Executive Summary

The Green Virginia Ethanol Project has determined that the production of fuel grade ethanol in the Commonwealth of Virginia is economically feasible. However to provide returns attractive to the investment community, the project faces challenges and hurdles not faced by plants that have been built in the Midwest.

Two plant sizes were studied, both located at the [Proprietary] site located [Proprietary]. Internal Rates of Return (IRR) based on Earnings Before Interest Tax Depreciation and Amortization (EBITDA) that assume total capitalization were calculated with financing and taxation treated as independent considerations:

Scenario	IRR (10 years)
40 MMGPY*	[Proprietary]
80 MMGPY	[Proprietary]

***MMGPY – Millions of Gallons anhydrous Per Year**

Assumptions and strategies for improving projected performance are provided in this Summary along with detailed information and additional scenarios in the body of the document.

Project Participants

The conclusions and the contents of this document are the result input from a collection project participants with varied backgrounds including Kilduff Oil, Delta-T, Latitude Associates, The College of William and Mary Technology and Business Center, Hampton Roads Clean Cities Coalition, The Virginia Center for Innovative Technology, and Old Dominion University. These organizations possess expertise in ethanol and related businesses, ethanol plant engineering, ethanol production technologies, and ethanol economics.

Overview of the Ethanol Industry

While this document describes an "ethanol project" and the primary revenue source product from the plant is fuel grade ethanol, additional co-products are produced that have revenue value to the plant. These are:

- Ethanol – blended with gasoline as an octane enhancer and to reduce emissions
- Distillers Grains – fed to farm animals for its excellent protein content
- Carbon dioxide (CO_2)– used to flash freeze food, carbonate beverages, and in industrial processes

Customers of the three products generally require quantities larger than a single plant produces and also seek to mitigate supply risk by sourcing from more than one source. Ethanol producers customarily enter into arrangements with marketers for each of their products. Marketers aggregate supply for their customers and in some cases hedge commodity risk. The selling price of ethanol selling price to describe the final price the producer receives net of transportation costs.

Ethanol

Currently 71 fuel grade ethanol plants produce more than 3.1 billion gallons of ethanol per year. The majority of these plants range in size from 20 million to 100 million gallons per year and there are 16 plants in the planning or construction phase with a combined production of 70 million gallons per year. While ethanol is produced in the Midwest, close to its primary feedstock – corn – the centers for demand coincide with large population centers such as those on the eastern seaboard.

There are no plants under construction on the East coast of the United States. The economics of shipping ethanol are more favorable than those of shipping corn.

Principal factors spurring the demand for ethanol and the industry's expansion are:

- Increasing oil prices
- Elimination of Methyl Tertiary Butyl Ether (MTBE), through legislative action, as a gasoline oxygenate.
- Federal, state, and local policies for increasing United States energy independence
- Federal, state, and local policies for the increased use of renewable energy sources

While the elimination of MTBE as a fuel additive is most significant with respect to the ethanol market for California, a significant East coast market will also develop (New York, and Connecticut have recently banned MTBE). This will create demand for 1.3 billion gallons of ethanol per year by 2010 on the East coast. This ethanol will be blended with gasoline as an oxygenate that improves the environmental characteristics of the fuel and brings it into compliance with federal, state and local regulations. The total demand for fuel grade ethanol in the United States under current blending requirements is expected to be approximately 5 billion gallons per year by 2010.

Distiller's Grains

Distiller's grains are the residual matter that is left over from ethanol production and they are consumed by livestock, primarily cattle, but there is also a developing market for swine and poultry. Their appeal as a feed is their high protein content and easy digestibility. There are two types of distillers' grains:

- Distiller's Wet Grains (DWG) are not dried, can be economically shipped up to 100 miles, and can only be stored for a period of days

- Distillers Dried Grains with Solubles (DDGS) are ostensibly DWG with residual syrup added back in that has been dried. While they can be shipped long distances and stored, the energy, normally natural gas, required to dry them significantly increases costs.

Carbon Dioxide

Carbon Dioxide (CO_2) is produced during the fermentation process and can be captured and sold. It has many uses including flash freezing food, carbonating beverages, and in industrial processes. The northeast corridor, from Richmond to Boston, represents a significant market for CO_2.

The Study Site

[Proprietary]

The Financial Model

The baseline financial scenario is based upon the following assumptions:

- Size: 40 MMGPY and 80 MMGPY fuel ethanol
- Site: [Proprietary]
- Feedstock: #2 yellow corn only
  supplied by Unit Grains Trains (UGT) from sources outside Virginia
- Commodity pricing: based on historical averages
- Ethanol pricing: no over the fence sales to [Proprietary]
- CO_2 captured and sold in raw, gaseous form
- Distillers grain: distillers grain and solubles sold as 100% dry DDGS
- Capitalization: 40% equity and 60% debt
- Interest rate and Term: 6% at 10 years
- Fuel: [Proprietary]
- Local tax grants: none
- State rail improvement: none (maximum available: $347,000)

Sensitivity analysis was conducted and based on the following changes to the model. These changes had the following impact on the IRR:

Scenario	IRR – 40 MMGPY	IRR – 80 MMGPY
Baseline scenario with historical pricing	[Proprietary]	[Proprietary]
Baseline scenario with $0.05/gal transportation savings	[Proprietary]	[Proprietary]
Baseline scenario with 50% energy savings	[Proprietary]	[Proprietary]
Baseline scenario with $0.20/bu in grain transportation savings	[Proprietary]	[Proprietary]
Baseline scenario with 3 year [Proprietary] County tax grants	[Proprietary]	[Proprietary]
Baseline scenario with Commodity Credit Corporation	[Proprietary]	[Proprietary]

(CCC) program administered under USDA taken in the first 3 years of production (see below)		
Optimized scenario with favorable pricing view, ethanol selling price of $1.30 per gallon, delivered grain price of $2.65 per bushel, effective energy cost of $2.14/MMBTU, 3-year local property tax relief, and 1-year benefit from the CCC program:	[Proprietary]	[Proprietary]

Strategies for Project Success

The baseline scenario, while providing a positive return based on very conservative assumptions, is likely insufficient in the eyes of the investment community to offset the risk of a venture that is tied to commodity pricing risks for both its inputs and outputs. The optimized scenario demonstrates excellent returns that are likely to attract the attention of potential sources of funding, but is based on supports that are cannot be guaranteed and a combination of prices that, while possible at some point over in the next 10 ten years, are not sustainable.

High feedstock costs, high product delivery charges, and the lack of state and local incentives are the primary factors that have created conditions not yet suitable for development of ethanol projects in the Eastern United States. Strategies and factors for success have been identified that will increase the attractiveness of the Green Virginia Ethanol project, its desirability in the eyes of the investment community, and that will ultimately improve its performance.

- **Strategic relationship with [Proprietary]** – Project participants are unaware of another ethanol plant that is collocated with a [Proprietary]. A relationship with [Proprietary], crafted in a way that results in share goals may result in:

    - Higher selling price for ethanol by reducing transportation costs to 0 for that portion sold "over the fence" to [Proprietary].
    - Significant reduction in energy costs by designing a plant that utilizes [Proprietary] and then supplies back to [Proprietary] additional energy capacity in the form of steam.
    - Leveraging [Proprietary]'s capability to provide ethanol to [Proprietary].

- **Leverage barge transportation** – All scenarios factor in a selling price that assumes rail transportation of ethanol. The [Proprietary] site possesses a pier with deep water access that, with some capital investment, can be used to load barges with ethanol for delivery to petroleum terminals along the eastern seaboard. This represents an advantage relative to Midwest plants that must use higher cost rail over a greater distance. Barge transportation will provide for an increase of the selling price for Virginia ethanol due to lower transportation costs.

- **Development of Hulless Barley as a feedstock** – the current model assumes that the feedstock for the plant is corn and that all corn required will be shipped via rail (Virginia is a corn deficit state). Corn transportation increase costs relative to Midwest competitors. Information obtained from the railroads or obtaining grain from the Midwest via unit trains results in transportation cost being in the range of $0.30-0.40 per bushel of corn. The Virginia Small Grains Association has expressed an interest in ethanol as a way to create a market for hulless barley, an alternative feedstock for ethanol (See Appendix ___). Pricing for locally produced hulless barley could be in the range 80% to 90% of the cost of Chicago corn thus reducing the plant's disadvantage relative

to Midwest producers. The production of hulless barley in Virginia could reach 7 million bushels.

- **Develop local and regional markets for DWG and DDGS** – Virginia possesses four industries that consume distiller's grains: cattle, diary, swine, and poultry. The project has determined that while the combined potential of these markets is insufficient to consume all of the plants distiller's grains, they are in their early stages of development. The plant can increase its selling price on distiller's grains by:

    - Developing a local market for DWG and thereby reducing energy consumption linked to drying distiller's grains
    - Forming a relationship with a marketer of distiller's grains is committed to developing local markets for DWG and DDGS including customers in the swine and poultry industries.
    - Forming a relationship with a marketer of distiller's grains that has experience with markets for DDGS in South Carolina and Northern Florida, two markets where Virginia will enjoy a higher selling price relative to Midwest product that will have higher transportation costs due to distance.