Chapter 6 Towards Eco-centric Governance in the Sustainocene with Global Artificial Photosynthesis

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May 23 Human Ecology Forum

Forum Theme: Transforming Culture

Abstract**:** This presentation explored the hypothesis that the great expansions of human sympathy and conscience that underpinned many substantial reforms in governance systems (such as abolition of slavery and of child labour as well as enfranchisement of women) were driven by technological revolutions that made such change economically feasible. It critically analysed how governance systems should begin planning for a Sustainocene period in which the globalisation of artificial photosynthesis (the production of hydrogen fuel and oxygen from using sunlight to split water and the making of basic foods and fertilizers through reduction of atmospheric nitrogen and carbon dioxide) allows human beings to dwell on earth as good stewards of its ecosystems for millions of years. Such a Sustainocene period, it was argued, will be characterised by local or community-produced agriculture and industry that lay stable preconditions for cultures with a greater emphasis on contemplative traditions.

Reflection: report and commentary

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Report

This presentation drew together two intersecting threads: that historical cultural transitions have been enabled by and consequent to change in technology, and that control of this technology gives particular institutions in society undue influence over the governance of society. Since the industrial revolution, it is the corporate sector (particularly those earning profits directly or indirectly from fossil fuels) who, with the assistance of so-called free-market ideology, that have altered the nature of our basic social contract, the ethical and legal rules of our democracy in ways that cede sovereignty and undermine the foundational social virtues of justice, equity, respect for human dignity and environmental sustainability. So much so that rather than perhaps we should be referring to our current era as the 'Corporatocene' rather than Crutzen's 'Anthropocene'. (Crutzen 2002)

Corporate entities, although considered by corporate law to be a hybrid species of people (capable, for example, of suing for defamation or to enjoy corporate free speech in some jurisdictions), resemble those 'zombies' much evaluated in the thought experiments of 'consciousness researchers: entities that appear to be alive, but lack conscience, the ability for self-reflection or self-abnegation for the good of others. Their primary legally required function is to maximise profit for shareholders and they hold little of consequence outside this short-term objective. The consequences are summarised by The Five 'Ps' that characterise life in the 'Corporatocene': population; poverty, preparation for war, profits and pollution.

The dominance of global corporate governance has precipitated the present global ecological crisis characterised by Epoch of profound human interference with various 'safe' boundaries for human occupation of the earth. These include *land use and land cover, coastal and maritime ecosystems, atmospheric composition, riverine flow, nitrogen, carbon and phosphorus cycles, physical climate, food chains, biological diversity and natural resources.* Pressure on such 'safe' planetary boundaries as human population 10 billion by 2050 with associated energy consumption rising from ≈400EJ/yr to over 500EJ/yr (Steffen, Crutzen, McNeill 2007).

Using a medical analogy, our situation is now like that of 19th Century medicine. We have good diagnostic skills and the capacity to determine when such 'safe' planetary boundaries are being breached, much like we could diagnose abnormal physiological parameters in human health in that period. Interventions have been proposed, but remain at the level of weak planetary therapeutics (see Box 1). But have yet to develop the therapeutic armamentarium to affect planetary pathologies. Hence there is a need not only to specify 'safe' planetary boundaries as a type of world healthy physiological framework (that could be supported by international or common heritage of humanity legal obligations) as wellas , most importantly, development of a planetary therapeutic.

Box 1 Representative Standard Portfolio of Weak Planetary Supportive Therapies

- Aggressive decarbonised electrification as core of power supply
- Stable regulatory incentives for AP investment
- Energy system wide strategic planning- including measurement of implementation of efficiency measures, electrification, green-energy processes and decarbonisation
- Aggressive efficiency measures for buildings, industry and transportation to reduce per capita energy demand
- Price signals about carbonised electricity and fuels
- Probably will need algal biofuels as transition

Source: *California's Energy Futures. View to 2050*

Access to large amounts of locally produced clean energy clearly is one technological method that can begin to open up ways to both meet energy needs and address the power of corporations. This is because the societal / cultural changes needed to do the one will address the other. Global Artificial photosynthesis (GAP) by capturing sunlight on every available sun-exposed surface and using 'biochemical' means to store that energy locally, in addition to supporting measures (see Box 1) will improve local resilience and productivity, and enhance local food and fuel production, and begin to remove power from energy and agricultural corporations. The process of introducing GAP to and promoting its uptake could also enhance democratisation of local communities.

Research into this technology is still in its early days. However multiple centres around the planet are looking at using sunlight to split water as a source of hydrogen and oxygen while absorbing atmospheric nitrogen to make ammonia (when mixed with hydrogen) fuel and fertiliser as well as carbohydrates (edible and non-edible). Utilising such technology, all human-built structures (buildings, roads, vehicles) on the earth's surface can become sources of fuel, food and positive contributors to the environment as they in effect do photosynthesis more efficiently than trees and grass. One impact of this distributed food and fuel will be to de-corporatise fuel and food, this is to make its production and distributed less centralized, and mass-scale as well as less dependent on long-distance transport and packaging.

NH_3 provides bulk of world's fertilizer but Haber-Bosch process is energy intensive (1-2% world's annual energy production). Some trees and grasses can convert atmospheric nitrogen into ammonia (NH_3) (via nitrogenase) via nodules in their roots. The energy for this process comes from sunlight. So another aspect of AP could be photosynthesis of ammonia from atmospheric nitrogen and the

hydrogen from water splitting. NH_3 meets US DOE 2015 H_2 storage target for H_2 based transportation fuels-can be blended with diesel for a fuel that releases H_2O and N_2 when combusted.

Lessons for distributing AP technology

Life cycle analyses of GAP are need to facilitate realistic predictions at the research development level, through to scalable production. Rapid deployment for unregulated use i.e. for localised H2-based fuel production at residential or farm level, requires recycling methods, environmental risk assessment and monitoring methods.

Continuous technological improvements in AP will require stable and certain incentive laws for domestic and community uptake. World Bank energy investment schemes and scalable business models with start-up funds derived from carbon pricing schemes or taxes on global financial transactions

There is at present poor public understanding of benefits of GAP. There is also a high likelihood that the globally highly profitable fossil fuel industries will resist aspects of GAP, despite attendant benefits to the poor and to the environment. One instructive lesson here involves the failure of the photovoltaics (pv) industry in the 1970's and 80's as a result of patents being bought up and legislative schemes for subsidies being constrained. One purpose of a GAP project will be to fund a protective shield of relevant ethicists, policy and governance experts. This needs to be done quickly as energy, food, water security and climate change problems associated with the expanding global human population constrain the time for developing GAP so it can meet such challenges. Window to develop governance of GAP before efficiencies rapidly increase, devices marketed and patents secured. Long lead time to get GAP into policy space. GAP lacks basic supporting governance documents at national and international levels.

If Carbon price is non existent at a national level or set too low, this will not incentivize venture capital investments in new renewable energy technologies such as GAP. The Clean Development Mechanism (CDM) under the Kyoto Protocol, is encouraging investments in emission-reduction projects in developing nations, is biggest offset market- 95 percent of total spot and secondary emissions offset trading.

Investor-State Dispute Settlement (ISDS) is a mechanism that constrains democratically elected governments by allowing foreign investors to sue before panels of trade arbitrators. Such a pro-corporate governance mechanisms emerges from the *Energy Charter Treaty (ECT)* signed in Lisbon in December 1994 with its associated *Protocol on Energy Efficiency and Related Environmental Aspects* (PEEREA) (both in force April 1998) as well as BITS and the TPPA. ISDS privileges MNCs in global governance. Will it be misused as an anti-competitive mechanism (like decreased OPEC oil price in 1970s-80s) to shut down renewable energy initiatives?

Once answer is to declare photosynthesis in its natural and artificial forms common heritage of humanity under international law. As such international law would ensure no private or public appropriation (ie., through patenting) of the whole of that process; no legal entity should own the entirety of photosynthesis in its natural or artificial forms. Representatives from all nations could manage artificial photosynthesis resources on behalf of all (via a special agency). All nations could equitably share benefits of artificial photosynthesis, linking the concept to global public good. No weaponry could be developed using artificial photosynthesis technology (ie., devices to destroy energy and food security). Making photosynthesis in its natural and artificial forms common heritage

of humanity under international law could assist its being preserved for the benefit of future generations and their ecosystems.

Towards a global project on AP

One strategy for working towards a global project on AP involves developing regional and national centers of excellence- competing-but bidding for funding and benchmarking with international collaborating groups. Regional and national groups also could coalesce into consortia with data-sharing arrangements. Another approach involves collaboration mainly on global governance architecture, for instance through international agencies such as UN and UNESCO. A further technique could facilitate collaboration on sharing major infrastructure being built into grant requirements and proposals. Such models could utilise corporate and private sponsorship for GAP with major researchers as directors. They could also draw upon and modify governance models of existing macroscience projects- HGP; ITER, CERN.

What we are looking at here is a *macroscience* project on GAP similar to the Human Genome Project, the Russian and US Space Missions, the Hubble Telescope or the Nuclear Fusion (ITER) project to achieve this.

Great moral revolutions such as the abolition of slavery, emancipation of women and the cessation of child labour were based on the emergence of ideals in values and virtue. Yet in each case it was the advent of new technology that supported the economy that permitted these ideals to be indulged in governance arrangements.

Comentary

GAP could provide the same catalyst for what Boyden calls a Phase 5 Transition to a biosensitive society. In Faunce's terms, this transition is from a human-centric worldview to a nature- / universe-centric one. Humans take their moral role of stewardship seriously, natural entities are afforded enforceable rights, and social institutions designed to permit this enforcement.

Historical changes in technology have been particularly in relation to developments to permit better harvesting of energy. This parallels David Christion's thesis in *Maps of Time* wherein access to increased energy permits expansion of the human project, until the next limit is reached. (Christian 2004) In our modern society, the sector of society having particular undue influence has been energy corporations, reflecting this importance of energy supply, followed by transport (also energy but mobility too) and more recently the financial industry. Faunce's contention about ceding sovereignty to corporations is similar to Deetz idea that corporations have colonised out culture and our society. (Deetz 1992)

The application of GAP technology would enhance the transformations in local democratic governance and energy resilience being advocated by the Transition Towns movement. (Hopkins 2009)

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