

Commercial Aquaponics Facilities and Location Considerations

Some of the critical decisions when starting a commercial aquaponics business are location and facility. Along with those two major components are a variety of additional factors that will contribute to the decision making process related to access to market and customers, water, energy or alternatives, transportation, employees, costs, security and many others. This list serves as a brief starting point to review the variety of considerations and possible alternatives between two types of facilities: warehouse structure or greenhouse structure.

Facilities Considerations

Building Structure – The physical construction of the building will help provide control over heating and cooling, access to natural lighting, security, shelter from severe weather, pest and disease control and other characteristics.

Heating the Air - In climates which experience cold temperatures during the spring, fall and winter months, it is necessary to maintain an air temperature at a minimum between 45-50° or more depending upon the crops being grown. Because the water is being heated in an aquaponics system, less emphasis needs to be placed on heating the air since the root system will have warm water provided at all times. In addition, the warm water will help provide heat to the plants and surrounding building. Some facilities use little if any air heat, instead they make use of the water heat, climate battery arrangement, thermal mass, poly tunnels over raft beds, compost heat, methane or other waste heat options. Heating the air in a building can be done through (in no particular order): passive solar, active solar, geothermal, natural gas, wood, coal, electricity. Water, brick, gravel, concrete, steel and other materials act as good thermal mass to store heat and slowly release overnight. Depending upon the location, outside temperatures and other factors, these may be adequate to heat the building air.

Cooling the Air – More plants are lost to overheating than freezing. Therefore, it is essential that the air temperature be maintained at appropriate levels for the types of plants being grown. As well, since hot air rises, plants that are closer to the roof of the greenhouse are going to experience higher stress conditions than plants lower to the ground. Some of the same techniques used to heat the greenhouse can be instrumental in cooling as well. For instance, the climate battery can be reversed to pump cold area from under the earth into the greenhouse which often reduces the air temperature 10-15°. Running water over evaporating cooling coils or pads, air circulation fans, building orientation and various shading techniques can help reduce overall temperatures.

Ventilation and Air Circulation – It is important that the building structure has a fresh air supply that. Plants need both oxygen and carbon dioxide to live. Vents, circulating fans, humidifiers/dehumidifiers, CO² generators, and air filtration or exchange systems should be considered for each type of building. Air handling systems can also be designed to minimize the change in temperature drawn from the outside as it is brought inside during particularly hot or cold periods of time.

Water Source – On site water may be provided by well, spring, river or municipal water source. Some things that will need to be considered for the facility is the total volume of water in the system, cost, source, contaminants, reliability, metals, chlorines/chloramines, filtration options, adjustments for pH

and nutrients. It is important to have your water source tested. A separate tank should be available for holding water prior to entering the system, this will allow the water to be filtered, dechlorinated, and temperature, pH or nutrient adjusted prior to entering the aquaponics system. Chlorinated water can cause damage to fish gills and the bacterial colony.

Heating water – Depending upon the fish species being raised, the water temperature will likely need to be heated between 68° – 80°. Heating water can be performed using various methods including hydronic boilers using natural gas, solar heat, electric, geothermal, waste oil, methane or compost waste heat, incineration and others. Electric stick heaters or pool and spa heaters are also options. In a large production environment heating water can be very costly. Having a hot spring or other renewable source of hot water can significantly decrease this expense.

Cooling water – It is often more costly to cool water than to heat it. Certain fish species like trout demand water temperatures lower than 60° and therefore in most building environments, they would either have to have the water chilled or only be farmed during the fall, winter and spring months in a greenhouse environment where temperatures are lower. Using seasonal harvest would be an appropriate method for minimizing the need to significantly heat water in the winter or cool water in the summer.

Power – Power is necessary in aquaponics facilities for water pumps, aerators, supplemental lighting (if used), heating or cooling water (as necessary), heating or cooling air (as necessary), and lights on business operations. The facility must have adequate power to run all the different system components.

Alternative Energy Sources – Being in a business that could be considered “green” or “sustainable” it is worth considering all possible alternative energy sources outside of using the traditional fossil fuel and electricity based power sources. Solar, geothermal, methane, wind, waste oil, and other methods should be designed into the systems in the beginning or adaptable in the future.

Backup Power - If the power were to fail, it is critical that aeration be maintained in the fish tanks. Next it would be important to be able to maintain water and possibly air temperature especially if the outage takes place during extreme heat or cold. A generator or other alternative power supply is an important investment when considering fish death or crop failure could result without it.

Security – Having secured access to the building and possibly the surrounding area is an important function in maintaining a safe food production facility. Establishing entry and exit areas away from the systems, quarantining plants and fish that are stocked on brought into the system and having food handling procedures are some of the things that should be considered. The introduction of pests, bacteria, diseases, or contaminants in the water or air could have devastating effects. Every person or thing that touches the water, rafts, plants or other components should be clean.

Safety – Have a safe work environment is important to any business. Ensure that all precautions are taken with open water, heights, electricity and water interactions, physical or biological hazards for people, plants or fish. Proper food handling procedures that comply with all federal, state and local regulations are necessary to bring a food product to market.

Sunlight and artificial light – Access to natural sunlight is an invaluable resource for plant growth as well as the potential for solar heating and electricity. Duration of light (photoperiod) and light spectrum are critical to specific plant growth and functions. Blue spectrum (4200° – 5500° K) lighting is better for vegetative growth, whereas red spectrum (1500°- 3200° K) light is necessary for flowering and setting fruit. There are a variety of lighting options available for indoor growing:

Ownership, Leasing, Sharing or Partnership Agreements – Finding the right facility and determining the best ways to finance the space are going to be important to the bottom line of the business. Owning a building requires substantial funding, but may offer flexibility with building use, access and control. It might also mean being responsible for all the capital improvements necessary to maintain the space. Leasing or other arrangements with building owners can get an operation up and running with lower cash outlay. Working with the builder owner to get improvements or maintenance taken care of may be challenging and if significant building renovations are necessary, they should be clearly spelled out prior to the contract. In some instances special arrangements can be made with building owners or government entities to establish new business in a building for a period of time without paying any type of rent. Profit share, education or research scenarios, demonstrations, grants and non-profits, community buildings, school, places of worship and others may be interested in pursuing arrangements where they provide building or lot space in exchange for food products, teaching opportunities or jobs. If loans and financing is difficult consider a wide variety of other options.

Regulations, licensing, permitting and zoning – State, county or city government may impose specific limitations, exemptions or exclusions on the type of business and activities that can be conducted in an area, land or building. This includes both residential and commercial property. Thoroughly investigate the legal, real estate, taxation, land use, building use, structural, business and other logistics prior to making a commitment. Often changes or exemptions can be made, but will require documentation, approvals, hearings, legal entitlements and other oversight that could delay startup and operations or could fine, bring legal action or shut down a facility that is not in compliance.