REVIEW OF CORN-BASED ETHANOL PRODUCTION AND USE AS A FUEL ADDITIVE AND AS AN ALTERNATIVE FUEL IN CALIFORNIA
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Information Item
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ISSUE:

This report summarizes the issues surrounding the production and use of corn-based ethanol as a fuel additive and alternative fuel in California. An application to the California Debt Limit Allocation Committee (CDLAC) for tax-exempt volume cap from the exempt facility pool, submitted by the California Statewide Communities Development Authority (CSCDA) on behalf of Pacific Ethanol Inc. (PEI), gave impetus to this report. The application requests $35 million in tax-exempt volume cap to cover costs associated with solid waste processing equipment that will be installed in two proposed corn-based ethanol manufacturing facilities in California. Since the CDLAC previously has not received a request for tax-exempt volume cap from the exempt facility pool for an ethanol manufacturer, it requested that the California Pollution Control Finance Authority (CPCFA) conduct a review of the industry in accordance with its procedures.[1]

As part of its research into this issue, staff contacted representatives from the following organizations: the San Joaquin Valley Air Pollution Control District, the Port of Stockton, the Central Valley Regional Water Quality Control Board, Imperial County Planning & Development Services, the Colorado River Basin Regional Water Quality Control Board, the California Air Resources Board (CARB), the California Energy Commission (CEC), the California Integrated Waste Management Board (CIWMB), the California Department of Food and

[1] Section 21.I.E. of CDLAC's procedures reads as follows: For Applicants other than the California Pollution Control Finance Authority, the Committee will perform a formal policy review prior to award of Allocation to new industries that apply for Exempt Facility bond authority. The Committee will establish a process for evaluating requests for Allocation for technologies that are unfamiliar to the Committee and for industries that have not previously or recently requested an award of Allocation from the Committee. When such Applicants request Allocation, the Committee will conduct a review of the technology, the industry, and the state of environmental or other regulations. The Committee may request assistance of other federal, state, and local agencies when conducting this review. The Applicant and/or Project Sponsor may be asked to provide additional information relevant to the Committee's review. The review process shall result in a written policy concerning the new area of business.

Agriculture (CDFA), the University of California, Davis and the California Biomass Collaborative, the University of California, Berkeley and the Low-Carbon Fuel Standard for California Project, the Natural Resources Defense Council (NRDC), the Sierra Club, the Union of Concerned Scientists, the Center for Energy Efficiency and Renewable Technologies (CEERT), California Communities Against Toxics, the California Environmental Rights Alliance and CARB's Global Warming Environmental Justice Advisory Committee, the Oregon State Treasurer's Office, and Blue Fire Ethanol.

BACKGROUND:

Company Information:

PEI is a publicly traded company formed in the State of Delaware in 2005.[2] In its 2006 Form 10-K filed with the Securities and Exchange Commission, the company reports that it produces and sells ethanol and its co-products and provides transportation, storage and delivery of ethanol through third-party service providers in the Western United States, primarily in California, Nevada, Arizona, Washington, Oregon and Colorado. The company represents that it has extensive customer relationships throughout the Western United States and extensive supplier relationships throughout the Western and Midwestern United States. With respect to its business strategy, PEI reports that its primary goal is to become the leading marketer and producer of renewable fuels in the

[2] In a Form 13D/A filed with the Securities and Exchange Commission on May 18, 2007, the following PEI ownership information is disclosed: "On April 13, 2006, Cascade Investment, L.L.C. ("Cascade") acquired 5,250,000 shares of the issuer's Series A Cumulative Redeemable Convertible Preferred Stock ("Series A Preferred Stock") at a price of $16.00 per share. Each share of Series A Preferred Stock is convertible at any time at Cascade's option into a number of shares of the issuer's common stock ("Common Stock") equal to the quotient of (x) $16.00 divided by (y) the conversion price in effect at the time of conversion...Using the current conversion price, Cascade's 5,250,000 shares of Series A Preferred Stock are currently convertible into 10,500,000 shares of the issuer's Common Stock…the Series A Preferred Stock votes together with all other classes and series of voting stock of the issuer as a single class on all actions to be taken by the stockholders of the issuer. Each share of Series A Preferred Stock entitles the holder thereof to the number of votes equal to the number of shares of Common Stock into which each share of Series A Preferred Stock is convertible… On May 18, 2007, Cascade acquired 1,000 shares of Common Stock…All shares of Common Stock held by Cascade may be deemed to be beneficially owned by William H. Gates III as the sole member of Cascade." The company's 10-K filed for 2006 includes the following ownership information: "As a result of our issuance of shares of Series A Preferred Stock to Cascade Investment, L.L.C., our common stockholders may experience numerous negative effects and most of the rights of our common stockholders will be subordinate to the rights of Cascade Investment, L.L.C… rights in favor of holders of our Series A Preferred Stock include: seniority in liquidation and dividend preferences; substantial voting rights; numerous protective provisions; the right to appoint two persons to our board of directors and periodically nominate two persons for election by our stockholders to our board of directors; preemptive rights; and redemption rights."

Western United States. The company's strategies to achieve this goal include: expansion of its relationships with third-party ethanol producers in order to market higher volumes of ethanol throughout the Western United States; expansion of its relationships with animal feed distributors and dairy operators to build local markets for wet distillers grains, a co-product of corn-based ethanol manufacturing; expansion of the market for ethanol by continuing to work with state governments to encourage the adoption of policies and standards that promote ethanol as a fuel additive and ultimately as a primary transportation fuel; development of additional ethanol production facilities to meet the expected future demand for ethanol; the construction or acquisition of additional ethanol production facilities in markets where local characteristics create the opportunity to capture a significant production and shipping cost advantage over competing ethanol production facilities; evaluation of technologies that may increase the efficiency of its ethanol production facilities and reduce its use of carbon-based fuels (e.g., technologies that will allow the company to use different and potentially abundant and cost-effective feedstocks, such as cellulosic plant biomass, to supplement corn as the basic raw material used in its production of ethanol); employment of mitigation measures to limit its exposure to fluctuations in commodity prices and in ethanol inventory prices; and, evaluation and pursuit of opportunities to acquire additional ethanol production, storage and distribution facilities and related infrastructure currently in operation or under development.

Currently, PEI owns and operates two corn-based ethanol manufacturing facilities, one located in Madera California and the other in Boardman, Oregon. PEI has ownership interest in a third corn-based ethanol manufacturing facility located in Colorado. In addition, the company currently has three additional plants under construction, located in Burley, Idaho, and Stockton and Calipatria, California. CSCDA proposes to use volume cap to issue $35 million in tax-exempt bonds and to lend the proceeds to PEI for expenditure on solid waste processing equipment in both the Stockton and Calipatria plants.[3]

PEI's Manufacturing Process:

The Stockton and Calipatria plants will each be built to manufacture 60 million gallons of ethanol per year. Construction of the Stockton plant is scheduled to be completed in August 2008 and construction of the Calipatria plant is scheduled to be completed in the 4th quarter of 2008.

Both plants will use natural gas as the energy source for the manufacturing process. Other elements of the manufacturing process will include large amounts of water (an average of four gallons of water per gallon of ethanol produced) as well as chemicals, enzymes, yeast and denaturants (e.g., unleaded gasoline).[4] Whole corn will be the feedstock, 90 percent of which will be transported by rail from the Midwest.

[3] PEI received tax-exempt volume cap from the State of Oregon and the State of Idaho for costs associated with the equipping of the Boardman and Burley plants, respectively. The total cost of constructing and equipping the Stockton and Calipatria plants is reported by PEI to be $204 million.

[4] According to PEI, the water used for the manufacturing process at the Calipatria plant will be recycled and reused.

Approximately .35 bushels of corn will be required for every gallon of ethanol produced. The corn will be ground into meal and then will be "slurried" with water to form a mash. Enzymes will be added to the mash to convert the corn starch into a simple sugar, namely dextrose. Ammonia will be added to control the acidic content (the pH) and to aid in fermentation. High temperature steam will be used to cook the mash, which will reduce the bacteria content. The mash then will be cooled and transferred to fermenters, where yeast is added to begin the conversion of the sugar to ethanol and CO_2. After fermentation, the "beer" will be transferred to distillation tanks, where the ethanol is separated from the residual mash ("stillage"). The distilled ethanol will be denatured with gasoline to a five percent content level prior to shipment to market. The stillage will be further processed into wet distillers grains and syrup. The wet distillers grains will be sold to local livestock operations as feed.

According to bond counsel, a 2002 Private Letter Ruling issued by the Internal Revenue Service (IRS) provides the basis for tax exempt financing of certain equipment used to process stillage into a feed co-product.[5] When rendering an opinion on the tax-exempt status of the interest on proposed bonds, bond counsel will identify each piece of equipment in an ethanol plant that collects, stores, transports and processes material that constitutes "waste" for federal tax purposes in order to determine which portions of the overall plant qualify for tax-exempt financing. Part of this process also involves the determination by bond counsel, with respect to each intermediate material, whether that material is itself waste or has "market value" for federal tax. This latter determination will be based on representations of the company supported by independent expert reports, as appropriate. The analysis required under federal tax law is complex and is based on the unique facts and circumstances surrounding each plant.[6]

For the Stockton and Calipatria plants, Pacific Ethanol represents that it has engaged CHS, an independent, Fortune 500 grain company with a substantial presence in the grain and feed markets, to conduct an analysis of potential markets for the intermediate product in the general vicinity of each plant. CHS will verify the point in the manufacturing process where the intermediary product, specifically the stillage, takes on value as a marketable product in the vicinity of each plant. Pacific Ethanol represents that it is not its intention to sell the stillage from either plant.

REGULATION OF TRANSPORTATION FUELS IN CALIFORNIA:

[5] According to the 2002 Private Letter Ruling issued by the IRS, "[t]he stillage is received at the Project heated and in a semisolid or 'sludge' form…it is too solid to pump and handle in the Project at ambient temperature. If it were disposable, it would be disposed of in a landfill rather than as water effluent…We conclude that it is solid. The stillage is also useless, unwanted, or discarded material that has no market or other value at the place where it is located. The Company is building the Project because it cannot find a person willing to take the stillage prior to its processing in the Project. We thus conclude that the stillage from the Plant is a solid waste…We conclude that the Project is a solid waste disposal facility."

[6] For its Broadman and Burley plants, Pacific Ethanol was granted tax-exempt volume cap from the states of Oregon and Idaho, respectively.

The primary regulators of transportation fuels in California are the U.S. Environmental Protection Agency (USEPA) through the federal Clean Air Act and CARB through its statutory and regulatory system. The roles of the federal Department of Energy (DOE) and the CEC with respect to transportation fuels are largely to encourage technological advances relating to fuel additives, alternative fuels, and fuel sources. One step removed from the regulation of fuels is the National Highway Safety Administration (NHSA), which establishes corporate average fuel economy (CAFE) standards for passenger vehicles.

USEPA

In 1970, Congress strengthened and expanded the Clean Air Act of 1963 ("the Act") and created the USEPA, which was given the responsibility for implementing the Act's programs designed to reduce air pollution nationwide. Programs under the Act are focused on: (1) reducing ambient concentrations of air pollutants that cause smog, haze, acid rain, and other problems; (2) reducing emissions of toxic air pollutants know to or suspected of causing cancer or other serious illnesses; and, (3) phasing out production and use of chemicals that destroy ozone. Individual states or Indian tribes may institute stronger air pollution laws, but they cannot adopt laws that have lower or weaker limits on air pollution than those established under the Act. The EPA must approve state, tribal, and local agency plans for reducing air pollution. Each state must submit a State Implementation Plan (SIP), which outlines the regulations, programs, and policies the state will adopt to control air pollution in accordance with the Act. If a state's plan does not meet the Act's requirements, the USEPA can issue sanctions against the state and, if it deems necessary, take over the enforcement of the Act within the state.[7]

[7] On November 8, 2007, the State of California filed a suit in federal district court against the USEPA for failing to act on CARB's request for a waiver under the Clean Air Act, which would allow the State to require automobile manufacturers to reduce GHG emissions from vehicles sold in California.

The USEPA's efforts to reduce harmful emissions from gasoline include the elimination of lead from gasoline, the requirement for oxygenate additives to make gasoline "burn cleaner," and the reduction in the sulfur content of gasoline.

CARB:

Historically, California has led the nation in establishing regulations and programs to reduce air pollution from motor vehicles. In 1966, the state enacted the nation's first motor vehicle emission standards. In 1967, the Legislature passed the Mulford-Carrell Act, which combined the Bureau of Air Sanitation and the Motor Vehicle Pollution Control Board to form CARB.

CARB is authorized to adopt standards, rules and regulations that achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to attain the state ambient air quality standards at the earliest practicable date. CARB's efforts related to transportation fuels are made up of several components, which broadly fall into two categories: (1) adopting and enforcing fuel specifications, and (2) controlling emissions from the marketing and distribution of fuels in California. As a result of these efforts, gasoline sold in California contains less pollution-forming sulfur, benzene, aromatic hydrocarbons, and olefins than most gasoline sold in other states.[8]

ALTERNATIVE TRANSPORTATION FUELS:

In the face of rising crude oil prices, which may soon reach an all-time high of $100 per barrel, there is a great deal of momentum behind federal and state efforts to find and develop reliable sources of alternative fuels, with an emphasis on renewable fuels, that overall have fewer negative environmental impacts. Several other factors also have contributed to this momentum including mounting concerns over the substantial contributions of petroleum-based fuels to increasing levels of greenhouse gases and other air pollutants, the negative environmental effects of exploring for and extracting new sources of petroleum, and the security of the United States' offshore sources of petroleum.[9] An alternative fuels plan issued jointly by CARB and the CEC in October 2007 states:

"The emergence of global climate change as a global imperative has attracted public attention to state and national level actions to reduce greenhouse gas (GHG) emissions. In

[8] Information obtained from CARB's website.

[9] The USEPA defines alternative fuels as transportation fuels other than gasoline or diesel, including natural gas, propane, methanol, biofuels (which includes ethanol and biodiesel), and electricity. It defines renewable fuels as alternative fuels made from biomass materials such as wood, waste paper, grasses, vegetable oils, and corn. Renewable fuels are a subset of alternative fuels.

California, the transportation sector is responsible for approximately 40 percent of statewide GHG emissions, over half of statewide criteria air pollution, and significant degradation of public health and environmental quality…California's transportation sector is more than 95 percent dependent on a single fuel source, petroleum, and over 60 percent of the nation's petroleum consumption comes from foreign sources. In 2006, Californians consumed an estimated 20 billion gallons of gasoline and diesel fuel on the state's roadways. The state and the nation are extremely vulnerable to petroleum price and supply disruptions…While the United States consumes nearly 25 percent of the world's petroleum, as a country it maintains only 2 percent of the world's petroleum reserves…[OPEC] continues to control 65 percent of the world's oil supplies, and instability in the Middle East continues to threaten oil supplies. Diversifying the state's and the nation's fuels supplies through the introduction of alternative and renewable fuels will help to ease price volatility and improve fuel supply security. However, it is imperative that these goals are pursued while maintaining or improving air quality and public health impacts."[10]

To address concerns about climate change, GHG emissions, energy prices, and energy security, there have been a number of federal and state initiatives aimed at the production and use of alternative fuels. The most recent of these alternative fuels initiatives have focused on the development of commercially viable biofuels from lignocellulosic feedstocks. The following is a brief summary of these recent initiatives:

Federal Initiatives:

The Energy Policy Act of 2005 established a nationwide renewable fuels standard (RFS), which required the use of four billion gallons of renewable fuels in 2006 and 7.5 billion gallons by 2012 as an additive to gasoline. The two percent oxygenate requirement for reformulated gasoline was eliminated. Under the 2005 RFS, fuel blenders can add ethanol or other renewable fuels to gasoline to meet fuel standards.

In the President's 2007 State of the Union address, he proposed a target of 35 billion gallons of renewable and alternative fuels as gasoline additives by 2017 in order to displace 15 percent of projected gasoline consumption. The President's proposal increased the scope of the RFS and renamed it the Alternative fuels Standard (AFS). The AFS includes fuels such as corn-based ethanol, cellulosic ethanol, biodiesel, methanol, butanol, hydrogen, and alternative fuels.

In response to the Presidents proposal, the DOE developed a strategy to protect national and economic security by promoting a diverse supply and delivery of reliable, affordable and environmentally sound energy. As part of this strategy, DOE's Office of Energy Efficiency and Renewable Energy is engaging its Biomass Program to assist with efforts to develop biofuel, bioproduct, and biopower technologies in cooperation with other government agencies, academia, and industry. The Biomass Program performance goals "…reflect the current strategy of focusing on cellulosic ethanol as the most immediate path to meeting the President's goals addressing both the technology advances required to

[10] *State Alternative Fuels Plan*. Prepared by the California Energy Commission's Transportation Committee and the California Air Resources Board. October 2007. CEC-600-2007-011-CTF.

reduce the cost of cellulosic ethanol production and the biofuels production volume increases required to meet petroleum fuel displacement goals."[11]

This fall, DOE announced the selection of six cellulosic plants that will receive $385 million in federal funding over the next four years. The proposed plants are slated for various locations nationwide and are expected to produce more than 130 million gallons of cellulosic ethanol per year when they are operational. According to DOE, "…these projects directly support the goals of President Bush's Twenty in Ten Initiative, which aims to increase the use of renewable and alternative fuels in the transportation sector to the equivalent of 35 billion gallons of ethanol by 2017. Funding of these projects is an integral part of the President's Biofuels Initiative that will lead to wide-scale use of non-food based biomass, such as agricultural waste, trees, forest residues, and perennial grasses in the production of transportation fuels, electricity, and other products. The solicitation, announced a year ago, was initially for three biorefineries and $160 million. However, in an effort to expedite the goals of President Bush's Advanced Energy Initiative and help achieve the goals of his Twenty in Ten Initiative…Secretary Bodman raised the funding ceiling."[12]

Further in response to the President's proposal, DOE announced in August 2007 the availability of $33.8 million "…to support the development of commercially viable enzymes – a key step to enabling bio-based production of clean, renewable biofuels such as cellulosic ethanol." The announcement further reported that "[b]y harnessing the power of enzymes, which are responsible for many of the biochemical processes in nature, biorefineries can more efficiently use cellulosic (non-food) feeedstocks for biofuels production. This funding aims to further reduce costs of enzyme system preparations in process-relevant conditions. Since 2000, DOE enzyme development advancements have yielded thirty-fold cost reductions mainly on enzyme production. This biofuels effort focuses on production from non-food materials and agricultural waste – such as corn stover, switchgrass, and prairie grass."[13]

Finally, it is worth noting that the 2007 Farm Bill passed by the House this summer "…expands and extends several provisions from the energy title of the enacted 2002 farm bill with substantial increases in funding and a heightened focus on developing cellulosic ethanol production. A key departure from the current [2002] farm-bill related energy provisions is that most new funding would be directed away from corn-starch-based ethanol production and towards either cellulosic-based biofuels or to new as-yet-developed technologies with some type of agricultural linkage."[14]

California Initiatives:

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[11] *Biomass Multi-year Program Plan.* U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Office of the Biomass Program. October 2007.

[12] "DOE Selects Six Cellulosic Ethanol Plants for Up to $385 Million in Federal Funding." United States Department of Energy, Office of Public Affairs Press Release. February 28, 2007.

[13] "Department of Energy to Make Available up to $33.8 Million to Support Commercial Production of Cellulosic Biofuels." Environmental and Energy Study Institute News Release. August 27, 2007.

[14] Renewable Energy Policy in the 2007 Farm Bill. Congressional Research Service, August 17, 2007.

The CEC/CARB State Alternative Fuels Plan outlines multiple state policies aimed at encouraging the development of alternative fuels. These include:

- In response to AB 1076 (Pavley, Chapter 936, Statutes of 2000), the CEC and CARB prepared and adopted a joint report titled *Reducing California's Petroleum Dependence*. Among other things, the report includes recommendations to increase the use of alternative fuels to 20 percent of on-road transportation fuels by 2020 and to 30 percent by 2030.

- In 2003, Governor Schwarzenegger called for a long-term plan to increase the use of alternative fuels. Subsequent legislation, AB 1007 (Pavley, Chapter 371, Statutes of 2005) directed the CEC and CARB to develop a state alternative fuels plan to increase the use of alternative fuels without adversely affecting air quality, water quality, or causing negative health effects.

- In 2005, the Governor issued Executive Order S-03-05 concerning climate change. The Order sets the state's GHG emission reduction goals to the level emitted in 2000 by 2010, to the level emitted in 1990 by 2020, and to 80 percent below the level emitted in 1990 by 2050. AB 32 (Nunez/Pavley, Chapter 488, Statutes of 2006), the California Global Warming Solutions Act of 2006, establishes requirements for CARB on achieving the 1990 GHG emissions levels by 2020. Finally, in 2007, Governor Schwarzenegger issued Executive Order S-01-07 concerning the development of a low carbon fuel standard for California. The standard, which is scheduled to be in place by December 2008, requires fuel suppliers and distributors to reduce the carbon intensity of their fuels by 10 percent by 2020.

- The CEC's *Bioenergy Action Plan for California* released in July 2006 sets targets for biofuels of .93 million gasoline gallon equivalents by 2010, 1.6 billion gasoline gallon equivalents by 2020, and 2 billion gasoline gallon equivalents by 2050. In addition, in Executive Order S-06-06, Governor Schwarzenegger established goals of in-state production of biofuels used in California of a minimum of 20 percent by 2010, 40 percent by 2020, and 75 percent by 2050. According to the Plan, "California has large, untapped biomass resources that can be used as a source to produce energy in the form of electricity, biomethane (natural gas), and biofuels. The gross potential of these resources approaches 80 million dry tons of biomass from the state's farms, dairies, forests, and landfills. Using California's waste stream as a source of transportation fuel provides multiple public benefits, contributing to the state's petroleum reduction, waste reduction, and climate change goals. Using waste materials from our state's agricultural, forestry, and urban waste streams to produce energy may improve forest and animal health, reduces the risk of catastrophic wildfires, and reduces the volumes of landfill wastes."[15]

[15] *State Alternative Fuels Plan*. Prepared by the California Energy Commission's Transportation Committee and the California Air Resources Board. October 2007. CEC-600-2007-011-CTF.

Further, AB 118 (Nunez/Laird, Chapter 750, Statutes of 2007) creates and identifies funding for the Alternative and Renewable Fuel and Vehicle Technology Program, to be administered by the CEC, to provide grants, loans, loan guarantees, revolving loans, or other appropriate measures, to public agencies, businesses and projects, public-private partnerships, vehicle and technology consortia, workforce training partnerships and collaboratives, fleet owners, consumers, recreational boaters, and academic institutions to develop and deploy innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies. The bill also creates and identifies funding for the Air Quality Improvement Program, to be administered by CARB, to fund air quality improvement projects relating to fuel and vehicle technologies.

Finally, in FY 06/07, CARB's budget contained a $25 million appropriation for the purpose of incentivizing biofuels and efficient, low emitting vehicle technologies. In fall 2007, CARB awarded almost $12 million of these funds to E85 and other alternative fuel infrastructure projects (e.g., installation of retail pumps along major thoroughfares in the state) and to the startup of small biofuels production facilities in California.[16]

ISSUES CONCERNING CORN-BASED ETHANOL:

Based upon staff's research, the following is a summary of the main issues concerning the production and use of corn-based ethanol as a fuel additive and alternative fuel in California.

Issue I: Although disputed by some, it is generally believed that, based upon currently available models and data, corn-based ethanol has a positive effect with respect to both green house gas (GHG) emissions and energy efficiency when used as a fuel additive or an alternative fuel relative to petroleum-based fuels. The positive effect varies depending on the processes used in manufacturing the corn-based ethanol (that is, corn-based ethanol production fueled by coal would probably have a negative overall impact on GHG emissions). The arguments in favor of corn-based ethanol are that it (1) is a fuel additive and an alternative fuel that is commercially available, (2) in the short-term provides a means of displacing petroleum-based fuels, and (3) provides a platform for manufacturing ethanol from non-corn feedstocks when science and technology make them commercially viable.

However, it also is believed generally by regulators, environmentalists, and researchers that the models currently available do not address the impacts on land use and land conservation, and possible effects on soil, water, and the surrounding ecosystem from growing corn as a feedstock for ethanol. The feeling is that California should update its models used to measure GHG and other emissions to include these other environmental impacts and should apply the updated model to ALL transportation fuels, including corn-based ethanol, so that the state can aim its policies at the best alternatives to petroleum-based fuels. There is a general concern that food crops grown for biofuel use large amounts of land, water, fertilizers, pesticides, and energy, and that increased land use for energy crops has potential negative impacts on natural habitats, biodiversity, and soil

[16] Note that none of these funds was awarded to corn-based ethanol production facilities.

erosion. There is skepticism among researchers and environmentalist that, using a more environmentally comprehensive model, corn-based ethanol will prove to have positive effects relative to petroleum and ultimately will become an authorized alternative fuel when California develops its LCFS.[17]

Discussion:
The recently adopted State Alternative Fuels Plan proposes the state update and refine the current "well-to-wheels" model used to evaluate fuel emissions:

"Results of the Plan's full fuel cycle (well-to-wheels) analysis further demonstrate that alternative fuels can provide substantial GHG emission reduction benefits, when used in mid-size passenger cars and urban buses. Depending on the fuel pathway chose, fuels such as ethanol, natural gas, liquefied petroleum gas, electricity, and hydrogen have decided advantages over conventionally produced gasoline and diesel fuels…However, the full fuel cycle analysis will need to be refined and updated to address sustainability issues and land-use conversion impacts of biofuels…Changes in land use due to biofuel feedstock farming can have a substantial GHG impact but are not included in a full fuel cycle assessment because they are variable and not fully quantified, one-time changes. The analysis provided only the vehicle tailpipe emissions and process energy and feedstock inputs employed."[18]

The report further adds that "[b]iofuels are a good option in the short term because they are available now and have petroleum reduction, waste reduction, and climate change benefits. The state should encourage and support the in-state production of these fuels from the state's agricultural, forestry, and urban waste residues. The report recommends that, as an immediate action related to ethanol, the state develop 30-60 ethanol plants using imported corn feedstocks initially "…but transitioning to production from agriculture, forestry, and urban wastes; producing biomethane and biogas; using purpose-grown crops such as sugar cane."[19]

Using the well-to-wheels model, the report shows that, while petroleum fuels with a 30 percent ethanol content produced with Midwest corn demonstrated a reduction in GHG emissions (approximately 6%) relative to current reformulated gasoline, petroleum fuels with a 30 percent ethanol content produced using California poplar (quick-growing tree) showed a three-times greater reduction in GHG emissions (approximately 19%) relative to current reformulated gasoline. The same results are reported for corn-based E85 (85% ethanol/15% petroleum) versus California poplar-based E85.[20]

A July 2005 issue paper released by the Natural Resources Defense Council argues that "…[t]he best science currently supports the conclusion that ethanol from corn kernels contains more high-quality energy than it takes to grow the corn and process the

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[17] Note that CARB is scheduled to develop it LCFS model, in accordance with the Governor's Executive Order S-1-07, by December 2008. Under the LCFS, fuel suppliers and distributors will be required to reduce the carbon intensity of their fuels by 10 percent by 2020.
[18] *State Alternative Fuels Plan*. Prepared by the California Energy Commission's Transportation Committee and the California Air Resources Board. October 2007. CEC-600-2007-011-CTF.
[19] Ibid.
[20] Ibid.

fuel…While producing ethanol from the starch in corn uses more fossil fuel than ethanol from cellulosic biomass will, ethanol from both sources actually uses very little petroleum. Ethanol from corn kernels or from cellulose uses 93 percent less petroleum than an equivalent amount of gasoline. The reason the biofuels industry needs to evolve away from just corn kernels to cellulose is so that it can grow much larger and still remain sustainable."[21]

Further, in a recent report issued jointly by the Natural Resources Defense Council, Western Resources Advocates, and the Pembina Institute, the authors write, in part:

"While biofuel technologies hold great promise in reducing heat-trapping pollution, it is equally important that the EPA ensure that the production and use of biofuels do not degrade our air, soil, and water quality; threaten sensitive wildlife habitat; or negatively affect public health. Realizing the benefits of biofuels will require close attention to details of crop cultivation and fuel production, as described by an NRDC expert in testimony before the Senate Energy and Natural Resources Committee:

> **[C]onsider a cellulosic ethanol plant. While such plants are often considered to be environmentally superior to corn ethanol plants, this is not necessarily the case, depending on how the cellulosic feedstock is produced. For example, if the biomass for the cellulosic ethanol plant is obtained by converting to biomass production land that had been enrolled in the conservation reserve program (CRPO), then the forgone conservation benefits and carbon benefits must be accounted for…"[22]**

A 2007 report published by Environmental Defense, using the Ogallala Aquifer as a case study, highlights potential impacts of the expansion of crop-based biofuels production, specifically corn-ethanol, on the surrounding environment.[23] According to the report, the Ogallala Aquifer, which supports the majority of irrigated agriculture in the southern Great Plains, recently has experienced substantial water table declines in areas where groundwater pumping has exceeded replacement. The report reads, in part:

"Water demands associated with individual ethanol plants – due to both ethanol processing and growing feedstock – are not exceptionally higher than demands form other industrial or agricultural users, but the construction of new ethanol plants in areas of existing water stress will exacerbate conflicts if water is already scarce…Rising corn demand and commodity prices related to the expansion of corn ethanol also put two types of 'fallow' land at risk: U.S. Conservation Reserve Program (CRP) lands and untilled native grasslands. The United States Department of Agriculture (USDA) has already halted new enrollment of lands into general CRP acreage in 2007 and anticipates that farmers are

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[21] Greene, Nathanael and Mugica, Yerina. *Bringing Biofuels to the Pump: An Aggressive Plan for Ending America's Oil Dependence*. Natural Resources Defense Council. July 2005.

[22] Bordetsky, A., Casey-Lefkowitz, S., Lovaas, D., martin-Perera, E., Nakagawa, M., Randall, B., Woynillowicz, D. *Driving It Home: Choosing the Right Path for Fueling North America's Transportation Future*. Joint report by the Natural Resources Defense Council, Western Resource Advocates, and the Pembina Institute. June 2007.

[23] Roberts, Martha G., Male, Timothy D., and Toombs, Theodore P. *Potential Impacts of Biofuels Expansion on Natural Resources: A Case Study of the Ogallala Aquifer Region.* Environmental Defense. 2007. Note that the Ogallala Aquifer region cover parts of Texas, New Mexico, Oklahoma, Kansas, Colorado, Nebraska, and Wyoming. This was the area of the Dust Bowl in the 1930s.

planning to put 4.6 million acres of CRP lands back into crops when their contracts expire in the next four years…Increases in corn ethanol production are likely to result in conversion of grasslands. Conversion may be directly linked to ethanol expansion, such as when grassland is converted to supply corn to a nearby ethanol plant; or more indirectly connected, such as when grassland is converted to satisfy demand for livestock feed or from export markets whose supply has been displaced by increasing use of corn for ethanol…Thoughtful fuel and natural resource policy can mitigate the negative implications of biofuels production and create incentives for the cleanest production pathways. One important step forward is California's ongoing development of a Low Carbon Fuel Standard…Such policies should also be paired with strong incentives for water and wildlife protection that should accompany any solely carbon-focused standard."[24]

With respect to the impact of the manufacturing process on the GHG emissions and energy efficiency of corn-based ethanol, a recent University of California report stated that "[e]thanol is now the principal biofuel used in the state, and with a current in-state production capacity of only 71 million gallons per year…most of the 900 million gallons used are imported, with 90 percent coming from the Midwest…Processing energy for ethanol from corn comes principally from natural gas, but about 20% of capacity uses coal…Without carbon capture and storage, net greenhouse gas emissions from coal-fired ethanol facilities exceed those of gasoline. In contrast, ethanol from facilities firing natural gas…yield reductions, if small, in greenhouse gas emissions compared with gasoline. In California, direct use of wet distillers grains as animal feeds further avoids emissions from dryers that are commonly utilized in Midwest ethanol production. However, emissions of residual alcohols in the wet distillers grains during handling can contribute to volatile organic compound (VOC) emissions affecting local or regional air quality. Full system evaluations are critical to evaluating overall impacts associated with the various biofuels pathways."[25]

In addition, a recent scientific paper raises the question of whether ethanol produced from energy crops, such as corn, which require a substantial amount of fertilizer, actually creates more GHG emissions than it saves as a replacement for gasoline. According to the report, "[w]hen the extra N_2O emission from biofuel production is calculated in 'CO_2-equivalent' global warming terms, and compared with the quasi-cooling effect of 'saving' emissions of fossil fuel derived CO_2, the outcome is that the production of commonly used biofuels, such as biodiesel from rapeseed and bioethanol from corn (maize), can contribute as much or more to global warming by N_2O emissions than cooling by fossil fuels savings. Crops with less N [nitrogen fertilizer] demand, such as grasses and woody coppice species have more favorable climate impacts. This analysis only considers the conversion of biomass to biofuel. It does not take into account the use of fossil fuel on

[24] Ibid. Note that the report states that, for the Ogallala Aquifer region, the production of one bushel of corn consumes 2,600 gallons of water. According to information provided by the Union of Concerned Scientists, corn needed to produce one gallon of ethanol requires 785 gallons of water in the field. Further, according to this report and to information provided by the Union of Concerned Scientists, corn ethanol production uses an average of four gallons of water for each gallon of ethanol produced.

[25] *A Low-Carbon Fuel Standard for California: Part 1: Technical Analysis.* Prepared by Farrell, Alexander E., U.C. Berkeley, and Sperling, David, U.C. Davis for CalEPA and the CEC. May 29, 2007. Note that the two proposed Pacific Ethanol plants will be powered by natural gas and will produce wet distillers grains as a feed by-product.

farms and for fertilizer and pesticide production, but it also neglects the production of useful co-products. Both factors partially compensate each other. This needs to be analyzed in a full life cycle assessment."[26]

A recent study conducted by a professor of Civil and Environmental Engineering at the University of California, Berkeley attempts to quantify the full life-cycle effects of growing corn for ethanol production on GHG emissions, energy usage, and the environment.[27] In this study, the author concludes that corn-based ethanol production is not sustainable. According to a campus publication, the professor "…factored in the myriad energy inputs required by industrial agriculture, from the amount of fuels used to produce fertilizers and corn seeds to the transportation and wastewater disposal costs. All told, he believes that the cumulative energy consumed in corn farming and ethanol production is six times greater than what the end product provides your car engine in terms of power."[28] In his study, the professor also voices a concern that environmentalists have voiced: Economic interests of corn-belt states and agribusiness are driving national policy toward the use of corn-based ethanol rather than scientifically sound, full life-cycle analysis.

Issue II: There is agreement generally that ethanol manufactured from lignocellulosic feedstocks is preferable from all standpoints.

Discussion:
Regulators, researchers, and environmentalists agree that ethanol production from lignocellulosic feedstocks is far preferable to food crop feedstocks from an overall environmental standpoint and must be encouraged and developed in California. The CEC/CARB alternative fuels plan recommends that California rely on the state's large volume of biomass residues from agriculture, forestry, and urban municipal solid waste as the feedstock for ethanol production. Prior to adopting the alternative fuels plan in October, the CEC engaged the California Biomass Collaborative (CBC) to develop a roadmap for the development and use of biomass for energy production in California in response to Executive Order S-06-06.[29] In its December 2006 report, the CBC stated that,"[i]n California today the three primary sources of biomass for energy are agriculture, forestry, and municipal wastes. Of the 81 million gross tons of biomass produced annually, it is believed to be technically feasible to collect and use about 32 million tons in producing renewable electricity, biofuels, and biobased products..."[30]

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[26] Crutzen, P.J., Mosier, A.R., Smith, K.A., and Winiwarter, W. *N2O release from agro-fuel production negates global warming reduction by replacing fossil fuels*. Paper prepared for Atmospheric Chemistry and Physics Discussions. Published August 1, 2007.

[27] Patzek, Tad W. Thermodynamics of the Corn-Ethanol Biofuel Cycle. *Critical Reviews in Plant Sciences*, 23(6):519-567 (2004).

[28] Pescovitz, David. Ethanol Stirs Eco-Debate. *Berkeley Engineering Lab Notes*. March 2005.

[29] Executive Order S-06-06 sets the following targets for biofuels and biopower development: by 2010, 20 percent of California's biofuels must be produced within the State, increasing to 40 percent by 2020 and to 75 percent by 2050; and, by 2010 and through 2020, 20 percent of California's renewable electricity must be generated from biomass resources within the State.

[30] *A Preliminary Roadmap for the Development of Biomass in California*. Prepared by the California Biomass Collaborative for the California Energy Commission. December 2006. CEC-500-2006-095-D.

The CBC report further reads, in part:

"Biomass energy can be produced sustainably, without increasing greenhouse gas emissions. Substituting biomass for fossil fuels eliminates the greenhouse gases that would have been emitted by combusting the fossil fuels. Biomass is the only renewable resource that can also sequester carbon and restore depleted soils by incorporating plant-derived materials into the ground…Biomass energy production provides a number of other environmental benefits. Purpose grown biomass energy crops [such as switchgrass, poplars, and willows] can make marginal croplands more productive. These crops may also perform some soil restoration and improvement, capturing metals and salts and helping to lower water tables in drainage-impaired lands…Lignocellulosic-derived ethanol offers several advantages over ethanol produced from sugar-starch feedstocks. These include the potential for higher-per-acre ethanol yields and lower agronomic inputs for the purpose-grown energy crops; improved product-life-cycle environmental performance, GHG balances and net-energy rations; the potential to utilize marginal and idle lands – which reduces competition with food crops…As the US will not be able to make enough biofuels…from conventional feedstocks (starch and sugar sources) to substantially reduce petroleum imports or lower GHG emissions from the transportation sector, lignocellulosic routes to biofuels will be needed."[31]

In response to Executive Order S-1-07, the LCFS, the California Environmental Protection Agency (CalEPA) and the CEC are coordinating the development of a proposed compliance schedule with researchers from the University of California. A recently released LCFS report reads, in part:

"We find it possible to either manufacture a significant amount of low-carbon fuel within California or to import it from outside the state…California has or could have sufficient feedstocks to produce over a billion gallons of biofuels per year by 2020 in state, and perhaps even twice that amount…Research and development projects are underway to investigate some of these new crops and new technologies; these efforts will eventually enhance the quantity and diversity of fuel options available…Ligno-cellulosic crops, both herbaceous and woody plants, represent a potentially more widely available biofuel feedstock than sugar and starch crops. Both herbaceous and woody crops are perennial, and whereby they replace annual crops they are likely to increase soil organic carbon…These crops may also have relatively low fertilizer and other input requirements, resulting in a relatively low GHG profile. Furthermore…the potential yields per land area are generally higher than for agricultural crops…Residues may be collected as a by-product of other crops, such as corn stover or rice or wheat straw, or they may be collected after processing of other crops, such as lumber mill, cotton gin, or vegetable processing

[31] Ibid. Note that the challenge for gasoline with 15 percent or greater ethanol content is that it requires different delivery mechanisms than the current 5.7 percent or the proposed 10 percent reformulated gasoline (e.g., special pumps) and can only be used with specially manufactured Flex Fuel Vehicles (FFVs). These low-level blends are thought to contribute to pollution, especially when used in older vehicles. The challenge for California's potential use of higher ethanol blends, then, is the installation and cost of the delivery infrastructure and the availability of and the cost and attractiveness to consumers of FFVs.

residues. Residues, especially corn stover, are expected to be the first feedstocks for cellulosic biofuels to be utilized."[32]

In a recent University of California, Berkeley press release, the coauthor of the LCFS report is quoted as saying that "[e]thanol can be, if it's made the right way with cellulosic technology, a really good fuel for the United States…At the moment, cellulosic technology is just too expensive. If that changes – and the technology is developing rapidly – then we might see cellulosic technology enter the commercial market within five years…Two things are going to push the commercialization of cellulosic technology…One is driving the cost down, which is mainly research and development; the other is that environmental concerns are increasingly entering into commercial calculations about biofuels."[33]

In 2005, the Natural Resources Defense Council issued a report that encouraged the U.S. to adopt a range of policy initiatives to encourage a viable cellulosic biofuel industry by 2015. These initiatives include government support of research and development efforts, cellulosic biofuels demonstration projects, and deployment initiatives to ensure cellulosic ethanol can be priced competitively, and the development of infrastructure and markets for the delivery of cellulosic biofuels and policies that encourage the production of FFVs.[34]

It is worth noting that BlueFire Ethanol Lancaster, LLC submitted an application to CPCFA for $34,200,000 in tax-exempt financing for a three million gallon per year ethanol production facility in Lancaster, California. The proposed facility will use biomass to fuel the production of ethanol from a feedstock consisting of green waste and other cellulosic debris diverted from landfills. In its application, BlueFire reports the following benefits expected from the proposed facility:

"Waste material will be diverted from landfills where it would otherwise have decomposed while creating methane gas…The plant process itself is designed and will be constructed to utilize recycled rather than potable water…Ethanol, the plant's end product, serves as a volumetric extender for fossil fuel by virtue of its being blended with conventional gasoline. In addition to assisting to reduce our societal dependence on foreign sources of crude, the plant process itself will consume about 70% less fuel than otherwise required through the use of a process by-product, lignin, to generate the facility's thermal and electrical energy requirements…The project will generate carbon credits."[35]

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[32] *A Low-Carbon Fuel Standard for California: Part 1: Technical Analysis.* Prepared by Farrell, Alexander E., U.C. Berkeley, and Sperling, David, U.C. Davis. May 29, 2007.

[33] Sanders, Robert. Ethanol can replace gasoline with significant energy savings, comparable impact on greenhouse gases. U.C. Berkeley Press Release. January 1, 2006.

[34] Greene, Nathanael and Mugica, Yerina. *Bringing Biofuels to the Pump: An Aggressive Plan for Ending America's Oil Dependence*. Natural Resources Defense Council. July 2005.

[35] BlueFire Ethanol Lancaster, LLC application submitted to CPCFA on November 5, 2007. Note that BlueFire Ethanol is the recipient of one of the six DOE grants described above for its cellulosic ethanol plant proposed for Riverside County. BlueFire Ethanol received a grant of up to $40 million to construct a plant on an existing landfill that will

BlueFire Ethanol anticipates that construction of the Lancaster facility and equipment purchases will begin in January 2008. The company estimates that construction will be completed in March 2009, and it anticipates requesting that CPCFA issue tax-exempt bonds to finance the facility in the second quarter of 2009.

Issue III. In the area of transportation, there is agreement generally that the most significant contribution to decreasing GHG and other emissions and increasing energy efficiency will be made by more fuel efficient vehicles (e.g., plug-in hybrid electric vehicles or PHEVs) and increased use of public and mass transportation.

Discussion:
Although most regulators and researchers anticipate that biofuels will be an important part of California's energy future, there are other initiatives which are anticipated to result in even greater environmental and energy benefits. In its *2007 Integrated Energy Policy Report*, the CEC states:

"Decreasing California's reliance on petroleum fuels is critical. By 2020, at current trends, over 44 million Californians will consume more than 24 billion gallons of gasoline and diesel fuels each year. The consequences are quite clear: major investments in petroleum refinery and delivery infrastructure expansions, more dependency on foreign energy supplies, and decreased environmental and public health quality…California's energy policy…identifies energy efficiency, renewables and new infrastructure improvements as the state's priorities in meeting growing demand…Improved efficiency of transportation energy use, in large part through vehicle standards, is the most effective and sustainable strategy for reducing our demand for transportation fuels…Efficiency improvements can be made in vehicle energy use, individual miles traveled, and goods movement…National experts, such as the National Research Council of the National Academy of Sciences and the American Council for an Energy Efficient Economy, have identified multiple pathways to achieve an on-road fleet average fuel economy of 30 to 45 mpg. Their analysis shows that, in most instances, increasing fuel economy creates consumer fuel savings that exceed the increased cost of the more fuel efficient vehicle. In addition, society benefits from the improvements to the environment and energy security."[36]

In the joint report issued by the Natural Resources Defense Council, Western Resources Advocates, and the Pembina Institute, the authors argue that "…[t]he cleanest, fastest, and cheapest method of reducing global warming pollution and slowing the rush toward unconventional sources of liquid fuel is more efficient use of oil…Efficiency would allow policymakers and the private sector time to focus on, and steer toward, longer-term technology solutions to oil dependence and global warming pollution…there is a growing confluence of interests pushing in this direction. Perhaps the best evidence of this is the call for a 20 percent reduction in projected gasoline consumption in 10 years by President Bush in his 2007 State of the Union address. ConocoPhillips and ExxonMobil also

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produce up to 19 million gallons of ethanol per year from sorted green waste and wood waste.

[36] *2007 Integrated Policy Report*. Draft report prepared by the California Energy Commission's Integrated Policy Report Committee. October 2007.

recently endorsed an increase in vehicle fuel economy standards, with other business and national security leaders following suit."[37]

In its 2006 Energy Resources Policy, the Sierra Club states that "…[e]nergy efficiency – using improved technology and operations to deliver the same energy services with less fuel – is the foundation on which all of our other recommendations are based…energy efficiency programs can be implemented now and make a substantial, immediate contribution to reducing energy use and greenhouse gas emissions…[The Sierra Club recommends that the U.S. increase vehicle efficiency]…by raising Corporate Average Fuel Economy (CAFE) standards for cars and light trucks to intermediate levels of 40 mpg as soon as possible, then to 55 mpg or higher…Electric and plug-in-hybrid vehicles may prove to be an important new options."[38]

Issue IV: There is concern by environmental justice advocates and international food policy experts that using food crops as feedstock for biofuels will drive up food prices and thereby harm the poorest citizens of the world who already are struggling to feed themselves. For example, this last summer, California's dairy farmers experienced an increase in the cost of producing milk. The primary reason identified for the increase in milk production costs was the increase of feed costs by over 10 percent. As a result of increased corn-based ethanol production in the U.S., the price of corn, rolled corn, grain by-products, and other feeds for livestock increased.[39]

Discussion:
A recent Foreign Affairs reports on the effects of rising corn prices in Mexico:

"Even major oil exporters that use their petrodollars to purchase food imports, such as Mexico, cannot escape the consequences of the hikes in food prices. In late 2006, the price of tortilla flour in Mexico, which gets 80 percent of its corn imports from the United States, doubled thanks partly to a rise in U.S. corn prices from $2.80 to $4.20 a bushel over the previous several months…With about half of Mexico's 107 million people living in poverty and relying on tortillas as a main source of calories, the public outcry was fierce. In January 2007, Mexico's new president, Felipe Calderon, was forced to cap prices of corn products."[40]

According to an October 16, 2007 press release by the United Nations Special Rapporteur on the Right to Food, "…[t]he sudden, ill-conceived rush to convert food, such as maize, wheat, sugar and palm oil, into fuels is a recipe for disaster. In this rush, there are serious risks of creating competition between food and fuel that will leave the poor and hungry in developing countries at the mercy of rapidly rising prices for food,

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[37] Bordetsky, A., Casey-Lefkowitz, S., Lovaas, D., martin-Perera, E., Nakagawa, M., Randall, B., Woynillowicz, D. *Driving It Home: Choosing the Right Path for Fueling North America's Transportation Future*. Joint report by the Natural Resources Defense Council, Western Resource Advocates, and the Pembina Institute. June 2007.

[38] *2006 Energy Resources Policy*. The Sierra Club. Adopted September 16, 2006.

[39] California Dairy Review, Volume 11, Issue 7. Published by the California Department of Food and Agriculture. July 2007.

[40] Runge, C. Ford and Senauer, Benjamin. How Biofuels Could Starve the Poor. Foreign Affairs, May/June 2007.

land and water. If agro-industrial methods are pursued to turn food into fuel, then there are also risks that unemployment and violations of the right to food may result, unless specific measures are put in place to ensure that biofuels contribute to the development of small-scale farming."[41]

On November 15, 2007, the United Nation's World Food Program Executive Director, Josette Sheeran, reported that the poorest in Africa are being challenged by the triple threat of rising food prices, climate change, and population growth. Global commodity prices are soaring, driven in part by the rising cost of fuels, which means the prices of food staples have surged in poor African countries this year, placing them out of reach of many consumers. Ms. Sheeran stated that high world prices for grains have made the World Food Program's operations more challenging than ever. The overall cost of reaching a hungry person has increased by 50 per cent in the last five years. An estimated 1.5 million children under the age of five in the Sahel region are now classified as acutely malnourished, the highest proportion of any region worldwide. This 'silent emergency' kills more than 300,000 children every year and stunts the growth of those who survive.[42]

CONCLUSION:

Staff's research shows that there is enormous pressure on governments to find sound solutions to the pressing problems related to climate change, GHG emissions, energy prices, and energy security. With respect to transportation fuels, the research shows that the focus of regulators, researchers, and environmentalists is to determine the best alternatives to petroleum based upon a full life-cycle model and to encourage and incentivize the commercialization of these alternatives. As an alternative fuel, corn-based ethanol raises many questions about its overall environmental benefits when subjected to a full life-cycle model. Many believe that growing food crops such as corn for energy is not a sustainable means of addressing climate change and other environmental problems associated with transportation fuels. Policymakers and elected officials nationwide are creating programs to encourage the development and commercialization of ethanol derived from lignocellulosic feedstocks, which is expected to yield GHG and energy benefits three times what may be achievable by corn-based ethanol.

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[41] "UN Special Rapporteur on the Right to Food Deplores Increase in the Number of People Suffering from Hunger." United Nations Press Release. October 16, 2007.

[42] "Triple threat looms over Africa's rural poor, warns UN agency chief." UN News Centre. November 15, 2007.