Sustainable Controlled Environment Agriculture: An Agricultural Model for a Changing World

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Annual Greenhouse Gas Emissions by Sector

- Industrial processes: 16.8%
- Power stations: 21.3%
- Transportation fuels: 14.0%
- Waste disposal and treatment: 3.4%
- Agricultural byproducts: 12.5%
- Land use and biomass burning: 10.0%
- Fossil fuel retrieval, processing, and distribution: 11.3%
- Residential, commercial, and other sources: 10.3%

**Carbon Dioxide**
- (72% of total)
- 20.6%
- 29.5%
- 19.2%
- 12.9%

**Methane**
- (18% of total)
- 40.0%
- 29.6%
- 18.1%
- 6.6%

**Nitrous Oxide**
- (9% of total)
- 62.0%
- 1.1%
- 1.5%
- 2.3%
- 5.9%
Greenhouse gas emissions from agriculture and land use

- Land use or soil management
- Methane from livestock (enteric fermentation)
- Wetland rice, manure management
- Deforestation (clearing of land and burning)
- Other

SOURCE: Baumert, 2005
HUMAN POPULATION GROWTH CHART
(including projections)

I THINK I CAN...
I THINK I CAN...
I HOPE I CAN...
I REALLY HOPE I CAN...
MAN, I HOPE I CAN...

YEAR
1 AD 200 400 600 800 1000 1200 1400 1600 1800 2000

BILLIONS
0 2.5 5 7.5 10 12.5
<table>
<thead>
<tr>
<th>Produce</th>
<th># States supplying this item</th>
<th>% Total from Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grapes</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Broccoli</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Asparagus</td>
<td>5</td>
<td>37</td>
</tr>
<tr>
<td>Apples</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Sweet Corn</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Squash</td>
<td>12</td>
<td>43</td>
</tr>
<tr>
<td>Pumpkins</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

* Information for this chart is based on the weighted average source distance, a single distance figure that combines information on distances from production source to consumption or purchase endpoint. For these calculations, USDA Agricultural Marketing Service arrival data for 1998 were used to identify production origin (state or country). Distances from production origin to Chicago were estimated by using a city located in the center of each state as the production origin, and then calculating a one-way road distance to Chicago using the Internet site Mapquest (mapquest.com). Estimations do not include distance from the Chicago Terminal Market to point of retail sale.

Graphic design by Matt Miller
Source: Leopold Center for Sustainable Agriculture
Vacant rooftops
New York City

Greenhouse Cultivation
Arizona
BRINGING NEW YORKERS LOCAL, SUSTAINABLE PRODUCE GROWN IN THE HEART OF NYC
Key Environmental Features

1. **Saves land.** Vegetable yields are about 20 times the typical yields of field agriculture.

2. **Saves water.** Recirculating irrigation consumes five to ten times less water than field agriculture.

3. **Protects rivers.** Recirculating systems eliminate fertilizer runoff to surface waters.

4. **Reduces pollution.** Urban greenhouses eliminate the use of fossil fuels in tractors and trucks.

5. **Recovers rainwater.** The roof can be designed to capture rainfall, reducing storm overflow.

6. **Improves food safety.** Integrated pest management does not require chemical pesticides.

7. **Increases the use of renewable energy** in urban areas.

8. **Reduces waste.** Waste heat from buildings can heat the greenhouse.

9. **Cools buildings.** A cover of vegetation mitigates the urban heat island effect, even under glass.

10. **Combats global warming.** Up to 1.5 kg of CO₂ emissions can be mitigated for each kg of vegetables produced in a sustainable urban farm.
Energy Monitoring

• Energy Use:
  – Metered kWh
  – Metered Therms

• Energy Production
  – Solar PV Output

• Transportation and Distribution
  – Fuel Use
  – Mileage

• Embodied Energy
  – Not being calculated at this time
Products

• Leaf Crops
  – Lettuce varieties
  – Leafy Greens: swiss chard, spinach, arugula, etc

• Culinary Herbs
  – Basil, Parsely
  – Cilantro, Mint

• Vine Crops
  – Tomatoes, Cucumbers, Peppers
  – Beans and Squash
Barriers to Entry

• Specialized Technical Skills:
  – Plant Science
  – Engineering

• Regulatory Novelty
  – Zoning and Building Permits
  – Leases

• Building Constraints
  – Roof suitability

• High Costs
  – Start up capital
  – Utility Costs
I am pleased to offer my support for Gotham Greens Farms’ efforts to build New York City’s first commercial-scale hydroponic rooftop farm in Jamaica, Queens.

This outstanding project, which would generate a year-round supply of fresh, pesticide-free produce, is consistent with several key goals of PlaNYC, our long-term plan to create a greener, greater New York, including: reducing fuel use and air pollution from trucks, minimizing our City’s carbon footprint, and capturing stormwater to protect local water quality. And by relying on cost-effective and commercially proven technologies, it is also consistent with PlaNYC’s practical approach to sustainability.

With its ambition to be a stand-alone business, not dependent on subsidies or special treatment, Gotham Green embraces New York’s entrepreneurial tradition at its best—and demonstrates that going green is a smart business strategy. I look forward to the project’s implementation and success. All the best.

Sincerely,

Michael R. Bloomberg
Mayor
“Gotham Greens’ innovative approach to growing food in NYC using rooftop greenhouses and best practices for minimizing energy and water usage is something we will be following closely. This is an exciting, cutting edge venture and if successful, will result in significant environmental benefits while serving as a business model for the rest of the world.”

Ashok Gupta,
Senior Energy Economist
Program Director – Air and Energy Group
Gotham Greens Wins The First Annual NY Green Business Competition

Brooklyn, NY (May 15, 2009) – The New York Green Business Competition is proud to announce the winners of the first annual competition at an awards ceremony that took place on May 14th at the Brooklyn Borough Hall. Gotham Greens, a company creating NYC’s first commercial scale, rooftop hydroponic farm, took the grand prize while e.c.o. Incorporated and DBA took second and third places respectively.

Over 300 invite-only green business leaders, city officials, sponsors, and media watched the five competition finalists present their business plans to an esteemed panel of judges and guests. Judges decided the winning companies shortly after the presentations.

The Green Business Competition attracted over 70 New York state green start-ups to compete for prize packages worth over $30,000 in investment capital, office space at Green Spaces, and other business support.

The first place winner received a package valued at $25,000, which includes $8,000 in investment capital, one rent-free year at Green Spaces, and marketing, legal and financial services. The second place winners received $1,000 and a similar prize package valued at $5,000. The third place winner received a prize package valued at $1,000.
Gotham Greens is a New York City based company dedicated to growing the highest quality vegetables and culinary herbs. Gotham Greens’ premium quality, pesticide-free vegetables and herbs are grown in sterile rooftop greenhouses using clean, renewable energy.
LOCAL
from Greenpoint, Brooklyn
Gotham Greens
4-38 miles from here

Located on a building rooftop in Greenpoint, Gotham Greens first greenhouse facility combines advanced horticultural and engineering techniques to optimize crop production, quality and production efficiency. The climate controlled facility grows premium quality produce all year-round.
bringing New Yorkers local, sustainable produce grown in the heart of NYC

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