

Outreach Support for Biomass Project Development in Florida: Value Added Metrics

Southeastern Regional Biomass Energy Program Southern States Energy Board

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Note on Internet Hyperlink Function in Report: Hyperlinks are included to our Internet resources that provide additional information on topics discussed. To utilize this tool, connect to the Internet, right click on the link, and then select open hyperlink.

Introduction and Background: For biomass energy projects (electricity and co-generation, ethanol, and bio-diesel production), the combination of five key factors highly determine short-term (ability to raise capital) and long-term financial viability:

- (1) Capital cost of the renewable energy technology used.
- (2) Avoided cost of displaced fossil fuels (e.g., gas, oil, coal).
- (3) Government policies and incentives.
- (4) Cost of feedstocks and their processing (waste streams and agriculture crops).
- (5) Value-added products and services.

In current project development efforts however, there are limited actions that can be taken to address items (1) through (3) of these above key factors. Biomass fuels (e.g., ethanol) and energy (e.g., gasification) technology capital costs will continue to be burdensomely high until breakthroughs in R&D and/or the economics of mass production occur. Also, fossil fuels are commodity products and will always be subject to [price swing volatility](#) in financial markets. Finally, the effectiveness and commitment of Government policies to support current biomass energy business development have been if not questionable, then unclear.

Two examples of ineffective Federal renewable energy policies have been experienced first hand in Florida: The [Renewable Energy Productive Incentive](#) (REPI) for municipal utilities; The [Section 45 Tax Credit](#). In 2000-01, The Common Purpose Institute, the University of Florida, and Energy Companies in Florida cost shared with the U.S. Department of Energy to commercially demonstrate:

- ✍ the engineering viability of co-firing solid biomass fuels in existing coal-fired power plants (cyclone, pulverized coal, and [IGCC coal gasification units](#));
- ✍ a biomass energy crop plantation to provide a dedicated feedstock source for sustainable power plant co-firing.

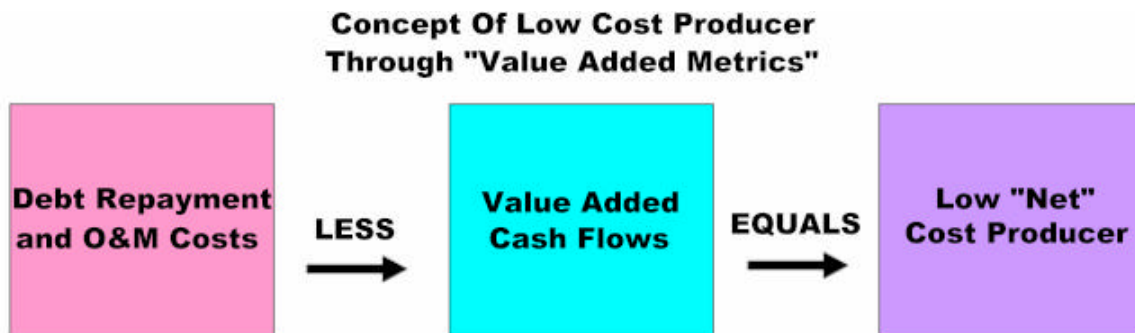
Both of these commercial demonstration efforts were by in large, successful. However, in 2005 when the energy crops were ready to be harvested, neither REPI nor the Section 45 Tax Credit provided any economic value. REPI is subject to annual Congressional appropriations. For fiscal year 2005, appropriations to the REPI program had a shortfall of ~\$45 million to qualifying renewable energy projects. Also in recent years, Parent Companies of many electric utilities incurred significant financial losses from domestic and foreign Independent Power Projects (e.g., fossil fuel merchant power plants). This has resulted in sizable federal income tax carry-forward positions, where these electric utilities can not currently benefit from the Section 45 Tax Credit.

Two key factors where current development efforts can have a major influence in determining a biomass project's financial viability are items (4) feedstock costs, and (5) creating value-added products and services. These two items and their linkage form the core basis of our SSEB sponsored Outreach Efforts during the past year.

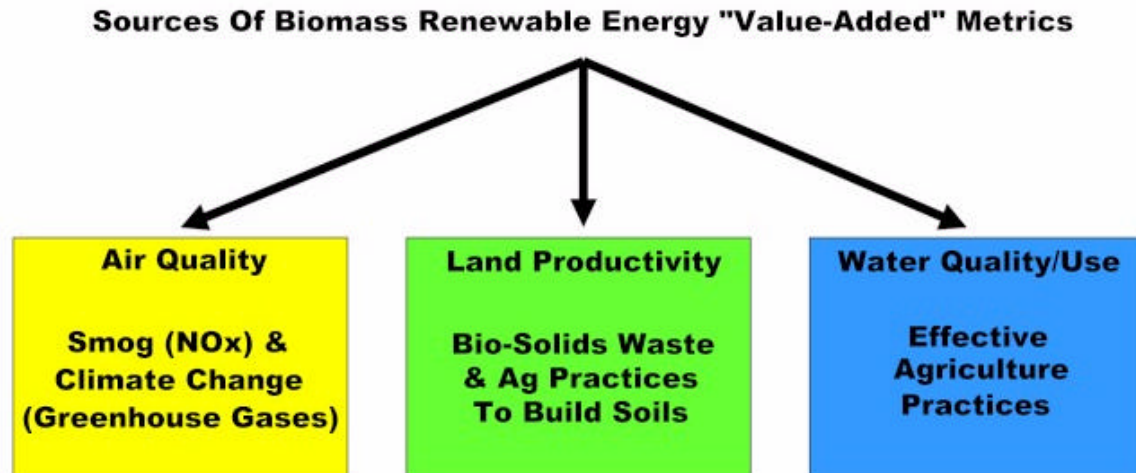
The Importance of Agriculture and Biomass Energy: Within many Forums on biomass energy development, quite often an **either or** debate occurs over which feedstock source is more appropriate – (1) biomass waste streams, or (2) agriculture crops. We believe this either/or debate is incorrect, and that long-term sustainability and the financial viability of many biomass projects will depend on the utilization of both resources. While biomass waste stream feedstocks may often have a current economic advantage (low cost, and even negative cost where tipping fees are available), the question of long-term sustainability of low-cost waste feedstock sources is often minimized.

Ethanol project development in Florida provides a good example of this above point. A very favorable **current** market condition in developing sugar platform based ethanol projects in Florida is the high volume of citrus processing wastes. However, several factors could quickly and dramatically change market dynamics. First, Florida citrus agriculture is under siege from two catastrophic crop diseases – canker, and greening. A second factor is continuing competition from South American (e.g., Brazil) agriculture. Third, with exploding population growth in the State, [farming lands are being sold](#) for residential/commercial development. Fourth, with any significant reduction in citrus production (e.g., from disease, foreign agriculture competition, land development, etc.), low cost feedstock for ethanol production could change dramatically, directly competing against an existing market demand of citrus waste for animal feed use.

Importance of Value-Added Metrics in Competitiveness: While specific products and services will be addressed in this Report, it must be emphasized that to realize maximum benefits, “Value-Added Metrics” must be a dynamic and on-going process which continuously looks “outside the box” of traditional renewable energy business development efforts. **The objective is to maximize a biomass energy project’s competitiveness to be a low “net-cost” producer, regardless of factors that Developers have little control over during the life of a project** (e.g., ineffectiveness or the elimination/under-funding of Government initiated policies and market incentives, fossil fuel energy prices, etc.). This concept is straight forward, where cash flow sources (value added metrics) are realized to offset traditional biomass energy project costs (e.g., repayment of project financing debt, operation and maintenance expenses, agriculture crop feedstock costs, transportation, working capital, etc.).



A common thread in much of our outreach efforts has been to build infrastructure through public and private partnerships/working relationships to establish and realize environmentally related “value added” products and services, focusing on areas inside and especially outside the traditional core business of energy.



Potential core market “value added” products and services from an Electric Utility bio-energy project include:

- ✍ Selling premium priced Green Electricity to utility customers and/or Renewable Energy Credits (RECs) nationally.
- ✍ An Electric Utility voluntarily reducing CO₂ emissions (by displacing carbon intensive fossil fuels with carbon cycle neutral biomass) and possibly selling CO₂ credits under future Greenhouse Gas Trading Programs (e.g., Chicago Board of Exchange).
- ✍ Selling SO₂ Credits to other electric utilities resulting from the displacement of fossil fuels by lower sulfur content biomass fuels.
- ✍ Possibly eliminating the need to install costly pollution control equipment like Selected Catalytic Reduction (SCR) at existing electric utility power plants by implementing biomass co-utilization gasification technology.

While the above core market items certainly can result in “value added” cash flows, most do not materially impact overall economic competitiveness of a bio-energy project with fossil fuel use options in electric utility decision making. An exception to this is the avoidance of high capital cost pollution control equipment like SCR. An example is to install an external biomass gasifier at an existing pulverized coal unit to achieve significant NO_x reductions through the use of biomass gas as the "re-burn" fuel.

However, potential “value added” products and services in non-core business areas of agriculture may have the ability to significantly improve overall bio-energy project economics not only for the generation of electricity/steam but for the production of bio-fuels like ethanol and bio-diesel. **The strategic objective of creating agriculture based “value added” cash flows is to be a low net-cost producer and providing an avenue to directly integrate Farming Interests into Biomass Energy Projects.**

Agriculture Based Value-Added Services: At least for central and southern Florida (which comprises the majority of agriculture farming in the State), it is strongly believed that without significant subsidies, biomass energy crops will not be able to compete against higher-return food crops (e.g., citrus, sugarcane, vegetable produce crops like tomatoes, etc.) which have established markets (e.g., Florida is the 2nd leading producer of vegetables in the U.S). Recognizing this land use concern and also that to create a meaningful biomass energy/bio-fuel industry in the State would require thousands of acres planted in energy crops (e.g., switchgrass, sweet sorghum, short rotation woody crops, energycane, sweet potatoes, etc.), we have partnered with the University of Florida (Schools of Agriculture and Soil Science) to address these above concerns by targeting the use of marginal lands (currently considered non-productive for agriculture use).

While our focus to date has been on environmentally damaged phosphate mined lands in central Florida (a large land base of potentially ~200 square miles), the science and market based approaches being developed could be applied on marginal lands throughout the U.S. to competitively grow crop feedstocks for biomass energy use. Key steps to this strategic approach include:

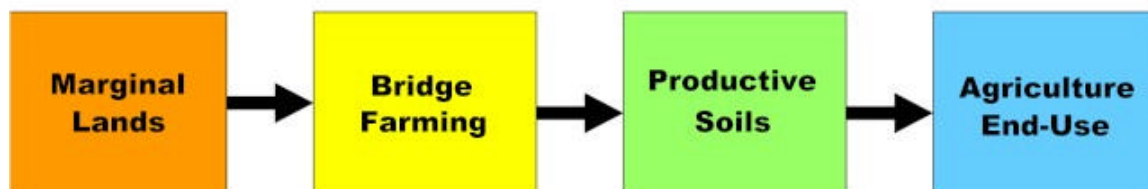
- ✍ Working closely with soil scientists to identify needed soil amendments and farming practices that could make these marginal lands productive for agriculture.
- ✍ Targeting available organic and non-organic waste streams that could be used as soil amendments where tipping fees could be charged to accept these waste streams.
- ✍ Developing Best Management Practices for “Bridge Farming Techniques” and “Bridge Crops” to build productive soils resulting in competitive crop yields.

By “Bridge Farming” we mean the use of farming practices and selected crops (which include energy crops) to transition/bridge low-value marginal lands into a productive agriculture end-use by improving soil characteristics through:

- ✍ The sequestration and building of soil organic matter (SOM) of which approximately 50% is comprised of soil organic carbon (SOC), and
- ✍ The catalytic chemical and biological effects of increased SOM (e.g., increasing available nitrogen in soils, balancing soil pH, soil structure, etc.).

By “Agriculture End-Use” we mean the eventual long-term agriculture use of the transitioned lands. While this end-use could be energy crops, depending on the level of improved soil quality, higher market return food crops could also be the eventual end-use.

**Using "Bridge Farming" Techniques and Crops
To Increase Values of Marginal Lands**



Examples of “Bridge Farming Techniques and Practices” in building soil quality on marginal lands involves the use of waste streams for needed soil amendments, such as:

- ✍ Urban Yard Wastes (primarily wood chips) to build soil organic matter/carbon.
- ✍ Bio-solid Wastes to build needed nitrogen levels.
- ✍ Gypsum Wastes to build soil structure.

Examples of using Energy Crops as “Bridge Crops” has, and continues to be jointly demonstrated by the Common Purpose Institute and the University of Florida through research and commercial demonstration efforts on marginal lands for:

- ✍ Short Rotation Woody Crops (power plant co-firing, cellulose based ethanol).
- ✍ [Energycane, Sugarcane, and Sweet Sorghum](#) (sugar based ethanol).
- ✍ Soybeans (bio-diesel).

University of Florida Crop Yield Research on Mined Marginal Lands
(dry tons per acre)

Crop	Yields
Energycane	19
Sugarcane	22
Sweet Sorghum	13
Eucalyptus	16

Soil science work performed in collaboration with the U.S. Department of Energy’s Oak Ridge National Laboratory (ORNL) provides a science-based starting point on the potential of energy crops to dramatically improve soil quality on marginal lands. [The ORNL soil research](#) was performed on the Common Purpose Institute/University of Florida 138 acre energy crop farm, sited on marginal lands last mined over 60 years ago. Prior to energy crop development, the Site was typical of mined phosphate marginal lands which have extreme soil deficiencies in organic carbon at levels of ~0.5% (~1.0% soil organic matter) available nitrogen, and structure (high soil compaction). Also, these lands are typically invaded and then dominated by exotic weeds and plants like [cogongrass](#). The following pictures reflect a two and one-half year time lapse sequence of the Site before and after energy crop development (transition from a prairie of cogongrass to fast growing trees).



Over a two and one-half year period after [high density energy crop tree planting](#), dramatic improvements in soil quality occurred. Soil color and texture changed from pre-existing conditions of gray, highly compacted, and plasticity to porous granulated dark soils ~4 feet in depth on treebeds. Also, a catalytic effect of the increased organic matter was available soil nitrogen increasing 1,150% during the two and one-half year period.

ORNL Soil Analysis of Soil Organic Carbon

Soil Chemistry Property:	Depth of Soil Samples (cm)	Average for Energy Crop Planted Areas
Carbon	10-20	5.29%
Carbon	40-50	3.06%

ORNL Soil Analysis of Available Nitrogen in Soils

Soil Chemistry Property:	Depth of Soil Samples (cm)	Average for Energy Crop Planted Areas
Nitrogen	10-20	0.46%
Nitrogen	40-50	0.22%

Value-Added Cash Flows from Waste Stream Soil Amendments: Working closely with Soil Scientists at the University of Florida, the following soil amendments have been identified to increase soil organic matter, nitrogen levels, drainage, stability, and workability on phosphate mining marginal lands:

- ✍ Clean Organic (primarily wood chips) Yard Wastes from Municipalities.
- ✍ Treated bio-solids/sludge from Municipal Waste Water Operations.
- ✍ Gypsum from sources like mining and recycling (wallboard typically landfilled).

While we are at various stages of research and commercial demonstrations (working with the University of Florida, the Florida Department of Environmental Protection, Regional Water Management Districts, Municipalities, Waste Companies), field trials using waste streams are indicating the following example of “value added” and “low-cost producer” economics:

- ✍ The cost of establishing and growing energy crops is ~\$1,500 per acre.
- ✍ Cash flows from charging tipping fees to apply waste streams (wood wastes, bio-solids, gypsum) to mined lands could very well exceed ~\$3,000 per acre.
- ✍ Thus, in this above “value added” example, the **net cost basis** of establishing and growing energy crops would be a **negative** \$1,500 per acre.

Another way to describe the above economics example is that even before the sale of energy crops, a net profit of \$1,500 per acre would have been realized by the Farmer.

This could provide both a significant financial incentive to grow energy crops and for Farming Interests to achieve a competitive advantage in being a low cost bio-fuel feedstock supplier (e.g., having and controlling negative “net-cost” feedstocks).

Value-Added Cash Flows by Increasing Real Estate Land Values: As universally accepted academic and government economic research reflects, there is a direct correlation between (1) the real estate market values of agriculture land, and (2) their level of soil organic matter (where ~50% is comprised by soil organic carbon) which highly determines agriculture productivity. A clear market example of this above correlation is marginal phosphate mined lands in central Florida, where these lands have some of the lowest real estate values in the entire State. Several avenues exist to realize near-term value added cash flows/benefits from “Bridge Strategies” to increase real estate market values of marginal mined lands by improving soil quality.

One option is for a Landowner to pay a Farmer under a performance based contract to reclaim/improve the land to agriculture standards (e.g., eliminating cogongrass, building soils to achieve specific organic matter criteria, etc.). A second option (which is being actively pursued by large Sugar Producers) is to buy marginal phosphate mined lands at current low market prices and then to implement soil quality building “Bridge Strategies”. Under both of these two above approaches, the cost of reclamation efforts to increase land market values and agriculture productivity would be offset by (1) charging tipping fees for waste stream soil amendments; (2) selling the Energy Crops used as a Bridge Crop to increase soil organic matter/carbon.

Another option is the modification of current mining regulations to encourage the use of “Bridge Strategies” for post-mined (e.g., phosphate, coal mining, etc.) land reclamation. It has been our experience that mining reclamation laws throughout the U.S. are often based on achieving a minimum-use standard (e.g., pastureland) of land use after mining is completed. We are working with the Florida Department of Environmental Protection to demonstrate if higher land use standards can be achieved at costs similar (or even below) current mining reclamation practices through the use of “Bridge Strategies”.

Additional Agriculture Based Value-Added Cash Flows: As previously stated, in order to realize maximum benefits, “Value-Added Metrics” must be a dynamic and on-going process which continuously looks “outside the box” of traditional renewable energy business development efforts. Below are agriculture based value-added cash flow streams that have been and are being pursued.

Quite often, an extremely damaging result of mining is the invasion and resulting dominance by exotic weeds and plants on these disturbed lands. Once established, these invasives usually spread to productive non-mined lands with catastrophic economic and environmental damage. An example of this in the Southeastern U.S. is cogongrass, which according to the U.S. Department of Agriculture is one of the most destructive weeds in the World. Per the U.S. Geological Survey, economic costs to control and in associated crop losses from cogongrass may approach [one-half billion dollars per year](#). The key word in this previous sentence is “control”, as no herbicide has been found to “kill” the dense mat of below ground rhizomes of cogongrass.

However, in research efforts performed by the University of Florida and the Common Purpose Institute on our mined land project, tremendous success has been demonstrated

in killing cogongrass rhizomes through the use of “Bridge Strategies”. The USDA has programs to fund the eradication of invasive weeds and plants, which we are using as a “value added” cash flow source to offset site prep costs in the establishment of energy crops on marginal lands.

Another source of an agriculture based “value-added” cash flow stream can be in the improvement of [regional water quality and water consumption](#) by using “Bridge Strategies” on marginal lands, with funding from State and Federal sources to offset development costs of establishing energy crop farms.

Integration of Farming into Bio-energy Projects: As will be discussed in the next section of this Report, a major component of our SSEB work effort was the sponsoring or co-sponsoring of over 50 bio-energy field seminars. While much of the information presented in these seminars focused on technical aspects of research results, business strategies were also emphasized. One key strategy is structuring bio-energy projects using a business model of vertical bottom-up integration of farming into bio-energy:

- ✍ Allowing Farmers to participate in a profitable “process end” of agriculture rather than just selling a commodity based raw product.
- ✍ Reducing and hedging financial risk for both Farmers and the Bio-energy Business.
- ✍ Creating needed rural economic development in many Florida communities.

The nexus of a vertical integration business structure is equity ownership by Farmers in the Bio-energy facility. An illustration of this “concept” is in efforts being implemented [in Minnesota](#) to directly integrate farming into the production of ethanol. According to the Minnesota Department of Agriculture, creating a vertically integrated farming/bio-fuel business can double the value of a Farmer’s raw agriculture product.

While the core business concept of “vertical integration” is identical between our Florida efforts and those in Minnesota, there is one major difference. Minnesota’s program relies on State Government subsidies, which do not exist in Florida. Without State subsidies, our approach uses the creation of cash flows from farming-based value added products and services (e.g., previously discussed “Bridge Strategies” on marginal lands) to provide financial support.

There are at least two approaches where Farmers could achieve equity ownership into bio-energy facilities. One option is for Farmers who have achieved low net-cost biofuel feedstocks, to sell the feedstock to a bio-energy facility (e.g., an ethanol producer) at below market prices. The difference between this feedstock sale price and actual market price would be an equity contribution, giving the Farmer an ownership position in the bio-energy facility. Since many bio-energy business ventures have high debt leverage capitalization, this type of approach could provide needed equity infusion for things like working capital.

Another option is for Farmers to form co-operatives to own and operate bio-energy facilities. Under this Business Model, numerous types of risk could possibly be mitigated. With Farmers both supplying raw crop feedstock and owning the bio-energy facility, an expanded

perspective of profit would occur. For example, with an ethanol facility such a perspective could help mitigate financial pressure with margins of the bio-energy business from commodity priced crop and gasoline markets. With vertical integration, Farmers would view profit from a combined crop and end-use (e.g., ethanol production) perspective.

Another example of risk mitigation through vertical integration is contract performance. In a business structure where farming is totally separate (e.g., only a supplier of feedstock) from the business of producing biomass fuel or steam/electricity, Farmers can face significant financial risks. These risks include the Bioenergy Producer's (usually small start-up companies as to ethanol and bio-diesel) credit worthiness and long term financial viability to perform under fuel feedstock contracts. This point is especially relevant to situations where Farmers would grow "dedicated energy crops" for a bio-energy facility where other agriculture markets for the dedicated crop does not exist. An example would be growing sugarcane in central Florida where Sugar Refineries do not exist (and transporting the crop to South Florida would be un-economic).

Also, Government bio-energy subsidies are usually targeted to the Bioenergy Producer and not Farmers. As we have experienced first hand in Florida, there is no guarantee that Government subsidies or tax credits directed at the Bio-energy Producer will be realized and flowed to the Agriculture Feedstock Supplier. Under a business structure of vertical integration, bio-energy subsidies would flow to Farmers.

Biomass Energy Field Seminars: During the past year, the Common Purpose Institute (CPI) held over 50 biomass energy seminars (often co-sponsoring with the University of Florida) to Target Groups representing Agriculture, Energy, Environmental, Government, and the News Media. Seminars were primarily held at the U.S. Department of Energy/[State of Florida Energy Office](#) sponsored CPI [Energy Crop Plantation](#) (a 138 acre commercial scale demonstration located in central Florida). Attendance at these seminars ranged from a high of ~120 individuals from throughout the World (e.g., [World Congress of Agro-forestry](#)) to individual Farmers (forestry and row crops) located in Florida and the Southeastern U.S.

While all Seminars had a common theme of biomass renewable energy development, each Seminar was structured to meet the (1) perceived needs/objectives of the Target Audience, and to (2) provide an information foundation to build needed strategic partnerships/working relationships among a diverse range of Interests in achieving "Value-Added Metrics" for biomass energy development. For example, many Seminars co-sponsored with the University of Florida were structured to more of an academic agriculture science audience ([web-link to Agenda](#)). Seminars to Farming Interests were heavily oriented to (1) the specifics of "best management practices" in crop establishment, maintenance, and harvesting; and (2) crop market economics including opportunities associated with Federal Farm Bill legislation.

Local, State, and Federal Seminars largely focused on synergies of how Governmental Agencies fit into the "big picture" as to biomass renewable energy development through the implementation of "win/win" cost effective environmental policies.

Outreach Group:	Seminar Emphasis:
Agriculture:	
-- Regional Small/Medium Farmers	15 Seminars on trees & row crops
-- University of Florida (UF)	Best Management Practices for high yields
-- Institute for Agriculture Science (IFAS)	County extension offices, Research Centers
-- Cargill Corporation	Growing crops on marginal lands
-- Mosaic Corporation	Growing crops on marginal lands
-- Clearsprings Corporation	Growing crops on marginal lands
-- CF Industries	Growing crops on marginal lands
-- Wallace Labs	Soil science
-- World Congress of Agroforestry	UF sponsored seminar
-- New Zealand Forest Research Institute	UF sponsored seminar
-- U.S. Forest Service	UF sponsored seminar
-- ArborGen	UF sponsored seminar
-- Queensland Australia Dept. of Forestry	UF sponsored seminar
-- Consolidated Forest Products	New business development
-- Greenleaf Wood Products	New business development
Ethanol Production:	
-- Florida Crystals	Sugarcane & tree crops on mined lands
-- U.S. Envirofuels, LLC	Ethanol (sugar, starch platform)
-- GreenWing Ventures	Ethanol (cellulous platform)
-- Bartow Ethanol, LLC	Ethanol (sugar platform)
Local Government:	
-- Polk County Commission	Rural Economic Development
-- Hardee County Commission	Rural Economic Development
-- Central Florida Planning Commission	Rural Economic Development
-- Central Florida Development Council	Economic Development
State Government:	
-- Florida Dept. of Environ. Protection	Air, Land, Water Quality Linkages
-- Southwest Florida Water Mgt. District	Water Quality & Conservation Strategies
-- Florida Institute for Phosphate Research	Land Reclamation, Economic Development
Electricity & Co-generation:	
-- Sterling Energy Services	Bio-energy co-generation
-- Tampa Electric	Ag Crops for Biomass Co-firing
-- Lakeland Electric	Ag Crops for Biomass Co-firing
-- EPRI (Biomass Working Group)	Examples of Value Added Metrics
-- Wheelabrator Renewable Energy	Fuel stock economics
-- Southern Fuelwood	Fuel stock economics
Value-Added Services:	
-- Consolidated Resource Recovery	Tipping fees from biomass wastes
-- Municipal Utilities Waste Water Operations	Use of bio-solids for soil building
Environmental Outreach:	
-- Sierra Club	Land use Environmental Benefits
-- Audubon Society	Land use Environmental Benefits
U.S. Government:	
-- Oak Ridge National Lab	Soil Carbon Sequestration
-- U.S. Department of Interior	Land reclamation practices
-- U.S. Senator Bill Nelson's Office	Renewable Energy
-- USDA (NRCS)	Farming Best Management Practices

-- FEMA	Using Hurricane debris for soil building
Newspapers:	St. Petersburg Times, Tampa Tribune, etc.
Farming Equipment Manufacturers:	
-- Brown Bear Corporation	
-- Madden Industries	
-- Savannah Forestry	

Internet Education Outreach: A significant resource tool in our biomass energy outreach and educational efforts has been our website at <http://www.treepower.org> providing information on all major aspects of biomass energy project development (engineering, economics, agriculture, environmental, marketing, policy and incentives). The website has been featured in numerous Florida newspaper articles and U.S. Department of Energy publications (e.g., Monthly Newsletters from NREL; EIA’s [Greenhouse Gas Volunteer](#)).

As a result of continued content upgrades (made possible from SSEB cost sharing), world wide viewership has doubled during the past year to a current level of ~700,000 hits per year. Representative of excellence in resource content is Internet Search Engine Rankings, where the treepower.org website is consistently ranked in the top ten of all major Search Engines using the search string of **biomass energy**.

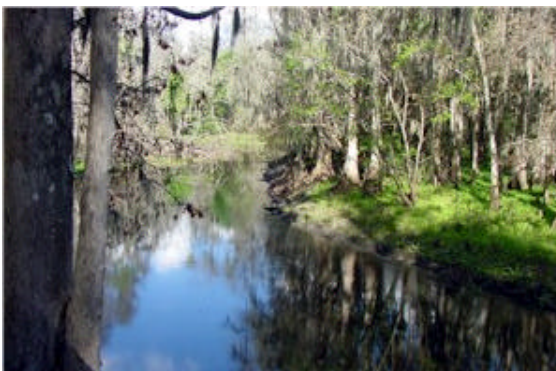
Internet Search Engine:	Treepower.org Rank:
MSN - Microsoft	#1
MAMMA	#4
Yahoo	#5
Google	#10

Educational Outreach on Carbon Management and Sequestration: In R&D for carbon management and sequestration, we continue to be perplexed as to the under-emphasis of terrestrial options – where the overwhelming amount of research funding is being allocated to advanced technology options for CO2 [capture](#) and [geologic storing](#). According to [NASA](#) Scientists, one-fifth of the carbon dioxide released annually from fossil-fuel emissions could be "sequestered" through the better utilization of marginal lands – such as growing energy crops on environmentally damaged mining sites. As soil scientists at NASA, Oak Ridge National Lab, and the University of Florida state: “Obviously, proponents of terrestrial sequestration just have not made the case to decision-makers in attaining needed research funding”.

Perhaps a key in changing the perspective of terrestrial sequestration is in changing the paradigm in how it is viewed. Using baseball analogy which is currently in vogue – while hitting a home run such as CO2 capture and geologic storing can have a dramatic impact, putting together a string of singles (individual actions on terrestrial sequestration and “no regrets” carbon management) can also achieve significant results.

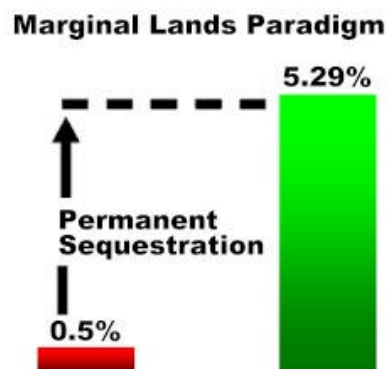
One critical aspect in achieving a needed paradigm shift is in changing a widely held misperception that terrestrial sequestration is mostly temporary. Since soils have a finite capacity to store carbon, this misperception probably became engrained in current thought by using a model that terrestrial sequestration would primarily be achieved on farming land (with soils at or near to carbon saturation). However, when marginal lands that are highly deficient in soil organic matter/carbon (such as environmentally damaged mined sites) are introduced into the model, dynamics can change dramatically.

Our work effort on marginal lands in Florida is an illustration of this above point. Prior to phosphate mining, soils of pre-mine lands (e.g., typically cypress swamps and hammocks) were probably at soil carbon saturation. However, even after more than a half century after the cessation of mining, the altered soils typically have extreme deficiencies in organic carbon at levels of ~0.5% (~1.0% soil organic matter).



As the previously discussed ORNL research work showed, after two and one-half years from high density plantings of energy crops on these marginal lands, soil organic carbon had increased to 5.29% (at 10-20 cm in depth).

Assuming that the heavy clay soils have not yet reached a carbon saturation level (where soil literature suggests that on these soils it may be as high as 18%), the incremental difference in post mined soil organic carbon content from approximately 0.5% to the current level of 5.29% -- **should be viewed as permanent carbon terrestrial sequestration.**



In building soils on mined marginal lands, we are applying two approaches to build soil organic matter/carbon to support agriculture use:

- ✍ Growing energy crops in high density planting.
- ✍ Disking in soil amendments to the heavy clays (e.g., urban wood waste chips, bio-solids), where bridge energy crops will be planted as soon as soil carbon to nitrogen ratios are stabilized.

While it is universally accepted that there are many low cost “no regrets” options that could be taken to reduce or sequester the release of greenhouse gases, barriers often exist (especially within Government) in the implementation of common sense ideas into actions. An example of this is the millions of tons of biomass waste created when hurricanes strike Florida. Historically, the primary means of disposal for hurricane debris like downed trees is open field burning – releasing millions of tons of CO2 into the atmosphere. As described in the U.S. Department of Energy’s Greenhouse Gas Volunteer [Newsletter](#), our outreach efforts to local governments and FEMA resulted in actions to use hurricane wood wastes for soil building on marginal lands and water conservation management rather than open field burning.

Facilitating this “common sense/no regrets” action was not easy however, as many Federal and Local administrative procedures and regulations (response planning rules for natural disasters) had to be changed. In fact, many local governments we contacted passed on this opportunity, saying they could not react quickly enough as cost/benefit analysis would have to be performed in order to change existing regulations. As a part of our continuing outreach efforts, we are working with Federal, State, and local governmental agencies to incorporate non-burning options for hurricane debris into hurricane response regulations/procedures.

During the past year, approximately 100,000 green tons of wood chips (largely coming from hurricane debris) have been used to increase soil organic matter on our energy crop farm (demonstrating bio-fuel feedstocks of fast growing short rotation woody crops, soybeans, sweet sorghum, etc.).



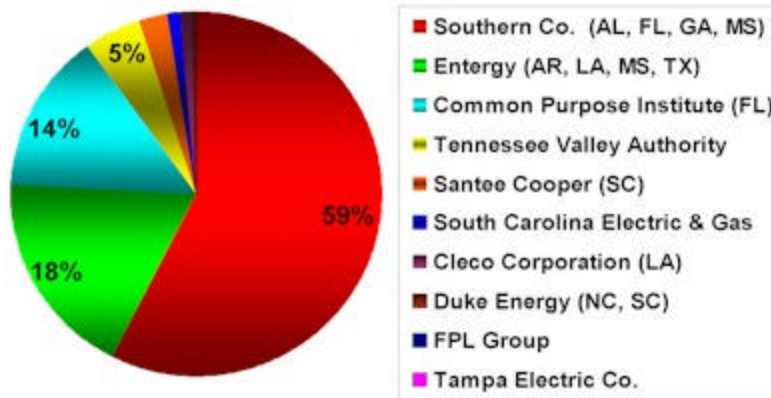
While we are unable to currently state with science-based confidence the amount of long-term “net” carbon dioxide benefits (CO2 emissions released from open field burning less CO2 emissions released as the wood chips decompose in the ground), reductions in gross emissions if the biomass had been open field burned can be easily calculated.

Green Tons of Biomass Wood Chips	100,000
Approximate Moisture Content	50%
Approximate Carbon Content	25%
Carbon to CO2 Multiplier (molecular weight)	3.67
CO2 Tons of Emissions Avoided	91,750

This above illustration reflects how a relatively small initiative and common sense effort may have a significant impact in reducing greenhouse gasses in a cost effective way. For example, 91,750 tons represents approximately 10% of yearly CO2 emissions from the use of coal at a power plant like Tampa Electric’s 250 MW Polk Power Station.

Another illustration of this above point is our participation in the U.S. Department of Energy’s [Voluntary Greenhouse Reporting Program](#) (Form 1605). For the past two years, below ground carbon sequestration data from the Common Purpose Institute/University of Florida Energy Crop Farm has been submitted to this Voluntary Reporting Program. We want to emphasize that our data has gone through three levels of science based peer review by scientists from the University of Florida and the U.S. Department of Energy’s Oak Ridge National Laboratory (ORNL) and Energy Information Agency (EIA).

Comparing the results of our carbon sequestration work reported in Form 1605 to efforts of others (major electric utilities) provides an interesting perspective – where our project work ranked third in the top ten of the voluntary carbon sequestration efforts performed in the Southeastern U.S.



As discussed in previous sections of this Report, we have also performed educational outreach efforts with numerous State and Local Agencies (Department of Environmental Protection, Southwest Florida Water Management District, County and Regional governmental agencies) how “Bridge Strategies” can achieve higher environmental results than current practices used in areas of mining reclamation, water quality and conservation, and solid waste disposal (typically landfilling).

Carbon Trading Markets: While it is widely recognized that selling carbon credits from Climate Change Trading Programs may provide a source of **future** “value added” cash flow, the likelihood of any near term actions to regulate U.S. greenhouse gases is minimal. Also, based on our limited exposure to carbon credits traded on the Chicago Board of Exchange (resulting from voluntary actions), it is our opinion that this is not a truly functioning market but highly dependent on who you know contacts.

Recognizing these political and market realities, we have initiated efforts to carbon trading markets outside the U.S., with the objective of forming a consortium of Florida Farmers to realize near-term cash flows from carbon trading. We are working with international trading companies (like [Carbonnetworks](#) in Vancouver) to:

- ✍ Identify Florida companies or companies having significant interests in Florida with foreign operations or that sell products in Countries that have signed the Kyoto Protocol.
- ✍ Determine if any of these corporations need carbon credits in their international markets.
- ✍ Determine if carbon credits requirements of these companies could be met from carbon sequestration projects located in Florida (or what needs to be changed in order for Florida projects to qualify under foreign trading programs).

In our educational process on international carbon credit Trading Programs, the need for highly reputable and independent third-party audit/verification has been heavily emphasized to us. We are addressing this issue by working with the University of Florida (School of Soil Science) to develop protocols and a program where UF would perform this third party audit/verification function.

Renewable Biomass Energy Accreditation: A potentially significant source of “value-added” cash flow for a bio-energy power project is in the marketing of premium priced renewable energy through (1) direct sales by an electric utility to its customers, (2) selling Tradable Renewable Certificates (TRC) in national markets (especially to governmental agencies). While we somewhat disagree with the U.S. Department of Energy’s [National Renewable Energy Laboratory](#) (NREL) assessment on the importance of [price points](#) in achieving higher market penetration levels (especially within the Southeastern U.S.), we do absolutely agree with NREL on the critical importance of consumer education in marketing efforts to achieve higher participation levels for voluntary renewable energy programs.

One approach that is widely used in the U.S. to increase consumer education and confidence in a Renewable Energy Program is through independent third-party accreditation that a Program’s attributes meets specific environmental standards. An example of this is the [Green-e Program](#) developed by the [Center for Resource Solutions](#).

In an extensive effort of over 1 year, the Common Purpose Institute joined with over 40 Participants (including every major Electric Utility and Environmental Organization in the State) to work with Green-e to establish accreditation standards for renewable energy power projects in Florida. Unfortunately, Participants were unable to agree with Green-e and this effort failed. Two major obstacles that could not be reconciled were Green-e’s (1) rigid pass/fail standard on air emissions, where if a biomass project failed to meet any one specific criterion (e.g., NOx, SOx, etc.) the entire project would fail to qualify, (2) rejection of biomass co-firing at coal power plants as a qualifying Green Technology option. The biomass co-firing issue was troublesome for many electric utilities especially Tampa Electric, which emphasizes this technology option in their [Green Energy Program](#).

In an attempt to fill the void with Florida’s electric utilities not having a credible and independent third-party mechanism for renewable energy project accreditation, the Common Purpose Institute initiated efforts with the Florida Sierra Club. The result of this joint effort has been the establishment of bio-energy accreditation standards for power generation and also energy crops in Florida.

While the Florida Sierra Club Accreditation Standards have specific environmental criteria for biomass energy projects (e.g., air emissions, energy crop criteria), their approach differs dramatically from Green-e, by using a holistic approach in project accreditation.

Florida Sierra Club Air Emission “Targets” for Biomass Power Generation

Air Emission Criterion:	Optimal Emission Target:
NOx	1.77 lbs/MWH
PM10	0.02 lbs/MMBTU
CO	0.75 lbs/MMBTU
VOC	0.15 lbs/MMBTU

Under the Florida Sierra Club approach, an individual bioenergy project that does not meet any specific “target” environmental criterion (e.g., NOx emissions), could still be accredited by considering the holistic environmental impact of the project. Unlike Green-e, the use of a holistic approach does not create a single individual air emission criterion pass/fail process, but considers:

- ✍ The context of all air emissions for the bio-energy Project.
- ✍ Other important environmental impacts such as water and land conservation.

For example, Smog is not just a problem of NOx, nor just VOC – smog is a problem from the combination of pollutants. Research by the U.S. Environmental Protection Agency illustrates this point where tests have been conducted in certain regions where NOx was reduced by 35% and VOC was reduced by 35%. In some regions, the reduction in VOC levels resulted in a reduction in O₃, but the reduced levels of NOx resulted in unchanged or increased O₃. In some regions, this above correlation was exactly the opposite.

The Florida Sierra Club Accreditation Process attempts to address air emissions in a holistic context of both overall local and global importance for air emissions of NOx, PM, VOC, and CO₂. – where a bio-energy project not meeting any individual air emission target but achieving other air emissions levels below target levels could be accredited.

Another important component of the Florida Sierra Club’s holistic approach to renewable energy accreditation is the recognition of other critical environmental factors such as power plant water use, impacts/improvements in water quality, and land conservation. Use of this holistic approach is especially significant for bio-energy projects using energy crops grown on marginal lands.

In the late fall of 2005, the Common Purpose Institute/University of Florida Energy Crop Farm was [accredited by The Chamberlyne Foundation/Florida Sierra Club](#) for Green Energy and Tradable Renewable Energy Credits (T-RECS). To our knowledge, this is the first energy crop project in the U.S. to be accredited by a major environmental organization – and hopefully will provide a “Model” for the accreditation of bioenergy and energy crop projects throughout Florida and the U.S.