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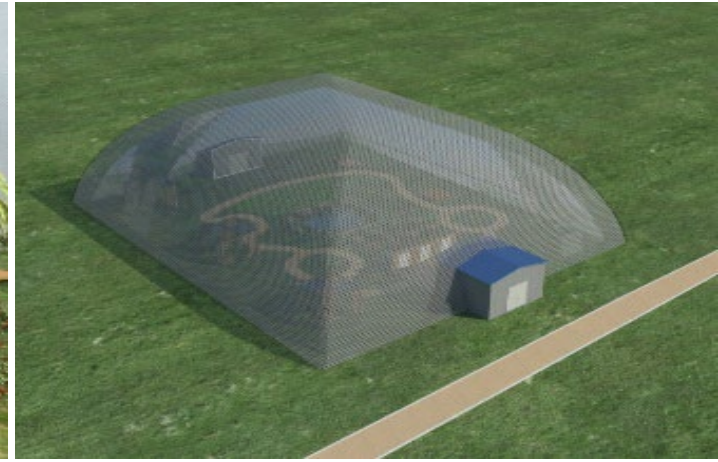


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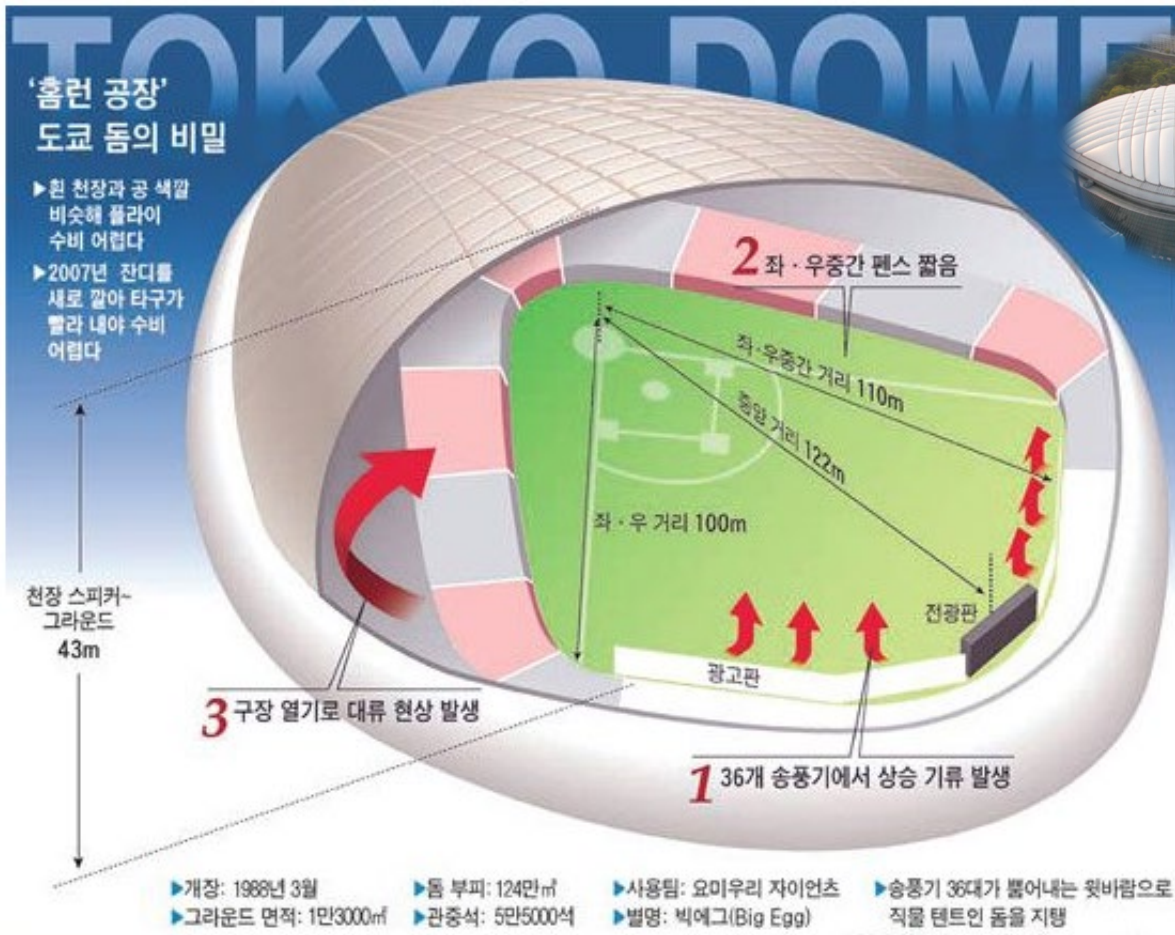


SUN MOK BIO LTD



2019. 01. 03.

Air Dome



CONTENTS

Part 01. What is Air-Dome?

Part 02. Technology

Part 03. Agricultural Air-Dome

Part 04. Multi-purposed Air-Dome

Part 05. Opportunity Factors

World Largest Air Dome Baseball Field

Tokyo Dome

What is Air-Dome?

Large-scale spatial structure without an inner column

Concept

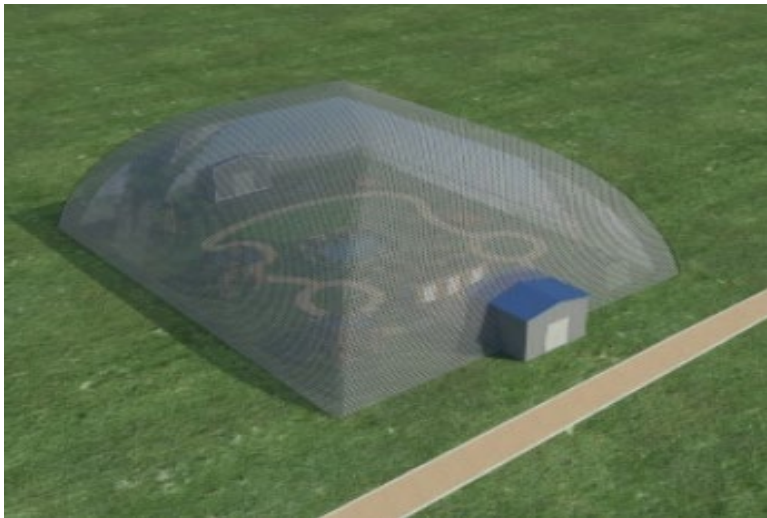
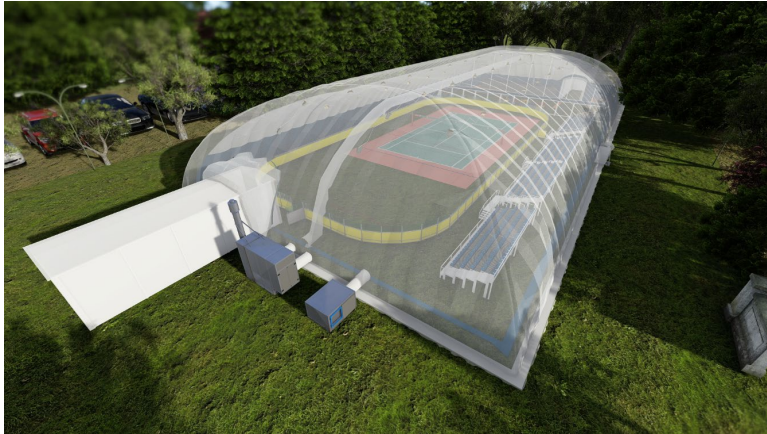
Air-inflated structure that maintains a stable shape by injecting air into a fabric or polyester

Purpose

Various facilities for farming, gym, swimming pool, theme park, etc.

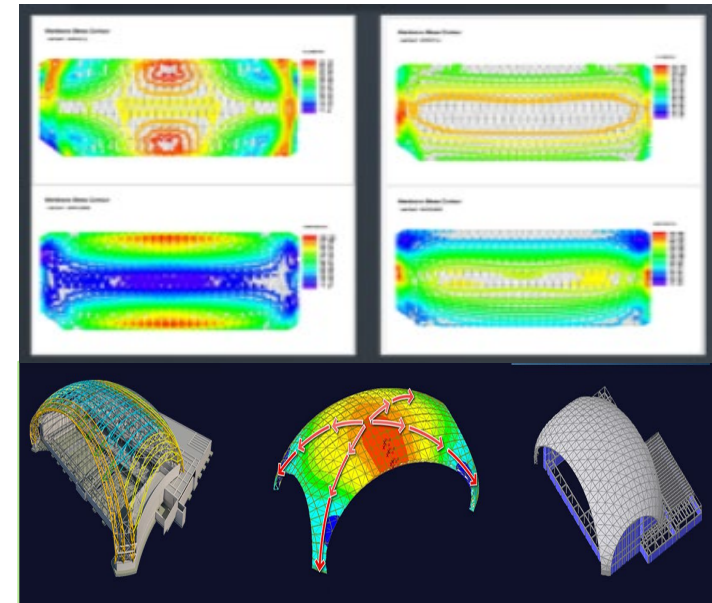


Three-Dimensional & Aerial Views



MODEL FOR INDOOR TENNIS COURT & COFFEE FOREST

Main Structure



- ◆ **External Structure** : Automatic control, Light, Doorway, Anchor, Membrane structure, Cable system
- ◆ **Control Design** : Ventilation, Depressurization control, Strain-Stress analysis, Temperature control
- ◆ **ICT Foundation** : Temperature/moisture control, CCTV monitoring, mobile web configuration

Air-Dome Types

- 99% of domestic air-dome companies in Korea have **air-tightening systems**
- **However, we use air-conditioning systems that air circulate and ventilation inside the air-dome**



WASTE LANDFILL



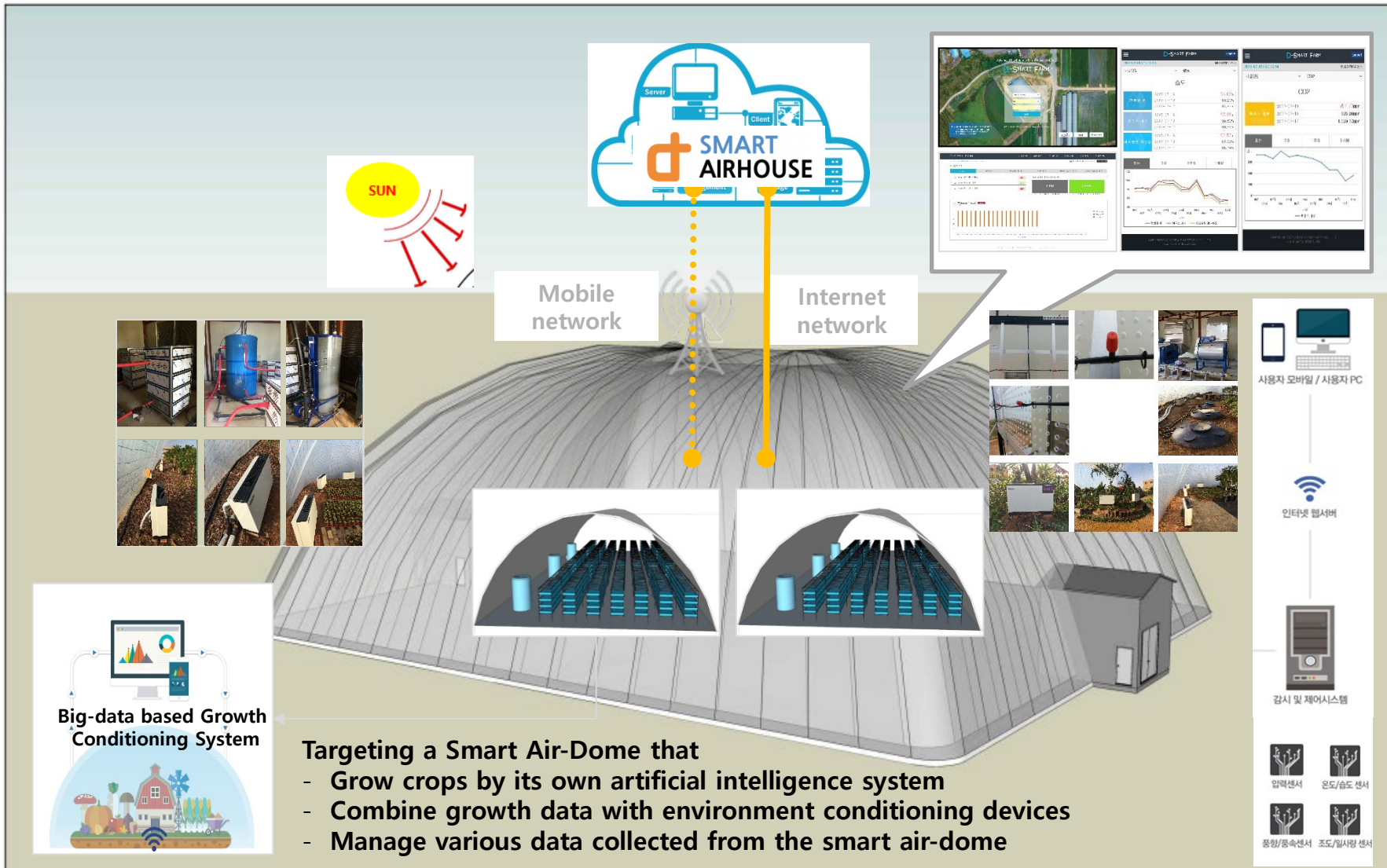
AGRICULTURAL PLANT



MULTI-PURPOSED SPACE

- ◆ **Waste Landfill** : **Air sealing technology**, Air pressure maintaining technology, Shape analysis
- ◆ **Agricultural Plant** : Technologies for Ventilation, Air beam installation, Cooling fog, LED
- ◆ **Multi-purposed Space** : Technologies for Doorway depressurization, **Air conditioning**, lightning

Next-Generation Advanced Management Systems



Strength I : Overcome Space constraints

Securing large space without restrictions on installation location & space



Overcome Space Constraints

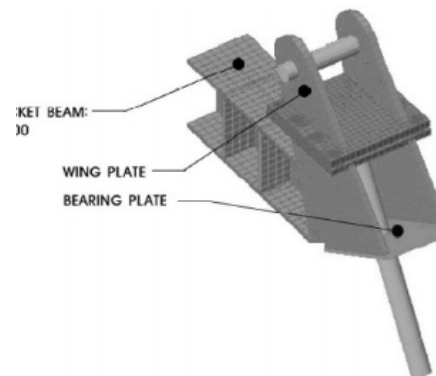
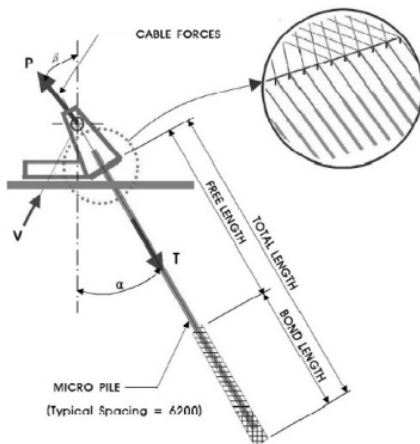
Fast Construction

Solid Structure

Lean Install/Maintenance Cost

Flexible and Multipurpose

High-tech & Aesthetic Value



(a) Front View



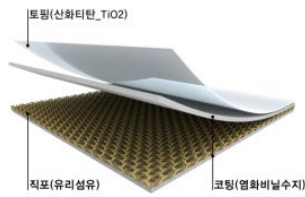
(b) Left View

WHERE, P : 케이블 장력
T : 마이크로파일 인장력
V : 수직반력
 α : 마이크로파일 정착각 (30°)
 β : 케이블 정착각 (40°)

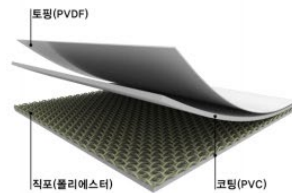
Strength II : Fast Construction

Membrane structure with cable system, On-site prefabricated construction:
all process within 1~3 months

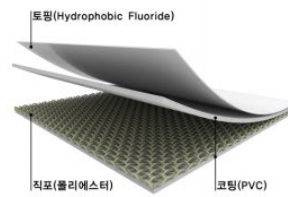
◆막재 재질



B-300:산화티탄코팅 오염방지
준불연재 유리섬유 원단

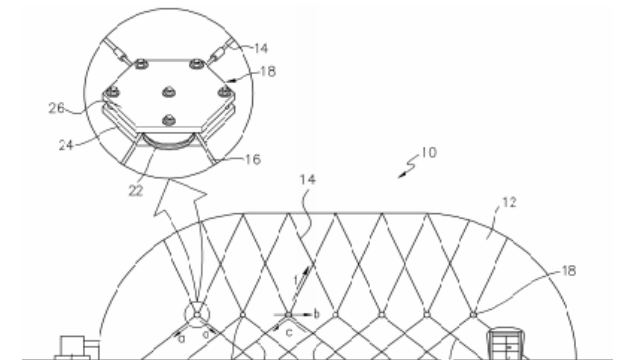


PVDF:불소수지 코팅 기본원단
난연재 폴리에스터원단



ECM:특수불소계 표면처리 코팅
난연재 폴리에스터 원단

Membranes are flame retarding polyester or glass fiber coated with anti-pollution materials



Overcome Space Constraints

Fast Construction

Solid Structure

Lean Install/Maintenance Cost

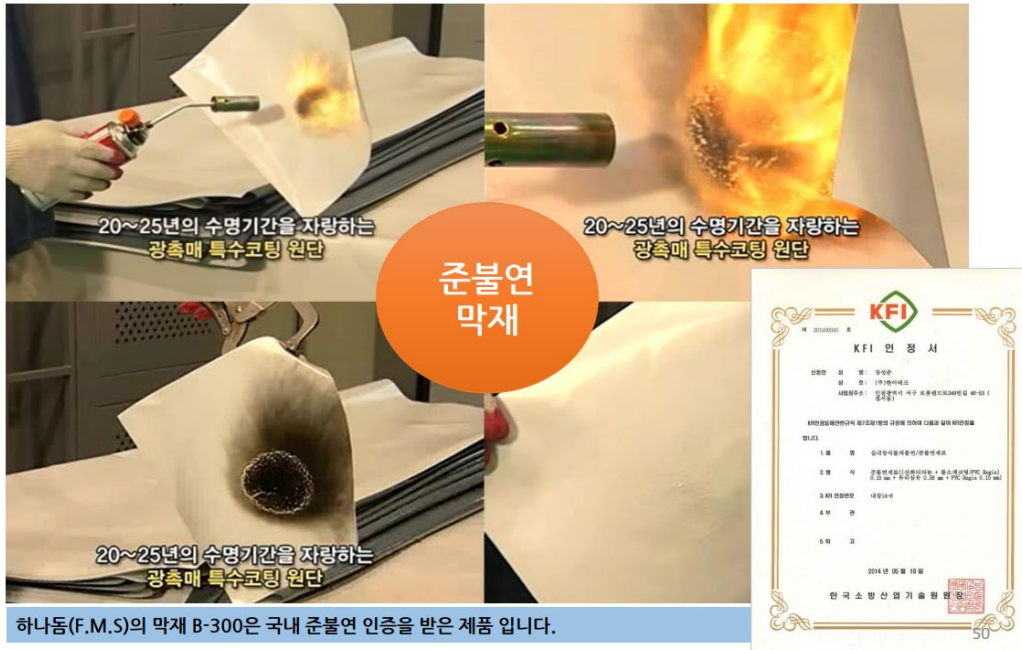
Flexible and Multipurpose

High-tech & Aesthetic Value

Strength III : Solid Structure

Structural Design and Shape Analysis Corresponding to Strong Wind, Snow and Fire

Design Criteria: Wind load 35~45m/sec, Snow load 3.0KN/m²



- Membrane materials last at least 20~25 years

Overcome Space Constraints

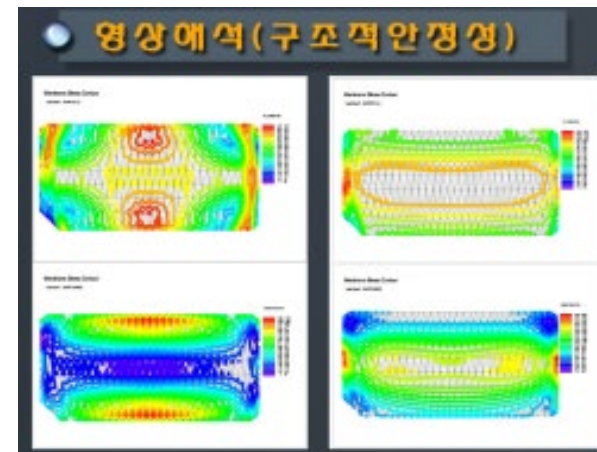
Fast Construction

Solid Structure

Lean Install/Maintenance Cost

Flexible and Multipurpose

High-tech & Aesthetic Value



Strength IV : Lean Install/Maintenance Cost

35 ~ 50% less construction costs compared to steel structures

Reduce maintenance costs

- Air conditioning efficiency improved by optimized daylighting, ventilation
- Easy optical transmittance setting
- No need for lighting during daytime
- 11% electricity cost savings for Sports Dome
- 82% heating cost reduction for Agricultural Dome

Overcome Space Constraints

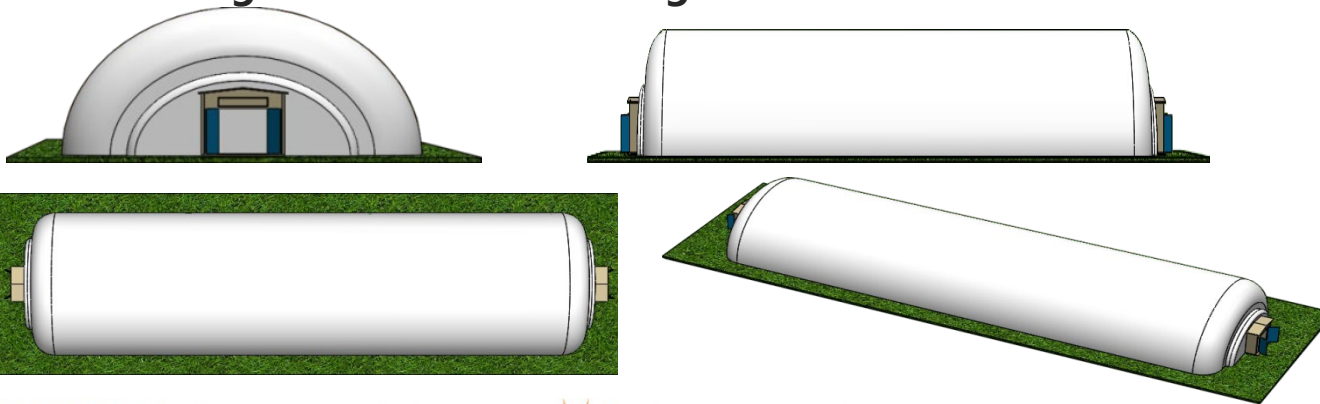
Fast Construction

Solid Structure

Lean Install/Maintenance Cost

Flexible and Multipurpose

High-tech & Aesthetic Value



◆ 유지관리 비용 절감 효과



- ① 10 year warranty for membrane material pollution
- ② Membrane material transmit 11% of solar radiation

- Intensity of illumination reaches up to 1100 lux inside of air-dome.

Strength V : Flexible and Multipurpose

By securing large spaces, you can play baseball, soccer, swimming pool, tennis court, etc. It is the best business for **life-friendly SOC**s such as small and medium event venues, book cafés and galleries.



Overcome Space Constraints

Fast Construction

Solid Structure

Lean Install/Maintenance Cost

Flexible and Multipurpose

High-tech & Aesthetic Value

Strength VI : High-tech and Aesthetic Value

- High-tech fiber materials, Perfect fine dust cut-off, and comfort
- **Securing aesthetic effects through painting and symbolic patterns on the exterior wall of the air dome**

Overcome Space Constraints

Fast Construction

Solid Structure

Lean Install/Maintenance Cost

Flexible and Multipurpose

High-tech & Aesthetic Value



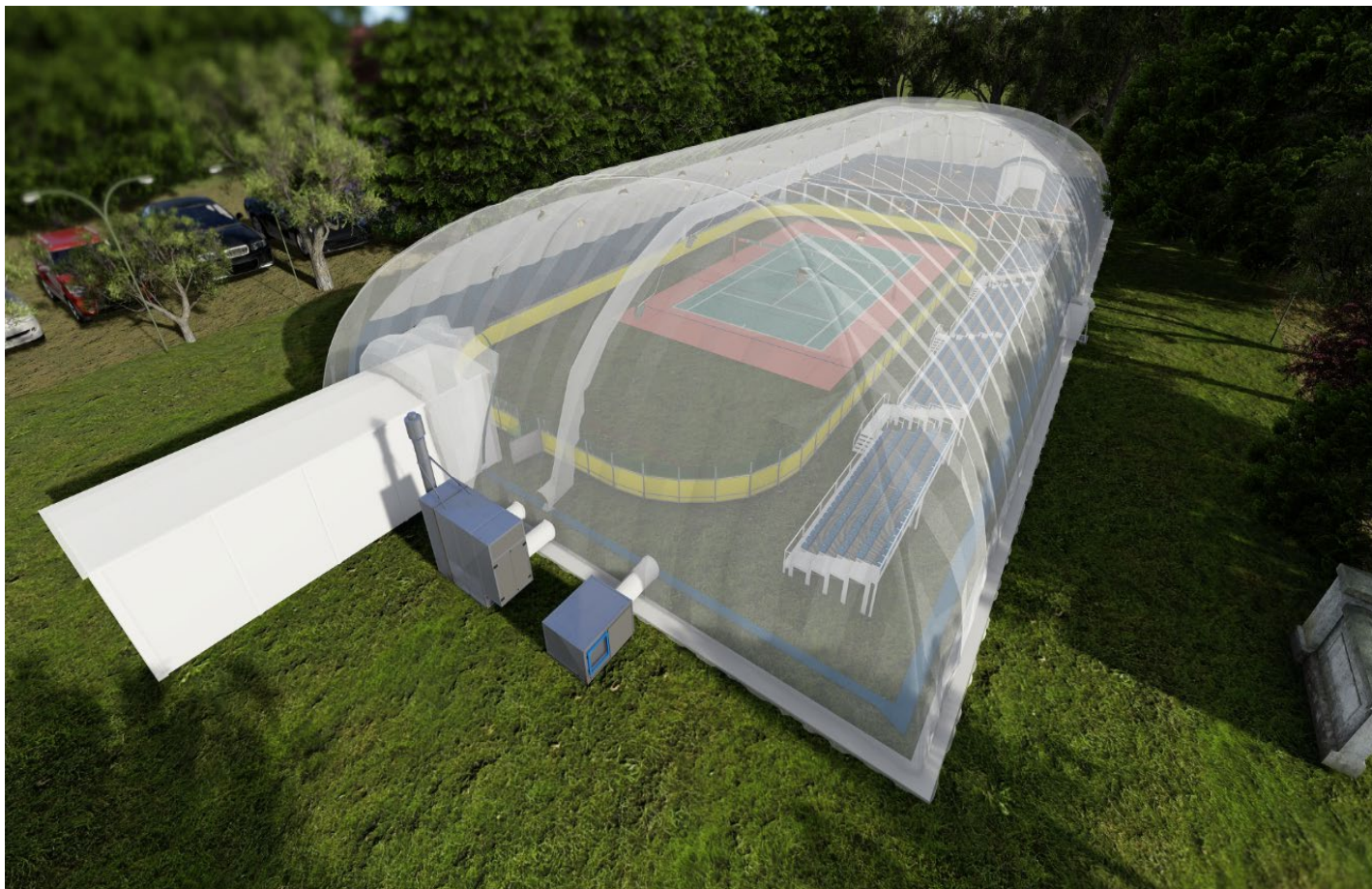
Technology

Air-Dome Related Specialties

Core Technologies

Thermostatic System

Antimicrobial Filter System



Technology I : Air-Dome related specialties

- Air-Dome Smart Farm Crop Cultivation System using real-time data
- Systems for Film condensation, Temperature control, air ventilation

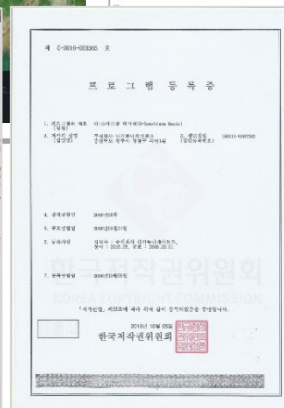
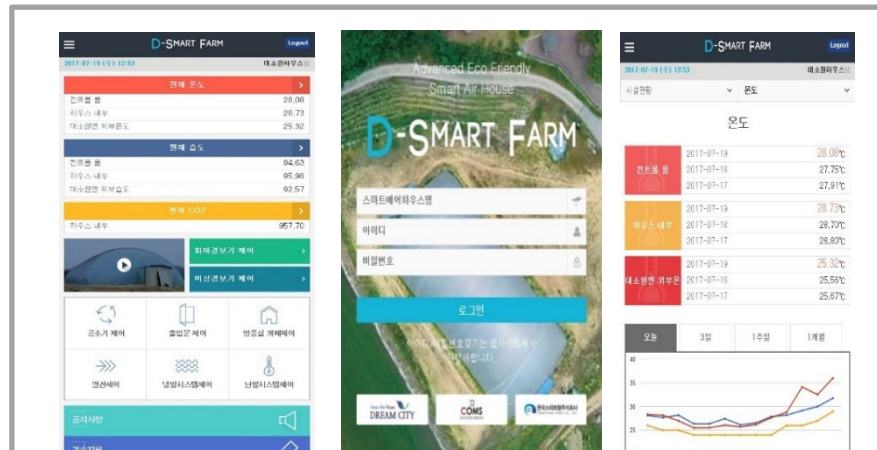
Technology

Air-Dome related Specialties

Core Technologies

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Antimicrobial Filter System



Technology II : Core Technologies

Technology

Established in 2012 and Continued to develop new technologies since the first Air Greenhouse project in Chung-ju city (broadcasted through MBC)

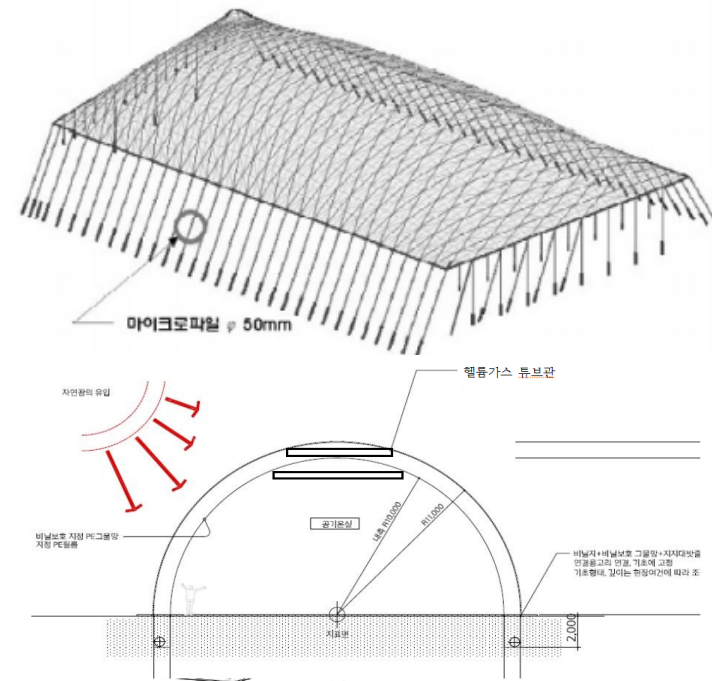
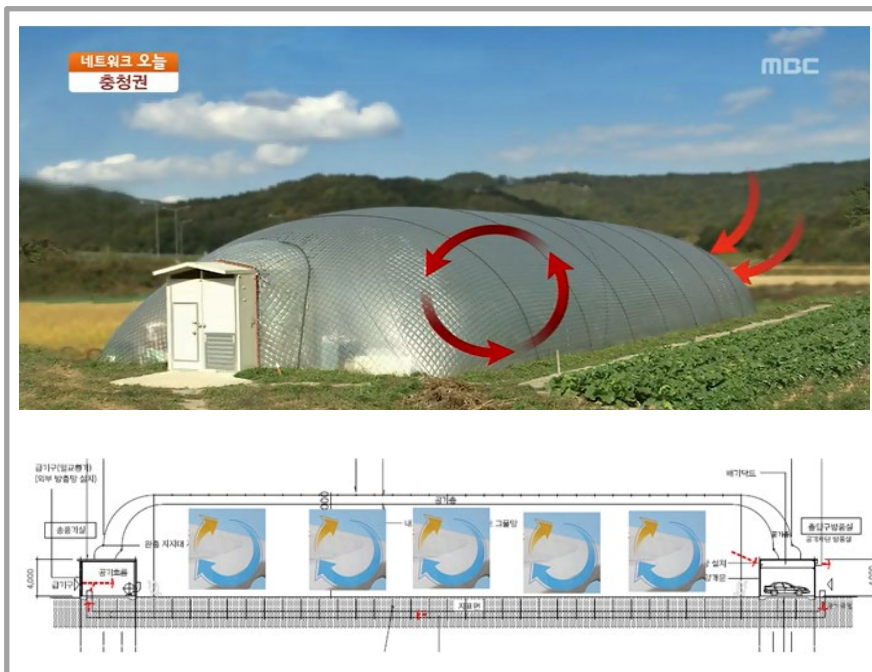
- **Frame Structure** construction knowhow
- **Air Filtering, Ventilation & Conditioning** System
- **Exit Depressurization & Air-lock**
- **Air-beam** to reduce tension

Air-Dome Related Specialties

Core Technologies

Thermostatic System

Antimicrobial Filter System



Technology III : Thermostatic System

Technology

Air-Dome Related Specialties

Core Technologies

Thermostatic System

Antimicrobial filter System

난방 시스템

- 겨울철 주간 실내온도 25~28℃ 자동조절
- 야간특성상 겨울철 새벽(04~07시) 실내온도 5℃ 이상 유지
- 전기보일러 및 서클레이터를 통해 야간 실내온도 10℃ 이상 유지 가능
- 냉방시스템과 호환 설치 가능
- 공조실 내부에 열복사 에너지 패널 설치로 데워진 공기 주입

H-SMART AIRDOME

냉방 시스템

- 공조시설 일체형-콜링포그 분사시스템 제어
- 열전소자를 이용한 지하수 급속냉각 시스템 기술 보유
- 여름철 외부기는 35℃ 기준 내부온도 28~32℃ 유지
- 추가 냉방장치 설치로 26~28℃ 유지 가능
- 공기순환 자동개폐장치 및 서클레이팅 시스템 기술 보유

Technology IV : Antimicrobial Filter System

- A five-fold natural filtering system prevents fine dust and creates anti-bacterial effects

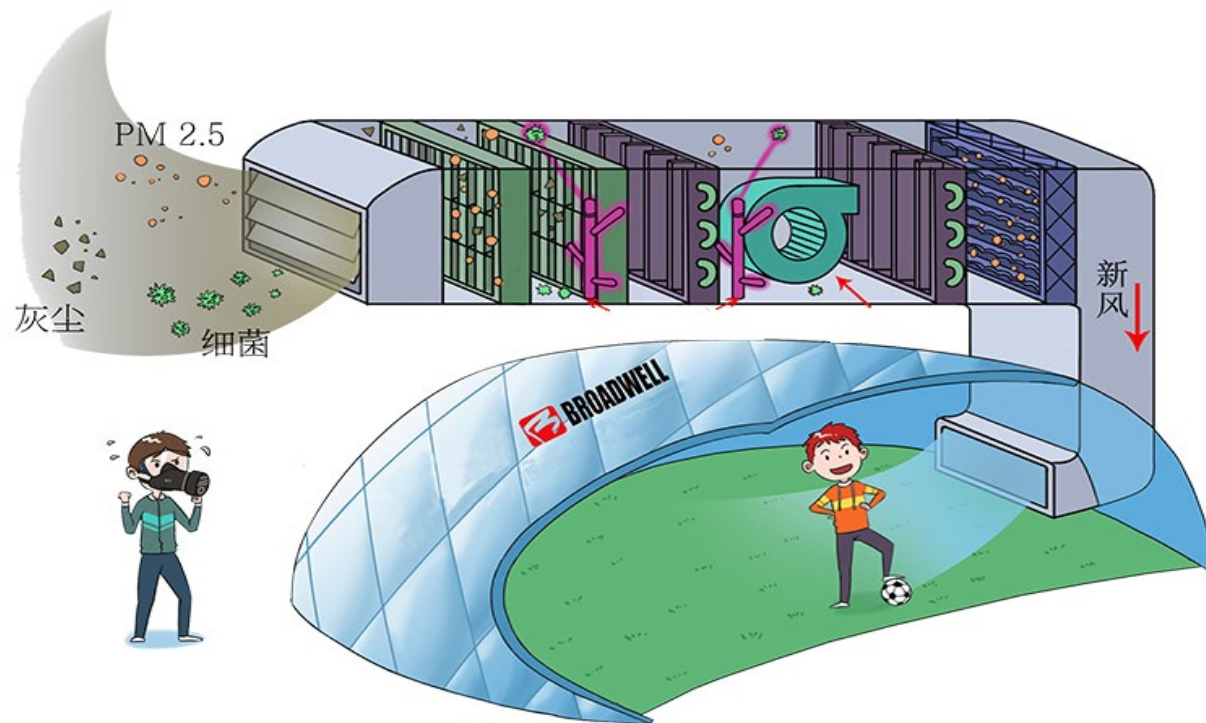
| Technology

Air-Dome Related Specialties

Core Technologies

Thermostatic System

Antimicrobial Filter System





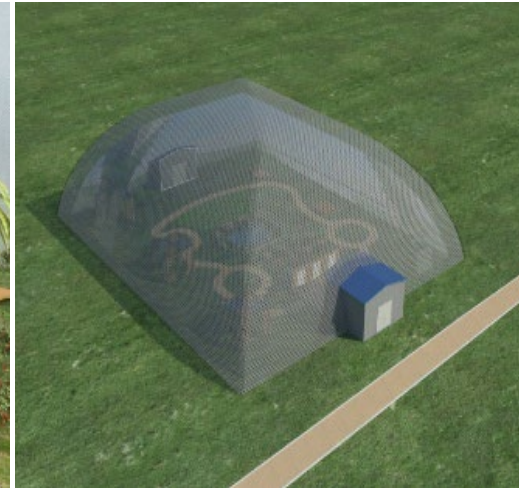
Agricultural Air-Dome

System Configuration

Smart Farm Solution

Performance Analysis

Main Install Case



Story I : System Configuration

Air-Dome House System

- State-of-the-art method for growing a variety of crops without internal columns
- Large-sized air-house with a non-pneumatic tube (double vinyl house)
- Wind-resistant Facility House against strong snow and strong winds
- Facility material : vinyl (0.15mm), supporting principle (air pressure 0.3 bar or higher)
- Air injection : 5 air blaster with 1 air ven-tilater
- Facility type : Dual tube type vinyl house

Main Components of Facility

- 1,650m² unit : L 75m, W 22m, H 10m (adjustable)
 - Entrance and Technical Compartment
 - Air Vent System Room
(Air Inlet - Cooling and Air Vent System Installation)
 - Ventilator Room
(air is vented into cabin - door automatic switch gear)
 - a double-vinyl house
 - Passage between inner and outer vinyl (about 1m)
- Vinyl Protection net : In/External double installation
- 0.15mm thick domestic and Japanese PO film
- Support Rope : Installed in an in/external house
- Vinyl, vinyl protection net, support rope buried underground

Agricultural Air-Dome

System Configuration

Smart Farm Solution

Performance Analysis

Main Install Case



Story II : Smart Farm Solution

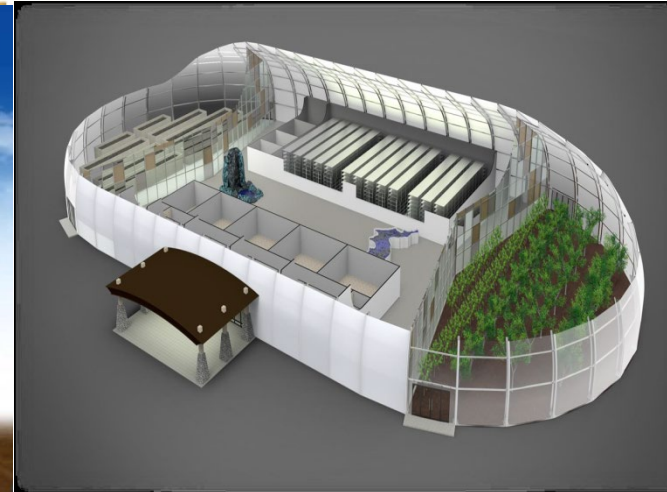
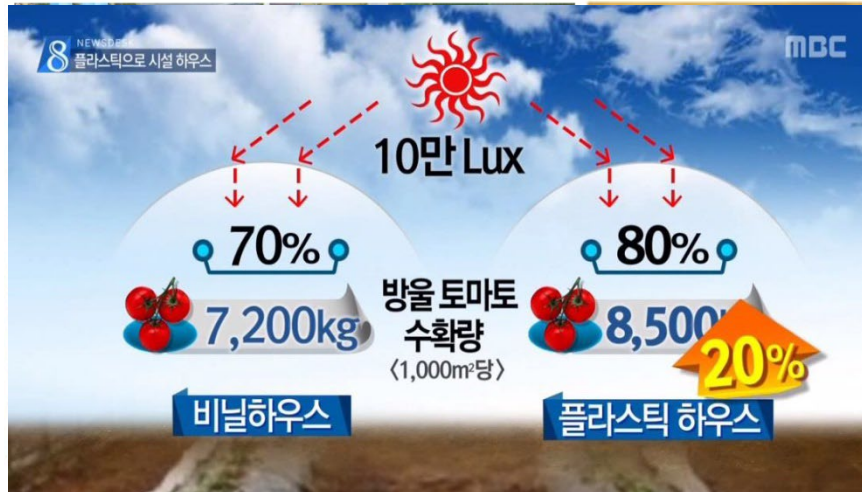
- Specialties for a Real-time Based Air-house Crop Cultivation System | Agricultural Air-Dome

System Configuration

Smart Farm Solution

Performance Analysis

Main Install Case



선진 생장 환경 제어 시스템 스마트 에어하우스

[차세대 농산물생육환경 솔루션 - 스마트 에어하우스]

- 센서 및 각종 제어장치를 이용한 스마트 팜 팩토리
- 실내 생육환경 설비 개별 동작 및 원격 제어를 통한 친환경 정밀농업 실현
- 하우스 실내 환경 (온도, 습도 등) 모니터링 및 알림 시스템

Story III : Performance Analysis

category	General house (1-2W type)	AIR DOME(Air-House)
Facility type	1-2W type (linked house)	a large single house
House size	W7m x L72 x 4linked	W100mxL50m(Wide Width Single)
House Height	Interval 1.8m, Height 4.8m	Interval 2m, Height 9m above
Facility material	Iron(Pipe, Vinyl, etc)	Special Vinyl(weaving film), PVDF, ETFE
Cladding Vinyl	Thickness 0.1mm(2 layer)	Thickness 0.3mm~1.0mm(2 layer)
Vinyl Durability	2-3 year	7-10 year (max15)
Construction period	More than 60 days	1~3 months needed
thermal effect	Min 0°C below, Max 50°C above	Winter Min : 5°C, Summer Max 30°C
Control function	Big Deviation (temperature, humidity)	No deviation
Transmission Rate	60,000 Lux	50,000 Lux
Work Condition	Below Small Tractor	Large tractor, Excavator, etc
Labor Force Required (Tomato)	627hr/10a	417hr/10a : 33.4% saved
Conditions of growing crops	Standard growth condition	Excellent growth condition
Grain quality (product rate)	75-81%	90-95% : Maximum Quality 20% improved
Amount of harvest (drop tomatoes)	Productivity : 6,800kg/10a	9,270kg/10a : Productivity max 36% improved

Agricultural Air-Dome

System Configuration

Smart Farm Solution

Performance Analysis

Main Install Case

Story IV : Main Install Case

Agricultural Air-Dome

System Configuration

Smart Farm Solution

Performance Analysis

Main Install Case



[커피하우스 - 내부전경]



[커피하우스 - 내부전경]



[커피하우스- 외부전경]

- Inside and exterior photos of a Coffee House



[커피하우스 - 송풍실]



[커피하우스 - 냉난방 설비]



[커피하우스- 냉난방 설비]

- Air cooling, heating and ventilating facilities of a Coffee House



Multi-purpose Air-Dome

Indoor Sport

Concert Hall

Event Venue

VR Theme Park

Story I : Indoor Sport



Multi-purpose Air-Dome

Indoor Sport

Concert Hall

Event Venue

VR Theme Park

- Various use based on membrane materials, light bulbs, and internally intalled facilities
- Tennis courts, Badminton courts, and Foot volleyball
- Kids café & Playgrounds
- For swimming pools, possible to maintain indoor temperature with no power

Story II : Concert Hall



- 360° beam projected, laser show
- A variety of multimedia shows

Multi-purpose Air-Dome

Indoor Sport

Concert Hall

Event Venue

VR Theme Park



Story III : Event Venue

Multi-purpose Air-Dome

Indoor Sport

Concert Hall

Event Venue

VR Theme Park



- Mini-capsule air-domes for event use or as an interior structure
- Can be configured as inside Shop-in-Shop
- Can be used as VR Corner

Story IV : VR Theme Park

Multi-purpose Air-Dome

Indoor Sport

Concert Hall

Event Venue

VR Theme Park



| Opportunities

Smart Farm Valley

Farm Complex Solution

Fine Dust & Evacuation



Opportunity I : Smart Farm Valley

Opportunities

Smart Farm Valley

Farm Complex Solution

Fine Dust & Evacuation



스마트팜 혁신밸리 - 경상북도 상주

- 스마트팜 관련 생산·교육·연구 기능을 모두 갖춘 산업단지
- 기존 농가가 입주하는 생산단지 11.2ha
- 경영실습을 위한 임대형 스마트팜 8.2ha
- 기반시설조성, 청년보육, 생산·유통, 기술혁신
- 지역경제 활성화 기반, 청년 인력 육성
- 양질의, 지속가능한 청년·지역 일자리 창출
- 스마트팜은 경쟁력 있는 생산시스템
- 스마트팜 확산을 위한 정책 지원 확대

- Smart Farm Valley in SangJu city, KyungPook province, South Korea

스마트팜 창업 생태계 조성

- 스마트팜 청년창업 보육과정
- 청년 임대형 스마트팜 조성
- 기술력, 가능성 중심 투자
- 경영위기 농가에 대한 안전망 강화

스마트팜 산업 인프라 구축

- 실증단지 구축 / 제품 신뢰도 향상
- 스마트팜 관련 R&D 체계화
- 스마트기술을 고도화, 표준화
- 농업 지원 강화 및 전문인력 양성
- 국내·외 판로 지원/ 시장·품목 다변화

스마트팜 혁신밸리 조성

- 스마트팜 혁신밸리 개념 조성
- 2022년까지 전국 4개소 조성
- 산·관·연 협업을 통한 먹거리 발굴
- 첨단 농업단지로 발전
- 지역 특성에 맞는 특화 모델 발굴

- In South Korea, 4 Smart Farm Valley is going to be constructed by 2022!

Opportunity II : Farm Complex Solution

Opportunities

Smart Farm Valley

Farm Complex Solution

Fine Dust & Evacuation

스마트팜 혁신밸리 & 이웃사촌 청년마을 시범사업

- 차세대 스마트팜 시스템 적용(ICT기반 작물생장 관리)
- 다양한 작물을 재배할 수 있는 내부 기둥이 없는 첨단 공법
- 무지주 공기압 튜브형 대형 에어하우스 (2중 비닐하우스)
- 적설과 바람에 강한 스마트팜 솔루션



[스마트팜 혁신밸리 조감도]

- 차세대 농업 선진화 기술
- 농업용 하우스와 ICT 기술 융합 기반 제품
- ICT 융합 기반 농업기술
- 에어돔을 이용한 한국형 스마트팜 구현

- Various kinds of crops can be cultivated together in a air-house (dome) without internal columns.

Opportunity III : Smart Farm Valley

Opportunities

Smart Farm Valley

Farm Complex Solution

Fine Dust & Evacuation

포항에 국내 최초 에어돔 지진대피시설 설치...400명 수용
(포항=뉴스1) 최창호 기자 | 2018-05-18 08:00 송고

기사보기 | 내리존회원 | Tweet | +1 | +1 | +1

"먼지 막자"...학교운동장 덮는 '에어돔' 검토

학교 미세먼지 대책 '에어돔' 건설... 전문업체 '시공상론 문제없다'
'시스템 운영할 관리원 필요'

최근 경기도교육청이 미세먼지 대응방안으로 검토 중인 것으로 알려져 주목받고 있다. 에어돔 시스템을 운영하는 관리자가 필요한데, 지난 9월 도 교육청에 따르면 지난해 미세먼지 대책으로 학교당 평균 7년에 달하는 기간을 10조원 이상이 필요해 현실적

에어돔은 공기막(membrane) 지붕을 가진 건축물 중 가장 경제적인 것으로 알려져 있다. 비는 빗물구조물의 약 35~50% 수준이다.

학교운동장 덮는 '에어돔' 검토

원근기... 김자호 참조
지역 600개소 등 해외에선
및 효율성 입증
만원

명성호 경기도교육청 체육건강교육과장
체육관보다 시설 투자도 적게 들고, 공사기간도 짧고 실제적으로 넓은 공간에서 많이 활용할 수 있겠다는 생각에서 에어돔을 제안했습니다.

<학교체육특별기고>미세먼지 해결, 에어돔은 어떻게
기사입력 2018-08-08 15:45:32 | 최종수정 2018-08-09 05:30:04

강한남자의 비결! 블랙마카?

중국 베이징 ISB국제학교의 에어돔.

- Air domes helped people under earthquake damage, reduce students' pain from fine dust!

Maintenance & Upgrade

- Provide emergency handling manuals
- Dispatch field companies for failure of ventilation system
- Smart system contents upgrade!
 - * Frequent monitoring S/W bugs and errors
 - * Inspect consumables once in a month
 - * Machine safety inspections frequently
 - * Upgrade every year, free of charge!
(replacing contents for charge)



Thank you!

