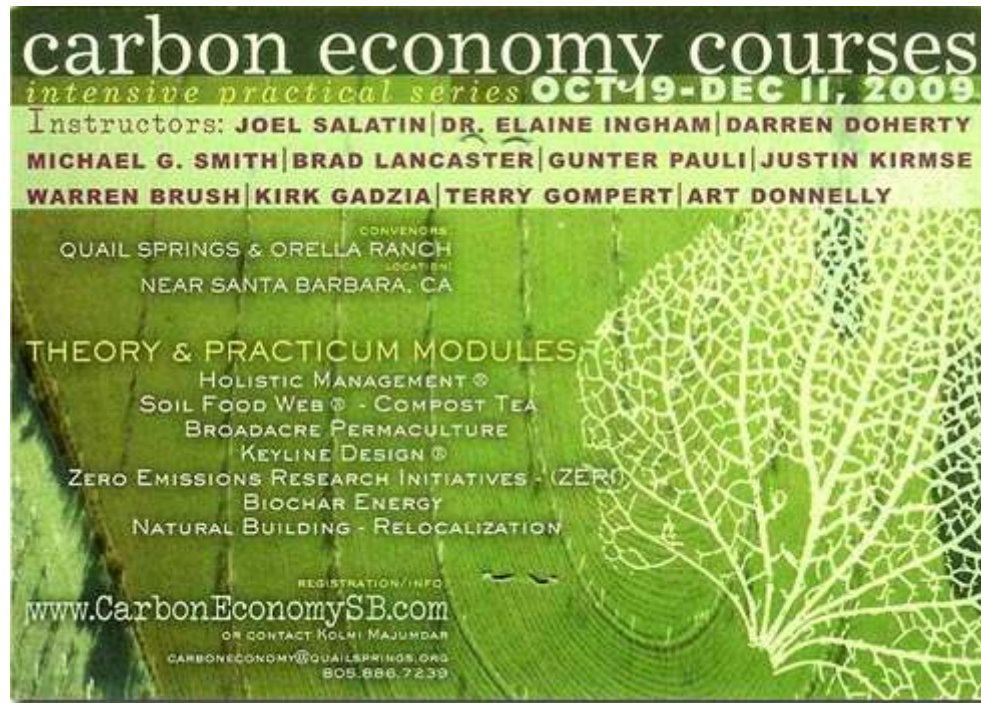


**A Report on ZERI Training Course (Zero Emissions Research Initiative)
Consumerism, Courses/Workshops, Society — by Owen Hablutzel January 17,
2010**

December 3-5, 2009

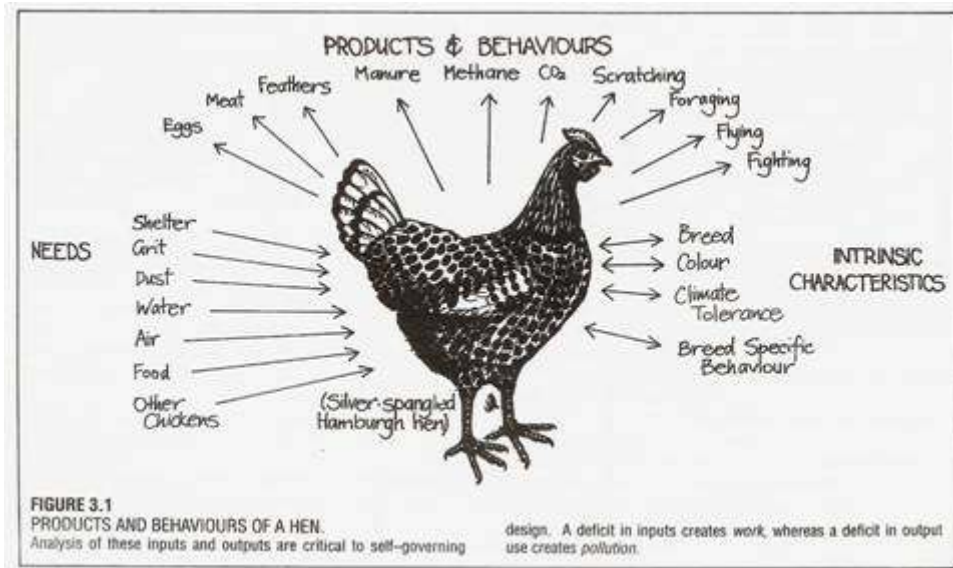
Orella Ranch, CA



Remember the Chicken?

The 'Permaculture Chicken' is a classic example used by Bill Mollison and many subsequent Permaculture teachers to illustrate an extremely useful analysis technique for use when designing systems. In the case of the classic chicken example, this 'element' of the system – the chicken – is analyzed for its needs (inputs) and its products (outputs). Using this information a designer can begin to make connections between each of the diverse components of the system, integrating all of these elements into a whole, functional system.





From *Permaculture: A Designer's Manual* by Bill Mollison, page 38

An ideal Permaculture design may provide all of the inputs for its diverse elements from within the system itself and, importantly, will find uses for all of the outputs of every element as well. This follows Nature's lead and fulfills the Nature-emulating, Permaculture principle: [Produce No Waste](#).

[Gunter Pauli](#) – an author, economist, professor of systems design, as well as founder and director of the global [ZERI](#) (Zero Emissions Research Initiative) network – uses similar, natural-system based epiphanies as a launching point, and has spent many years developing a framework to make precisely this sort of 'Permaculture-chicken-thinking' the basis of a fundamentally new model for business and industry. ZERI principles and methodology aspires to catalyze a uniquely powerful and even global economic system that is capable of meeting the needs of all through systemic thinking and action, innovation, localization, diversification, and creative abundance. This framework is ZERI, and clearly 'Zero Waste' is only the beginning.



The ZERI training module of the [Carbon Economy Course](#) was led by ZERI Certified Ms. Erin Sanborn. Her organization development and systems design background blended well with the Permaculture practitioners and organizers, international aid workers, eco-preneurs, as well as government agency employees who participated in this training. Like the [Soil Food Web](#) and [Sustainable Land Management](#) modules in the

leading-edge Carbon Economy series, this was held at the western edge of North America, amongst the gorgeous, coastal oaks and cool, Pacific breezes of [Orella Ranch](#).



Ms. Erin Sanborn delivers ZERI training

The Problem and the ZERI Response

Although Orella boasts impressive views into the vast blueness of the Pacific, if one were only able to see a bit further – in this, or any major ocean on the planet – evidence of why the sort of thinking and training happening at Orella is so crucial would be unmistakable. I refer of course to the [Great Pacific Garbage Patch](#) (aka: the Eastern Garbage Patch) floating around in the North Pacific Gyre current, by some estimates nearly the size of Africa [1] (others claim it is merely twice the size of Texas). And this is only one of the ocean trash vortexes. There are six others. Altogether 40 percent of the oceans (a quarter of the planet's surface) are trash covered [2] (this might explain why there is tens times more plastic than phytoplankton in the middle of our Pacific ocean [3]).

Bringing our focus back to land-based systems, we know that every last stream in the U.S. contains carcinogenic dioxins [4] (dangerous to many forms of life even at only several parts per trillion [5]). Bring it closer to home and we note that production of a two gram computer chip creates fifty pounds of waste material [6] (not to mention that computers have actually greatly increased the use of paper and corresponding waste, rather than decreasing these as was mistakenly predicted). Closer still, and we note that

every human mother's breast milk everywhere on the planet also contains dioxins. Chief Si'ahl (Seattle), back in 1854, had barely seen the beginnings of the trends leading to our current scenario when he addressed the colonizers with a clear, ecological warning: "continue to contaminate your bed, and you will one night suffocate on your own waste." Being a natural born systems thinker, and holding a deep respect for nature, the eventual result was quite obvious to the great chief. [7]

It is no accident that central concepts of the ZERI framework begin with what has too often been missing during the industrial age bubble; a healthy respect for nature. This esteem for nature's several billion years of 'research and development' is given substance by a core directive to emulate nature [8]. Mr. Pauli is unequivocal in his book, *Upsizing: The Road To Zero Emissions*: "The starting point: respect nature. The ending point: imitate nature." Mr. Pauli apparently understands that 'Imitation is the sincerest form of RESPECT,' rather than simple 'flattery.' His ZERI framework conceives that in human projects, businesses, and lives the more we are able to think and act like ecosystems the more productive and integrated into those ecosystems that sustain us we will be. Here we might even hear echoes of the #1 Mollisonian design principle: "work with nature, rather than against it." [9] Mr. Pauli wants nothing less than to see this design principle leading a "fundamental redesign" [10] of all industry. An extraordinary shift that "must go way beyond existing best practice." [11]



Training at the Orella Ranch Learning Pavilion

With a current world system in which "industrial civilization is essentially a complicated way of turning land into waste" [12], where in the U.S. alone, every year, 100 million tons of raw materials are converted into 90 million tons of wastes (averaging near 1.5 tons per person/per day) [13], Mr. Pauli's call to end the very concept of waste and begin a fundamental paradigm shift for industry is not remotely extreme.

ZERI concepts that demonstrate new thinking while reflecting the ethic of aligning with nature include, obviously, producing Zero Waste, but also:

- Geographic clustering of enterprises and industries (not unlike [Permaculture Zoning](#) concepts)
- Using outputs of one process or industry as inputs for another (precisely as products from a given kingdom of nature – plant, animal, algal, fungal, bacterial – become inputs of food or energy for another kingdom. Fallen tree leaves feeding soil life, for example)
- Creatively producing added value and livelihood through intensifying diversification of products (or 'yields' as Mollison might put it).

These strategies align with key observations that constitute the ZERI principles:

- No species eats its own waste without harm (mad cow disease was a result, after all, of feeding cows to cows—and recall Chief Si'ahl's warning above)
- What is toxic for one species is nutrient for another (cyanide is deadly to animal kingdom humans but needed by plant kingdom apples)
- A virus harmful to one species is harmless for at least three other kingdoms
- The more diverse and local the system, the more efficient and resilient it is
- The most efficient systems occur when all five kingdoms work together. These are the most diverse, integrated systems, in which matter can be put together (generation), or taken apart (decomposition), completely at ambient temperature and pressure, powered by the sun.

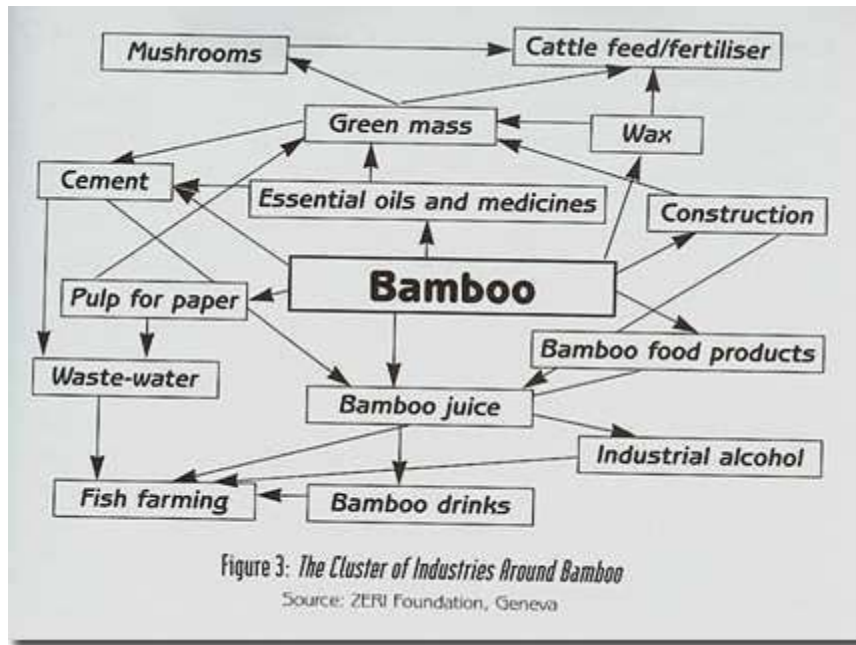
Methodology

Alright, but what do you do with these concepts and principles? How does a project or organization proceed to practice ZERI methodologies? Beyond shifting paradigms – dropping the linear, reductionist, 'command-and-control' mindset that has brought the world-system to the ecocidal present, and instead embracing and acting on a systems-thinking approach, embedded in the reality of ecological limits and opportunities – the beginning step is normally an intensive program for achieving Zero Waste. An assessment of product life cycles – cradle to cradle – is undertaken, looking for areas where waste can be reduced or eliminated in the existing process, developing improved processing where sensible, and further reducing costs of production by improving the efficiency of all material use at all stages. This analysis will necessarily include a thorough input/output survey (as for the Permaculture chicken).



Systems modeling for analysis and design

Once input/output tables are completed one can have a look at the unused outputs, by-products, or co-products of the processing and get creative about where these might be able to be used in new processes or enterprises 'downstream.' To facilitate this thinking, outputs are quantified in terms that describe exactly what is available for potential use. An example given for a brewery by-product of 'spent grain' is broken down into categories like 'moisture-content-80%, dry-basis protein content-70%, dry-basis fiber content-24%.' At this stage new, value-added uses for these 'left-over' components are determined and prioritized based on criteria such as markets for the value-added products, energy requirements for production, capital investment, land space needs, and job creation opportunities. Any new enterprises, in turn, will also generate their own outputs that will be examined through the same systematic thinking process. The end goal in this step is clean production all the way through.



Once you have an idea of what all the newly identified components and enterprises might be in your evolving system you can begin to geographically connect the dots by clustering your industries and elements in a manner that makes the most sense for transport, energy, water, materials, and the system as a whole (another area where experience with Permaculture Zoning principles would be of service).

A further ZERI step involves identifying the breakthrough technologies or processes that will optimize the value added to the ‘new,’ raw materials—formerly known as ‘waste.’ This step includes any research and development for new or old, previously existing (sometimes forgotten) technologies that will enable a capacity to use all outputs as new inputs, and so achieve zero waste. Mr. Pauli has worked with environmental luminaries such as [Janine Benyus](#) (author of *Biomimicry: Innovation Inspired by Nature*), as well as with over 2,000 scientists around the world, on developing many such innovations that may help to revolutionize the global economy by way of thousands of local initiatives that using these, and other similar breakthroughs.

A final step in this general ZERI process demands working with governments and local communities at the level of policy, in order to permit sensible enterprise clustering and to end the fragmenting and isolating zoning laws that hold sway in far too many places. Too often these were largely a result of the scale, noise, wastes, smells, and other ills that came to be associated with large-scale industry performed in the highly polluting, non-ZERI model (the same dynamic that understandably leads to NIMBY—‘not in my backyard’—attitudes in local communities... should we not aim for NIABY instead—‘not

in anyone's backyard'!?). The goal here merges seamlessly with the Permaculture principle, [Integrate Rather Than Segregate](#).

Ground Truthing

Ms. Sanborn peppered the training with references and examples from the many ZERI projects, initiatives, and success stories from around the planet. One example, the 'Wildwood Brewery' in Montana, adds value to the spent grain byproduct of the brewing process by sending some of it into a bio-digester. What formerly produced an expense and a 'waste-problem' now produces biogas for use (energy savings) and sale (new income stream). The remainder of the spent grain then becomes substrate for production of both oyster and shitake mushrooms. The mushrooms are another new income stream while the spent mushroom substrate (formerly 'spent grain') becomes an input for a worm farm. Worms are sold for further income as well as producing vermicompost for use and sale in the process. The former 'waste' water from this brewery is used in a similar fashion and is now cascaded through the expanded system into biogas, algae production, and fish farming.

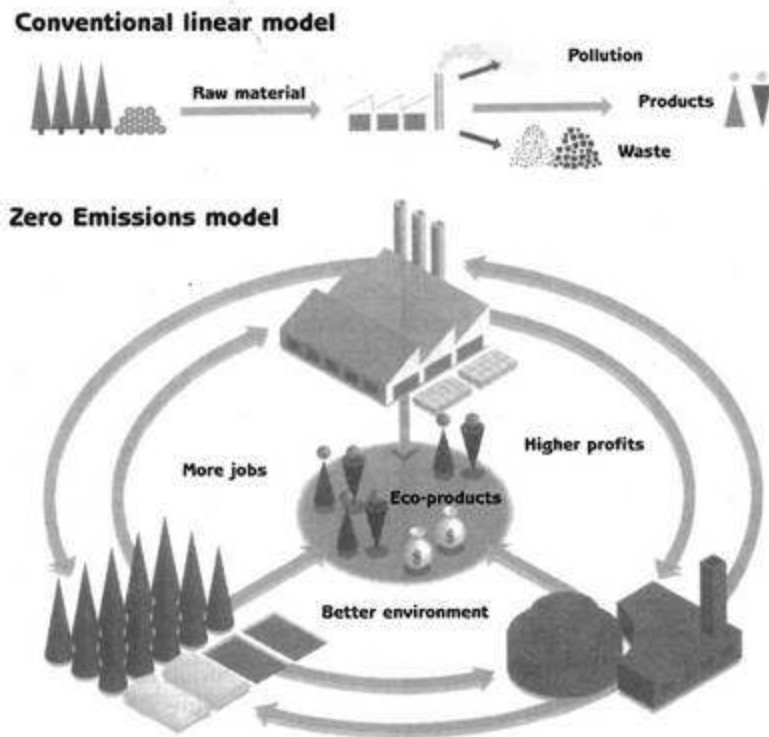


Figure 2: *Conventional Linear Model versus Zero Emissions Model*

Source: ZERI Foundation, Geneva

This example demonstrates as well as any the essence of the ZERI methodology. What began as one income stream reduced by costly 'waste' expenses is diversified into at least nine income streams—all while cutting costs, eliminating waste, and doubling income (talk about 'stacking your functions'!). ZERI methods certainly recognize and leverage the truth of Mollison's declaration that "the yield of a system is theoretically unlimited," the only limit being "the information and imagination of the designer." [14] When it comes to our interaction with the biological bounty of earth this sort of imagination has been all too lacking. This is one reason why Mr. Pauli proposes 'bio-refineries,' pointing out that humans have engineered a distillation and fractionation process for petroleum that permits the use of all the molecules derived from this non-renewable resource, while we have never designed a system that permits the similar separation of all the valuable components from renewable resources. As a result, we use only a small percentage of biomass and simply throw the rest away. [15]

Bio-refineries and aligned concepts would be giant leap forward in human integration into the landscapes and ecologies we inhabit. This requires understanding and actually thinking like an ecosystem. "Ecosystems," according to Mr. Pauli, "always evolve towards abundance." The better we understand these systems the greater our yields

from them will be—following Mollison’s concept of yield as simply “a measure of the comprehension, understanding, and ability of the designers....” [16]

Importantly, Pauli recognizes that this unlimited potential for yields does not change the fact that our Landbase is the primary and fundamental source of human economy. This essential fact dictates a strict responsibility to work only within the ecological limits of that Landbase. This notion, of course, aligns perfectly with the dual-purpose third ethic of Permaculture. Often stated as ‘[Fair Share](#),’ it means living in a manner that respects ecological limits—only requiring your ‘fair share’—as well as returning (‘sharing’) the surplus (which may include ‘waste’) to the system. Because it respects what is primary and therefore enables a human future, living this ethic may be “the most civilized activity a person can pursue.” [17] Recognizing all of this, Mr. Pauli insists “Humankind cannot expect the earth to produce more. Humankind must do more with what the earth produces.” [18] Indeed, the opportunities are endless. And the time is now.



A Mighty Orella Oak

The Blue Economy

Having developed the ZERI methodology and put it into practice, through multiple initiatives around the world, Mr. Pauli will unleash in 2010 his most expansive vision yet. It is a vision of global sustainability he is calling “The Blue Economy.” By way of contrast

and explanation, Mr. Pauli refers to all planned, controlled, and debt-based economies as ‘the Red Economy’ (including all massive state run economies, or any in the current, dominant mode of global scarcity and debt capitalism). The ‘Red Economy’—what Pauli calls “an economy based on what we do not have”—has failed. ‘The Green Economy’ was intended to address the systemic failures and inequalities of the Red Economy in order to move our global economy towards a more sustainable model. What has occurred, according to Pauli, is that the ‘Green Economy’ model remains mired in the dynamics of debt, requires more up-front, capital investment to see eventual returns, and therefore tends only to ‘work’ for those relative few who are already wealthy. He points out that this approach has never really taken off, does not address the less-than-sustainable present situation of increasing global economic inequality [19], and the fact that, in a time of global economic downturn, “expecting capital managers and consumers to spend more to have less faces a greatly reduced chance of success.” [20] Enter, the ‘Blue Economy.’

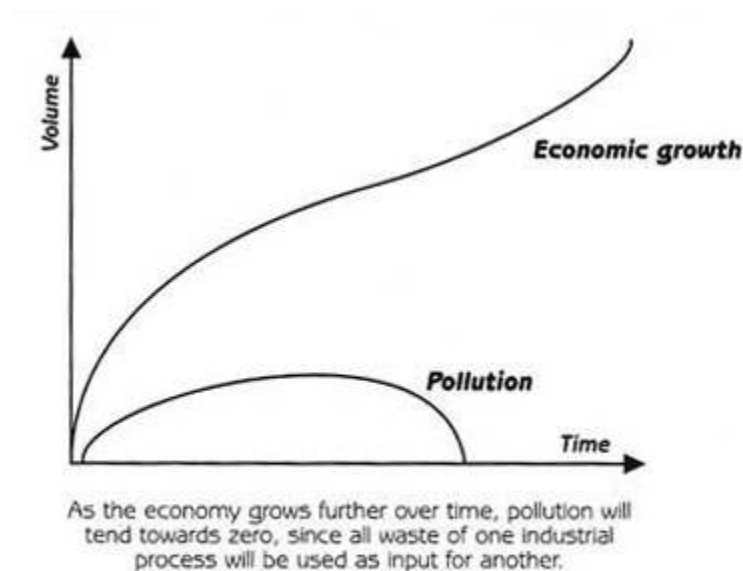
The broad outlines of Pauli’s bold and necessary vision (which has been well received with groups such as The Club of Rome, the United Nations Environment Program, and the International Union for Conservation of Nature) can be stated simply:

- Invest Less
- Innovate More
- Stimulate Entrepreneurs
- Generate Multiple Cash Flows
- Create Jobs
- Build Social Capital
- Economies of Scope not Scale (highly diverse, quality yields—rather than quantity of single yields)

It is nothing less than the ZERI methodology writ large—extremely local in application (using local materials and resources for a broad scope / diversity of yields, saturating local markets before any export, creating local jobs and economies addressing local needs) but planetary in its potential (innovations available to local entrepreneurs worldwide, providing local economy and jobs, as well as the improving health of local landbases, all of which scales up to reverse the global environmental free-fall currently underway).

Just as ecosystems evolved to ever more efficient nutrient and energy cycles, bringing ever more diversity while developing resilience, flexibility, and performance, the Blue Economy will increasingly rely on less energy and provide more diversity through

innovations brought to the market by ever more entrepreneurs fortified with a vision of real sustainability and prepared to take the risks. [21]



Graph 2 : The Zero Emissions Economic Development Model

A few examples of the kinds of innovations developed in conjunction with the ZERI network:

- Using natural silk (no petroleum or corn starch) to replace titanium and stainless steel (in disposable razors for example—but also used as bone graft and cartilage repair material) is less expensive, requires no mining of materials, and could entail planting mulberry trees (for the silk worms) on 250,000 hectares of degraded land, regenerating topsoil, sequestering carbon, and creating millions of jobs in harvesting, processing, and production
- Food grade fire retardants (will eliminate toxic PBDEs – Poly Brominated Diphenyl Ethers)
- Very small, and noiseless, wind power generation
- Sunscreen, as well as UV stabilizers in plastics, made from enzymes in tomato skins
- Termite nest bio-mimicry technology, developed by Anders Nyquist, able to construct buildings designed to warm and cool themselves simply via air flow (as termite nests are able to do), even in Scandinavian winters—making energy intensive, automated climate control obsolete
- 'Piezo-electric' cell phones, and other small electronics, powered only by the differential between ambient and users body temperature, or just the pressure generated by the voice – eliminating the need for energy and mining-intensive toxic batteries (40 million of which end up in landfills every year)
- A gravity powered vortex capable of removing bacteria and air from water without any chemicals – potential to clean and deliver drinking water with minimal energy or expense
- CO₂ into cashflow – CO₂ from existing coal fired power plants is captured and converted into spirulina algae (for local nutrition), then excess spirulina is converted into biogas for

energy, and leftovers become esters and polyesters – moving the local economy from scarcity to abundance

These innovations, along with many others developed by the same principles that use “natural physics and biochemistry to cascade matter and energy in fully harmonious and renewable flows,” [22] will be discussed in Mr. Pauli’s new book, titled *The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs*, coming by April 2010.

Ms. Sanborn rounded out the ZERI training by pointing out a variety of networks and groups doing work aligned with ZERI (and Permaculture) principles – natural potential allies in moving forward toward a Blue Economy and sustainable world. Those interested in connecting or collaborating with like-minded groups and individuals, and broadening the base of your effective networks might do more research into some of these, if you haven’t already. Networks mentioned included [Slow Food](#), [Slow Money](#) (treat money like water in the landscape: slow it, spread it, sink it!), and the [Business Alliance for Local Living Economies](#), or BALLE (a ‘living economy’ ensures economic power resides locally to the greatest extent possible).



The Problem Is the Solution?

An important point, which many may not have yet realized, is the fact that even were we to achieve personal Zero Waste in our households and small business communities—

even to the point that our municipal solid waste facilities had no further additions of waste—we would still have only reduced the total amount of waste generated by less than 3%! [23] For, as excessive as it normally is, the waste of the average individual, family, and community barely scratches the surface of the deeply systemic problem at hand. This is why, though we may applaud the intent, inspirational effects, and general efforts of someone like [No Impact Man](#) – doing indeed, many ethical and responsible things – we should be under no illusions that activities solely at that scale will be commensurate to the issues we and our planet face. [24]

Industry produces over 8 BILLION TONS of waste each year in the U.S. alone. This is the ‘iceberg’ that municipal waste – with its ‘mere’ 251 million tons of waste per year – is merely the tip of. Of course similar ratios apply elsewhere in the world, and when we include not only solid waste but all energy consumption, the vast majority – always over 75% – remains the responsibility not of individual consumers but of the industrial, corporate, agri-business, commercial, military and government sectors. [25]

Here in large part is why many people working for change in the world often identify industry, and more often the transnational-capitalist-corporate-juggernaut engine presently driving industry, as being the most serious logjam to ecological and social progress in the world. We live in a corpratocracy, these folks would say, and its corporate-industrial, economic system is a relatively one-dimensional, narrowly focused, linear-throughput system that expends vast quantities of energy gobbling up vast quantities of raw resources – including ecological and social capital – only to spit these back out again as mostly entropy, chaos, and garbage (on many levels). Few will deny that the ecological and social disasters that result are unfolding more rapidly with each passing day. These are, after all, real problems in the real world with a real cause. Even those with a relatively conservative outlook on the global economic picture have concerns that our present system, which leaves something like two thirds of the earth’s people essentially destitute, is seriously flawed. So perhaps the perception is understandable that Industry, especially as performed currently – with a pauperized, scarcity-based, reductionist, corporate-centric world-view – is largely ‘the problem.’



What I might like to challenge Permaculturalists, and others working for positive change, to consider is whether and how the oft-quoted Mollisonian Permaculture design principle #2: “the problem is the solution” [26] would apply to this currently dangerous and only-too-real scenario. If we agree that the intensely destructive way our culture, civilization, and its massive industrial infrastructure affects our land base and planet is largely the problem, then how do we re-make this same basic infrastructure into part of the solution? Rather than continuing simply to condemn business and industry as the problem while tending our gardens, isn’t our challenge to also change our own thinking, to catalyze, activate, and propel this existing infrastructure into a more imaginative and viable solution? Might it not be the case that business is in fact the only force that exists on the planet powerful and flexible enough to respond to the sheer scale of our planetary crisis quickly and effectively enough? [27] Aren’t we really talking about ‘8 billion tons’ of pure opportunity!

Now it is clear that our retrofit can’t simply be a corporate green washing, or a half-hearted do over. Changes need to be fundamental and systemic through all sectors of business. And, to be effective, honesty with each other about this aspect must be paramount. There is no faking it. We can afford to mask no difficulties and tell no lies. [28] Otherwise we risk “running over the cliff while driving a hybrid,” “suffocating ourselves on the fumes of ‘clean’ coal,” or merely “putting a ‘green roof’ on a concentration camp.” Pick a metaphor. The point is these are still not remotely

sustainable. At this stage in the collapse of the industrial age bubble – even if slightly greened – an attitude of ‘Business as Usual’ will be the demise of all human business.

Part of the power of Gunter Pauli’s Blue Economy model is in the implicit recognition that, as much serious damage as business and industry have done, when we re-think, re-structure, and re-imagine them, fundamentally, through an overdue and necessary shift in our collective awareness, actions, and perception, these same resilient and robust social institutions have an immense potential to become an equal or greater positive force for change in the world than they once were (and still too often are) a negative and destructive force. That is, the problem is the solution.

These greatly needed changes are already underway and gathering momentum in more and more leading-edge organizations and institutions each day. We might not be far off the mark were we to predict that any companies left standing by the end of the 21st century will have long before, necessarily, adopted these kinds of measures. These will produce not only truly regenerative products and services but local empowerment, employment, and health. The needs of all of nature will be met through the always cascading powers of nature; sunlight, air, water, wind – amplified and made to resonate through our systems by human creativity, design, and yes, business. We are getting there by ever more deeply seeing our systems as whole, sharing information, building relationships, collaborating across boundaries, envisioning and acting like ecosystems, accessing the collective intelligence in our systems, ‘Permaculture-chicken thinking,’ and collectively pursuing adventures in creative applications of these principles and concepts.

Mr. Pauli’s three simple steps to the Blue Economy: “First, Think Positive. Second, Creative Learning. Third, Make it Happen.” Risks of not carrying this great shift forward are grave, well known, and essentially certain. Creativity is our species birthright and our longest lever. Opportunity arises from all sides. Let us ensure together it never goes to waste.

Many thanks are due to Ms. Sanborn, Mr. Pauli, and all participants in the training, as well as to [Orella Ranch](#) and [Quail Springs](#) for excellent hosting and organizing every step of the way. Thanks also to [Darren Doherty](#) for originating and spearheading the Carbon Economy Course series concept.

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14. Mollison, B., 35
15. Pauli, G., 24
16. Mollison, B., 35
17. Hawken, P. (2007, 100) *Blessed Unrest: How the Largest Social Movement in History Is Restoring Grace, Justice, and Beauty to the World*. Penguin Books.
18. Pauli, G., 6
19. As Paul Hawken points out in *Blessed Unrest*, "One of the failures of the arguments opposing (WTO style, top-down) market globalization is the visible lack of an alternative economic model that might address the plight of the world's poor." (pg. 135) Mr. Pauli would agree, and the Blue Economy is an attempt to deliver this alternative model in a benchmarked and ground proven package. Says Mr. Pauli, "It works in the First world. It works in the Third world. It produces revenue rather than promises of something good downstream. It provides jobs." (see note 22 for source) Pauli also notes that there are "over 1 billion young people entering the labor market in the next decade." (see note 20 for source) To not put this generation to meaningful work in right livelihoods would itself be a massive social waste, which Mr. Pauli intends to eliminate as well. Perhaps, by weaving together related threads of intellectual forebears, and by stimulating and developing the next level of innovations needed to catalyze the essential entrepreneurship, as well as by developing the ZERI framework itself, Mr. Pauli has finally packaged the requisite alternative model flexible enough, focused where it counts, and with important capacity for local applications: the Blue Economy.
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21. Ibid, 3
22. Pauli, G. (2009, 65) *Building the Blue Economy: Nature itself shows us how to innovate, generate wealth and create jobs*. ODE Magazine, December 2009 Issue.
23. Jensen /McBay, 290
24. For, even when one goes beyond just the solid waste equation and includes all the energy consumption, cars, etc. of individual consumers, the vast majority of energy consumption—

always over 75%—remains the responsibility of the industrial, corporate, agri-business, commercial, military, and government sectors. (see Kirkpatrick Sale, “An Illusion of Progress,” *Ecologist*, June 2003)

25. Numbers are from U.S. Environmental Protection Agency.
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27. To paraphrase Paul Hawken from *The Next Economy*.
28. To quote Amilcar Cabral, the African revolutionary and strategist