



Letter to the Editor

The Authors respond

1 August 1997

Dear Editor

This letter is in response to the letter by David Scienceman (Scienceman (1997)) regarding emergy terminology, prompted by our recent contribution to *Ecological Engineering* (Prado-Jatar and Brown, 1997). In our manuscript, which dealt with emergy evaluation of a Venezuelan oil spill, we provided several definitions such as energy, emergy, transformity, etc. Dr Scienceman appears to have taken exception to these definitions. He is concerned that we have defined several things and used terms differently than he prefers.

Dr Scienceman's contributions during his stay with H.T. Odum in Florida as visiting scholar from Australia were important, as were the contributions made by many during those years. Development of concepts, terminology and methodologies during that time was a team effort of faculty, visiting scholars, students and friends led by H.T. Odum. It was a most stimulating period when the group in Gainesville, meeting regularly in our seminars and courses, made significant progress in advancing the concepts of emergy and conducting numerous studies of processes, regions and nations that supported our theoretical work. Many scientific reports, manuscripts, theses and dissertations were published during those years, often with differing terminology, as our use of terms and nomenclature coalesced. It was during this period that Jean Michael Cousteau and his late father Jacques Yves Cousteau provided research funds and logistical support to our group. Through their support we were able to evaluate many economies and production processes around the globe, helping to advance the concepts and principles of emergy evaluation. The Cousteau's Vice President for Science and Education, Dr Richard Murphy, was instrumental in getting our group involved with the Cousteau Society and contributed to several of our studies.

Dr Scienceman brings up several points regarding our definitions. First he takes issue with our definition of energy, suggesting that it is ambiguous. I agree. In light of what we understand about energy quality and our work using emergy, the term

energy and its definitions are very ambiguous, but never-the-less they still exist. Second, he is concerned that we use the phrase 'equivalent solar energy' when describing solar energy, fearing, I believe, that we will then be tempted to suggest that 'sej' means solar equivalent joule. However, we are well aware that 'sej' is the unit abbreviation for solar emjoule. He now prefers 'semj', but we do not see the need to change the nomenclature.

Scienceman also is concerned with our use of the term 'emdollar'. He believes that the emdollar should be a fixed standard reference quantity, relative to the US dollar. For several years now, in published literature, scientific reports, theses and dissertations, we have used the term to mean the amount of economic activity that is related to a given flow of emergy. The quantity of emdollars associated with an emergy flow is obtained by first calculating a ratio of the total emergy use in an economy, U , to gross domestic product, GDP ... (U/GDP ; whose units are sej/\$). Emergy flows can then be divided by this ratio to express them in emdollars. A unit other than dollars is necessary to describe this measure, since it in no way resembles price, that which dollars usually measure. We continue to use the emdollar as the unit measure for the amount of economic activity associated with (flowing counter-current to) a given amount of emergy.

Numerous proposals for new symbols are contained in Dr Scienceman's letter including: 'fJ' for form energy, 'hJ' for heat energy, 'se.J' for solar equivalent energy, 'em.se.J' for embodied solar equivalent energy, etc. Some of these we find useful for concepts we have been wrestling with for a decade or more (i.e. form energy = fJ), but believe that their use will add confusion rather than clarity. The proliferation of symbols does not serve well to synthesize, but requires us to travel farther and farther down the road of reductionism splitting concepts into an ever increasing speciation of terms and symbols.

In all, David Scienceman made important contributions to our work in careful and thoughtful propositions of words and nomenclature to describe concepts and theories that have been in the making for decades. We acknowledge his contributions yet feel that they do not constitute ownership.

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References

- Prado-Jatar, M.A., Brown, M.T., 1997. Interface ecosystems with an oil-spill in a Venezuelan tropical Savannah. *Ecol. Eng.* 8, 49–78.
Scienceman, D., 1997. Emergy definition. *Ecol. Eng.* 9, 209–212.