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Developer of the Hexayurt.

Gupta's Laws

Gupta's First Law

- All exceptional abilities initially arise as defenses.

Gupta's Law of Potential

- Every unrealized potential implies an equal and opposite invisible barrier.

Gupta's Law of Network Politics

- In a networked environment, the person who knows what to do next is in charge.

Gupta's Law of Whole Systems

- It's a whole system if the costs show up in one place and the benefits show up in another.

Gupta's Libertarian Observation

- Free people create free markets. Free markets do not necessarily create free people.

Gupta on Infrastructure

- Infrastructure is a land multiplier

(this is not a law, but it is an observation which many military people find permanently paradigm altering)

Gupta's Rule of Achivement

- If a thing is worth doing, it's worth doing badly.

(originally said by G.K. Chesterton, so even this was done badly)

Gupta's Difficult Law

A thing is as hard as its consequences.

Articles

Three Essays on Environmentalism

August 2004

This is an outline of three essays I'll probably never get around to writing.

1. A Simple Model of our Economic/Environmental

System

1. 1. The IPCW diagram
        http://www.archive.org/download/InvestmentProductionConsump
    2. Systems Thinking
        1. The notion of many small changes resulting in large impacts
            1. i.e. 10% fewer cars, driven 10% less, with 10% better
                gas milage is plausible. A single 30% saving in any one
                of those areas is probably not.
    3. Using the model to think about sustainability
        1. Facing the reality that almost all of our capital is currently
            invested in unsustainable industries
            1. what would it look like to reallocate the 30 trillion dollars
                of world-wealth into sustainable forms?
            2. that's pretty much what the sustainable future looks like.
            3. I don't buy it either, but that's what we're talking about
        2. Facing the reality that there is no currently successful model
            of sustainability for first world lifestyles
            1. some history of sustainable peasant agriculture or
                nomadism

2. no way in hell of even beginning to design a sustainable first world lifestyle
3. therefore it's going away, sooner or later

2. The Business of Symbiosis

1.   1. Human beings are not apart from the general concepts of biology
        1. Biology has perfectly complete models for the general relationship between human beings and their environment
            1. Humans as an invasive species
                1. we continue to spread and get everywhere
                2. any areas of equilibrium which evolve (rainforest indians?) are rapidly overturned by contact with other cultures
                3. the force of constant technological / social change is much the same in effect as continually introducing a new species into an ecosystem.
                4. Homo technologicus is basically a predator, or at least a pathological over-grazer.
                5. none of this is remotely outside of standard biological

thinking. there is just some reluctance to examine humans as just another species

2. An ecological classification scheme for business activities - This is the basis of an idea I'm working on called "The Business of Symbiosis" which intends to extend the Natural Capitalism model to better reflect what we see in the world around us.
    1. Six kinds of basic relationships between entities in nature also apply to business
        1. Symbiotic with the ecosystem as a whole
            1. in nature trees are a good example, as are most in balance plant populations
            2. are there any businesses like this?
        2. Symbiotic with specific species
            1. farming, for example
            2. still can have negative overall effects, but at least some biota are involved
        3. Neutral, or nearly neutral
            1. soft industries, like entertainment
        4. Parasitic businesses
            1. feeding off the strength of the ecosystem without

necessarily destroying it
   2. most businesses are in this category
5. Predatory businesses
   1. businesses which profit directly from consuming natural resources.
      1. most resource extraction businesses, such as logging
6. Ecocidal businesses
   1. businesses that produce byproducts which are actively toxic to life or destabilizing of the ecosystem
   2. most obviously, CO2, dioxins etc.
   3. in nature, the blue-green algae which started to product oxygen as a byproduct of photosynthesis, and (if memory serves) wiped out pretty much all other forms of life on the planet at the time.

3. Gunboat Environmentalism

1.   1. Facing Failure: the ineffectiveness of environmental policy
        1. we tried

   1. all kinds of different approaches to minimizing human
      impact
2. we failed
   1. huge CO2 emissions
   2. catastrophic biodiversity losses
   3. no real hope of transformation to sustainability in time at
      current rates of change
3. we're screwed
   1. weather volatility
   2. rapid climate change
      1. agricultural impacts
   3. beginnings of catastrophic collapse in some places
2. Taking ecological chaos seriously
   1. if environmentalists are correct in saying that the ecosystem
      is fragile and being damaged, then we should start to see
      serious trouble soon.
      1. where serious trouble includes mass starvation,
         uninsurable regions, collapse of farming in some areas
         and the like
   2. if this happens, there are going to be geopolitical

consequences to environmental inaction
3. The potential for political struggle over ecological impact
   1. externalization of environmental impact is almost certain
      1. one nation produces CO2, another gets walloped by weather changes
      2. the complexity of the climate almost guarantees that the polluters won't be the ones who get hit the hardest (Bangladesh today, for instance)
   2. climate is a natural resource
      1. held as a commons
   3. some nations are using too much "climate"
      1. leaving less for others, which makes them angry
   4. threatening to bomb the crap out of your neighbors if they don't improve their environmental performance is a not-unlikely outcome
      1. i.e. what will Europe do if the Woods Hole Oceanographic Institute prediction of 10-20F cooling due to ocean conveyor changes comes true?
         1. radically increased motivation to change global carbon emissions

2. faced with impact of this scale, continued over-emissions of carbon constitute an act of war from some perspectives
3. this is not all that improbable
    1. although it sounds pretty weird today, that doesn't mean it isn't coming tomorrow
4. Finally some motivation for rapid environmental improvement
    1. what plans would we make if we had to reduce carbon emissions by 50% or get nuked?
    2. how long before organizations like the WTO weigh in on protection of climate for financial reasons?
    3. how do organizations like NATO see having the social and economic viability of their nations affected by climatic change?

Green and Black Capital 2

Sunday, June 20th 2004

Sustainable Investment, or Green and Black Capital

I've been thinking about an old chain of thought recently: green and black capital. Black Capital is capital held in forms which depete the world's resources. Black Capital degrades the ecosystem in continuing itself. Examples would be a coal mine or unsustainable farms.

Green capital is held in forms which do not damage the ecosystem (much) like an organic farm, or a wind farm. Of course, most capital is mixed - almost black or nearly green or somewhere in the middle.

We have about 30 quadrillion dollars of capital in the world, of which almost all is black capital. Our problem is that we need to turn black capital into green capital, without losing capital in the process. If the conversion process is inefficient - say 30% of the capital gets lost in the transformation - people will resist the transformation because it will make them all poorer. If moving from coal to wind wipes out 30% of your assets, few will do it, and the ones who do will have lost our economic game in the process.

This is really how I look at our environmental crisis these days: the challenge is how to transform our wealth from destrictive to non-destructive forms. Not technical fixes, not piecemeal replacements of

individual industries, not little bits of engineering, but fundamental overhauls of how our wealth is stored and managed. The problem isn't how to make a greener car, but how to transform the assets of the human race.

I wrote some of this up in a paper I wrote for the Rocky Mountain Institute a while back, which you can find here: A whole systems framework for sustainable consumption and production.

http://files.howtolivewiki.com/A%20Whole%20Systems%20Framework%c

The core of the paper, to me anyway, is the notion of "sustainable investment" - managing capital in sustainable ways. There's also a particularly good diagram which really helps illustrate the relationships between investment, production, consumption and waste particularly well:

Most models focus on waste first, then consumption and production, which are essentially the metabolic processes of the economy. This model focuses on investment as the basic motive force of the macroeconomy - the desire of wealth to propogate, perpetuate itself, and increase, and how that interacts with the creation of productive capacity,

which then influences what choices are available to consumers, which influences the environmental impacts of the entire system. Investment is a critical way of understanding the environmental impact of humanity.

If you click on that link there are different versions of the diagram, released under a creative commons license.

http://www.archive.org/download/InvestmentProductionConsumptionWas (diagram here)

Here's my old blog entry on this from last year.

Green and Black Capital 1

September 25 2003

http://www.archive.org/download/InvestmentProductionConsumptionWas (diagram here)

I've been codifying a couple of ideas. I typically ramble about things for years, and then they tend to happen all at once (the earliest small six sided building I did is like two years old, perhaps longer).

I've been hacking away for about six months on the notion of "sustainable capital management" - given my druthers, that would have been about a third of the href=http://mst.dk/udgiv/publications/2003/87-7972-614-3/html/default_eng.htm>Danish EPA paper but significant new theory was vetoed for that effort, which I quite understand.

http://files.howtolivewiki.com/A%20Whole%20Systems%20Framework% (the paper)

The core distinction I was trying to get at at that time was the notion of sustainable and unsustainable capital management. Unsustainable capital management being management of capital in any of it's forms which cannot be maintained indefinitely - including financially or environmentally lossy approaches. Sustainable meaning that the capital can be maintained in that form indefinitely, which could include not degrading the environment or eating away at our life support systems,

say.

The problem is that it allows the essence of the dilemma we all face to escape untouched. Here's the basic deal: our over-consumption is destroying the balance of the planet as it currently stands. Business as usual is ecocidal and allows 800,000,000 people to experience severe, body-damaging hunger for the longer part of most years.

Business as usual is simply black capital management. In financial terms, the capital is sustained, but it consumes the unmeasured natural resources of various kinds and, in the long run, will destroy the world as we know it.

Green capital management is sustainable capital management: natural resources are not irredeemably eroded, and the financial capital involved is not depleted either. That's the key: if you save the planet and make a loss, whatever you have is not an Evolutionarily Stable Strategy. You have failed to be sustainable in the environment you are living in as a capital manager.

Here's the bit I missed before: there is no middle ground. If a sustainable business rests on one unsustainable component, it's black, not green.

Why? Because we need to solve the whole problem. If we get distracted by compromises involving harm reduction, we may postpone or delay the crunch, or lessen it's severity, but we're no closer to an answer. Either a hundred generations could live this way, or we simply have a milder form of the same problems we have now.

The MBDC paradigm is one part of the answer. Be sustainable by endlessly recycling your toxics into new forms - if you use a solvent, clean it and use the same two tons for fifty years. Redesign your processes so that "technical nutrients" (i.e. waste) are used as inputs for other processes. This sort of sealed industrial ecology is, in the limit, pure green capital, assuming that the energy inputs are green and the material inputs are sustainably harvested. In theory a first-world standard of living could be produced with these kinds of technologies, if the extended to post-consumer waste.

So that's one sustainable model of the future I can believe in: closed loop industrial ecology. But what if we can't pull that off? What if it is simply impossible not to be left with "black tar in the bottom of the test tube" (thanks for the phrase, Brian!) - toxins nobody can use as the final product of the supposedly closed-loop system?

Where do we go from there? Is there another way forward?

Here's the crunch. Almost the only supplies of green capital we have are in the form of peasant farmers. That's it. That's probably 90% of completely sustainable humanity. They, plus a few ancient-culture holdouts, are more or less the only people who could have one hundred generations live exactly as they are living.

If we are required by ecological fragility to become green in this zero-impact sense, then that is currently only example we have.

There is almost no first world green capital. In those terms, we are the poorest people on the planet.

Our culture is faced with a problem: our wealth is all in an unsustainable form. If we can't either transform our wealth, or give it up, we are going to destroy the world.

We have to transform the capital into a sustainable form, or lose it. If we lose too much capital, either to inefficient transformation or simply by shutting down the factories and not reopening them, our high standard of living based on long years of accumulated capital will be destroyed by

capital and infrastructure losses to environmental necessity.

We need to find efficient processes to transform black capital to green capital. Then we have to transform all of the capital in the world.

Now I'm beginning to feel like I've made some sense of why environmentalism in it's usual forms rubs me the wrong way. It has the right basic ideas, it just doesn't go nearly far enough.

Imagining 22nd Century Environmental Policy

February 17, 2005 8:45 PM

What will environmental policy look like in the 22nd century? This is a deceptively simple question but, for me at least, it has proven to be a window into a whole new way of seeing the environmental challenges of the present.

This essay explores three ideas:

1. A World Without Mistakes
2. Planetery Specifications
3. Global Democracy

1. A World Without Mistakes

In a hundred years, assuming we make it with our technological society intact, it is reasonable to guess that DNA sequencers will cost less than laser printers do today, and that fabrication of living organisms from DNA sequences won't just be economical, but routine. Nanotechnology will be a fact, and space technologies like orbital mirrors or asteroid mining may be completely integrated parts of our technical culture.

10,000 years ago, the number of people who could wipe out a good chunk of the ecosystem by voluntary action was zero.

Fifty years ago, it was a few thousands if you counted the Nuclear Bomb command and control structures, and a few tens of millions if you counted first world consumers.

Now the number of people who could make an ecosystem-critical mistake continues to grow: everybody with access to a bioweapon, or a genetics lab past a certain level of complexity, or who controls a nuclear reactor.

Potentially anybody using a large accelerator, if you believe in tiny black holes or microuniverses as a potential risk. Possibly anybody who designs earth monitoring instruments. Or who processes the data they collect.

In the future, many of the new technologies we will deploy have an incredible destructive power in their shadow: we're going to have to evolve social and legal systems to contain them - to reduce the damage a single mistake or intentional act can inflict.

An EPA with the power to monitor **all** of the potential entry points for new trouble is hard to imagine, but seems like a necessity in the long run. Closing the loop between the "War On Terror" and "The Environment" seems like a long jump, but it's not really: it's all about controlling access to and use of high technology. Today the threats are left over bioweapons, and nuclear bombs made from material stolen from nuclear reactor programs. Tomorrow it might be bad software that will drop mining asteroids on cities or cause high-school replicators to product infectious diseases.

Although I'm picking on simple to see, acute causes of trouble, the same

logic percolates all the way down the line: a badly designed but common household object can cause enormous destruction - witness the automobile - but the effects are more dispersed and harder to see. Auto accidents kill tens of thousands of people a year in America but because the risk is distributed evenly and there is no point-event we have little reaction. How much more subtle accumulated cancer deaths from poisioning ourselves?

A global framework for controlling the damage done by technology seems, to me, like an inevitable part of our future. You can think of this as sheathing our claws, or building a global immune system, but there's no two ways around it in the long run.

2. Planetary Specifications

How do we know when something is damaging to the environment in unacceptable ways? Right now, there are basically two tests:

A. What does my conscience tell me, based on available data?

B. What does the law of the land say?

It's clear that this framework is wholly incapable of guiding our action

accurately: just look at the state of the place. A "Planetary Specification" would be a definition of how the world should be working - temperature, ocean currents, ecosystems, weather patterns. Anything which takes the planet out of specification is, by definition, a problem.

This is the underlying assumption of the EPA, of Kyoto - "the Planetary Specification says no more than 2.3 parts per billion" so you bring action back inside of that threshold.

At the moment, we are in the very, very early stage of writing that specification, and we're doing it from the worst-problems-first: we see when an emission causes visible problems, like an oil spill or DDT, and then we act to try and get things back under control.

In the future, it seems likely that efforts on various fronts will converge to a single model of global health. There might be generations of haggling and discovery of hidden assumptions to get there, but it is clearly a requirement for coordinate global action on the environment: if nobody knows what the goal state is, how can one reach it? How do you prevent see-saw effects as regulations against CO_2 emissions produce blooms of nuclear waste 30 years later?

To model the health of a whole system, you need an accurate model of that system. That's the Planetary Specification. Right now it is implicit and piecemeal, but eventually it is likely to become explicit, and its accuracy and fairness vital.

3. Global Democracy

Let me plug Gupta's Rule of Whole Systems:

You know it is a whole system if the costs show up in one place and the benefits show up in another

At the moment, most of our environmental damage is caused by the First World, and the effects are felt most severely in the Third World. You can substitute North and South if you prefer :-)

Fixing that is going to require cross-border or no-border political processes, where by the people effected by global warming can vote to stop it.

Let that sink in for a moment. Bangladeshis voting on North American energy policy? Well, yes. If the Maldives get sunk by our CO2, one might expect them to have recourse.

This entire process has played out already in America over water use and water pollution: people downstream exert massive political control of those upstream and what they can do with the water in the river as it flows by. Entire bodies of law and precedent establish what you can and cannot do with the water which flows over your land in America.

As they say, however **we all live downstream** so, as cause and effect are more and more clearly demonstrated, so political control will emerge or, as so often happens, political pressure with no outlet will manifest as social protest and perhaps eventually violence.

But how are we to maintain our values, the uniqueness of our culture, its egalitarianism, race-neutrality, gender-neutrality and the other fruits of the enlightenment, in the face of very large cultures without extensive traditions and institutions in these areas?

At the moment, our approach is that the strong nations of the west essentially self-regulate their environmental impact. This works about as well as the rich of a society running the tax policy and is, in fact, a directly analogous problem.

Of the three platforms of 22nd century environmental policy I've

outlined, this is the one I have the least comfort with. The political problems which Marxism attempts to answer about divisions between the Haves and the Have-Nots re-manifest in an even sharper form between the Global Rich and the Global Poor, not just in economic, but in the military and environmental domains. When the Rich and the Poor were members of a single political group, the Poor eventually created institutions like Labor Unions and used the political process to get a fair shot (at least at times).

But right now, your Bangladeshi Farmer who gets flooded every five years is very, very short on political steps to control the process which is ruining his life. On this one, I am simply at a loss. I see a problem, but short of a global democracy with all the risks inherent of putting all of our eggs in a single political basket, I see no solutions.

Over to you: how do you see 22nd Century Environmental Policy? How do you see your ideas about the far future percolating back into action in the present?

Envisioning a Leapfrogged World

February 24, 2005 2:52 PM

I'm going to take a brief shot at outlining what a "Leapfrogged" world might look like, one in which smart use was made of available technologies. In a sense, this Leapfrogged World is already around us, it's just very heavily mixed in with both the traditional-technologies world and the direct-copy-of-worst-practices world.

In particular, I'll be covering what can be leapfrogged, what cannot be leapfrogged, some thinking about the embedded capital base of the first world, and "invisible leapfrogging" - the leapfrogging which happened so

fast, nobody called it that!

1. Leapfrogging

Leapfrogging (one of our favorite topics!
(http://www.worldchanging.com/cgi-bin/mt-search.cgi?
IncludeBlogs=1&search=leapfrogging)) is the idea that countries
without basic infrastructure like universal telecommunications can go
directly to the best, most fitting solutions without having labor through
the developmental struggle of telegraph, manually-switched telephony,
direct-dial, brick-sized cell phones, analog cell phones, 3G digital. They
just hop straight to 3G, piggybacking off the enormous human and
capital investements it took to get there.

Leapfrogging is said to be a great equalizing force because the rich
nations have already paid the price of developing these technologies,
competition among companies in those nations keeps the technologies
cheap, and the world's poor gets the benefits. The poster-child for
Leapfrogging is the the cellphone
(http://www.boston.com/news/world/latinamerica/articles/2004/10/28/w
. (link goes to excellent and very human article about cellphone

deployment in the poorer parts of the globe)

If you question the value of the consumer society, please remember that the only reason that the peasants in China have cell phones is because the people in LA demanded them (and were willing and able to pay) them 20 years ago!

2. One limit on leapfrogging

There is one proviso: according to Amory Lovins of the Rocky Mountain Institute (http://rmi.org/) individual developing-world consumers will only leapfrog to technologies which are already deployed by the rich. Everybody wants an "American Toilet" not a urine-separating or composting one. Consumer preference is "do as the rich do" and there's not much we can do about it, even if we know that "the rich" are doing it in a poor, expensive, messy way.

Other solutions may be ecologically better, but poor consumers are usually no more ecologically motivated than rich ones are, and often less. That's damned inconvenient, but may not constrain institutional investment quite so much. Individuals may want the loud flush and the

gleaming porcelain for their own house, but most people do not care how their school is lit or cooled.

3. What, exactly, did Industrialization buy us?

This is actually a really important question, and not one I've seen commonly asked. To understand what we **have** is critical to understanding what we might be able to **export**.

Start where you are, and work out from your skin to the edge of what you own and use.

For me, my clothes are mostly imported and/or high tech fabrics, then there is this laptop I'm writing on containing dozens of incredibly refined components, requiring tens of billions of dollars of capital to create. It plugs into 120V AC power. That runs back to another trillion dollars of capital: the National Grid. The lights over head are CFL, imported from China. The wireless internet connection goes to a cable modem, running over incredibly expensive buried copper wires laid to carry yesterday's-big-thing, Cable TV. The water I'm drinking is drawn from Lake Michigan, filtered and purified by a giant factory, and fed to my house through a

baroque system of sterile pipes - another few hundred million, right there. The house I am in is, in itself, another couple of hundred thousand dollars worth of capital, and relies extensively on the availability of lumber, shingles, glass.

This is modernity: a pile of capital, of sunk costs, running into the quadrillions of dollars. This is the amount of capital that it takes to provide average Americans or Europeans with our lifestyle.

Leapfrogging provides a way of freeing the poor world from the **development cost** of technologies like the mobile phone. Fortunately, higher technology tends to have **lower and more modular** installation capital requirements. But still, this world we are taking about exporting parts of is expensive, interwoven, complex, and took many, many generations to build up. It's existence is not just a scientific or technological phenomena, but has roots in democracy, christian and secular culture and long-dead greek philosophers.

Our Rome was not built in a day.

4. The leapfrogging nobody noticed.

Consumer goods and global services turn out to travel extremely well. You simply put consumer goods in a box and ship them: leapfrogging achieved. You can put a Gameboy anywhere on the planet and leapfrog the entertainment revolution. Perhaps not helpful, but true :-) The truck that carried the Gameboy is also leapfrogging - no Model T, no horse-drawn carriage, but an 18 wheeler likely lugged it most of the way. Transport technologies were the first leapfrogging! All those land rovers in Somalia? Real leapfrogging.

Likewise, services like GPS in hiking gps (http://hikinggpsinfo.com/) and satellite imaging are already more-or-less pre-leapfrogged. The hardware has global reach and you just need to know who to call to get the images.

This kind of leapfrogging is, in essence, done. You can buy Coca-cola or a derivative product more or less anywhere on the planet and the same is largely true for television and radio. (see this great article for a discussion of television availability in the world (http://www.worldpress.org/Europe/947.cfm))

There may be some issues with cost, and support infrastructure and so

on, but basically, this stuff has worked. Television, radio, satellite services and the like are everywhere. It's notable that "luxuries" like television appear to have out-paced "necessities" like clean water. What this says about human nature I'm not quite sure.

5. The Leapfrogging Gap: Leapfrogging Infrastructure

What's left to leapfrog is, in fact, the dull old Industrial age stuff: reliable electricity, plumbing, water supply, farming. Most of the fruits of the Space Age - chips and waveguides and orbiting birds - turns out to travel easily. It's the backhoe-centric world of civil engineering that we need to make available or help find substitutes for.

This is a genuinely hard problem. Industrial age artifacts are quintessentially **different** from Space age artifacts. They are raw, big, dug-in, enduring, measured in gigawatts not miliwatts. They require elaborate maintenance from skilled work teams, rather than working forever and being downcycled at obsolescence.

Think about trying to provide rural telephone service in China using Industrial Age telephony technologies. Thousands of kilometers of cable

per village. Trenches, poles and strung wires. Wire stolen to be sold on the black market: a problem nearly everywhere there are poor people and exposed cabling. It's just never going to happen.

This is the leapfrogging gap: **all of the services which our society continues to deliver using essentially Industrial Age solutions have turned out not to travel universally into the poor world.**

Satellite dishes are everywhere, but many of those households don't have a completely reliable clean water supply, because you can put the satellite dish on a truck, but the water supply requires Victorian England to construct.

Leapfrogging infrastructure is going to require a new generation of infrastructure, and the good news is: it is already here.

6. Small is Profitable and the New Infrastructure

Small is Profitable (http://smallisprofitable.org/) is the Rocky Mountain Institute's book on distributed power generation. A 400 page door-stopper, selected as The Economist's Book of the Year (2003) SiP

outlines the financial and technical case for a new approach to providing high quality and high profit margin electrical services to the world. This new approach is a "Post-Industrial" power generation methodology: fewer Industrial style power stations, lots of analysis and feedback loops, lots of technology like microturbines, combined solar-and-wind energy provision, lots of financial modeling to understand the real cost of options. Rather than one-size-fits-all 120V from every socket, powered by a single continent-spanning machine, SiP envisages highly **granular** power delivery, with each location getting its power from the best available resources: microturbines for some kinds of factories, solar/wind for some percentage of city supplies because the availability of those natural resources closely matches power demand, and so on.

The vision is a fine-grained lattice of different power generation systems not as a stop-gap measure **until** a national grid is deployed, but in many cases, **instead of a national grid**, simply because it delivers better quality power at a lower cost.

It is impossible to do the book justice, or (frankly) even make it's case comprehensible, in a single paragraph: it's like trying to summarize Lord of the Rings! Power To The People

(http://www.vijaytothepeople.com/book.html) by Vijay Vaitheeswaran covers a lot of the same ground and is a much easier read!

The critical point from the "New Infrastructure" perspective is that the SiP style power-services model can be rolled out in a very fine-grained fashion: one household, one village, one town at a time. Rather than sinking a billion dollars into a power station, and another billion into a grid to distribute the power, SiP envisages a thousand small investments in solar, wind, hydropower, microturbines, even diesel generators where appropriate, leading to an incredibly efficient, fine-grained distribution of power generation resources.

This break from the industrial model gets us back into the "sweet spot" for leapfrogging: technologies one can put on a truck and ship, which do not require a thousand miles of trenches to be dug at the destination or Victorian engineering to maintain. Power generation with the same dynamics as satellite dishes and televisions.

As the book says, "it is already happening" - it documents a trend and lays out the financial and technical case for the trend to accelerate, but it is based on what is happening in the real world, not futurism.

Surprisingly, there are similar approaches to other areas in which our civilization is dependent on Industrial infrastructure. Water purification and sewage disposal are both areas which are still firmly embedded in the giant-factory-and-trench-based-service-distribution-network model.

Technologies like solar-powered ultraviolet water purification, for example, have great promise for village and even household-level deployment. A box you can ship which, on arrival, provides first-world-standard drinking water **anywhere there is sunlight**.

There are a billion people without clean water. They are likely never going to get services from giant water chlorination factories, with thousands of miles of brick-lined tubes and a spiderlike network of PVC and copper running to shiny chrome taps. But they could have drinking water.

Composting toilets likewise offer safe, sanitary disposal of human waste without an industrial sewage processing facility and super-abundant clean water to carry the human waste to the factory.

This is the new infrastructure.

7. The Leapfrogged World: Services without Industrial Infrastructure

I've simplified, almost to the point of parody, by saying "if you can put it in a box and ship it, it's leapfroggable."

However, as a rule of thumb, it is close enough to explain most of what we see around us: even a cell phone tower is, in essence, something you can ship in a Sea Container.

The Leapfrogged world is shipped in boxes. There are almost no backhoes. In the rural world, on arrival, unskilled or semi-skilled people open the boxes and unpack the goods. Instructions make it clear how the devices are to be used and once every couple of weeks, a Barefoot Solar Engineer (http://www.worldchanging.com/archives/000954.html) comes around to help make sure everything is set up correctly and that the water is clean, the toilets properly operated, the batteries charged properly, the refrigerators used correctly, and so on.

In the urban world, it's the same process, but the boxes are microturbines, cell-wireless routers, microwave backhauls. In the

leapfrogged world, the endless snaking corridors of pipes are largely replaced by trucks which come around once in a month and recharge the fuel supply on your fuel cells.

Modular, granular, fine-grained, and shipping in on trucks. Not the Aswan Dam, but a hundred thousand 12 volt village solar grids. A curiously future-retro combination of space-aged and mud-and-stick houses. High density, ultra-wire(less)ed urban hubs, and villages with solar-electric lighting and drinking water.

This is the leapfrogged world.

Thoughts on Limited Liability

June 1, 2006 8:23 AM

One of the persistent threads running through environmentalism is the notion of "Corporate Responsibility." I've been thinking through some of the issues involving how corporations are formed and how the nature of the corporation affects how the economy assesses and handles risk and I'd like to present an idea for comment and examination.

The seed of the idea is that the limited liability corporation is a **government subsidy to risky investments** and as such may be partly what drives the reckless attitude of corporations towards the environment. Read on for more details.

So, please follow my chain of thought and see where it leads:

1> The difference between a partnership and a corporation is that shareholders in a corporation are protected from liability for the debts of the corporation in bankruptcy ("limited liability.")

2> The same protection from liability could be obtained in partnership by the purchase of "liability insurance" which would, if the company you co-owned went down, cover your debts. Because of the open-ended nature of the liability being insured against, this insurance would probably be fairly expensive.

3> The fiat (government-created) limited liability provided by the state is actually a subsidy at the expense of those whom bankrupted corporations owe money to, in favor of the investors, and its financial value can be calculated as the total value of the insurance services provided to investors or perhaps as the total cost to the creditors.

It surprises me that I can't find an analysis of how large this subsidy to investors is!

Possibly, if this question was analyzed, we would discover that limited liability protection is the largest goverment programme there is, perhaps even larger than the military. Plausible? Well, consider the total size of the stock market - the market capitalization of the entire economy. Now imagine insuring that. Limited liability moves a **lot** of wealth from creditors to investors in any given year, through bankruptcy proceedings - how much wealth is transferred in a given year?

This may explain why limited liability creates wealth so fast: by taking an intangible like "risk" and providing an equally intangible "protection from risk" goverments subsidied real, tangible spending with a vast, intangible subsidy.

The Polluter Pays (http://en.wikipedia.org/wiki/Polluter_pays_principle) principle becomes interesting when examined from this perspective. If the real polluter is not the corporation, but the benificiary of the corporation's actions - that is to say, the owners/shareholders - then making the real polluter pay may require a change in corporate law.

Providing shareholders with blanket protection from the actions taken on their behalf may no longer be a sensible approach.

Unlimited limited liability may, in fact, be a perverse insentive (http://en.wikipedia.org/wiki/Perverse_incentive) encouraging the economy to continue high risk activities such as unregulated release of GMOs into the environment by subsidising shareholders who assume these risks in their investment strategies.

What if we phased out limited liability? Suppose, for example, we made shareholders liable for up to 1% of their assets in corporate bankruptcy cases - you can lose up to 1% of your net worth to cover the unpaid debts of corporations in which you own stock. Would that change shareholder behavior to less risky investments? Would it cool the economy - or increase corporate responsibility at no cost to the tax payer?

Could regulating the degree of investor protection become one way of pulling corporations back into line when corruption becomes rife? Would ENRON have happened if shareholders had been even partially liable?

I'm not enough of an economist to really understand the implications of

this idea, but I'd like to open the floor up to discussion: is viewing limited liability as a subsidy to the investor a valid way of thinking about it, and is reducing that subsidy to the investor a plausible way of making our economy a little more risk-averse and therefor environmentally responsible?

What do you think? Please comment!

How Much More Can We Do With Less?

June 20, 2006 8:18 AM

Just how much more can we do with less?

I recently read an article which discussed a company which went to a 32 hour work week with no drop in productivity (http://positivesharing.com/2006/04/the-cult-of-overwork-again) . (the story is taken from The Time Bind (http://www.amazon.com/gp/product/0805066438/102-8382858-2319333?v=glance&n=283155) by Arlie Hochschild (http://sociology.berkeley.edu/faculty/hochschild/))

While this example would not scale over an entire economy - a steel mill, for example, is unlikely to be able to replicate it - it fascinates me that a company could cut 20% of one of it's most critical and expensive inputs (human time) and not change its outputs. While not in the same category as Factor Four (http://www.wupperinst.org/FactorFour/index.html) it is in an unexpected domain. How much more slack is there in the system?

Is it possible that the inefficiencies in our economy are so large that, in fact, we could tighten 80% of our resource use right out of the loop over a period of fifty years, without developing any radical new technologies (although, of course, we will!). The poster child for this idea in my own understanding is a roll of kitchen plastic wrap a friend bought at a warehouse store. This roll is a two thousand square feet and was

purchased for around six dollars, replacing 20 rolls of 100 square feet each, with correspondingly larger purchase, packaging and transportation costs. It is an identical product, of identical utility, simply bought in a larger size.

This might seem like a trivial example compared to green buildings and zero emissions polyester factories and so forth. But what would be the net environmental impact if all products simply dropped the two smallest sizes they were available in? The social impact might hit the poor quite hard at first, but lower long term prices might restabilize them in unexpected ways. Could we really cut 5% or 10% of our national environmental impact simply by never buying anything except in the Super size? It sounds silly, but when you start counting trips to the store, and packaging, and use of temporary alternatives when basics run out. If such huge savings are possible from small changes, what kinds of savings would be possible from big changes?

The more I look at the world around me, the more I realize that a relatively small set of behaviors would have to change to solve nearly all of our environmental problems. From the current status-quo those changes look untenable, but they are not: insulate what is heated or

cooled, streamline what is pumped, buy the efficient model. These basic truths are repeated over and over again in different environmental frameworks - everybody has their own way of saying "do the right thing."

If one does not look at demand side reduction, it is easy to assume that we are really in trouble. "Use less" has become contaminated with a thrifty penny pinching mindset. But "use smarter so you get equivalent or better service for less energy" - and we need a catchy mantra for that - might be a very simlar world to the one we live in now, just with the waste taken out.

Diesel hybrids, high performance buildings and pervasive industrial efficiency efforts could reasonably half our nation's energy use. Studies at different times estimate the benefit and potential at different levels, but the savings are huge. But somehow the concept of the "negawatt" - a unit of energy saved replacing a unit of energy generated - seems to have failed to penetrate far enough into the environmental discourse to becoming the defining goal of our movement. New wind capacity is many times more expensive than energy efficiency, but because it is a "more" solution, rather than a "less" solution, somehow it gets higher billing than green home construction.

I feel like the concept of "doing more or the same with less" needs a new brand, a new word, a new identity. Efficiency is too cold and doesn't capture the "picking gold up off the sidewalk" quality of doing the same work in 32 hours as forty, and being happy with it, or cutting your heating bills by 75% and being warmer.

I feel like this may be a quirk of human evolution: we are well programmed at the deep levels to be able to identify "more" - more food, more land, more water, more cattle. But identifying an invisible entity like "better insulated" is more subtle. A windmill pumping out electricity is a "tangible more" but a lot full of well insulated houses is an "intangible less." The low-hanging fruit of energy efficiency simply garners less press, less attention, less buzz.

Can we change that by branding? Can we change that with new tools and new markets which trade "less" as "more?" as Amory Lovins and others have suggested? How do we make it as good business to save power as generate power, given that the environmental benefits are as large or larger? These are not new questions.

What I see in my minds eye is a garbage bag full of waste and two

gallons of gasoline attached to two thousand feet of plastic wrap, divided up into 20 small tubes. Every day customers buy that product, over and over again, unthinking and unknowing. And we wonder why the waste continues!

Personal Factor Four: Organizing Real Environmental Action With The Internet

June 24, 2006 7:46 PM

Once in a while, somebody notes that the Internet should be materially contributing to solving the world's problems. I think the notion has been around since about 1965. I'd like to raise some ideas for you, WorldChanging's Open Thinktank, to think about, speculate on,

contribute to and improve. Our goal is to get to a personal Factor Four (http://www.wupperinst.org/FactorFour/index.html) improvement in your environmental impact and mine by using the collective intelligence and collective action that the internet enables...

Natural Capitalism and Waste Aggregation

One of the key concepts ofNatural Capitalism (http://www.natcap.org/) is "Sell Services, Not Products." Part of the rationale for this is what I'm going to loosely term "Waste Aggregation." To take a canonical NatCap example, imagine an elevator. If the elevator is owned by the business which uses it (say a hotel) then the energy efficiency and reliability of the elevator has relatively minor impact on the bottom line of the hotel. As long as it basically works, nobody cares about its quality.

Now imagine this elevator is leased, and the company which leases it to the hotel also has to keep it running. Suddenly this company's bottom line is massively impacted by the reliability of their elevators, because every repair costs them money. For the hotel, a few thousand dollars a year on the bottom line is no big deal. But for the elevator leasing service, all those repair costs **aggregate** and turn into a large enough pool of money to do real engineering with. By aggregating the waste we

make it profitable to get rid of it.

Recycling is a form of "waste aggregation" by the way.

Demand-Side Aggregation

To push this example further, suppose the company which leases the elevators pays for the power they consume too. Now the waste aggregated covers not just the mechanical reliability of the elevator, but also its electrical efficiency. If they also recycle / reuse elevators at end of life there is yet more aggregation. This can be termed "demand+side+aggregation"&hl=en&gl=us&ct=clnk&cd=23&client=firefo a demand side aggregation (http://72.14.203.104/search? q=cache:6GyEslrXcT4J:www.det.csiro.au/rtf%20files/aggregation.rtf+) . (sorry I don't have a better link for that!)

The Internet is theoretically a great place for birds of a feather to flock together to produce demand side aggregation. (Dan Savage'sLaw of Internet Perversion (http://www.thestranger.com/seattle/SavageLove? oid=457) more or less states that, no matter how weird your kink, there is a community online for you) Another good example of Internet-enabled demand-side aggregation is Fundable.org (http://fundable.org/)

a site which purports to allow groups of individuals to collect money together in the manner of the Street Performer Protocol (http://www.firstmonday.org/issues/issue4_6/kelsey/) .

Where could the Internet's ability to create demand side aggregation be turned into real environmental gains? One idea - and nobody do this as a start-up before I get to it - would be to aggregate demand in an area for green real estate development. Find two hundred potential buyers, then approach green builders and set up a deal for perhaps twenty units, given that the proven demand exceeds the supply by a factor of 10-to-1, reducing risk. Another example might be communities coming together to mass purchase energy efficiency improvements or wind credits.

If we have to solve the problems we have on this planet with the tools available, the Internet is potentially a very, very good tool. Where can we use the aggregating power of the Net to reduce environmental impact worldwide?

All of Us Are Smarter than Any of Us Are
The Peak Energy Blog (http://peakenergy.blogspot.com/) reads like it was written by a fellow traveller

(http://en.wikipedia.org/wiki/Fellow_travelers) . I just came across it today by chance via a google search. Every time I look something environmental up online, I wind up one of two places: the EIA (http://www.eia.doe.gov/) or **some random green weblog**. There are a **lot** of us out there - tens or hundreds of thousands I think.

The environmental problems we face are huge and many of them are amenable, at least in part, to relatively small actions by large groups of people. Furthermore, the intellectual labor of sorting out our environmental problems may not have to be done by a few think tanks stocked with full-on genius polymaths. It may be that a lot of our problems can be analysed to solution by "peer production (http://blogs.osafoundation.org/mitch/000828.html) ." If it's good enough for Linux and Wikipedia, after all...

So how do we mobilize the Yacking Hordes of the Internet, of whom I am one, into effective teams to do something about our environmental problems?

There are a set of questions I have about the environment that I have never been able to find a good, clear answer for. That doesn't mean that

there **are** no good, clear answers, but that I haven't been able to find them.

1. Paper or Plastic at the checkout? (I'm joking)
2. How does personal income correlate (on average) with net environmental impact (graphs, please!)
3. What are the ten most environmentally damaging consumer products in America?

These are just examples, you understand. But it seems that small teams of people, like those who operate some areas of Wikipedia, could answer these questions in a definitively well-researched form. If the programmers and architects had enough spare resources to recreate Unix and are working on recreating Windows/MacOS, can the Greens create something of equivalent power and value, a Manual Of Doing The Right Thing that people can refer to to solve their ecological quandries? What other artefacts could peer production create to help us do a better job of living on the planet? Could we start with an annotated library of Buckminster Fuller's patents, for instance?

How many other, better ways are there that we could take the combined

brainpower of the ecologically-minded amateurs and start churning out real solutions? How do we actually start to harness our collective intelligence to think our way out of the potentially fatal cultural deadlock we are in about our current energy and environmental crises?

Speculation, if you will, in the comments...

Space travel is a better accelerator for technology than war

"Down throughout history, war has been an accelerator for technology. You might notice, however, that most of our current 'high' technology is derived from the NASA space program. It turns out that not only is space

travel an accelerator for technology, it's a much better accelerator than war. The implication is that nations who invest in space technology will out-compete those who are stuck fighting wars." -- David Hurst

It's getting better all the time...

October 21, 2004 9:46 AM

A new generation of consumer electronic devices integrates digital age technologies into traditionally analog systems, producing devices which are massive improvements on the analog systems they replace. The digital revolution is moving outside of computers and cell phones and into items as simple as a **flashlight**.

Exhibit A: The Underwater Kinetics 4AA ELED

(http://www.uwkinetics.com/I_4AAeLED.htm) . Which is a mouthfull for what is, in essence, a fancy flashlight.

So what's worldchanging about a fancy flashlight? Three things:

1. The flashlight uses a Luxeon 1 Watt LED - an incredibly bright, efficient LED. A single Luxeon can deliver more light than a 4D cell Maglite, although this one is about only 50% brighter than a 2AA cell Maglite. It will essentially never burn out.
2. The flashlight is voltage regulated. A tiny power conversion chip compensates for tired batteries, giving you constant brightness right up until just before your batteries die. It's like a tiny transformer. Result? Eleven hours, let me say that again, **eleven hours** of consistently bright, white light from four AA batteries.
3. The flashlight is twenty dollars online.

Ok, you say, so what? I'm not a boyscout, why does this matter to me? What's important about a fancy flashlight, even if it is only twenty bucks?

The ELED is an example of a discontinuous improvement in a simple consumer-level product based on adoption of incredibly sophisticated new technologies. In the course of twenty years, a twenty dollar flashlight has gone from a lifespan of three hours and dim-but-usable yellow light, to blindingly white light for four times that length of time, based on intelligent power regulation and super-sophisticated LED bulbs. Lighting of this kind was simply not available until a few years ago, at any price point.

At the current level of development, this is still a first world novelty. But if we look another twenty years into the future the "flashlight" is no longer a flashlight, but a science-fiction like lighting device which has properties we can't even guess at, but might include adaptive response to lighting needs, on-the-fly recharge from sunlight or other power sources, and so on. You can't really appreciate how unlike a conventional flashlight one of these things is until you play with one and the light goes on... and on... and on.... and you never worry about bulbs burning out, or dropping it, or getting it wet. Pushed further, as our technologies always are, we start seeing genuinely novel objects within the existing cognitive framework of existing categories. The "Future Flashlight" will still be called a flashlight. But it won't work like one, not at all.

Let's look at another example: Exhibit B, the Panasonic SA-XR45 Digital Amplifier (http://www.audioreview.com/Receivers/Panasonic/PRD_172733_1593crx . It's a consumer level amplifier intended for home theater systems.

What makes it special? It's the first cheap ($300) amplifier to feature digial amplification. The production of the signal which drives your speakers is done in power-handling VLSI chips, rather than a bunch of componentized transistors and capacitors.

So what? Why does it matter how the amplification is done? Well, here's a clue: you can't buy an XR45 in America any more. Panasonic sold out. There are simply none left.

Why? Because on listening tests, a new-technology $300 dollar home theater amp regularly beats out thousand dollar two channel audiophile amplifiers.

Now, to really understand that, you have to understand a little about audiophile culture: as a breed, audiophiles hate and fear new technology, viewing each generation as **worse** than the one before. That's often

because new technologies start out unpolished and take time to mature, and also because they often simply are worse (CDs, for example, are said to contain about 40% of the data found on an LP record).

So to have the first generation of a new product recieve this kind of attention is nearly unheard of. For it to be **cheap** adds insult to injury. But they have flown off the shelves, and a cottage industry has grown up around rebuilding the analog electronics in the power supply to improve the sound quality just-a-little-more so you can still buy an expensive, custom version if that suits your aesthetics.

Things are beginning to change. Both flashlights and amplifiers used to be dumb analog systems. It's no longer true, and even the very early steps in adding intelligence and new power handling technologies are resulting in amazing results.

This is a huge trend to watch: one can look at Hybrid cars as an other example of this trend - replace the analog with digital systems with power handling capabilities - and amazing things result.

We've moving towards a world in which there are no switches, no circuits which are simply open or closed, and into a world in which every power

handling system, be it lighting, audio or automotive, incorporates brains which regulate and control. It's been coming for a long time… **it's here**

Three Approaches to Adaptive Agriculture

September 3, 2004 11:50 AM

Agriculture is hard. Actually getting things to grow in the ground which produce enough enough excess energy to eat is a difficult problem! Our current industrial age agricultural approach is "bang the ground flat and work it with chemicals, machines, and row-upon-row of identical plants." It's inspired by the industrial revolution, by standardization, by quality control and by the fundamental machine-age paradigm of "identical products from identical processes." Every ear of corn alike!

However, there are radically more location-aware and intelligence-added approaches to agriculture, both ancient and modern. "Adaptive Agriculture" is agriculture that pays attention to every square meter of land, producing higher yields with less inputs.

Let's look at a historical example of adaptive agriculture first. The Inca were the first to cultivate the potato. Their model of cultivation is radically different from the factory farming model - the culture knew of around 3,000 varieties of potato (http://www.mongabay.com/07davis_incas2.htm) , of which over 1200 are still in use, with 250-300 varieties being grown in a single plot [great link (http://66.102.7.104/search? q=cache:mwa7mDv9WSYJ:www.iucn.org/themes/wcpa/wpc2003/pdfs/pro .] Because the Inca had to get every last calorie out of the ground, lived in the same places for many generations and had a stable culture to pass on wisdom about species and place, they bred crops to work well in every available niche and for as many purposes as possible. The practiced complex crop rotation and were, in general, great farmers. This is using human intelligence to assess local conditions to maximize agricultural productivity.

The high-tech big-yield model of adaptive agriculture is Precision Agriculture (http://www.directionsmag.com/article.php?article_id=31) , also called Precision Farming. As farm plots have increased in size, the human knowledge about each hectare of land has fallen and fallen. Precision Agriculture seeks to remedy that by replacing human knowledge with machine knowledge. By using satellite imagine and GPS locators on tractors (http://www.geotimes.org/nov03/feature_agric.html) , yield monitors which measure meter-by-meter of land and dose-precise dispensers for fertilizer and pesticide, PA seeks to put knowledge back in the farming process. Each meter of the field gets individual treatment within an industrial farming context, reducing use of pesticides and fertilizers to the minimum-required levels for a given yield. Precision Agriculture leaves on thing invariant: what is in the field. It still works largely with the concept of monoculture as an invariant.

At the other end of the spectrum, we find the delightfully holistic practice of Seedballing (http://www.seedballs.com/3seedpa.html) . A seed ball is an earth-and-clay ball with seeds and fertilizer added. Each seed ball contains a mixture of different varieties and different species. even a child can prepare them (http://www.loe.org/archives/970523.htm#feature6) . When planting

time comes, the seed balls are scattered on the land, each falling in place at random. In each location whichever seeds are best suited thrive in their protected mud starter-home, so the field becomes a non-uniform melange of intermixed species.

In seedballing, the intelligence is not human, but evolutionary. By seeding many different possibilities, and letting nature winnow them down to what works and what does not, seedballing puts the right plant in the right place without heavy technical infrastructure. It puts the intelligence back into agriculture in a profoundly different way.

Global scale food production is likely to require the great-grand-children of current Precision Farming approaches. But it's a loveless post-industrial practice. Seedballing, at least to me, has a beautiful and delightful human-scale rightness. Even if it won't feed the planet, it's still beautiful and inspiring. Perhaps future Precision Farmers will use the tools of their ancestors, but have the aesthetics of seedballers, letting each plant grow in it's right place.

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