

**SUMMARY DESCRIPTION OF THE PROJECT** (Max. 3 pages; to be completed in English)

**Project title:** The sustainable Greenhouse: demonstrative action for zero emission intensive greenhouse agriculture

**Objectives:**

In the next future climate change will impose the implementation of adaptation and mitigation strategies in many sectors of human activity. In agriculture this implementation will be specially apt to the greenhouse horticulture sector. In fact rising a crop in a confined environment will enable more adaptation to the forecasted abrupt climate weather phenomena and a mitigation of the bad effects of winds, drought and excessive rainfall. Another advantage of greenhouse horticulture respect to the open field is that the cultivation could be performed with continuous cycles independent from season and from soil disposability. This helps to bypass the actual problem of "competition for the soil" between energy-crops and food-crops. The problem is that traditional greenhouse agriculture is very environmentally unfriendly, requesting a lot of chemical, energy and water inputs directly and indirectly connected to greenhouse gasses emissions and polluting effluents. The overlying purpose of the project is to demonstrate that the future of intensive horticulture will be adequately answered by a sustainable model of greenhouse that will try strategically:

- a) to demonstrate that greenhouse agriculture could be fulfilled with more environmental friendly modalities in terms of: 1) direct or indirect greenhouse gasses emission; 2) water consumption; 3) pollutant nutrients and chemicals drainage into soil and diffusion in the air. All this will be accomplished utilising the best innovative already existent market technologies applied in a global approach context to the problem. It is well known that intensive agriculture is very pollutant and could be dangerous for the environment. This is particularly intensified in case of crops cultivated into greenhouses, where the high structural costs and the limited place availability oblige the farmer to push forward the growth, utilising chemicals instead of organic matter; where the absence of satisfying rotation systems prevents the utilisation of soil enhancing crops like Leguminosae; where the higher value of productivity and the consequently higher economical risk pushes the farmer to utilise anti-frost methods very expensive for the environment, like water sprinkling; where the need of a confined environment forces to utilise many artificial not-biodegradable materials and high energy inputs. All this is bringing at risk everywhere in Europe the areas subjected to greenhouse agriculture, with risk of soil desertification, groundwater saltiness increase, due to the elevated pumping of groundwater, pollution increase, and clearly high carbon gas production linked to the high energy consumption.
- b) to demonstrate that greenhouse agriculture, when accomplished following the project proposed technologies, could be compatible with nature protection and could be present inside natural parks and reserves, without causing ecological problems and, moreover, giving thus a substantial financial help to the local community economy.
- c) to help farmers and students to understand the complex of links and relations that represent the dynamic exchange among air-water-soil present into the greenhouse structure, with particular relevance to the carbon cycle, with the purpose of a better environmental education and a better awareness of the responsibilities that agriculture operators have in the global carbon foot-printing.

**Actions and means involved:**

- a) two (or more) demonstrative greenhouses will be accomplished: the first following the traditional practice to be considered as control, the second one utilising the best commercial technologies to reduce all kind of emissions. Particular attention will be given to recover anti-frost irrigation water in a close-cycle system and in the adoption of materials totally environmentally friendly. The greenhouses will be cultivated for three years with the traditional local selected cycle of crops and varieties but in the "Living Greenhouse" the common agricultural practice will be replaced by totally nature-friendly technologies,

utilising manure, compost and zeolhytes as substrate integrators and selected enzymes and fungi to enhance a rational and ideal transformation of inorganic into organic substances through the vegetal organisms.

b) The two demonstrative greenhouses will be realised inside the Special Protected Area of the Natural Monument of Lago di Fondi, an area of particular vulnerability compelled to live with a superimposing reality of 250 hectares of greenhouses for a total extension of 1,000 hectares territory. All the Fondi Plain is actually at risk of geological subsidence and saltiness intrusion, due to the great utilisation of underground water for anti-frost irrigation systems that the farmers utilise in average 30 night/year with 1,500 litres/minute/ha consumption. Moreover the recently established Reserve Authority has to resolve the problems originated by this traditional highly polluting and environmental destroying economy co-existence with the Nature reserve management, and will be eager to acquire the project results evidence.

c) The project will assimilate the greenhouse system to a global living organism, trying to give evidence of the structure of the dynamic laws that rule its functioning through a continuous visualisation of its main components status. This will be achieved thanks to the utilisation of lysimeters to check the water content of the soil under the crops, rhizotrones to display the radical growth of the crops, energy-counters to display the energy utilisation of the greenhouse in its wholeness. These instruments will be connected to a website continuously updated to enable far control of each greenhouse model situation and will represent visually the "organism state". Global evaluations of energy balances, emissions level and economic balance of the productions will be carried out by academic professionals. The dissemination of the results will be targeted to students and farmers thanks to on-place visits, ad-hoc training courses for divulgators and extension agents and to the website monitoring tool itself.

#### **Expected results (quantified as far as possible):**

Achieving a cost-efficient emission reduction (quantified at last around the 10%) of the emissions in CO<sup>2</sup> derived from intensive greenhouse agriculture thanks to the utilisation of market based instruments and existing technologies enabling reduction of water input and subsequent energy consumption;

Reducing the level of effluents (according to the Plant Protection Products and Nitrates Directive, and the Flood Directive) into the underground water and the lake water of the Monumento Naturale del Lago di Fondi (quantified at last around the 20%), thanks to a new adequate management of fertilisation and subsoil inputs;

Support new awareness among the farmers and a better policy of local authorities toward agriculture practice in general and in particular inside Environment Reserves and Natural parks thanks to the diffusion of the sustainable greenhouse agriculture model through:

a) specialised training of technical divulgators (at least 20 participants);

b) educative short course visits to secondary schools and visiting groups (at least 1,000 participants);

c) enabling permanent on-line information concerning the operating parameters through distance internet monitoring of the functional, economic and energy inputs/outputs of the model greenhouse in a dedicated website (at least 2,000 website visitors during the project lifetime).