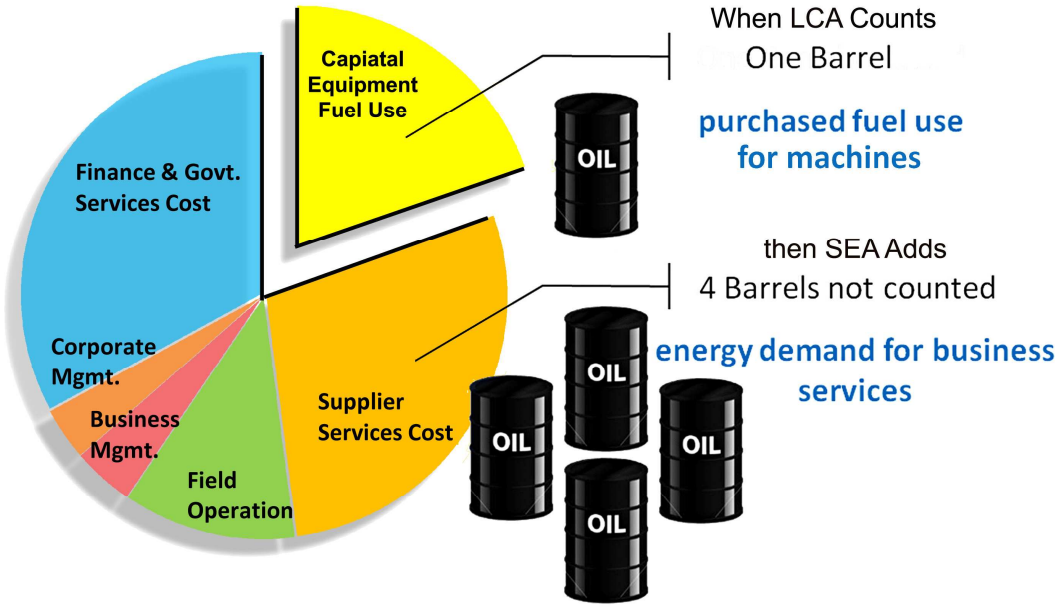
Shining Light on "Dark Energy":

Systems Energy Assessment Measures the Total Impacts of Business[1]

There's a significant inaccuracy in the standard method for measuring business impacts that my colleagues (Cary King and Jay Zarnikau of the University of Texas, Austin) and I recently identified. It's a conceptual error that comes from focusing on information instead of effects, and it raises important questions about what impacts we've been missing with standard business metrics. The error is so big, correcting it would change our view of our impacts on the earth, kicking our quest for sustainability a good distance down the road.

Carefully designed metrics such as Life-Cycle Assessment (LCA) and the Greenhouse Gas Protocol (GHG) were defined to count business impacts on the earth from available business records. So information recorded in normal business operations were treated as the physical measure of business impacts on the environment. It overlooks that businesses only record what they need in order to control their operations; and not what they don't need to. 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(SEA)– displayed here graphically for illustration purposes in the pie chart.



The SEA case study results. The energy costs for capital investment were only 20% of the total needed to deliver wind energy to market - Figure 1

[1] Jessie Henshaw – On the whole system impacts of money, using the Systems Energy Assessment(SEA) method; other writings http://synapse9.com/signals

The biggest gap in impact information is for the business services that work by themselves. Business records show just their dollar costs. So, businesses typically do not record the resource demands or other impacts from those self-managing services: of staff and consultants, or paid for by taxes and other in-house or outsourced services. 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'.

We first noticed this gap looking at the estimated energy impacts of individual businesses, which seemed too low, so we compared the 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 research paper[2], we started with an LCA energy estimate from a government sponsored study of the same wind farm model we used (see also SEA resource site)[3]. As in the pie chart above, 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 turned out to be about a factor of five, showing about 80 percent 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. 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 (which seem to be the most energy intensive component of the process), recorded in material purchase receipts. And business decision makers are accountable for those purchase decisions.. But the machines are 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 purchased services needed to operate. Those all generate demands for resource use and other impacts on the environment. While such services may be a bit less energy intensive than the machines, these services also comprise bigger parts of business budgets, and so usually represent the largest energy users, in aggregate. Yet they've consistently gone uncounted, with no one asking for their itemized receipts—a kind of "dark energy," hidden from view.

So, a single 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 simply outsourcing,

[2] http://www.mdpi.com/2071-1050/3/10/1908

[3] http://synapsse9.com/SEA

thereby hiding impacts in purchased services. Errors of this type, on the scale of 500 percent 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.

When today's standards were defined, the unrecorded impacts might have seemed unimportant, or perhaps impossible to count—or too uneconomic to count. Today, it's clearly neither unimportant nor impossible to count them.

One reason is that the error is big enough to easily notice, making it important. It drastically changes anyone's "triple bottom line." Getting these numbers wrong also alters investment profiles, creating bias in competitive investment market assessments, and changing winners and losers.

SEA has developed a simple way, using new systems physics, to inexpensively estimate businesses' full impacts. It starts with what we call the "null hypothesis," the standard practice of counting impacts on which you lack specific information as "0" (otherwise known as ignoring them.) To increase accuracy, we average them using known proxies, such as the dollar 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 (factoring in purchasing power parity, or PPP) is an initial estimate for the impacts of any dollar cost, until 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 others repeating the effort will need to take the same approach and use the same starting assumptions. Further discussion of applications for this new kind of analysis is found in section 4, Interpretations, of the research paper and on the website, also in a proposal for using SEA to define ecobalance sheets[4] of assessed economic liabilities, and for relating financial and energy ROI's[5] in a paper by co-author C. King

[4] Budgeting for business with "ecobalance" sheets - http://synapse9.com/signals/2012/06/05/budgeting-the-commons-needs-business-ecobalance-sheets/

[5] Relating Financial and Energy Return on Investment - http://www.mdpi.com/2071-1050/3/10/1810/pdf

The problem is the common practice of counting impacts as “zero” for lack of information, creating a very large blind spot 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 enabled us check for omissions. It relied on how purchase dollars and energy uses are both globally distributed, to make “average” meaningful second test. That then forced us to look at the parts from the view of the whole (the apples *and* the tree, so to speak). Recent findings of particle physics, also allow estimating of total matter in the universe, indicating around 80% is composed "dark matter and energy" of some kind unknown to us. That's nominally the same fraction as the "dark energy" and impacts missing from the economic accounts of business operations too.

Science has long had difficulty studying systems in nature that work by themselves, finding it easier to describe control relationships with sets of equations. By defining a way to measure the energy use of businesses as whole systems, SEA also opens a new door to measurement and study of other kinds of whole self-managing systems too. It points to how their own internal organization can serve as a self-defining closed boundary, for studying them as net-energy systems with accountable energy budgets.

Perhaps that recognition, that businesses work as whole cells of organization, points more directly to the misunderstanding that led to our 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 according to theories based on 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.

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