Answering Caldwell

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In his 2003 essay, *The End of the World, and the New World Order*[1], George Caldwell, lays out an extremely pessimistic view of the global future. Caldwell is provocative, and for anyone who has thought deeply about the issues he raises, difficult to answer. However, there are a number of key points on which I believe one can credibly challenge his assumptions:

1. Caldwell conflates at least three key trends:
    a. Cheap abundant fossil fuel
    b. Advanced (vs. advancing) technology
    c. Debt-based financial system with uncounted externalities

2. He ignores the possibility of an adaptive technological transformation

3. He confuses "hardware" and "software" and thus fails to see the potential for a qualitative change in b. driven by the end of a. and the transformation of c.

4. He, and the source he quotes[2], thus underestimate the population that can be supported on solar due to failing to take account of increased energy efficiency

5. He seems to totally ignore wind, biomass and tidal as major energy sources

6. He is unaware of a new breakthrough in sustainable biomass & agriculture

7. He discounts the effect of population stabilization possible when women gain control of contraception secret from men

8. His estimate of the total sustainable population is therefore artificially low

9. On the darker side, he seems to gloss over the potential for disease to substantially reduce population in favor of appearing to almost advocate nuclear war

10. Much of his language casts the situation as if some central global entity were now, or will be, in control when all aspects of his scenario imply the opposite

It would appear that he has purposely taken the darkest possibly vision. In this piece I will take the opposite tack, but I want to acknowledge that I am not predicting that what I am suggesting *will* necessarily happen, only that this is the most optimistic, but still possible, scenario that I can imagine. In support of this I will also point out that if we look at the history of evolution of the Universe, and of life on this planet, it would appear that time after time, whenever life has come up to a point of extreme crisis, where the path that had to be traversed to survive, prosper and leap to the next level, was the narrowest knife edge imaginable, life has in fact chosen that unique path toward survival and ever greater complexity. With that said, here are some observations.

There appears to be a potential technological plateau state that humanity could achieve in coming centuries. To have any chance of achieving this, the initial lunge necessary to get there must be well underway within our lifetime. We, the Earth, only have one shot at it. To take that shot we must descend into history, as we have known it. We must eat the apple and take the fall to have any possibility of achieving redemption. Now, we are at the critical moment when we either make the leap, or crash in the process of trying.

Caldwell is correct that one key measure of how well we do will be how much of nature we are able to steward through the neck of the hourglass. However, what he fails to see is that the other key measure is whether we make a fundamental breakthrough in both our technological implementation and consciousness to move toward stable climax technology. Such technology is actually the only way for us to achieve the necessary stewardship of nature. Thus, he inadvertently demonstrates that this shift is the only possibility for our survival, as even his aborted *minimal regret* scenario does not appear to actually lead to a viable world in the long run.

Here is a rough outline for a sequence of events that look most likely to lead to the climax-state technology, which I call MetaNature.

I. Rapid structural increase in the price of energy

1. Resulting in rapid acceleration of R&D and deployment of energy efficiency
    a. Lighting
    b. Electric motors
    c. Heat pumps
    d. Super-insulation
    e. Mass reduction in vehicles
    f. Direct passive space conditioning

2. Resulting in rapid acceleration of R&D and deployment of renewable energy
    a. Wind
    b. Biomass
    c. Solar
    d. Hydrogen fuel cells
    e. Lithium ion batteries
    f. Geothermal heat pumps
    g. Tidal

3. Resulting in agricultural restructuring
    a. Reduced mechanization
    b. Reduced petrochemical inputs
    c. No-till cultivation
    d. Drip irrigation
    e. Integrated Pest Management
    f. Increased residential scale gardening

I. Collapse of debt-based money and reinvention of the global fiscal system

1. Commodity backed trade credit currency
2. Internalization of economic externalities in the global terms of trade
3. Financial valuation of biodiversity
4. Financial valuation of negative birth rate
5. Local mutual credit currencies
6. Time-dollar systems for social services

II. Active reduction of atmospheric CO2 through new high carbon fertilizer

1. Biomass to: hydrogen, biodiesel, ethanol & ammonium bicarbonate
2. Coal + biomass to: hydrogen, electricity & ammonium bicarbonate
3. Hydrogen energy storage & transport

III. Stabilization of human population

1. Female control of fertility
2. Paid incentives (to men?)
3. Possibly large scale epidemic(s)?

IV. Closed loop materials reuse to reduce demand on the biosphere

1. Full recapture recycling of all metals
2. Effective reuse of all organic fiber
3. Replacement of new fiber from plantations
4. Mining of dumps and landfills
5. Plastics formulated to recycle as feedstock for the same plastics

V. Long-term increase in longevity of sufficiently high-efficiency technology

1. Energy harvest
    a. Solar
    b. Wind
    c. Tidal
    d. Geothermal
    e. Biomass

2. Building envelope
    a. Super-insulation
    b. Ultra-high R glazing
    c. Heat recovery

3. Transportation
    a. Light rail
    b. Carbon fiber vehicles
    c. Computer dispatched shared shuttle vehicles
    d. Human powered vehicles with propulsion assist infrastructure
    e. Lighter-than-air craft

VI. Redesign of human activity patterns
1. End of the work week
2. End of rush hour commuting
3. More time in child care & education
4. More time in gardening
5. More time in craftsmanship

VII. Reclaiming of desserts and marginal or deforested land
1. Tree planting
2. Check dams & earthworks
3. Swales (contour ditches)
4. Aquaculture
5. Permaculture
6. Mycology (mushroom cultivation)
7. Re-mineralization of soils
8. Charcoal fertilization

VIII. Bioremediation of toxic pollution
1. Mycology (mushroom cultivation)
2. Bioaccumulation of heavy metals
3. Aquatic waste treatment (living machines)
4. Constructed wetlands

IX. Active redeployment of endangered species in human co-inhabited areas
1. Wild farming
2. Urban forests
3. Suburban intensive farms

X. Passive low cost water treatment
1. Biosand filters for drinking water
2. Constructed wetlands for waste water

XI. Removal of chlorine and halogens from industrial chemistry
1. Halogenated hydrocarbons
2. PVC
3. Vinyl
4. Urethane
5. PCBS

The preceding outline is largely a laundry list of the component technologies needed for near, middle and long term sustainability, but it also contains and perhaps almost glosses over three events that would, and indeed will, be regarded as extremely negative by most of society when they occur. Like Caldwell I agree that they must occur, and that the sooner they occur the better. Indeed, if we succeeded in stalling them off too long we would face a fourth possibility, the wholesale collapse of the biosphere, which is already happening in slow motion locally in many parts of the planet.

Fortunately, there is every sign that the Bush administration is doing everything in its power to accelerate us into crisis. However, unfortunately, they appear to be doing everything they can to delay and forestall the one crisis we need first, the rapid rise in the price of energy. But maybe they are so beholden to the oil industry that they will not be able to resist giving that industry a big windfall at the expense of the rest of the economy by allowing the price of oil to go up even before peak oil forces it up. Then again, peak oil may already be here.

The three crises (opportunities) are: 1. a sharp steady increase in the price of energy ahead of the actual crash in supply; 2. a collapse and transformation of the prevailing economic game rules; and finally, unfortunately, here I must admit that I do to some degree agree with Caldwell; 3. most likely an outbreak of lethal epidemics sufficient to stabilize population at, or substantially below, our current level. The most compassionate possibility would be some exotic new disease that would massively inhibit human fertility without affecting other animals, except perhaps beef cattle. But, that is pretty far-fetched and most likely not sufficient to reduce the population overshoot. It is remotely plausible that we could be temporarily sustainable at our current or even lower projected population, if we were able to make all of the other necessary adaptations quickly enough.

Caldwell apparently basis his population assumptions on a study[2], which claims that total solar income can only sustainably support a human population of around 500 million. That number is critically dependent upon the overall energy efficiency of the technologies used in conjunction with the energy source. It will also depend on the conversion efficiency of solar technology, though that does not seem likely to increase substantially. However this number actually represents the number of people that can be supported by the overall mix of renewable energy technologies available including not only solar, but also wind, biomass, geothermal heat pumps and tidal, as well as passive savings in building design. It is unclear whether these were already included in the figure he called solar, but I would have expected it to instead be called “renewables.”

Professor Hans-Peter Durr of the Max Planck Institute for Physics of Germany has suggested in the Trilemma Symposium 1996 that 10 billion kW represents the maximum consumption rate of energy that can be used without impacting the global environment. This is equivalent to 20 percent of the total energy absorbed by the Earth's vegetation, and is close to the current level of global primary energy consumption.[3]

As Caldwell successfully points out, the key problem may not be energy per se, but rather our propensity to over-consume the biosphere given enough (cheap) energy to do it. So, the deeper problem is very likely not our overall ability to derive renewable energy, but our ability to change our pattern of ecological destruction in time to avert irrevocably damaging, if not outright destroying, the biosphere. Here I would argue that the problem is not the existence of industrial technology, but rather what kind of technology, and even more critically what kind of economic system. I believe that at this point our fiscal system is far more to blame for the wholesale destruction of nature than our technology. If we can change the fiscal system to one that does not, literally, *discount* the future, but instead values intact biodiversity and rewards its preservation, we may have a chance. If we were to degenerate into the kind of violent anarchy that Caldwell seems to at once predict and almost champion, all bets are off, as desperate people with guns would rapidly turn all of nature into bush-meat, even if there were much fewer of them left to do it after the major cities were destroyed by nukes.

The other main threat to intact biodiversity, beyond outright destruction from timbering, hunting and over-consumption, is global warming. This could actually be addressed by a new breakthrough carbon utilization technology, which can use both biomass and coal, or biomass by itself, to create a high-carbon fertilizer that returns carbon to the soil where it is needed, while still allowing carbon-negative combustion to generate the heat we need for electricity, cement or steel production. In addition to sequestering carbon and other pollutants from combustion, it strips off the hydrogen we need for fuel cells or to hydrogenate biodiesel and the same process can be used to make biodiesel or ethanol out of biomass, while also producing hydrogen and the ammonium bicarbonate fertilizer.

This is perhaps the best example of a set of new *just-in-time* climax state technologies, which when combined with a transformation in economics and consciousness could allow humanity to use the tremendous momentum of our technological infrastructure to jump to a truly sustainable new world. As Caldwell points out, the alternative is oblivion, and perhaps it is precisely the glimpse into the abyss that he represents, which is necessary to motivate us to make the adaptive shift required.

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[1] *The End of the World, and the New World Order,* George Caldwell, Ph.D. http://www.foundationwebsite.org/TheEndOfTheWorld.htm

[2] Pimentel, David, and Marcia Pimentel, eds., *Food, Energy, and Society*, Revised Edition, University Press of Colorado, Niwot, Colorado1996

[3] Trilemma problem and energy Proposals for the Realization of the "4-2-1 kW Society" http://criepi.denken.or.jp/trilemma/en/tpx/tpx1.html