Public Utilities Commission

Docket No. 05-0145

O`ahu Power Plant

Testimony of

Henry Curtis

Vice President, Life of the Land

re HECO's Proposal

LOL T-2

My name is Henry Curtis. I am Vice President of Consumer Issues for Life of the Land.

Education

I attended Queens College, City University of New York. I have a B.A. in Theoretical (Mathematical) Economics, and completed my graduate course work but not my masters thesis for my M.A. in Theoretical Economics. I focused my graduate thesis research on macroeconomic agricultural policy.

I became intrigued with the fact that during the early 1930s Brazil adopted macroeconomic policies which led to a significant loss of their world trade in coffee. The Great Depression caused a huge drop in world coffee demand. State coffee price support programs in Brazil failed. The Brazilian federal government stepped in to protect prices, and purchased and destroyed huge amounts of coffee. Taking advantage of the situation, Colombia sharply increased its coffee exports, undercutting the Brazilian industry. Consumers in the largest coffee consumption country in the world, the US, switched their preference from harsher Brazilian coffee to milder Colombian coffee. I sought to build an Input-Output Model for the Brazilian economy, but due to inadequate and unreliable data, I was forced to switch topics. I pursued my graduate research in California, studying the international grain trade and agricultural commodity market futures. I studied at the Stanford, UC Davis, UC Berkeley, UC Santa Cruz, UC Santa Barbara, and UCLA libraries.

I became involved with the California environmental movement, focusing chiefly on unsustainable agricultural policies. I moved to Hawai`i in 1991, joined the Life of the Land

Board in 1994, and became the Executive Director in early 1995. The major issues I focused on were land use and toxics. I served on military Restoration Advisory Boards (RAB) and Technical Review Committees for the Army, Navy and Air Force, serving as co-chair of the Hickam AFB RAB for 9 years. The major military cleanup focus dealt with hydrocarbon contamination. In 1996 Life of the Land became involved with HECO's proposal to build a 138-kV Transmission Line on Wa`ahila Ridge. I recently calculated that I spent more time over the past 10+ years learning about energy issues than everything I studied and learned in my combined undergraduate and graduate education. Now with the rise of the ethanol controversy, I sought to investigate all sides and decide for myself. Ironically, that is how I met Dr Tad Patzek. I initially questioned his research since he was connected to the oil industry. (See LOL-EXH-BF-1). Upon reading further, I came to appreciate his encyclopedic knowledge and his deep understanding of thermodynamics and fuels. I have returned to my starting point, establishing contacts in Brazil, and delving deep into world agricultural policy. I intrinsically understand this area.

Fossil Fuels

Fossil fuels are hydrocarbons, such as natural gas, coal or petroleum, which are derived from living material that died millions of years ago. Hydrocarbons are ranked by the number of carbon (C) atoms in the molecule. The more carbons, the heavier the compound. At room temperature, the first four -- CH4 (methane), C2H6 (ethane), C3H8 (propane) and C4H10 (butane) -- are gases, hydrocarbons with 5 to 18 carbons are usually liquids, and hydrocarbons with more than 18 carbons are usually solids. Hydrocarbons are given special names for the amount of carbon (C) atoms: gas (C1-C4), naphthas (C5-C7), gasoline (C5-C12), Kerosine (C10-C16), Diesel (C15-C22). Gasoline has a legal definition that varies by location.

Historical Use of Fossil Fuels

Historically, fossil fuels transformed the world from a pre-industrial era to a post-industrial era and into the information/technology era. However, the rapid advancement of society has come with enormous negative externalities. Climate changes caused by mankind threaten our very existence, perhaps not in our generation, but in the coming generations.

CLIMATE

Climate Change

Climate Change refers to systematic changes to climatic elements (wind, pressure, temperature), caused by natural or man-made (anthropogenic) events.

Greenhouse Gases

Greenhouse gases are gases, such as water vapor, carbon dioxide, nitrous oxide, methane, sulfur hexafluoride, hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs), that allow solar (short-wave) radiation to penetrate the atmosphere but prevent (long-wave infrared) radiation from escaping the atmosphere, thus trapping heat and warming the planet.

HECO re Greenhouse Gases

HECO does not seriously concern themselves with greenhouse gases. In their Externalities Handbook, they could not determine what value to assign carbon dioxide emissions, so they gave it a value of $0/ton. In HECO's current Integrated Resource Planning process (HECO IRP-3),

HECO did consider one bizarre plan with a green label. Of the 7 alternative plans they considered, HECO identified one as the "Maximize Renewable Energy Plan. " Over a 2 decade period, this plan would emit over 150 million tons of carbon dioxide, the chief greenhouse gas, over 9000 tons of Volatile Organic Compounds, over 56,000 tons of Carbon Monoxide, over 320,000 tons of Nitrogen Oxides and over 300,000 tons of Sulfur Oxides. (Source: HECO-220H).

The Insurance Industry

The insurance industry is concerned about climate change. For example, Lloyd's (formerly Lloyd's of London) issued a report "360 Risk Project: climate change: ADAPT OR BUST" (www.lloyds.com/360). (LOL-EXH-GW-3) The report stated:

> "Although debate continues, the growing body of evidence on greenhouse gases suggests that significant climate change is inevitable. Even if we stopped producing greenhouse gas emissions immediately, we would still experience rising temperatures for decades to come and sea temperatures will continue to rise for many centuries, due to inertia in the climate system.
>
> We might hope that extreme 'tipping points' – the point beyond which change cannot be reversed – can be avoided. However,

> evidence so far must lead us to conclude that some level of change has already occurred and that it will continue to occur, perhaps at a higher level than previously thought."

The Department of Defense

The Department of Defense studied the climate change threat. A Report "An Abrupt Climate Change Scenario and Its Implications for United States National Security" (October 2003), written by Peter Schwartz and Doug Randall, analyzed one potential future climate scenario. (LOL-EXH-GW-1)

> Imagining the Unthinkable. The purpose of this report is to imagine the unthinkable – to push the boundaries of current research on climate change so we may better understand the potential implications on United States national security. ... We have created a climate change scenario that although not the most likely, is plausible, and would challenge United States national security in ways that should be considered immediately. ...
>
> There is substantial evidence to indicate that significant global warming will occur during the 21st century. Because changes have been gradual so far, and are projected to be similarly gradual in the future, the effects of global warming have the potential to be

manageable for most nations. Recent research, however, suggests that there is a possibility that this gradual global warming could lead to a relatively abrupt slowing of the ocean's thermohaline conveyor, which could lead to harsher winter weather conditions, sharply reduced soil moisture, and more intense winds in certain regions that currently provide a significant fraction of the world's food production. With inadequate preparation, the result could be a significant drop in the human carrying capacity of the Earth's environment.

The research suggests that once temperature rises above some threshold, adverse weather conditions could develop relatively abruptly, with persistent changes in the atmospheric circulation causing drops in some regions of 5-10 degrees Fahrenheit in a single decade. Paleoclimatic evidence suggests that altered climatic patterns could last for as much as a century, as they did when the ocean conveyor collapsed 8,200 years ago, or, at the extreme, could last as long as 1,000 years as they did during the Younger Dryas, which began about 12,700 years ago. ...

The Cooling Event 8,200 Years Ago. The climate change scenario outlined in this report is modeled on a century-long climate event that records from an ice core in Greenland indicate occurred 8,200

> years ago. Immediately following an extended period of warming, much like the phase we appear to be in today, there was a sudden cooling . Average annual temperatures in Greenland dropped by roughly 5 degrees Fahrenheit, and temperature decreases nearly this large are likely to have occurred throughout the North Atlantic region. During the 8,200 event severe winters in Europe and some other areas caused glaciers to advance, rivers to freeze, and agricultural lands to be less productive. Scientific evidence suggests that this event was associated with, and perhaps caused by, a collapse of the ocean's conveyor following a period of gradual warming.

Articles about this report appeared in major science and business magazines, such as Chemical and Engineering News (March 1, 2004) (LOL-EXH-GW-7) and Fortune Magazine (Feb 25, 2004) (LOL-EXH-GW-8). As they noted, the Department of Defense study found that climate changes can lurch from one state to another, similar to the rocking of a boat which suddenly and abruptly flips. Such an occurrence would have a greater impact that all wars ever fought combined.

The Religious Community

The religious community is concerned about climate change.

Earlier this year, a group of evangelical Christians, usually supporters of President Bush's policies, announces it is breaking with the White House to back legislation that will fight global warming. The 86 signers included: Jo Anne Lyon, executive director of World Hope International, James Dobson, head of Focus on the Family; Charles Colson, founder of Prison Fellowship Ministries; the Rev. Richard Land of the Southern Baptist Convention; Richard Roberts, president of Oral Roberts University; Donald Wildmon, head the American Family Association; and the Rev. Louis Sheldon, head of the Traditional Values Coalition.

Evangelicals founded "The Evangelical Environmental Network" (www.creationcare.org/) which was formed because they recognized that many "environmental" problems are fundamentally spiritual problems. Member organizations include the Baptist General Convention of Texas, Association of Evangelical Relief, Council for Christian Colleges and Universities, Christian Reformed World Relief Committee, International Bible Society, Mission for United Methodists.

Sponsoring Exhibits

I am Sponsoring Exhibits LOL-EXH-GW-1, 3, 7, and 8.

LOL-EXH-GW-1 The Department of Defense Report "An Abrupt Climate Change Scenario and Its Implications for United States National Security" (October 2003), written by Peter Schwartz and Doug Randall

LOL-EXH-GW-3 Lloyd's (formerly Lloyd's of London) Report "360 Risk Project: climate change: ADAPT OR BUST"

LOL-EXH-GW-7 Chemical and Engineering News (March 1, 2004)

LOL-EXH-GW-8 Fortune Magazine (Feb 25, 2004)

BIOFUELS

Ethanol

A. Unlike the terms fossil fuel or gasoline, ethanol is not a collection of hydrocarbons with a range of carbon atoms, but rather is a specific chemical CH3CH2OH (C2H6O). Most ethanol is produced from sugarcane. The US uses corn. France uses beets. Most of the rest of the world uses sugar.

Role of Ethanol in this Docket

This docket deals with ethanol and other biofuels. The Commission's Stipulated Procedural Order No. 22381, Issue 2b states: "Is it reasonable to use naphtha, low sulfur diesel, biofuels or blends thereof in the proposed combustion turbine?"

It's interesting that HECO, a company that has stifled innovation, is choosing to build the first power plant in the world to run on ethanol. "The unit will also be capable of operating on alternate fuels such ethanol, biodiesel, or blends thereof. ... Ethanol is a fuel that is derived from

agricultural crops (e.g., sugarcane, sorghum, corn) through a distillation process or from any cellulose material (including "green waste") through a biochemical conversion technology. While the distillation process is state of the art, the biochemical conversion technology is still under development. ... ***there are no other combustion turbine generator units in the world that use ethanol or blends of ethanol***. ... As currently planned, a single combustion turbine at Campbell Industrial Park, using a 50% blend ratio of naphtha + ethanol would require about 7 million gallons of ethanol per year." (HECO T-9)

"From a policy standpoint, Hawaiian Electric hopes that its solicitation of interest for the utilization of ethanol in the production of electricity will contribute to the creation of an agricultural energy business in Hawaii which grows the feedstock for ethanol in the islands as well as refining it here. This is a policy issue that Hawaiian Electric ***anticipates will be reviewed by the Commission*** and other State agencies with concerns about the development of agriculture and renewable energy." (HECO T-12)

There will be 50 MW of ethanol in the new plant; and 83 MW of ethanol or bio-diesel in existing plants. (Full Page HECO Ads in the local newspapers starring Jade Moon).

This docket offers the Commission to first opportunity to rule on ethanol and other biofuels as a power plant fuel.

Ethanol Energy Balance

There is an international debate going on dealing with the energy balance of crops, i.e., what the

amount of energy created (BTUs) is relative to the amount of energy used (BTUs). If the energy input are fossil fuels that can be used for transportation and/or electricity, and if the outputs are ethanol and biodiesel that can also be used for transportation and electricity, then the agricultural conversion process is simply a storage mechanism. The process gains a little photosynthesis energy, and loses energy since all conversion processes lose usable energy (Second Law of Thermodynamics). There may be some net gain or loss of BTUs. The increased use of fossil fuels by the unregulated agricultural industry and the corresponding decrease of fossil fuels by the regulated utility industry is a form of fuel laundering. The Commission has the right and the obligation to review this.

Greenhouse Gases

A. There is evidence that corn ethanol lowers greenhouse gas emissions from 12-29%. The reductions range from the absurd comment by the National Corn Grocers Association: "Because the energy balance of ethanol production is positive (1.67 to 1), greenhouse gas benefits are also positive." (LOL-EXH-BF-2) to more thoughtful analysis: Argonne National Lab and the US Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE): On a per-gallon basis ... corn ethanol reduces GHG emissions by 18% to 29% (LOL-EXH-BF-3) Monsanto: Putting ethanol instead of gasoline in your tank saves oil and is probably no worse for the environment than burning gasoline, according to a new analysis by researchers at the University of California, Berkeley. ... Despite the uncertainty, it appears that ethanol made from corn is a little better - maybe 10 or 15 percent - than gasoline in terms of greenhouse gas production. (LOL-EXH-BF-4) American Oil Chemists' Society: University of Minnesota study found "corn grain ethanol produces 12 percent less greenhouse gas emissions than gasoline."

(LOL-EXH-BF-5). Ethanol may be slightly better, but it will not stop destructive climate change.

Environmental Externalities

Sugar production in Hawai`i led to groundwater contamination, non point source pollution, damage to the coral reefs, and health issues surrounding the burning of sugar. Burning sugar fields is directly related to asthma and other health issues. Bank Sarasin (Switzerland) published a port 'Biofuels May Not Be Sustainability Panacea' (August 02, 2006) (LOL-EXH-BF-6) noting that there are several negative impacts, including (1) Environmental impacts of monocultures, (2) Increased rainforest clearance in developing countries for growing biofuel stock, (3) Negative impacts on food prices, (4) Higher costs than other forms of carbon reductions, (5) Harsh agricultural labor conditions, and (6) Increased use of genetically engineered crops. Obviously not all apply in Hawai`i, but we also have other negative impacts. While there is great controversy concerning the long-range impacts of genetic engineering, no one is reviewing using genetic engineering to create energy crops and to create microbes to break down these crops into ethanol. Biofuels do have some positive externalities: (1) keeping areas green; (2) keeping areas unpaved, allowing for aquifer recharging; (3) minor reductions in some greenhouse gases; and (4) economic diversification.

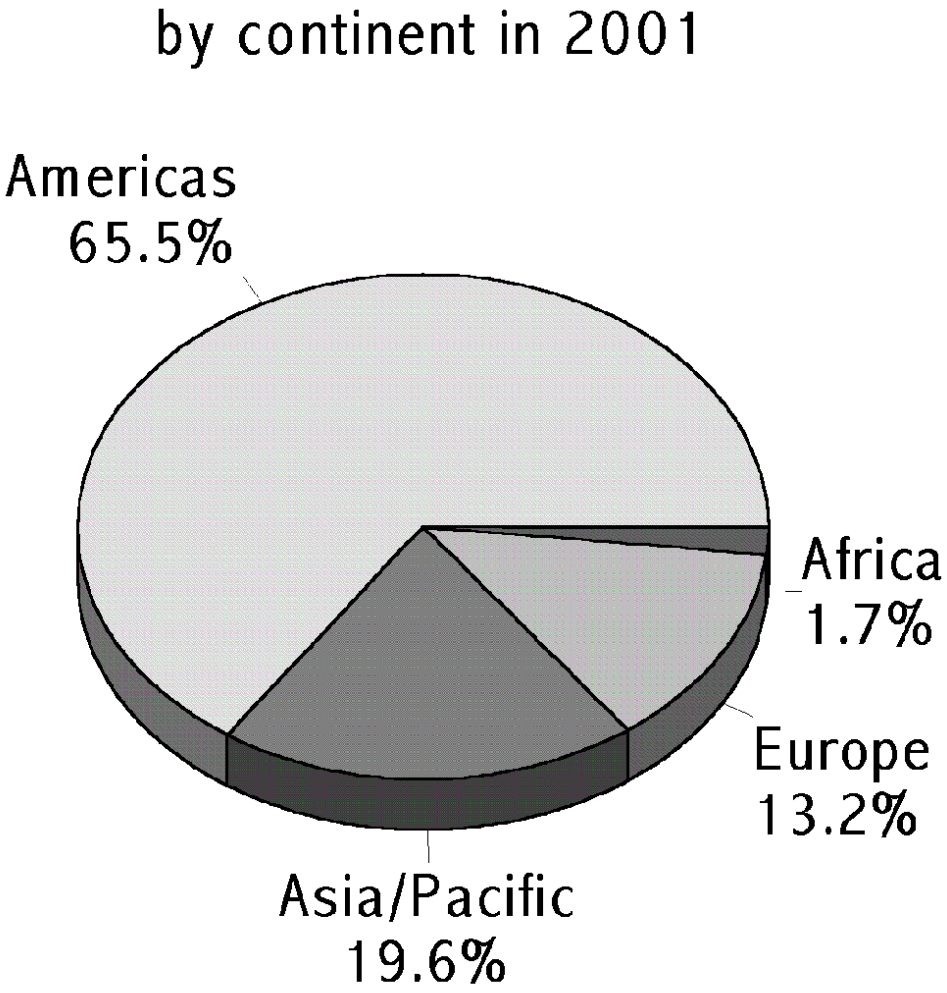
Issues for the Commission

The state constitution was amended in 1978 strengthening protection of the environment, and the public trust doctrine. Sugar uses a large amount of water, a public trust resource, which has led to extensive administrative and court actions (Waiahole, Io, East Maui Irrigation). The Commission is required to follow the constitution, to protect the public trust, to safeguard the environment.

The Commission and the Department of Health are the only state agencies with regulatory oversight at this time. It is important, in the first proposal to burn ethanol in a power plant (anywhere in the world), to get it right. The Commission is the correct place to hear the ethanol witnesses, and to evaluate the evidence upon the cross-examination.

Ethanol Production

Brazil and the US dominate world ethanol production. In 2001, and 2005 world production was 33 and 45 billion liters respectively. Brazilian ethanol grew from 11.9 to 16.1 billion liters and US ethanol grew from 7.6 to 16.2 billion liters. Other major producers are: China, India, France, Russia. (LOL-EXH-BF-7)



(LOL-EXH-BF-8)

Brazil

*** Ethanol proponents often use Brazil as an example. Brazil converted their energy production to ethanol, se we should follow their lead. This simplistic analysis is stated often but understood far less.**

*** Ethanol has not made Brazil energy self-sufficient. In fact, among vehicular fuel use, ethanol ranks third, behind diesel and gasoline.**

* It is irrelevant whether most Brazilian cars can run on ethanol. The is analogous to Detroit receiving tax breaks for making cars that can run on ethanol, and then failing to tell those who bought the cars that the cars can run on ethanol. The talk, and the tax breaks are irrelevant. The walk is what matters. Ethanol ranks third as a transportation fuel in Brazil.

* The United States Department of Energy's Energy Information Agency (EIA) County Analysis Brief on Brazil (2005) states:

"Brazil has made great strides over the past decade in increasing its total energy production, ***particularly with regards to oil.*** Increasing domestic oil production has been a long-term goal of the Brazilian government." Brazil is becoming energy self-sufficient. Brazil is drilling more off-shore oil wells, increasing its use of natural gas and coal, and has nuclear power. Just because Brazil has ethanol and is becoming energy self-sufficient does not mean that the two are related.

The EIA website states: ‘‘In 2001, Brazil was the third largest energy consumer in the Western Hemisphere and the largest in Central and South America. In 2001, Brazil consumed approximately 8.8 quadrillion Btus (quads), slightly above Mexico (6.0 quads), but below both the United States (97.1 quads) and Canada (12.5 quads). Petroleum accounts for about 51% of Brazil's total energy consumption, hydroelectric power 31%, renewable energy sources 13%, natural gas 4%, and nuclear 1.7%. Though Brazil consumes 2.2% of the world total energy, the

country is responsible for only 1.5% of total world energy-related carbon emissions, due in part to the country's heavy dependence on hydroelectricity. Brazil emitted 95.8 million metric tons (MMT) of carbon in 2001. Though still the largest carbon emitter in Central and South America, Brazil ranks fourth in the Western Hemisphere behind the United States (1565.3 MMT), Canada (156.2 MMT) and Mexico (96.1 MMT).'' (LOL-EXH-BF-9)

The EIA notes that Brazil has 10.6 billion barrels of proven oil reserves, produced 0.4 million barrels per day in 1980, growing to 1.8 million barrels per day in 2000, representing a growth rate of 9%/year. Rio de Janeiro state accounts for 80% of the total production, most of which is offshore in very deep water and consists of mostly-heavy grades. Petrobras controls virtually all Brazilian crude oil production. Brazil is seeking to expand its coal operations to become self-sufficient by 2010 and eventually a net exporter. Brazil has 8.8 trillion cubic feet of proven natural gas reserves. Brazil has rapidly increased its use of natural gas, from 42 billion cubic feet in 1980 to 500 billion cubic feet today. Natural Gas accounts for about 6% of total energy consumption. Petrobras controls over half of the natural gas wholesale market. The dominant fuel used to generate electricity comes from hydroelectric dams, both Brazilian and imported. The other 6-16% comes from a mix of conventional thermal plants, nuclear and non-hydro renewables. Over half of the cars are flex-fuel meaning they can run on 100% ethanol. But they don't. Ethanol ranks third as a transportation fuel, behind diesel and gasoline.

Chemical Engineer Robert Rapier notes: "According to BP's recently released 'Statistical Review of World Energy 2006', Brazil consumed 664 million barrels of oil in 2005. In 2005, Brazil produced 4.8 billion gallons of ethanol, or 114 million barrels. However, a barrel of ethanol

contains approximately 3.5 million BTUs, and a barrel of oil contains approximately 6 million BTUs. Therefore, 114 million barrels of ethanol only displaced 67 million barrels of oil, around 10% of Brazil's oil consumption. In other words, Brazil's energy independence miracle was 10% ethanol and 90% domestic crude oil production. Therefore this claim, despite being constantly repeated, is false. It presents a very misleading picture of Brazil committing to ethanol, and then farming their way to energy independence. In fact, they drilled their way to energy independence. ... According to a March 2006 presentation by the Brazilian Ministry of Mines and Energy, the actual breakdown of vehicle fuels in Brazil at the present time (by volume) is 53.9% diesel, 26.2% gasoline, 17% ethanol and 2.9% natural gas." (LOL-EXH-BF-10)

Hydroelectric

Brazil should not increase its hydroelectric capabilities. There is a danger in relying on one major fuel source. Just as Hawai`i imports of oil is impacted by world oil shortages, Brazilian hydroelectric power is impacted by natural changes in climatic conditions. Ethanol will also be impacted by climatic conditions, both natural and man-made. Our impact on climate will likely have major impacts on future agricultural patters.

Description of Brazil

Brazil is the fifth largest country in the world, after Russia, Canada, China and the US. Brazil is also the fifth most populous country in the world, after China, India, the US and Indonesia. The population is about 190 million, will about 80% living in urban settings. Fourteen cities have populations over 1 million people, and Brazil has 8 of the 100 largest cities in the world. Sao Paulo ranks fourth among world cities with a population of 18,000,000. Brazil is now the world's

third agricultural food exporter - following the European Union and the United State. Sugarcane occupies 2.4% of cultivatable land in Brazil or nearly 5.6 million hectares. Brazil produced 19% of global sugar production (2003), 32% of global sugar exports (2003), and 37% of world ethanol production (2004).

Sugar Operations in Brazil

Brazil has two sugar growing regions. The North/Northeast accounts for almost a quarter of the sugar produced, with more used for sugar export and less for ethanol production. The Center/South region accounts for 90% of the ethanol production, 70% of the sugar produced, and 75% of the sugar cane grown. The state of Sao Paulo in the Center/South region accounts for 60 percent of the country's sugarcane production.

Sao Paulo

Sao Paulo state is about 95,000 square miles, or about 9 times the size of Hawai`i. It is slightly smaller than Oregon, Wyoming or Michigan. The state is the financial, industrial, commercial and agricultural hub of Brazil. The state population is 33 million, and is predominantly haole (65% Caucasian), 20% mixed, 10% Asian and 5% black. Sao Paulo is home to 3 million Italians, 1 million Japanese, 1 million Arabs, 1 million Portuguese, and 1 million East Europeans. There are no large natural lakes in the region, but the Guarapiranga and Billings reservoirs are used for power generation, water storage, and recreation.

The city of São Paulo is the fourth largest city in the world, with a population of about 18 million, and occupies an area of 3000 square miles. Sao Paulo is really two cities, one with the

highest living costs in Latin America, gated communities, high-rise secured condominiums, trendy restaurants, museums, sport arenas, etc. and the other a city where over 800,000 people live in favelas (shantytowns), crime rates are high, police brutality is high, where there is currently an on-going gun battle between the police and a major gang, park space in inadequate, floods are common, air pollution is high. The two rivers crossing the city, the Rio Tietê and the Rio Pinheiros, are severely polluted.

Adopting the Best of Brazil

It is naive to believe that we can choose to adopt Brazilian ethanol experience, while ignoring the Brazilian environmental, labor, energy and social impacts. It is even more naive to embrace the Brazilian experience without even being aware of these other impacts. Ceteris paribus is Latin for "all other things being equal." In basic economics it is often assumed that changing one variable will only impact the other thing you are studying. Altering supply affects demand only, and not velocity (how often the average dollar is spent), investments or balance of payments. The ceteris paribus arguments are best left to introductory school lessons.

The USDA noted in July 2006: "Currently, no U.S. plants are producing ethanol from sugar feedstocks. As a result, no data exist on the cost of producing ethanol from sugar feedstocks in the United States. Brazil and several other countries are producing ethanol from sugarcane, sugar beets, and molasses, demonstrating that it is economically feasible to convert these feedstocks into ethanol. However, the economics of producing ethanol from sugar feedstocks in these countries is not directly comparable to the economics of producing ethanol from sugar feedstocks in the United States. The prices of sugarcane and sugar beets, sugarcane and sugar

beet production costs, ethanol production facility construction and processing costs, and government sugar and ethanol policies and programs vary considerably from country to country. For these reasons, the above cost of production figures for converting sugar feedstocks may be imprecise. (USDA (2006) (LOL-EXH-BF-11. Summary and Conclusions , page vi)

Environmental Conditions in Brazil

There are few environmental laws and less enforcement. While the issue of the loss of the Amazon rainforest is well documented, the impacts due to sugar are far less documents. There is no direct relationship between the Amazon rainforest and ethanol. Sugar is not grown there. An indirect relationship may exist as some agriculture is displaced by sugar, and as some multinationals, such as Cargill, have eyed the Amazon as an area for expansion.

Labor Conditions in Brazil

Labor laws are weak in Brazil. Brazil has a small elite and a very large lower class. There are a number of ways of measuring income equality. Regardless of which is used, Brazil ranks in the bottom 2% of world nations in income equality. The GINI Index places them at country number 157 of 160, with only three small African countries ranked worse. As the OECD recently said: ‘’The distribution of income remains stubbornly skewed in Brazil’’. The upper 1% owns nearly half the land. Two thirds of the population makes minimum wage or less, with half of them making less than half of that. There has been runaway inflation for decades: $100 billion in 1945 would be worth $1 today.

Brazil become a major Ethanol Player

A. Brazil became a major ethanol player following the Arab Oil Embargo. A military dictatorship massively subsidized wealthy agricultural players and imposed ethanol as the solution.

HECO

It is the responsibility of the proposing party to lay out the necessary justifications. As of today no ethanol plants have been approved in this state.

Ethanol Plants in Hawai`i

Ethanol Plants have been proposed in Hawai`i. They include: (1) Maui Ethanol LLC (William Maloney): Puunene, Maui; (2) Maui Ethanol LLC (William Maloney): Kaumakani, Kauai; (3) Worldwide Energy Group Inc (Eric Darmstaedter): Kaumakani, Kauai; (4) Kauai Ethanol LLC (E. Alan Kennett): Kaumakani, Kauai; (5) Oahu Ethanol Corporation (Daniel KenKnight): Campbell Industrial Park, Oahu; (6) Aloha Ethanol/Hamakua (Sam Monet) Hilo, Hawaii

Sugar growers on Maui and Kauai are debating whether they should create ethanol themselves, outsource it to someone else, or abandon pursuing ethanol. They are also debating what energy crops make sense, if any.

Maui Ethanol's Application

The only company to file for permits to build an ethanol plant in this state is Maui Ethanol LLC. They filed applications with the Department of Health for plants on Maui and Kauai. Their Maui

application is being withdrawn.

According to an application filed with the Hawaii Department of Health, Maui Ethanol LLC proposes to burn 4.18 pounds of imported Australian coal for every gallon of ethanol produced. The BTU content of the coal represents 58-63% of the BTU content of the ethanol produced. The plant would not sell excess power to the grid.

Biofuel in Hawai`i

There are other proposals for biofuels in Hawai`i. Pacific Biodiesel collects used cooking oil for biodiesel. The current supply is sold for transportation use. The company is investigating growing dedicated energy crops toincrease biodiesel production. Recycling cooking oil makes economic sense. Growing virgin oil for biodisel use has impacts both similar to and different from ethanol production.

Recent Ethanol Reports and Briefs

A. I have reviewed the the USDA report "The Energy Balance of Corn Ethanol: An Update" (July 2002) by Hosein Shapouri, Stillwater Report (2003), NRDC report 'Growing Energy' (2004), Ethanol Across America's Ethanol Issue Brief" (2004), the 2006 Farrell Study, and the 2006 USDA Sugar Study by Dr. Hossein Shapouri.

The 2002 USDA Report

The Energy Balance of Corn Ethanol: An Update. (July 2002) by Hosein Shapouri et al (USDA) (LOL-EXH-BF-12) argued that "for every Btu dedicated to producing ethanol there is a 34

percent energy gain" The report gave a brief history of the current ethanol controversy. The report noted: "While the Government's commitment to ethanol has been welcomed by agricultural interests and the ethanol industry, critics question the rationale behind policies that promote ethanol for energy security benefits, stating that corn-ethanol has a negative energy value. That is, according to critics, the non-renewable energy required to grow and convert corn into ethanol is greater than the energy value present in the ethanol fuel. Thus, they claim that corn ethanol is not a fossil energy substitute and that increasing its production does little to displace oil imports and increase energy security." (page 1)

"Others argue that although energy balance is of some concern, it is not the major issue for addressing energy security. What really matters is that the production of ethanol can achieve a net gain in a more desirable form of energy. In other words, abundant domestic feedstocks such as coal and natural gas can effectively be used to convert corn into a premium liquid fuel that replaces imported petroleum. This approach reduces the energy balance issue to just looking at the energy value of the liquid fossil fuels used in the production of corn-ethanol. We use both approaches in our analysis." (pages 1-2)

"Estimating the energy input for determining the [Net Energy Value] NEV of corn-ethanol involves adding up all the nonrenewable energy required to grow corn and to process it into ethanol. Most studies, including this one, include only primary energy inputs in their NEV estimates. Secondary inputs, such as energy required to build ethanol facilities, farm vehicles, and transportation equipment are extremely difficult to quantify. Moreover, secondary inputs related to the ethanol plant would account for very little energy on a per gallon basis. This is

because the energy embodied in fixed inputs, such as the cement used to build the plant, would have to be distributed over total production (including coproducts) during the lifetime of the plant." (page 4)

"Total energy used in U.S. agriculture, including pesticides, fertilizers, other chemicals, liquid fuels, natural gas, and electricity, increased from 1,545 trillion Btu in 1965 to a peak of 2,244 trillion Btu in 1978, and then steadily declined to a low of 1,548 trillion Btu in 1989. Since 1989, there has been a slight upward movement in energy use, but still well below the peak levels that occurred in the 1970s." (page 4)

"Input efficiencies for fossil energy sources, which were estimated with Argonne's GREET model, were used to calculate these additional energy input values. In particular, GREET estimated the energy efficiency of gasoline (80.5 percent), diesel fuel (84.3 percent), LPG (89.8 percent), natural gas (94.0 percent), coal (98.0 percent), and electricity (39.6 percent). After adjusting the inputs by these energy efficiencies, the total energy required to produce a bushel of corn in 1996 was 57,476 Btu" (page 8)

"We conclude that the NEV of corn-ethanol is positive when fertilizers are produced by modern processing plants, corn is converted in modern ethanol facilities, and farmers achieve average corn yields. Our NEV estimate of over 21,000 Btu per gallon could be considered conservative, since it was derived using the replacement method for valuing coproducts, and it does not include energy credits for plants that sell carbon dioxide. Corn ethanol is energy efficient, as indicated by an energy ratio of 1.34; that is, for every Btu dedicated to producing

ethanol there is a 34 percent energy gain. Furthermore, producing ethanol from domestic corn stocks achieves a net gain in a more desirable form of energy, which helps the United States to reduce its dependence on imported oil. Ethanol production utilizes abundant domestic energy feedstocks, such as coal and natural gas, to convert corn into a premium liquid fuel. Only about 17 percent of the energy used to produce ethanol comes from liquid fuels, such as gasoline and diesel fuel. For every 1 Btu of liquid fuel used to produce ethanol, there is a 6.34 Btu gain." (page 12)

The 2003 Stillwater Report

The 2003 Stillwater Report recognized that a full cost analysis is warranted: "The cost of producing ethanol will obviously depend on the process configuration and feedstock selection. One potential route ... assumes that the ethanol plant is operated as a stand-alone facility which purchases raw sugar and molasses from a sugar mill. ... The potential problem with this configuration is that it assumes that the majority of the cost for growing and processing the sugarcane is born by the production of sugar as the main product, so that the ethanol feedstock cost will benefit from by-product or incremental cost economics. However, there is uncertainty surrounding the continued economic viability of Hawaii's sugarcane industry in the face of more open competition when tariff protection is lifted. Therefore it seems more realistic to assume that future ethanol production will have to carry the full feedstock cost for the total harvest." (LOL-EXH-BF-13, pages 3-4)

The 2004 NRDC report 'Growing Energy'

In December 2004 the NRDC released its report: "Growing Energy: How Biofuels Can Help End

America's Oil Dependence." (LOL-EXH-BF-14)

The report stressed that biofuels are not cost-effective today, but need taxpayer investments. "Three Steps to Make Biofuels Affordable and Sustainable. ... Investing in a package of research, development, and demonstration policies that create the innovations and advances needed for a large-scale, competitive biofuels industry. Funding deployment policies that drive the development of the first billion gallons of cellulosic biofuels capacity at a price approaching that of gasoline and diesel. Adopting a renewable fuels standard and flex-fuel vehicle requirements." (LOL-EXH-BF-14, page 12)

"There is room for improving corn growing and corn kernal fermentation into ethanol, but these improvements are expected to be incremental, not revolutionary. As a result, while the price of corn ethanol (currently at least twice that of gasoline on a BTU basis) will continue to come down, few expect corn ethanol to become commercially competitive with gasoline or to be able to replace gasoline at a large scale in the foreseeable future" (LOL-EXH-BF-14, page 21)

"The main reason that cellulosic biofuels technology is not further developed today is a lack of a sustained commitment to overcome the technical challenges and to reduce our dependency on oil. These are the same reasons that no type of biofuel provides more than a few percent of our transportation needs." (page 62)

"We have identified three key steps to realizing the promise of biofuels ... These measures can unlock the technological potential of biofuels, drive the cost down to the point where biofuels are

cost-competitive with gasoline and diesel, and make these fuels available to all." (LOL-EXH-BF-14, page 74)

The 2004 Ethanol Across America report: "Ethanol Issue Brief"

The 2004 Ethanol Across America publication: "Issue Brief: Net Energy Balance of Ethanol Production" (LOL-EXH-BF-15) noted that the price we pay at the pump for gasoline does not reflect its true cost: "What we have paid at the pump is only a small portion of the real cost of oil. It does not reflect the environmental, military, economic, and other costs directly related to our dependence on imported oil. It is critical to understand this reality, and help put in perspective the value of domestic replacement fuels, regardless of cost or BTU rhetoric." (LOL-EXH-BF-15, page 6)

The report stated that the cost of ethanol should be limited to the corn-ethanol conversion process, not the total cost: "To be fair, it is important to look at the energy used to make energy. What is unfair is the refusal by detractors to apply realistic, practical assumptions so that we can make more informed judgments. For example, it is unfair to attribute all the energy used to grow a bushel of corn and process it into its value as an energy product (i.e. ethanol). Ethanol production is a co-product of corn processing and therefore should only be charged with the energy that was used to turn it into ethanol. In addition, the nature of agricultural commodities is that they are rarely grown for a specific purpose. That bushel would be grown and processed into feed as a matter of course. Corn is grown as a result of overall demand, and sold into broad markets. Of course there is energy used in growing corn; the issue is to recognize that energy is going to be expended either way. The rub seems to come when the BTU counters start adding

on everything they can think of that is even remotely related to the ethanol process. Sure, it's reasonable to count the energy used to transport corn to a processing plant. But is it reasonable to attribute the energy used to make the steel that made the truck doing the hauling? Some detractors would have you believe so." (LOL-EXH-BF-15, 2-3)

The report supports import substitution: "Regardless of whether one believes ethanol has a positive energy balance or not, one fact still remains: ethanol lessens America's reliance on foreign countries for oil. And, buying our energy here, at home, keeps our dollars home and stems the flow of a staggering transfer of U.S. wealth to foreign countries. Every dollar we spend on the ethanol program including dollars on energy—generates seven more dollars in our economy." (LOL-EXH-BF-15, page 11)

Reliability of USDA Reports reliable

A. The USDA Reports have not been peer reviewed. They are agency pronouncements that their agency is on the right path. As Robert Rapier noted: "The pro-ethanol contingent is quick to point to certain studies published by the USDA to support the claim that the energy balance of grain-ethanol is positive. Many anti-ethanol advocates will point to studies by Professors Pimentel and Patzek to support claims that the energy balance is negative. Say what you will about the Pimentel and Patzek studies, but they have one thing going for them that that USDA studies do not: They have been published in peer-reviewed journals. Why does this matter? Peer reviewed papers have been examined by reviewers familiar with the subject matter (but who are not colleagues of the authors) who are looking for deficiencies or gross errors. Peer review is no guarantee that errors won't slip through, but it is a check on papers that establishes that they have

met certain scholarly guidelines. Peer review can be a pretty rough ordeal, but does a pretty good job of weeding out poor arguments. ... Given the selective accounting employed in the USDA papers (both 2002 and 2004), it is doubtful that it would have passed peer-review without substantial modification. While I have my reservations about the data used by Pimentel, the USDA work is very shoddy in comparison. It has all the ear-marks of an agency attempting to push a political agenda. Certain data were selectively omitted from the energy calculation. The reported EROI of 1.67, parroted by the pro-ethanol contingent, completely breaks down under close examination. It is simply inaccurate and irresponsible to claim this EROI given the factors examined in this essay." (LOL-EXH-BF-16)

The 2006 USDA Sugar Study

In July, 2006, the USDA released a report "The Economic Feasibility of Ethanol Production from Sugar in the United States" by Dr. Hossein Shapouri (USDA), Dr. Michael Salassi (LSU). (LOL-EXH-BF-11) "The purpose of this report is to investigate the economic feasibility of producing ethanol from sugar feedstocks in the United States. These sugar feedstocks include: (1) sugarcane juice, (2) sugar beet juice, (3) cane or beet molasses, (4) raw sugar and (5) refined sugar. Estimated costs of producing ethanol from these feedstocks are presented along with a discussion of other factors that may influence the economic feasibility of converting sugar feedstocks into ethanol. Comparisons are made with grain feedstocks, specifically corn." (LOL-EXH-BF-11. Summary and Conclusions , page iii)

"Major conclusions from this study relative to the economic feasibility of using sugar crops as a feedstock for ethanol production in the United States are:

* It is economically feasible to make ethanol from molasses. The cost of that feedstock is low enough to make it competitive with corn. Challenges may involve having a large enough supply of molasses at a given location to minimize transportation costs to justify construction and operation of an economically efficient ethanol production facility.

* The estimated ethanol production costs using sugarcane, sugar beets, raw sugar, and refined sugar as a feedstocks are more than twice the production cost of converting corn into ethanol. While it is more profitable to produce ethanol from corn in the United States, the price of ethanol is determined by the price of gasoline and other factors, rather than the cost of producing ethanol from corn. With recent spot market prices for ethanol near $4 per gallon, it is profitable to produce ethanol from sugarcane and sugar beets, raw sugar, and refined sugar.

* Over the next several months, ethanol prices are expected to moderate as ethanol production expands. Based on current futures prices, the price of ethanol could drop to about $2.40 per gallon by the summer of 2007, making it unprofitable to produce ethanol from raw and refined sugar." (LOL-EXH-BF-11. Summary and Conclusions, page v)

The 2006 Farrell Study

In January 2006 a UC Berkeley Study was published in the journal Science (LOL-EXH-BF-17). The study by Alexander E. Farrell et al, found that corn ethanol reduces petroleum use by about 95%, but that only 5 to 26% of the energy content is renewable, since corn ethanol relies heavily on coal and natural gas, both of which are fossil fuels. But more importantly, the study found that

corn ethanol only reduced greenhouse gas emissions by 13%. This is a problem since worldwide energy use is increasing. Ethanol may deal with the peak oil crisis, but Hawai`i would still be importing fossil fuel and climate change would still occur. The report noted: "To study the potential effects of increased biofuel use, we evaluated six representative analyses of fuel ethanol. ... All studies indicated that current corn ethanol technologies are much less petroleum-intensive than gasoline but have greenhouse gas emissions similar to those of gasoline. However, many important environmental effects of biofuel production are poorly understood. ... Thus, the energy and environmental implications of ethanol production are more important than ever. Much of the analysis and public debate about ethanol has focused on the sign of the net energy of ethanol: whether manufacturing ethanol takes more nonrenewable energy than the resulting fuel provides. It has long been recognized that calculations of net energy are highly sensitive to assumptions about both system boundaries and key parameter values. In addition, net energy calculations ignore vast differences between different types of fossil energy. Moreover, net energy ratios are extremely sensitive to specification and assumptions and can produce uninterpretable values in some important cases. However, comparing across published studies to evaluate how these assumptions affect outcomes is difficult owing to the use of different units and system boundaries across studies. Finding intuitive and meaningful replacements for net energy as a performance metric would be an advance in our ability to evaluate and set energy policy in this important arena. ... The published results, adjusted for commensurate system boundaries, indicate that with current production methods corn ethanol displaces petroleum use substantially; only 5 to 26% of the energy content is renewable. The rest is primarily natural gas and coal.... Our best point estimate for average performance today is that corn ethanol reduces petroleum use by about 95% on an energetic basis and reduces GHG emissions only moderately,

by about 13%. Uncertainty analysis suggests these results are robust. It is important to realize that actual performance will vary from place to place and that these values reflect an absence of incentives for GHG emission control. Given adequate policy incentives, the performance of corn ethanol in terms of GHG emissions can likely be improved. However, current data suggest that only cellulosic ethanol offers large reductions in GHG emissions."

Subsidies for Ethanol Plants

One way of shifting costs is through taxes. Just as electricity consumers pay low energy bills while taxpayers pay $50 billion/year (pre-Iraq war) to guarantee oil supplies, taxpayers will pay for ethanol plants so that gasoline consumers can have low rates at the pump. "Hawaii's Gay & Robinson, one of just two remaining sugar operations in the Aloha State, will receive a major financial boost — a 30-cents-a-gallon refundable ethanol-production investment tax credit for eight years, courtesy of the state. 'In effect, the state is building the plants for us,' Alan Kennett, Gay & Robinson's president, said Tuesday of the credit that will amount to $36 million. Construction is expected to begin this fall on the first of two ethanol plants. Kennett was one of four panelists who discussed ethanol and sugar's role at the 23rd International Sweetener Symposium this week at the Grove Park Inn in Asheville, N.C." (LOL-EXH-BF-18)

Betting on Ethanol

Proponents of ethanol often state that it is irrelevant if ethanol production makes sense today. They argue that we need to build the infrastructure so that when ethanol is competitive, we will be able to immediately rely on it. This vision of the future is predicated on technological breakthroughs that catapult ethanol to the top of the fuel list. Proponents are looking for the

perfect energy crop (through bioprospecting and genetic engineering), the cheapest way to convert energy crops into ethanol (bioengineered bugs and microbes), and the ability to use the whole plant instead of a small part of the plant (cellulosic ethanol). These proponents are receiving huge taxpayer funds for research, advocacy, and public relations. NRDC, a major proponent of ethanol, argues that "Cellulosic biofuels are at least as likely as hydrogen to be a future sustainable transportation fuel of choice" (Yerina Mugica, NRDC. www.sciencenews.org/articles/20051001/bob10.asp)

Having attended the Biotechnology Industry Organization's Industrial Biotechnology and Bioenergy Conference at the Hilton Hawaiian Village from January 11-13, 2006, I could see the fever behind finding and patenting the next energy solution: the crop that replaces fossil fuel. The issues of greenhouse gas reductions, environmental degradation, and externalities were not on the radar screen. Rather, there is the belief that bioenergy is green, so why worry. Life of the Land believes that all energy systems have harmful impacts, and all impacts deserve to be studied instead of buried.

Sponsoring Exhibits

I am sponsoring exhibits LOL-EXH-BF-1 through LOL-EXH-BF-18 as listed below.

LOL-EXH-BF-1 Science in Society. Comments re Dr Patzek.

LOL-EXH-BF-2 National Corn Grocers Association. www.ncga.com/ethanol/main/killing_myths.htm

LOL-EXH-BF-3 Ethanol Brochure. U.S. Department of Energy.
www.eere.energy.gov/vehiclesandfuels/pdfs/program/2005_ethanol_brochure.pdf

LOL-EXH-BF-4 Monsanto comments re Ethanol Study.
www.monsanto.co.uk/news/ukshowlib.phtml?uid=9849

LOL-EXH-BF-5 www.aocs.org/news/story.asp?id=293

LOL-EXH-BF-6 Bank Sarasin (Switzerland) published a port 'Biofuels May Not Be Sustainability Panacea' (August 02, 2006)

LOL-EXH-BF-7 F. O. Licht, www.earth-policy.org/Updates/2006/Update55_data.htm)

LOL-EXH-BF-8 www.distill.com/world_ethanol_production.htm

LOL-EXH-BF-9 www.eia.doe.gov/emeu/cabs/brazenv.html

LOL-EXH-BF-10 http://i-r-squared.blogspot.com/2006/07/vinod-khosla-debunked.html

LOL-EXH-BF-11 "The Economic Feasibility of Ethanol Production from Sugar in the United States" by Dr. Hossein Shapouri (USDA), Dr. Michael Salassi (LSU). Summary and Conclusions , page vi)

LOL-EXH-BF-12 The Energy Balance of Corn Ethanol: An Update. (July 2002) by Hosein Shapouri et al (USDA)

LOL-EXH-BF-13 Hawaii Ethanol Alternatives. Stillwater Associates. Draft for Review Revised October 17, 2003. pages 3-4)

LOL-EXH-BF-14 NRDC released its report: "Growing Energy: How Biofuels Can Help End America's Oil Dependence."

LOL-EXH-BF-15 2004 Ethanol Across America publication: "Issue Brief: Net Energy Balance of Ethanol Production"

LOL-EXH-BF-16 How Reliable are Those USDA Ethanol Studies?" (March 30, 2006). http://i-r-squared.blogspot.com/2006/03/how-reliable-are-those-usda-ethanol.html

LOL-EXH-BF-17 Ethanol Can Contribute to Energy and Environmental Goals by Alexander E. Farrell et al (Energy and Resources Group, University of California, Berkeley; Goldman School of Public Policy, Renewable and Appropriate Energy Laboratory, University of California, Berkeley). Science (January 2006) www.sciencemag.org)

LOL-EXH-BF-18 Palm Beach Post. August 09, 2006. www.palmbeachpost.com/business/content/business/epaper/2006/08/09/a8d_ethanol_0809.html