Testimony

Commission on Security and Cooperation in Europe

Clearing the Air, Feeding the Fuel Tank: Understanding the Link between Energy and Environmental Security

Jetta Wong

Senior Policy Associate, Sustainable Biomass Program

The Environmental and Energy Study Institute

Washington, D.C.

May 6, 2008

Mr. Chairman and Members of the Commission, thank you for the opportunity to testify here today on behalf of my organization, the Environmental and Energy Study Institute (EESI), on sustainable biomass and the increased price of food. Energy and food security are important globally and here in the United States. EESI is an independent non-profit organization founded by a bi-partisan Congressional caucus in 1984 to provide policymakers with reliable information on energy and environmental issues, to help develop consensus among a broad base of constituencies and to work for innovative policy solutions. Our Board is interdisciplinary and is drawn from academia as well as the public and private sectors, including Dr. Rosina Bierbaum, Dean, School of Natural Resources and the Environment, University of Michigan, and Amb. Richard Benedick, who was a lead US negotiator of the Montreal Protocol. Our Board is chaired by Richard L. Ottinger of New York, a former chair of the House Energy & Power Subcommittee and the Dean Emeritus of Pace University Law School.

EESI began its Energy & Climate Program in late 1987 to focus on the nexus between energy and global climate change - the most serious challenge facing the world today. Evidence of existing climate change impacts is staggering and alarming new ramifications of global warming are reported weekly. While skepticism about the reality of climate change has waned, agreement on the policy approach, technologies of preference, and time frame are still very much in debate – with no clear consensus yet emerging. We are faced with a very dynamic and exciting opportunity for creating significant change. Energy, both as a security and (now more prominently) as a climate issue, is on top of the national policy agenda. We now have candidates for the Presidency who have outlined for voters what they plan to do to address climate change and energy (security and price). More than 780 US mayors have signed a Climate Protection Statement, and numerous Governors of both parties have taken strong leadership positions addressing climate change. As evidence of climate change builds, the pressure to become 'green' or sustainable has become a driving force not only in politics but in the economy. Multinational corporations and many others in the private sector, including many energy companies, have emerged as interested players in renewable energy and energy efficiency (RE/EE) technologies as a way to combat climate change and increase their bottom line. Biomass-to-energy technologies, such as biofuels, clearly have been recognized by the federal and many state governments, corporations and investors as a renewable energy technology that is a critical component of a climate change mitigation strategy.

Climate, Energy and Food Security

As global climate change progresses, rising sea levels, hurricanes, droughts and drastic weather changes have the potential to alter the geography in many areas of the world with significant consequences. As the price of oil rises along with demand, production from mature fields is declining, new petroleum sources have become scarcer, much more costly to produce, with most of these resources coming from places which harbor feelings of mistrust for the United States. As previously pristine environments are forever altered by oil exploration and production, the indigenous communities living off of the land are often displaced. As global markets continue to weave themselves together, the tie between energy, land use (for agriculture) and climate change will become strikingly more clear. Biofuel development has brought a laser beam of attention into this tangled mess, but will it not only highlight these connections, but be able to alleviate future events?

Few countries in the world will face a greater challenge than Bangladesh. Situated along the Bay of Bengal, Bangladesh's low natural elevation, combined with a growing population and high poverty rate, have the potential to lead to a humanitarian crisis. In a September 2007 report, the government of Bangladesh predicted that rising sea levels would create over 25 million refugees displaced from their homes seeking a new place to live[i].

Although this is a prediction, events have occurred in the past few years which can give light to future events. In August 2007, the Brahmaputra River flooded leading to the evacuation of 500,000 people[ii]. News agencies have reported that Bhola Island, the largest island in Bangladesh, has lost nearly half of its land mass from rising sea levels and subsequent increased rates of erosion. Previously in 2005, a reported 500,000 people were left homeless by flooding [iii].

Aside from the physical loss of land, rising sea levels also will have an impact on the amount of available land for agricultural development. The government of Bangladesh predicts that 1,000 square kilometers of agricultural land will be converted to salt marshes. Sea level rise may also lead to increasing salinity in groundwater reducing the amount of arable land even further. The IPCC predicts that by 2050 rice and wheat production in Bangladesh will drop by 8 and 32 percent respectively[iv]. All of these factors have the potential to cause a humanitarian crisis in an already struggling nation.

Sub-Saharan Africa has long been a region rife with problems. The lack of available water and food have been identified as primary concerns. Issues of expanding deserts, overpopulation, climate change, and poor land management practices have only exacerbated current problems. In a report released by the United Nations (UN), just over 50% of Africa's population has access to safe drinking water, 65% of croplands and 30% of pastures have been affected by environmental degradation. According to the UN, current climate models predict that more than 600,000 square kilometers of agricultural land currently classified as "constrained" will become "extremely limited." It is predicted that by 2025, 480 million people could be living in water stressed or scarce areas[v].

In addition to environmental degradation and famine, impacts of local oil development have contributed to the current conditions in some African countries. The Sudanese government along with oil companies have come under criticism from human rights groups over what has been called a "scorched earth policy" as well as accusations of murder and rape. Foreign oil companies have faced accusations of assisting the war effort in Sudan by building an oil industry and offering other assistance. A Congressional Research Service report from 2004 details this, along with reports of Sudan doubling its military budget since exporting oil, and the belief by some that since receiving oil revenues, Sudan may not be interested in negotiating to end the clash.

Current conflicts such as in Sudan have caused a mass migration of people seeking safety as well as food and water. If any of the land and climate predictions outlined by the UN come to pass, millions of refugees seeking food and water will increase – as will conflict – causing a humanitarian crisis. If sustainable agricultural practices are introduced into some of these areas, some of the current problems may be alleviated.

The World Food Crisis

The World Food Program of the United Nations (UN) has described the increase in the price of food as the 'silent tsunami' threatening every continent. Indeed, the world is in the midst of a food crisis. Unfortunately, much of the media has jumped to point fingers without doing due diligence to find out what the real problem is. The easiest target for blame was the increased production of biofuels. As an organization that follows biofuels (policy and technology development) very closely we have paid much attention to the news on this issue. At first, corn-based ethanol was the only culprit being discussed in the news (no doubt this knee-jerk reaction was spurred by the fossil fuel industry that has opposed the production of renewable fuels). As the media now has begun to dig into the complexity of the international commodity markets, it has come to see that there are several factors driving up the price of food. This has also been recognized by the UN's Food and Agriculture Organization (FAO), which has been assessing the food crisis on a constant basis. The FAO has stressed that "there is no single factor that can be identified as being the main one responsible." It goes on to say, "Nor is it possible to make a quantitative assessment of the contributions of the factors that have been influential," on the increase in the price of food.[vi] All the same, it is important to discuss the factors that underpin this critical world phenomenon. The factors influencing the increase in the price of food can be broken down into two categories, supply and demand.

Supply Side Factors Influencing the Price of Food

Production Shortfalls due to Weather-related Activities

Historically, weather-related disruptions such as drought, floods, and hurricanes have contributed to short price spikes in the cost of food. Crop failures in eight major exporting countries during 2005 and 2006 dropped their production of cereals by 4 and 7 percent, respectively. This caused a jump in prices, which then increased production for cereals in 2007, but it was at the expense of oilseeds, such as soybeans[vii]. Global supplies of corn, wheat, and soybeans are at historically low levels due to a multi-year drought in Australia and poor weather in other major exporters such as Canada, Europe and Ukraine.[viii] Australia, a large exporter of wheat to Asia, has had significant crop failures, forcing Asian countries to fill their wheat demands with rice, putting increased demands on rice markets. Several Asian countries which are traditionally important rice exporters have stopped exporting as a matter of national policy.

Diminishing Stock Levels

Since 1995, global stocks levels of cereals on average have declined by 3.4 percent per year[ix]. Several reasons exist for this draw down of stocks. The FAO sights changes in the policy environment due to the Uruguay Round Agreements. Policies adopted or discouraged under the agreements have made it difficult for countries to withstand price volatility at the same time as tighter international markets have made this price volatility more pronounced.[x] Due to high prices some commodity exporters such as Argentina, China, India, Russia, Ukraine, and Vietnam have reduced the world supply by reverting back to policies that restrict supply, such as additional taxes on exports[xi].

Increasing Energy Costs

The rising cost of energy has rippled through the agriculture industry just as it has in every other industry. Whether it is the fuel for transporting, harvesting or storing an agriculture commodity – the price is up. Input costs for the production of agriculture commodities have also increased; for example, between 2000 and 2007 the price of ammonia, the main source of nitrogen in fertilizer production, increased 130 percent from $227 to $523 per ton in the U.S.[xii] – natural gas is a major component in ammonia. In areas of the world where irrigation is needed, the price of energy has slowed this activity.

Demand Side Factors Influencing the Price of Food

Changing Demand Due to Consumption Patterns

Increased demand for agriculture products in emerging countries including China and India is due to increased income growth and changes in consumption patterns. These countries are moving from one meal to two meals a day, while also diversifying their diets from starchy foods to meat and dairy products. This increased demand for meat and dairy applies increasing demand on the grain market to produce feed for livestock. For example it takes seven pounds of corn to produce one pound of beef.[xiii] The FAO reports that the growth rate in cereal production increased on average two percent per year from 1980-2007, but the increased demand for feed for livestock has averaged over 3.5 percent per year. The increase in the production of cereal is not keeping up with the increase in demand for feed[xiv].

Speculation in Financial Markets

As investors look to diversify their portfolios they have increasingly moved into agriculture commodities markets. Speculators using a combination of financial instruments, used to increase portfolio diversification and reduce risk exposures, have artificially increased the price of commodities. The increase in investments also has increased price volatility further, pushing up the price of raw commodities[xv].

Biofuels and Agricultural Commodities

Biofuels also have created an increase in demand. Just as demand has increased for livestock feed, demand also has increased for biofuel feedstocks to replace petroleum products. Demand has been increased for commodities including: sugar, maize, cassava, oilseeds and palm oil. As the price of petroleum and other energy sources increases, the use of commodities for biofuel production becomes more economically viable. Of world ethanol production in 2007, about half (5 billion gallons per year of the 13 billion total) is derived from Brazilian sugar cane[xvi] but the price of sugar is not changing; in fact, the FAO price index for sugar declined by 32 percent in 2007.[xvii]

Domestic Food Prices

According to the U.S. Department of Agriculture(USDA), U.S. food prices rose by 4% in 2007 and are expected to increase another 4-5% during 2008.[xviii] This increase is relatively high compared to the average food price inflation of only 2.7% per year for the previous 20 years, and is especially hard on families earning less than $20,000 who, on average, spend more than 20% of their after-tax income on food.[xix] Given that the United States is a part of the global commodity market, several factors influencing U.S. food prices are the same as those influencing global commodity markets. In the Unites States a few factors play a larger role in the increase in the price of food, specifically the acceleration in food price inflation, including rising labor (including health care) prices which (make up 38% of the retail food price)[xx], rising commodity prices and rising energy prices. **Although it is clear that the price of food is influenced by a number of factors, a April 2008 Texas A&M University study, *The Effects of Ethanol On Texas Food and Feed Commodity,* explained, "the underlying force driving changes in the agriculture industry, along with the economy as a whole, is overall higher energy costs."**

Several inputs have increased over the last few years driving the price of food higher. According to the United States Department of Agriculture, commodity prices comprise 19.5% of retail food prices in the United States, but volatility in commodity prices does not imply equivalent changes in retail food prices[xxi]. The percentage will be higher in foods such as fresh produce, which is basically sold in its original form (without much processing). Foods that require more processing and packaging, however, have so many other inputs that **commodity prices represent a very small percentage of the retail price.** Therefore, processed foods are much less sensitive to changes in commodity prices. As one example, USDA wrote that an increase in the price of a bushel of corn from $2.28 (the 20-year average) to $3.40 (the year 2007 average) would translate into a 1.6 cent increase in the price of an 18-ounce box of corn flakes[xxii].

Farmer input costs have been increasing across the board, some of them tied to the skyrocketing price of fossil fuels. Between February 2007 and February 2008, U.S. farmers paid an average of 35% more for fuels and 40% more for fertilizer, which in turn depends on natural gas as an input. The average price of seeds increased 13% during the same period; farmers also paid more for other inputs such as farm machinery, rent, taxes, interest, and wages[xxiii]. As I have just described, energy prices are actually intertwined with commodity prices, greatly affecting input costs for farmers. Furthermore, energy is also required to process and transport food after it leaves the farm, and these costs comprised an additional 8.5% of retail food prices as of 2005.[xxiv] That means a 10% climb in energy prices will lead to a 0.85% increase in retail food prices. The Department of Energy projects the average price of oil for 2008 to be 40% higher than the average 2007 price.[xxv]

Demands on the supply of commodities are different around the world. The weak value of the U.S. dollar has contributed to increased demand for U.S. food exports, thus driving prices higher here. Current exchange rates also make imported food more expensive in the United States. Increased pressures in other markets such as those for meat in emerging countries and shortages due to weather-related events also have impacted U.S food prices. Growing demand for ethanol production accounted for 17% of 2006 harvested corn crop[xxvi] and that percentage is projected to grow to 24% for the 2007/08 crop[xxvii]. This too has contributed to the price of food. However, it should be noted that in ethanol production, corn protein and oil is still available for feed and other products.

Sustainable Biomass

Although rising food prices are complex and multifaceted, it is clear that the production of biofuels has had a role in affecting commodity markets, agricultural policy, and ecosystems in many places across the globe. This should not come as a surprise. Like food production, forestry, and conservation, the decision to use biomass for the production of biofuels is ultimately a land use and economic decision no matter where the biomass is being produced. Land is the most finite of resources and ultimately the basis for all wealth – we rely on it to feed, clothe, and shelter our civilization. When land is managed in an unsustainable way, our ability to provide these and other basic values is compromised. For every acre of land that is eroded or acidified or desertified or otherwise degraded, we have one less productive acre that can provide food, biofuel feedstocks or ecosystem services. Likewise, inappropriate allocation of land for the wrong use can carry negative consequences, including adverse impacts to the environment and the economy. Fortunately, good stewardship and wise allocation of our precious land resources can provide abundant biomass for both fuels and food, as well as diverse and healthy ecosystems. The following broad principles can help identify biomass resources that can be used to produce truly *sustainable* biofuels and other energy products everywhere in the world.

Sustainable Feedstocks

It goes without saying that sustainable biofuels must be created from sustainable feedstocks, but what constitutes a sustainable feedstock is not always clear. On a broad level, a sustainable feedstock is one whose production of would not impair society's ability to maintain functional ecosystems, clean water, healthy soils, high biodiversity, and ample food supplies for both current and future generations.

As long as biofuels are tied to agricultural commodity markets, effects on the demand, price, and market structure for those commodities will be inevitable. Because these market effects can have unintended consequences in the global market, it behooves us whenever possible to **focus policies and societal efforts on those feedstocks that will not impact agricultural commodity markets.** This means avoiding the use of agricultural commodities, but more importantly it means avoiding the diversion of agricultural land. Planting corn fields to switchgrass reduces the potential corn supply just as readily as directly using corn for biofuel production. The feedstocks that meet this criterion fall into two broad categories: agricultural byproducts and feedstocks from non-agricultural lands.

An enormous quantity and variety of wastes and residues are produced in the process of growing and harvesting food and fiber crops. Straw, stover, prunings, unmarketable produce and other unused biomass form a significant portion of the plant matter produced in a crop. (Table 1, only for the western states) After leaving an adequate quantity on the soil to maintain nutrient levels and protect against erosion, some of this material could be used in the production of biofuels without setting aside any additional land or decreasing the global supply of agricultural commodities. In fact, utilization of this material would create and additional revenue stream for some farmers and other businesses. Although these materials are produced on agricultural land, they are produced as byproducts of existing crops and do not replace them.

Table 1: Estimated supply of various agricultural residues in the Western U.S. at two different prices. Western Governors' Association. 2008.[xxix]

Feedstock	Supply (dry tons) at $35/ton	Supply (dry tons) at $50/ton
Corn stover	153,018	788,081
Winter wheat straw	2,728,816	3,578, 682
Spring wheat straw	255,864	579,335
Barley/oat/rye straw	21,399,308	54,642,172
Total	24,537,007	59,588,270

Non-agricultural landscapes are also potential sources of sustainable feedstocks disconnected from agricultural commodity markets. Small-diameter, low-quality trees ('culls'), brush, and slash are regularly harvested from forests as part of stand improvement treatments, habitat management, and forest restoration activities. (Table 3) Utilization of these materials could increase the cost-effectiveness of timber production, wildlife management, forest restoration, and other objectives of sustainable forestry. Acres of degraded lands exist where former forests, meadows, grasslands, and farmlands were used unsustainably and then abandoned. Planting these lands to fast-growing trees, shrubs, and grasses could be a cost-effective way to secure soils, reduce erosion, sequester carbon and provide regular quantities of renewable feedstocks. Even cities, suburbs, and other settled areas can provide a variety of feedstocks, including municipal wastes, landscape clippings, and urban wood waste.

Table 3: Estimated quantity of total and available* woody biomass in the United States. U.S. Department of Energy and U.S. Department of Agriculture. 2005.[xxx]

Feedstock	Total quantity (million dry tons)	Available quantity (million dry tons)
Logging residues	67.1	40.9
Industrial wood residues	52.1	7.8
Hazardous fuels residues	8410	59.6
Construction debris	11.6	8.6
Demolition debris	27.7	11.7
Yard debris	9.8	1.7
Total	8591.5	136.3

* Availability refers, in general, to material that is physically accessible, cost-effective to remove, and which can be used without incurring any negative environmental or social costs. Methods of defining and estimating availability differ among assessments and reports.

Much of the biomass described above is cellulosic material and can be used in the production of "second generation" biofuels, such as cellulosic ethanol, methanol, butanol, and a variety of diesel equivalent fuels. Cellulosic biofuel technologies are now quickly becoming established technology, with a number of plants currently in operation or under construction.

Cellulosic feedstocks also have great potential for mitigating global climate change. A report by the Union of Concerned Scientists (UCS) estimates that cellulosic ethanol could boast average direct life-cycle emissions 80% lower than those of gasoline.[xxxi] This is just an average. Depending on choice of feedstock and agricultural practices, some cellulosic renewable fuels have the potential to substantially exceed the average 80% emission reduction found by UCS. A 5-yr field study jointly undertaken by the USDA Agricultural Research Service (ARS) and the University of Nebraska found a 94% reduction in direct life-cycle greenhouse emissions from switchgrass-based ethanol compared to gasoline.[xxxii] These statistics illustrate the great potential that cellulosic biofuels have to dramatically reduce our greenhouse emissions compared to petroleum fuels.

These numbers only tell part of the story, however. They cover the direct life-cycle emissions of these biofuels: the emissions associated with growing, harvesting, and transporting the feedstock, as well as the emissions associated with converting it to liquid fuel. Included among these direct emissions are those associated with the clearing and conversion of natural vegetation to grow the feedstock – e.g. direct land changes. In addition to direct emissions, production of some biofuels can result in indirect emissions through land use change (or 'leakage')[xxxiii]. These are land use changes that occur as a result of existing agricultural land being diverted from producing food to producing biofuel feedstocks. Because agricultural commodity markets are relatively inelastic (i.e., demand does not change much in response to reduced supply), new farmland will be brought into productivity somewhere else to compensate. The emissions created as a result of land clearing associated with this leakage are referred to as indirect emissions. This logic is sound, although an agreed-upon methodology for quantifying these emissions has not yet been established. In the absence of such a tool, the wisest course of action would be to avoid those feedstocks that have the potential to catalyze such leakage. As mentioned above, **many cellulosic feedstocks do not impact agricultural commodity markets and therefore would not result in leakage and its associated emissions.**

In addition to the wastes and residues generated directly on the land, a significant quantity of waste is produced as a result of secondary processing – food scraps, yellow grease, and restaurant waste being some of the more prominent examples. (Table 2, only for western states) Large amounts of money and infrastructure are currently dedicated to the treatment and disposal of many of these potentially valuable materials. A variety of technologies can be used to produce a number of liquid fuels from this material: ethanol, methanol, biodiesel, and renewable diesel being some of the more notable. Gaseous transportation fuels, such as hydrogen and biogas (methane), also can be produced using gasification and anaerobic digestion (AD). In 1995, the USDA Economic Research Service calculated that over 48 million tons of edible food was wasted by retailers, consumers, and the food service industry.

Table 2: Estimated supply of various biomass feedstocks in the Western U.S. Western Governors' Association. 2008.[xxxiv]

Feedstock	Supply (tons)
Edible and inedible tallows	833,431
Yellow grease (restaurant waste)	198,900
Biosolids (wastewater treatment)	2,495,336
Native prairie grasses ($20/ton)	516,367
Native prairie grasses ($70/ton)	49,521,480
Orchard prunings	2,706,031

Anaerobic digestion can also be used to capture methane from livestock manure, wastewater treatment sludge (biosolids) and municipal solid waste (MSW). These are especially abundant forms of biomass and ones that are closely associated with a host of water and air quality problems, as well as high treatment costs. There is considerable incentive, both economic and environmental, to turn these troublesome pollutants into valuable and sustainable products.

It is important here to stress the importance of feedstock diversity. Taken individually, the feedstocks described above can all be produced without impact to the global agricultural market; but taken together, they can form the basis of a truly sustainable biomass economy. Excessive reliance on a few feedstocks would leave the energy supply vulnerable to weather events, pest infestations, changes in climate, and market events that impact those feedstocks. Such a narrow focus would likely reduce landscape diversity, reduce the number of players in the market, exclude some regions of the country from feedstock production, reduce the overall availability of feedstock, and increase the likelihood that market demand will drive unsustainable harvest levels. On the other hand, a diverse and distributed national portfolio of feedstocks would be more resilient to natural and market fluctuations. Greater diversity would provide more opportunities for regional producers to opt for those crops, materials, and management practices that are more suitable and sustainable for a given landscape.

Good Production Practices

Feedstock choice is an important part of sustainability, but so is the manner in which those feedstocks are produced. Biomass should be grown and harvested using the very best management practices available in order to protect and improve soils, conserve water, provide habitat, sequester carbon and minimize emissions of greenhouse gases. Some of these practices will be similar from one location to the next, but most of them will need to be tailored to meet local conditions, such as soil type, topography, and weather. Land management is fundamentally local in its scope and **the first and most important step in sustainable land management is to begin with a management plan.** A management plan outlines the resources and site characteristics of the land and describes in detail the timing and extent of harvesting, site preparation, soil additives and other management activities. The plan should demonstrate how the practices described will maintain and improve soils, water quality, biodiversity, productivity, and ecosystem functioning.

On agricultural lands, practices such as no-till cultivation, contour plowing, and reductions in chemical inputs are proven means to protect soils and water. When utilizing residues from these lands, careful assessment is needed to determine the amount of material that needs to be left on the soil to maintain nutrient levels and protect against erosion. Methods to boost carbon sequestration in soils and living biomass can help reduce atmospheric concentrations of greenhouse gases and improve the overall positive climate effects of biofuels.

On non-agricultural lands, focusing on cellulosic materials will provide many of the same benefits as improved agricultural practices. Trees, shrubs, and perennial grasses have better soil-holding characteristics, greater biodiversity, and require less chemical inputs than many agricultural crops. The success of the Conservation Reserve Program (CRP) in stemming erosion and providing wildlife habitat on degraded or marginal lands is largely due to this type of vegetation. Woody plants and grasses are generally more self-sufficient than commodity crops, requiring fewer entries with machinery. This helps to further prevent soil erosion, water pollution, and emissions from diesel-burning farm equipment.

When collecting woody biomass from working forests, logging roads and skidtrails must be arranged in a way that minimizes soil erosion and avoids traffic through new growth, unique habitats, wetlands, and riparian areas. Appropriate harvesting equipment should be selected to minimize soil erosion, root damage, and soil compaction. During the harvesting, extreme care must be taken to avoid damaging the residual stand. A rule of thumb in sustainable forestry is **not to focus on what you are taking, but on what you are leaving behind.** That is, a harvest should be thought of as a way to improve stand conditions and not just as a way to obtain wood. As on agricultural lands, efforts to reduce the time and distance that machinery and log trucks are driven will result in reduced fuel costs and greenhouse gas emissions.

Sustainable practices are also necessary in the handling, processing, and storage of wastes and residues from food processing, wood products industry, and livestock operations. Careful storage and treatment of these materials can help reduce nutrient pollution, air pollution, and water degradation resulting from leaching and decomposition. Animal manure, biosolids and municipal wastes are especially notorious for causing nutrient pollution in waterways. Diverting these wastes to secure bioenergy conversion facilities instead of engineered lagoons and landfills could provide a helpful tool to reduce these wastes and provide energy. Furthermore, methane emitted from decomposing organic matter is 21 times more powerful as a greenhouse gas than carbon dioxide. Capturing this gas and using it as a renewable fuel has a twofold positive effect of mitigating climate change and reducing dependence on natural gas.

Appropriate Uses at the Appropriate Scale

Scale is an incredibly important component of sustainability. A production facility that is too large can exceed local resources, overwhelm local water supplies, and ultimately be unable to remain in business. As feedstock demand increases past a certain point, feedstock production must either increase to unsustainable levels or else feedstock must be shipped in from a wider and wider circle, increasing greenhouse gas emissions.

Sustainability depends on selecting sustainable feedstocks and producing them in a sustainable way, but it also depends on what you do with those feedstocks once you have them. Conversion of feedstocks to fuels will never be entirely free of environmental impacts. Technological and process improvements can help to reduce pollution, resource use, and energy use per gallon of fuel produced, however. A report by the Argonne National Laboratory[xxxv] showed that between 2001 and 2006 use of water and energy at U.S. ethanol facilities decreased substantially. During the same time period, both average yields and capture of carbon dioxide increased. Once fuels are produced, decisions regarding distribution and blending also will have ramifications on overall sustainability. Optimizing fuel blends as well as optimizing vehicles to run on biofuels for maximum efficiency can help us offset the greatest amount of petroleum using the least quantity of biofuels.

As a final point, it is important to note that renewable biomass can be used effectively in a number of energy applications in addition to liquid transportation fuels. Woody biomass can be combusted at very high efficiency (up to 90%) to produce renewable thermal energy, electric power, or in "combined heat-and-power" applications. Co-firing experiments with both wood and switchgrass have demonstrated potential to reduce fossil fuel use and improve emissions in traditional coal-fired power plants.[xxxvi] Anaerobic digestion has been used to produce both electric power and heat from livestock manure and other biomass. A number of valuable biomass co-products can be produced in tandem with energy, including soil additives, industrial chemicals, plastics, resins, and livestock feed. Production of these co-products will increase the benefit that we gain from each unit of biomass and further reduce our dependence on fossil fuels, making biomass more profitable and more sustainable.

Technological Progress

The transition to advanced biofuels such as cellulosic ethanol has already begun. Range Fuels has broken ground on a biorefinery in Georgia that will use a thermo-chemical process to convert woody biomass to cellulosic ethanol. The first phase of the project will yield 20 million gallons of ethanol per year, and is expected to be completed in 2009.[xxxvii] Mascoma Corporation has announced plans to build a plant in Michigan that will use a biochemical process to convert wood waste to cellulosic ethanol and a 5 million gallon switchgrass-to-ethanol refinery in Tennessee that should be completed by 2009.[xxxviii]

Researchers across the country have made great strides in increasing the efficiency of conversion technologies and thus bringing down production costs. The University of Maryland has worked with a bacterium found around the Chesapeake Bay that produces enzymes that rapidly break down cellulose into simple sugars.[xxxix] Microbes that live in the guts of termites are being studied by another research team, including the U.S. Department of Energy's Joint Genome Institute, for their ability to break down cellulose.[xl] USDA researchers at the Forest Product Laboratory have engineered a yeast strain that improves both the rate and yield of ethanol production from xylose wood sugars.[xli] Syntec Biofuel is using gasification to convert a variety of agriculture, wood, and municipal wastes into syngas, which can then be processed into ethanol, methanol, or butanol.[xlii] New public-private partnerships between scientists and the private sector are being announced every day.

Possible Response from Congress and the Commission

Although biofuels have been the scapegoat for many failing policies in agriculture, energy, and food security, they have provided an opportunity for the country to finally face some very major issues. Sustainable biomass, specifically for biofuel production, can play a key role in addressing these important issues. It is time for a new green revolution in which science and technology improve the lives of everyday people and not just for multi-national companies – a new green revolution based on historical and cultural food systems, appropriate uses of fertilizer and native species of plants which can contribute to ecosystems and not degrade them. If used appropriately new technologies can help lead the way to sustainable biofuels, food sovereignty not just food security, and reduced GHG emissions. What is critical is to be able to make policy changes that are going to alleviate high food and fuel prices immediately, while also taking steps to address long-term price volatility, social inequities and climate change. As the Commission and the Congress debate actions to address these issues I would encourage them to take a two-pronged approach. First, they could address our country's reliance on fossil fuels through increased production of sustainable biomass for energy and, second, they could assess how international trade and foreign policy are affecting the United States and citizens of other countries on these food and price issues.

Sustainable biomass technology research, development and deployment

The oil industry began in the mid-1800s and has developed an efficient, opportunistic, and integrated system from discovery to consumption of petroleum products. The ability of biofuels to allow the public to fill up its cars with moderately priced fuel, while providing jobs, protecting the environment, reducing our reliance on oil and competing in a low carbon world, will only happen through the strategic adaptation of the current system.

As consumers are being hit by both high fuel prices and high food prices, which are of course inextricably linked, Congress is considering a suspension of the 18.4-cent-per-gallon gas tax during the summer months. According to an open statement by a consortium of economists[xliii], this approach would yield very little benefit for consumers and, instead, result in increased trade deficits, increased profits for oil companies, and further strain on limited oil supplies. The letter was signed by over 100 economists, including several Nobel Prize winners.

A number of other scientists and tax-related organizations have mirrored these concerns[xliv]. One of these, Jeffrey Perloff of UC-Berkeley, said his models showed that a suspension of the 18.4-cent federal tax on gasoline would likely result in a temporary 9- to 12-cent reduction in the cost of a gallon of gas to the consumer[xlv]

At the same time, Congress shied away from making long-term investments in areas with potential not only to reduce our dependence on fossil fuels and mitigate global warming, but that could create job growth in the US, where as many as one in four jobs by 2030 could be a green job[xlvi]. While the Green Jobs Act in EISA 2007 and increased efficiency measures and biofuels requirements are a step in the right direction, to pull back from these measures now, as well as failure to extend the renewable energy investment and production tax credits for the short or long term, sets the United States up to continue to fall behind. For example, the United States possesses the best solar resources in the world, and yet Germany installs **seven-times as much PV as the United States**. Germany and Japan have taken the lead in solar manufacturing and installations because of long-term national incentive policies designed to make solar power mainstream. The surging player in the industry, China, has gone from having no PV industry to manufacturing twice the level of the United States in just three years[xlvii].

New technologies only become staples of our everyday lives through investments in considerable research, demonstration, deployment and commercialization. The creation of a biofuels infrastructure means adapting an agriculture system developed over decades for a well established set of crops – the confines of existing equipment, harvesting techniques, and systems for transportation, are limitations that need to be overcome for this new bioeconomy. A greatly expanded bioeconomy will require diversifying feedstocks and conversion technologies, which also will garner greater support for biofuels from the environmental community and increase participation from a wider spectrum of farmers and foresters. Furthermore, to penetrate the transportation market, which is currently 97 percent dependent on petroleum, biofuels distribution systems will need to be flexible and compatible with current transportation systems. Policies must undertake and incentivize educating the public, research, rural economic development through local ownership, feedstock production, biorefinery development, increased market development and use of biobased products.

Education and Outreach

To achieve a considerable reduction in our country's oil imports, to reduce greenhouse gas emissions and to catalyze rural economic development, the United States has to act as a nation to overcome barriers to acceptance of renewable energy technologies. National efforts to build a railroad system across the country, to win World War II and to go to the moon, happened because of strong national leadership around these goals and the willingness to invest in them. Similar efforts are necessary to move the whole country towards national renewable energy goals thereby changing the way this country uses energy. There is growing recognition that biomass is a critical and exciting piece of the transition away from fossil fuel dependence. However, there still is a tremendous lack of information about the real contribution that bioenergy can make (and a clear misunderstanding of its impacts, e.g. food prices). A public education campaign on renewable energy technologies, specifically biomass technologies, is needed.

For individuals, communities and small businesses to keep/increase ownership of production and biorefineries, they will need a number of new skills including business development, financial planning, networking, technical training, etc. Rural development programs should spur innovation and entrepreneurship while developing these skills. USDA should assess training programs, community colleges, land-grant colleges and universities, and the agricultural extension service for their ability to develop the human capital necessary to meet the challenges and opportunities that renewable energy brings to our rural communities and report their findings back to Congress.

Research

Tremendous breakthroughs have been made in biomass technologies. These gains move the renewable energy industry closer to becoming a larger player in energy markets every day. But more needs to happen to continue to phase in these important technologies. The ability to produce biomass in a sustainable manner is essential to its success as a renewable resource for energy. **Key areas of research include: sustainable production, social and economic impacts of production and technical applications including conversion of materials, harvesting and storage infrastructure.**

A **national biomass assessment** needs to be funded on a state/regional basis. Specific attention needs to be paid to crop residues, current and potential new energy crops (perennial and annual), and other streams (woody and herbaceous). Assessments should be done on a state-by-state basis, and should take into account the specific soil type, climate, precipitation, and inputs, etc., within that state. Given the increased attention and issue with land use conversion for crop production (leading to significant GHG emissions), low-carbon feedstocks including waste materials from food manufacturing facilities, landfills (MSW), urban construction, disaster debris and other wastes should also be assessed. Furthermore, economic models have to be created and tested to determine/predict feedstock availability and cost. The goal should be to help farmers, foresters and policymakers know which feedstocks are most appropriate to grow where and with as little inputs as possible. Assessment of Renewable Energy Resources (Sec. 201), a program authorized in EPAct ’05, could be used to carry out these assessments or similar language could be used for a new biomass assessments program similar to the programs included in both the Senate and House Farm Bills.

A variety of sciences are needed to develop economically and environmentally sustainable biomass. Research and innovation in biology and chemistry have been focused on petroleum and synthetic materials for generations. General scientific research needs to be refocused on organic natural processes. To the extent possible, care should be taken in the development of crops and other technical areas to preempt undesirable consequences. Our academic and research institutions are the lifeblood of establishing a sustainable bioeconomy in the United States. Research, demonstration and deployment needs to happen in the public domain so our society can reap the benefits. Public institutions need to have a surge of new federal funding to galvanize farmers, foresters and rural communities interests in a renewable energy industry. These essential research areas are also key to our energy and national security. The price of oil for the foreseeable future is going to increase, and with predictions by the Energy Information Administration (EIA) that automobile and truck use (as measured by vehicle miles traveled or VMT) will increase 48 percent by 2030,[li] it will be vital that our country reduce our dependence on foreign oil. Making the investments in our agriculture and forestry industries now will be necessary to meet the challenge of additional price peaks in energy, but also in food as the two are closely related.

The growth of energy crops is going to happen if there is a market for them. The transition to cellulosic energy crops from traditional row crops will be very risky, especially if markets are not fully developed. A program that will incentivize this transition through pilot projects and research will be needed to bridge the time between when a farmer plants a crop for a biorefinery and when the crop is ready to be harvested or when a biorefinery exists to buy the crop. Due to the fact that there will not be a *substantial* market for cellulosic energy crops for a few more years, any program that funds the production of cellulosic energy crops should be based on pilot plots used to gather information about new and diverse crops. How and where these crops will be grown will determine how environmentally sustainable bioenergy production can be and how we can best limit "indirect impacts" from adverse land use changes.

Rural Development

As our country continues to lose jobs and our work force continues to age, it is the responsibility of our policymakers to stop this regression. Biomass can help propel the manufacturing economy for the 21st century. Farmers can be at the forefront of an 'employment and energy' revolution, utilizing the commodities they grow, and even the waste streams they now must dispose of, in innovative new ways to produce power, transportation fuels, and a new generation of biobased products and chemicals. Linking agriculture and renewable energy is key to diversifying our energy market, protecting our environment, and revitalizing rural America, while providing jobs to our overall economy.

Over the last several decades major changes in production agriculture and federal policies have created an environment enabling enormous concentration within the agriculture industry. Current agriculture policy has encouraged large scale production while providing few incentives to small farmers and foresters. Bioenergy production has the opportunity to break this trend because it can, and must, be vastly different than conventional production of crops. **As the new biomass industry develops, unique policies need to be adopted to make sure its growth is not just environmentally sustainable but economically beneficial to rural communities.** It has been found that the economic contribution of farmer-owned ethanol plants to the local community is 56 percent more than an absentee-owned corporate plant[lii]. Innovative incentives for small businesses, farmers and foresters to take advantage of the opportunities presented by biomass production should be a priority of rural development.

Furthermore, the current energy industry is dominated by a select few who have already expressed interest in funding, owning and operating huge biorefineries. The opportunity exists for our farmers and foresters to play a larger role in owning facilities, allowing their local communities to receive the benefits of higher value products further down the production chain. Indeed, we believe that "scale" and significant local ownership are key to sustainability. Until the playing field for energy is levelized through **monetizing the externalities of fossil fuels** and **cutting tax breaks to conventional fossil technologies**, small farmers and small rural businesses investing in renewable energy technologies will need additional incentives to compete against these large energy companies.

Technology Commercialization

Biorefineries and biobased products can play a vital role in a renewable energy future. Biorefineries – facilities that process biomass into multiple end products (biofuels, biopower/cogeneration thermal energy or biochemicals/ biobased products) are an effective way to develop biomass economically. Utilizing several (or all) components of the feedstock improves the profitability, environmental gains and energy production capacity of a biomass project.

To make bioenergy more economically viable and environmentally acceptable, innovative pairing of technologies should be encouraged. Biomass facilities including ethanol, biodiesel, wood-combustion, pellet, and existing pulp and paper mills should have access to grants and loans for retrofitting their facilities. Priority should be given to innovative pairing of technologies that reduce carbon through the use of biomass or other types of renewable energy systems (e.g. gasifiers and methane digesters) and energy efficiency improvements, especially "combined heat and power." Co-firing with biomass at facilities that use coal for energy production should be included.

International Trade and Foreign Policy

The United States is not alone in the world. As we are seeing with the increase in food prices, many other countries are under even worse pressures. Just as we want and need programs in the United States to keep our agriculture system efficient, productive and sustainable, developing countries and the rest of the world need similar programs. Unfortunately, our trade agreements have reduced the ability for the United States, as well as other countries, to stabilize its own food production through these kinds of programs. Countries around the world want the same things, energy and food sovereignty, not just security. Countries and individual communities should have access and control over where food and energy come from – current trade agreements have minimized this control. It should not be a surprise that people want control over their food and energy, especially given the last few years where energy 'independence' or security has been a major political driver and where contaminated food has been constantly in the news. Farmers want to make a living, everyone needs to eat, and everyone uses energy and all of us have an impact on climate. The solutions to our food and energy sovereignty problems will be similar to those of other countries, but solutions may be on a different scale or implemented at different times, but in general they have the same effect. **International climate and trade initiatives dealing with land use, whether for agriculture, forestry or carbon sequestration will need to be examined to produce benefits that will be sustainable, for the environment, the economy and society.**

In the short-term it is going to be critical to get food to communities that need it. This can be done through emergency food aid programs implemented on an international (World Food Program) and domestic level. Under the Emergency Food Assistance Program (TEFAP), USDA buys food and ships it to state agencies for distribution. The amount received by each state depends on its low-income and unemployed population. Congress appropriated $189.5 million for TEFAP for FY 2007--$140 million to purchase food, and another $49.5 million for administrative support for state and local agencies.[liii]

In the medium-term, it will be important to encourage farmer-owned "value-added" production chains throughout the world. Providing incentives for farmers and smaller producers to gain more from increased control over their products helps them benefit from the 'trickle-down' effect of high prices. In the United States we have several key programs including our Value-added producer grants which has been very successful. This has helped farmers expand their businesses and earn more from the crops they grow, process and distribute.

In the long-term it will be important to moderate high prices by increasing agriculture productivity. This can be done by investing in rural education and infrastructure, developing innovative risk management tools and developing plans to address long-term stability during what could possibly be rapid changes due to climate change (and very high energy costs). As agriculture assets (including land) continue to increase in value, it will be increasingly important to maintain the ability for small farmers/businesses, in the United States and globally, to have access to credit or other types of incentives that allow them to enter into a market or to purchase assets allowing them to participate in the economy. Similarly, in the United States we have seen the price of land skyrocket and the cost to purchase equipment cripple small farmers. Just as we have tried to implement "beginning farmer" programs in the United States, we should be encouraging that in developing countries.

Current agriculture programs should be reassessed for their ability to meet the needs of farmers, foresters, small rural business and the food, feed, fiber, fuel and sustainability needs of our country – not the needs of multinational corporations, who have been the major drivers and benefactors of US agriculture policy. In fact, such assessments are needed globally. Commodity program changes and competition law reform (not included in this hearing) should be considered and initial steps should be taken to prepare for change. The 2008 Farm Bill could have been a time to make further shifts to conservation, energy production, food security and fair prices for our farmers and foresters, unfortunately this may have to wait until the next farm bill. Indeed, this is essential to the ability of biomass to contribute to rural economic growth and environmental sustainability as competition in this industry grows.

Finally, the United States should consider a return to a supply management program or strategic grain reserve. Financial advisors encourage the creation of a 'rainy day' savings account which can provide a buffer of funds that can be pulled down in case of an emergency – car accidents, hospital expenses, fire in your home, etc. Congress created the Strategic Petroleum Reserve (SPR) for several reasons, but primarily to dampen the effects of major supply interruptions in petroleum. The SPR has become strategic to our country's oil supply, a key to our economy. A grain reserve would do the same for food, a necessity for life. This would make our markets more resilient during times of volatility in international markets. Other supply-related policies could also work; what is important is for the United States and other countries to be in better control of their energy and food supply.

Conclusion

Although it is clear that several factors have increased the price of food, a strong domestic U.S. market for biofuels has also contributed to this increase, but it also has reduced trade pressures created by the excessive dumping of cheap commodities on international markets. This in turn has helped to increase international prices for farmers worldwide – a good thing – but only if countries have the ability to react to those high prices in a way that is beneficial to their citizens. Unfortunately, this is not happening. But, what is worse – excessive dumping of cheap U.S. commodities which have flooded markets in developing countries, slowly destroying those markets and putting farmers out of business, eventually forcing them into urban communities where they no longer have the ability to produce food, putting them at risk of starvation? Or extremely high food prices due to weather-related crop failure, political turmoil, depletion of commodity stocks and increased demand all converging at once, creating a shortage that hits developing countries and poor citizens, causing many to starve? I know that neither of these two scenarios are what we want, but pointing a finger at biofuels is not going to solve the problem.

Furthermore, it is important to acknowledge that biofuels are already playing a substantial role in extending our finite supply of petroleum, which some are saying is the underlying cause of high food prices. Currently, two thirds of all gasoline sold in the United States is blended with ethanol.[liv] If this ethanol were to be removed from the marketplace, we could expect to see sharp increases in the price of petroleum as oil is used to fill the demand currently satisfied by biofuels. In the absence of biofuels, Merrill Lynch concluded that gasoline prices today would be 15% higher than they are currently.[lv] This trend is only likely to strengthen in the near term. What kind of effect would this have on the price of food?

Future petroleum supplies are uncertain. Dwindling supply coupled with sharply increasing prices are likely to weaken the economic viability of petroleum at some point. In 2007, the countries that comprise OPEC produced 38.5% of the worldwide petroleum supply[lvi]. Given the precarious political situation in many of these countries, the availability of this resource down the road is far from certain. Ultimately, we will need to shift to electricity, hydrogen, or other forms of alternative transportation. Biofuel policy must be considered **ONE** part of a larger strategy to address ongoing concerns about energy security as well as climate change. Increased vehicle fuel efficiency, "smart growth" practices (enabling more transit, biking and walking), conservation and a variety of other technologies (like plug-in hybrids) will also play a role. In the meanwhile, biofuels offer the only viable substitute to petroleum and the only means to protect our energy supply in the face of uncertain international politics.

As the price of oil rises along with demand, and as the increase in the price of food hits more countries, I can only wonder what will happen in the future as the effects of climate change impact the earth and the people of Bangladesh, Sub-Saharan Africa and other countries like Haiti.

Recent news reports have documented conflicts in several nations due to food shortages including Haiti. Having long been a country rampant with poverty and conflict, at the crux of Haiti's problems is the issue of environmental sustainability. Deforestation is primary among their environmental issues. Currently, forests cover about one percent of the country largely due to a lack of forest protection by the government and the widespread use of wood as an energy source. Deforestation in Haiti has led to the erosion of already scarce arable land needed for agricultural development and has left Haiti more vulnerable to natural disasters. In a report released by the World Bank, the hurricanes of 2004 killed over 4,000 people while destroying 6,500 homes.[lvii]

Because of extreme poverty, many Haitians have fled their country seeking a better life. In 2005 the Office of the UN High Commissioner for Refugees reported that 105,727 refugees left Haiti seeking asylum between 1996 and 2005.[lviii] In 2006, the Department of Homeland Security reported that between 2004 and 2006, 8,261 individuals receiving asylum in the United States were from Haiti.[lix] These are documented refugees only; the actual number of individuals fleeing Haiti is most likely larger.

Sustainable development and the utilization of biomass have the potential to remediate some of the problems which Haiti currently faces. The sustainable use of Haiti's current forests may allow some of them to recover, decreasing the rate of erosion, slowing or reversing the current rate of deforestation (allowing for more carbon sequestration to occur mitigating climate change) and allowing agricultural development to grow. The sustainable use of biomass and biofuels for energy may provide a boost to their economy allowing development to occur, while reducing their need to import increasingly expensive petroleum, which is another huge drain on the country.

---

[i] Bangladesh Department of Environment. *Climate Change and Bangladesh*. September 2007

[ii] Ibid

[iii] Wax, Emily. "In Flood-Prone Bangladesh, a Future That Floats." *Washington Post*, September 27, 2007.

[iv] Bangladesh Department of Environment. *Climate Change and Bangladesh*. September 2007

[v] United Nations Environment Programme, "New Report Underlines Africa's Vulnerability to Climate Change", http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=485&ArticleID=5409&l=en November 4, 2006

[vi] Trade and Markets and Agriculture Development Economics Division of the Food and Agriculture Organization of the United Nations. *Growing demand on agriculture and rising prices of commodities*. Feb 14 2008.

[vii] Ibid

[viii] CRS report

[ix] Trade and Markets and Agriculture Development Economics Division of the Food and Agriculture Organization of the United Nations. *Growing demand on agriculture and rising prices of commodities*. Feb 14 2008.

[x] Ibid

[xi] Testimony of Joseph Glauber, USDA Chief Economist, before the Joint Economic Committee. May 1, 2008.

[xii] http://www.ers.usda.gov/AmberWaves/November07/Findings/TightSupply.htm (accessed on May 2, 2008).

[xiii] Leibtag,Ephraim. "Retail Food Price Outlook: 2008." Presentation at the 2008 Agriculture Outlook Forum 'Energizing Rural America in the Global Marketplace', Arlington, Virginia, February 21, 2008.

[xiv] Trade and Markets and Agriculture Development Economics Division of the Food and Agriculture Organization of the United Nations. *Growing demand on agriculture and rising prices of commodities*. Feb 14 2008.

[xv] Ibid

[xvi] Renewable Fuel Association. "Industry Statistics." http://www.ethanolrfa.org/industry/statistics/#E. (accessed May 1, 2008).

[xvii]Trade and Markets and Agriculture Development Economics Division of the Food and Agriculture Organization of the United Nations. *Growing demand on agriculture and rising prices of commodities*. Feb 14 2008.

[xviii] USDA Economic Research Service Briefing Room for Food CPI, Prices, and Expenditures: CPI for Food Forecasts. Accessed at http://www.ers.usda.gov/briefing/CPIFoodAndExpenditures/Data/cpiforecasts.htm on May 1, 2008.

[xix] Testimony of Joseph Glauber, USDA Chief Economist, before the Joint Economic Committee. May 1, 2008

[xx] Retail Food Price Outlook: 2008. Ephraim Leibtag. Presentation for the 2008 Agricultural Outlook Forum. February 21, 2008.

[xxi] Ibid

[xxii] Corn Prices Near Record High, But What About Food Costs? Ephraim Leibtag. Amber Waves. February 2008.

[xxiii] USDA Indexes of Prices Received and Paid by Farmers, U.S. Average. Accessed at www.ers.usda.gov/publications/agoutlook/aotables/2008/03Mar/aotab04.xls on May 1, 2008.

[xxiv] Retail Food Price Outlook: 2008. Ephraim Leibtag. Presentation for the 2008 Agricultural Outlook Forum. February 21, 2008.

[xxv] Short-Term Energy and Summer Fuels Outlook. Energy Information Administration. April 8, 2008.

[xxvi] Renewable Fuels Association. *Ethanol Industry Outlook 2007: Building New Horizons*. February 2007.

[xxvii] Testimony of Joseph Glauber, USDA Chief Economist, before the Joint Economic Committee. May 1, 2008

[xxix] Western Governors' Association Biofuels Team. *Transportation Fuels for the Future, Biofuels: Part 1.* 8 January 2008. Appendix ACR, Appendix HEC, and Appendix O&V.

[xxx] Oak Ridge National Laboratory (DOE) and USDA. *DOE GO-102995-2135, Biomass as Feedstock for a Bioenergy and Bioproducts Industry: Feasibility of a Billion-Ton Annual Supply.* April 2005.

[xxxi] Union of Concerned Scientists. *Biofuels: An Important Part of a Low-Carbon Diet.*

[xxxii] Schmer, M.R., K.P. Vogel, R.B. Mitchell, and R.K. Perrin. 2008. Net energy of cellulosic ethanol from switchgrass. Proceedings of the National Academy of Sciences. 105(2):464-469.

[xxxiii] Searchinger, T., R. Heimlich, R.A. Houghton, F. Dong, A. Elobeid, J. Fabiosa, S. Tokgoz, D. Hayes, and T. Yu. 2008. Use of U.S. croplands for biofuels increases greenhouse gases through emissions from land use change. Scienceexpress, published online 7 February 2008; 10.1126/science/1151861.

[xxxiv] Western Governors' Association Biofuels Team. *Transportation Fuels for the Future, Biofuels: Part 1.* 8 January 2008. Appendix ACR, Appendix HEC, and Appendix O&V.

[xxxv] Wu, May. 2008. Analysis of the Efficiency of the U.S. Ethanol Industry 2007. Center for Transportation Research, Argonne National Laboratory, U.S. Department of Energy.

[xxxvi] Amos, W. 2002. Summary of Chariton Valley Co-firing Testing at the Ottumwa Generating Station in Chillicothe, Iowa: Milestone Completion Report. NREL/TP-510-32424 National Renewable Energy Laboratory, U.S. Department of Energy.

Hughes, Evan E. *Utility Coal-Biomass Cofiring Tests.* (No Date). [Online] http://www.netl.doe.gov/publications/proceedings/98/98ps/ps4-2.pdf.

[xxxvii] "Range Fuels Raises over $100 Million in Series B Financing. Range Fuels News Release". April 1, 2008.

[xxxviii]"Mascoma Corporation to Build Nation's First Switchgrass Cellulosic Ethanol Plant". Mascoma News Release. September 27, 2007.

[xxxix]"UM Invention Promises Major Advance in BioFuel Production". University of Maryland News Release. March 10, 2008.

[xl]"Scientists Sequence and Analyse Genomes of Termite Gut Microbes to Yield Novel Enzymes for Cellulosic Biofuel Production". Biopact. November 22, 2007.

[xli]"Xethanol Researchers Report Significant Increases in Cellulosic Ethanol Production Rates at Test Lab". Xethanol News Release. January 15, 2008.

[xlii] "Syntec Biofuels Achieves Yield of 105 Gallons of Alcohol per Ton of Biomass" CNN Money 14 February 2008.

[xliii]"An Open Statement Opposing Proposals for a Gas Tax Holiday." http://www.politico.com/static/PPM43_080502_list_gastax.html

[xliv] Lavelle, Marianne. "The Gas Tax Vacation: A Cheap Holiday" U.S. News & World Report 5 May 2008.

http://www.usnews.com/blogs/beyond-the-barrel/2008/5/1/the-gas-tax-vacation-a-cheap-holiday.html

"The Gas Tax Policy: Good Politics, Bad Policy" Taxpayers for Common Sense 30 April 2008.

http://www.taxpayer.net/TCS/PressReleases/2008/04-30gastaxholiday.html

Burman, Len and Eric Toder. "What Were They Thinking?" Tax Policy Center 15 April 2008.

http://taxvox.taxpolicycenter.org/blog/_archives/2008/4/15/3641270.html

[xlv]Francis, David R. "Gasoline-tax Reprieve: An Idea Running on Empty" Christian Science Monitor 5 May 2008.

http://www.csmonitor.com/2008/0505/p14s03-wmgn.html?page=1

[xlvi] ASES report

[xlvii] Resch, Rhone. Testimony before the Subcommittee on Select Revenue Measures of the House Committee on Ways and Means. 19 April 2007. http://waysandmeans.house.gov/hearings.asp?formmode=printfriendly&id=5795

[li] Environmental and Energy Study Institute. Growing Cooler Briefing. April 25, 2008.

[lii] Urbanchuk, John M. "Economic Impacts on the Farm Community of Cooperative Ownership of Ethanol Production." LECG LLC. Paper prepared for the National Corn Growers Association September 2006.

[liii] United States Department of Agriculture. Emergency Food Assistance Program. http://www.fns.usda.gov/fdd/programs/tefap/tefap_faqs.htm. (accessed on May 2, 2008).

[liv] Cooper, Mark. Rising Gasoline Prices: Why Can't Consumers Catch a Break? March 2008. Consumer Federation of America.

[lv] Barta, Partrick. "As Biofuels Catch On, Next Task Is to Deal with Environmental, Economic Impact". The Wall Street Journal 24 March 2008.

[lvi] Monthly Oil Market Report: April 2008. Organization of Petroleum Exporting Countries.

[lvii] World Bank, *Haiti: Restoring Hope, Delivering Credibility*, April 2007.

[lviii] Office of the UN High Commissioner for Refugees, *2005 UNHCR Statistical Yearbook,* April 2007.

[lix] Department of Homeland Security, *Refugees and Asylees: 2006*, May 2007.