THE URGENCY FOR ENERGY ECONOMICS

Rui Namorado Rosa

Centro de Geofísica de Évora, Universidade de Évora, 7000 671 Évora, Portugal
rrosa@uevora.pt

Mainstream literature favours a number of widespread ideas which are essentially flawed and block the public perception of reality. One is that material production can be conceived outside the physical world, as result of the sole combination of two production factors, capital and labour, unconstrained by physical laws. Another is that environmental scarcity and impacts are external to the economic process, sufficing to be internalized to account for sustainability and social responsibility. By failing to recognize and account the impending limitations on growth and threats on survival, a number of theoretical and very practical consequences issue which deserve urgent consideration.

I. ECONOMY AND NATURAL LAW

Material production is a human and social process which develops in a natural framework, making abundant use and being strictly subjected to natural laws. Conservation of mass and of energy, energy and information degradation, are the most evident of such natural laws. The econosphere exists as an open and non isolated subsystem within a much larger but finite geosphere. Economic production is the process of transformation of materials into products, and results from the application of energy and information to such materials, by the human factor labour. Machines employed to that effect embody materials, and both spend and convey energy and information in the process.

The idea of economic dematerialization is a misconception that appears closely associated with the ignorance of the prevalence of natural law. Monetary value per unit mass of finished product and mass embodied in finished product per unit mass of raw material might both increase in some sectors or in some developed economies, but are not global trends.

When observing a particular product one might be mislead to abstract it from the chain of individual technical steps that anticipated and eventually lead to it. Being hardly able to seeing a microchip, one plainly ignores the tons of rock from where tiny amounts of rare substances where extracted, the large concentration plants where they were separated, the chemical reagents and the heat and work spent, the intermediate products in which they were converted, and the complex installations where they were finally fabricated. One ignores the usually much larger "invisible" or "indirect" flows of materials generated and discarded upstream, at the stage of raw material and energy extraction from natural resources, as much as one used to ignore or keeps ignoring the waste flows that are generated downstream, at the successive stages of transformation right till final use and deposition back to nature. One ignores also the means which necessarily supported the whole chain of social and technical steps - including the resources consumed in sustaining and qualifying the labour force as well as the energy spent in carrying products and workers along such "invisible" economic flow.

Another misconception, according to which information would be void of material content, is akin to the idea of economic dematerialization. Information can be stored, as energy can be, in very compact ways, what might once again delude the observer. One is lead to take it for granted - ignoring the possibly huge amount of human labour, assisted by proportional amounts of other production factors, spent and embodied in the particular information data base collection, discovery or invention process.

As a falsely logical consequence of the said misconceptions, another one emerges and is widely spread, namely that all-powerful and pervading technological innovations would solve all economic problems at limitless natural costs.

II. ENERGY AT THE CRUX OF GROWTH

Material flow analysis (MFA) is recognized as a useful framework to assess economic throughput in relation with material flows between econosphere and geosphere. Total material requirement (TMR) is one of the telling indicators of the magnitude of that interaction [1]. Fuel flow is not only among the largest but also the one that necessary drives the remaining flows.

Energy is an essential production factor on its own whose importance has increased continuously, in step with the growth in available work extracted

from nature in the form of fossil fuels, as compared to the somatic work performed by man and to the solar energy man makes use of – and on which was entirely dependent up to the early stages of the industrial revolution. The increasing amount as well as the improving quality of "produced" and "consumed" energy, have been shown to have great explaining potential for the economic product growth which was observed during the past century [2]. In particular, the high grade and the improved quality of energy resources mix allowed for progress in energy extraction, conversion and use efficiencies.

However, the ultimate reserves of the present main primary energy sources are limited. The exhaustion of particular geological fields or provinces have been observed and documented. Geological and physical arguments and criteria, such as yield per effort in prospecting and energy return per energy investment in extracting, are recognized as unsurmountable constraints at planetary level.

That essential role of useful energy in the economic process and its likely central role in propelling economic growth confer to the energy availability a crucial importance. The real size of reserves and the impending scarcity of present primary energy sources are questioned and appear to threaten our common future well-being. The dematerialization misconceptions appear as contributing to obscure this dire reality.

III. ACCOUNTING AND LIFECYCLE

The perception of impending scarcity of resources and of increasing environmental impacts of wastes has eventually led to a Natural Resource Accounting system (NRA) to revise the System of National Accounts (SNA). NRA should be a means of monitoring and understanding the relationships between human, socio-economic and natural systems.

Nature is the source of both raw materials and of non-consumptive largely non-marketed resources which traditionally belonged to the realm of common property rights. But this is a sensitive borderline that moves at the rate that commons and natural heritage are of late being privatized. Anyway, assessing and maintaining the value of a country's natural system, as part of the national accounting system, should be a useful tool for preserving the population's wellbeing and welfare.

To fulfil that need, an Integrated Environmental and Economic Accounting System (SEEA) was conceived and eventually adopted by the United Nations Statistical Office in 1993 as a supplement to the SNA. SEEA provides a framework for assessing physical stocks and flows of forest, ocean or mineral resources and their monetary consequences. It aims at compiling physical accounts with linkages to monetary accounts; completing monetary accounts for both depletion and degradation in resources and environment; extending the concept of capital to include natural assets. SEEA, being implemented in the form of satellite accounts to the core accounts of the SNA, maintains the central concepts and principles embodied in it, however, there is not universal agreement as to how the adjustments to the SNA should be made to reflect economic externalities. This is another very sensitive issue indeed. For instance, economic progress being measured by GDP per capita, when adjusted by subtracting the net national resource depreciation, produces an estimate of NDP that demonstrates that GDP overstates net income level and its growth rate [3].

The natural resource flow through the economy starts at the natural source hasting its depletion and, after production and consumption, ends by waste emission and pollution. A resource tax at the point of extraction can reflect external costs of scarcity and waste impact, in addition to capturing rent. Taxing at the beginning or at the end of the resource throughput, lead to quite different consequences. A resource tax at the point of eventual depletion induces greater efficiency in production, consumption, and in final waste disposal, it leads to internalizing external costs and benefits throughout the economic lifecycle of raw-materials and fuels. Higher resource prices force production technologies to use the resources more efficiently and also force more frugal and efficient patterns of consumption. And as further extraction of resources from nature becomes more expensive, recycling of wastes is stimulated because it is a less costly alternative; recycling reduces both depletion and pollution.

The real productivity of energy should be recognized and its actual availability accounted for, so that sound policies and attitudes can be rooted and would be adopted, for general welfare and survival perhaps.

REFERENCES

[1]. European Environment Agency. Environmental assessment report No 10, pp. 15-34. Copenhagen, 2003.

[2]. Hall, C., D. Lindenherger, R. Kummel, T. Kroeger, and W. Eichhorn. 2001. The need to reintegrate the natural sciences with economics. *BioScience* 51(6):663-673.

[3]. UNESCAP, Development Papers No 25. Integrating Economic and Environmental Policies: The Case of Pacific Island Countries. UN, New York, 2004.