



# Money and Energy – Again!

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**The relationship between money and 'energy  
available to do useful work'**

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# An Energy Standard for Money

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- Motivation
  - Measurable quantity
  - Meaningfulness
  - Money supply pegged according to the work that can be done
- Current financial situation makes it clear that forms of money beyond cash are not real

# Historical Attempts/Suggestions

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- Desire to:
  - Have a rational basis for paper currencies
  - Integrate human economy with the larger Ecos
- Technocracy – energy credits
- Odum – energy flows
  - Energy
- Exergy

# Basically, Odum Got It Right

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- “Environment, Power, and Society for the Twenty-First Century”
- Exergy – energy available for work
- Emergy – energy content of useful work
  - What constitutes ‘useful’ work?
  - Emjoules to emdollars
- But, its scary and off-putting to regular folk!

# A few 'tweaks' to Odum's Ideas

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- Distinction between information and knowledge
  - Information – news of difference, message states and probability wrt: the receiver; use the communications theoretic definition of information (Shannon)
  - Knowledge – structure of receiver, adaptive agents and dissipative structures



# 'Tweaks' continued

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- Refining the definition of useful work
- Constructing tools that:
  - Increase exergy – building oil rigs or solar collectors
  - Maintain exergy – improve efficiency of other work processes such that existing exergy can be 'spread around'
  - Recreate and inform the mind

# On what should money be based?

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- The proposal is to use an energy standard for money (like Odum's emdollars) so as to regain the coupling between the information value of price and the meaning of work to be accomplished
- Emergy seems too tight a bound
- Exergy might be more useful



# Monetary Policy (?)

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- Set the money supply to the total exergy level (e.g. number of Tw of electricity producible)
- Each dollar would then represent a fraction of the total work that can be accomplished
- Borrowing would be based on savings from prior periods rather than expected production





# Smil's Objections

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- Vaclav Smil (“Energy in Nature and Society”) lists some objections to an energy standard:
  - Life’s relation to energy, “Life’s intrinsic properties determine how energy flows, not the other way around”, page 342)
    - Vagueness on what “life’s properties” means
    - Metabolism is a dissipative cycle the rate and details of which **are** determined by energy flows (Morowitz)
    - Origin of life and evolution of living systems very much is a response to the selective pressures of energy flows



# More of Smil's Objections

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- "... all single-item theories of value suffer from selective inattention to the complexity of civilizations and to the interconnectedness of things, and hence no single-variable valuation can be satisfactory." (page 344)
  - In fact, isn't an energy flow model of the economy bound to take complexity into account?
  - What about substitutability? Isn't it the case that material substitutions can be accounted for by more work, hence more energy useage?
  - He refers to geotectonic cycling (same page) supplying minerals (for life) and while it is true these do not depend on real-time sunlight for energy, geotectonic movement still requires energy (I think he is making too strong a case about solar emergy)



# Yet More of Smil's Objections

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- “Management of a civilization is far from being merely a matter of energy conversions.” (page 344)
  - Stating something doesn't make it so
  - At higher levels of organization (civilization) many emergent properties obtain – no argument
  - But at base everything is motivated by energy flows – management means grasping this in relation to the emergent properties



# And Just for Emphasis...

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- “Net energy assessments encounter their most frustrating problems in the choice of boundaries and the treatment of mental labor.”
  - That something is hard to do is no reason to abandon the effort
  - There are ways to approach boundaries choices through differential (marginal) analysis
  - Mental labor is no different from other labor in terms of information processing per unit of energy per unit of time. Concepts are embodied energy! Muscles are just work amplifiers.