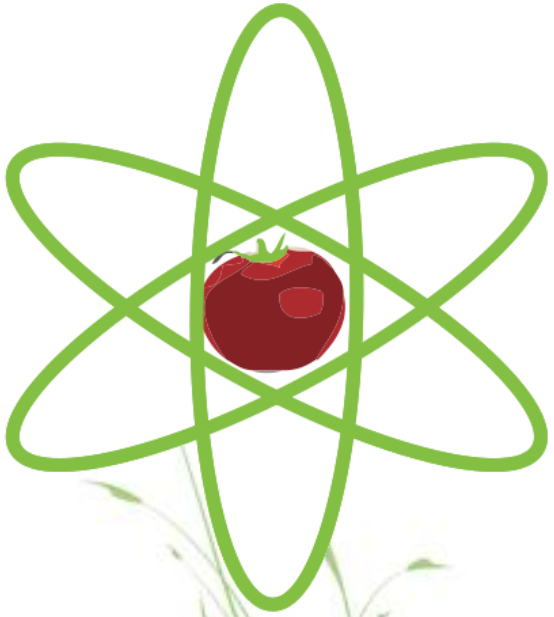
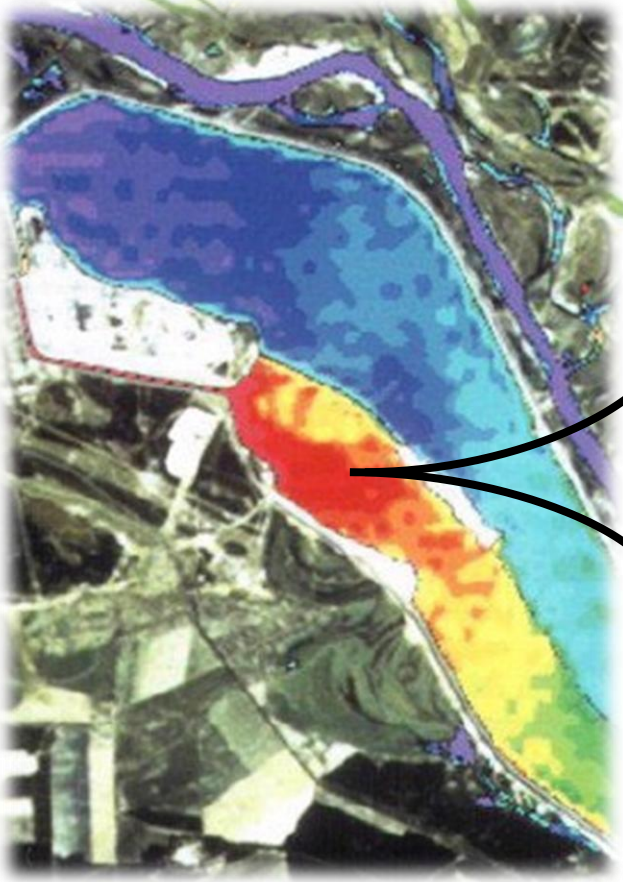
AtomIc PROduce 342



Utilizing Waste Heat for Greenhouses

Introduction

- Nuclear power plants convert about 40% of energy used into electricity
- Other 60% is released into atmosphere
- Semester project was to make use of this energy so it was not wasted



Is this safe?

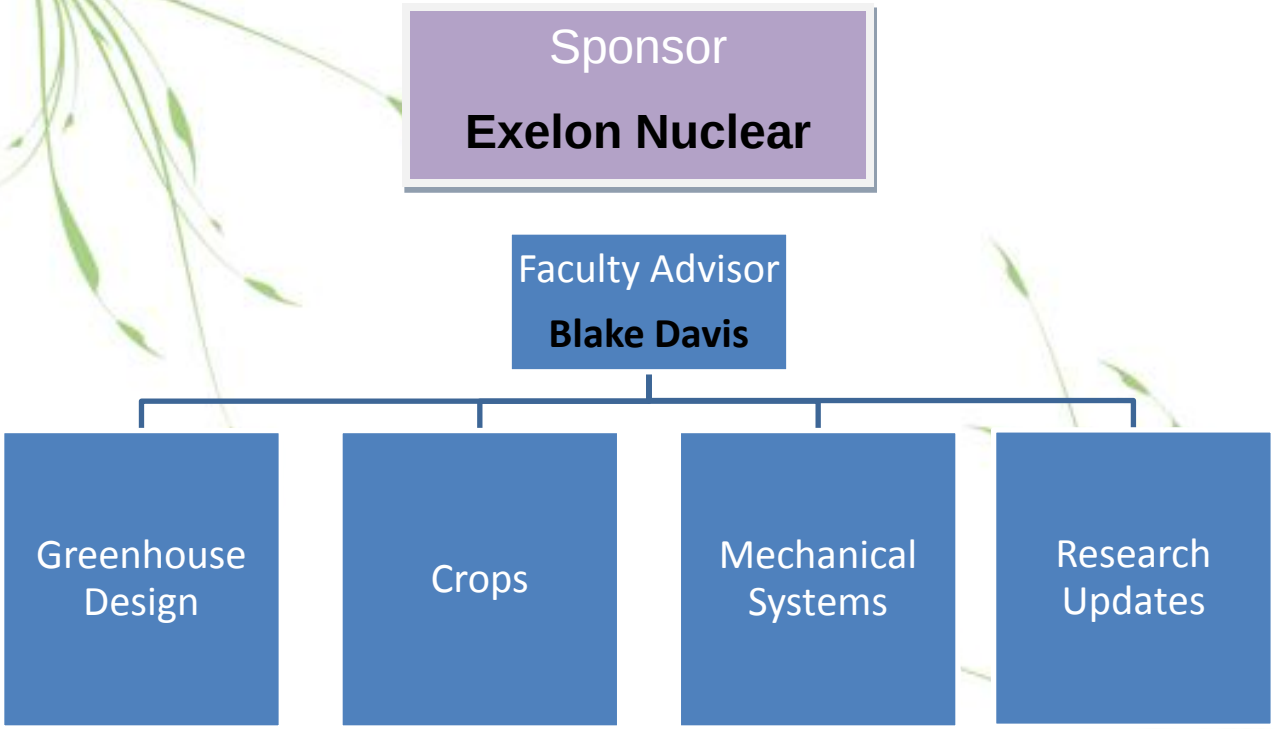
- Water carefully controlled
- Fish in cooling pond now
- No radioactivity in produce

Yes.

Background

- Exelon
- Braidwood Nuclear Generating Station
- Two 1200 MW reactors
- 1.5 million gallons per minute enters cooling pond
- Water temperature range 70-110 ˚F

Team Organization and Approach



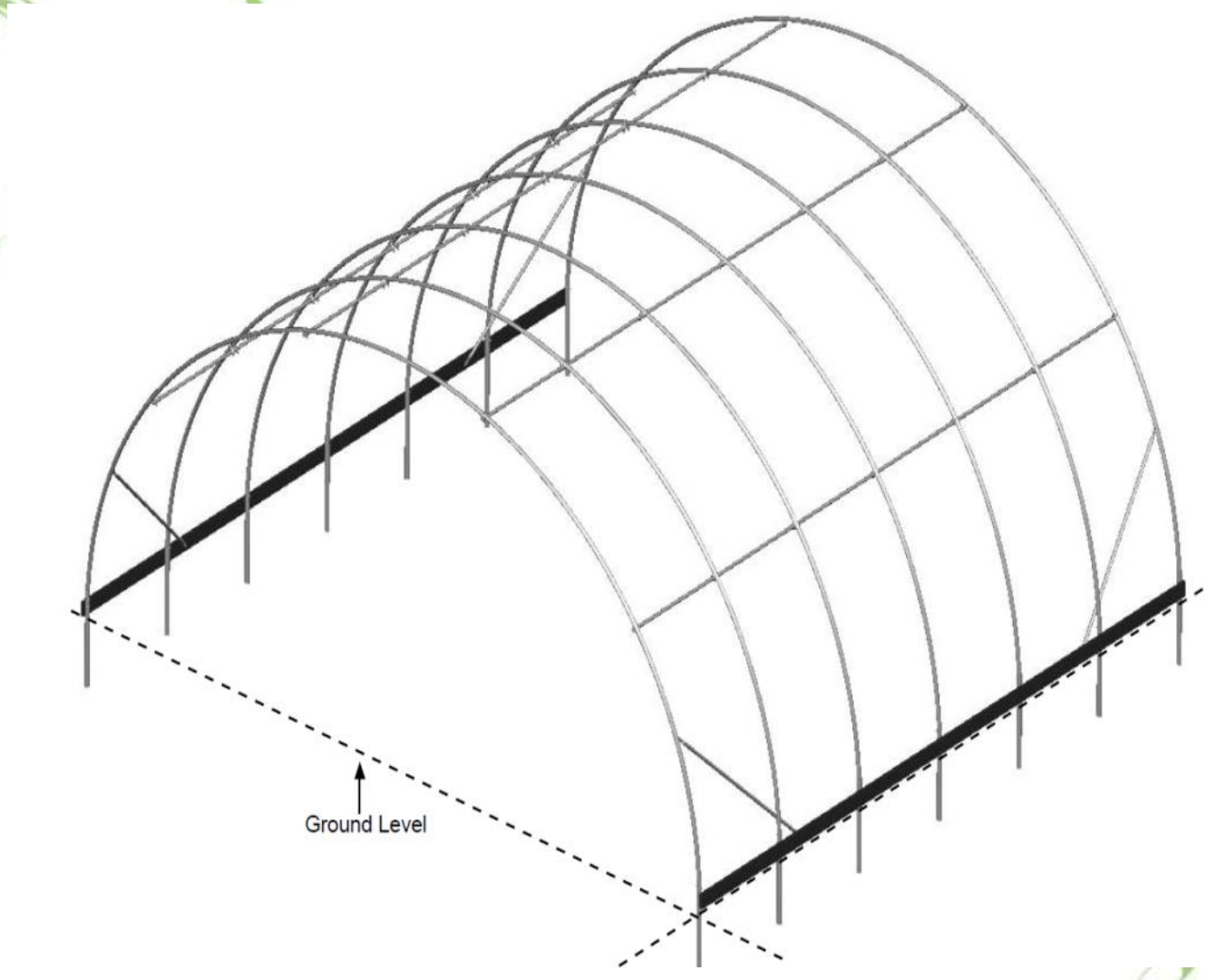
Caged Fish Farming

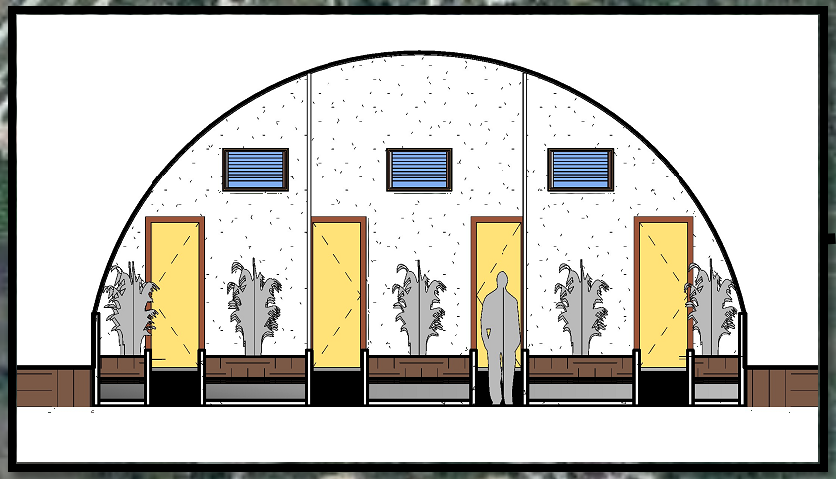
- System of cages to manage growth of fish
- Tilapia chosen because of water temperature
- Year round operation

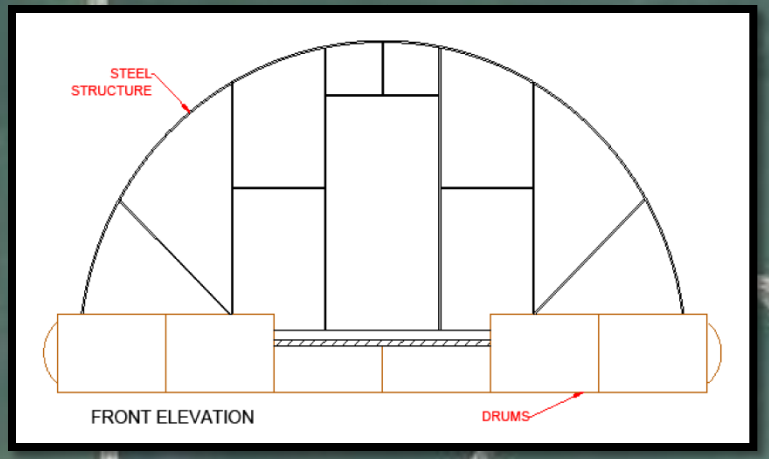
Greenhouse

- Waste heat applications in greenhouses
- Most research 30 years old
- Updated finding with current market prices:
  - Savings with current natural gas prices less
  - Savings with projected numbers much higher
- Previous projects used higher temperature water

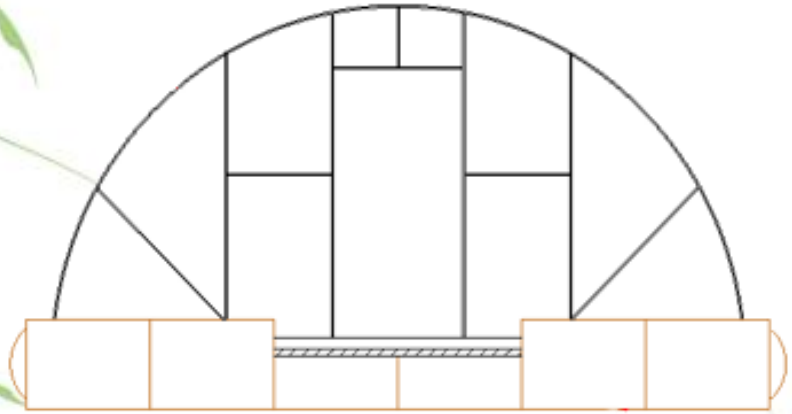
Core Design Concept



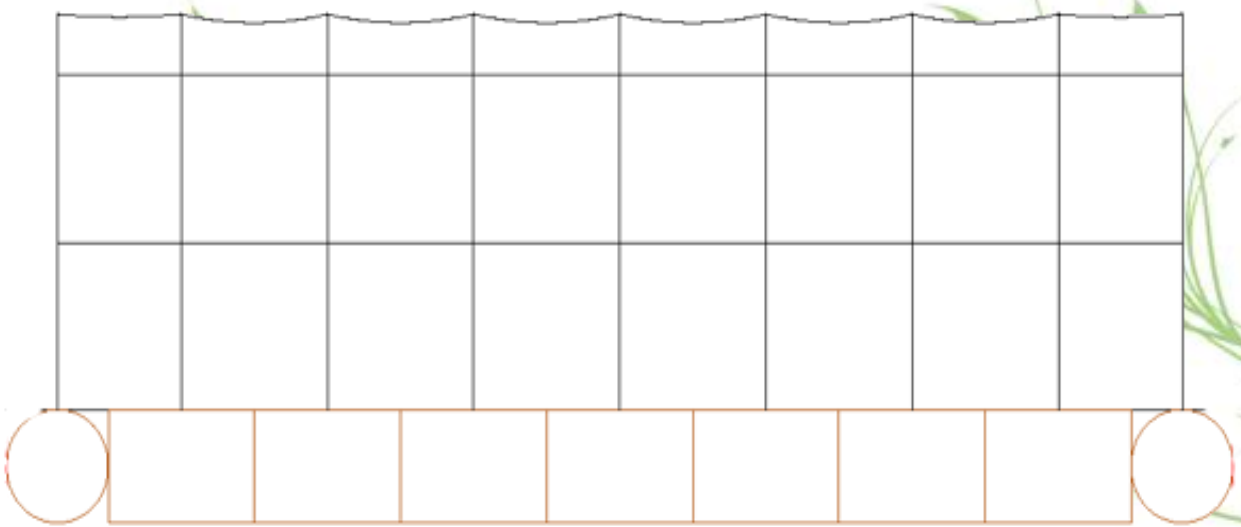



STEEL
STRUCTURE
FRONT ELEVATION
DRUMS

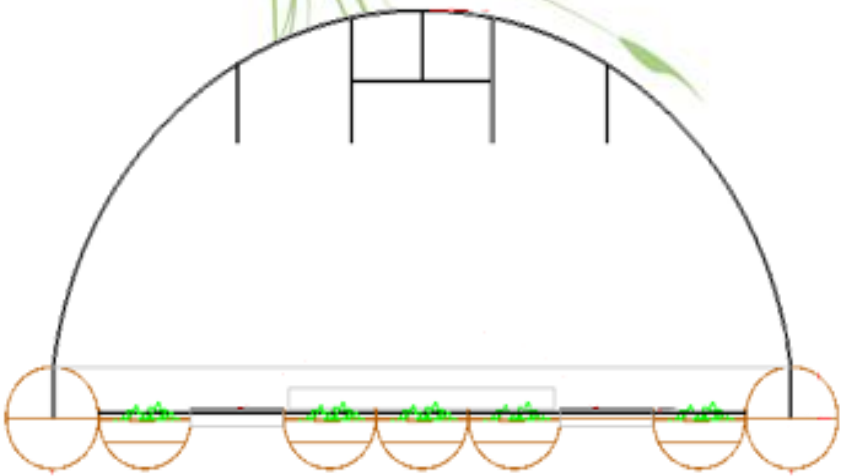
Water-Based Greenhouse



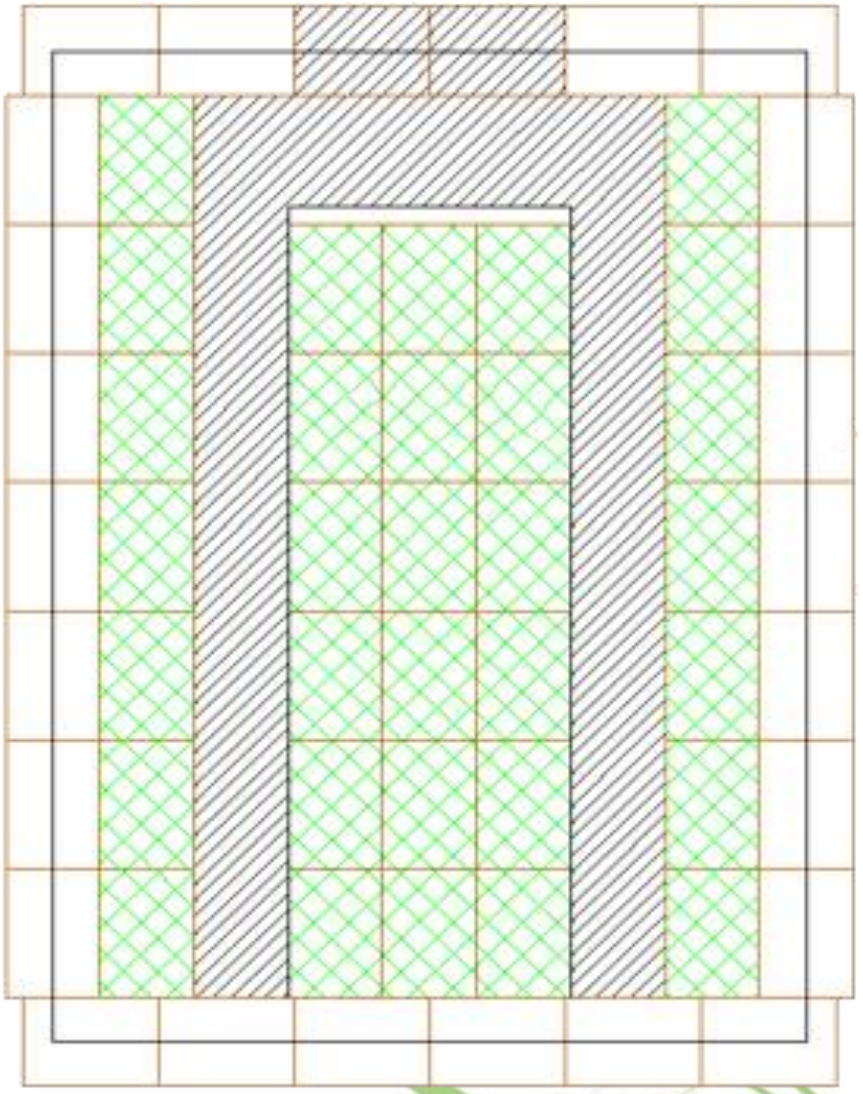
End View



Side View



End Section



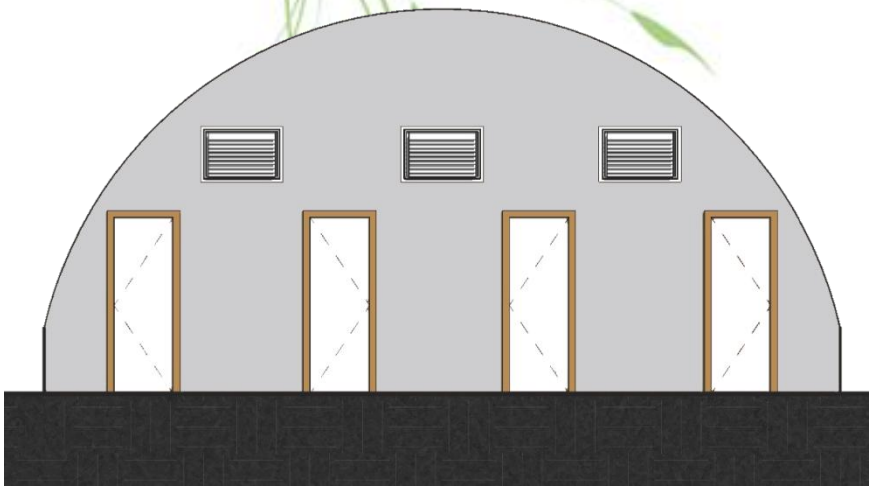
Plan View

Disadvantages/Advantages

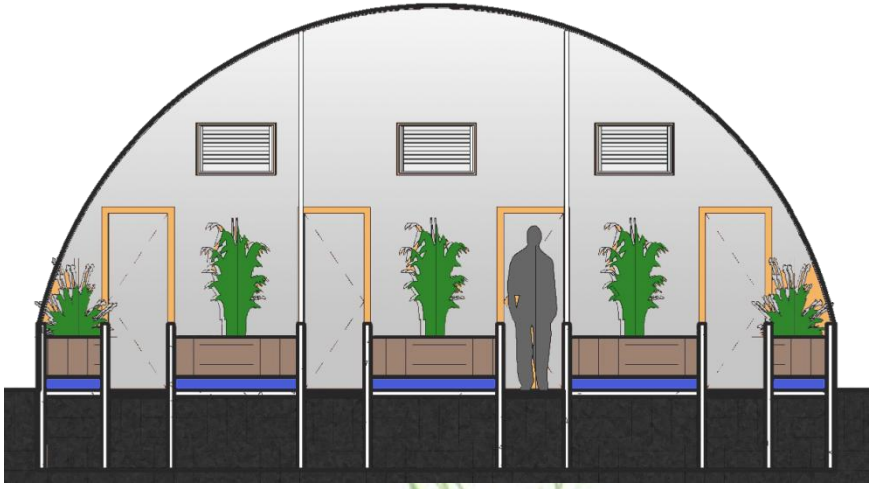
- Irrigation and electricity are issues
- Accessibility
- Temperature and humidity control

- Effective heating
- Supports fish cages

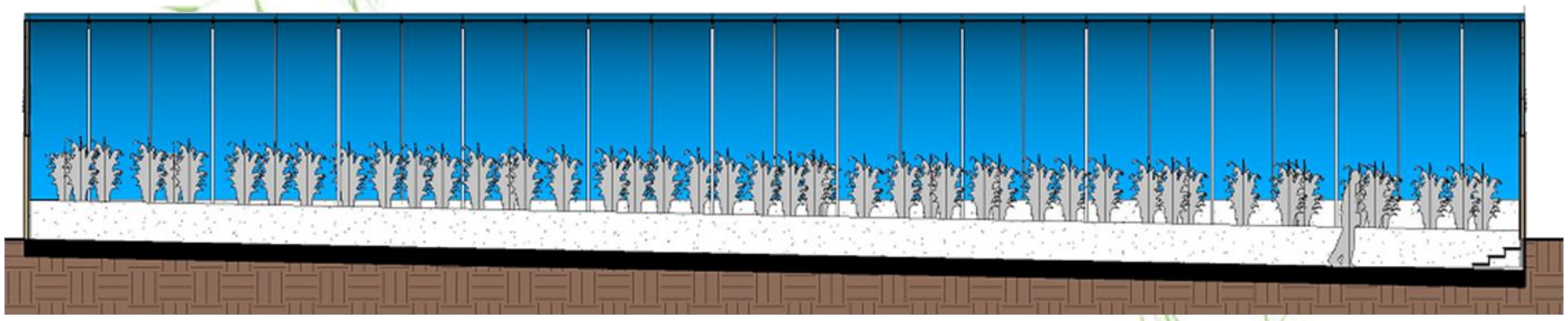
Land-Based Greenhouse



End View



End Section



Side Section

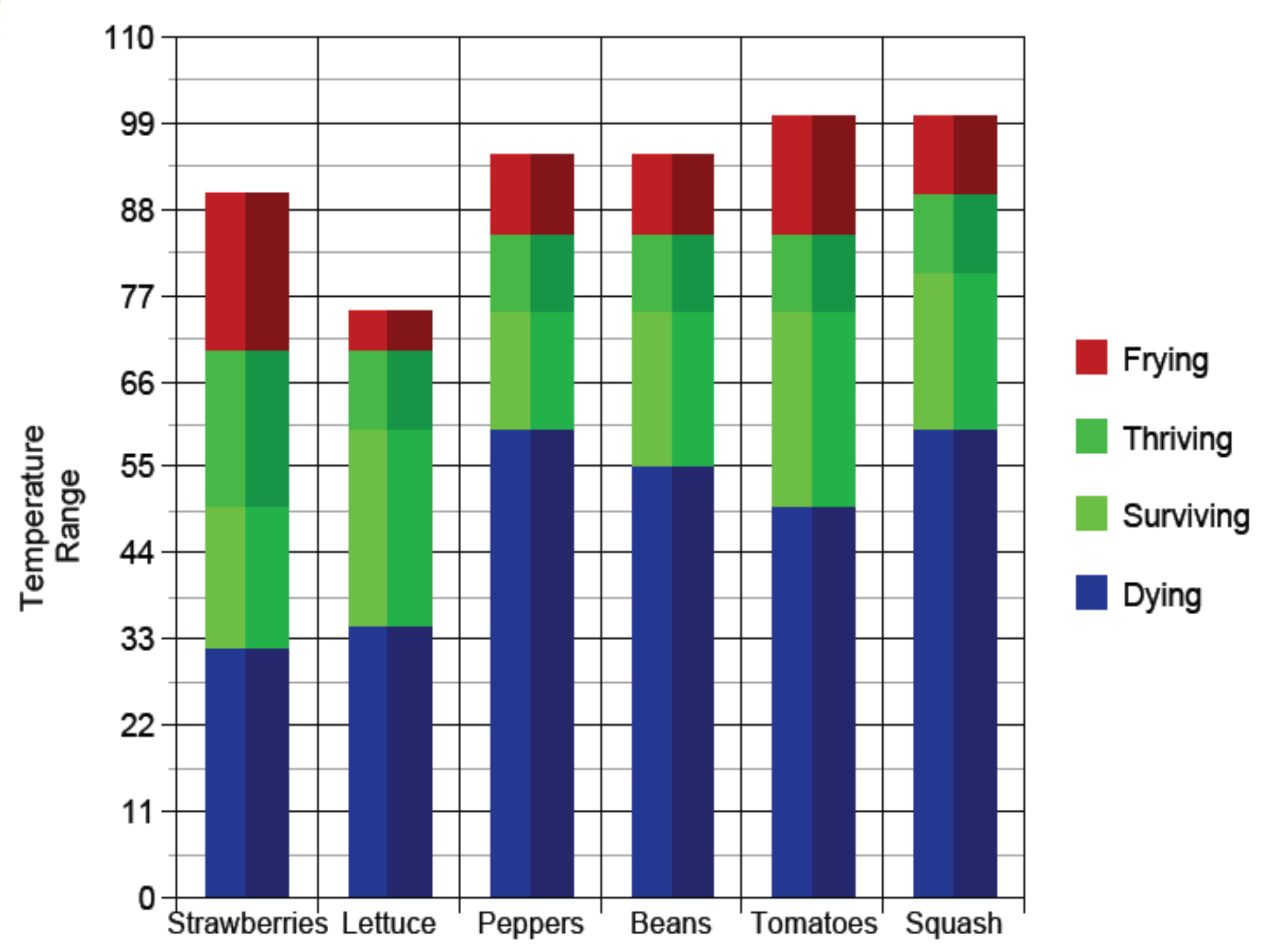
Disadvantages/Advantages

- Greenhouse temperature lower

- More conventional construction
- Easily accessible

Crops

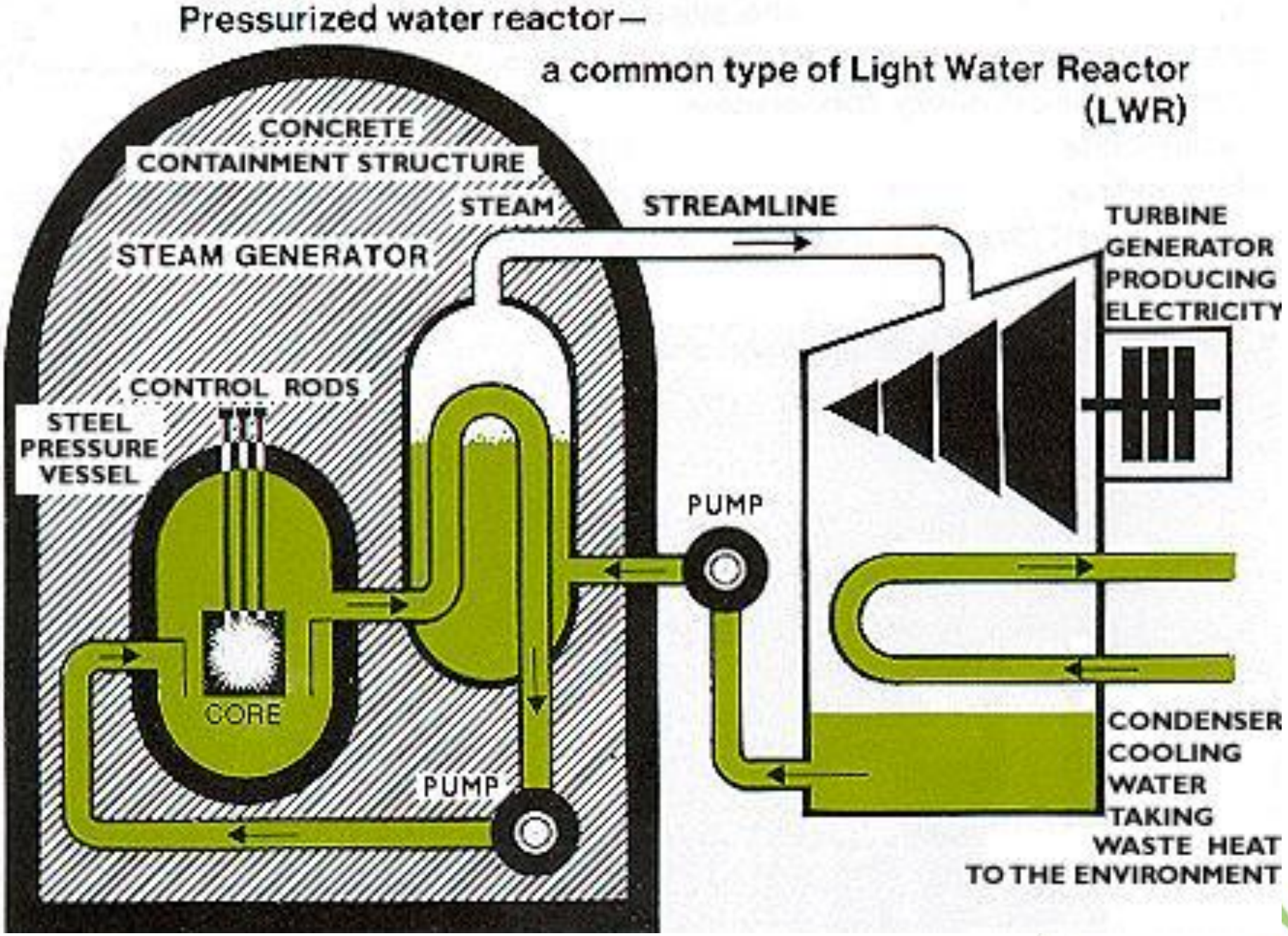
- Chose commonly grown crops
  - Consistently in demand
  - Existing seed sources and research
  - Grow well in greenhouses


Temperature Range
110
99
88
77
66
55
44
33
22
11
0
Strawberries
Lettuce
Peppers
Beans
Tomatoes
Squash
Frying
Thriving
Surviving
Dying

Conclusion

- Solutions make use of waste heat effectively
  - Technically feasible
  - Economically viable
- Suggestions for future:
  - Development of detailed business plan
  - Finalize design and build prototype
  - Present the business plan to Exelon

Many thanks to our sponsor 


Pressurized water reactor—
a common type of Light Water Reactor
(LWR)
CONCRETE
CONTAINMENT STRUCTURE
STEAM
STEAM GENERATOR
STREAMLINE
TURBINE
GENERATOR
PRODUCING
ELECTRICITY
CONTROL RODS
STEEL
PRESSURE
VESSEL
PUMP
CORE
PUMP
CONDENSER
COOLING
WATER
TAKING
WASTE HEAT
TO THE ENVIRONMENT