INDOOR VERTICAL FARMING
PLANT FACTORY

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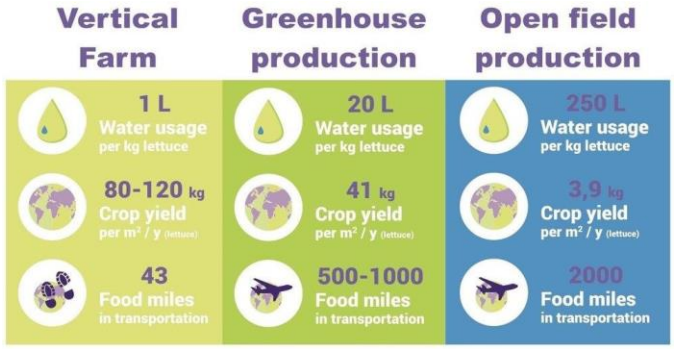
➢ VERTICAL FARMING

- ✓ Vertical farming refers to the process of producing crops in vertically stacked layers. It often integrates soilless agriculture techniques such as hydroponics, aquaponics, and aeroponics, as well as controlled environment farming, which seeks to optimize plant growth.
- ✓ The main benefit of using vertical farming technologies is higher crop yields that come with less unit land requirement. At the same time, the ability to grow more varieties of crops is increasing.
- ✓ In vertical farming practices, controlled environment agriculture (CEA) is used to alter the natural environment to increase crop yield or extend the growing season. Since the crops are indoors, they are not affected by unexpected weather events and the crop loss rate is very low. Environmental factors such as air, temperature, light, water, humidity, carbon dioxide and plant nutrition can be controlled and by being in well-controlled environments, vertical farms can grow food anywhere in any climate and in any country with access to a power source and water.
- ✓ With the cultivation in a sterile and controlled environment, much lower quantities of fertilisers and zero-chemical pesticides are used. Vertical farming produces pesticide-free, non-GMO and organic equivalent food with high nutritional value. There is no need for triple washing to remove pesticides before eating.
- ✓ According to UN reports, it is estimated that the world population will exceed 9 billion and more than 50% of the population will be living in cities by 2050. Vertical farming is a predictable response to possible food shortages as the population increases.



- ✓ With this method, environmentally responsible production can be achieved by reducing emissions and reducing the water needed. This type of urban farming will reduce the expense of intermediary distribution, logistic costs and product losses, from farm to sale.
- ✓ The food problem and nutritional insecurity is a serious problem in urban centers where the global population is projected to increase. Especially with the COVID-19 outbreak, food access has been restricted due to the increase in food insecurity in the food supply chain. Vertical farming can potentially benefit the quality and safety of food, contribute to sustainable urban agriculture, and increase food production.

- ✓ Traditional agriculture is plagued with concerns over the freshness, health and nutrition of food as well as the consumer's health and ecological sustainability. Vertically-farmed food solves many of the issues related to traditional farming. By operating in a controlled environment and in an ecologically efficient manner, it opens an array of opportunities for sustainable food sourcing.
- ✓ Vertical farming requires energy. The use of sustainable energy sources such as solar energy, wind turbines and other clean energy alternatives is in line with the high sustainability references of vertical farming. These sources provide an increasingly cheap source of electricity in many parts of the world, and vertical farms are using renewable energy sources for their energy needs.

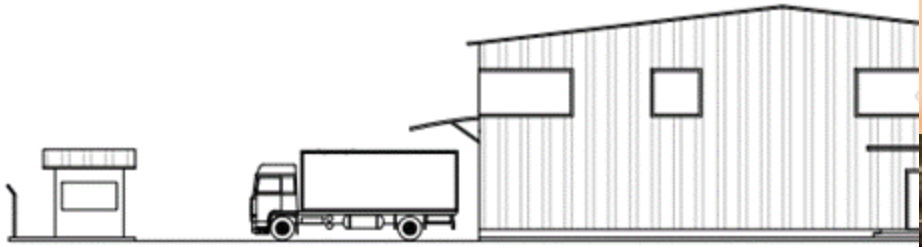
Production unit at -8th floor of a closed car park.

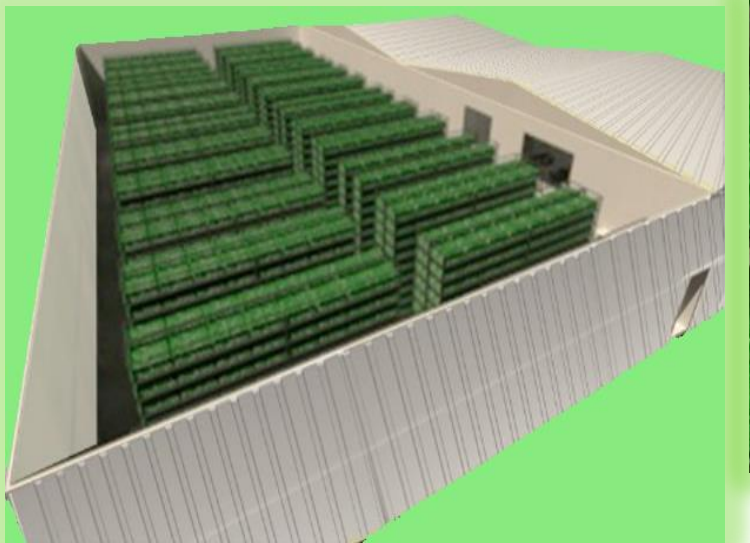
➢ INNOVATIVE FLEXIBLE SYSTEMS

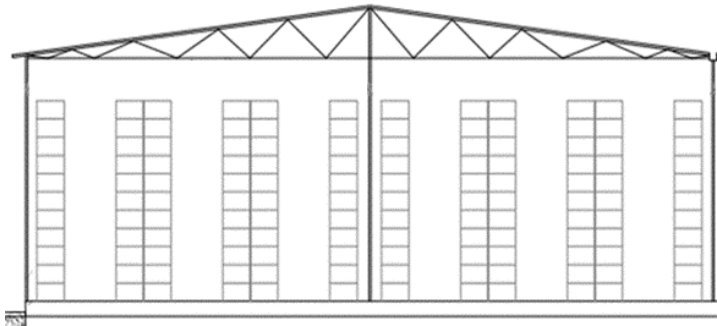
- ✓ Plant Factory which will increase Crop Production, ensure safe access to food, and include high agricultural technologies.
- ✓ The environmental conditions necessary for the cultivation of medicinal and aromatic plants as well as agricultural food products.
- ✓ Grow plants for 12 months using special LED grow lights, using pesticide-free, soilless growing method, with 95% water savings regardless of the climate.
- ✓ Production parameters such as pH, electrical conductivity, temperature, humidity, and carbon dioxide in the plant growing environment will be controlled by the automation system and sensors, and production will be realized by providing the optimum conditions required.

➢ INDOOR FARMING

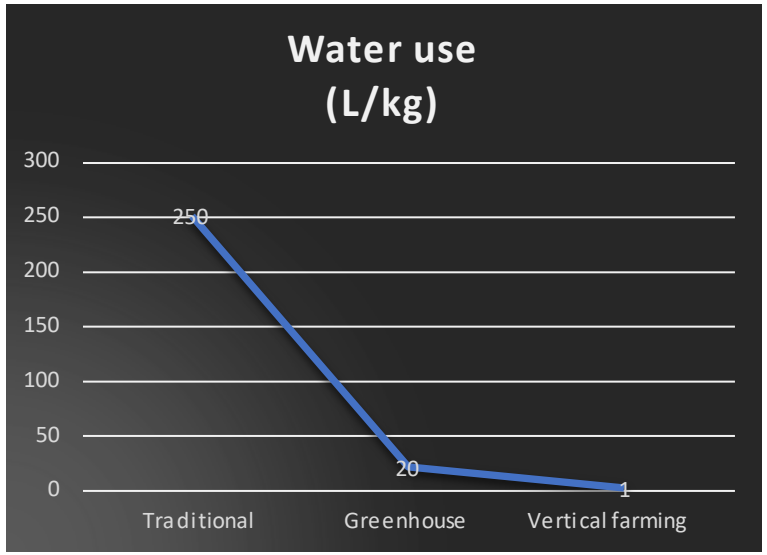
- ✓ Idle warehouses, hangars
- ✓ Underground metro structures
- ✓ Factory buildings designed by

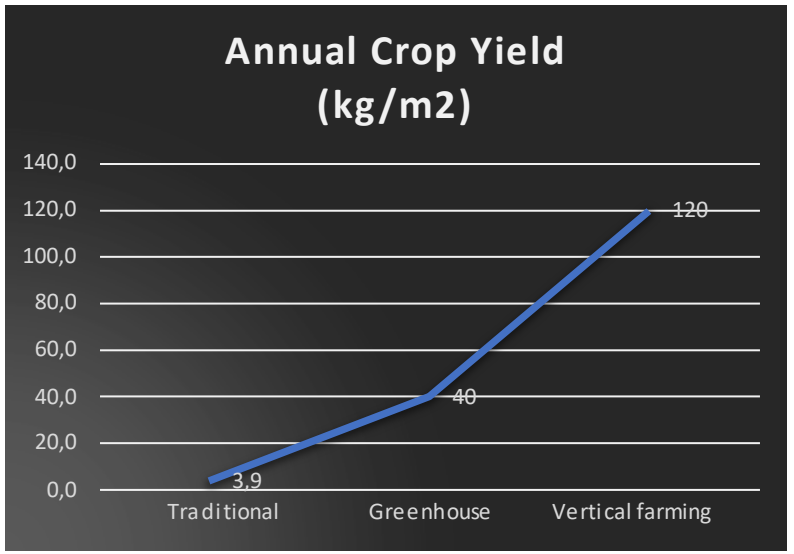


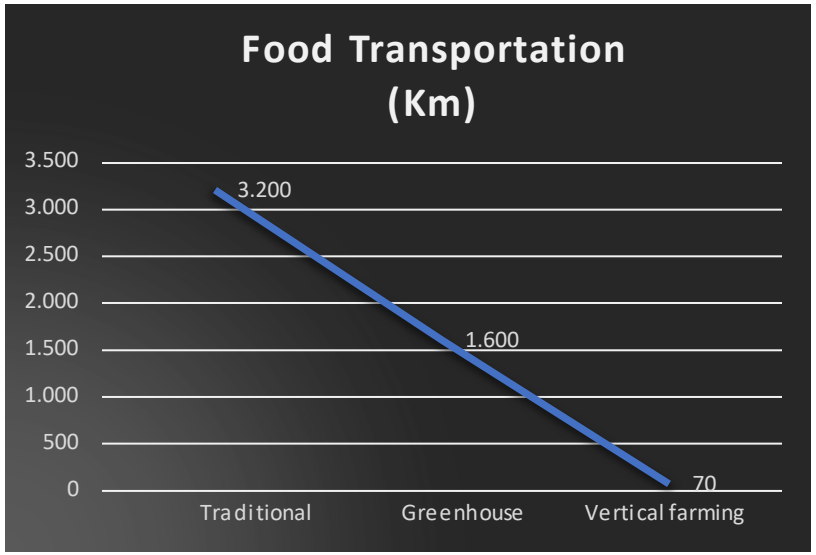




➢ SUSTAINABILITY







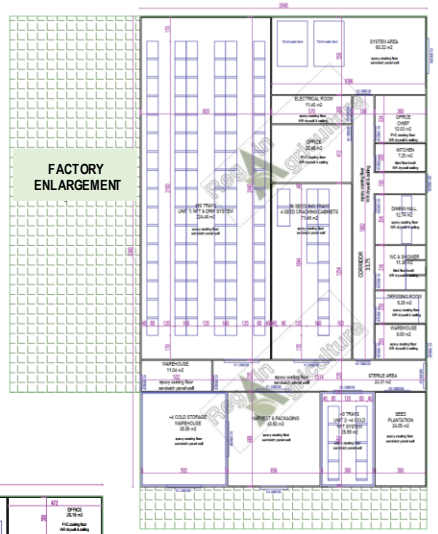
➢ PLANTS TO GROW

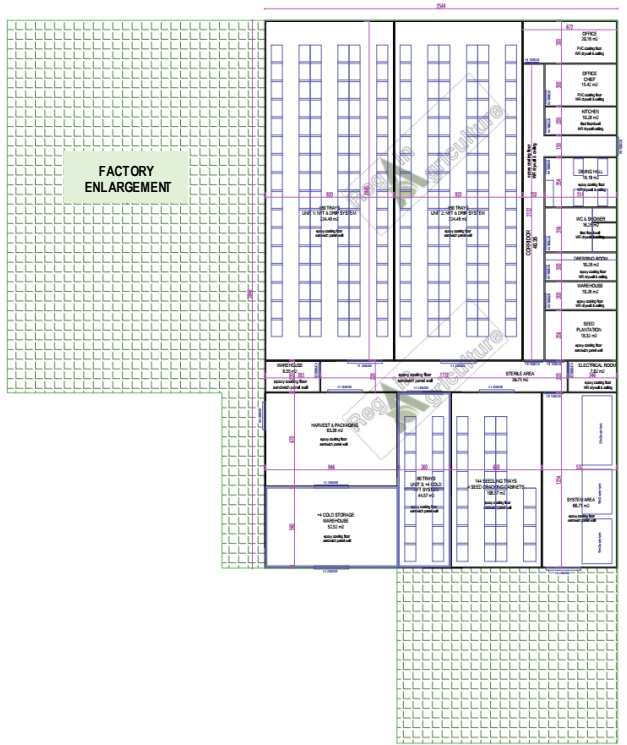
- ✓ Lettuce
- ✓ Strawberry
- ✓ Wheat
- ✓ Stevia (Sugar Grass)
- ✓ Mint (Chocolate mint)
- ✓ Tomatoes
- ✓ Basil
- ✓ Rocket
- ✓ Dill
- ✓ Sour Grass
- ✓ Parsley
- ✓ Basil
- ✓ Kalanchoe Flower
- ✓ Broccoli microgreens
- ✓ Sunflower
- ✓ Mung bean
- ✓ Beluga lentils
- ✓ Purslane
- ✓ Red beet
- ✓ Turnip
- ✓ Black/Yellow Mustard
- ✓ Wheatgrass
- ✓ Black chickpea grass
- ✓ Cabbage
- ✓ Amaranth

➢ PLANT FACTORY UNITS AND SIZE

- ✓ The plant production process begins with the planting of the seeds by Seed Sowing Machine in the **Seed Planting Unit**.
- ✓ Then, the seeds sown in viols are taken to the **Seedling Unit** and placed in the Seed Cracking Cabinet.
- ✓ After the germination process, the seeds are placed in the Seedling Trays for rooting.
- ✓ The seedling process in accordance with the soilless cultivation method is completed in the Seedling Unit.
- ✓ Some valuable plantings need to stay in **+4 Cold Production Unit** which is an optional unit.
- ✓ Plants that have become seedlings are taken to **Plant Production Unit** for their growth and planted in a sterile environment.
- ✓ The plants grown in the production units will be collected and taken to the **Harvest Unit** when the harvest period comes. At the end of the harvest, trays are washed with a Tray Washing Machine and sterilized.
- ✓ Harvested products are then taken to the **Cold Storage** for shipment.
- ✓ The number of production trays indicates the production capacity of the Plant Factory. Each production unit includes 480 trays. There are 4 designs of new factory buildings at 700-1000-1700 m^2 areas.
- ✓ Initial capacity of 480 trays is enlargable to 960 trays and initial capacity of 960 trays is enlargable to 1920 trays.

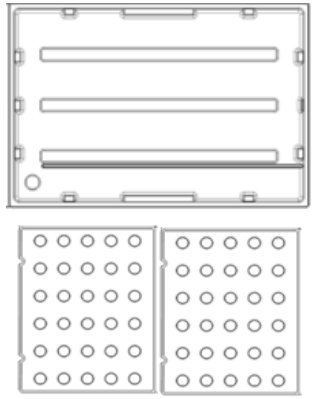
- ✓ Steel construction
- ✓ Insulated thermo panel walls and roof, epoxy coating floor, industrial doors.
- ✓ All necessary installations, lighting, data, camera, fire detect, transformer, generator, ups, sanitary, etc.
- ✓ Air conditioning installations, HVAC, handling units

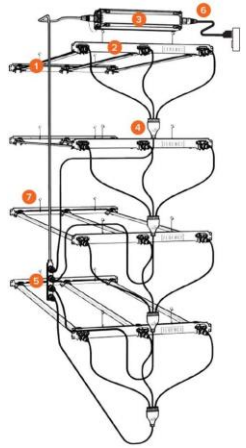




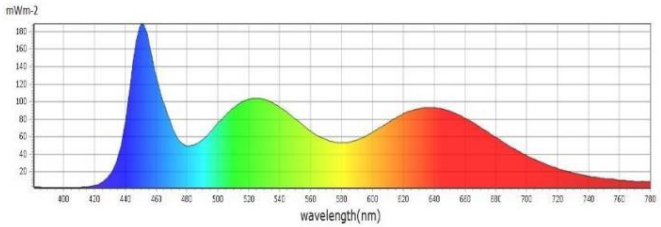
➢ PLANT GROWTH SYSTEM

- ✓ Plant Growing Rack System offers perfect solutions for vertical farming applications. It enables to reach maximum product efficiency in minimum area with vertical farming.
- ✓ One of the important parts of the system is the plant growing trays. The plant growing tray is presented as a set of 1 lower and 2 upper parts. There are 60 holes and 0.96 m² production area in 1 tray set.
- ✓ An indispensable part of the Plant Growth System is LED Grow Lights. T8 Plant Grow Lights, which are connected to each other in each plant production tray, are included in the system specially designed for the growth stages of the plant.
- ✓ 4 rows of T8 LED grow lights are used on each plant shelf floor. LED lamps used in all units are dimmable. It is also possible to change the spectrum according to plant growth. The system operates at 3 different spectrum wavelengths.
- ✓ Grow Light Specifications:
  - Light Output PPF380 µmol/s
  - Efficiency 3.8 µmol/J @220AC
  - External LED Driver
  - IP67 protection
- ✓ Irrigation and fertilization system includes reverse osmosis, nutrient film technique (NFT) which measures water values instantly, manages and saves %95 of water, optional drip system, water tanks with blowers.
- ✓ Air conditioning sytem includes heating/ cooling, dehumidification, humidification with fogging, sterilization air with ozone, fresh air inlet and polluted air outlet, hepa filters.

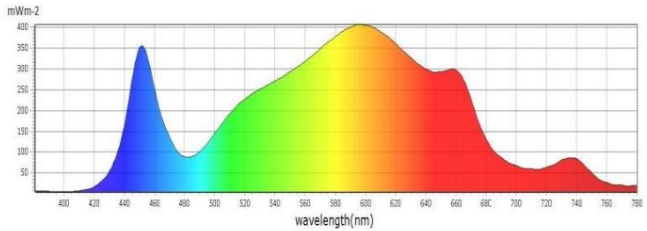


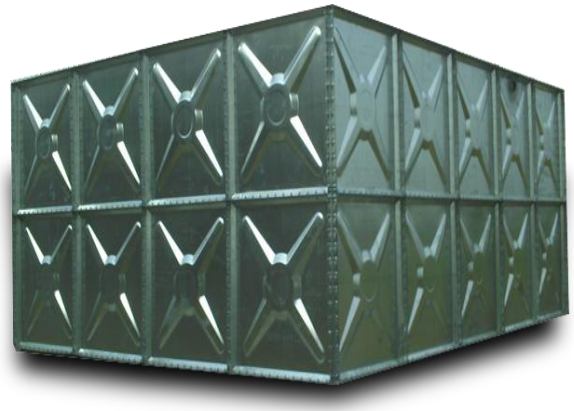


Vegetation Spectrum:



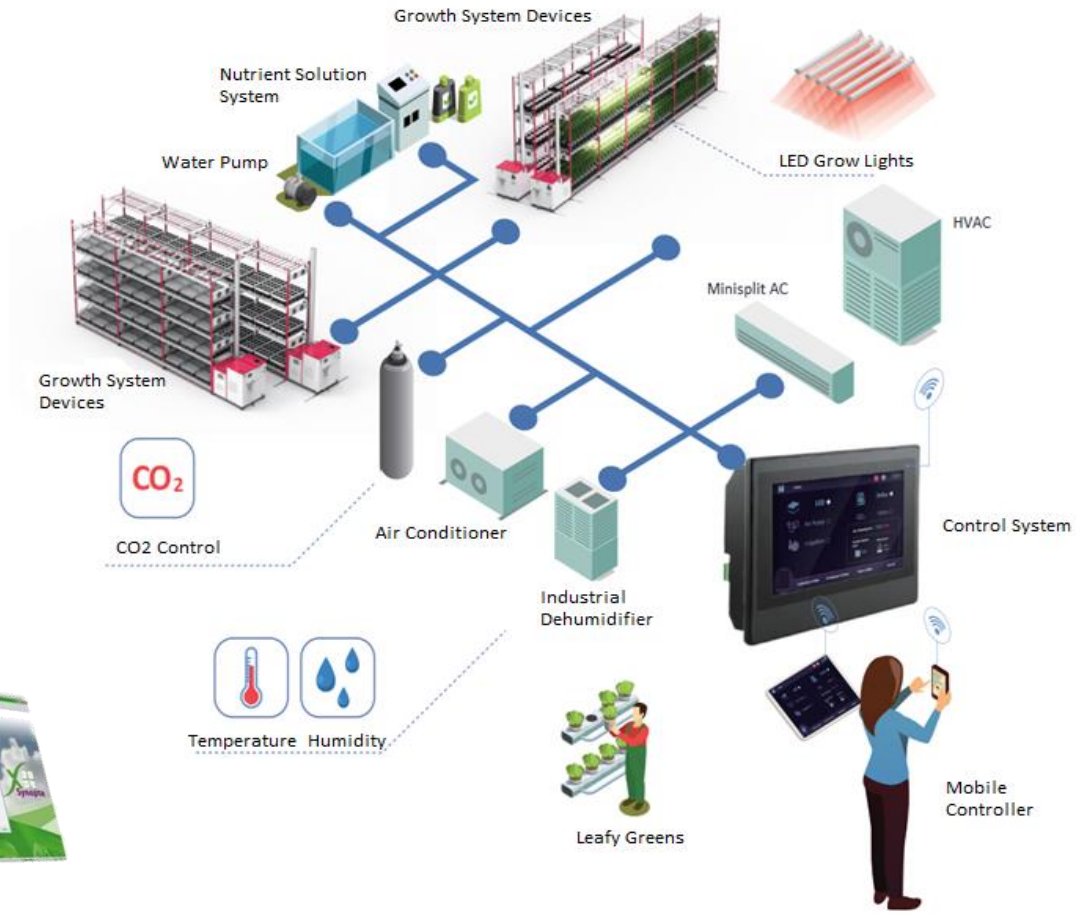
Flowering Spectrum:





➢ SYSTEM MANAGEMENT

- ✓ The system software has climate control. Climate Management allows you to manage the values of temperature, humidity, CO^2, lux, PAR.
- ✓ Climate management is one of the most important issues in vertical farming. The management of heating, cooling, humidification, cleaning the air with ozone, dehumidification and ventilation from a single point and integrating it with the system ensures healthy growth of plants.
- ✓ It is designed for distributing air equally in plant growing environments with clean air line, evacuation of polluted air, sterilization of air with HEPA filter systems and antimicrobial air channels in air conditioning devices (HVAC).
- ✓ The system software allows you to manage the PH, EC, temperature, dissolved O^2 values in water and fertilization system management.
- ✓ All light management is done through the system software which simulates the daily light to grow the plant in the production unit.
- ✓ The system software has the properties; plant growth parameter definitions, ability to manage different units, remote access and management, availability of IOT feature, reporting.
- ✓ The central hardware consists of an industrial process computer (IPC) and the necessary I/O modules. All I/O modules are connected to the main cabinet via a special protocol.
- ✓ This modern software is easy to use and offers any control you might need to control processes. The standard edition includes chart settings and data analysis tables. It also offers many possibilities to expand its features.



➢ BUDGET & ROI

960 production tables as anew facility (1000 m2)	Parsley (100gr)	Med. Green (150gr)	İtalian Basil (25gr)
No of tables		960	
No of holes or pcs in a table	120	50	100
Monthly harvest (pcs)	115200	48000	96000
Monthly harvest (kg)	17280	7200	2400
Table growing leds (kW/day)		1152	
HVAC and others (kW/day)		2073,6	
TOTAL (kW/day)		3225,6	
kW price ($/kW)*		0,13	
Monthly electricity cost ($)		12.579,84	
Monthly workers cost 4000$/worker ($)		16000	
Monthly technician cost 5500$/technician ($)		11000	
Monthly maintenance and office exp. ($)		6000	
Fertilizers, consumables etc. ($)	1.382,40	576,00	1.152,00
Seed ($)	2.304,00	960,00	1.920,00
Rockwool ($)	345,60	144,00	288,00
Packaging ($)	40.320,00	2.400,00	4.800,00
Water ($)	57,60	57,60	57,60
Other monthly cost SUM ($)	77.409,60	37.137,60	41.217,60
TOTAL monthly cost ($)	89.989,44	49.717,44	53.797,44
Unit cost ($)	0,78	1,04	0,56
Unit price ($)	5,00	3,18	3,35
Monthly sales ($)	576.000,00	152.640,00	321.600,00
Unit profit ($)	4,22	2,14	2,79
Monthly profit ($)	486.010,56	102.922,56	267.802,56

➢ CONTENTS

- ✓ Infrastructure and devices designed for 18-24°C production and +4°C cold storage.
- ✓ Electrical installation, indoor lighting, power, data, camera, fire detection and alarm systems, transformer, generator, ups, panels, inter-panel lines.
- ✓ Mechanical installation, plumbing, heating, ventilation, air conditioning (HVAC), fire extinguishing system, building automation system, cooling system, spare unit.
- ✓ Plant Production Units, shelf system (5 tiers), white trays, led grow lights,
- ✓ Seedling Production Unit, shelf system (6 tiers), white trays, led grow lights,
- ✓ Spectrum switchable/dimmable led grow lights, circulation fans (between shelf tiers), water supply, circulation and return lines, nutrient film technique (NFT), irrigation management, water sterilization with ozone system, ph calibration fluids, EC and PH meters and testing kits, electric water heaters, blower water aeration and silencer, pumps (dosing, submersible), water lines and sample measuring line, reverse osmosis water treatment system,
- ✓ Control and electrical system, air conditioning control system, water management and fertilization control system, automation system, automation software, electrical panels and installations, cabling between panels and pgs, modbus data lines,
- ✓ Seeding machine, 15-layer seed crusher/spreading cabinet, tray washing machine,
- ✓ Any infrastructure to be connected to the factory/site is not included. Taxes and fees are not included. Any machinery/equipment/materials are not included unless expressly stated.
- ✓ +4°C Cold Production Unit and Drip Irrigation system can be added optionally. Solar Energy System can be added optionally.

DESCRIPTION OF WORK	COST		
	480 tables 700m2	960 tables 1000m2	1920 tables 1700m2
CONSTRUCTION WORKS	$1.185.839,00	$1.646.142,00	$2.689.463,00
ELECTRICAL WORKS	$309.701,00	$517.492,00	$902.287,00
MECHANICAL WORKS	$407.117,00	$680.268,00	$1.186.100,00
LIGHT, OUTOMATION AND OTHER SYSTEMS	$1.520.306,00	$3.048.410,00	$6.112.415,00
TOTAL	$3.422.963,00	$5.892.312,00	$10.890.265,00

➢ CABINET : PERSONAL VERTICAL FARM

- ✓ Cabinet system not only brings Vertical Farming very close to you, but delivers it directly to your home. The smart growing cabinet can be used to grow crisp Leafy Greens, Herbs and Microgreens. It provides ideal growth conditions with its automatic LED lighting, its own water circuit and climate control. This allows you to harvest healthy greens free of pesticides directly onto your plate.
- ✓ Automation controls all parameters. The system controls watering, solution dosing for Electrical conductivity (EC) and PH, air conditioning, humidity and CO_2 system. Datalogger and internet connectivity are optional.
- ✓ Sensor-based climate control provides ideal conditions for faster plant growth that is up to 3 times.
- ✓ The closed-loop hydroponic watering system with an integrated water tank saves up to 98% of water compared to conventional farming.
- ✓ LED Grow Lights provide the most important solar wavelengths for 16 hours a day.
- ✓ White coating is for maximum light reflection. Heat-insulated body helps to manage air-conditioning. 60 holes in each tray offer maximum variety and simple, ergonomic harvesting.

➢ MODELS & SPECIFICATIONS

✓ **GENERAL**

- Up to 70% energy saving,
- Full spectrum daylight LED Grow Light, homogeneous dimmable lighting, no dark corners, high light intensities, LED's: 100 µMol, 200 µMol (optional:400 µMol).
- Flexible shelving system, maximizing growth height, exterior / Interior: black / stainless steel white coated, Growth height at 3 LED layers: 450 mm.
- Minimal heat radiation on the plants
- Accurate climate control
- CO_2 system: optional.
- Internet connectivity

✓ **RG-PRO CABINET**

- Exterior dimensions: 1400 x 900 x 2050 mm (w x d x h). Interior dimensions: 1280 x 820 x 1440 mm (w x d x h). Internal volume: 1511 liters.
- Growth area: 3 shelves (1200 w x 800 d mm = 2.88 m2).

✓ **RG-HOME CABINET**

- Exterior dimensions: 700 x 900 x 2050 mm (w x d x h). Interior dimensions: 620 x 820 x 1440 mm (w x d x h). Internal volume: 732 liters.
- Growth area: 3 shelves (600 w x 800 d mm = 1.44 m2).

✓ **RG-MINI CABINET**

- Exterior dimensions: 700 x 900 x 1570 mm (w x d x h). Interior dimensions: 620 x 820 x 960 mm (w x d x h).
- Internal volume: 488 liters.
- Growth area: 2 shelves (600 w x 800 d mm = 0.96 m2).

➢ CABINET : HOW IT WORKS

- ✓ **STEP-1** Select variety
  Select plant to grow in the system or enter the growth prescription into the system!
- ✓ **STEP-2** Plant seedling
  Insert the plants in the trays of the cabinet.
- ✓ **STEP-3** Harvest
  Harvest directly onto your plate.

➢ SMART CONTROL SYSTEM

- ✓ Smart Control System can control all of the parameters while growing plants until to the harvest.
- ✓ Smart Control System can also be communicated and controlled via Internet. This allows you to record what is currently planted, the temperature, carbon dioxide, humidity, EC and PH values of the solution, the water level.