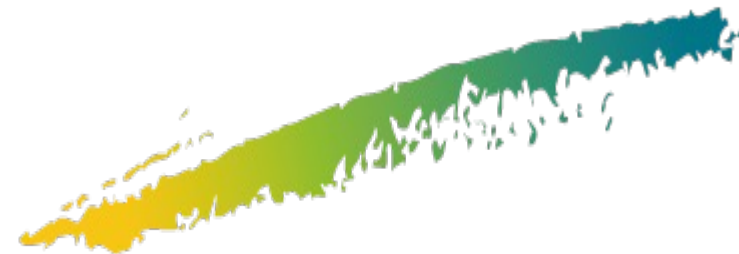


The MED Greenhouses project
Training Course Material for Stakeholders/actors
regarding MED Greenhouses installations
University of Thessaly (Lead Partner)



Contents

- ❑ Objectives & Incentives
- ❑ Introduction of MED Greenhouses
- ❑ Pros & Cons
- ❑ Transferability factors



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.



Incentives 1/2

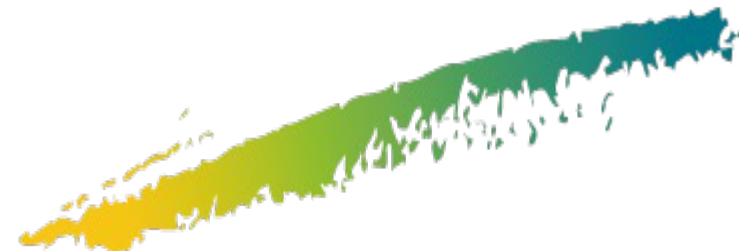
- ❑ *Contribute to Climate Change Adaptation, coping with:*
 - **Water scarcity**
 - **Water pollution**
 - **Extreme weather conditions**





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***



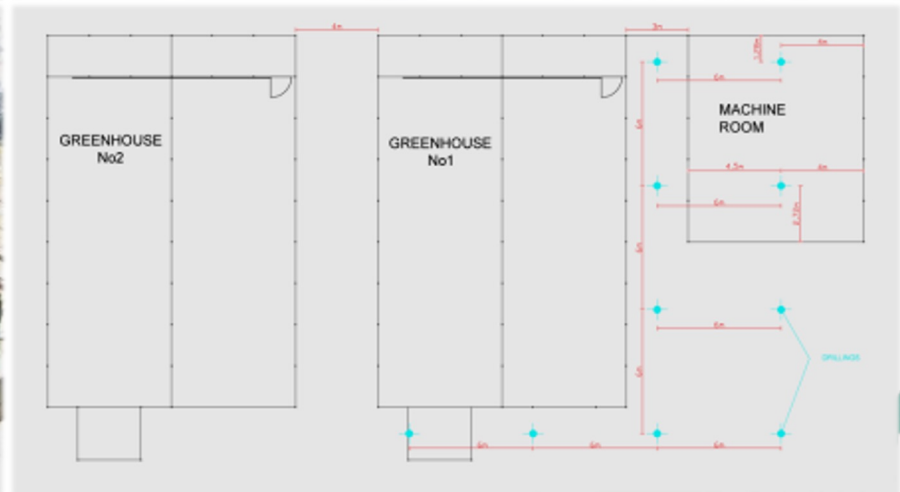


Introduction of MED Greenhouses



Introduction of MED Greenhouses

Overview of the Construction process





Introduction of MED Greenhouses

Subsystems:

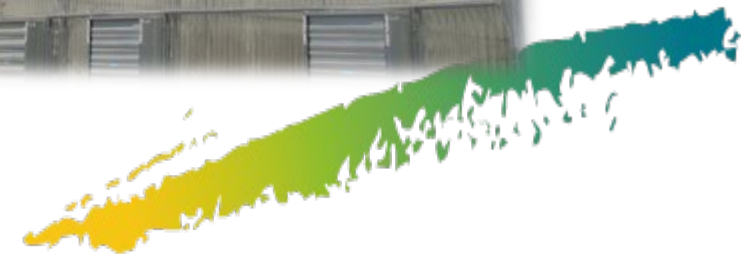
- Natural cooling & ventilation system
- Dynamic cooling & ventilation system
- Heating system
 - Geothermal heat pumps
 - Oil boiler
- Curtain / thermal insulation curtain system
- CO₂ Enrichment System
- Air Drying System
- Hydroponics system
 - Closed System
 - Open system
- Central System Control System



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
- CO₂ Enrichment System
- Air Drying System
- Hydroponics system
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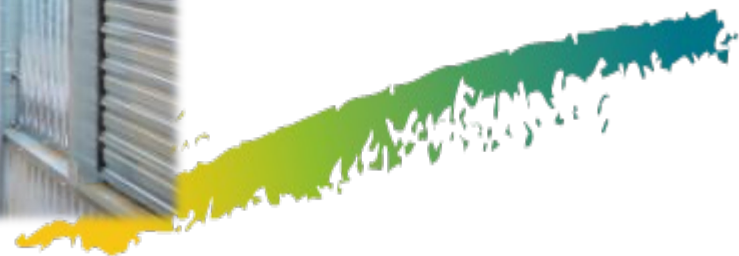


Introduction of MED Greenhouses

□ Natural cooling & ventilation system



□ Central System Control System





Introduction of MED Greenhouses

- Natural cooling & ventilation system
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Introduction of MED Greenhouses

Geothermal Energy Subsystem

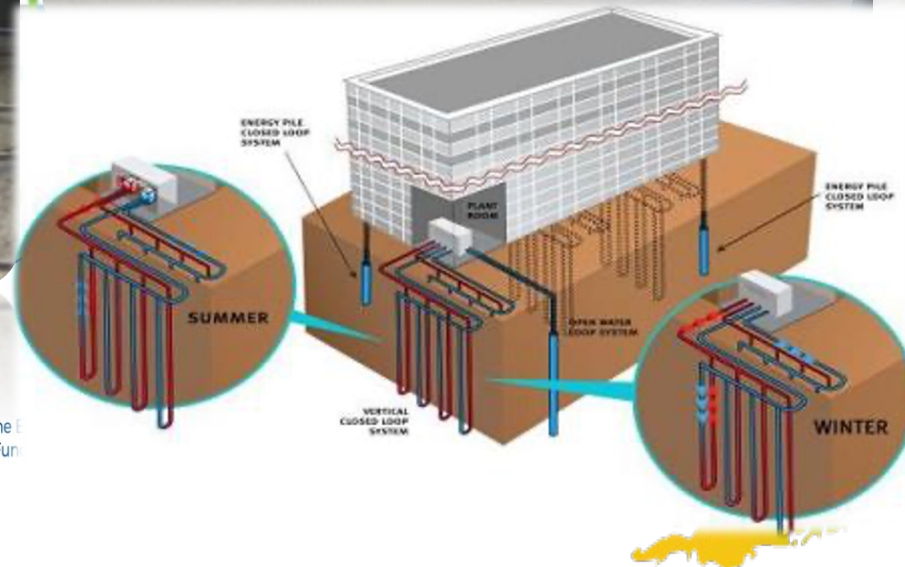
- ❑ The greenhouses' energy needs for cooling, heating and conversion of water vapour are being covered by a vertical closed loop geothermal system which is built next to the greenhouses, exploiting the available shallow geothermal energy field.
- ❑ This system offers significant advantages over other 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 $<25^{\circ}\text{C}$)



Introduction of MED Greenhouses

Geothermal Energy Subsystem

The system consists



Introduction of MED Greenhouses



Hydroponics system

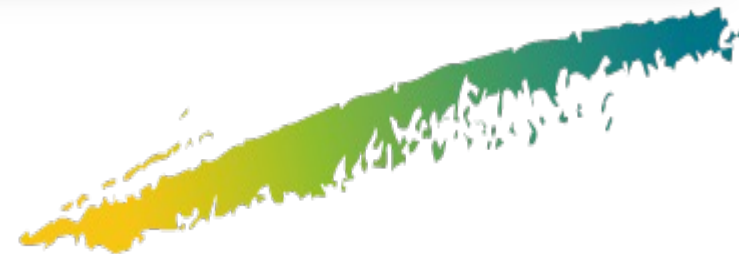


Introduction of MED Greenhouses

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



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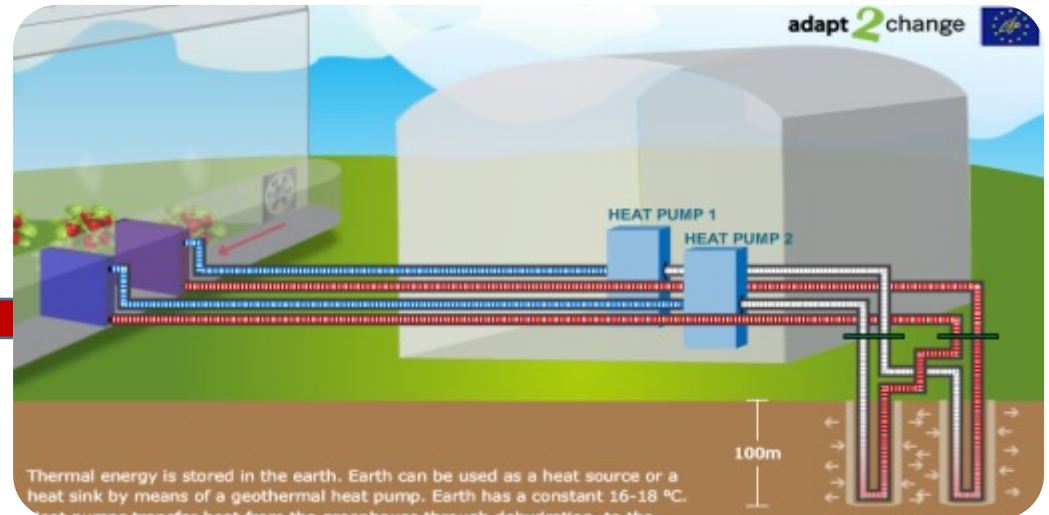


Introduction of MED Greenhouses

□ Natural cooling & ventilation system



□ Central System Control System

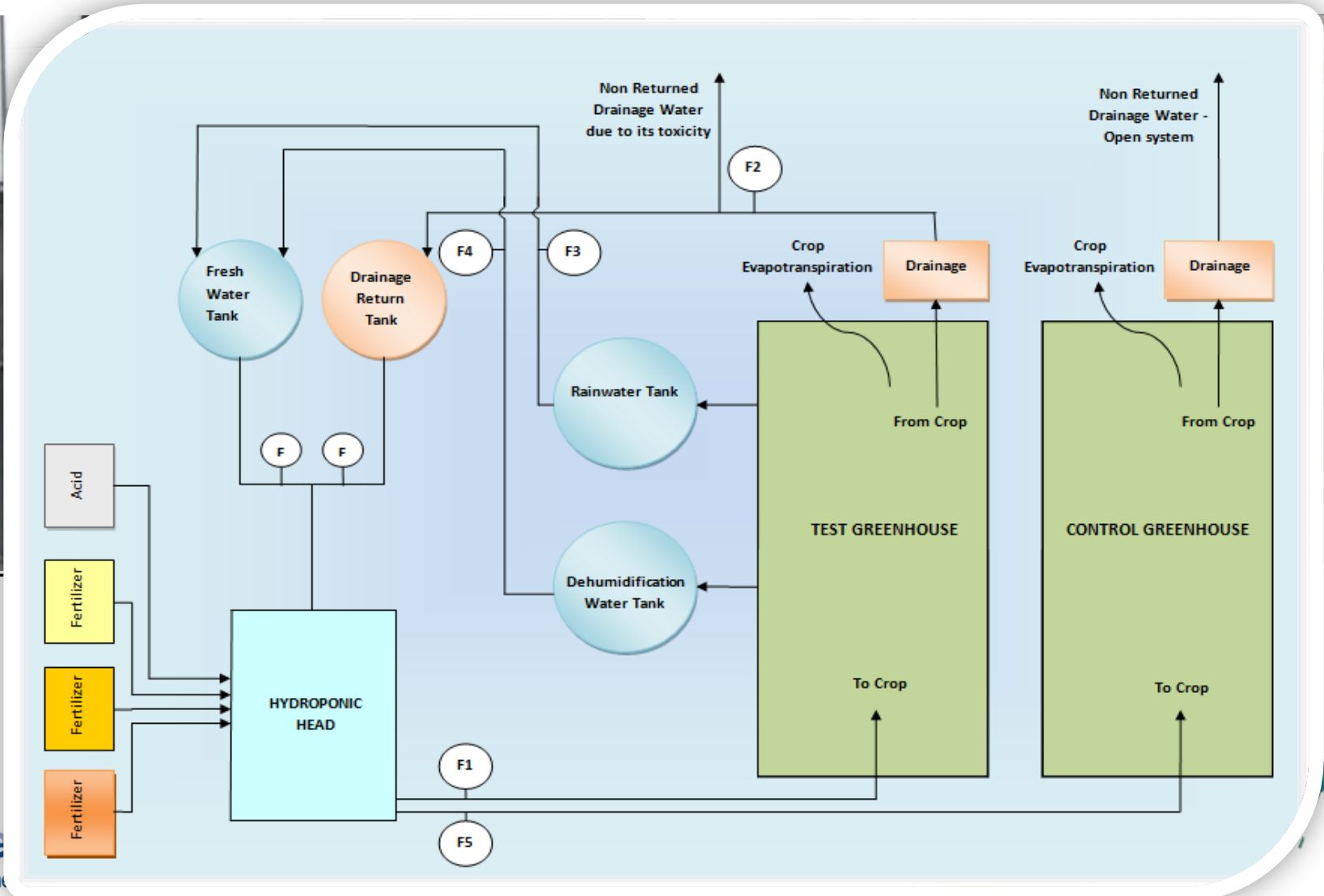


Thermal energy is stored in the earth. Earth can be used as a heat source or a heat sink by means of a geothermal heat pump. Earth has a constant 16-18 °C. Heat pumps transfer heat from the greenhouse through dehydration to the

□ The humidity of the air is converted into water

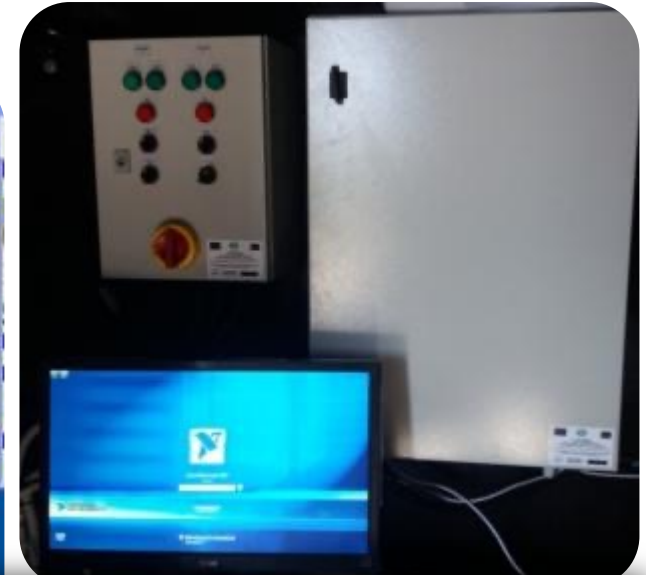


Introduction of MED Greenhouses

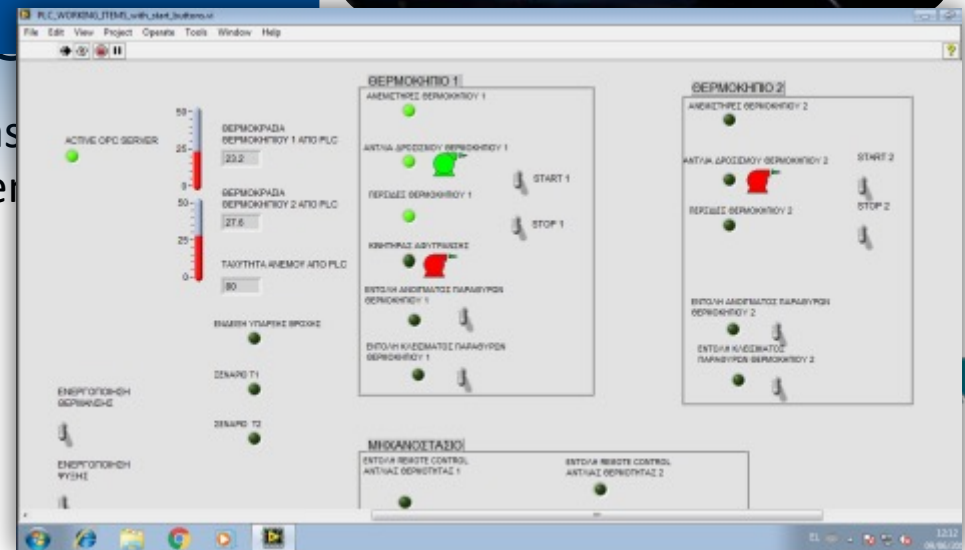


Introduction of MED Greenhouses

□ Natural cooling & ventilation system



- Easy
- Re





Advantages compared to Conventional GH

Energy Performance

- ✓ The mean Energy reduction (Kwhe) can be 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

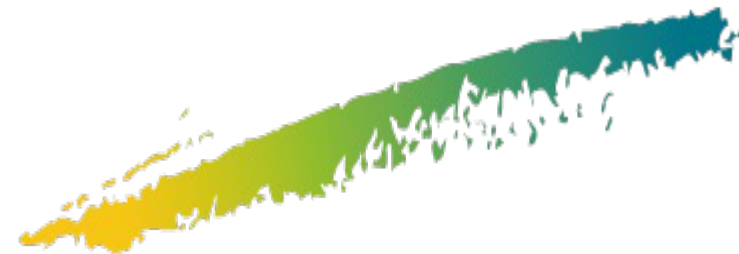
- ✓ The mean CO₂ emissions reduction can be ranged between **46-52%**.
- ✓ The use of fertilizers can be reduced by approximately **30%** compared to an open hydroponic system; this reduction can reach and surpass **60%** compared to open cultivation practices.





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.



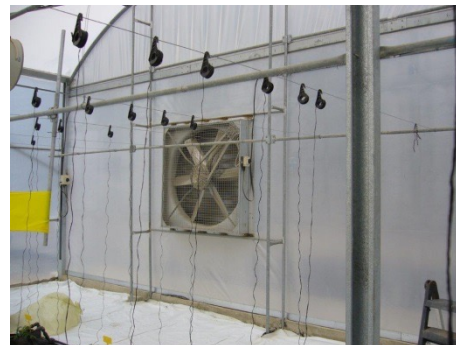
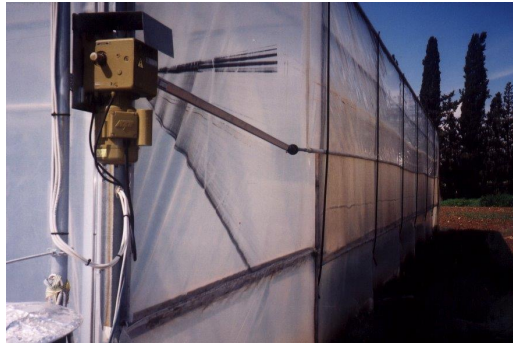
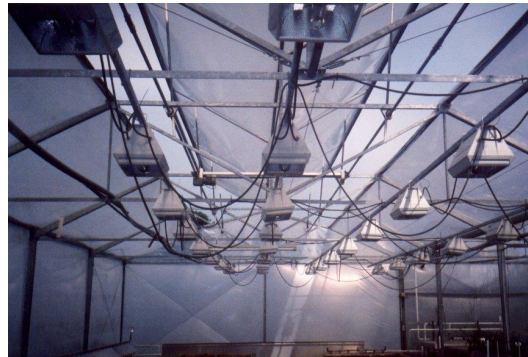


Transferability factors

- ❑ 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 – Photo Gallery 2/2





Thank you for your attention!

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<https://medgreenhouses.interreg-med.eu/>



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