

# ATTAINING SUSTAINABILITY THROUGH ECOLOGICAL ECONOMICS

(Revised 06 Oct 08)

**Plank Seven:** Base all governmental economic policy and measures on the discipline of “ecological economics” in order to identify sustainable solutions.

## Ecological Economics

Herman Daly founded the discipline of ecological economics and coined the term, “steady-state economics.” He describes his economic theory in several books: *Valuing the Earth*, *Steady State Economics*, *Beyond Growth*, and with John Cobb, Jr., *For the Common Good*.

Ecological economics views the human economy as a subset of the larger world ecosystem. It deals with three fundamental economic problems: allocation, distribution, and scale.

Neoclassical economics deals primarily with allocation, somewhat with distribution, and not at all with scale.

Allocation deals with how resources are apportioned to produce different products and services. The measure of good allocation is efficiency. Are the products and services what people want and are willing to pay for? Distribution is a measure of how these goods and services are apportioned among consumers: how many of the products and services go to me, you, or someone else? The measure of distribution is justice: is it fair? Scale deals with how big the human economy is relative to the total system it is part of. The measure of scale is sustainability. Does the scale of the economy impose on the larger ecosystem a “through-put” or depletion greater than can be regenerated? A sustainable economy requires that throughput be “within the regenerative and absorptive capacities of the ecosystem.”

In economics, “optimal scale” of operations is that at which marginal revenue equals marginal cost - the addition to the enterprise’s revenue from the last unit of output produced and sold equals the addition to cost. In ecological economics, the economy’s optimal scale is the output level at which marginal gain from growth (additional utility from manmade capital stock) equals the marginal cost of growth (lost services from natural capital, pollution, resource depletion, lost carrying capacity due to environmental degradation, etc.). Ecological economics evaluates the point at which human economic growth generates more costs than benefits within its context as a subset of the planetary ecosystem.

Acknowledging the value of liberty, the difficulty and undesirability of micromanagement, and the market’s effectiveness at resource allocation, Daly advocates that a steady-state economy should rely as much as possible on macro-level social controls and preserve the maximum possible individual freedom. He notes that, the greater the strain on ecosystem resources, the greater the need for intrusive micromanagement. He observes that natural and man-made capital are complements, not substitutes: they must be used together in proportion. Adding more of one does not compensate for the loss of the other.

The recent Millennium Ecosystem Assessment, prepared over four years by 1,300 scientists in 95 countries, concludes that humans have changed ecosystems more profoundly in the past 50 years than at any previous time, but argues that governments and businesses can reverse the trend with policies that fully value ecosystem services. The Assessment calls for employing market mechanisms from ecological economics so nature's services won't be seen as "free and limitless." For example, Dr. Bill Chameides observes: "The services a forest provides in clean water, watershed management and carbon storage are worth much more than its lumber. Yet we cut down our forests for timber, it's often a poor economic choice." Observing different timber-management practices among nations, it appears that valuing the watershed and carbon sequestration services of a forest in economic analysis would economically justify techniques which do not compromise these values, e.g., low-impact selective harvest techniques like those used in Czechoslovakia and active, consistent vegetative management techniques such as tree planting, mortality monitoring, thinning, and restoration of natural fire regimes. Such techniques would be practiced within the conceptual framework of Plank Five, restoring and maintaining ecological integrity in the forest ecosystem, but would be evaluated as to their "profitability" to the human economy under Plank Seven.

#### Energy Economics:

Example one: Petroleum. Petroleum dominates the energy economy, as especially the transportation sector which is 95 percent dependent on petroleum in the U.S., because no other fuel offers the same combination of massive energy density and ease of handling. Author Richard Heinberg has observed that enough energy is contained in a single gallon of gasoline to replace 240 hours of human labor. Historically, oil producers burned the energy equivalent of one gallon of oil to produce 20. Now that we are past the Hubbert Peak of world oil production, this energy return will drop as more energy investment is required per barrel of oil produced to extract oil from deep or remote locations, refine more difficult petroleum fractions which are neither "light" (low viscosity) nor "sweet" (low sulfur), and transport it further distances from source to refinery to market.

Example two: Hydrogen. Currently hydrogen is tricky to separate and handle, so that, by one study, a gallon of hydrogen contains 25 percent less energy than was required to produce it. Production of hydrogen as a transportable fuel for traction only makes energy-economic sense if the hydrolysis of water into oxygen and hydrogen through application of direct electric current to water uses electricity generated from sun or wind. If the choice is between shutting down a wind turbine whose output is currently not needed by the electrical grid to which it is connected, or using its output to hydrolyze water into hydrogen, then there is no "waste" of energy by capturing 75 percent of the wind turbine's output in the form of stored hydrogen, rather than turning the turbine off and not producing the energy at all.

Similarly, at a concentrating solar plant with compressed-air storage for night-time power generation through the plant's turbines, supplemental combustion fuel is needed to complement the compressed air's energy to maintain turbine speeds during night operation. If methane that

has a lower embedded-energy cost is not available to serve as this combustion gas, then the solar plant can use part of its electricity output to hydrolyze water into hydrogen gas which can be burned to supplement compressed air for night generation. Surplus heat energy generated from concentrated solar energy on the fluid medium used to drive the turbines at the concentrating solar electrical plant has to be designed into the facility to power the compression of air for night generation. Surplus electrical output can be designed into the plant to generate hydrogen as well. This extra capital investment in production capacity becomes an amortized “cost” overhead item for the plant’s production of electricity at night.

### **Sustainability**

“Sustainable” is defined in the dictionary as “that which can be sustained over time.”

The 1987 Brundtland Report of the World Commission on Environment and Development was the first to use the term “sustainable development,” defining the term as: “...meets the needs of the present generation without compromising the ability of future generations to meet their own needs.”

In 1989 Swedish oncologist Dr. Karl-Henrik Robèrt formulated four conditions for sustainability in his *The Natural Step*:

1. “In order for a society to be sustainable, nature’s functions and diversity are not systematically subject to increasing concentrations of substance extracted from the earth’s crust.
2. In order for a society to be sustainable, nature’s functions and diversity are not systematically subject to increasing quantities of substances produced by society.
3. In order for a society to be sustainable, nature’s functions and diversity are not systematically impoverished by physical displacement, over-harvesting, or other forms of ecosystem manipulation.
4. In a sustainable society, people are not subject to conditions that systematically undermine their capacity to meet their needs.”

In 1992, Canadian ecologist William Rees introduced the concept of the “ecological footprint” - the amount of land and water needed by a population to support itself and absorb its wastes, given prevailing technology. The Footprint Network calculates the current world population’s footprint is 23 percent larger than what the planet can regenerate.

In 2008 in *Peak Everything: Waking Up to the Century of Declines*, Richard Heinberg synthesizes all previous efforts to describe the principles of sustainability into “Five Axioms of Sustainability.”

1. Tainter’s axiom: Any society that continues to use critical resources unsustainably

will collapse. Exception: a society can avoid collapse by finding replacement resources; these replacement resources are finite. The axiom is named after Joseph Tainter, author of *The Collapse of Complex Societies*. Tainter described “collapse” as a reduction in social complexity: population size drops, as does technological sophistication, consumption rates per capita, and the diversity of specialized social roles in the culture. The critical resources which must be maintained to prevent societal collapse are food, energy, and water.

2. Bartlett’s axiom: Population growth and/or growth in the rates of consumption of resources cannot be sustained. The axiom is named after Albert A. Bartlett.

3. To be sustainable, the use of renewable resources must proceed at a rate that is less than or equal to the rate of natural replenishment.

4. To be sustainable, the use of non-renewable resources must proceed at a rate that is declining, and the rate of decline must be greater than or equal to the rate of depletion.

5. Sustainability requires that substances introduced into the environment from human activities be minimized and rendered harmless to biosphere functions. In cases where pollution from the extraction and consumption of non-renewable resources that have proceeded at expanding rates for some time threatens the viability of ecosystems, reduction in the rates of extraction and consumption of these resources may need to occur at a rate greater than the rate of depletion.

### **Measuring Progress Towards Economic Sustainability**

Thinking about the purpose of our social arrangements goes back at least to Aristotle. The full development of human beings as the end of all our economic activities was a recurring theme in the writings of most philosophers from the ancient Greeks to David Hume, Immanuel Kant, and John Stewart Mill, and of such political economists as Adam Smith, Karl Marx, Alfred Marshall, and John Maynard Keynes.

In the 1950's, economic growth was emphasized as the key to poverty eradication. In 1955 the Nobel Prize-winning West Indian economist Arthur Lewis defined the purpose of economic development as widening “the range of human choice.” exactly has the Human Development Reports since 1990 have done. Economic growth per se was seen as the means of expanding the range of human choice and thus promoting the full development of human beings.

Three justifications were given for the emphasis on economic growth as the principal performance test of a civilization’s progress towards meeting the human development needs of its citizenry:

The first justification assumes that through market forces - the rising demand for labor, rising productivity, rising wages resulting from labor demand and rising productivity, and the consequent lower cost of goods available for purchase by the public - economic growth would spread its benefits widely and speedily. This is the underlying premise to “free marketeers”

reasoning that the invisible hand of a free market will best serve the interests of all citizens. Skeptics rejoined that under certain conditions - increasing returns, restrictions to entry, monopoly power, unequal initial distribution of income and assets - the benefits of economic growth accrue to those who already have advantages, and thus tends to concentrate income and wealth in the hands of a few.

The second justification is based on the premise that governments are concerned with the fate of the poor. Therefore through such mechanisms as progressive income taxation, social services, and other government interventions, governments will act to spread the benefits of economic growth downwards. The reduction of poverty would not be automatic, as in the first assumption above, but would instead result from governments taking action to correct situations where market forces by themselves concentrated benefits in the hands of an economic elite. In this justification we see the roots of Franklin Delano Roosevelt's "New Deal" policies.

The third justification holds that the fate of the poor should not be a concern in the early stages of economic development. Instead, emphasis should be on building up capital, infrastructure, and thus productive capacity of an economy, so that it can be used to improve the lot of the poor later. The rich receiving most of the benefits of economic growth is justified if they are incentivized to innovate, to save, and to accumulate capital which is invested in means of production. Classical and neoclassical economists all agreed on this justification: inequalities are justified if they are a necessary condition for improving the lot of the poor. Here we see the origins of the "trickle down" theory of economics promoted by the Republican party since the advent of the Reagan administration. Acceptance of the third justification was promoted by the Kuznets curve, named after Nobel Laureate Simon Kuznets, which relates average income to an index of equality and suggests that early stages of growth in an economy are accompanied by growing income inequality among its citizens. Only when an income per capita of \$1,000 in 1979 dollars is achieved is further economic growth associated with decreased income inequality.

None of the assumptions underlying these three justifications has turned out to be universally true. Except in countries with special conditions such as radical land reforms or heavy emphasis on mass education and public health measures, there is no automatic tendency for increasing incomes to be spread widely. Governments often did not take corrective action to reduce poverty through income redistribution, often because governments are often formed of people with close links with the beneficiaries of concentrated growth. A period of mass poverty is not needed to accumulate savings, improve investments, and increase economic productivity: small farmers save at least as high a proportion of their incomes as big landowners; small farms are more productive in yield and profitability per acre; entrepreneurial talent is widespread in societies and not confined to big firms; and some forms of consumption by the poor are not only desirable in themselves but increase productivity.

The measure of economic productivity which was adopted based on these justifications was the Gross National Product (GNP). The GNP measures the cumulative dollar value of all sales of goods and services occurring in the nation in a given period of time. There are numerous problems with what the GNP does not take into account:

(1) It does not measure employment or income distribution, and is thus blind to social issues of equality/inequality and justice. Freedom, human rights, and participation are ignored. It would be perfectly possible to generate a high GDP score for a well-managed prison which forced its prisoners to engage in slave labor.

(2) It puts no value on goods and services that are not sold in the marketplace, e.g., the services of family members as caregivers, any civic improvements performed by volunteers, subsistence farming and the value of goods and services exchanged through a barter economy. The enjoyment people derive from interaction with unspoiled nature; satisfaction from work and participatory political engagement; the sense of community, brotherhood and sisterhood that grows out of social activities; the freedom, peace, and security that are common in a well-run society - these are not valued in dollars and cents on the market and therefore ignored. In Marxian economic terms, the GDP measures “exchange value,” not “use value” of a good or service. The Marxist critique of our consumerist culture is that the value of products consists to a large extent of the labor embedded in producing the product, which is a human value connected to the interdependent human community. The current market, and the GDP which measures total cash transactions within that market, turns all products into things denominated by money as the sole measure of their value to the human community.

(3) It counts as economic production anything which involves an exchange of money. Thus, the expenditure of federal and private insurance and other private funds on disaster clean-ups and reconstruction adds to GNP, even as the event decimates normal economic productive activity, tax revenues, and the value of capital infrastructure. The production of a million dollars worth of armaments counts the same as the production of a million dollars worth of farm implements or machine tools. The production of whiskey sold to rich men is valued more than the production of milk distributed to poor children. Products needed to combat “bads” are not distinguished from goods and services which promote “good.” Addictive eating and drinking are counted twice: when the food and alcohol are consumed, and when large sums are spent on the diet and health industry and rehabilitative services. Much of what is now counted in the GDP as economic growth is really combatting evils, fixing blunders and social decay from the past, borrowing resources from the future, or shifting functions from the community and household to the market.

(4) Public services are counted at their cost. Doubling the wages of all public servants appears to double their contribution to development of the economy.

(5) There is no accounting made by the GNP for the depreciation of assets resulting from money-denominated transactions. In business accounting, companies are required by accounting standards to reduce gross profits by the value of the depreciation or depletion of their asset base resulting from the production of goods sold. Instead, environmental degradation, pollution, and resource depletion are not deducted, so that the earth is treated like a “business in liquidation.”

**Measuring Labor Utilization:** Since 1969 the International Labor Organization has attempted under the World Employment Programme to promote jobs in developing countries, and those concerned with jobs and justice have endeavored to come up with a measure which would “dethrone GNP” by taking employment, income inequality, and economic productivity into account.

“Employment” and “unemployment” turn out to make sense only in an industrialized society where there are employment exchanges, organized and informed labor markets, and social security benefits for the unemployed who are trained workers, willing and able to work, but temporarily without a job. In poorer developing countries, most of the labor pool is involved in livelihood work, not wage employment.

Nobel Laureate Gunnar Myrdal tried to replace the concept of “employment” with the concept of “labor utilization,” which has numerous dimensions that can be applied to self-employed subsistence farmers, artisans, and women in societies without organized labor markets. From this viewpoint, the root of poverty turns out to be, not “unemployment” as in being idle, but low-productivity employment - working very hard for long hours in unremunerative, unproductive forms of economic activity. Economists working on the concept of measuring labor utilization discovered that not only labor but capital is grossly underutilized in many developing countries. In these circumstances, lack of capital is not the problem and any economic policies directed at increasing accumulation of capital will be irrelevant to reducing poverty through increasing labor utilization in the society.

The causes of low labor utilization can be classified under four headings:

(1) Nutrition, health and education are important preconditions for fuller labor utilization. Better nutrition, health, education and training can be very productive forms of investment in human capital.

(2) Attitudes make a difference in the kinds of jobs people will accept. In many societies manual or rural work is held in contempt among those with some education. In Sri Lanka, a large part of unemployment is the result of high aspirations of the educated who are no longer willing to accept “dirty” manual jobs. In Africa those with primary education wish to leave the land and become clerks in government offices.

(3) Institutional problems: the absence or weakness of institutions such as labor exchanges, credit facilities, marketing organizations, centers of information, and a system of land ownership or tenancy that provides incentives and ability to till the soil.

(4) Bad national economic policies: e.g., labor in the organized sector is over-priced, capital is under-priced, food bought from small growers is under-priced, the exchange rate is over-valued making labor-intensive exports difficult.

**The “basic needs” approach to measuring social welfare:** As we have seen, development thinking started with the GNP measure of economic growth, then turned to employment/labor utilization. The discussion then narrowed down to specific groups of “unemployed,” e.g., recent migrants to cities, landless laborers, small-scale farmers without a secure water supply, etc. The discussion then evolved to identify deprived groups of individuals and families - women, children under five, the elderly, youth with specific needs, ethnic groups suffering discrimination, and communities isolated from the economic life of a country. As the discussion shifted, economic growth became no longer the ultimate objective of economic development, but an incidental result of aiming at the right composition, distribution, and use of production.

The basic needs approach appealed to members of national and international aid-giving institutions and was therefore capable of mobilizing resources. The objectives of development under this approach is to achieve sustainable growth of consumption with equity of access across income groups to the goods and services consumed. Achievement of equity across the board is not something that can be achieved at once; some groups or regions may have to be favored for a time as part of a strategy to lift all out of poverty. However, inequality can be a source of hope if those left behind rightly understand that they will be able to catch up with those ahead and grasp the opportunities to advance by their own efforts. The practical conception of social equality is that people believe that they receive equal consideration from society and so have a stake in it. Equality of freedom to choose is particularly desirable.

Basic needs comprise more than economic benefits. We have basic needs for security and stability: economic, political, and legal. As a first approximation of movement towards meeting basic needs, the basic needs theorists set an objective of productive, remunerative, sustainable, stable and equitable growth of consumption. In practice, this approach to aid delivery tended to devolve into a “count, cost, and deliver” approach: count the poor, cost the bundle of basic commodities to be delivered, and then deliver the bundle to the “target groups” which become objectified rather than being regarded as active agents. This paternalism neglected opening up opportunities for the poor: access to jobs, income, assets, credit, and power. Instead, what was quantified was the number of calories or yards of cloth delivered to the “target group.”

The 1980's were a time of turmoil. Several authors proposed a variety of “new growth theories.” What evolved was an understanding that the long-term growth rate of an economy is not determined by the exogenous rate of technical progress, but by the behavior of the people responsible for the accumulation of productive factors and knowledge - the “endogenous” behavior of people explains economic growth, not technological progress that comes from outside the economic system. Better-educated people are more likely to innovate and to be more efficient in general. This underscored that investing in human capital can overcome the diminishing returns of investing in physical capital.

Economists then realized that the external benefits of education, research and development, and knowledge cause private agents to tend to under-invest in them. Thus public subsidies are necessary to ensure adequate investment in education, research and development, and the expansion of knowledge.

In the 1980s Amartya Sen proposed an alternative approach to utility and “welfarism,” expanding and deepening the basic needs approach. Sen argues that people value commodities for their characteristics and the needs they meet. The results of consuming commodities depend on the characteristics of the consumer and the society of which he or she is a member. The freedom to choose is important to individual well-being. Thus, the standard of living of an individual must be judged by the person’s “capability” to lead the life he or she values, from being well-fed and healthy to achieving self-respect and participating in the life of the community.

**The Human Development Index:** The first Human Development Report of the United Nations Development Programme was published in 1990 under the leadership of its architect, Mahbub ul Haq. It defined human development as the process of enlarging people's choices of jobs, education, and leisure, not merely of different detergents or TV channels. These choices can change over time. Infinite choices without limits and constraints were seen as pointless and mindless. Choices have to be combined with allegiances, rights with duties, options with bonds, liberties with ligatures. Bonds without options are oppressive; options without bonds are anarchic.

Today we see a reaction against the extreme individualism of the free market approach and mass advertising-driven consumerist culture in the form of "communitarianism." The idea that the exact combination of individual and public action, of human agency and social institutions, will vary from time to time and from problem to problem, but complementarity is always necessary.

Three basic choices are reflected in the Human Development Index: the ability to lead a long and healthy life, to acquire knowledge, and to have access to the resources needed for a decent standard of living. If these essential choices are available, many other opportunities are opened. Many additional choices valued by people include political, social, economic, and cultural freedom, opportunities to be productive and creative, and enjoying self-respect while being secure in the respect of one's human rights.

If one examines the priorities of the poor, one discovers that more income is only one of the things they desire. Adequate nutrition, safe water at hand, better medical services, more and better schooling for their children, cheap transport, adequate shelter, continuing employment and secure livelihoods, and productive, remunerative, satisfying jobs are all desired. Higher order non-material benefits desired by poor people include: good and safe working conditions, freedom to choose jobs and livelihoods, freedom of movement and speech, self-determination and self-respect, independence, mobility; liberation from oppression, violence and exploitation; less dependence on patrons, security from persecution and arbitrary arrest; not having to move in search of work; a satisfying family life; the assertion of cultural and religious values; a sense of identity; access to power or direct empowerment; recognition, status, adequate leisure time and satisfying forms of its use; a sense of purpose in life and work; the opportunity to join and participate actively in the activities of civil society; and a sense of belonging to a community. None of these values is registered in per capita or family income figures.

In summary, economic growth can be quite rapid without an improvement in the quality of life of a nation's citizens, and many countries have achieved a high quality of life with only moderate growth rates of income. Some economists have noted the positive correlation between per capita income increases and the indicators of human development. Other economists have shown that only if the extra income arising from growth is used for public education and health and specific attacks on poverty does the correlation exist. If initial assets are well-distributed - land ownership and mass education - the benefits of economic growth are reflected in human development measures. If initial assets are not well-distributed, economic growth does not

increase human development measures.

The Human Development Index used in composing the U.N.'s Human Development Reports comprises:

- (1) The logarithm of GDP per head, calculated at the real purchasing power, not at exchange rates, up to the international poverty line.
- (2) literacy rates, and since the 1991 Report, mean years of schooling.
- (3) life expectancy at birth.

These disparate items are brought to a common denominator by counting the distance between the best and worst performers on each item. This common denominator is used to rank countries on the Index in each Report.

Partha Dasgupta has criticized the HDI for not deducting capital depreciation. It measures only these aspects of human well-being, and thus is an index only of human capital, leaving out natural capital.

Another problem with the HDI is the trade-off between life expectancy and income. For a country where per capita income is less than the world average of \$5,711 in 1993 dollars (about the per capita income of Costa Rica), an increase of GDP of \$99 per person will exactly compensate for one year less life expectancy. As national incomes go down from the average, it takes less GDP gain to compensate for a year's life expectancy; as national incomes exceed the average, the value of an extra year of life expectancy rises exponentially: e.g., it takes \$65,038 per capita rise in GDP to offset a year of life expectancy loss in Switzerland. The implication is that life is less valuable in poor countries than rich ones. Also, if you have poor country A which increases GDP by \$200 per capita on average by building hordes of toxic, polluting industries which reduces the average life expectancy by two years, country A will have a higher HDI score than Country B which enjoys a GDP per capita rise of \$90 and no change in life expectancy.

In order to develop an index that measures progress towards sustainable development, we must come up with measurements of development of the productivity of human capital and natural capital resources.