts to less environment-damaging products and, if necessary, birth control, are interacting with deliveries of all products, including services. So, when bringing these measures into practice, the interdependences between the producers, consumers and the environment make all commodity flows and prices change. For a correct approximation, such calculations have to be done by a general equilibrium model, which also generates the shadow prices for produced goods in a sustainable economy. The level of sustainable national income (see Section 5) follows from such a model as well.

4. Five ways to correct information about growth

Based on the theory briefly described above, five ways can be distinguished to improve the current information about economic growth.

5. First way: estimate environmentally sustainable national income (eSNI) to indicate the distance to environmental sustainability

Environmentally sustainable national income (eSNI) is defined as the maximal attainable production level by which vital environmental functions remain available for future generations, based on the technology available at the time. Thus the eSNI provides information about the distance between the current and a sustainable situation. The length of the period to bridge this distance, that is the transition period towards a sustainable situation, is limited only by the condition that vital environmental functions must not be damaged irreversibly. In combination with the standard national income (NI), the eSNI indicates whether or not the part of the production that is not based on sustainable use of the environment, is becoming smaller or greater. Because of the precautionary principle, future technological progress is not anticipated in the calculation of eSNI. When constructing a time series of eSNI's, technological progress is measured after the event on the basis of the development of the distance between the eSNI and standard NI over the course of time. When this distance increases, society is drifting farther away from environmental sustainability, if this distance decreases, society is approaching environmental sustainability.

The theory of and the necessary statistics for an eSNI have been worked on since the mid sixties. A first rough estimate of the eSNI for the world by Tinbergen and Hueting [17] arrives at roughly fifty percent of the production level of the world: the world income. Estimates for The Netherlands by a cooperation of Statistics Netherlands, the Institute of Environmental Studies and the Netherlands Environmental Assessment Agency also arrived at about fifty percent of the production level or national income of The Netherlands; see Verbruggen *et al.* [18]. This corresponds with the production level in the early seventies. In view of the smaller size of the population, the consumption per capita was by that time substantially higher than fifty percent of the current level. In the period 1990-2005 the distance between NI and eSNI increased by thirteen billion euro or 10%.

The methodology of the present calculation was proposed in 1992 by Hueting *et al*. [19] and was developed further into the model approach published by Verbruggen *et al.* [18] and Hueting and De Boer [12]. The necessary condition for sustainability is that environmental functions are maintained for future generations, at the lowest levels of availability that enables the physical elements of the environment, which are the carriers of the functions, to remain supporting these levels. This is the case when the sustainability standards – see Section 3 – are met. The data of the cost of the measures to attain the standards and thus maintain vital functions, that rise progressively per unit of function restored (expressed in physical units, see Figure 1), are estimated in the way exposed in Section 3. The model yields an approximation of the eSNI.

The model traces the changes in the produced quantities in reaction to the change in price ratios (environment burdening activities become relatively more expensive, whereas environmentally benign activities become relatively cheaper) and vice versa. . The change in price ratios can be elucidated as follows. It follows from Hueting [20] and Hueting *et al*. [19] that, during a long period, the bulk of national income growth has been generated by industries that caused the greatest losses of environmental functions, both in production and in consumption. The increase in productivity in these industries, measured in terms of goods produced, has been much greater than elsewhere in the economy, so the real prices of these products have decreased strongly, and, with them, the price ratio between environmentally burdening and less burdening products. As a result, any present or future shift to environmentally friendly products will have a negative impact on the volume of national income;

see Hueting *et al*. [19]. When, as in the simulation of environmentally sustainable income, the costs for attaining environmental sustainability are internalised in the prices of environment burdening products, the real prices of the latter increase, as does the price ratio between environmentally burdening and friendly products. The latter price ratios reflect the situation in an environmentally sustainable situation. *Attaining environmental sustainability without a (drastic) change in price ratios is infeasible*.

The eSNI has been calculated each fifth year, because data on the cost effectiveness of the available technical measures for elimination of the emissions involved were generally updated with that frequency.

Key results of the model calculations are the environmentally sustainable net national income of the Netherlands in a number of years, shown in Table 1 and Figure 2 in comparison with the actual net national income. Quantitative comparison of the actual and the sustainable national income both *in* a certain year and *between* the years of calculation requires that both series of national income figures are expressed in the *same* set of product prices, for which the set of actual prices in the first year of the time series, 1990, was chosen.

Though eSNI showed a greater relative growth than NNI did, the difference between NNI and eSNI increased between 1990 and 2005 from 56% to 60% of the NNI of 1990 (see the index of NNI-SNI in Table 1), indicating that the economy has been drifting away environmental sustainability. This includes a decrease of the distance by 2% since 2005.

The model also provides the possibility to show the division of the production volume, i.e. NNI or eSNI, over the production sectors. Other model variables, such as the labour volume and the environmental tax, may also be represented as totals and as amounts per production and consumption sector.

Table 1. *Net National Income and environmentally Sustainable Net National Income in the Netherlands*

		1990	1995	2000	2005
Volume (billion €)	NNI	213	235	273	307
	SNI	94	107	141	179
	NNI - SNI	119	128	132	128
Growth (billion €)	NNI		22	38	34
	SNI		13	34	38
	NNI - SNI		9	4	-4
Growth (% in 5 years)	NNI		11%	16%	12%
	SNI		14%	32%	27%
	NNI - SNI		8%	3%	-3%
Index (NNI 1990 = 100)	NNI	100	111	128	144
	SNI	44	50	66	84
	NNI - SNI	56	60	62	60

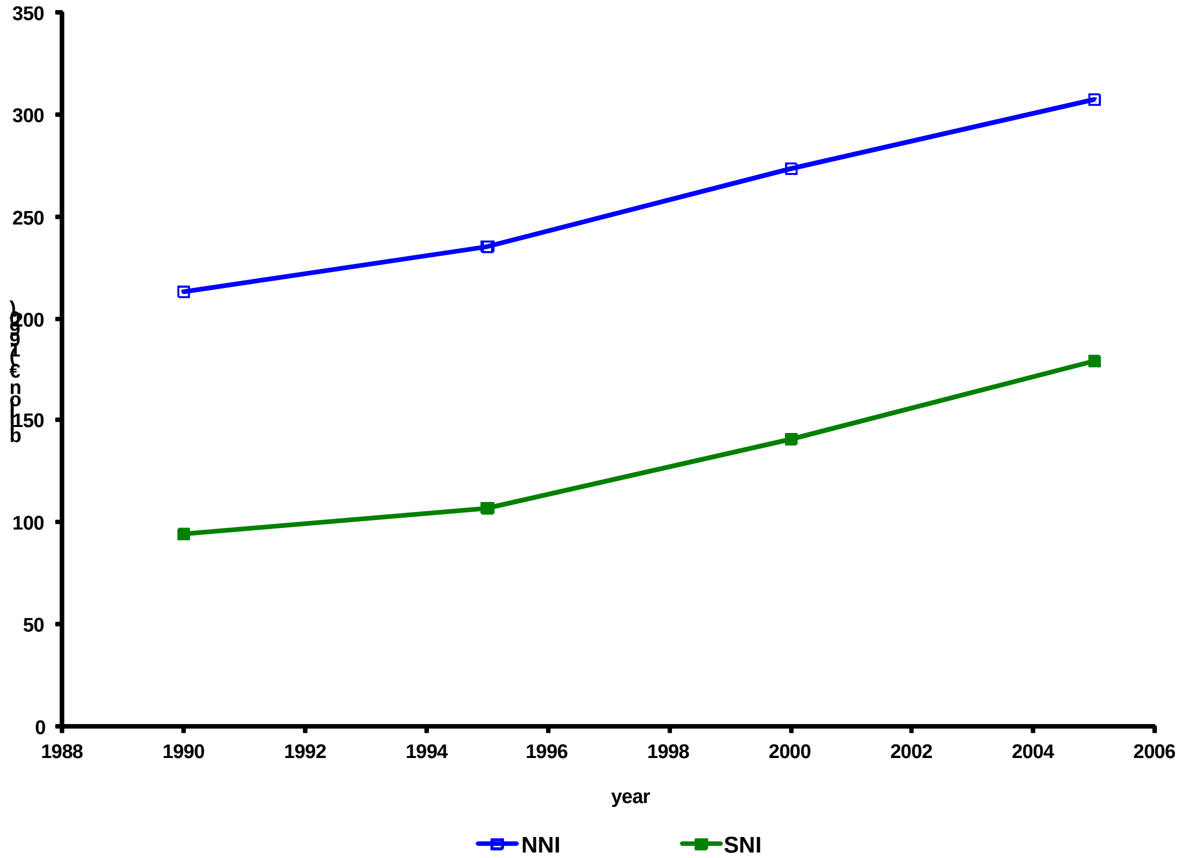

Figure 2. *Evolution of Net National Income and environmentally Sustainable Net National Income in the Netherlands*

The eSNI is the only indicator which (1) is directly comparable with standard NI because it is estimated in accordance with the conventions of the System of National Accounts (SNA), (2) relates the measurable physical environment ('ecology') with subjective preferences (economy) as shown in Figure 1, (3) provides the distance between the actual (NI) and sustainable (eSNI) production level in factor costs and (4) shows the development of this distance in the course of time and thus shows whether or not society is drifting further away from environmental sustainability defined as keeping vital environmental functions available for future generations. Therefore the eSNI is indispensable information for society and policy making.

A recent overview of the development of eSNI is given by Colignatus [21].

6. Second way: refute the fallacy of the political statement that production must grow to finance safeguarding the environment

The official policy of all countries in the world is that standard NI - production - must increase in order to create scope for financing environmental conservation, and thus attain sustainability. The theoretical mistake of this reasoning is shown by Hueting [22]. Of course, the future cannot be predicted. But the *plausibility* of the statement can be examined. On the grounds of the data discussed below the statement seems extremely unlikely. The author feels the opposite is more plausible for the following seven reasons.

(1) Theoretically, the possibility cannot be excluded that growth of production and consumption can be combined with restoration and maintenance of environmental quality. However, such combination is highly uncertain and scarcely plausible. It would require technologies that *simultaneously*: (i) are sufficiently clean, (ii) do not deplete renewable natural resources, (iii) find substitutes for non-renewable resources, (iv) leave the soil intact, (v) leave sufficient space for the survival of plant and animal species and (vi) are cheaper in real terms than *current* available technologies, because if they are more expensive in real terms then growth will be reduced.

Meeting all these six conditions is scarcely conceivable for the whole spectrum of human activities. Especially simultaneously realising both (i) through (v) *and* (vi), which is a prerequisite for combining production growth and conservation of the environment, is extremely difficult. Anyhow, technologies necessary for the combination of production growth and full conservation of the functions of the environment are not yet available. Anticipating the future availability of such technologies conflicts with the precautionary principle, and consequently with sustainability, which is, of course, certainly not the same as forecasting or not expecting technological progress.

(2) An analysis of the basic source material of the Dutch national accounts shows that roughly one third of the activities making up standard NI (measured as labour volume) do not contribute to its growth. These activities include governance, the administration of justice and most cultural activities. Part of the services sector contributes moderately to the growth of NI, while the remaining one third contributes by far the largest part to the growth of production. Unfortunately, this latter third consists of activities associated with production and consumption that cause the greatest damage to the environment in terms of loss of nature and biodiversity (by use and fragmentation of space), pollution and depletion of resources. These activities include the oil and petrochemical industries, agriculture, public utilities, road construction and mining. These results are almost certainly valid for other industrialised countries and probably valid for developing countries; see Hueting [20] and Hueting *et al.* [19].

(3) The burden on the environment as represented in standard NI equals the product of the number of people and the volume of the activities per person. Reducing this burden by decreasing population lowers growth or leads to a lower production level.

(4) Applying technical measures has a negative effect on growth of production because they enhance real prices: more labour is needed for the same product. The research for the estimates of eSNI's has shown that environmental sustainability cannot be attained solely by applying technology. In addition, direct shifts, such as from car to bicycle and public transport, and from meat to beans, also are necessary. From point (2) above it follows that these shifts also reduce growth or lead to a lower production level.

(5) A price rise resulting from internalising the costs of the measures which restore the environment means, like any price rise in real terms, a lowering of production growth. Depending on the situation, this decreases the production level. For a given technology, product costs will rise progressively as the yield (or effect) of environmental measures is increased. Of course, technological progress leads to higher yields. As production increases further, however, so must the yield of the measures increase in order to maintain the same state of the environment, while the fact of progressively rising costs with rising yields remains unaltered.

(6) An unknown part of the value added in standard NI consists of asymmetric entering (see Section 7) and should therefore not be considered as a contribution to its volume, see Hueting

[4]. This part will increase considerably because of the expenditures on (1) measures to eliminate the origin of the climate problem (caused by damaging the functions of life support systems due to production growth) by reducing the emission of greenhouse gases and on (2) measures to compensate the effects of climate change, e.g. by building dikes and moving to higher elevations.

(7) A sustainable production level with available technology is about fifty percent lower than the current level, both for the world: see Tinbergen and Hueting [17] and for the Netherlands: see Verbruggen *et al.* [18]. From this it follows that eSNI has to grow more than twice as fast as NI in order to reduce the distance between NI and eSNI. This seems to be an almost impossible task for environmental technology, which is the only means for increasing eSNI.

7. Third way: estimate a national income ex asymmetric entries (NI ex asyms) for a better indication of the development of production

Producing is defined, in accordance with standard economic theory, as the adding of value. National income (NI) equals the sum of the values added. So NI measures - the fluctuations in the level of -production. It does so according to its definition and according to the intention of the founders of its concept to get an indicator for one of the factors influencing welfare - and a tool for quite a few other purposes. See Tinbergen and Hueting [17]. (Nobelist Jan Tinbergen was one of the founders of the concept of NI and its quantification).

As mentioned just now, producing is adding value. *This value is added to the non-human-made physical surroundings.* Consequently, environmental functions (the most fundamental economic goods at human's disposal) remain outside the measurement of standard NI. This is logical and easy to understand, because water, air, soil, plant and animal species and the life support systems of our planet are not produced by humans. So losses of functions, caused by production and consumption, are correctly not entered as costs. However, expenditures on measures for their restoration and compensation *are* entered as value added. This is asymmetric. These expenditures should be entered as intermediate, as they are costs.

This asymmetry is often defended by the remark that these expenditures contribute to welfare and generate income; see De Haan [23] and Heertje [24]. This is of course self-evident, counting from the moment at which the loss of environmental functions and the consequential adverse effects have already occurred. However, the production factors, used for the measures, do not add any value counting from the moment that the functions were still available. With respect to that situation there is consequently no increase in (1) the quantity of final goods produced and (2) the availability of environmental functions. Opposite to the income earned with carrying into effect the measures there stays consequently no increase in production volume (= final goods produced) with respect to that situation. By entering these expenditures as final instead of intermediate, the growth of production is overestimated, thus obscuring what is happening with both environment and production.

Asyms (asymmetric entries into NI) can relate to events in the past, to events in the current financial year (e.g. oil spills) and, as prevention, to events expected in the future due to loss of function; that does not make any theoretical difference. It always boils down to undo or counteract the effects of production growth that should not contribute to the same growth. Asyms are clearly in conflict with the original intention of the founders of NI as a measure of fluctuations in the level of production; see Tinbergen and Hueting [17].

The information about the development of production is improved by estimating an NI ex asyms alongside the NI. An NI ex asyms, apart from being useful in itself, is also important for the environmentally sustainable national income (eSNI) dealt with in Section 5. The eSNI is above all intended for gauging the distance between the achieved and the sustainable level of production in the course of time. Because expenditure on a number of elimination measures and a great deal of expenditure on repairing damage and on compensation measures are booked as contributions to the NI, NI is not a good yardstick of the (development of the) level of production. During a transition to the sustainable path the distance between NI and eSNI may increase as a result, while the gap between the sustainable and the present level of production (the NI ex asyms), which is what it is all about, decreases. Hence the gap that has to be bridged to achieve a sustainable level of production (the eSNI) is (NI ex asyms – eSNI) and not (NI – eSNI). See De Boer and Hueting [25] for the formal mathematical details.

8. Fourth way: refute the fallacy of a conflict between environment and employment

The main stumbling block on the way to environmental sustainability is the alleged conflict between environment and employment. The refutation of this alleged conflict can be found in Hueting [22]. Environmental functions are scarce goods which require the use of production factors for their restoration, preservation and substitution. Of these, labour is the most important. In the Netherlands more than 80% of Net Domestic Product is labour income. Capital goods are manufactured by labour, using elements of our physical surrounding. The production and consumption of the same amount of goods requires more labour with safeguarding the environment than is required without. Hueting [22] shows that with direct shifts to environmentally benign activities attaining a certain goal requires more labour. Therefore, there is, under the most logical conditions, no such conflict. On the contrary, the opposite holds true. These logical conditions are: (1) income has to be reduced in proportion to the costs of the measures required to conserve the environment, (2) these or similar measures must be taken to the same degree simultaneously by other firms involved, in all countries.

The absurdity of the alleged conflict becomes evident when we trace its consequences. If conservation were to be achieved at the expense of employment, then ‘clean’ production and consumption should require less time than the ‘dirty’ production and consumption. Because labour is the dominant cost factor (see above), clean production would then be cheaper. From this it follows that there would be no environmental problem! The market would force to produce and consume without burdening the environment. The environmental problem can be conceived as a process involving the steady substitution of time, or working hours, through depletion of the environment.

Openly admitting the above obvious fact and creating the logical conditions under which the problems of unemployment and the environment would neutralize one another would lead to a structural drop in (traditional) labour productivity. This certainly checks the growth of production or leads to a lower production level and consequently to a step in the direction of environmental sustainability.

9. Fifth way: refute the proposition that saving the environment is unpayable

The fifth way to counteract myths about growth is to refute the fallacy that preserving the environment is too expensive. A wide-spread fallacy about the environmental problem is: ‘We would like to save the environment, but alas, it is too expensive’. However, the contrary holds true: all fundamental solutions for safeguarding the environment are clearly much cheaper than continuing the process that is threatening life on this planet.

For example: travelling by bicycle is much cheaper than driving the same distance by car. Heating one room, in combination with a sweater and an extra blanket, is much cheaper than heating the entire house. A vacation by boat or train is cheaper than a holiday flight. A diet combining some meat and beans is cheaper than eating lots of meat. Winter vegetables in winter are cheaper than summer vegetables in winter. Raising two children is cheaper than raising ten.

The burden on the environment is determined by the number of people, the amount of activity per person, and the nature of this activity. Because activities with little or no impact on the environment can be expanded, the shift to environmental sustainability comes down to adapting the number of individuals of our species and the kind of activities we engage in to the carrying capacity of our planet. This adaptation is extraordinarily cheap.

Of course there is an economic sacrifice to be made; otherwise there would be no environmental problem. Most of us would love to make unrestricted use of the private car, are mad about eating meat, and prefer to have sex without a pill or condom. Recent initiatives to calculate a sustainable level of activities, the eSNI, show a major difference with the standard NI. But if we delink our credo of progress from the growth of our consumption, there is no reason at all to panic. In the first place, shifting to sustainability will not damage our health. On the contrary, environmentally-friendly activities are usually healthier than those that harm the environment. Second, a sustainable level of activity by no means implies a return to the middle Ages, as often claimed. The global national income is in 1990 four times higher than that in about 1950. Were living conditions in 1950 worse for most of the people in the world than they were in 1990? A sustainable level of activity will probably be considerably higher than that of forty years ago. Thus, according to a rough estimate by Tinbergen and Hueting global production and consumption in 1990 would have to be halved in order to attain sustainable levels, thus to repay our debt to future generations (see above). The same holds true for The Netherlands in 2005 (see above).

References

(Most articles by the present author can be downloaded from www.sni-hueting.info)

[1] IUCN. The World Conservation Strategy, Gland (Switzerland), WWF/IUCN, 1980.

[2] Kapp KW. The Social Costs of Private Enterprise. Cambridge (Mass.), 1950.

[3] Daly H. Toward a Steady State Economy, Freeman, San Francisco, 1973.

[4] Hueting R. New Scarcity and Economic Growth. Dutch edition: Agon Elsevier, 1974. English edition: North-Holland Publishing Company, Amsterdam, New York, Oxford, 1980.

[5] Goodland R. The concept of environmental sustainability, Ann. Rev. Ecol. Syst. 26, p.1-24, 1995.

[6] Boulding K. What do we want to sustain? Environmentalism and human evaluations.
In: R. Costanza (ed.) Ecological Economics, Columbia University Press, 1991.

[7] Brundtland GH et al (World Commission on Environment and Development). Our Common Future, Oxford University Press, Oxford, 1987.

[8] Hueting R. The Brundtland Report: A Matter of Conflicting Goals', Ecological Economics 2: 109-117, 1990.

[9] Hueting R. Functions of Nature: Should Nature Be Quantified? London, World Wildlife Fund, 1969.

[10] Brown LR, Flavin C and French H.. State of the World 1998, W.W. Norton, New York, 1998.

[11] Reijnders L. Environmentally Improved Production Processes and Products, Kluwer Scientific Publishers, Dordtrecht, 1996.

[12] Hueting R, De Boer B. Environmental Valuation and Sustainable National Income According to Hueting. In: Van Ierland E. C. *et al.*, editors. Economic Growth and Valuation of the Environment: A Debate, pp. 17–77. Edward Elgar, London, 2001.

[13] Hueting R. Correcting National Income for Environmental Losses: Towards a Practical Solution. In Ahmad Y, El Serafy S and Lutz E (eds.)), Environmental Accounting for Sustainable Development, The World Bank, Washington, D.C., 32-39, 1989.

[14] Hueting R. The Economic Functions of the Environment. In: P. Ekins & M. Max-Neef (eds.), Real-life Economics, Routledge, London, New York, 61-69,1992.

[15] Hueting R. The Use of the Discount Rate in a Cost-Benefit Analysis for Different Uses of a Humid Tropical Forest Area', Ecological Economics 3 (1): 43-57, 1991.

[16] Hueting R. An Economic Scenario That Gives Top Priority to Saving the Environment', Ecological Modelling 38 (1/2): 123-140, 1987.

[17] Tinbergen J, Hueting R. GNP and Market Prices: Wrong Signals for Sustainable Economic Success that Mask Environmental Destruction. In: Goodland R, Daly H, El Serafy S, Von Droste B, editors. Environmentally Sustainable Economic Development: Building on Brundtland. United Nations Educational, Scientific and Cultural Organization, Paris, 1991. Also published in: Goodland R *et al*., editors. Population, Technology and Lifestyle, The Transition to Sustainability. Island Press, The International Bank for Reconstruction and Development and UNESCO, Washington, D.C., 1992. Also published in: Goodland R *et al*., editors. Environmentally Sustainable Economic Development: Building on Brundtland. Environment Working Paper No 46, The World Bank, Washington, D.C., 1991.

[18] Verbruggen H., Dellink R.B., Gerlach R., Hofkes M.W., Jansen H.M.A. Alternative Calculations of a Sustainable National Income for the Netherlands According to Hueting. In: Van Ierland EC *et al.*, editors. Economic Growth and Valuation of the Environment: A Debate. Pp. 275–312, London, Edward Elgar, 2001.

[19] Hueting R., Bosch P., De Boer B. Methodology for the Calculation of a Sustainable National Income. Statistics Netherlands, Statistical Essays, M 44, The Hague, SDU Publishers,1992. Also published as WWF International report, Gland, Switzerland, June 1992.

[20] Hueting R. Some Comments on the Report *A Low Energy Strategy for the United Kingdom*, compiled by Leach G. *et al.* for the International Institute for Environment and Development. Paper prepared for the working party on Integral Energy Scenarios, Den Haag, 1981.

[21] Colignatus T. The Old Man and the SNI. Munich Personal RePEc Archive. http://mpra.ub.uni-muencheb.de/12690, 2008

[22] Hueting R. Three Persistent Myths in the Environmental Debate. In: Ecological Economics 18: 81–88,1996.

[23] De Haan M. Accounting for goods and for bads. Statistics Netherlands, 2004.

[24] Heertje A. Echte economie. P.138. Valkhof Pers, Nijmegen, 2006.

[25] De Boer B, Hueting R. Relatie NI en mDNI. www.sni-hueting.info.