

Conference Summary

Innovations in Agriculture Conference

Session 1

Controlled Environment Agriculture

Empire Room

New York State Fairgrounds

Syracuse, New York

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Executive Summary

Innovations in Agriculture Controlled Environment Agriculture

On April 16-18, 2007, the New York State Energy Research and Development Authority (NYSERDA) sponsored its 7th Annual Innovations in Agriculture Conference. Session I was devoted to the Controlled Environment Agriculture (CEA) industry in New York. The term CEA is generally defined as the year-round greenhouse production of floral and vegetable crops in a controlled environment. CEA also refers to the technological attributes that allows for year around production of these crops in varying climates. The conference was held at the NYS Fairgrounds in Syracuse and was co-sponsored by Cornell University, the New York Farm Bureau, Northeast Agriculture Technology Corporation, the NYS Department of Agriculture and Markets, and USDA Rural Development.

The purpose of the Controlled Environment Agriculture session was to:

- Identify the potential for a thriving CEA industry in New York
- Determine the market potential for CEA crops in New York
- Review current CEA technologies and identify future technology research and development needs
- Determine how CEA technologies relate to food quality and food safety issues
- Discuss CEA Industry status and challenges in New York
- Consider key CEA development issues:
 - Facility design and construction for energy efficiency and high productivity
 - Business development and financing issues
 - Industry expansion opportunities and changing market demands
- Identify key challenges and solutions for an industry road-mapping process

Gunnar Walmet, Program Director of Industrial Buildings and Research at NYSERDA opened the conference and reviewed NYSERDA's 20-year interest in developing and facilitating a CEA industry in New York. He noted that changing consumer demands and demographics as well as the 3E's of Energy, Efficiency and Economy all factor well into the CEA opportunity. He concluded that a clear roadmap that defines necessary steps to CEA industry success is needed.

William Reinhardt, Senior Project manager, NYSERDA, shared the NYSERDA vision of CEA in New York. First he addressed the question, "Why CEA?"

1. CEA supports a sustainable economy
2. CEA leads to sound energy management
3. CEA can reduce dependence on oil imports

He explained that CEA is a real growth opportunity in New York and described two successful CEA production facilities that NYSERDA has supported (Underwood's Shushan Valley Hydro and Modern Landfill's tomato and raspberry greenhouse production system). He concluded his remarks with reasons why the CEA industry future in New York is bright including vast markets, a strong network of economic and technical support, and a consumer base that demands safe, healthy, locally grown produce.

Dr. Merle Jensen, University of Arizona (retired) and a worldwide CEA consultant provided a detailed history of CEA industry development in the U.S. He emphasized the Dutch-based greenhouse design and technologies that have been adapted here to create productive CEA facilities. He discussed key factors such as climate control, strategic plant shading, greenhouse cooling, disease control process automation, and plant enhancements that improve crop quality. He concluded that marketing is a key component of a successful CEA enterprise and that producers need to work closely with retail outlets to establish effective marketing programs.

Mike Hall, CEA Systems, and Kristen Park, Extension Support Specialist in the Department of Applied Economics and Management, Cornell University, presented information about the **market potential for CEA crops in New York**. Mr. Hall noted key questions about CEA that must be asked with the first being: What is the energy outlook for CEA? The answers:

1. CEA facilities are adaptable to alternative energy sources
2. Photosynthesis in an incredibly effective energy conversion system
3. CEA greenhouses enhance the process of converting sunlight (or artificial light) to energy in the form of edible plant life.

The second question is what are the environmental factors involved in CEA facilities?

1. CEA greenhouse crops require less pesticides than field-grown crops.
2. CEA crops require less water than field-grown crops
3. CEA facilities have a very low discharge of chemicals or waste into the air and ground environment

What about CEA economic challenges?

1. Current production costs in the northeast climate zone reduce competitive edge
2. We are at the tipping point where superior advantages of CEA will enhance economics

What are the overall advantages of CEA?

1. Safe and secure growing systems
2. Overall energy competitiveness
3. Localized production to market systems

Kristen Park considered the **market potential for CEA crops from the consumer perspective**. Consumers today want foods that are convenient, safe and have a minimal impact on the environment. Another key issue is the value of the food compared to its

price. The value of the benefits of a particular food need to be greater than the negative impacts of higher price. Can CEA provide a better value? CEA products are usually local, available year-round and offer healthy food advantages.

Ms. Park also identified issues that produce buyers consider when identifying fresh produce sources including logistics, transportation costs, availability of a variety of products, and sourcing issues that impact daily deliveries of fresh produce.

She concluded that the challenge for CEA is to develop more profitable crops into the available mix of vegetables. Right now, she suggested that only tomatoes, peppers and cucumbers are considered to be profitable CEA crops. We need to introduce more crops to successfully grow the industry.

Dr. Louis Albright, Professor of Biological and Environmental Engineering at Cornell and leader of the Cornell CEA program provided a **summary of current CEA technologies and an energy efficiency update**. Currently successful technologies include:

- Controlled and optimized plant growth lighting systems
- Adding CO₂ to the plant environment reduces need for supplemental lighting by as much as 41%.
- Neural Network Fault Detection system quickly detects system failures to reduce plant losses
- Pseudo-derivative Feedback control can provide temperature control within a tightly defined range, further optimizing the plant growth environment

CEA production provides numerous opportunities for biological controls and environmental manipulation that cannot be applied to field crops, including root zone environment enhancement. Also CEA is a tool for bio-molecular farming systems for the rapid production of pharmaceutical and other non-food crops.

Dr. Albright listed several research needs or opportunities to enhance CEA growing systems, including

1. Daily light integral control
2. Air temperature controls
3. Natural ventilation controls
4. Develop a means of improving long-term health and stability of nutrient solutions
5. Developing a detailed understanding of the metabolic pathway (chemical reactions occurring within a cell) in growing plants
6. Create a testing facility for grow lights
7. Develop biological and mechanical fault detection algorithms
8. Develop adaptive environmental control systems
9. Improve Photosynthetically Active Radiation (PAR) transmissivity of greenhouse structures, improve lighting systems
10. Develop effective treatment systems for municipal source water used in greenhouses.

Dr. Albright concluded his remarks with a summary of the Cornell vision for a vigorous CEA industry in New York and the establishment of a CEA Institute of Excellence at Cornell.

Energy costs for CEA operations are critical. Representatives from NYSEG/RG&E and National Grid discussed industry-specific electric-rate structures and economic development programs available from utilities, as well as natural gas options. When planning a new CEA enterprise, check with the utility early about available rates and programs that are often keyed to demand and geographical location (development zones).

Dr. Robert Gravani, Professor, Cornell Department of Food Science discussed **CEA and Food Quality**. Produce poses special challenges regarding food quality and safety:

- Produce is often consumed uncooked
- It is difficult to remove pathogens from produce once they have attached to the surface
- Pathogen infiltration and internalization in produce is documented
- There are multiple pathogen sources since produce is globally traded
- Produce is highly perishable and initial source of pathogens is hard to trace

Dr. Gravani discussed how microbial contamination occurs in produce and the advantages of CEA production systems as related to food safety. The numerous advantages include:

- Produce is handled under very controlled conditions
- Root and plant environments are controlled separately
- Water quality and nutrient solutions can be closely monitored
- Growing system excludes insects and birds
- Strong worker health and hygiene programs can be developed and implemented

The final session of the day focused on the **status and challenges of the CEA industry in New York**.

Ed Harwood, GreatVeggies, LLC, discussed his efforts to use customer needs and market trend data to develop a CEA enterprise producing “interesting salads”. After determining that the gourmet food market is growing, that private label products are gaining market share and that the consumer demands local, pesticide-free, healthy food, he developed a system of planting a mix of tasty, fragrant leafy greens on a cloth medium. The plant varieties are planted and harvested as a salad mix as a means of meeting demands for niche market specialty salads.

Wayne Underwood, Underwood’s Shushan Valley Hydro, reviewed the ten-year development of their CEA tomato and basil production enterprise. The greatest challenge for the business is to balance increasing energy costs while maximizing production in their greenhouses. Mr. Underwood advised prospective CEA producers what needs to be done to achieve CEA business success:

- Link with strong information resources

- Study and learn before making large expenditures
- Keep the operation simple at first
- Develop a niche market
- Don't compromise on quality, stand behind your products
- Pay constant attention to details

Mike Hall, CEA Systems, discussed his company's role in developing a commercial standard for CEA production systems and to deploy and support the intellectual property and technology in CEA held by Cornell University. Mr. Hall then focused on his vision of the future of CEA.

While CEA is currently focused on the production of edible and ornamental plants, the promising future opportunity for CEA is Biomolecular Farming for the production of Plant-Made Pharmaceuticals. Plants can produce a variety of the key proteins used in the manufacture of medicines to treat many diseases afflicting us today. Thus, the knowledge developed to produce today's commercial crops can be leveraged to enable the production of Plant-Made Pharmaceuticals at levels two orders of magnitude greater than conventional production systems. The capability to do that has to evolve, but is not far away.

The second day of the conference opened with breakout sessions focused on three issues affecting CEA industry development and growth:

- **CEA Facility Design and Construction for High Productivity and Energy Efficiency**
- **CEA Business Development and Financing**
- **CEA Industry Expansion and Changing Market Demand**

CEA Facility Design and Construction Session

John Hoogeboom, Rough Bros., Inc. a greenhouse system design and construction company based in Ohio, provided a detailed overview of what needs to be considered when planning a new or expanded greenhouse enterprise. He focused on questions about the proposed greenhouse site and how the business may be expected to grow over time. Energy availability and cost, transportation, available high quality water, labor and automation considerations, available markets and project finances and timelines are important issues that must be clearly resolved before going forward. Mr. Hoogeboom's discussion ended with a look at the future of the greenhouse industry in the United States. There will be more large-scale growers, but there will also be a need for more small growers (less than 2 acres of greenhouse space) to fulfill specific local markets. Automation will become increasingly important, and new technologies such as "smart glass" will be adopted. Open-roof greenhouse designs are quickly giving way to limited ventilation designs which allow improved environmental control.

CEA Business Development and Financing session:

Three speakers in this session focused on available financial assistance and business planning services.

Tom Gilson, Vice President and Central New York Regional Director for Empire State Development, (ESD) provided information about services available from ESD to assist small businesses, including greenhouse operators. ESD can provide financial assistance to support land, building and equipment acquisitions, construction finances for new buildings or expansions and infrastructure improvements, employee training, and productivity enhancement. In some cases, working capital can also be provided.

Mr. Gilson then reviewed the various programs ESD offers to assist small businesses and how to contact the organization.

Bill Kimball, Director of the Division of Agricultural Protection and Development, NYS Department of Agriculture and Markets, provided a detailed overview of services and assistance available from the department. He provided a summary of the Food and Agricultural Industry Development (FAID) Grants program. The purpose of FAID is to further the development of the food and agricultural industry in New York. Project eligibility includes new product development, alternative methods and technologies as well as organizational methods. Eligible costs must be directly related to the project and can include costs ranging from wages, fringe benefits, professional services, travel, promotion, materials, and more. The FAID grants can not be used for depreciable equipment or structures, land acquisition, proposal preparation costs, or costs incurred before the award is announced. FAID grants are up to a maximum of \$60,000 per project. A 50% match is required which can be in-kind services or equipment costs for the project.

The FAID program RFP was released in May, 2007 and proposals are due in July, 2007. Mr. Kimball then shared information about several funded projects as well as contact information for the program.

Ed Staehr, Communications Director for New York FarmNet/ New York FarmLink program based at Cornell. Ed spoke about business planning services available at no cost to greenhouse operators. The FarmNet/FarmLink programs services include complete business planning services, project feasibility evaluation, family business meeting facilitation, farm business transfer assistance, communication improvement and business conflict resolution.

Business plans have many uses for a new or expanding enterprise including:

- Providing a roadmap to the future
- Identifying business objectives
- Measuring progress
- Marketing the project to lenders
- Provide a means to obtain grant funding

CEA Industry Expansion/Changing market Demand session:

In this session, two invited speakers addressed key issues related to growing the CEA industry in New York.

John Nettleton, Senior Extension Associate, Cornell Cooperative Extension, New York City, introduced a web-based resource called MarketMaker. MarketMaker is currently used by several states, and will soon be available in New York. The MarketMaker resource network allows consumers and buyers to find local, in-state or out-of-state producers of value-added food commodities. Conversely, producers of these commodities can use the network to find and develop their markets. MarketMaker is a free tool that can be used by anyone with internet access. It is of use to anyone who grows food, processes food, sells food or eats food. While the MarketMaker program is still under construction for New York, several marketing groups have been listed including Pride of New York, NY Wine Grape Foundation, NY Vegetable Growers and several others

Rhett Smith, Manager of Birdseye Fresh, Birdseye Foods, provided the Birdseye company view of CEA. He provided a graphic summary of vegetable consumption trends in the U.S. based on demographics including gender, age, education, and income levels. Generally, females over 65 years of age, with a college education and incomes over \$50,000 are primary targets for fresh vegetable retailers. Consumption of the most popular fresh vegetables including lettuce, tomatoes and peppers is expected to increase through 2020.

Mr. Smith then provided insight into the consumer definition of “local foods”. Consumers have a differing idea of the meaning. To some, local means natural or farm fresh, or green, or organic. Mr. Smith then discussed the issue of sustainability which can be defined as a profitable, socially conscious, environmentally friendly, safe and secure food production system. These are the generally accepted attributes of CEA. However, Mr. Smith suggested that CEA market opportunities may be limited because the total energy and operating costs of CEA may not be competitive with vegetable products sold in grocery stores under current commodity pricing models. Until CEA can reduce energy use and costs, he suggests that CEA producers cannot be competitive.

Mr. Smith concluded by suggesting areas where CEA does have opportunity. Value adding, such as producing bagged cut lettuce or herbs, forming CEA alliances or coops, or developing CEA facilities as an integral part of restaurant chains may be the best near-term opportunities.

Innovations in Agriculture Conference

Session 1 Summary

Controlled Environment Agriculture

I). The Vision and Potential for a CEA Industry

A). Conference welcome and opening remarks

Gunnar Walmet, Program Director of Industrial Buildings and Research at NYSERDA, welcomed the conference attendees with an overview of NYSERDA activities associated with NYSERDA's 20 year interest in Controlled Environment Agriculture. He spoke of the changing demographics of consumers and of the economics that may drive a CEA industry forward. The 3Es of Energy, Efficiency, and Economy factor well into the opportunities a thriving CEA industry can provide.

However, if we are to successfully move a CEA industry forward, we need to develop a clearer roadmap that defines the necessary steps to success. Mr. Walmet concluded by recognizing the support that the current CEA program in New York has received from NYSERDA, the former Empire State Electric Energy Research Corporation (ESEERCO), Niagara Mohawk (a National Grid Company), NYSEG, and Cornell University.

B). A Vision of Controlled Environment Agriculture in New York

William Reinhardt, Senior Project Manager for NYSERDA, shared the NYSERDA vision for Controlled Environment Agriculture in New York. He stressed that one outcome of the conference will be the development of the Roadmap to a successful industry. He then shared a presentation outlining the vision. The primary question that needs to be answered is: Why Controlled Environment Agriculture? NYSERDA focuses on three advantages of CEA:

- CEA supports a sustainable economy
- CEA leads to sound energy management
- CEA can reduce dependence on oil imports

Mr. Reinhardt discussed current trends toward globalization in some instances to localization in others. Trends that support a CEA industry include:

1. More processing of foods to meet consumer needs
2. Consumers want more locally produced products
3. There is a trend toward more greenhouse production of salad crops

However, Controlled Environment Agriculture is not well recognized yet as a solution to several challenges that face the salad crop and cut flower production industries. It is clear, that CEA is a growth opportunity. The average value of harvested field grown

crops in New York is about \$440 per acre/year. The production value of CEA grown crops is up to \$6.8 million per acre/year.

Mr. Reinhardt shared details of two commercial CEA production facilities that NYSERDA has supported. Underwood's Shushan Valley Hydro is tomato and fresh basil production greenhouse system in Shushan, (Washington County). The Underwoods market their crops through local chains including Hannaford Brothers and Price Chopper markets. They have worked closely with NYSERDA, Cornell University, and Merle Jensen, University of Arizona to develop and expand their successful CEA enterprise.

Modern Landfill, Model City, (Niagara County) near Niagara Falls, will produce tomatoes and raspberries in eight CEA greenhouses. The facilities have been designed with the help of researchers at Cornell University and Buffalo State University. Methane gas from the adjacent landfill will provide all heat and electricity required to operate the greenhouse system. There is enough gas available to support up to 10 acres of greenhouses.

The future of CEA in New York is bright. There are vast markets within easy transport distance. There is a good network of economic and technical support available to producers, and New York has a consumer base looking for safe, healthy, locally produced food. However, to develop a thriving CEA industry in New York, we need to plan a Roadmap to Success that defines the vision and goals, identified the barriers and challenges, develops sound project specifications and establishes projects that move the industry forward.

C). The Potential for a CEA Industry

Merle Jensen, Professor Emeritus, University of Arizona and internationally noted CEA expert, provided a historical to modern-day perspective of a CEA industry. Dr. Jensen focused on greenhouse design changes that have evolved over time and that facilitate CEA growing systems. The influence of Dutch greenhouse designs has resulted in greenhouses that feature heights of up to 20 feet to the gutters and small gutter designs coupled with large, unobstructed glass area that provides excellent light transmittance to plants.

Greenhouse cooling is critically important, and modern ridge vents are designed to provide most of the cooling. During the warmest weather, evaporative cooling systems maintain proper growing temperatures. Temperature and humidity need to be carefully controlled at all times of the year. Greenhouse heat is usually provided by boiler systems, many of which also provide carbon dioxide to enhance the growing plant environment.

Shade systems are very important in the greenhouse to protect the plants from too much sunlight exposure. Dr. Jensen emphasized that "shade systems are for the plants, not for people."

Dr. Jensen discussed the competitive environment that impacts the development of a CEA industry. Competition comes from Europe, Canada, and Mexico. Our competitors face the challenges of high-cost transportation as well as disease issues and product quality deterioration due to handling and age when the crop reaches the ultimate consumer. Greenhouse acreage in Canada and the United States has stagnated in recent years, while the Mexican greenhouse industry is growing rapidly.

Hydroponic systems provide a unique opportunity to raise the sugar content and thus enhance the flavor of the crop. CEA growing systems allow for the control of electrical conductivity of the nutrient solution provided to the plants, which reduces the water content in the fruit while concentrating sugars.

Investment in a modern CEA facility averages about \$0.5 million to \$0.6 million per acre. The large investment provides a return in increased productivity and high quality. The ability to meet just-in-time delivery schedules as well as to provide high customer satisfaction often results in above average or premium pricing for CEA produce.

Dr. Jensen then discussed successful CEA enterprises in the US. In Arizona, Eurofresh has 300 acres of greenhouses. Their tomatoes are found in 50% of the retail grocery stores throughout the nation. However, much smaller, more localized CEA enterprises can also be successful. MacPhail Berry Farms in Lynden, WA has two 8000 ft² greenhouses producing beefsteak tomatoes profitably.

CEA greenhouse systems will continue to become much more automated. Computer control systems are far more effective at controlling and maintaining a uniform plant environment than manually operated systems. Automation allows the staff to concentrate on general plant care and harvesting rather than making constant adjustments to systems. Automated vent and climate control systems and harvest carts reduce labor requirements and enhance productivity.

Diseases can be more effectively identified and controlled in CEA greenhouse systems. There have been great advances in plant breeding to improve disease resistance. Recent work has perfected the grafting of disease resistant wild tomato roots onto tomato plants. Continuous efforts to enhance disease resistance will allow CEA systems to advance more rapidly.

Dr. Jensen concluded with thoughts about marketing. Growers need to work closely with the stores that sell their products. Growers should become familiar with proper display methods and work with produce people who display products well. Some produce departments will allow the producer to help develop effective, consumer friendly displays.

D). Market Potential for CEA Crops in New York

Michael Hall, CEA Systems and PFA Consulting and Kristen Park, Extension Support Specialist in the Department of Applied Economics and Management at Cornell,

provided their assessment of the potential for CEA grown crops in New York. Mr. Hall began his discussion with some basic question we need to understand and answer. The first question is: What is the energy overview of CEA? First, CEA systems are adaptable to use alternative energy sources including green energy. Secondly, photosynthesis is an incredibly effective energy conversion system, and CEA greenhouse facilities enhance the process of converting sunlight (or artificial light) to energy in the form of edible plant life. However, there are key logistics that must be considered, including proper sheltering of greenhouses that provides reasonable protection while producing an ideal growing environment in the variable New York State climate.

The second question is: What are the environmental factors involved in CEA facilities? First, CEA greenhouse systems generally require far less pesticide use than field grown crops. CEA facilities require much less water than fields grown crops. CEA greenhouses have a very low discharge of waste or chemicals into the air and ground environment. For example, in many CEA greenhouses, discharges are generally confined to the wastes from the employee washroom facilities. Finally, CEA facilities capture carbon.

The economics of CEA are still challenging. Production costs, especially in the Northeast climate zones and in regions of high energy prices currently reduce competitive edges. However, we are at the tipping point where the superior advantages of CEA production systems will enhance the economics.

What are the overall advantages of CEA? The principle advantage is that CEA greenhouse systems allow for the control of more parameters more precisely. This produces optimum plant performance, making this system highly productive when compared to non-CEA greenhouse systems and field growing systems. CEA provides a safe, secure and reliable growing system where excellent growing performance can be anticipated and repeated. CEA growing systems provide for better food security from seed to consumer. CEA growing systems can be strategically located to reduce transportation distance and cost.

CEA provides ideal environments for the production of fresh leafy greens, fruits, vegetables and a large variety of floral crops. CEA growing systems can also provide for the development of Bio-Molecular Farms to harness the full potential of plant genetics.

Mr. Hall summarized that the key CEA advantages are:

- Safe and secure growing systems
- Overall energy competitiveness
- Localized production to market systems

Kristen Park considered the market potential for CEA crops from the consumer perspective. Consumers today look for several attributes in their food supply. They look for foods that are convenient, healthy, and that have a minimal impact on the environment. Today, the consumer is becoming more concerned about food safety, and recent national outbreaks of food-borne illnesses are raising food safety awareness.

Consumers define food value in terms of benefits/price. The value of the benefits of a particular food need to be greater than the negative impacts of the price.

Ms. Park addressed the question, Can CEA offer a better value? When considering consumer demands, CEA produce is local, available year around, and offers healthy food advantages. Produce buyers look at a variety of issues when considering fresh produce sources:

1. What are the logistics?
2. What are the transportation costs?
3. What sourcing issues impact daily deliveries of fresh produce?
4. What is the infrastructure? Are producers or a variety of products clustered near the market?
5. What commodities and varieties can be provided?

If CEA facilities respond to consumer and produce buyer concerns effectively, then CEA can be a competitive player in the marketplace. Ms. Park stressed that when choosing plant varieties to grow in CEA facilities, one should consider the key consumer issues such as anti-oxidants and other health attributes.

In conclusion, a recent produce trade journal suggested that tomatoes, peppers and cucumbers are the only vegetables that are currently profitable in greenhouse growing systems. If that is true, what do we have to do to introduce other profitable crops into the mix? She also suggested that, since marketing is a key and often costly component of successful CEA enterprises, producers might consider contract growing for larger companies as a way to come into the industry.

II). CEA Technology and Energy Efficiency Update

Dr. Louis Albright, Cornell University Department of Biological and Environmental Engineering provided a review of current CEA technology and a summary of needs. He described two important attributes of CEA growing systems: Locally produced and distributed production and HACPP capability in the production system. Selected field grown produce travels an average of 2000 miles to reach the consumer. CEA produce travel distance tends to be very localized.

Dr. Albright reviewed some CEA development within the past 15 years. Plug production research in the early 1990s helped identify the best plug materials and processes to quickly grow healthy seedlings for transplant. Total energy consumption studies confirmed a model that CEA production would reduce peak oil consumption in the plant based food production industry. Also, nighttime greenhouse production systems would contribute to a flattened electricity demand, which is ideal for electric utilities to serve.

Development of a controlled and optimized plant growth lighting system was a major technology breakthrough. Light for plant growth is known as Photosynthetically Active Radiation (PAR) Extensive research at Cornell led to the development of a proprietary

plant lighting control algorithm that provides good light control for optimum plant performance. For example, in a lettuce production greenhouse, the light control system will provide light at a uniform 17 mols/meter² for each 24-hour period. Computerized light control is just one key aspect of a modern controlled environment production facility.

Further research at Cornell has determined that adding carbon dioxide to the greenhouse environment allows the plant to be more efficient in the use of light. Adding CO₂ reduces the need for supplemental lighting by as much as 41%. However, this requires more environmental control to avoid exhausting the CO₂ with ventilation air. It appears that adding CO₂ would be quite possible in the fall and spring. Limited application of air conditioning for temperature and humidity control would avoid the loss of CO₂ through open ridge vents. The savings in reduced supplemental lighting costs would more than offset the cost of air conditioning the greenhouse space during moderate spring and fall weather.

Another development that optimizes CEA production systems is a Neural Network Fault Detection system that quickly detects system failures. Additionally, a Pseudo-derivative Feedback Control can provide temperature control within a tightly defined range, which further optimizes the plant growth environment. CEA production provides numerous opportunities for biological controls and environmental manipulation that cannot be applied to field grown crops.

CEA also allows the manipulation of the root zone environment, which helps control plant diseases. For example, greenhouse-grown spinach is very susceptible to root rot caused by Pythium. By reducing the root zone temperature, the Pythium cannot survive and the spinach plant stays healthy.

CEA is a tool for bio-molecular biology. Bio-molecular farming systems can be developed for rapid production of pharmaceutical and other non-food crops.

Additional Research opportunities

Dr. Albright cited the need for numerous research activities to further enhance CEA growing systems. These include:

1. **Daily light integral control** to allow effective use of time-of-day electric rate schedules
2. **Air temperature controls** to allow more uniform temperatures
3. **Natural Ventilation controls** to optimize natural vs. mechanical ventilation and cooling
4. **Need to improve the long term health and stability of nutrient solutions** – the deterioration of nutrient solutions causes costly production delays as solutions are drained and replaced with fresh, healthy solutions
5. **Need a more detailed understanding of the metabolic pathway in growing plants**

6. **Adaptive environmental control systems** will allow tighter, more accurate environmental control during unexpected or rapid changes of the existing environment
7. **A luminaire testing facility** to determine optimum luminaire efficiencies and to develop most effective PAR patterns
8. **Develop biological and mechanical fault-detection algorithms**
9. **Research efforts to improve PAR transmissivity of greenhouse structures**
10. **Development of Good Agricultural Practices for CEA facilities**
11. **Develop treatment systems for municipal source water used in greenhouses**
12. **Develop effective, economical water jacketed lamps for greenhouse lighting**
13. **Develop effective LED lighting systems for CEA facilities**

Dr. Albright concluded by sharing a Cornell vision for a vigorous CEA industry in New York State and the establishment of a CEA Institute of Excellence at Cornell. With links to other colleges and universities, existing and potential commercial and industrial collaborators and CEA technology users, Cooperative Extension educators and state-wide agricultural organizations. The Institute would be **grounded in reasonable and practical solutions for the future, focused, viable, visible and proactive.**

The proposed institute would be comprised of three elements: research, technology transfer and education and training. Examples of appropriate expertise within the Institute would include horticulture, engineering, economics, entomology, food science, plant pathology, microbiology, communication, plant sciences and education.

III). Utility Rate Structures and Economic Development Programs for a CEA Industry

Frank Roma, PE, Lead Engineer in Marketing and Sales at New York State Electric and Gas provided a general overview of electric and natural gas rates offered by NYSEG and sister company, Rochester Gas and Electric. There are a variety of rate structures applicable to greenhouse growers, including, where applicable Economic Development Zone Incentive rates (EDZI). Commercial greenhouse operators should contact their utility and discuss available rates to determine the most beneficial rate application. Another issue is to consider the electric and natural gas supplier in a deregulated market. NYSEG can provide a complete list of available alternative suppliers of electricity and natural gas.

NYSEG also has some economic development funding available for infrastructure upgrades to new or expanded facilities. For example, funds could be available to help offset customer charges for primary electric system upgrades to enable increased electric service capacity to a new or expanded CEA facility. NYSEG or RG&E should be contacted directly to discuss rate information and available economic development incentives. Contact Frank Roma at NYSEG at 607-762-7671 (or email him at fproma@nyseg.com). Contact John Zabliski at RG&E at 585-771-2660 (or email at John_Zabliski@rge.com).

James Stapleton, Principal Energy Manager and Linda Clark, Senior Economic Development Representative at National Grid presented information about available rates and economic development opportunities available to National Grid greenhouse operators. Jim Stapleton spoke of National Grid's limited rate structure which is broken down by customer size (under 100 kW and over 100 kW). If greenhouse operators can keep their peak demand under 100 kW, they can qualify for the most advantageous rates. Greenhouse operators should contact their local National Grid offices for detailed information about applicable rates for electricity and natural gas.

Linda Clark discussed National Grid's Shovel ready economic development incentive program. She referred customers to the National Grid Shovel Ready website where detailed information and contact phone numbers are available. There are some available incentives for business expansion and development. Linda can be reached at National Grid's Syracuse Economic Development offices at 315-428-6891 or email her at lclark@shovelready.com.

IV). CEA and Food Quality

Dr. Robert Gravani, Department of Food Science, Cornell University and Director of the National Good Agricultural Practices Program provided an excellent overview of Food Quality and Safety issues related to produce. There are 350 produce items from 130 countries on our produce shelves. Produce ranks highest among all foods involved in food born illness outbreaks. In fact, produce is involved in an increasing proportion of outbreaks and the outbreaks are larger than in the past.

Produce poses special challenges, according to Dr. Gravani:

- Produce is often consumed uncooked
- It is difficult to remove pathogens once they attach themselves to the surface
- Infiltration and internalization of pathogens is documented in produce
- Multiple pathogen sources – produce is globally traded
- Produce is highly perishable and initial source of pathogens is hard to locate

Food-borne outbreaks have dramatic and long lasting impacts on related commodity sales. The outbreak in 2006 related to spinach from one farm in California continues to depress fresh spinach sales. Food-borne outbreaks work against commodity promotion campaigns. Outbreaks often result in unwanted and unneeded regulation in the food industry.

The risk of microbial contamination results from interaction of several factors:

1. commodity characteristics
2. geographic area of original contamination
3. agricultural practices followed

Food safety at the point of production is enhanced by following Good Agricultural Practices as determined by the National Good Agricultural Practices Program. A good practice is defined as any operational or management practice that reduces microbial risk in fresh produce. Following proper sanitation procedures is one of the most important issues in produce production and handling.

Dr Gravani listed several advantages of CEA production systems as related to food safety:

- Produce is grown and handled under very controlled conditions
- Root and plant environments are controlled separately
- Water quality and water/nutrient solution can be closely monitored
- The growing system excludes insects and birds
- CEA facilities can develop, implement and maintain a prerequisite program
- CEA facility managers can develop a strong worker health and hygiene program

Finally, Dr. Gravani emphasized that CEA growers can prevent food-borne illness outbreaks by:

- Learning about all hazards and risks
- Strengthening their Good Agricultural Practices
- Developing and maintaining a food safety plan

V). New York CEA Industry Status and Challenges

Edward Harwood, GreatVeggies, LLC, Wayne Underwood, Underwood's Shushan Valley Hydro, and Michael Hall, CEA Systems, presented a panel discussion about the status of the New York CEA industry and the challenges that the industry faces as it grows.

Ed Harwood (GreatVeggies, LLC) shared his knowledge of customer needs and industry trends. The consumer is demanding more packaged salads. His research shows that the fresh-pack salad market in New York State is \$200 million per year. Industry trends indicate that:

- The gourmet food market is growing
- Private label products market share is growing
- All costs for current producers are rising
- The consumers demand local, pesticide-free, healthy, and safe food

Mr. Harwood then shared some information on the growing system he has developed. He uses no soil, but grows salad crops on a reusable cloth medium. The medium is over seeded and then thinned to allow healthiest plants to grow. He uses aeroponics to deliver water and nutrients in a closed system. No transplanting is required, and mixed salad greens are harvested in 21 days.

GreatVeggies, LLC has developed the concept of producing “interesting salads” to meet special consumer demands. An interesting salad is made up of small leafy greens in a variety that is tasty, fragrant and colorful. The crops are planted and harvested as a salad, naturally mixed and grown on the cloth media. The crop is entirely pesticide free. This system is a means of meeting demands of niche market specialty salads.

Wayne Underwood (Underwood’s Shushan Valley Hydro) emphasized that their greatest challenge is balancing increasing electricity and heating costs while maximizing production in their CEA tomato and basil production greenhouses. Wayne and his wife Phyllis have focused on maximizing the use of space and light. They have a four-bay, gutter-connected tomato production greenhouse that has been in operation for 10 years. A year ago, they added a 30’ x 100’ hydroponic Basil House, which is designed to maximize use of sunlight and off-peak utility rates.

The Underwoods have built their CEA enterprise on a solid foundation of expert information resources. They have worked closely with Cornell University for several years and have had a consulting agreement with Dr. Merle Jensen for the past four years. Through these relationships, they strive to continually improve crops, maximize yields and to adopt new and innovative practices.

Tomato and basil are currently marketed through area supermarket chains. There are many store customers who seek out their tomatoes. Recently, a very large out-of-state tomato operation began competing for the market in the stores carrying the Shushan Valley brand, and some stores changed to the new supplier. Soon, customers began complaining that the Shushan Valley tomatoes were not available. Maintaining high quality to ensure customer loyalty is an important factor in the Underwood’s success.

The new basil production greenhouse is innovative, and dramatically reduces growing time. The greenhouse maximizes solar energy. The facility has a radiant heat floor. Basil is grown using a bench system. A recirculatory injection feed system provides plants with a water nutrient mix. An ultraviolet sterilization system keeps the water free of damaging bacteria. The basil plants receive a uniform 8 moles of light per-24-hour period. If supplemental light is required, the system defers to lower cost off-peak rate periods as much as possible. Currently lights are operated in the winter 8 hours each week night and 16 hours per day on the weekend, all during available off-peak price times. Basil that normally takes 95 days to produce is grown in the Shushan Valley facility from seed to sale in just 42 days during the lowest winter light conditions. The peak electrical demand at the Underwood’s greenhouses was 22 kW before the basil production facility was added and increased to 28 kW with the basil house.

The Underwoods provided a list of things for prospective CEA producers to do:

1. Link with strong information resources (universities, expert consultants, other growers).
2. Study and learn before making large expenditures.

3. Keep the operation simple at first.
4. Develop a niche market.
5. Produce a quality product, stand behind it, and don't compromise on price.
6. Pay constant attention to details.

Mike Hall, CEA Systems, discussed his view of CEA Industry Status and Challenges. CEA Systems is a privately held New York Corporation that is a joint venture with the Cornell Research Foundation. CEA Systems is the exclusive licensee of a suite of intellectual property that evolved from CEA research. CEA Systems is responsible for the commercialization of Controlled Environment Agriculture.

The mission of CEA Systems is to develop a commercial standard for CEA production systems and to deploy and support the intellectual property and technology in Controlled Environment Agriculture held by Cornell University.

Mr. Hall then devoted the rest of his discussion to a focus on the future. So far the CEA focus has been on the production of edible and ornamental plants. However, a significant future opportunity is Biomolecular Farming. He discussed an initiative to determine the feasibility and benefits of combining existing state-of-the-art CEA techniques with transgenic plant-based protein production. This technology could replace very expensive microbial fermentation facilities for enzyme and protein production. Indoor agricultural systems provide a sustainable and environmentally responsible approach to transgenic plant production and utilization.

Biomolecular Farming increases the production of a specific target protein using environmental controls. Specific plants can be enabled to produce therapeutic proteins that could ultimately be used in medical applications. Thus, plants would become the factories to manufacture therapeutic proteins. These proteins are extracted, refined, and used for pharmaceutical production. Plant-Made Pharmaceuticals (PMPs) are made from common plants such as alfalfa, barley, corn duckweed, rice, safflower and tobacco. APHIS regulatory permits have been granted for field trials aimed at delivering the next generation of essential proteins for life-saving medicines.

As an example of the potential for the CEA industry to be enhanced by the production of plant-made pharmaceuticals, Mr. Hall explained that the existing 8,000 square foot Cornell CEA greenhouse could produce 5 pounds of Interferon per year. This would have an incredibly high value in the pharmaceutical and medical industries.

Mr. Hall summarized that producing plant-made pharmaceuticals would open up a new and very significant production measure for CEA facilities. Plants can produce a variety of key proteins that are used in the manufacture of medicines to treat many diseases afflicting us today including Alzheimer's disease, cancer, Chron's disease, cystic fibrosis, diabetes, heart disease, Hepatitis C, HIV and many more.

Plant-Made Pharmaceuticals leverage much of the agricultural biotechnology applications and knowledge used in the production of genetically enhanced food and feed, but for a different purpose and end use. Plant-Made Pharmaceuticals could be produced at levels two orders of magnitude greater, compared with conventional production systems. While the full potential of CEA-based PMP production cannot be determined today, the capability is not far away. That defines a very real and exciting opportunity for the growth of the CEA industry.

Break-out Session and Discussion Summaries

The second day of the CEA Conference included three breakout sessions that focused on three key considerations impacting CEA industry growth:

Session 1 – CEA Facility Design and Construction for High Productivity and Energy Efficiency

Session 2 – CEA Business Development and Financing

Session 3 – CEA Industry Expansion/Changing market Demand

CEA Facility Design

John Hoogeboom with Rough Brothers, Inc. a greenhouse design and construction company located in Cincinnati, OH offered some considerations for planning a modern greenhouse facility. When considering a new greenhouse facility there are numerous key questions that should be answered before proceeding:

- How much does energy cost?
- What crops will be produced?
- What and where is the market for the products to be grown?
- How will product be moved in and out of the greenhouse?
- What are the prevailing climate conditions in the area?
- Is there enough good quality water available?
- Is three phase electricity available?
- Is natural gas available?
- What are the labor issues? How much does labor cost?
- What kind of automation will be used?
- Where will the headhouse be located?
- How much money is available?
- What is the timeline?

As the design and construction of the greenhouse are considered, answers to the questions are very important. In addition, permitting issues must be considered. Who will be involved in the permitting process? (e.g., EPA, fire officials, local building inspectors, health department, others) Are stamped drawings required for permitting? (there is often little continuity between municipalities regarding permitting requirements.) How long will it take before a permit is issued? Plan on at least six months. Other considerations that could affect permitting include water issues and nuisance factors such as truck traffic and facility lighting that could be labeled a highway hazard. Permitting issues must be determined and negotiated early in the process to avoid costly delays.

Energy costs are important. Energy costs affect transportation, heating, electricity, and material costs. The design of the greenhouse and the operating systems should consider energy efficiency applications wherever possible. In modern greenhouses, the heating design often includes low-level piping (delivering heat close to the plant level) and higher roof height to improve climate control capabilities. Consider the availability of all energy sources. Are electricity and natural gas lines readily accessible? Are alternate energy sources available, such as landfill gas, biogas or geothermal energy? Coal and wood can be used as heat sources, but they are high maintenance systems, fuel storage is a problem and there are stack emissions issues. Will the heating system also be used for CO₂ production? Ventilation is a very important energy issue. Air exchanges in the greenhouse during the heating season should be limited to ½ exchange per hour. Finally, careful planning of greenhouse systems (heating, ventilation, electrical, etc) is necessary so that one system doesn't interfere with another.

Minimizing labor costs is a consideration of greenhouse design. The distance from the plant preparation area to where plants need to go is important. Design should be for one-way traffic flow to maximize product and personnel movement efficiencies. Automated cart systems can improve overall labor efficiency significantly. Also, climate control systems should be automated. Without automation, climate control requires a great deal of time. To achieve maximum labor efficiency, the investment in greenhouses has increased significantly. In the past, greenhouse structures required 75% of the construction budget, while operating systems in the greenhouse required 25% of the budget. Today, it is just the opposite.

Financing of greenhouses is a challenge today. Few lending institutions understand greenhouse business operations and are often reluctant to provide financing for start-up greenhouse operations. Lenders are concerned about the value of a greenhouse facility if the business fails. It is important to search out lenders who are very familiar with greenhouse operations.

Mr. Hoogeboom finished his discussion with a look to the future of the greenhouse industry in the United States. Currently, US bedding plant greenhouse acreage is decreasing by 5% per year. As the industry moves forward, there will be more large-scale growers. At the same time, there will be more small-scale growers (1-2 acres) to fulfill specific local markets. Greenhouses will be built closer to the customer to reduce transport costs and to ensure fresher products for the market. Automation will become

increasingly important to further reduce labor costs. New technologies will be adopted, including the use of “smart glass” technology, where molecules in the glass are manipulated to provide a range of light transmittance as needed (from full light transmittance to low-light transmittance). Open-roof designs will give way to limited ventilation designs with increased environmental control.

Mike Porter, President of NEXUS Corporation, Northglen, Colorado, was unable to get to the conference because of the major snowstorm that forced his flight to be canceled. However, a summary of the material he planned to present follows:

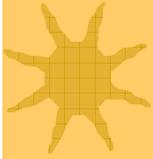
NEXUS Corporation is a leading company in greenhouse systems integration. They specialize in developing controlled agriculture environments within greenhouse facilities. The primary considerations for a Controlled Environment Agriculture greenhouse include:

- Design and build facility around crop, growing system and local climate.
- Ideally, growing conditions would be uniform 365 days per year
- However, some compromises may have to be made for cost considerations
- Facilities must be designed for future flexibility in crops and technology
- Crops to be grown and growing media to be used should be carefully considered
- The growing system considerations include:
 1. Crop timing and spacing affect greenhouse widths and lengths
 2. Material flow must be planned from germination to shipping
 3. Insect screening is necessary
 4. Supplemental lighting contributes to a uniform plant environment
 5. Automation should be considered either now or later
- Regulatory issues are important
 1. Product sanitation issues
 2. Pesticide and or fertilizer applications
 3. Water use, conservation and disposal
- Greenhouse zone partitions should be considered
 1. Create different environments for different stages of production
 2. Separation of different plantings to prevent disease spread
- Packing and shipping area design is an important factor

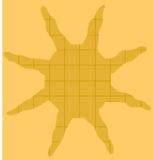
The design criteria need to address energy implications starting with greenhouse coverings. Covering choices impact heat loss, light transmittance and the relative cost of the greenhouse. The following chart demonstrates a comparison of typical greenhouse coverings:



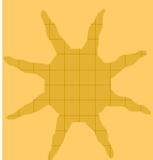
Design Criteria – Energy Implications



- Coverings
 - Necessary light levels



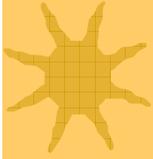
Product	R-Factor	U-Factor	Relative Cost	Light Trans %
8mm Twin wall	1.72	.58	.72	80%
8mm Triple wall	1.99	.50	.85	76%
16mm Triple wall	2.36	.42	1.21	76%
Double Poly Film (4yr)	1.43	.70	.10	82-83%
Corrugated	.83	1.20	.38	90%
Glass	.93	1.08	1.0	100%



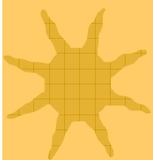
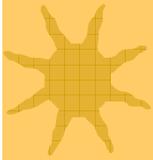
Shade curtains help reduce excessive light on bright, sunny days and reduce heat loss on cold nights:



Design Criteria – Energy Implications



- Shade/Energy curtain (cont.)
 - Double systems – both curtains deployed on cold nights
 - 74% Energy savings



The style of the greenhouse impacts energy requirements for ventilation. Traditional greenhouse design usually requires mechanical ventilation:

Design Criteria – Energy Implications

- Greenhouse Style
 - Traditional

Typically requires mechanical cooling



However, greenhouses can be designed to facilitate natural ventilation to reduce mechanical ventilation energy costs:

Design Criteria – Energy Implications

- Greenhouse Style
 - Natural ventilation

Can eliminate fans

Less control, but normally good enough

Some can be screened



Proper heating and cooling are challenging design considerations. The major problem with heating is the energy cost. Facility design needs to consider maximization of heating efficiency while allowing for adequate ventilation. Ventilation (cooling) is a technical problem in many climates.

CEA Business Development and Financing

The CEA Business Development and Financing segment featured three speakers focusing on financial assistance programs and business planning services.

Representing Empire State Development, Thomas Gilson, Vice President and Central New York Regional Director, spoke about the services available to greenhouse enterprises. Opportunities are available within the program that serves the Agribusiness Cluster which includes the broad range of activities relating to New York's food processing industry. Activities within the cluster include commercial farming, agricultural products, warehousing and storage, farm machinery and equipment, intermediary buying and selling and food and beverage processing.

The food processing industry in New York is highly competitive and fragmented with many small firms. The demand for food products is stable while consumer spending on food as a percentage of personal income continues to decline. Thus, the food processing industry must compete for consumers' disposable income based on price and/or perception. Changing demographics continually reshapes markets. To meet current challenges, the food process industry is restructuring itself to streamline manufacturing base and to lower costs.

Empire State Development can assist:

- Manufacturers
- Service providers
- Warehouse and distributors
- Research and development companies
- Tourism and destination businesses
- Minority and women-owned businesses

ESD can provide financial assistance to support:

- Acquisition of land and buildings or machinery and equipment
- Construction or renovation of buildings to house business operations, including lease-hold improvements
- Construction or improvement of infrastructure required for expansion
- Working capital in some cases
- Employee training
- Expanding a company's export opportunities
- Productivity enhancement

Empire State Development offers **financial assistance** through a variety of programs:

- JOBS Now and Economic Development Fund for large capital investment and job creation projects
- Environmental Investment Program provides funds for investment in projects that result in pollution reduction and prevention, and the reuse and recycling of waste materials
- Job Development Authority (JDA) loans for fixed assets
- Industrial Effectiveness Program provides grants for developing and implementing management and production processes to improve efficiency and competitiveness
- Linked Deposit Program provides reduced-rate loans to businesses
- Manufacturing Assistance Program assists manufacturers to invest in projects that will significantly increase the productivity and competitiveness of their operations

The New York  **Small Business program** provides:

- A one-stop shop for small business entrepreneurs
- Latest information for starting and growing a small business
- Links to all New York State small business programs and services
- Business planning, financing, permits and licenses, taxes and insurance information
- Help in solving problems with government
- Help to identify financing resources
- Information for small businesses about state regulations
- Assistance to businesses with state bidding opportunities

The Small Business Ombudsman at ESD:

- Provides general business assistance
- Helps businesses cut bureaucratic red tape
- Provides problem solving assistance on a variety of issues

Contact ESD Small Business:

**30 S. Pearl Street
Albany, NY 12245
518-292-5220**

Speaking for the New York State Department of Agriculture and Markets, Bill Kimball, Director of the Division of Agricultural Protection and Development Services, provided an overview of services and assistance available from the department. He provided a summary of opportunities within the Food and Agricultural Industry Development (FAID) Grants program.

Eligible grant applicants include:

- Public and private agencies and organizations
- Business and industry
- Educational institutions
- Local governments
- Individuals

The purpose of the FAID program is to further the development of the food and agricultural industry in New York State. For the purpose of the program, food and agriculture industry projects shall include those involving farm woodland or fresh water aquatic products produced in either man-made bodies or controlled structures.

FAID project eligibility includes:

- New product development
- Alternative production, processing, distribution and marketing methods or technologies
- Organizational methods

FAID Eligible costs must be directly related to the project, including:

- Salaries and wages
- Fringe benefits
- Contractual services (professional, technical, operational)
- Travel
- Advertising and promotion
- Supplies and materials
- Communication
- Leased or rented equipment or structures needed for project

FAID Ineligible costs include:

- Depreciable equipment or structures either intact or as component materials
- Land acquisition
- Cost of preparing proposals
- Costs incurred prior to the date of the announcement of awards

FAID Funding level information:

- Maximum of \$60,000
- 50% match required
- Match may be in-kind services or cash
- Cost of equipment needed for project may be used as match

FAID Funding Criteria:

- Project identifies or addresses significant industry need
- Project is responsive to purpose of RFP
- Project key personnel are qualified

Funding Criteria, Cont.

- Project cost is reasonable
- Project is an innovative approach to research, development, production, processing and distribution of New York State products
- Degree to which project is low risk

FAID General Information:

- RFP released May, 2007
- Proposals due July, 2007
- In 2006, 80 applications were received totaling requests for \$3,771,237
- In 2006, 17 proposals were funded for a total of \$635,193

FAID Examples of funded projects:

- Big Tree Maple (Chautauqua County) \$5,540 to evaluate the feasibility of packing and marketing New York maple syrup and maple cream in single serving plastic containers
- SUNY-ESF (Onondaga County) \$60,000 to develop sustainable willow biomass as a feedstock for bio-refineries
- Hunter & Hilsburg Corporation (Onondaga County) \$60,000 to develop a market in the European that are perceived as uniquely American

FAID Contact Information:

Stephen McGrattan
 Agriculture Development Specialist
 NYS Department of Agriculture and Markets
 10B Airline Drive
 Albany, NY 12235

Phone: 518-457-7076

FAX: 518-457-2716

Email: steve.mcgrattan@agmkt.state.ny.us

Web site: www.agmkt.state.ny.us

The final speaker for this session was **Ed Staehr, Communications Director for New York FarmNet/NY FarmLink**. Ed spoke about services available from this Cornell-based service organization. Farm operations that request planning assistance fall into three categories:

1. Farm businesses considering a change (30%)
2. Farm businesses that have made changes (35%)
3. Entrepreneurs/Urban farmers embarking on a new farm business venture (35%)

New York FarmNet and NY FarmLink staff and consultants work with farms undergoing major changes. Work is performed individually with farmers and the majority of farms worked with develop a plan for the future. Business planning is identified by farm operators as a major need.

The FarmNet/FarmLink approach includes:

- Listening with enthusiasm
- Asking pointed questions
- Doing the legwork (bringing in the attorney, banker, accountant, etc)
- Assisting in the development of the business plan

The Business Planning program was expanded with a grant from the NY Farm Viability Institute in a two year funding cycle. So far, the Business Planning program has received 165 requests for planning assistance. There are 64 business plans in stages of completion. Over 1000 copies of the Business Planning Workbook (developed by FarmNet/FarmLink staff) have been distributed. Business plans being developed represent a \$12 million investment in the NYS agricultural economy by farms.

There are **numerous uses for business plans:**

- Provide a road map to the future
- Identify business objectives
- Measure progress
- Market projects to lenders
- Serve as a means to obtain grant funding

Business plans can also help a farm operator obtain grants for business development and expansion. Grants augment other funding sources, build on the foundation of a feasible business, and are achievable with a sound business plan.

FarmNet/FarmLink program services include:

- Assisting in business planning
- Serving as a resource for meetings
- Evaluating project feasibility
- Facilitating family business meetings
- Assisting farm business transfer
- Improving communication
- Resolving conflict

Contacting NY FarmNet/NY FarmLink:

NY FarmNet/NY FarmLink
413 Warren Hall
Cornell University
Ithaca, NY 14853
Phone: 800-547-FARM (3276)
FAX: 607-254-7435
Web: www.nyfarmnet.org or www.nyfarmlink.org

CEA Industry Expansion/Changing Market Demand

In this session, two speakers addressed issues related to CEA Industry Expansion and changing market demands.

John Nettleton, Senior Extension Associate, Cornell Cooperative Extension, New York City, spoke about a web-based resource network available to develop the value-added food supply chain. The resource is called **MarketMaker**.

Mr. Nettleton noted that six states, including New York have completed the MarketMaker program. The other active states are: Kentucky, Illinois, Iowa, Missouri and Nebraska. In addition, Indiana, Michigan, New Jersey and Texas are formal state partners in the program. Prospective state partners include Colorado, Georgia, Massachusetts, Ohio, North and South Carolina, Pennsylvania, Tennessee, and Vermont. He stated that our food system in the US is marvelous and deploys massive amounts of food quickly and cheaply. The supply chain efficiently connects disaggregated enterprises, suppliers, distributors and sellers. However, there are challenges.

The challenges for Value Added Agriculture include:

- Determining food prices before value is added
- Food products move anonymously
- Distribution can ignore regional and local systems and foodsheds
- Niche markets lack distribution economies of scale. Market intelligence is costly

The MarketMaker resource program provides features that help deal with the challenges:

- Maps markets by demographics
- Provides census profiles of the targeted markets
- Maps and profiles farmers, food related retail and processing businesses (45K in Illinois alone)
- Allows users to query all data: web inquiries 84,000 in January, 133,000 in February

Who can use MarketMaker?

- Anyone with internet access
- MarketMaker is a free tool for those who:
 - Grow food
 - Process food
 - Sell food
 - Eat food

Mr. Nettleton then demonstrated how the MarketMaker site works. For example, the program can identify potential markets by income levels. It can locate food processors

within specific region, a state or multiple states. It can also identify commodity producers. Once a list of processors or producers is found, the system can be used to gather specific information about an individual business on the list. The system is easy to navigate and should be very useful to anyone contemplating a new, expanding or changing enterprise.

Why develop a network of state partners?

- Markets aren't defined by state (or national) bounds
- Producer database presence is driven by farmer involvement
- States are key to creating and maintaining buyer and seller awareness
- Local outreach is key to an effective, vibrant MarketMaker network

Mr. Nettleton explained that the New York MarketMaker is still under construction. Several marketing groups are listed to date including:

- Pride of New York
- New York Wine and Grape Foundation
- NOFA-NY
- Catskill Pure
- Finger Lakes Culinary Bounty
- NY Farmers' Markets
- Cooperative Extension, South Central New York
- NY Vegetable Growers

An important point to be made is that New York's producer database is equal to the total producer database of the four states now online.

Rhett Smith, Manager of Birdseye Fresh, Birdseye Foods, closed out the session with a "Birds Eye View of CEA". His remarks were given in the context of the Birdseye Foods view of the produce industry today. He began by providing a graphic summary of per capita fruit and vegetable consumption in America over the past 10 years. Extensive data shows that Americans are consuming more vegetables (in spite of a small decrease in consumption in 2005) and consumption of the most popular vegetables including tomatoes and lettuce is expected to increase through 2020. He also noted that 80% of vegetables are consumed in the home, and that age, level of education and income levels impact vegetable consumption. His data suggests that females over 65 years old with college educations and household incomes over \$50,000 are prime targets for vegetable retailers. Lettuce, tomatoes and peppers are high on the list of most consumed vegetables.

Mr. Smith then focused on the consumer trend toward favoring "local" foods. He explained that the definition of "local" varies among consumers. Local may suggest "natural" to some, "farm fresh" to some, or "green" or "organic" to others. He also discussed the emphasis on sustainable agriculture in the context that sustainable signifies

a profitable, socially conscious, environmentally friendly, safe and secure food production system. These are generally accepted attributes of CEA production systems.

Mr. Smith then discussed his view that CEA may not meet all of the goals of sustainable agriculture. He cited information from Arizona State University that suggests that to grow 1 kilogram of tomatoes in a greenhouse in Cleveland, Ohio requires energy equivalent to 1.142 gallons of diesel fuel at a current cost of \$3.39/kg. In comparison, the cited data suggests that to grow 1 kilogram of field grown tomatoes and ship 3100 miles to Cleveland requires the equivalent of 0.1676 gallons of diesel fuel at a total cost of \$0.48/kg. Thus, using those figures, it appears that CEA cannot be competitive.

Mr. Smith summarized his remarks by posing questions. Are we developing CEA just because we can? Who is the consumer? What does the consumer want? Is the CEA industry ahead of technology and costs? Is the term CEA meaningful or “sexy” to the consumer? He suggests that the opportunity for CEA may be in value adding such as producing bagged cut lettuce or herbs, but there is limited opportunity. Another consideration would be to form alliances or coops to help control costs, provide marketing, etc. CEA production facilities might also become an integral part of a restaurant chain.

Breakout Session Summaries and CEA Roadmap Discussion

Following the breakout sessions, conference speakers and participants reconvened to hear summary discussions of the breakout topics. Following a summary of the session on **Greenhouse Design and Construction**, a participant responded with a comment that there needs to be a thorough checklist for assessing a location for a new greenhouse/CEA facility. Issues to consider include availability of energy (three-phase electricity, natural gas, alternative energy sources, etc.), access to transportation, suitable soil structure for construction, slope of site (should be level), wind exposure, etc. A question was asked about suitability of brownfields as potential sites for CEA facilities. Bill Reinhardt, NYSERDA, commented that brownfields are being considered as potential sites and that a CEA greenhouse might meet capping requirements in brownfield remediation efforts. Bill also noted that tax credits are available to businesses such as CEA for site improvements and equipment if the business is located at a brownfield site.

In summary discussions of the **CEA Business Development and Planning** session, several key points were made:

- There needs to be a clearinghouse to gather and disseminate focused information about the CEA industry
- CEA stakeholders are a small part of New York agriculture and, thus, do not speak with a strong voice to legislators (etc.). It was noted that there were no legislators or their representatives at the conference
- Markets need to be tracked through available agricultural statistics resources
- Need to compile true operating cost data for CEA facilities in New York

- A Mentoring system needs to be established to help new CEA business startups.

A comment was made that energy use and cost are key issues when evaluating the potential of CEA. We are concentrating on how to make energy-intensive CEA systems more energy efficient rather than looking at low-tech, low-energy systems (such as high tunnel systems) as an alternative. We also need to clearly define what we mean by CEA. Does CEA reference just high tech year around greenhouse growing systems, or can it refer to any technology that extends the growing season and increases productivity. As we move forward, developing a clear and conclusive definition of CEA is very important.

In summarizing the session **CEA Industry Expansion/Changing Market Demand**, the key issues include addressing the consumer understanding of the term “local” produce and maintaining sustainability in a CEA industry in New York. Is CEA a commodity business or a specialty business? If viewed as a commodity business, then it has to compete head-on with all other production and marketing systems that produce and sell the same crop. If viewed as a specialty business, CEA crop marketers have to appeal to consumer desires for crops that meet specific concerns such as price/value, safety, environmental compatibility, etc. Some existing producers are concerned that programs such as MarketMaker will increase competition by allowing the consumer, produce buyer, etc. to identify more producers. There is also concern that some marketers will buy cheaper produce from other states or countries and sell them as local. The proposed **Origins Laws** may protect local growers from such unscrupulous competition.

A comment was made that the knowledge that consumers have about CEA, local production, safe foods, etc., must be considered. Consumers don’t always understand where their produce comes from, how it is produced, and what issues should they be concerned about. To be successful, the CEA industry needs to determine what the consumers need to know and provide them with sound information on which to base their purchase decisions.

Developing a Roadmap for CEA

The final discussion of the conference was an exercise to identify the most significant barriers and challenges to the CEA industry in New York and to suggest how to address those issues.

The conference concluded with strong encouragement to participants to continue sharing thoughts and information about growing a CEA industry in New York State. The conference materials will be used to develop a Roadmap that identifies the steps that must be taken to facilitate the CEA industry expansion.