

The Self-Sustaining Vertical Farm for all of Planet Earth

By Chelsea Webster

Mankind is expanding, growing, multiplying at an exponential rate, which has not been seen before in previous millennia. It is estimated by the United Nations that by 2050 the earth's population will have grown by further 2.5 billion people to a total of 9.6 billion on a planet which cannot produce the resources we need anymore.

Since man became the dominant species on Earth this planet has not, and is not, able to produce a single extra drop of water, rare minerals or fossil fuels. So without outside interference (asteroids) conservation is a must for the survival of all living organisms on planet earth.

My vision of Self-sustaining vertical farms reaching into the sky, creating more food and being fully ecological can no longer be considered too expensive or impracticable. This type of revolutionary farming will free up land usage, use less of our valuable limited water supplies and reduce harmful Greenhouse gases. This would appear to be the Holy Grail of agriculture and for this we must pursue it for the future of our existence and planet.

A multi-functional super high-rise farm which can combine realistic renewable energy and sustainable environments which also pay attention to the welfare of animals must be the aim. The buildings central core will form both the access/egress as well as a renewable energy wind tunnel. By applying moisture, via a grey-water mist system, the air flowing over the tunnel will become cooler. Cooler air naturally falls, and by progressively narrowing the tunnel we can produce faster and faster wind speeds and higher pressure flow. This faster flowing air will then be expelled at the bottom of the building by fans which turn due to the force of the air. These turning fans act as turbines so generating electricity which can be used to power systems within the building. The taller the building the faster the flow and thus the more energy can be collected.

The below ground basements will house a bio-mass power systems which will run on the solid waste which the farm will generate. A water filtration and collection systems will collect liquid waste and any natural water falling. This system will be a combination of an Aquatic/Fungi/Moss/Carbon and Silicon filtration system. The water/liquid waste will be graded into Black, Grey and Portable water and will undergo various stages within the natural filtration systems. This will clean all water and waste for reuse within the farm so allowing a 20 times more use from every drop.

Other benefit from the filtration system is the production of an additional farm element, Fish Farming, to ease the pressure on our dwindling natural fish stocks. Conversion of liquid waste to solid waste that can then be used as Bio-Mass fuels. Eventually what small amount of waste that cannot be used will be a totally natural waste which could be used to fertilize other landmass areas. Within certain geological areas the use of a geothermal plant may also be viable to produce energy and replenish water waste due to the extreme geothermal temperatures.

The exterior of the building will be made of photovoltaic glass and moss panels to allow natural sunlight to penetrate deep into the building while capturing 20-25% of the sun's rays and turn this into usable electric energy. The moss panels will produce shading when needed and also work as a

natural humidity generator for the dry regions of earth. Other elements to be incorporated into the structure would be external wind-power helix generators, methane/carbon air scrubbers to reduce greenhouse gas emissions.

I envisage these buildings stand some 600+ metres high with a land base of 2 square miles. This would give around 1000 acres of land per floor on the lower third of the building (10 floors). The middle section would be around 700 acres per floor (20 floors) and finally 400 acres per floor for the last third. Based on the United Nations food security council (2 below) the average person takes around 0.75 acre of farmland to be sustained. However it appears we will need to increase output per acre by at least 70% more to sustain our living with the growth of population by 2050. The vertical farm system I have shown would increase output by more than 500% and would cut in half the amount of resources we use to gain this increase, saving in total 10 times the amount of resources.

I also believe that due to the way we would build these farms they could be placed in areas which at this time are not viable land for farms. Deserts, Dry wasteland and even a floating version (on a smaller scale) is possible. This would increase our viable land use by 100% and make good commercial and environmental sense.

The lower floors (10 triple height floors) of the vertical farm will house the livestock from heaviest to lightest in weight (i.e. Cattle, Pigs, Lamb, and Poultry). The spaces will be planned to be as open-range as possible so allowing the livestock to roam around an enclosed space. Fast growing regenerative grasses and moss would be used as the floor which would overlay the concrete sub-base.

The middle section of the building (20 double height floors) will be set aside for the growing of grains, pulse, vegetables and natural flora and mosses. Creating high yield organic produce by means of hydroponics will reduce stress on the water system while allowing the natural purifying of the environment. The replenishing of mosses and animal feed resources will allow the farm to maintain a year round controlled supply for the farm animals. This means that imported goods will not be required and less (if any) outside fertilisation will be needed.

Finally the upper floors will house both human habitats and open green space use by the human population. This situation will allow on-site living for all farm employees and their families. Facilities such as schools, hospitals, shops and most other facilities will be readily available in the complex.

I have worked only to use systems available and viable at this time but believe I have combined these in such a way as to move forward a positive and viable future vertical farm for today.