Draft for discussion but not general distribution

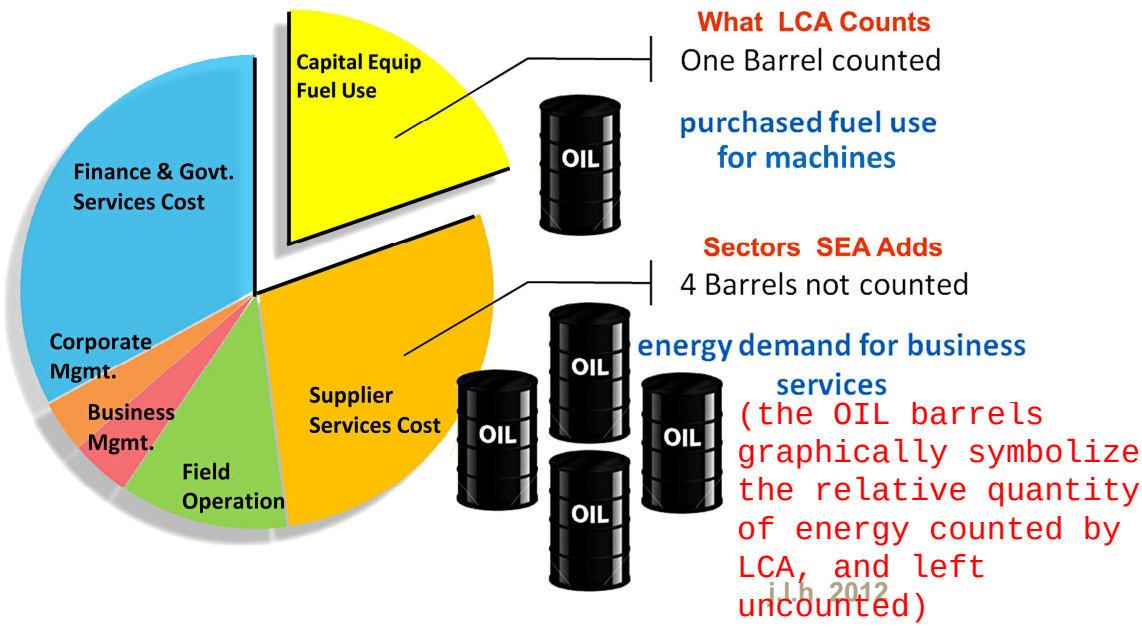
New Sustainability Metrics –

Toward more truthful economic measures

the true impacts of business as whole systems

There's an unusual inaccuracy recently found in the standard method for measuring business impacts. It's so big, correcting it would change our view of our impacts on the earth, moving the cause of "getting it right" a good distance. It's a conceptual error, of counting our information not our effects, opening up questions we've been missing.

Even carefully designed metrics like LCA and GHG protocols were defined to count business impacts on the earth from available business records. So information recorded in normal business operations became treated as the physical measure of business impacts on the environment. Businesses only record what they need to control their operations, however, so don't record impacts they don't need to operate. My co-authors and I noticed the problem as a discrepancy between business accounts and world accounts of energy use, and developed a general method to correct it, "Systems Energy Assessment"[(1)], displayed here graphically in the pie chart (I.).



I. – Business energy demand = Equipment demand + Services demand From Systems Energy Assessment[(1)] Figure 6, a case study of a wind farm with 50 turbines, as if operating in Texas over a 20 year life. The yellow sector reflects the scale of fuel purchases counted by LCA, for making, installing and operating the capital investment. Energy demands of business and public services, also paid for to operate, are added.

The biggest gap in impact information is for business services that work by themselves. Business records show just their dollar costs. So, for those self-managing services, of staff, consultants, or paid for by taxes and other in-house or outsourced services, no records of resource demands or other impacts are needed or recorded. Those services turn out to consume the great majority of the

resources most businesses pay for to operate. For lack of information, though, those resource demands and other impacts have been counted as 'zero'.

The error was noticed from the estimated energy impacts of individual businesses seeming too low, comparing known energy use per dollar of business revenue with the global average per $GDP. Even for energy intensive products like building construction, the energy use per $GDP appeared well below average. That was the tell-tale-sign of something very big.

In the published study on the problem(1) we started from an LCA energy estimate from a well funded government sponsored study of the same wind farm model we used. As in the pie chart (I.) we then added the other energy uses that would have to be paid to run the business and deliver the wind power to market. The difference shown was about a factor of five, showing ~80% of the energy needed was not counted by LCA.

Economics has long been both a science of money and a study of the working systems and networks of economies too. So it's surprising that impact measurements were for only one narrow category of the purchased services, the machines. It may be easier to count the material needs of the machines used, recorded in material purchase receipts. Business decision makers are accountable for those purchase decisions. They seem to also be the most energy intensive. They're just not the only, nor the largest, of business energy demands and other impacts.

Business decision makers also purchase and are responsible for the employee, professional and other kinds of purchased services needed to operate as well. Those all generate demands for resource use and other impacts on the environment. If those services are a bit less energy intensive, they are also bigger parts of business budgets, and so usually the largest energy users. They've consistently gone uncounted, though, with no one asking for their itemized receipts.

So, the one category of recorded equipment impacts gets called the whole, like counting "apples" and calling it "trees". It's much more than just inaccurate. It creates total misconceptions, as if businesses might reduce energy demands by just outsourcing, to be hidden in purchased services. Errors of this type, on the scale of 500% and larger, are apparently occurring in both quantitative and qualitative metrics of business sustainability generally. Comparisons of similar businesses for the same metric become undefined too, as the uncertainty of the built in undercount will be easily as large as the total included count.

It's fascinating! As today's standards were defined, the impacts no one had a record of might have seemed annoying, or perhaps impossible to count, and so uneconomic to even try to count, and certainly treated as unimportant. Today it's clearly neither unimportant nor impossible to count them.

One reason is that the error was found big enough to easily notice, making it important. It drastically changes anyone's "triple bottom line" if a focal impact measure increases by a factor of five. Getting these numbers wrong also alters investment profiles, creating bias in competitive investment market assessments, and changing winners and losers.

The new importance also led to new systems physics making it inexpensive to count them. SEA offers a simple way to estimate at least the true scale of total business impacts. It starts with changing what is called the "null hypothesis", for how to count impacts that you lack specific information about. The accepted choice had been to count them as "0". A more accurate choice would be to count them as "average", opting to use a proxy measure based on what you know, like the $ cost, when a direct physical measure is unavailable.

The ultimate reason why prices are a good proxy measure of impacts is seen from a macroeconomic view. Every dollar a business spends ends up going to a diverse cross section of the world economy's human end users. So, any dollar spent will represent a widely distributed sampling of typical consumption habits, and not far from "average". It's specifically those end recipient costs that are passed up the supply chain to accumulate as the end product cost, and become the price to the purchaser, so "average" is a direct normative measure of the impacts paid for by the product price.

In practice, the ratio of world resource use (or other impact) to world GDP(PPP) is an initial estimate for the impacts of any dollar cost, till you have more information. For SEA we adjusted proxy measures for the categories of business spending we used. We then found a way to combine them with direct measures. We feel confident that further research will need to take the same approach and use the same starting assumptions.

The problem is the common practice of counting impacts as "zero" for lack of information, creating a very large blindspot in our perception of the world. It can be hard to avoid. It can be hard to even think about what one is leaving uncounted. We found a way to define "uncounted" in relation to global totals that needed to be accounted for. That alternate method estimating let us check for omissions. It relied on how purchase dollars and energy uses are both globally distributed, to make "average" meaningful 2nd test. That then forced us to look at the parts from the view of the whole.

People have habitually viewed the workings of economies with a mix of myths and scattered information about the parts they know. That produces sketchy theories of ratios, in particular ignoring the economy's functionally organized self-managing working units, like its markets and networks. SEA opens the door to recognizing and studying those self-organizing working parts of economies. It starts with a way to study a business as a set of its working parts that operates as a unit, permitting it to be analyzed as an energy system with a closed boundary.

Perhaps that recognition, that businesses work as whole cells of organization, points more directly than other things to the misunderstanding that led to our whole conflict with the earth. Our way of explaining things has been ignoring the parts of our world that work by themselves. We've been describing the natural world as our theory for the information we had, unaware of missing anything, and unaware of the working systems we're part of by which "missing" would be defined. That this blindspot apparently causes us to miss much of what matters most to us, would make it a good thing to begin to correct.

JLH

1) Henshaw, P.F., King, C., Zarnikau, J., 2011a, System Energy Assessment (SEA), Defining EROI for Energy Businesses as Whole Systems, *Sustainability* **2011**, *3*(10), 1908-1943; doi:10.3390/su3101908, See Reference Examples, Notes and Slides http://www.synapse9.com/SEA

2) Gray, N. 2009, Using charcoal to fix the price of carbon emissions. Editorial, *Sustainability: Science, Practice, & Policy* 5(2):1 http://sspp.proquest.com/archives/vol5iss2/editorial.gray.html

3) Henshaw, J.L., 2011b, Your DollarShadow**:** How to Understand the True Scale of Your Energy Use, Research notes: http://www.synapse9.com/design/dollarshadow.htm

4) Henshaw, J.L, 2012, Budgeting for "The Commons" needs business "Ecobalance Sheets". 2012 RioDialogues, Proposal for a new Commons Based Institution http://www.synapse9.com/signals/2012/06/05/budgeting-the-commons-needs-business-ecobalance-sheets/