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The MED Greenhouses project

Training Course Material for Stakeholders/actors regarding MED Greenhouses installations

University of Thessaly (Lead Partner)

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- ❑ Introduction of MED Greenhouses
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Objectives

The Innovative Technology of MED Greenhouses aims to address issues related to energy & water efficiency & sustainable agricultural production, contributing to Green Growth & Circular Economy.

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Incentives 1/2

- *Contribute to Climate Change Adaptation, coping with:*
  - ***Water scarcity***
  - ***Water pollution***
  - ***Extreme weather conditions***



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Incentives 2/2

- *Addressing issues of agricultural production:*
  - ***Water availability***
  - ***Increased cost for energy***
  - ***Increased cost of raw materials***
  - ***Increased market competition***
  - ***Increased demand for product quality***
  - ***Loss of agricultural land for other activities***

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Introduction of MED Greenhouses

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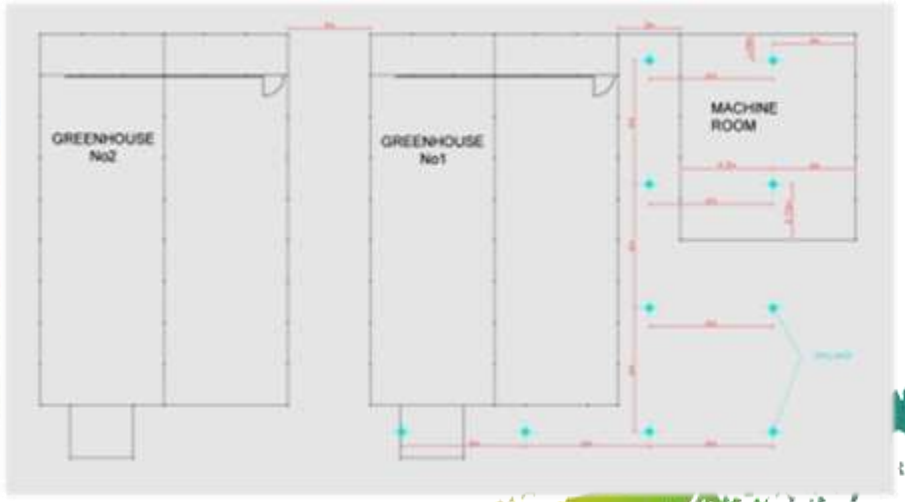
Introduction of MED Greenhouses

Overview of the Construction process



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Introduction of MED Greenhouses

Subsystems:

- Natural cooling & ventilation system
- Dynamic cooling & ventilation system
- Heating system
  - Geothermal heat pumps
  - Oil boiler
- Curtain / thermal insulation curtain system
- CO_2 Enrichment System
- Air Drying System
- Hydroponics system
  - Closed System
  - Open system
- Central System Control System

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Introduction of MED Greenhouses

❑ Natural cooling & ventilation system (Top windows)

- ❑ Dynamic cooling & ventilation system
- ❑ Heating system
  - ▪ Geothermal heat pumps
  - ▪ Oil boiler
- ❑ Curtain / thermal insulation curtain system
- ❑ CO_2 Enrichment System
- ❑ Air Drying System
- ❑ Hydroponics system
  - ▪ Closed System
  - ▪ Open system
- ❑ Central System Control System

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Introduction of MED Greenhouses

❑ Natural cooling & ventilation system

❑ Central System Control System

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Introduction of MED Greenhouses

- Natural cooling & ventilation system
- Dynamic cooling & ventilation system
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Introduction of MED Greenhouses

Geothermal Energy Subsystem

- The greenhouses' energy needs for cooling, heating and conversion of water vapour are being covered by a vertical closed loop geothermal system which is built next to the greenhouses, exploiting the available shallow geothermal energy field.
- This system offers significant advantages over other forms of energy as it is a renewable energy source which does not burden the environment with additional pollutants, reducing carbon emissions footprint.
- MED Greenhouses are based on Geothermal Heat Pumps Systems that exploit shallow geothermal energy (exploitation of stored energy of low depth rock and surface / ground water with temperatures <25ºC)

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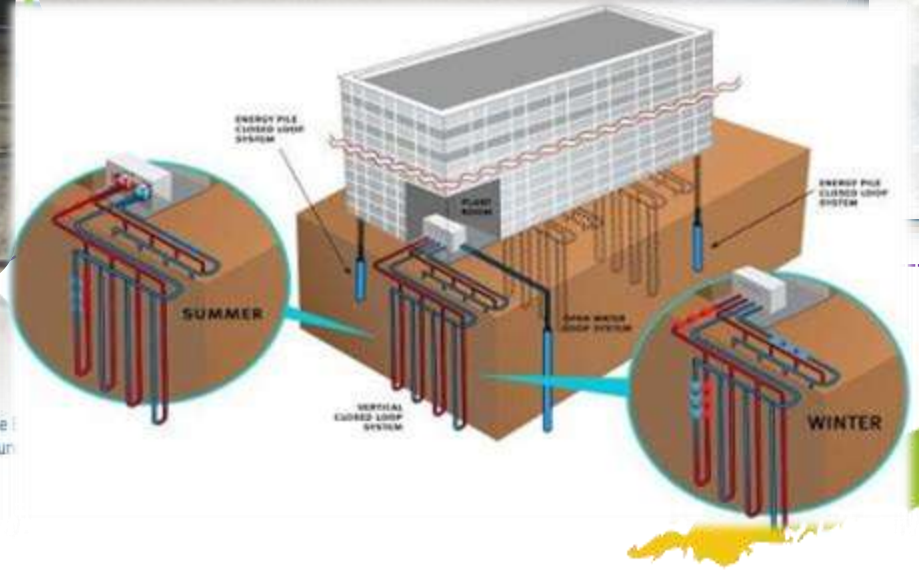
Introduction of MED Greenhouses

Geothermal Energy Subsystem

The system consi



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Introduction of MED Greenhouses

Mediterranean

MED Greenhouses

Introduction of MED Greenhouses

- Natural cooling & ventilation system
- Dynamic cooling & ventilation system
- Heating system

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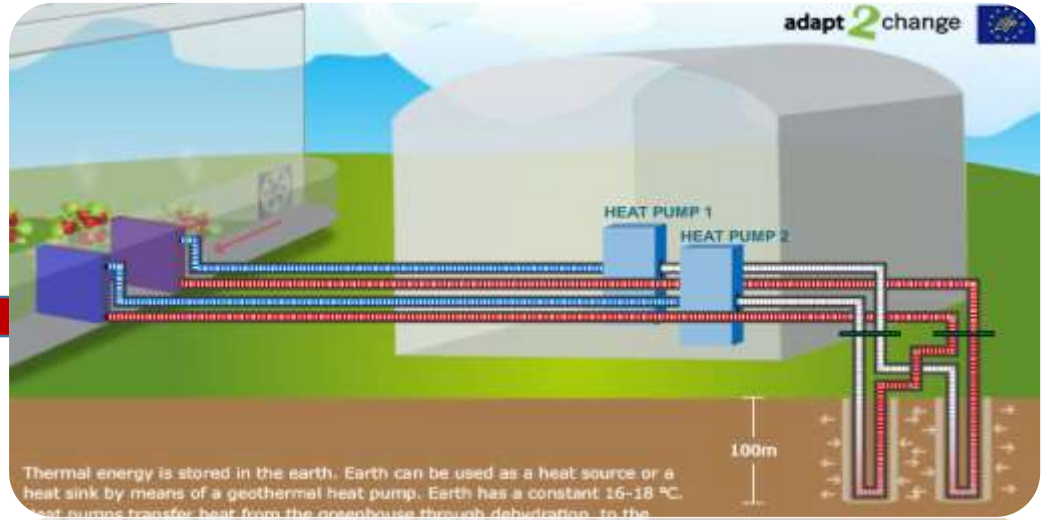
Introduction of MED Greenhouses

❑ Natural cooling & ventilation system

❑ Central System Control System



❑ The humidity of the air is converted into water

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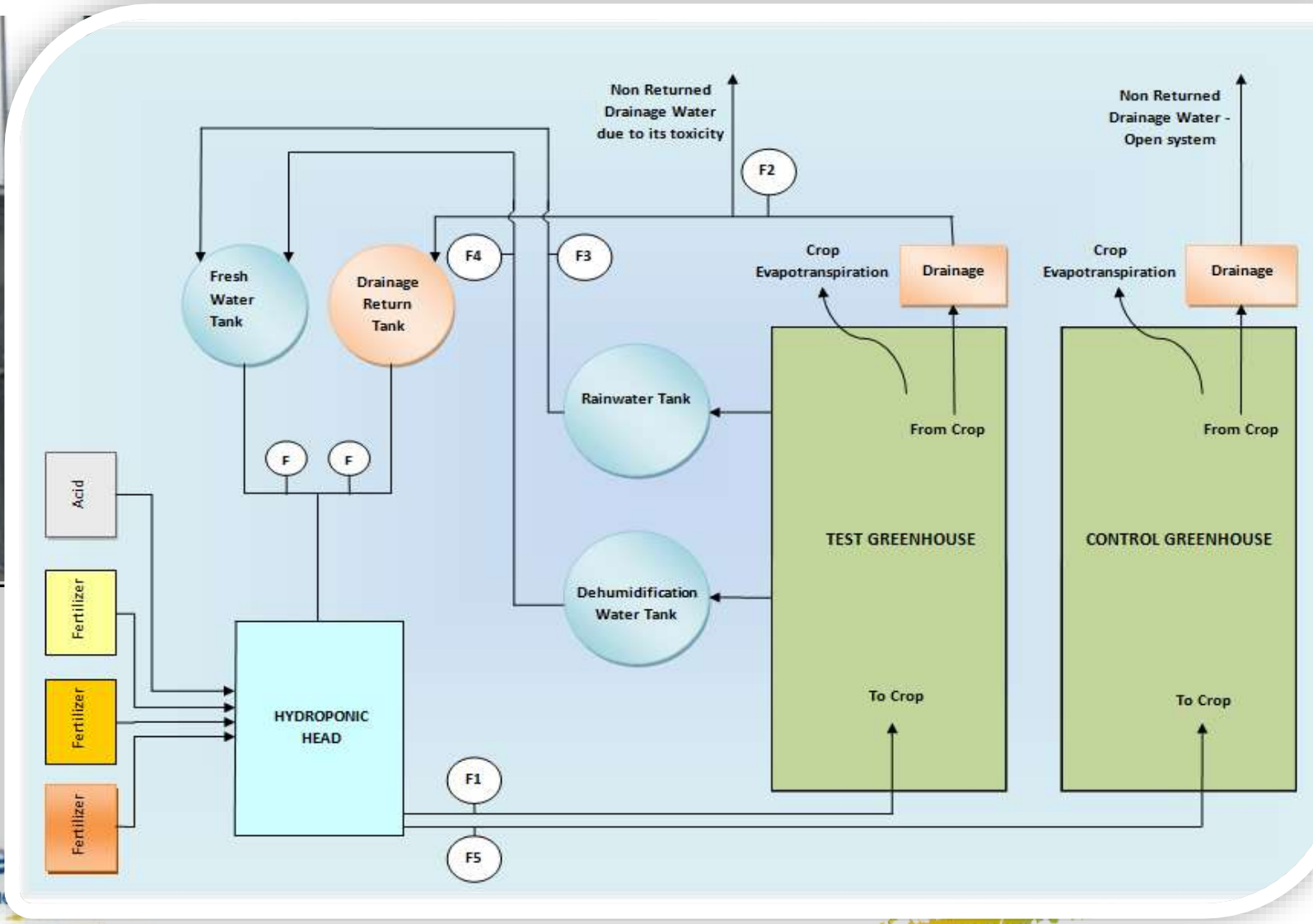
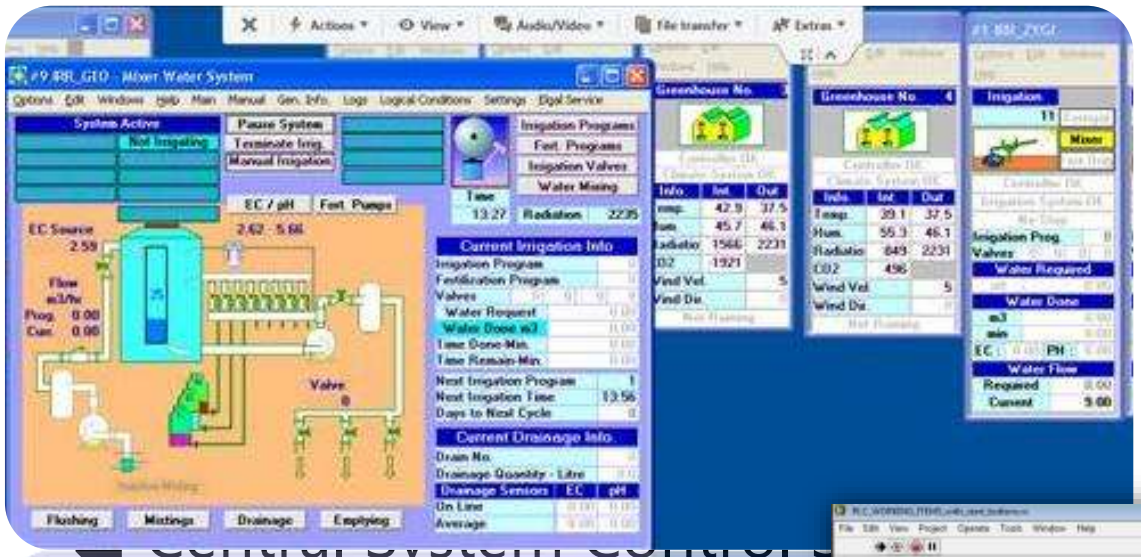
Introduction of MED Greenhouses



Introduction of MED Greenhouses

- Natural cooling & ventilation syste



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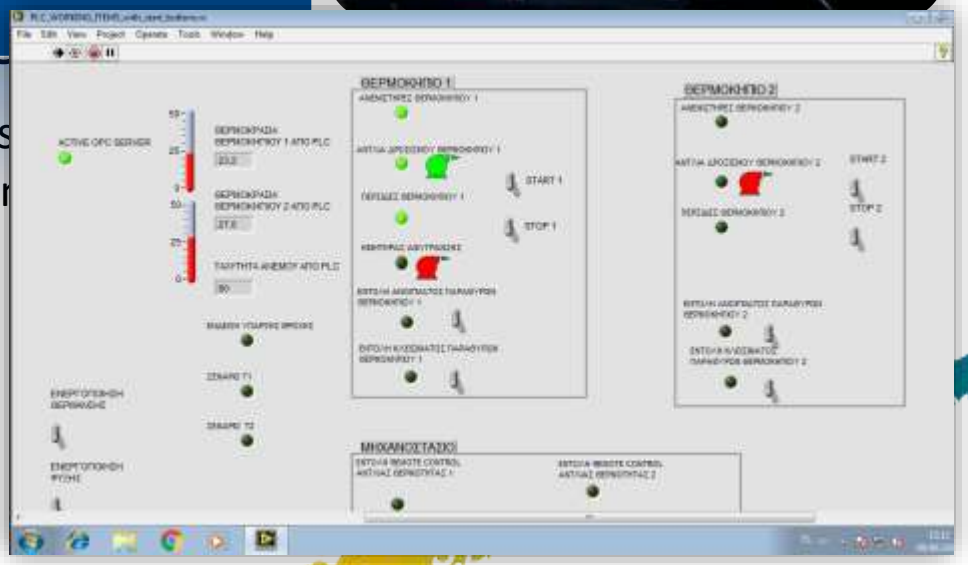

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Advantages compared to Conventional GH

Energy Performance

✓ The mean Energy reduction (Kwhe) can by up to **67%**.

Water Efficiency

✓Working as a closed hydroponic system the MED Greenhouses can reduce water consumption by up to **45%**
✓This reduction can reach **70%**, compared to open filed cultivation practices.
✓Considering the additional water retention systems installed inside the MED Greenhouses (i.e. rain-water re-circulation systems), the water re-use can reach, in some cases, **100%**
✓The cooling system of the MED Greenhouses (capacity of 150 W m-2) has the potential to increase the water use efficiency by up to **75%**.

Environmental Benefits

✓The mean CO_2 emissions reduction can be ranged between **46-52%**.
✓The use of fertilizers can be reduced by approximately **30%** compared to an open hydroponic system; this reduction can reach and surpass **60%** compared to open cultivation practices.

Disadvantages of MED Greenhouses

- The up-front **high capital cost** in order to establish the MED Greenhouse. Although such investment seems profitable, the need for drilling and installing this innovative technology increase the cost of the construction/investment. **Overall, it is worth-wile to invest in large scale geothermal greenhouses, payback.**
- A drawback of applying geothermal energy in greenhouse operation is, additionally, the **extended land required for drilling and exploitation**. Generally, the geothermal unit delivers the maximum capacity, as less is the distance between the greenhouse and installed point of the drilling wells. That makes geothermal systems hard to be applied in already established greenhouses, unless a vertical ground source heat pump is used.
- **MED Greenhouses require experts and well trained operators to establish and monitor the whole system**, while proper education and training of the users is also required for its operation.

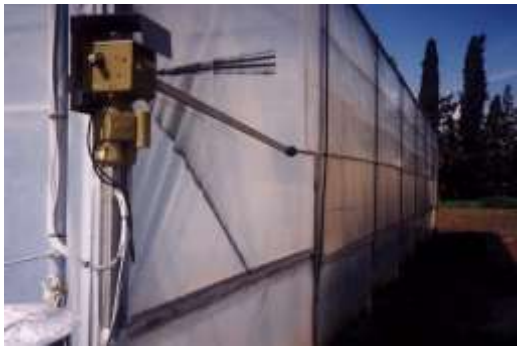
Transferability factors

- There is no significant geographical limit
- In vertical loops, ground is not the limit but the investment and functional cost demanded to drill to this depth and the accessibility in innovative technologies needed for producing geothermal
- Drilling aspects:
  - Geology
  - Hydrology
  - Land availability
- Access by the responsible ministry authority of the area
- An access to the spatial distribution data, therefore, of the area in which geothermal technology intended to be transferred will aid the experts to clarify the feasibility of the system in the specific area

MED Greenhouses – Photo Gallery 1/2












MED Greenhouses

MED Greenhouses – Photo Gallery 2/2

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Thank you for your attention!

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