

Introduction of Korean Smart Farm K-Plant Technology and Promotion of Collaboration Project

1st Myanmar-Korea ICT Collaboration Conference & Roadshow ICCR (M+K ICCR 2019)



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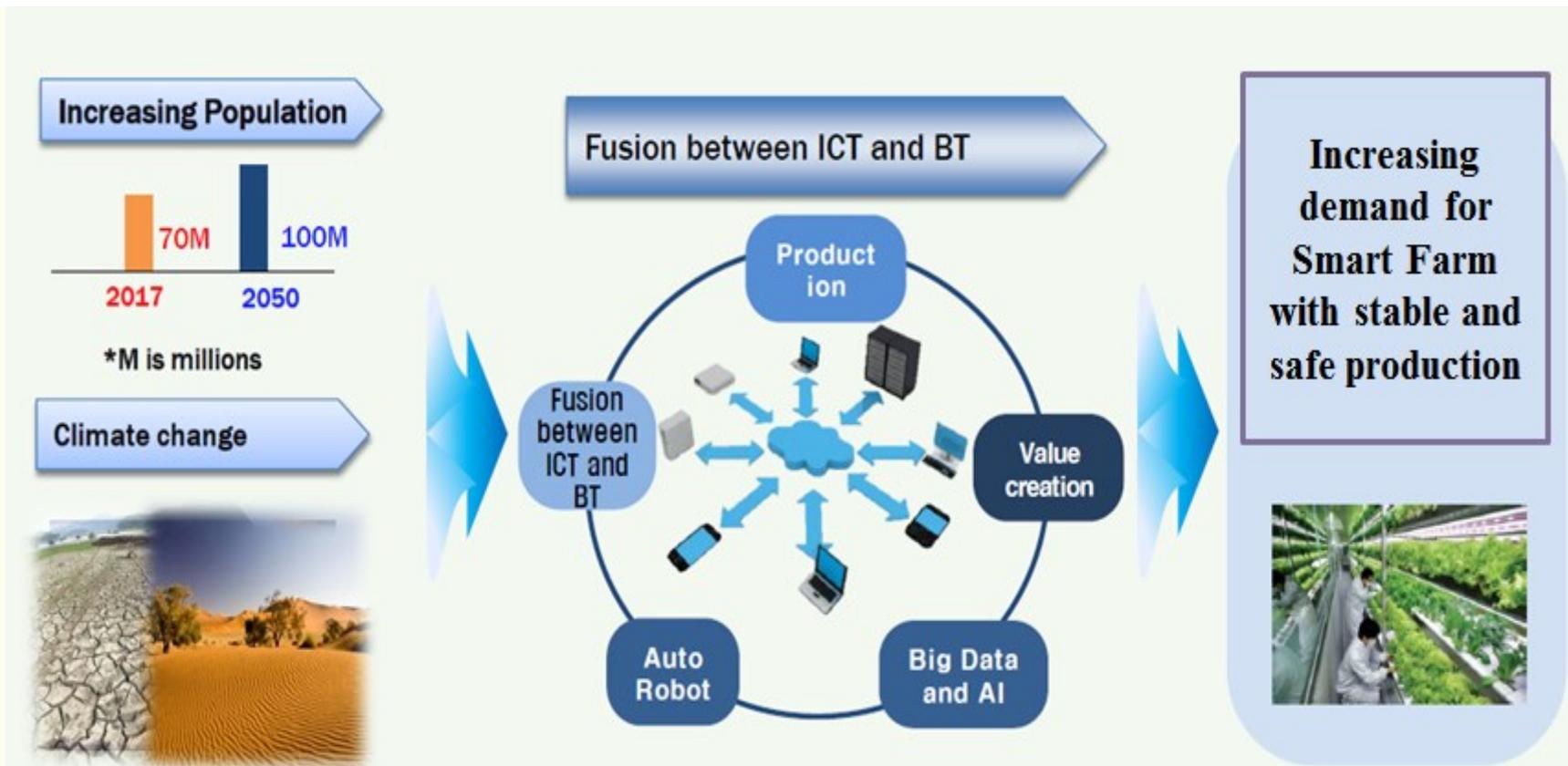
3 **Export Model of Smart Farm / K-Plant**

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1. High Tech Agriculture and Smart Farm

Need of Smart Farm

- The demand for smart farms is rapidly increasing due to population growth, climate change, aging of the rural population, and automation by the fourth industrial revolution



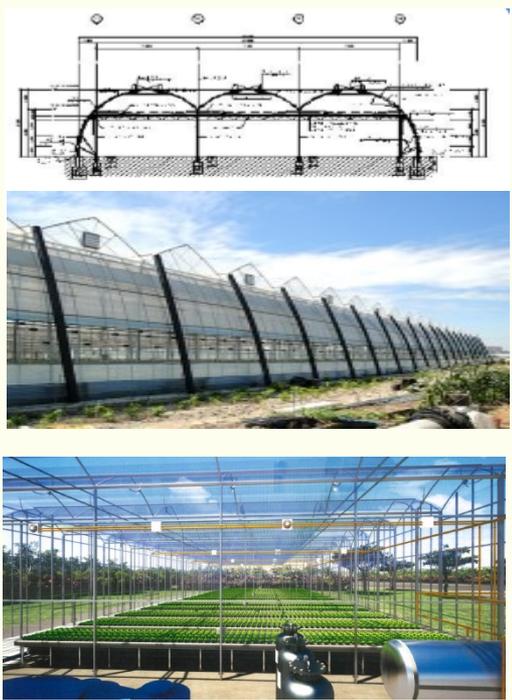
1. High Tech Agriculture and Smart Farm

What is Smart Farm

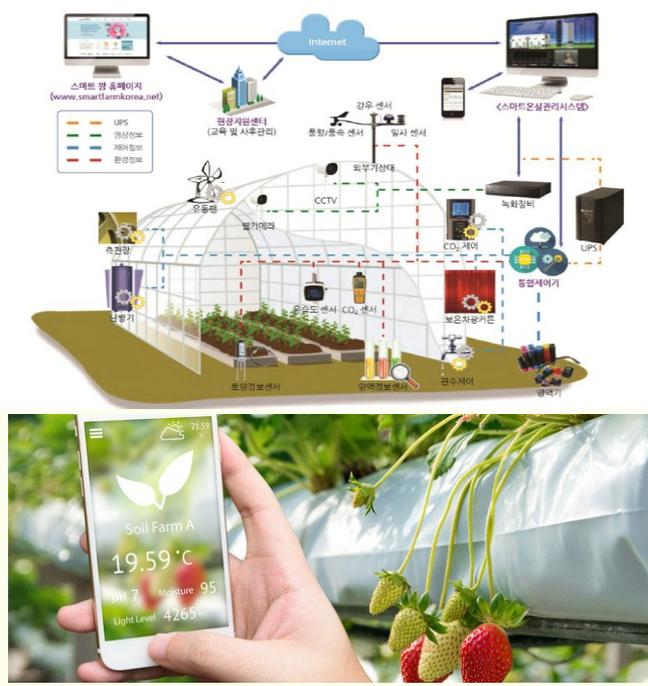
➤ Smart Farm is a facility that can artificially control the cultivation environment (light, temperature, humidity, carbon dioxide concentration, culture liquid) to produce high quality crops stably throughout the year

◆ Structure of Smart Farm

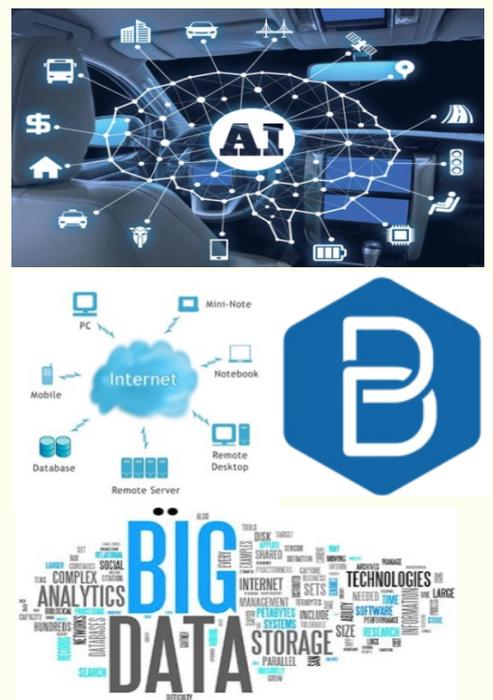
Greenhouse



ICT



Big Data



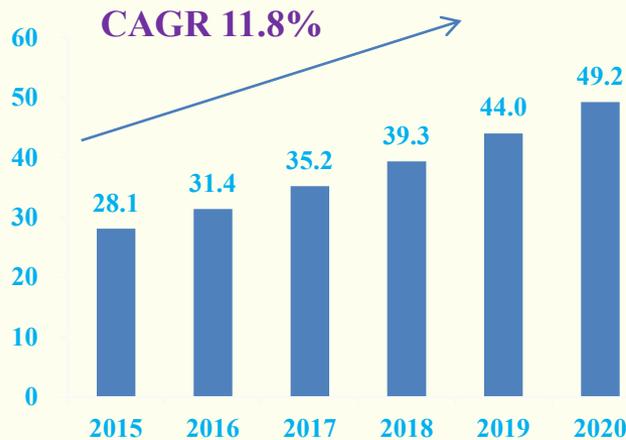
1. High Tech Agriculture and Smart Farm



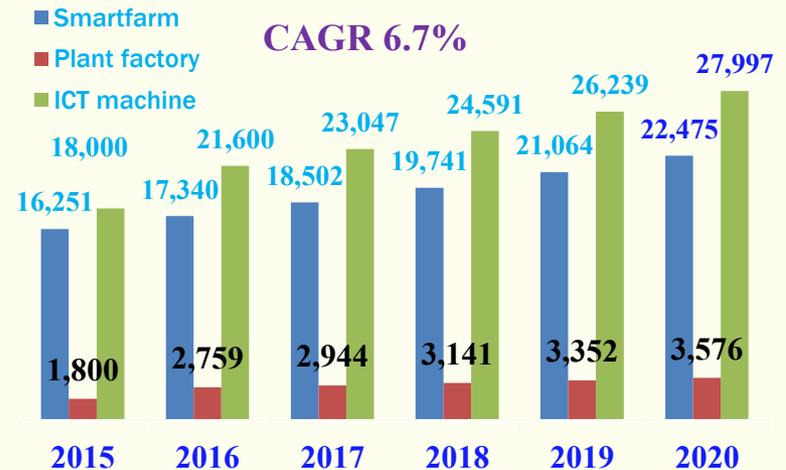
Smart Farm Market

- ➔ The global smart farm market increased up to 28,000 billion dollar and 11.8% growth at 2015 and they may expect the extension up to 49,200 billion dollar.
- ➔ The domestic smart farm market increased up to 9.6 billion dollar and 6.7% growth at 2015 and they expected extension up to 23.3 billion dollar.

Unit : 100 billion dollar **World Market demand and vision**



Korea Market demand and vision



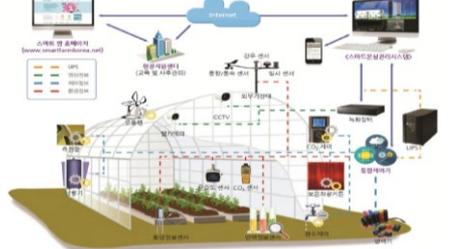
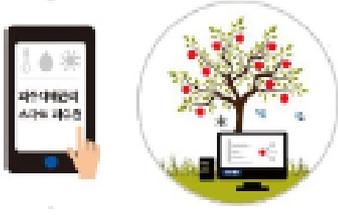
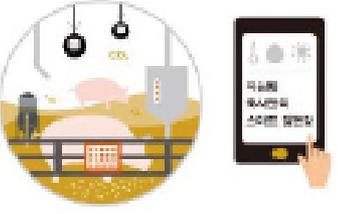
CAGR = Compound Annual Growth Rate,

Source : Technology roadmap in Ministry of SEMs and Startups

1. High Tech Agriculture and Smart Farm

Korean Smart Farm Application Fields

➔ A farm where information and communication technology (ICT) is applied to greenhouses, animal sheds, orchards, etc. to remotely and automatically manage the growth environment of crops and livestock properly with Smart phone tablet pc

분야	내용	
	<p>Smart greenhouse</p> <p>Maintain optimal growth environment of crops by monitoring the temperature, humidity, CO2, etc. of greenhouses and remotely and automatically controlling skylight and nutrient supply through PC or mobile</p>	
	<p>Smart orchard</p> <p>Maintain optimal growth environment of crops by monitoring the temperature, humidity, CO2, etc. of greenhouses and remotely and automatically controlling skylight and nutrient supply through PC or mobile</p>	
	<p>Smart livestock</p> <p>Monitor the livestock environment, such as temperature and humidity, and remotely and automatically control the timing and amount of feed and water supply through a PC or mobile</p>	

1. High Tech Agriculture and Smart Farm

Effect of Smart Farm

- **Productivity 40% ↑, Quality 30% ↑, Labor costs 30% ↓**
Total incoming 60% ↑



Example (Paprika)



Example (Tomato)

- ▶ **Hwasun, (multi-span, 1.3ha)**
 - Yield increase: 65kg/3.3m² → 101 (55% ↑)
 - Labor saving: 8h/day → 4 (50% ↓)
 - Energy saving: 35% ↓



2. Smart Farm Plant System / K-Plant

◆ Korean smart farm export model (K-Plant)

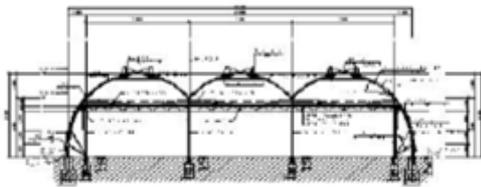
K-Plant concept

K-Plant is a smart farm system that combines a complex environment control system based on ICT with a PosMAC greenhouse structure based on WEF equipment

Smart Farm Greenhouse

WEF-based Key Tech.

ICT-based CAM System



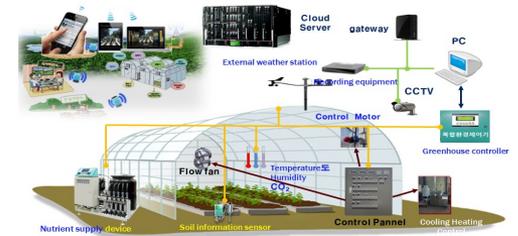
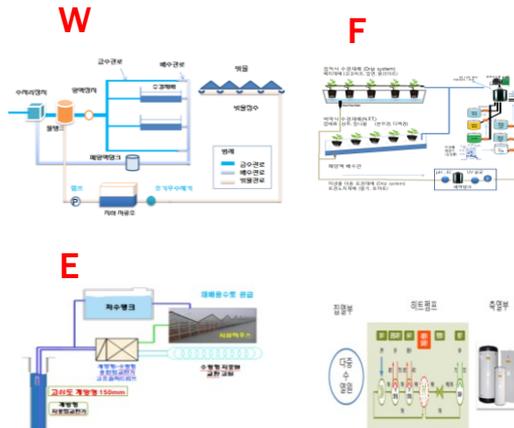
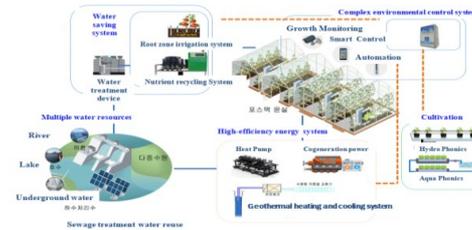
PosMAC steel- greenhouse



Complex environmental control system



WEF-based Smart farm



2. Smart Farm Plant System / K-Plant

◆ K-Plant Type

Category	K-1 Type (Entry-level)	K-2 Type (ICT O&M Level)	K-3 Type (Auto O&M Level)
Goal	Productivity and Convenience	Productivity, Efficiency, Environmental Intelligence	Process Management Automation Integrated management of water, energy and resources
Composition	Smart link (Internet), Sensor nodes, controller nodes	ICT complex environment control Intelligent farming decisions, Cloud service	Resource integration management, robot farming
Core Equipment	ICT complex environment control Monitoring of temperature, humidity, CO ₂ , etc. Shading screen, flow fan, skylight, sidewind control Nutrient supply, air conditioner control Smartphone, Tablet PC	ICT-based complex environment control Sensor-based nutrient solution Intelligent Farming Decision Making with Big Data Wireless communication, cloud	Integrated water + energy management Robotic Cultivation Process Management ICT-based Greenhouse Control GS1-based production, processing and distribution history management
Conceptual Diagram			

2. Smart Farm Plant System / Element Tech.

◆ K-Plant Green House Structure

- Taller, stronger (suitable for each crop), better environment than the old model.
- 30~40% higher yield than the old model, 90% level of glasshouse yield.
- Construction cost: 2/3 level of glasshouse



Single-span type



Multi-span type



Tunnel type



Mammoth type

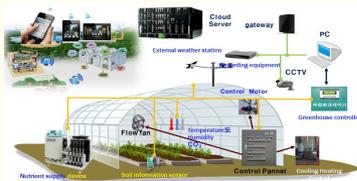


2. Smart Farm Plant System / K-Plant Core S/W

◆ K- Plant Core S/W

K-Plant core program consists of integrated control program, WEF base i-FDSS Service program, complex environment control, nutrient solution recycling system

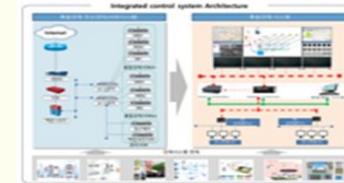
Complex environment control System



i-FDSS service system



integrated control System
K-Plant 통합관제 시스템



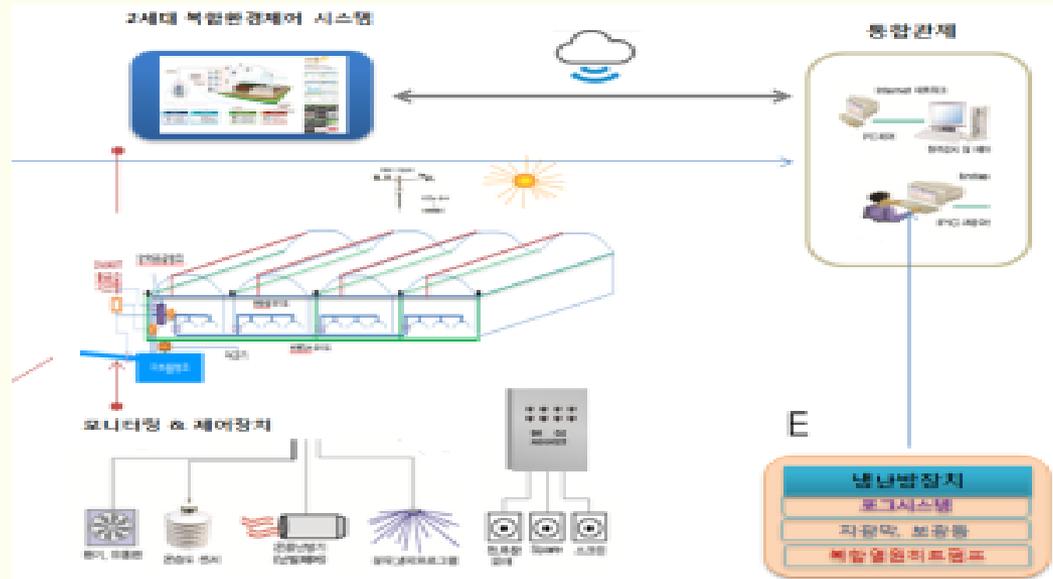
Circulating nutrient supply



Nutrient Management System



Nutrient recycling device



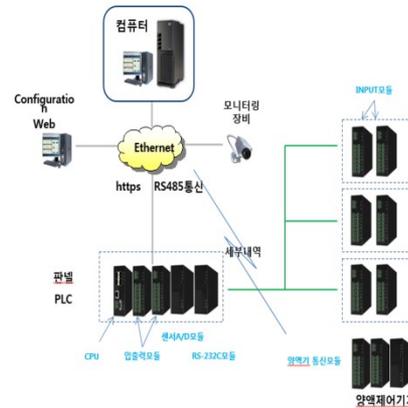
2. Smart Farm Plant System / K-Plant core Tech.

◆ K-1 Type (Entry-level) Complex Environment Control System

온실환경제어 개략도



복합환경제어 시스템 구성도



환경제어용 외부 기상대



양액처방 알고리즘 (SMART Fertilizer)



양액재활용 시스템 메인 UI



복합환경제어 시스템 메인 UI



메인 컨트롤러

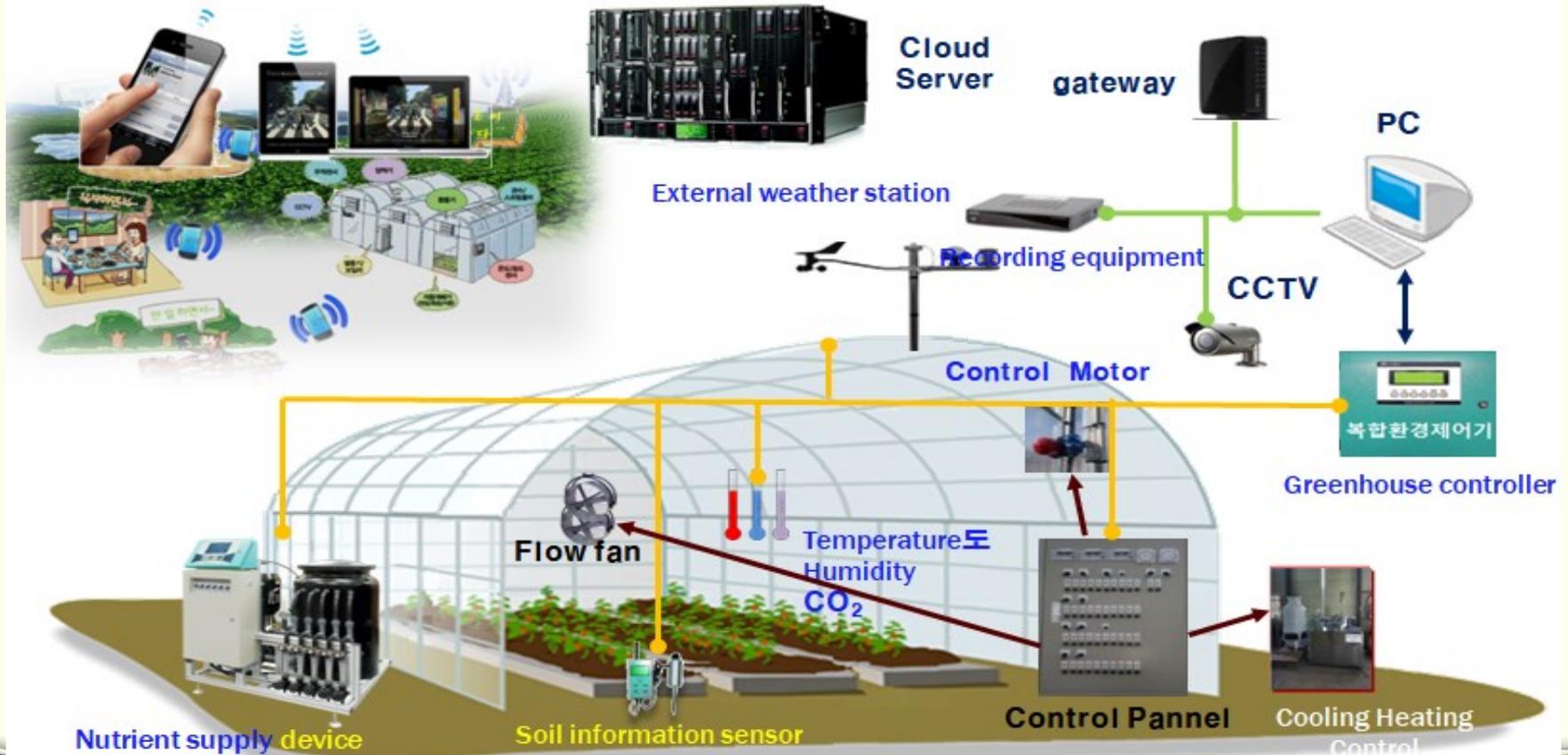


2. Smart Farm Plant System / K-Plant core Tech.

◆ K-2 Type (ICT O&M Level) Complex Environment Control System

Solution regarding realization of best growth environmental conditions such as temperature, humidity, water, CO₂ through each element monitoring progress

KT-GiGA Smart Farm

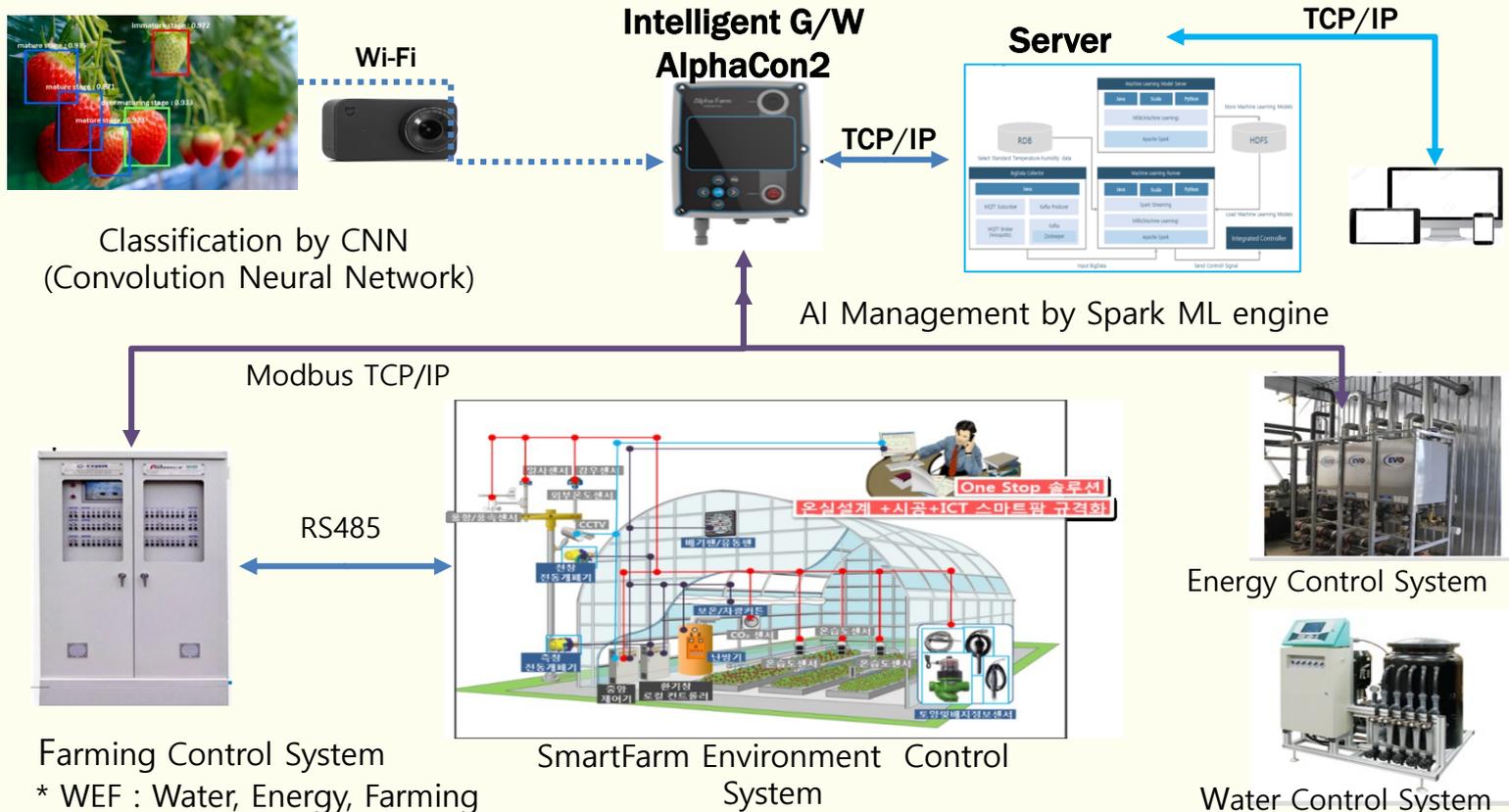


2. Smart Farm Plant System / K-Plant core Tech.

◆ K-3 Type (Auto O&M Level) Machine Learning Based Complex WEF control System

K-Plant Service Platform is a WEF base i-FDSS Service System that consists of water, electricity, complex environment control, and nutrient recycling system.

➤ WEF base i-FDSS Service System



2. Smart Farm Plant System / Element Tech.

◆ Irrigation system

▪ Automatic irrigation

- Timer : 1-2L/plant/day, 4-12times
- Solar radiation sensor
- Lysimeter
- Moisture sensor (Tensiometer, FDR, TDR)



Tensiometer



Timer



Solar radiation sensor



Lysimeter



FDR sensor

2. Smart Farm Plant System / Element Tech.

◆ Energy saving technology

Ministry of Agriculture, Food and Rural Affairs, MAFRA

■ Greenhouse heating

- Heating costs ratio to operation expenses: 30~40%
- Heating fuel: oil (84%), coal · wood(8%), electricity(6%), ..
- Renewable energy : geothermal (214 ha), Solar thermal (68 ha)



Hot air heater



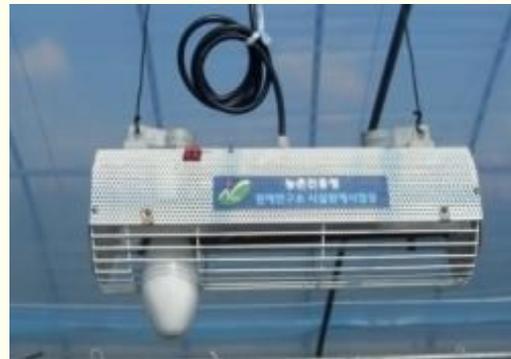
Hot water boiler



Coal boiler



Electric heater



Electric heater with lamp

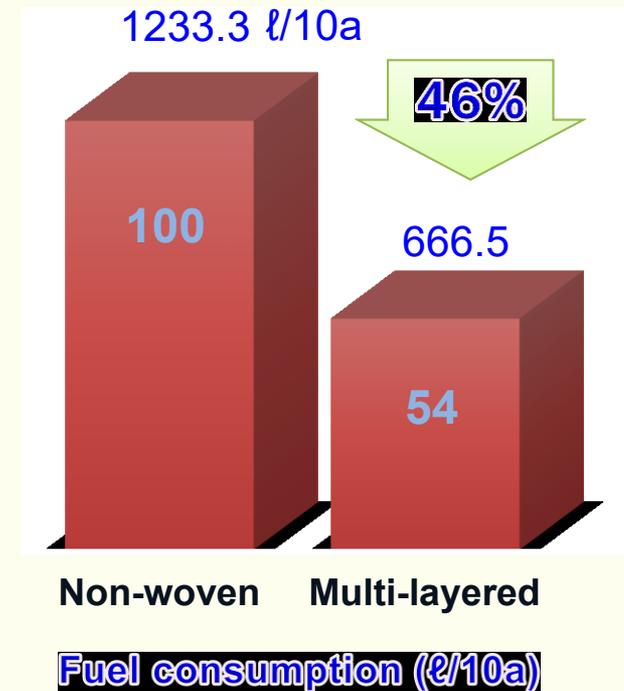
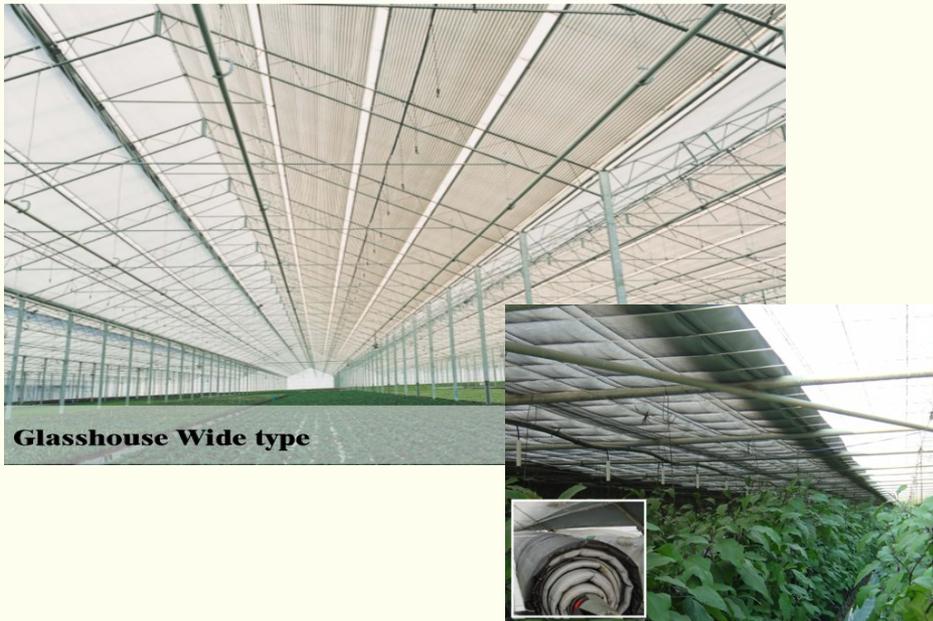


Fan coil unit

2. Smart Farm Plant System / Element Tech.

◆ Energy saving technology

▪ Multi-layered insulation curtain in a multi-span GH



- Crop : **green pepper**
- Experimental plot: Non-woven (control), Multi-layered
- Fuel Consumption decreased by 46%, yield increased by 27%

2. Smart Farm Plant System / Element Tech.

◆ Energy saving technology

- Package technology for energy saving in glasshouse

- Crop : **paprika**

- Package configuration: Geothermal source heater, aluminum multi-layered curtain, root zone heating



Geothermal source heater



Al multi-layered curtain



Root zone heating

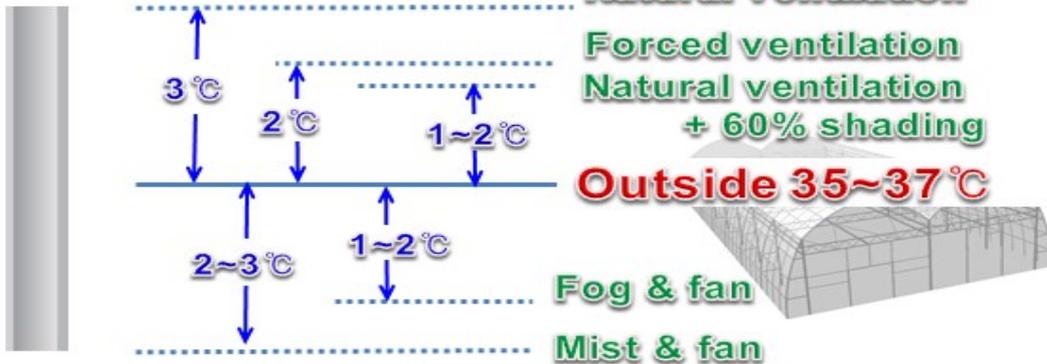
- Fuel decreased by **85%**, yield increased by **12%** (control : oil heater)

2. Smart Farm Plant System / Element Tech.

◆ Energy saving technology

Temp., Humidity, Light, CO₂, Irrigation, ...

■ Cooling



Aluminum screen for shading



Paint spray for shading



Fog & fan

- Temperature drop: 6~7°C
- Humidification
- Low installation and operation cost

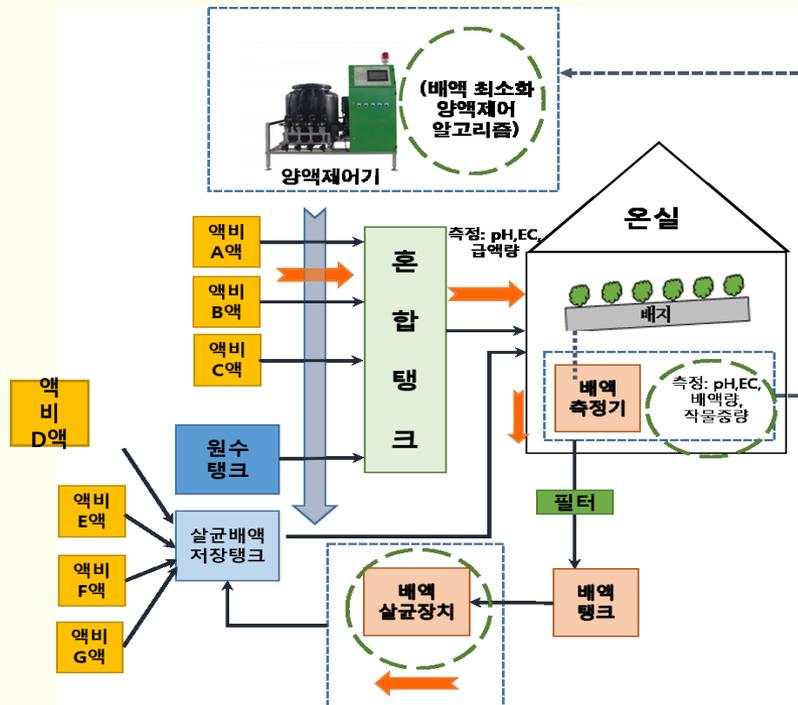


Fan & Pad system

2. Smart Farm Plant System / Element Tech.

◆ Nutrient Recycling technology

The nutrient recycling system is sterilized with PLAZMA to reuse the culture solution,
Minimize the supply of nutrient components by measuring waste nutrient solution



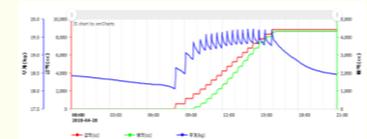
Circulating Hydroponic Cultivation System

Minimize environmental pollution,
Reducing nutrient and cost saving

Circulating nutrient supply system



Nutrient Control Program



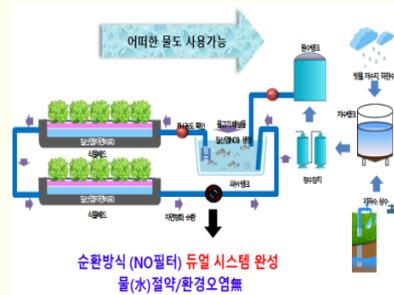
2. Smart Farm Plant System / Element Tech.

◆ Cultivation technology

Hydroponics



Aquaponix



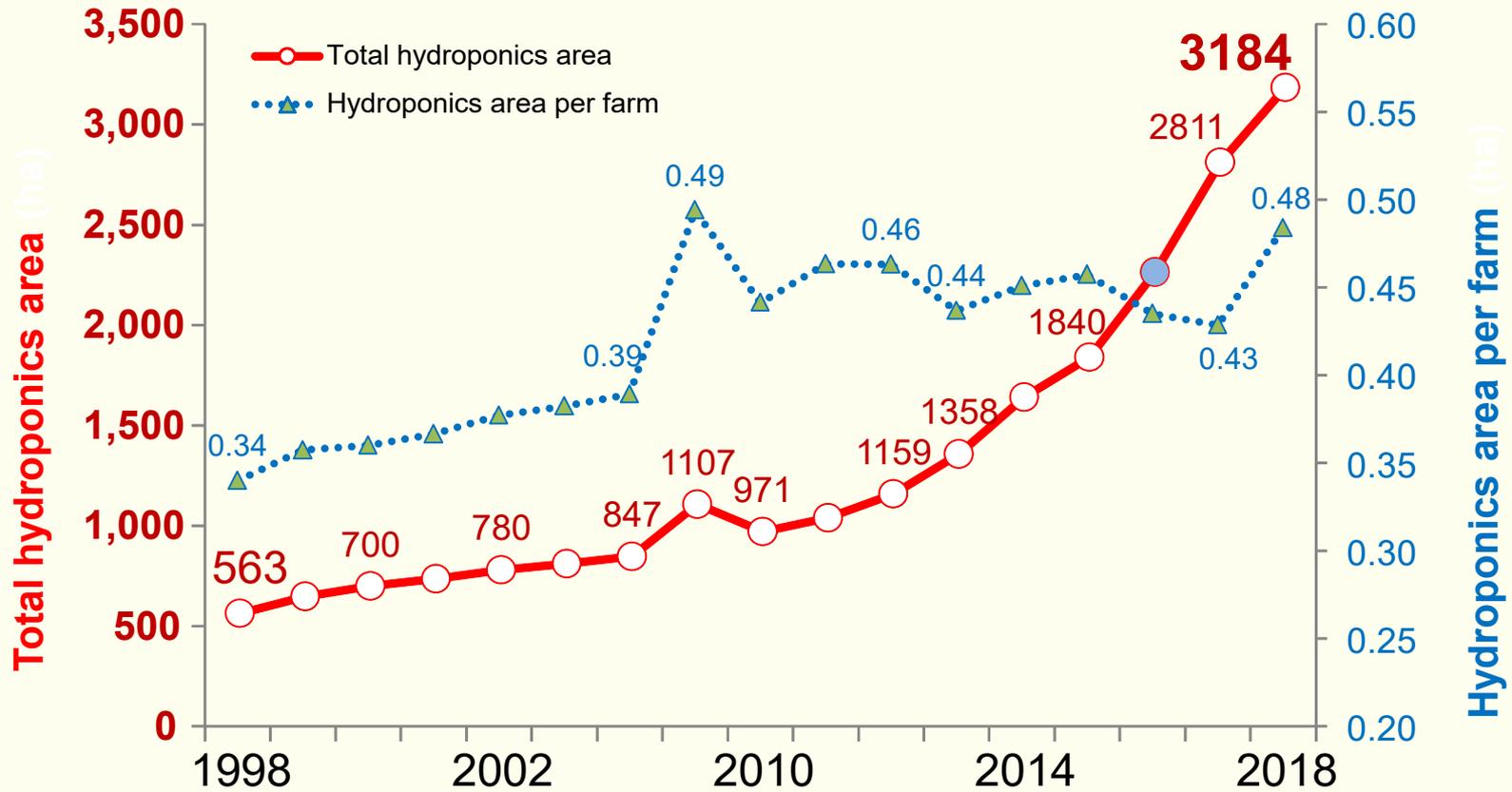
Hangin gutter

In order to compensate for the disadvantages of the existing fixed gutters, it is convenient to provide a cultivating environment by installing a portable walk-in gutter



2. Smart Farm Plant System / Element Tech.

◆ hydroponics cultivation area changes in Korea



2. Smart Farm Plant System / Element Tech.

◆ hydroponic technology

▣ What is ?

- Definition : The method of growing plants without soil, using mineral nutrient solutions in a water solvent.
- Medium : Perlite, rockwool, clay pellets, peat moss, or vermiculite, etc.

▣ Advantages

- Growth is fast
- Better for the environment (less water)
- Make better use of space and location
- Saving labor and time

▣ Disadvantages

- Experience and technical knowledge
- Initial installation cost



Tomato grown on coir substrate
in hydroponics

3. Export Model of Smart Farm / K-Plant

◆ Export Model Design

Package System of Water + Energy + Fertilizer + environment control
(a-farm, bandi, GIGA farm) system + greenhouse + Logistics + ICT

WEF based intelligent smart farm



Narae-Bandi



Korea Greenhouse

Green house



PO film
Benlo type

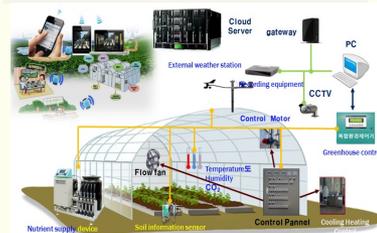
Glass house



Water supply + Energy + Farming



KT- GIGA smart farm



water purifier + circuit + nutrient solution



Renewable energy + heat pump + heat storage tank

Chungoh smart farm



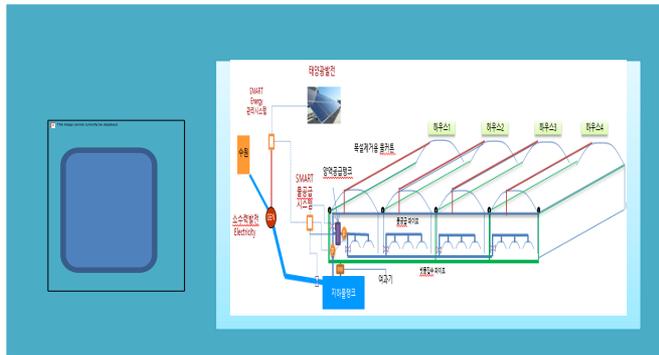
K-PLANT

3. Export Model of Smart Farm / K-Plant

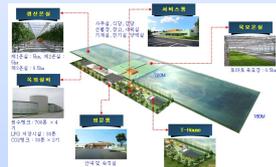
WEF-based greenhouse

WEF-based greenhouse including PosMAC steel structure, Water circulation Tech. and high efficiency energy tech. Environment friendly farming tech.

Standard Model



Product in whole year



Auto greenhouse
Hanging cultivation and Hydroponics
Circuit type water supply tech.
various energies source

Element Tech.

New material steel structure

- PosMAC material based greenhouse structure

Water circulation tech.

- sensor based demand expectation
- ICT base water controlling system

High-efficiency energy tech.

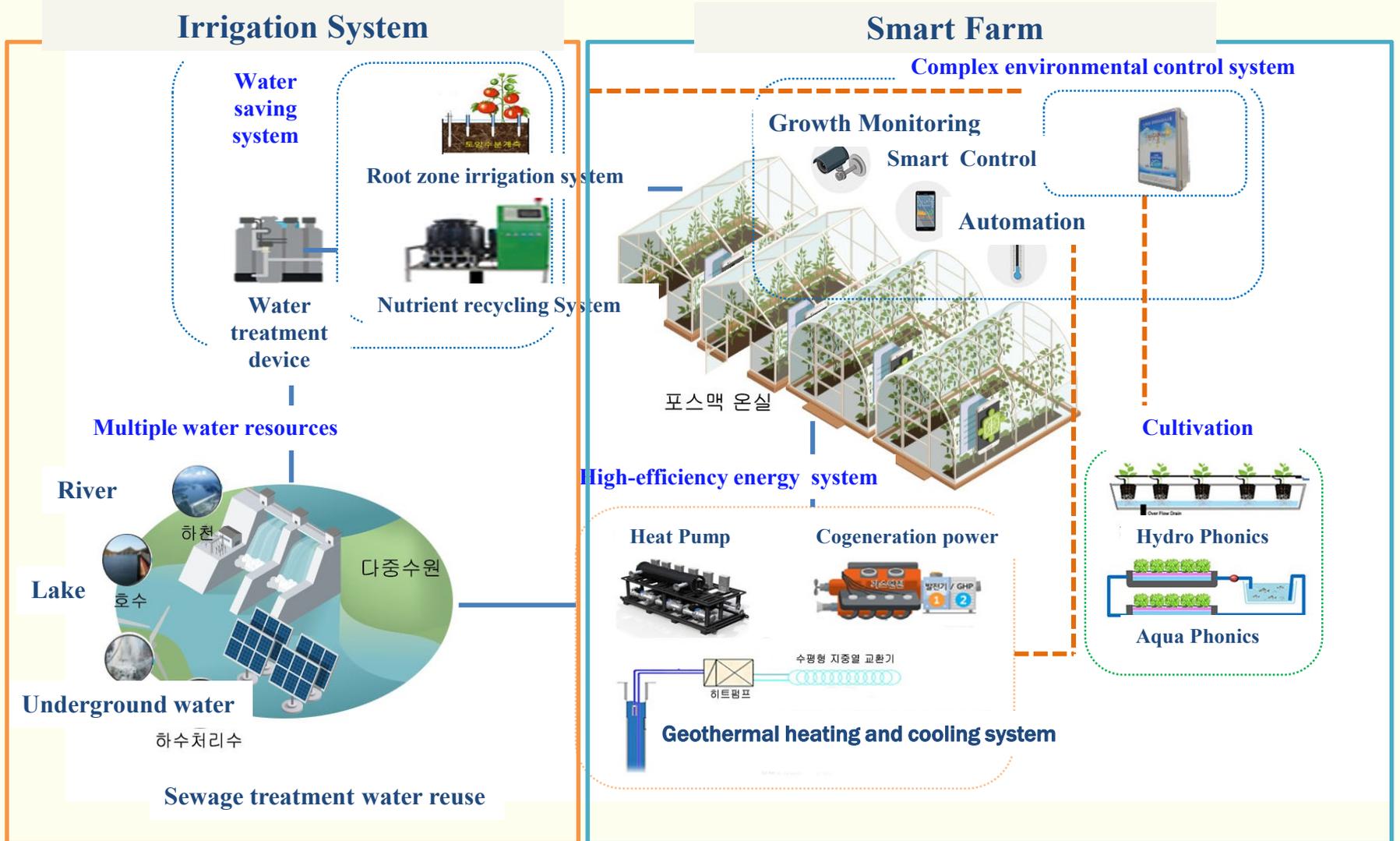
- Multiple heat source heat pump system

Environment friendly farming tech.

- Nutrient recycling base hydroponics system
- Water Reuse base Aquaponics farming
- Environment-friendly microorganism farming

3. Export Model of Smart Farm / K-Plant

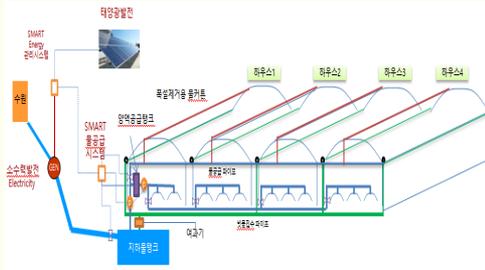
◆ K- Plant Export Model - Expanded system architecture



3. Export Model of Smart Farm / K-Plant

◆ K- Plant Export Model - Key Technology

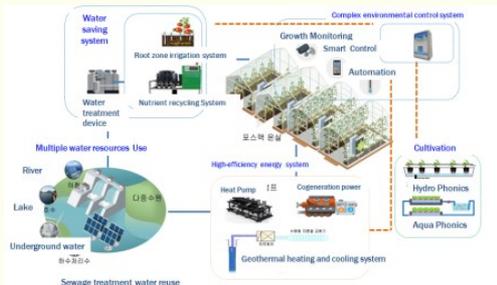
K- Plant Structure



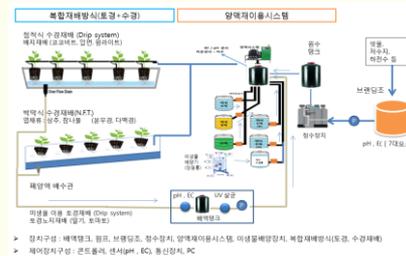
Single Greenhouse model



Complex Greenhouse model



Water Reuse



Nutrient reuse 30%



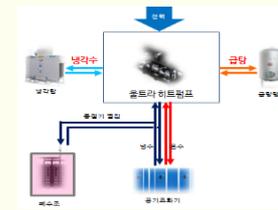
Water cycle utilization 90%



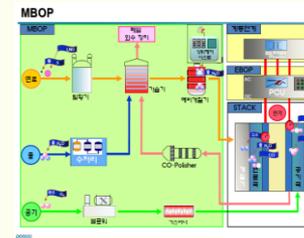
Energy Supply



Ground-water geothermal combined heating and cooling



Heat pump + heat storage tank



Fuel cell cogeneration power generation

Cultivation



Hydroponics



Hanging growth



Hydroponics

3. Export Model of Smart Farm / K-Plant

◆ K- Plant Export Model - Smart farm Greenhouse complex

➤ Complex build including high tech., energy supplement, and logistic center



Smart farm Innovation center



Glass type Greenhouse Complex(10ha)



Smart farm remodeling Project



Plastic green house complex model

3. Export Model of Smart Farm / K-Plant

◆ Smart Village Project Proposal : Rural New town

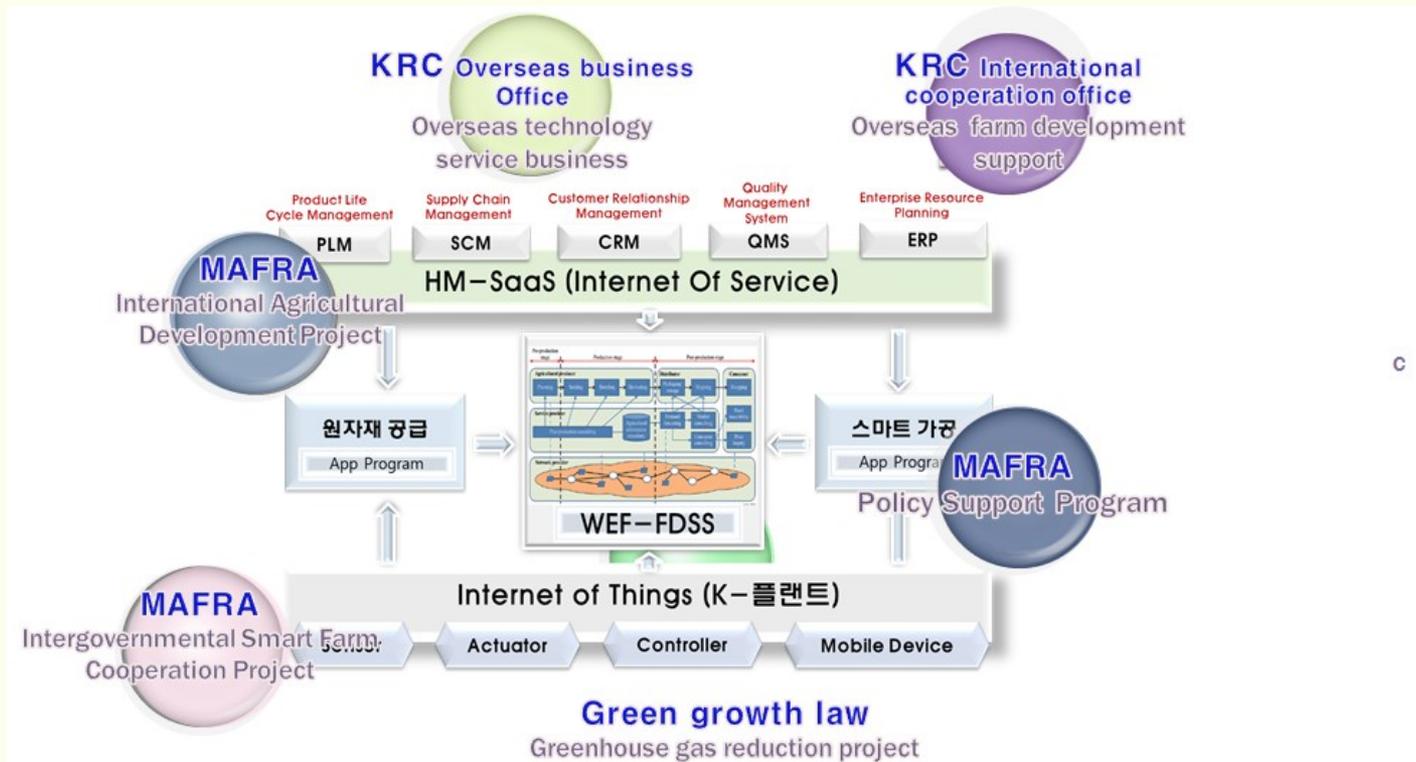
- I hope that your nation, Myanmar would start this smart village project near future by help of Korean ICT technology



4. International Corporation Strategy

◆ Smart Export Research Group Network

- We have many organizations as KRC Overseas business Office, MAFRA International Agricultural Development Project, etc



4. International Corporation Strategy

◆ Cooperation Strategy and Financing Plan

➤ Utilization of overseas infra and corporation institute

KRC Infrastructure : International cooperation (technology , farm), overseas offices etc

Partners : Export-Import Bank (Foreign Economic Cooperation Fund, EDCF) and Koica , ODA
The International Agricultural Cooperation Project is the MAFRA, ODA, IDB

➤ Searching BO_(Business Opportunity) through overseas corporation project

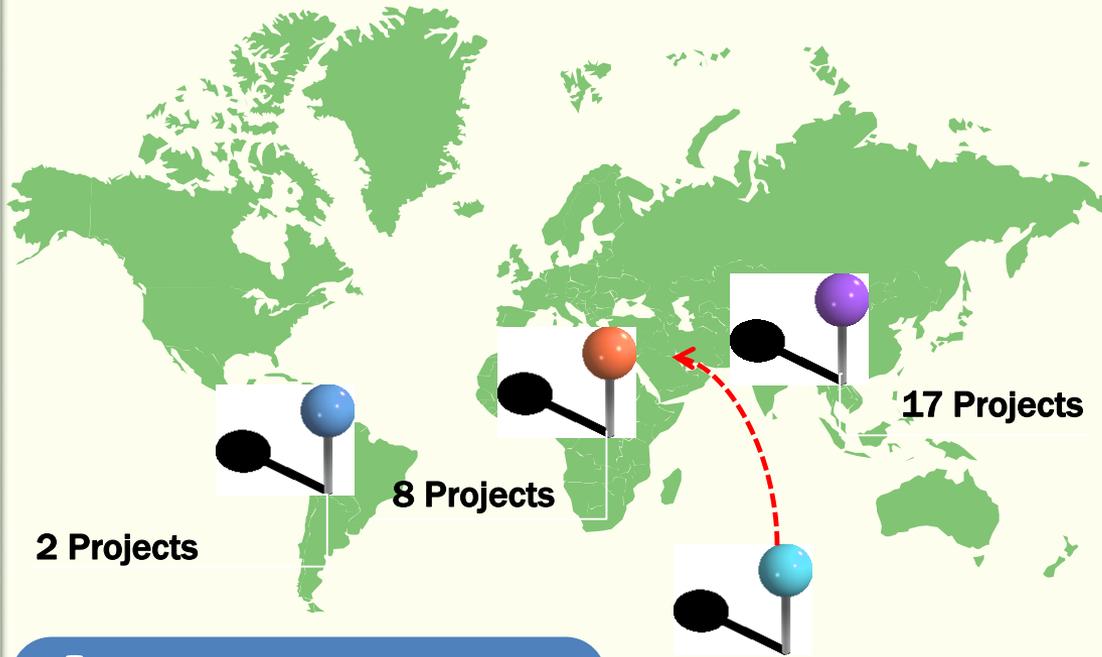
- **(Koica)** Promoted export of smart farms in connection with farm development and construction support projects in agriculture, forestry and fisheries sector
- **(KDB Korea Bank)** Identifying and promoting Korean countermeasures against climate change
- **(Private-public)** Co-financing of enterprises and institutions and public-private partnership projects

➤ Corporation between smart farm project and GCF project

- **(2016.10)** Approved by the 14th GCF Board of Directors on the Korean model of climate change response model including smart farm
- **(Business model)** Smart farm, renewable energy + ESS, eco-friendly energy town, etc.
Customized support to improve climate adaptability of agriculture in developing countries
(can be linked with electric power supply business)

4. International Corporation Strategy

◆ Global Reach- Consulting Services



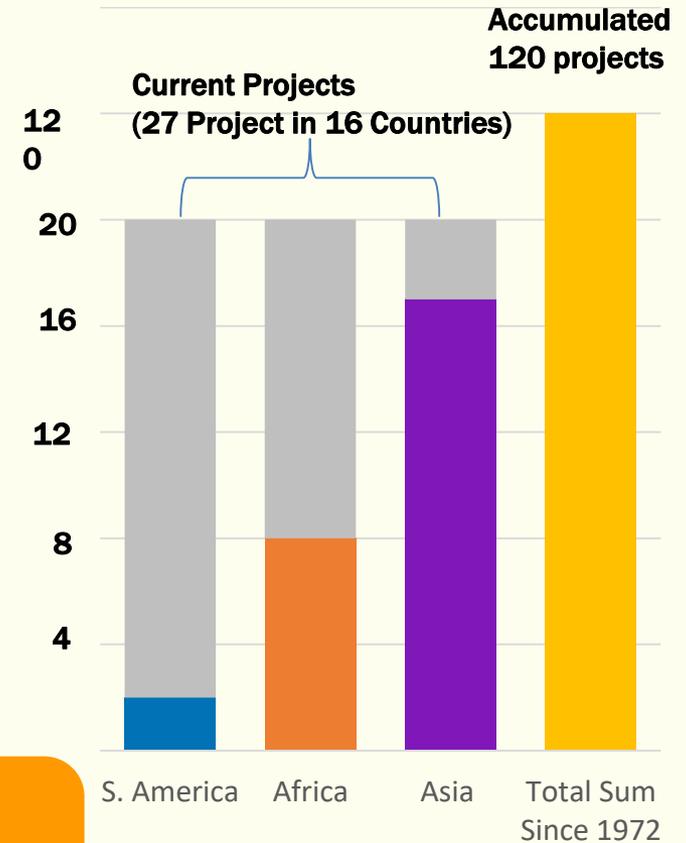
35 Countries

120 Projects Since 1972

: OJT more than 3,000 trainees

Participate in Technical Consulting Services

Irrigation and Drainage
 Flood control & watershed management
 Rural community development, etc.



Total Contract Amount :

USD 98 Million \$

4. International Corporation Strategy

◆ Conclusion

1. I introduce you about the K-plant Smart farm Technology and model today.
2. I think your nation Myanmar need to start the agricultural innovation project by help of Korean ICT technology as I introduce you today ASAP.
3. If you decide to start the new Agricultural Innovation project that you would start by help of our team will help your nation's development very fast and high income situation. I think this is the same target of your national government now.
4. I hope this proposal could help your national agricultural policy and your farmer's life improvement and national income in the end.

Thank You!



Director of Intelligent Smart Farm Export Research Group

Dr. Kim, YoungHwa

kimyh6115@gmail.com, kimyh6115@ekr.or.kr

1. High Tech Agriculture and Smart Farm

Smart Farm generation division

1st
(‘16)

Farmers control greenhouses directly remotely through image

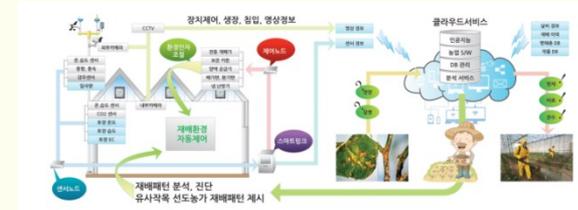
“Farm work more comfortable by smart technology”
Relieve out of tied time and space to control greenhouse environment



2nd
(‘18)

Greenhouse environment can be automatically controlled

“Increasing productivity and quality by smart technology”
Upward leveling of farming skills by analysis of big-data and advanced prescription



3rd
(‘20)

Optimally control energy of smart greenhouse system and robot farm work

“Developing agriculture industry by Korean smart greenhouse”
Entering global market by adjusting international standards

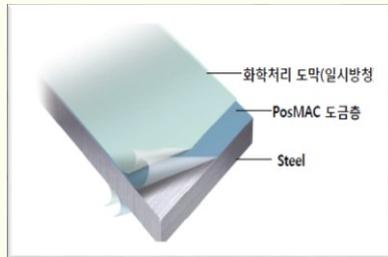


2. Smart Farm Plant System / Element Tech.

➤ K-Plant : PosMAC

Greenhouse structure

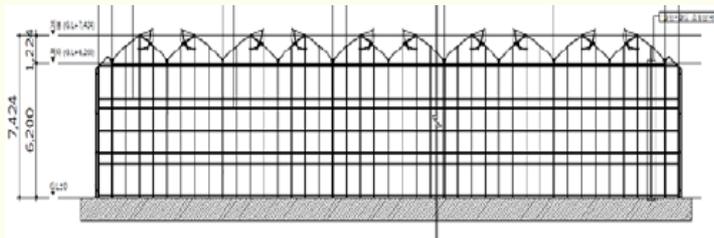
POSCO's steel-frame greenhouses are equipped with an integral opening / closing device Greenhouse Improvement of Greenhouse Environmental Control Conditions



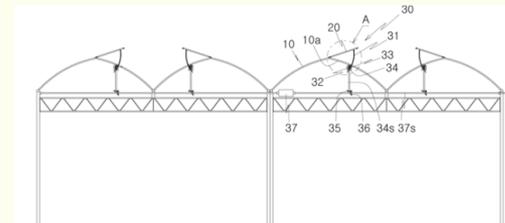
Characteristic

Durability 1.7 times,
Corrosion resistance 5 times
Strength 1.15 times

➤ Integrated type opening / closing device



PosMAC steel-frame greenhouse



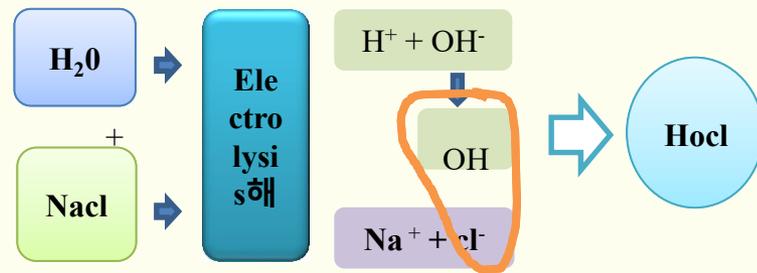
➤ Easy construction with prefabricated structure

2. Smart Farm Plant System / Element Tech.

◆ Plasma sterilizing water

Realization of eco-friendly agriculture by controlling pesticides using plasma sterilized water

➤ Manufacture principle



➤ Sterilization and Active Water



Liquor, nutrition

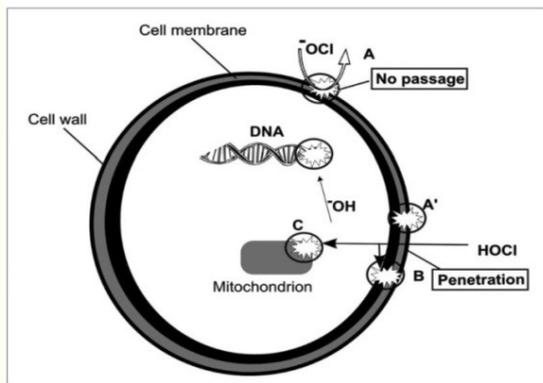
Make Ionized Water and Nanobubbles and Water Supply



Root development
Increased absorption
Waterborne Disease Prevention

➤ Infiltration Sterilization Principle

HOCl penetrates and destroys cell walls
 Physically destroy DNA inside



Strawberry



Melon, Tomato



Cucumber



Lettuce



2. Smart Farm Plant System / Element Tech.

◆ K-Plant Green House Internal facilities

