COMMERCIAL SCALE URBAN GREENHOUSES
Bringing New Yorkers Local, Sustainable Produce Grown in the Heart of New York City.

The project will establish New York City’s first commercial scale rooftop greenhouse farm A currently unused Brooklyn rooftop will be transformed into a 15,000 ft², state of the art greenhouse facility that will annually produce nearly 50 tons of premium-quality food crops for the robust New York City retail and restaurant markets.

The facility will use technologically sophisticated and commercially proven horticultural techniques combined with unique energy saving innovations. Controlled Environment Agriculture (CEA) provides secure, healthy, cost effective year-round production of many premium edible, high value plant species.

Crops will be allowed to naturally ripen on the vine ensuring optimum taste and nutrition and will be harvested just a few hours before they reach a restaurant plate or supermarket shelf, ensuring absolute freshness. By operating year round, the greenhouse will have the advantage of selling locally grown vegetables and herbs, even in the winter months, when prices are typically at their highest. Steady, reliable supply will provide leverage to incorporate long-term sales contracts that act to offset any volatility in the market, and will secure a constant revenue stream.

CEA is practiced on a commercial scale in many parts of the world including the United States. Large commercial greenhouse companies have hundreds and hundreds of enclosed acres where they grow premium crops in a controlled environment. The project essentially takes that existing technology and brings it into the city onto the hundreds of acres of unused rooftop space.

Controlled environment agriculture, or CEA, is a combination of horticultural and engineering techniques that optimize crop production, crop quality, and production efficiency.

Plants are grown within a sterile, controlled environment in an advanced and intensive form of hydroponic-based agriculture. Nutrients are delivered to the plant in irrigation water eliminating soil. Water is re-circulated and none is wasted. Pesticide use can be eliminated by using beneficial insects. Hydroponics eliminates a range of problems associated with conventional soil farming and the risk of soil-borne pathogens.
DESIGN AND IMPLEMENTATION  Architectural plans have been completed and regulatory approvals from state and city authorities have been obtained. Construction is schedule to commence in the summer of 2010 and full scale commercial production, sales, and distribution is planned for the early months of 2011.

When compared with a conventional, slab-mounted greenhouse, rooftop integration of this facility will yield direct energy savings by eliminating heating losses through the building roof and the greenhouse floor, and by capturing waste heat from the building exhaust air when possible. Special greenhouse design features, including double glazing and thermal curtains, will result in substantial additional reductions in heating demand.

Locating the project in a dense urban area, where temperatures are warmer due to the urban heat island effect, also plays an important role in reducing heat demand.

The electrical needs of the greenhouse will be partially met by on-site solar photovoltaic panels, and the crops will be irrigated with captured rainwater. Electrical load will be minimized by using natural ventilation, evaporative cooling, and high-efficiency pumps and fans.

As a result of these energy saving innovations and close proximity to the market, the facility will produce vegetables with a lower total energy input, per pound of delivered product, than either conventional greenhouses or conventional field agriculture, and with a lower carbon emissions profile. The environmental benefits are rounded out by land and water savings, and the elimination of fertilizer, pesticide, and stormwater runoff.
Growing ecological and public health concerns surrounding conventional agriculture, including high resource consumption, long distance food transport, and food safety have underscored the importance and role of local and sustainable food. Agriculture is the largest consumer of land and fresh water on the planet, is responsible for the lion’s share of carbon emissions and is the leading cause of global water pollution. Food, particularly high value perishable vegetables, travels thousands of miles to reach urban consumers often in refrigerated planes and trucks adding to traffic congestion, air pollution and carbon emissions.

Natural disasters and extreme weather events are increasingly affecting supply and pricing in the vegetable and fruit sectors. Last year’s ‘Florida freeze’ damaged millions of tons of crops and the resulting shortages kept prices high. Persistent drought conditions in California, the nation’s fruit and vegetable basket, are also bringing uncertainty to supply and pricing.

Conventional produce is often harvested unripe and sprayed with chemicals for artificial ripening which compromises nutrition. The proportion of food borne illness associated with fresh fruit and vegetables has increased over the last several years. Tainted produce now sickens more people than tainted meat. Food safety experts expect that the problem will worsen. Millions of New Yorkers live in areas with limited opportunities to purchase fresh produce. These also have the highest levels of diet-related diseases, including obesity and diabetes.

When compared to conventional agriculture, re-circulating hydroponics uses 10 times less land and twenty times less water. Pesticide use and fertilizer runoff can be eliminated. The project’s proximity to the retail market will sharply reduce transportation fuel consumption and associated air emissions, while improving product quality. Controlled Environment Agriculture is largely immune to weather as well as pests and disease outbreaks. Greenhouse operators can avoid fluctuations in supply and price.

City greenhouses can contribute to urban food security in the face of urbanization, climatic, economic, and political shocks. Crops will be allowed to naturally ripen on the vine ensuring optimum taste and nutrition and will be harvested just a few hours before they reach a farmer’s market or supermarket shelf. Food grown in these facilities will not have any contact with manure or soil reducing the risk of e.coli and Salmonella. The proximity to the end-user ensures not only a fresher product but less handling, providing more control over the delivery chain.

By setting up neighborhood farmstands and participating in community farmer’s markets, the greenhouse operator can increase the supply of fresh produce in so-called ‘food-deserts’. As
FINANCIAL SUSTAINABILITY  The company behind the greenhouse project has raised financing through a combination of collateralized debt, grants, and equity to: fund capital expenditure requirements; pay for intangible expenses such as architecture and engineering costs; and support working capital requirement necessary to operate the business. The first greenhouse in Brooklyn projects an impressive gross profit of 46% and EBITDA of 23%. These projections conservatively assume a gradual build up of revenue during the first 4 months of crop production. Based on extensive market research, as well as pilot produce sales, the company is confident in its ability to reach its revenue projections.

The main variables that impact revenue are Price and Yield. Cognizant of fluctuations in market price as well as potential variations of yield in the greenhouse, the company performed a series of sensitivity analyses to determine profitability under a broad range of conditions. Even under scenarios that assume low wholesale market prices, less than average yields, and high crop spoilage, the company reaches breakthrough profitability.

Over the next 5 years, the company plans to build three additional greenhouses in New York, totaling 200,000 ft². The company expects that profitability will greatly increase with economies of scale. The company has identified future project sites and is currently exploring the feasibility of those sites. The company projects a substantial increase in Gross Profits from 46% to 65% and Adjusted EBITDA from 22% to 38% which is driven by the increased scalability and profitability of operating larger CEA facilities.

TECHNOLOGY TRANSFER  The company will work closely with the broader urban agriculture movement to demonstrate that this project can be built upon and integrated into a more ambitious and comprehensive plan for sustainable urban CEA. The growth of urban CEA faces barriers including appropriate sites, zoning and building regulations, and permitting, as well as certain technical challenges, particularly with regard to robust, replicable energy saving innovations. The Company’s relationship with public sector agencies provides an opportunity to elicit increased interest in urban CEA and urban agriculture as well as renewable energy and energy productive enterprises. There are currently no sections or provisions in the NYC building code on agricultural uses or commercial greenhouses on commercial or industrial buildings. Using the project as a model, the company will leverage its position to attempt to clear some of the existing hurdles to widespread implementation of urban CEA.

Green roofs, which as little as 5 years ago were considered radical by some, now enjoy a devoted section in NYC Building Code and are widely implemented on new and existing buildings in NYC and urban areas worldwide. The benefits of building integrated greenhouse systems match those of green roofs: stormwater collection, urban heat island mitigation, and increased building insulation. The project can serve as a flagship project for the NYC Department of Buildings to conduct due diligence and write appropriate code. The project also provides a significant opportunity to gain positive media exposure for CEA, local and sustainable food production, renewable technologies, and energy efficiency measures.
The enclosed greenhouse facility allows for year-round production of fresh, healthy produce and protects crops from inclement weather and pollution.

On-site solar panels create electricity to power greenhouse equipment, including irrigation pumps & ventilation systems.

Energy use is reduced in the greenhouse facility through efficient equipment & advanced thermal design.

Beneficial insects protect the vegetables & herbs without the use of pesticides.

Rainwater is collected off the greenhouse roof & used for irrigation, contributing to urban stormwater management.

Within hours of harvest, produce is available at local retailers, restaurants, & farmer’s markets.

Produce is harvested at peak ripeness, ensuring optimum flavor & nutrition, & is delivered using alternative fuel vehicles & bicycles.