Theroux Environmental

March 8, 2006

Commissioner James Boyd, Chair
Bioenergy Interagency Working Group
California Energy Commission

Attn: **Dockets Unit**
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512

DOCKET
6-BAP-1
DATE MAR 8
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SUBJECT: Docket No. 06-BAP-1
Comments: Bioenergy Action Plan

The Bioenergy Interagency Working Group has circulated a report entitled, "Draft Bioenergy Action Plan" and has requested public comment. We are pleased to respond, submitting the attached comments for consideration.

We commend the Energy Commission, the Interagency Working Group and Navigant Consulting for developing a concise and cohesive summation of the state of California's biomass-based energy, fuels and products use and development.

Thank you for the opportunity to engage in this important and timely effort; we will be available for discussion during the Public Workshop scheduled for March 9th at the Energy Commission.

Sincerely,

Theroux Environmental

Michael Theroux

Michael Theroux
Principal

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Comments:

Bioenergy Action Plan

Docket No. 06-BAP-1

General Comments:

Overall, the draft Bioenergy Action Plan perspective is correct:

> ***Far greater utilization of our western regional biomass resources must be brought about, through an integration of increased pubic awareness, agency support, and industrial development.***

The report clearly shows that the ancillary socio-economic and environmental benefits of a dramatically increased utilization of biomass extend well beyond the strict balance of commerce for energy. The net positive impact has to date not found proper valuation in the marketplace. Subsidization and externalization of "wellhead-to-tailpipe" costs, and a general malaise regarding true life-cycle impacts associated with petroleum-based fuels, energy and commodities have effectively discounted such benefits. This is despite repeated attempts by the Commission, by other state and federal agencies, and by the industrial community at large to bring these disparities to light.

Re-Invigoration Must Be Interagency

With Governor Schwarzenegger's direction that the Bioenergy Interagency Working Group be "Reinvigoration", we again seek to increase biomass utilization, and in so doing, slow the useless waste of our biomass resources. Yet our efforts in the past have in general failed to produce the results desired. The costs of energy, and the benefits of resource conservation in the generation of that energy, have not provided the impetus to secure biomass utilization as a significant source of heat, electricity, fuels and commodities.

While the draft report was intended to provide broad guidance to the Bioenergy *Interagency* Working Group (emphasis added), a quick scan of the reference documents for this draft clearly point to a problem: the emphasis has been and continues to be on the lead agency's purview, that of energy, while the problem statement and proposed goals span the breadth of our culture.

The Draft Bioenergy Action Plan extends beyond electricity into the areas of bio-fuels and other bio-commodities, but (a) lacks recognition that using the same approach may indeed bring about the same lack-luster result, and (b) lacks detail regarding what California *en toto* is presently doing that might impinge either positively or negatively on the stated goals.

This is an *excellent* summation of recent efforts of the California Energy Commission into promotion of bioenergy. We can collectively use this to launch more inclusive discussions toward forming public policy, but must somehow avoid past errors. We need to determine *why* combined efforts haven't been enough, and look for alternative paths to the same goals. Our comments are intended to build upon the concepts presented, and to offer a plausible approach for advancement.

Parallel Efforts

Synergies exist with on-going and intensive State-lead programs and should be thoroughly examined in finalizing the proposed Bioenergy Action Plan. Three key programmatic efforts are noted below that directly contain significance for Biomass Utilization.

H2 Highway: Perhaps the most glaring omission in the draft report: any reference to the Governor's "Hydrogen Highway" Plan[1]. The Plan evaluated the various options for hydrogen production and delivery in terms of availability / industry readiness, technical and economic barriers, and environmental impacts and considerations.

The focus of the Hydrogen Highway Blueprint was on production options that can eventually assure energy security and clean air for California. Both centralized and distributed production of hydrogen was considered in the comprehensive analysis. The various production options evaluated were: Electrolysis, • Reforming (principally of methane and methanol), • Photobiological and photoelectrochemical, • Biofermentation, • Pyrolysis and gasification of biomass and coal; High temperature thermochemical, • Membranes[2].

GHG: On September 24, 2004 the California Air Resources Board announced that they had approved a landmark regulation to reduce greenhouse gas emissions by model year 2009. Early in 2005, Governor Schwarzenegger announced greenhouse gas (GHG) emission reduction targets for California at the United Nations World Environment Day in San Francisco. [3]

As referenced in the draft Bioenergy Action Plan report, the California Biomass Collaborative[4] recognized that new industries utilizing biomass conversion technologies could significantly help to reduce GHG precursors and net carbon by substituting for fossil fuels. Air Basin emissions credit trading constitutes an additional aspect of market development needing consideration in the final report.

CTs: Noncombustion thermal [and non-thermal] technologies, referred to as Conversion Technologies or "CTs", provide significant promise as alternatives to landfilling of solid waste. AB 2770 helped to ensure that these technologies are compatible with the goals of the Integrated Waste Management Act, are environmentally beneficial when compared to landfilling, and produce beneficial byproducts, including electricity, for the marketplace. These technologies can produce clean burning fuel for the purpose of producing electricity, while having minimal environmental impact.[5]

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[1] On April 20, 2004, the Governor signed **Executive Order S-7-04** calling for the development of the California Hydrogen Blueprint Plan, completed and submitted May of 2005.

[2] Rollout Strategy Topic Team Report, CA 2010 Hydrogen Highway Network, Jan 2005

[3] **Executive Order S-3-05** establishes GHG targets and charges the California Environmental Protection Agency secretary with the coordination of the oversight of efforts to achieve them.

[4] California Biomass Collaborative Policy Committee Progress Report. (CBC). January 2004.

[5] From the Legislative Counsel's Digest for AB 2770, Conversion Technologies, signed into law September 20, 2002

Conversion technologies can offer substantial benefits for California, including production of renewable energy, reduced dependency on fossil fuels, and reduction of greenhouse gases. On a life-cycle basis, conversion technologies were found to be superior to recycling, composting, landfilling and transformation in terms of energy balance, NOx emissions, and carbon emissions.[6]

Barrier Identification

Three closely-linked specific difficulties have not been overcome by our past attempts; exploring each should provide direction.

***Technology*:** The lack of cost-effective, community- and small-industry scale systems necessary for distributed deployment, technologies and methods capable of the clean conversion biomass, has often been identified as a critical barrier to greater utilization. Big systems are hard to "feed"; the few small systems available are not yet broadly commercial, thus too expensive for common use.

If the economics of forest biomass conversion, for example, are not sustainable at other than massive scale, that market sector cannot be expected to create a demand for smaller, modular approaches. Sufficient variety of systems has not been carried forward from research and development into demonstration and validation, such that the public, the agencies, and the marketplace can find confidence in their integration.

***Feedstock*:** The cost of acquisition and transport of high-volume, low-value feedstock is particularly crippling when prices are based on the spot-market, yet lack of sustainable supply & demand foreshortens the economic range and hinders or precludes long-term contracting. Whether feedstock is generated from urban, agricultural or forest sources, acquisition and transport becomes super-critical as scale increases.

Even when biomass is in local abundance, transport remains a choke-point. Regionalization of facilities to accommodate economies of scale demands maintenance of a stabile delivery infrastructure, not inherent in the highly-variable supply of a very few types of feedstock.

***Market*:** Over-reliance on the vagaries of "as generated" electricity purchase removes too much control from the bioenergy producer. No diversity in the commodity market venues available eventually destabilizes the producer's supply-side infrastructure when this one-market path collapses, or settles into a balance that brings in less than the cost of the production, resulting in death by attrition.

Only recently have there been significant indicators that biofuels and bioproducts might supplant or at least augment electricity generation; still, thermal energy usage and the value of carbon sequestration (both attendant to most biomass conversion methodologies) remain just out of reach as viable western regional markets.

Overarching Concerns become "Alternative Drivers"

The most potent socio-economic "drivers" revolve around prominent issues that have caught the public's attention, and have become motivating forces dictating public policy.

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[6] Research Triangle Institute "Lifecycle and Market Impact Assessment of Noncombustion Conversion Technologies," contract report to CIWMB, 2005

At present, these drivers are creating conditions that are deeply influencing technical commercialization, resource management and market demand. These have the potential to accomplish many of the biomass utilization changes not achieved to date. These "work-arounds" need to be supported by integrated public policy, and optimized with our current goals in mind.

Paralleling, or perhaps even eclipsing the public's recognition of the need for *clean and renewable bioenergy,* are two overarching and inter-related emergencies. Our time may be best spent, working *with* this rising tide of public concern:

❖ ***Waste Management*** - Our urban regions now are confronted with a veritable tsunami of trash, a never-ending flow of our precious resources into expensive and less-than-reliable long-term containment "disposal" devises, called *landfills.* Our federal and state agencies and larger municipalities know that this tool, so long relied upon, has become incapable of addressing either the volume or the contamination, regardless increasing cost projections.

❖ ***Water Quality*** – Where landfills have long been the supposed secure means of *solid* waste control, our *liquid* wastes end up in the soil, aquifers and waterways. California agricultural production is about to be choked off at the "out-flow", if no economical alternative is found for effluent management. As one example familiar to the Energy Commission's *Ag Process Energy* program: shutting down much of the milk & dairy industry is now a distinct possibility, because the millions of gallons per day of liquid waste no longer have an acceptable place to be dumped.

Creating & Sustaining Access

California has not been able to implement integrated, community scale biomass utilization. The same appears true throughout the US: linking technology, feedstock and market access has been an almost insurmountable challenge. Where clean, efficient and functional biomass conversion tools were available, feedstock constraints often proved "deal killers". Where technology and feedstock could be secured, *interconnection* barriers precluded access to the meager market for wholesale of electricity. Even when interconnection rules began to ease bioenergy entry into the formative Renewable Portfolio Standard, dependence on sale of electricity alone seldom provided sufficient economic return to justify the high risk of emerging technical development.

❖ ***Access to appropriate technology*** for scalable, integrated biomass utilization must be improved, facilitating methods that are scalable, clean and diverse in both feedstock and product. As the report shows, Biomass constitutes a significant fraction of the urban waste stream.

If Waste Management has become such a driving force dictating public policy for our densely populated urban areas, then the *technical solutions* under consideration as alternatives to landfilling and "flushing" will incorporate methods for biomass management. Technologies for the conversion of the broader category of Waste into useful electrical & thermal energy, fuels and other co-products should prove applicable to a much broader array of biomass utilization problems. Much attention of late is being paid to *conversion technologies*, or "CTs", for their potential as alternatives to the disposal of the post-recycling Municipal Solid Waste residuals[7].

The converse is also true: this extension of concept for biomass utilization, that in addition to the many *benefits* provided, such increased usage can concurrently and significantly decrease *waste*, provides a quantifiable and very positive value that seems under emphasized in the draft Action Plan[8]. More detailed consideration of the life-cycle impacts of disposal, and to "use constituting disposal"[9] of such recyclable biomass resources, is warranted; in this way, valuation of biomass use will take into account a more comprehensive view.

❖ ***Access to a sustainable biomass feedstock supply*** depends on (a) the proximity of the conversion mechanisms to the sources of feedstock generation, (b) the status of the local acquisition and transport infrastructure appropriate to the diverse feedstock, (c) the scale of the conversion related to throughput rate, to match the local demand for heat, electricity, fuels and bioproducts, and (d) the socio-economic motivation for the biomass source to be a reliable supplier.

(a) Proximity: Characteristics of biomass feedstock supply have been studied extensively, as noted in the draft. Geographic information systems (GIS) data delineating sources are available and current for urban, agricultural and forest biomass sources, indicating the nature of the feedstock and the relative magnitude of the supply. Understanding where concentrations of acceptable biomass feedstock may be reliably obtained should help inform and direct policy. Siting facilities near the source concentrations minimizes transport costs and environmental impact.

(b) Infrastructure: Forest biomass collects at timber landings and at the wood lots and sawmills that process raw materials from silviculture and vegetation management. Agricultural biomass excess starts accumulating at the side of the field, mounds where crops and animals are collected and stored for future handling, and increases again during pre-consumer food processing. Municipal solid waste collection infrastructure delivers combined post-consumer waste streams through Transfer Stations and/or Material Recovery Facilities, or MRFs, and on to landfills.

The point is that each sector's waste stream exhibits an existing acquisition and transport infrastructure, in varying degrees of integration and efficiency. Our task is not to *create* a new infrastructure, but to *adopt & co-locate with* the local and regional mechanisms already in place. If a new wood lot, food processing plant, animal holding facility or MRF needs to be sited in order to ensure biomass feedstock supply continuity; at least we will have existing industrial templates to work from and existing regulatory framework to act as an environmental "safety net".

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[7] For State and Municipal assessments of "Conversion Technologies", see http://www.ciwmb.ca.gov/organics/Conversion/BioEnergy; www.lacity.org/san/alternative-technologies.htm; http://ladpw.org/epd/tf/conv_tech.cfm#Report;

[8] CIWMB's Waste Characterization: www.ciwmb.ca.gov/WasteChar/

[9] In part, per Code of Federal regulations, Title 40, Part 266, subpart C- Recyclable Materials Used in a Manner Constituting Disposal.
See http://frwebgate6.access.gpo.gov/cgi-in/waisgate.cgi?WAISdocID=59057054334+1+0+0&WAISaction=retrieve.

(c) Scale: Appropriate scale of biomass conversion must follow from inherent feedstock supply characteristics. To place modular systems closer to the source, we must find ways to move modular biomass conversion systems research and development into fully commercial, economical production. As each element supports the other, a greater emphasis on modular technologic commercialization will in turn help stabilize the more regional feedstock supply network, by facilitating a "cascade" of utilization from local source to final regional hub.

(d) Motivation: The near-total collapse of California's large-scale bioenergy facility industry (following on the 1996 changes to regulations governing power purchase agreements) has been well documented, and exemplifies the dangers to industries and communities alike of a one-feedstock, one-market economic structure. As big bioenergy plants cut back or shut down, rural communities that relied heavily on sale of wood chip to that demand became stranded; the impacts continue to be felt today. Transport heuristics of that "chip market" prior to, during and following collapse could help us understand the realities we face, with this resurgence in interest to promote bioenergy. Foothill communities already know that the lessons can be devastating.

Today, the maximum allowable contaminant loading has been reached or exceeded in many aquifers and fields. This has so tightened waste discharge allowances that large sectors of the milk, dairy and animal husbandry industries now face imminent closure. Although technical solutions may exist, economies remain marginal at best. Management shifts from one form or location of disposal to the next least costly. Recognizing this biomass as a *resource*, and responding with local, state and federal support *at least equal to* the degree of penalties levied, could intercept the highest contaminant sources and convert them into the most reliable feedstock supplies. The largest overall gain is experienced when liabilities are converted into benefits.

❖ ***Access to sustainable, diverse markets*** requires going beyond the wrangling for Power Purchase Agreements (PPAs). In order to succeed at state-wide bio-commodities redevelopment (assuming for the moment that we can surmount questions of appropriate technology and sustainable feedstock supply), we need to sustain production flow to market of a broad array of clean, economical and quality-assured bioproducts.

Perhaps first in this arena: Biofuels. The draft report focuses on burgeoning production of ethanol and biodiesel, but points out that demand still grossly exceed regional production. But two problems are becoming critical to address: (a) technical barriers to dependence on ethanol, in our most advanced and high efficiency engines (both for transport and stationary usage), and (b) lack of adequate technical validation programs and facilities, ready to match engine to biofuel to emissions. Ethanol alone has a low vapor pressure, causing separation from other fuels at higher temperatures and pressures; ethanol also weighs more, comparatively, than its petroleum counterparts, and greater fuel loading reduces overall efficiency. The final Bioenergy Action Plan needs to approach both difficulties, exploring "next generation" biofuels, and supporting creation of a western regional External Technology Validation complex with the ability to certify specific biofuels foundation chemicals and blends.

Yet economics of green fuels production from post-recycling waste residuals appear better than economics for "electric first" CT facility design. Waste derived green fuels production can include hydrogen, ethanol, methane and methanol, biodiesel blended to ASTM specifications including but not limited to trans-esterification biodiesel, Fischer-Tropsch liquids, and ancillary emulsifiers, lubricants and acids necessary for blending biofuels. Economics of on-site (at the source) conversion of biomass to gaseous and liquid intermediary products including biofuels as an element of processing integrated with combined heat and power production, should be modeled in considered of biomass utilization project development.

Biomass and fuels derived from biomass can be used to produce renewable hydrogen. H2 fueling may not be economical on a state-wide basis at this time, but the ability to do so is of particular interest. Multi-fuel "energy stations" that can be economically self-sustaining if created now, such as biogas, syngas, or ethanol and other liquid fuel production facilities, may be seen as **"latent hydrogen stations".** If and when the market demand for hydrogen increases in an area served by a MRF-based multi-fuel energy station, capital cost would be minimized for siting and permitting, for conversion of biofuels to hydrogen and installation of H2 storage, and for the addition of H2 "pumps" that can dispense fuel-grade H2 to the public.

Recommendations[10]

- **Integrate the Bioenergy Action Plan within the current Hydrogen Highway and Greenhouse Gas Emissions Task Force structure,** furthering consideration of synergies between urban, agricultural and forestry integrated waste management, conversion of crops, by-products and post-recycling wastes into green fuels and hydrogen, implementation of the Hydrogen Highway, and reduction of greenhouse gases.
- **Expand the resulting Bioenergy / Hydrogen Highway "roll-out plan" to consider socio-economic and environmental costs and benefits of creating self-sustaining multi-fuel "energy stations", based on conversion of the many forms and sources of biomass**. Outline a plan for expansion of multi-fuel capability, with staged addition of fuel grade hydrogen to highest priority station locations. Expand current Hydrogen Highway permit standardization and streamlining efforts to include conversion technology biofuels production facilities (biorefineries). Expand current biofuels standardization.
- **Increase scope of anticipated Bioenergy Action Plan, Hydrogen Highway and Greenhouse Gas Emissions reduction funding to assist in Conversion technology research, development, demonstration and on-going emissions assessment.** Seek federal assistance and direct involvement. Provide state guidance and support to integrate current Hydrogen Highway and Greenhouse Gas Emissions reduction plans with on-going agency, municipality, institutional and industrial efforts toward conversion technology deployment.
- **Expand current Public Outreach messages to include utilization of non-incineration Conversion technologies.** Incorporate findings and on-going assessment programs by the Integrated Waste Management Board, the University of California and the City and County of Los Angeles. Incorporate findings and on-going assessment programs by government, academic and private organizations in California related to Biomass Utilization and Conversion Technologies, emphasizing ability of non-incineration conversion technologies to produce clean-burning biofuels, including hydrogen.
- **Assess economics of an implementation model using expansion of California's existing waste management, recycling and resource recovery infrastructure to incorporate conversion of biomass to green fuels, including fuel grade hydrogen**. Consider aspects of vertical integration for representative conversion facilities and multi-fuel stations, including efficiencies from on-site combined heat, cooling and electricity production.
- **Materials Recovery Facilities can host technologies for conversion of waste to biofuels and renewable energy, and would facilitate multi-fuel "energy station"**

[10] From "Exploring Synergies: The Hydrogen Highway Network (H2Net) Conversion Technologies (CTs) & Biofuels Greenhouse Gas Emissions (GHG) Reduction", June 2005. White paper & presentation to then-Secretary of the California EPA, Dr. Alan Lloyd, by a 20-member contingent representing industries, agencies and associations, chaired by this document's author, Michael Theroux.

deployment at or near the MRF. California has a state-wide integrated waste management infrastructure with a strategic network of MRFs. These visible, accessible locations could encourage the transition to biofuels for public use, facilitate fueling municipal and waste hauler fleets, and displace the MRF's on-site diesel use with biofuels. Integration of these could include provision of power, heating, and cooling the MRF and surrounding buildings. Economics need to be assessed; by carefully planning, such "energy stations" could also reduce the life cycle cost of waste management.

- **Co-located production of biofuels from conversion of agricultural wastes at existing large commercial operations (such as food processing plants and dairies) and other locations where agricultural biomass (such as rice straw) can be economically aggregated would facilitate development of multi-fueling stations along rural segments of the interstate freeways that connect urban centers.** The integration of bioenergy and biofuels facilities with agricultural operations can provide onsite distributed energy, environmentally sound alternatives for waste product management, and new economic development opportunities for California agriculture.
- **Large-volume MRFs and large agricultural operations that currently aggregate biomass feedstock and that could host "energy stations" are located in close proximity to interstate freeways.** Developing a strategic network of co-located biorefineries at such facilities can greatly accelerate the commercialization of hydrogen in California by establishing an intermediate biofuels platform from which hydrogen can be derived. Establishment of "energy stations" offering a diversified suite of renewable fuels with immediate markets will provide greater access to private capital for infrastructure funding.
- **Rule of the 5 E's:** Assess all options for Economics (E1), Environmental Friendliness (E2), Energy Efficiency (E3), an Evaluation (E4) of each technology's viability, and Effectiveness (E5) (e.g. socio-political factors such as government regulations, organizational objectives, environmental stewardship and stakeholder needs).