

Greenhouse Cogeneration for the US

heat, light and CO₂ fertilization = sustainable food production



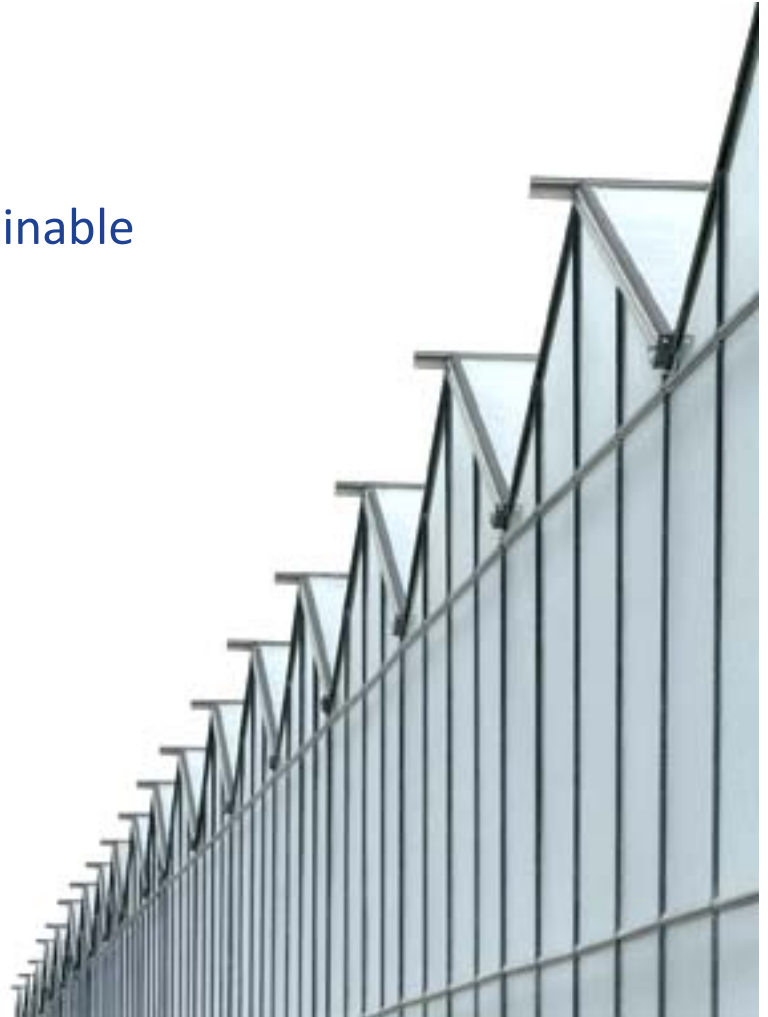
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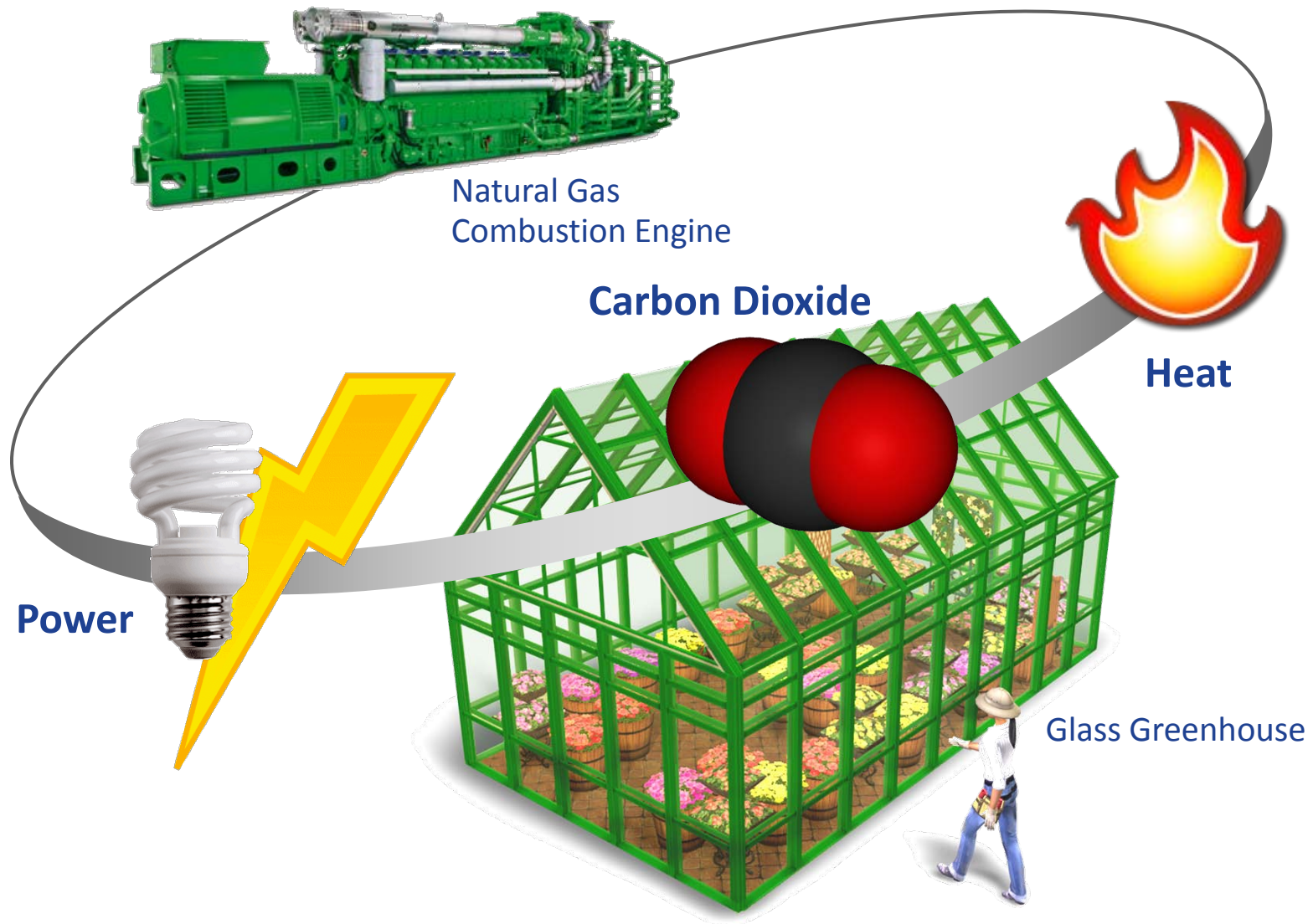
imagination at work

Greenhouse cogeneration

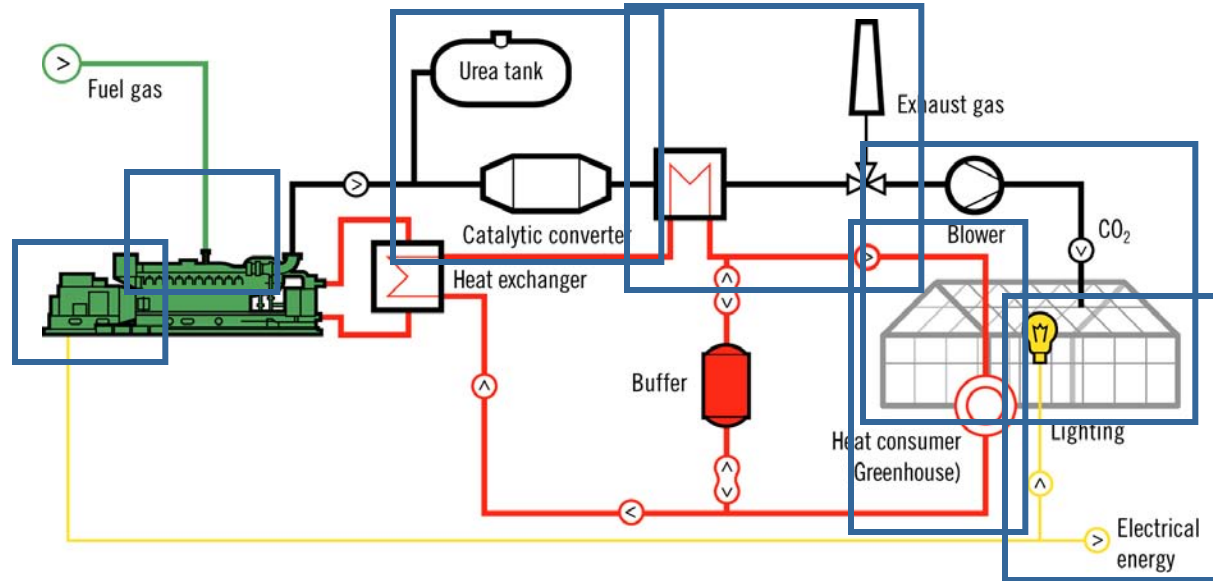
- What is it and how does it work?
- Technological advantages
- US versus the world in food supply
- Benefits of greenhouse cogeneration to sustainable food supply and much more
- The business case to move forward



What is it?

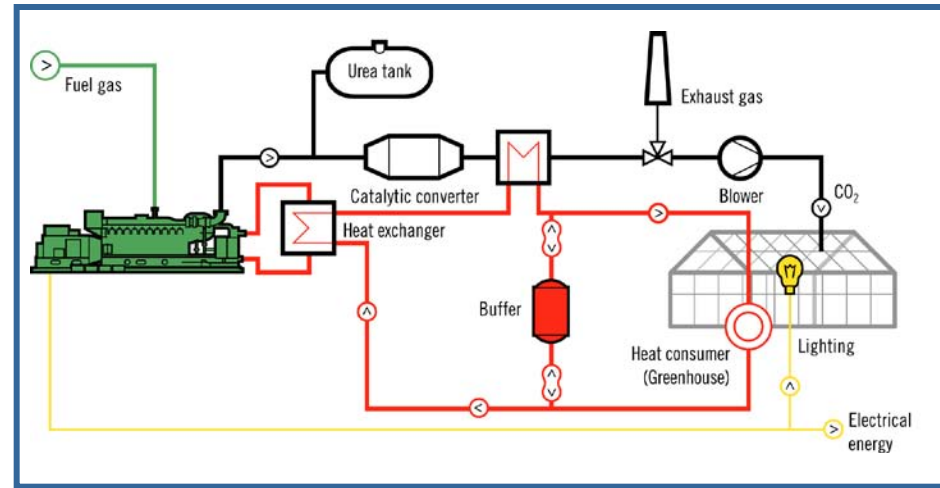


How does it work?



Remote monitoring and support

Help desk in Netherlands provides online monitoring to over 800 greenhouse cogeneration facilities around the world.

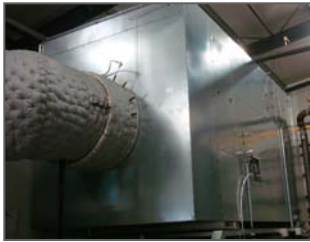


Technological advantages



Standardized design. High efficiency.

Simultaneous supply of heat, electricity and CO₂ with total efficiency of up to 96%



Ultra-low emissions.

NO_x, CO, C₂H₄ removed for CO₂ supply to greenhouse



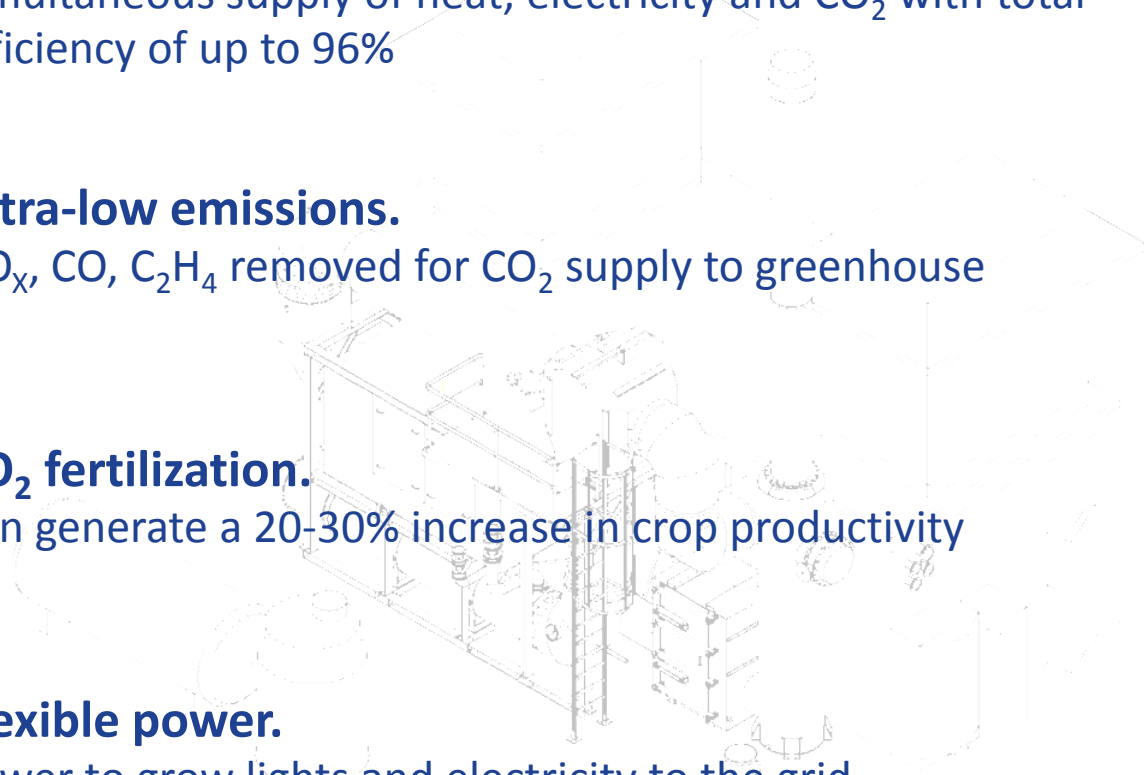
CO₂ fertilization.

Can generate a 20-30% increase in crop productivity



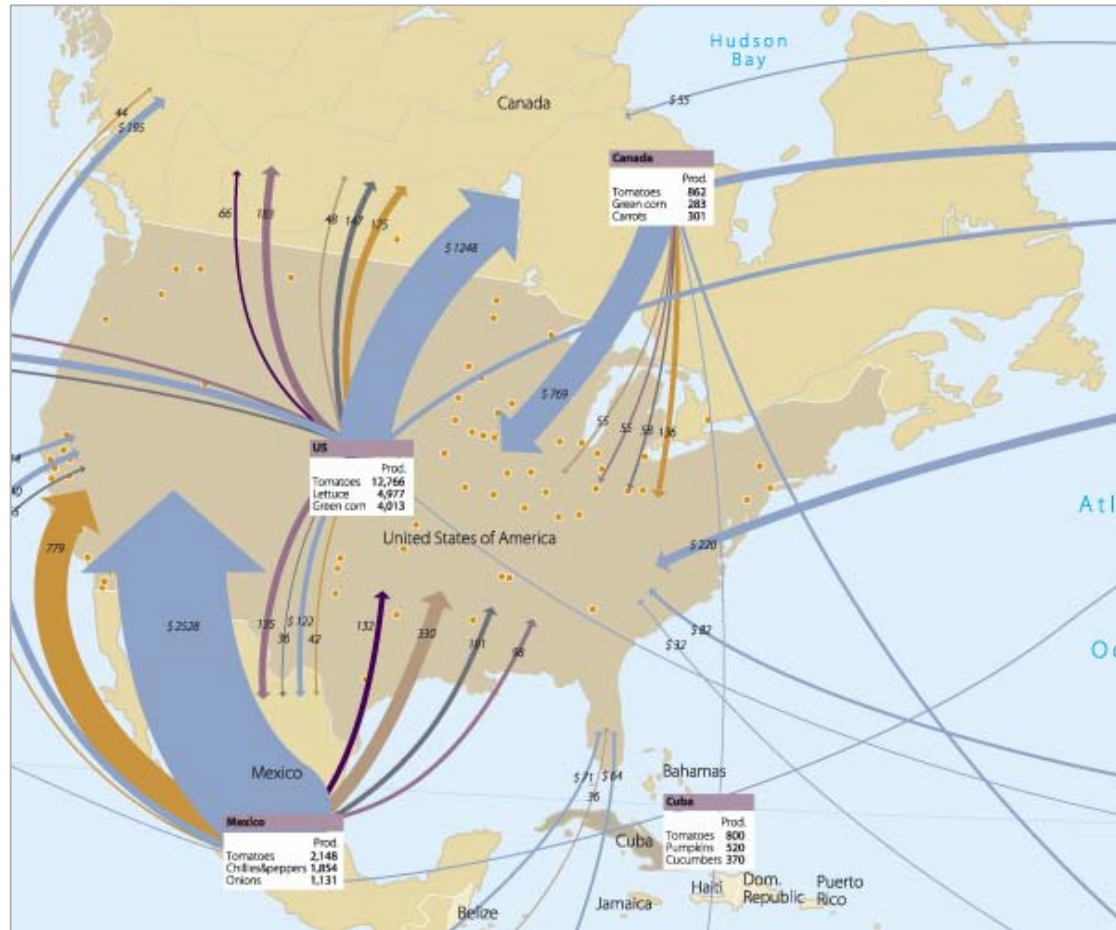
Flexible power.

Power to grow lights and electricity to the grid

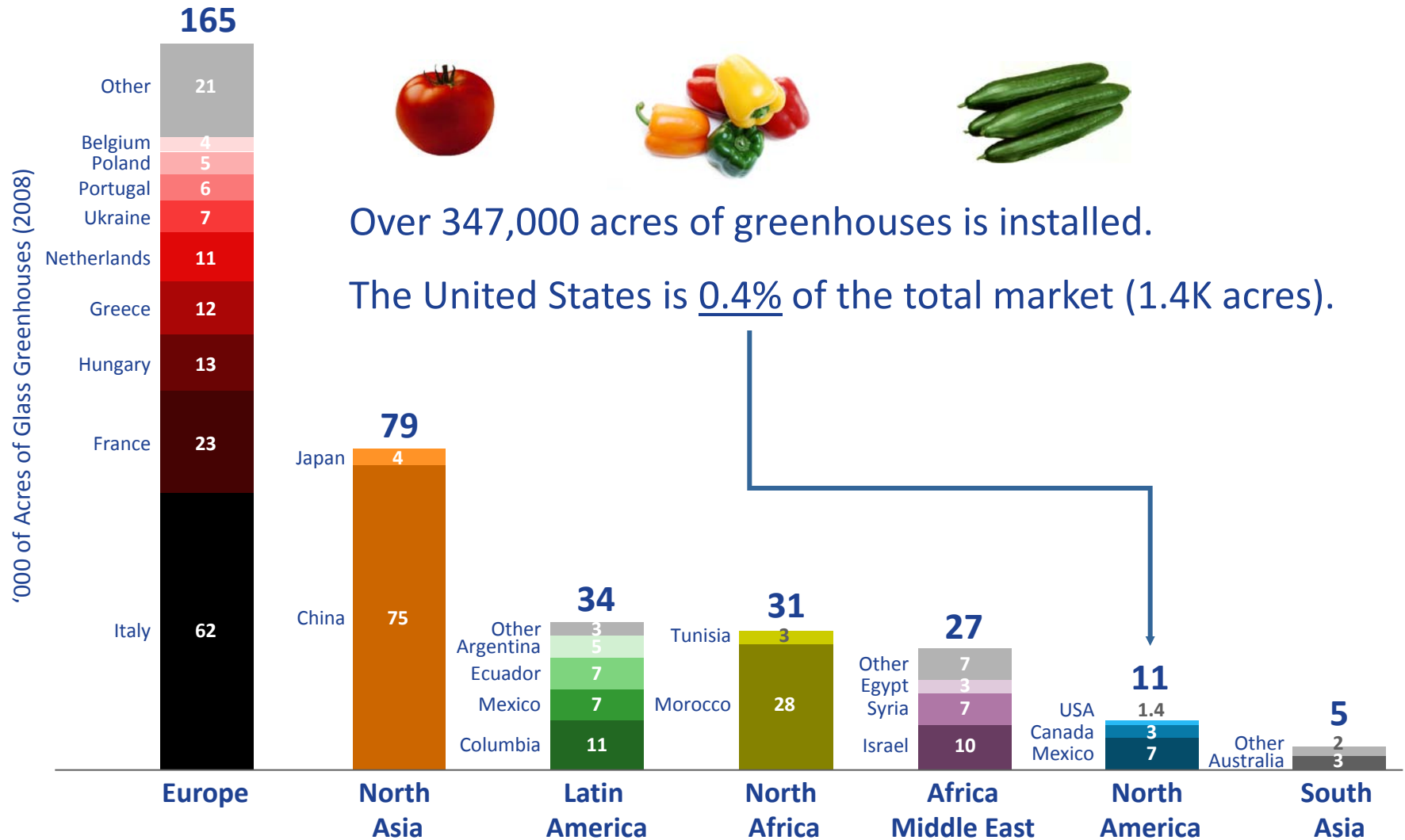


The US is a net importer of produce

In 2009, the gap between imports and exports of produce in the United States was nearly **-\$6B**.



And the US lags behind the world in greenhouses

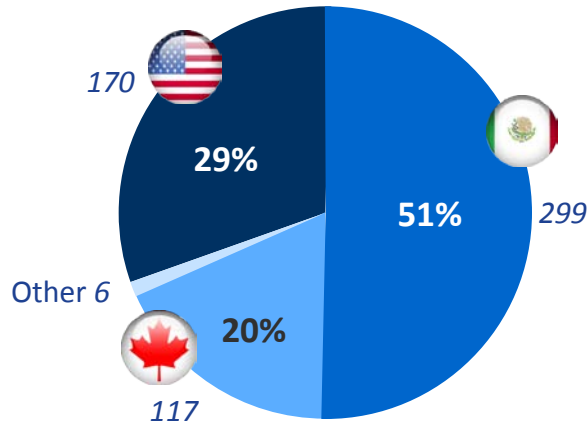


Greenhouse tomato consumption in the US

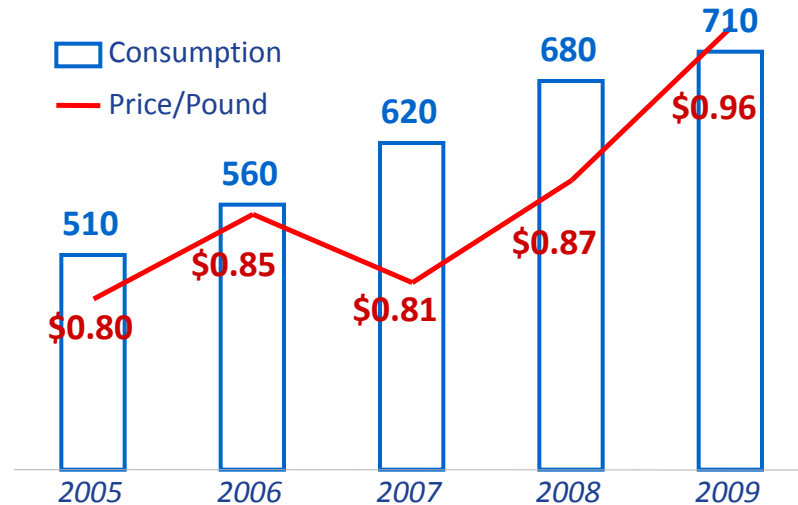


The US imports 2.5x more GH tomatoes from Mexico and Canada than it produces domestically to satisfy consumption.¹

US Greenhouse Tomato Consumption, Source of Production...Today¹
'000 Metric Tons/Year, 2007



US Greenhouse Tomato Consumption, Consumption and Price Trends¹
'000 Metric Tons/Year



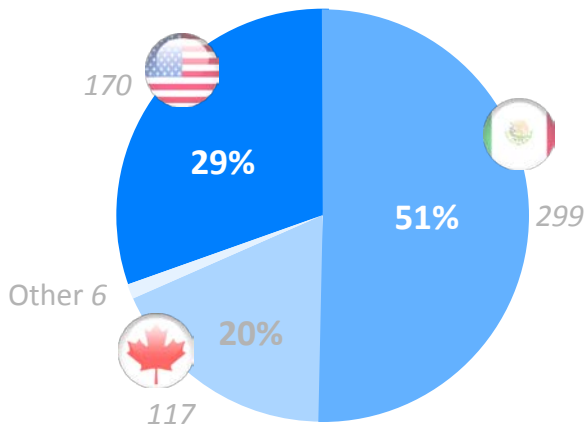
And as consumer demand increases, so does the price.

Can be turned into an opportunity

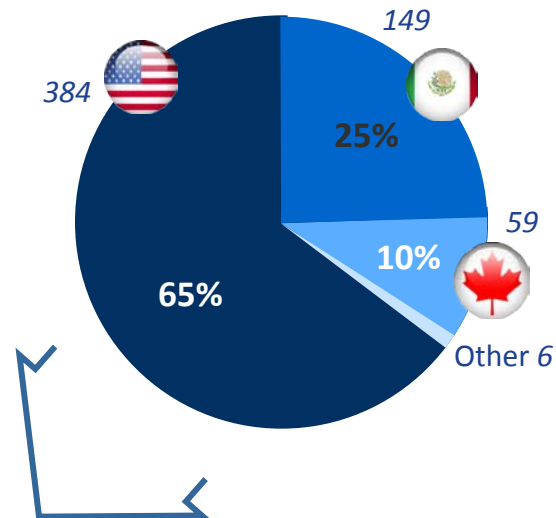


If new greenhouses were built to offset just 50% (300 ktons/yr) of imported greenhouse tomatoes, we would see...¹

US Greenhouse Tomato Consumption, Source of Production...Today¹
 '000 Metric Tons/Year, 2007



US Greenhouse Tomato Consumption, Source of Production...With 50% Conversion¹
 '000 Metric Tons/Year, 2007



Creation of over 3,200 Jobs and 218 Megawatts of clean energy²

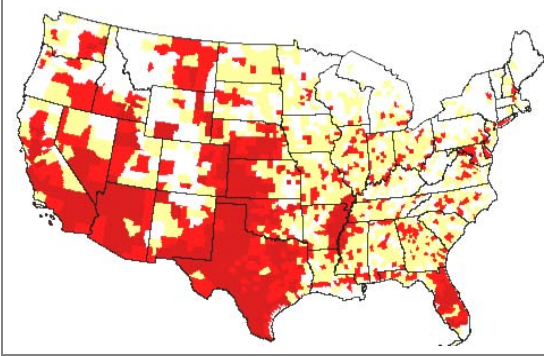
And secure employment in the existing US greenhouse industry through cost reduction and improved competitiveness.

1. Hickman, Gary. Greenhouse Vegetable Production Statistics, July 09 Survey. Cuesta Roble Greenhouse Consultants, www.cuestaroble.com.
 Table 15. Major Countries Exporting Greenhouse Tomatoes to the US, 2008 (Mexico = 299,045 Mtons, Canada = 117,000 Mtons, US Domestic Production = 170,000)

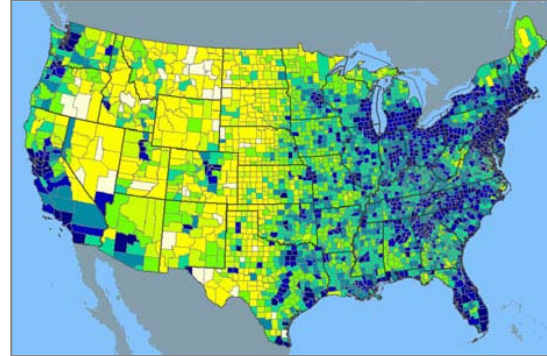
2. Table 31. Average Number of Greenhouse Vegetable Production Employees

Providing tools for sustainable food consumption

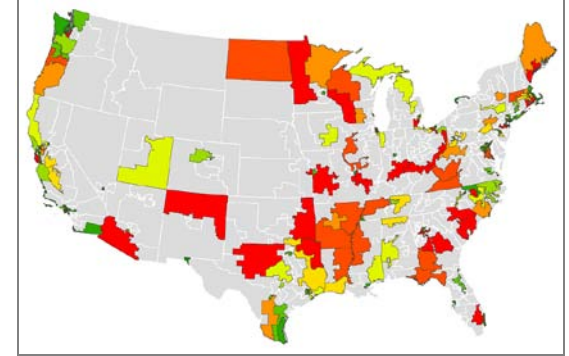
Forecasted Water Scarcity, 2050



Population Density, 2025



Carbon Dioxide Emissions, Today



Water and Land Scarcity

- Greenhouses have higher production volumes per acre of land
- Water can be precisely measured and applied to plants

Safer, Locally Grown Food

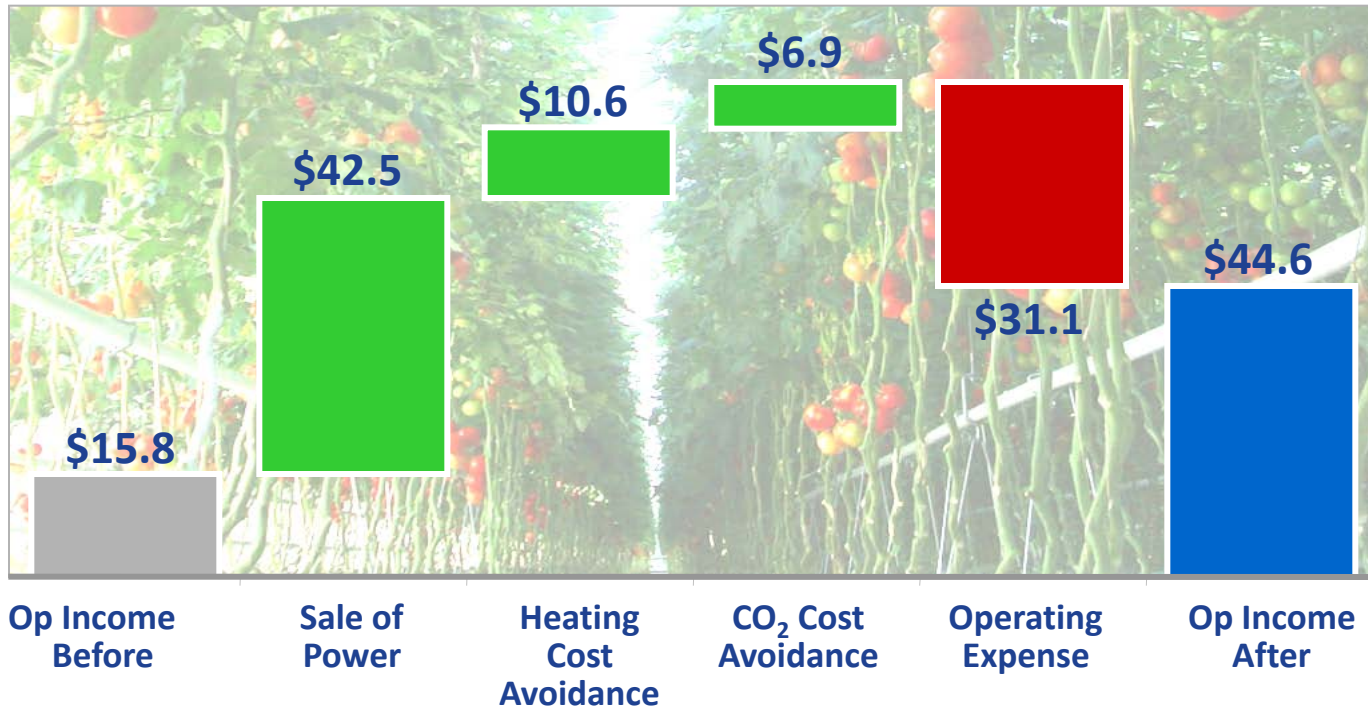
- Greenhouses can be located anywhere, esp. to serve densely populated regions
- Controlled environment reduces chance of disease

Reduced GHG's*

- Combined heat and power systems on greenhouses are over 40% more efficient
- 47% reduction in CO₂
- 99% reduction in SO₂
- 93% reduction in NO_x

With great economic benefits to growers!

Real World Case Study \$K/Acre



- Sale of excess power will increase revenues by +8%, op income by +172%
- Heat and bottled CO₂ cost avoidance reduces OPEX by -3%
- Project payback is near 4 years with pre-tax IRR of 24%

Thank you.

Royal Pride AgriPort
35 MW



Van de Lans
8 MW



Prominent Group
76 MW



Bathpolder Rilland
34 MW



Dmitrov
5 MW



Great Northern
12 MW



Questions?

