The proposal consists of two subproject packages A) and B).

Package A) refers to projects that are constructed at low altitudes and the water taken does not meet the existing and increasing needs of humanity, whether they refer to quality or quantity or to hydropower. These projects are short-term and are the following: a) groundwater pumping: water is polluted and requires energy consumption; (b) water in hydroelectric projects in rivers has lost its hydrodynamic, which means that the energy obtained is little, expensive, non-renewable and has an environmental burden; c) water in water tanks at low altitudes has lost its hydropower; d) Construction of dams to force water to sink; e) desalination requires energy consumption; f) acidification of water; g) flood defense projects and resilience projects in climate change; i) **in all these cases these projects can be limited or abandoned over time and new sources of water be searched by recovering quality, quantity and energy. They can also effectively reduce climate change. These can be achieved if research is extended to higher altitudes on the mountains in order to collect water in existing or constructed and sealed cavities. At this point, the human should recognize that has made the following error. He is programming journeys to space and has stress for the high altitudes on Earth. The projects in mountains are the following**: (1) open low-slope channels or ditches at the sides in mountains that will collect and lead the runoff to pipelines and physical or technical cavities: (2) The natural cavities should be sealed and mechanisms be located in sinkholes for adjusting the water supply to springs, when it is necessary. If it is difficult surface pipes will supply water there. This will happen until the proposed projects replace the water of springs with surface water, giving hydroelectricity and minimizing water losses. Only the springs of healthy drinking water will remain; (3) Similarly, technical cavities will be constructed at sites with existing shallow sinks or anywhere will be decided; (4) On the rocky or porous areas of mountains sealed photovoltaics and on suitable sides wind turbines can be mounded. Photovoltaics could collect water and wind turbines store energy with pumping water; (5) the water with surface or underground penstocks will be driven from the reservoirs to power stations and from there for any beneficial use. In this way could be achieved (multi-actor objectives): **a) renewal of rural areas, since in addition to new farms in the plains, into farms could be turned the mountains; b) conservation and renewal of biodiversity and cultural identity; c) springs and rivers will have a regulated supply resulting in flood, erosion and drought protection; d) cheap renewable energy mainly from hydro projects and in addition from photovoltaics, wind turbines and biomass; e) progressive replacement of fossil fuels; f) investment interest by farmers, cooperatives, municipalities, entrepreneurs and the state; g) renewal of rural generations. (6) Additional exploitation will take place in the mountains converted into tourism destinations. (7) Proper policy design, which could be created a circular socioeconomic growth in rural areas in EU and in whole Earth.**

1.2. Objective and work program relation : it addresses 100% of the specific challenges and Work Program scope. **1.2.A. With the proposed projects could be exploited 90% of the Earth from 30% today,** with the following multi-actor approach: i) **This new land will play a role analogous to the colonization of the American continent**; **ii) something similar to the development of the last 50 years in coastal tourist areas or cities will could become; iii) all these projects will attract the interest of intelligent capital for investment, resulting in goodwill on Earth; iv) the projects will contribute to the modernization, sustainability and renewal of rural areas, as: a) the areas will become productive with eco economic development; b) will be exploited new territorial resources with ecosystem services; c) will enhance the natural, cultural and economic potential without pose a risk to the environment; d) will become socially just and politically strong; v) livestock farming will be possibility to spread on vast areas, making it naturally, healthy and offering jobs; vi) the same will apply for the food and the non food chain; vii) existing research and best practices for rural areas in EU will be complemented; and vii) excellent management of water.**

1. 3 ***Concept and methodology (a) Concept***

--1.3. 1 Conventional and proposed projects. Today, the theoretical hydro potential of a watershed is considered technically feasible, if it flows in a lake with exploitable head or in a river with dam construction opportunity in it.

This is economically feasible, when it flows in river from narrow valley, in which can be manufactured economic dam and the upstream basin to be relatively watertight. There are many mountains with no significant river or stream and their hydrodynamic is considered technically non-exploitable. **We will describe the application of the proposed method on watersheds with hydrodynamic a) technically no feasible and b) technically feasible.**

1.3. 2 Instead of dams with small heads, the flumes and reservoirs with large heads are proposed.

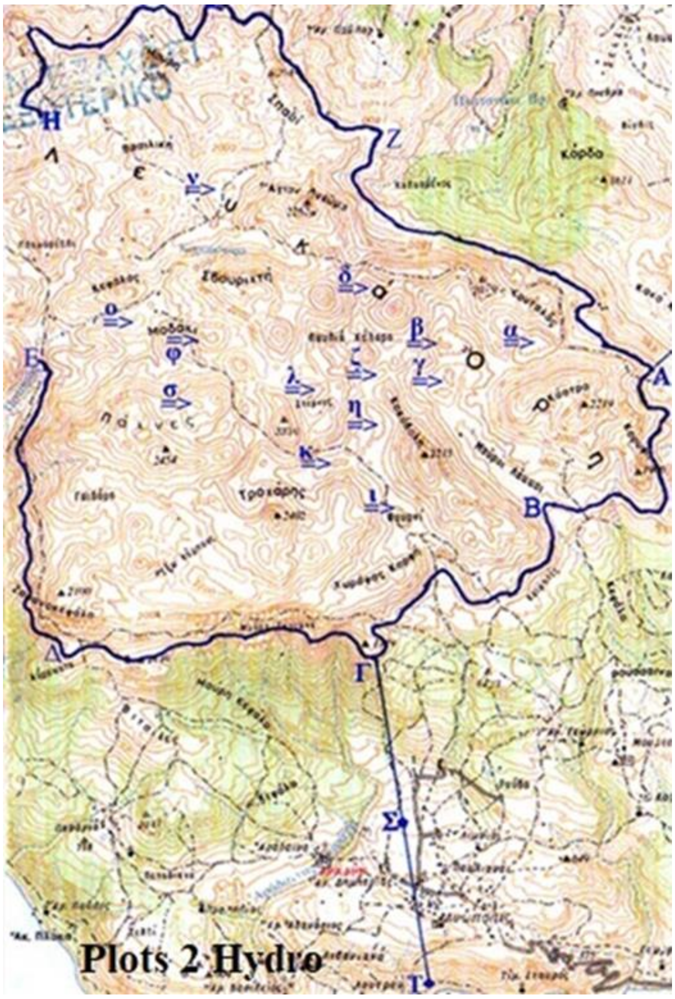
a) Hydropower potential development which is considered unexploited, with the use of new method could be feasible. This method could be applied on any mountain and at any its altitude whatsoever, constructing open channels around in the mountain side to the peak and a road situated at the other side. Extension of one meter along of the open channels and for the mountain top, in which will be constructed ditches for water runoff collection, also is needed (Is there runoff? The ditches which are constructed in the side of all roads this reveal). The open channels and the roads must have the appropriate inclination for the flow of water into natural or artificial cavities, which have sealing liner and will collect runoff, as well. Cooperation with watertight photovoltaics mounted on proper areas of watershed, which will produce electricity and together with porous areas with sealing liner, could collect water and will be channeled with pipes to cavities, as well. From the cavities and from appropriate slope, the water will be driven with penstocks to power stations and from there for any use**. So, we could be achieved very high heads, quantity and quality of water, most of which today is lost unused.** Such flumes could be made at various altitudes of mountain forming similar projects at various mountain sites. Existing natural cavities in karst soils have been created by karstic erosion and today work as sinks or sinkholes [2]. When the soil is watertight we could be made more economic reservoirs and collecting of runoff will be much more. **b) The proposed projects could be built on river watershed**: We consider a watershed spanning altitudes from 1900 m to 0 m and the river formed by altitude 500 m to sea level (0 m). Then, as was described above, we can consider an open channel construction at altitudes e.g. 1500 m – 1450 m, with the power station near the river, where the water is channeled after the station. Other construction by altitudes of 1200 m -1150 m etc. Then, if financial exploitable hydropower has left on the river by constructing a dam at any its location, you may proceed.

1.3.3 Disadvantages of conventional projects. On river sites, where conventional projects are constructed, the water flows having small slope, i.e. there is not exploitable head. This is a disadvantage for conventional projects. The cavity behind dam constructed is used for water storage, which must give the head and a useful water volume. **This huge reservoir is too costly,** both because the project is not included in renewable energy, resulting in the sale of electricity at low kWh price and also huge water losses from evaporation, infiltration and overflow, other than environmental damage. Conventional projects have head by 4m to 300m [3]. If you ask the contractors **can you build a dam e.g. with a 1500 m head?** They will answer you that, if it could be manufactured technically, such project cost must be prohibitive. **But nature gives altitudes of 1000 m or 2000 m or bigger and does not need nor a Euro for their manufacture.** With the proposed projects could be constructed projects with **head by 10 m to 5 000 m** exploiting the mountain altitudes which exceed 7 000 m [4]. **Leave the runoff hydro potential untapped until reach in the river, where it becomes zero, this is a mistake.** Dam **construction for hydro, has limited results. This planning contains misinformation, as it gives the illusion that, only a small percentage is all the technically feasible. The proposed projects that utilize the Nature water resources, services all humanity and ecosystem. With these projects, can be achieved vertical development to produce renewable energy, food security, sustainable agriculture and forestry and protection to climate change.**

1.3. 4 The economically hydropower potential. In Greece per year, the gross theoretical hydro potential amounts to 84 TWh [5], the technically feasible amounts to 20 TWh and the financially feasible one amounts to 13 TWh [5]. Projects producing 5 TWh [5] annually have been put to operation until now. Conventional projects are not promoted due to known environmental effects. The wholly produced electric energy amounts to about 55 TWh/year [6]. With the proposed projects, economically feasible, might rise up from 40 to 50 TWh/year.

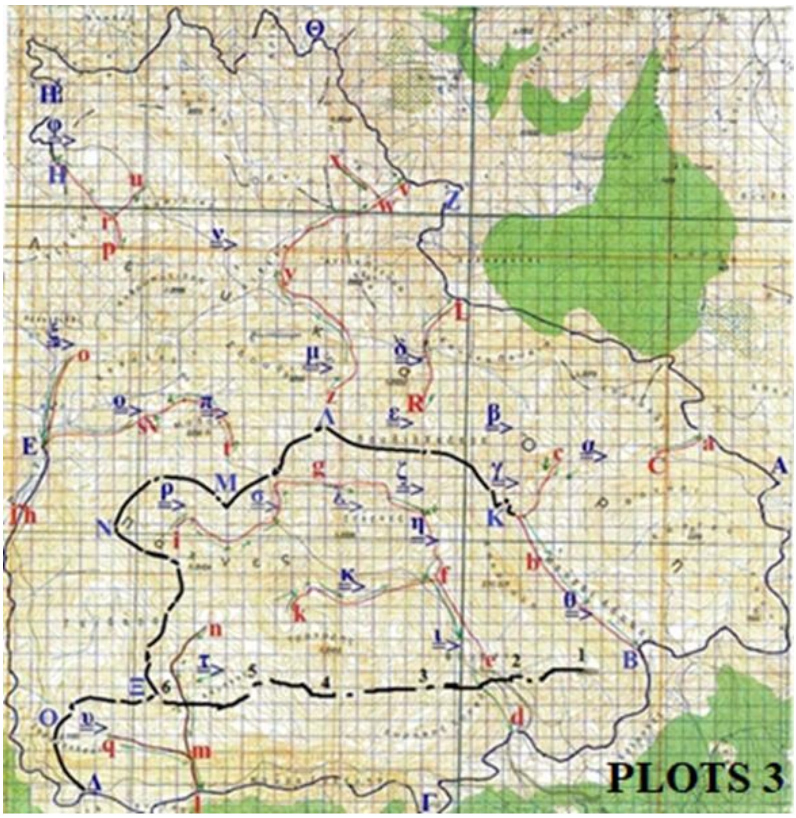
1.3. 5 Advantages. The proposed projects have all the advantages of conventional ones and more. They can produce renewable energy all the year instead of instant and clear production of conventional projects.

1.3.6 LEFKA ORI PROJECT. Crete island is rich in precipitation but the more water is lost in the sea untapped. and the problems of pumping water from wells up 400m depth and of drought are exacerbated by climate change The Lefka Ori (2 453m) with a 1850mm mean precipitation height and karst rocks [8], is situated in island western part. The proposed project will be examined on this mountain. The open channels along with the roads at H-Z-A – **B-**Γ-Δ-E (Plots 2) could be constructed from the H, E points, at an 1,700m altitude with an 1.6‰ inclination, a 0.0013 Manning friction coefficient and hence, the water intake could be at Γ point (Plots 2), at 1,650m altitude.



Plots 2 Hydro

In terms of the 15MW power stations at Σ, T points, a $1.25m^3/s$ discharge from either stem of the open channels will be needed, so a $2.5m^3/s$ discharge on water intake is achieved. An 0.75 m extension along the open channels for mountain top, in which will be constructed ditches for runoff collection. Also, 78 natural cavities, the main of which are shown by Greek letters α, β,… on arrows (plots2 and 3) [enlarge (plots 2) for visible cavities] and 150 technical cavities made in places that exist sinks or sinkholes with important runoff or anywhere else, will collect water. All these will connect with ducts (plots 3). The cavities are drainage with pumps or horizontal drillings. Water from ditches and cavities will be driven from cavity to cavity and open channels and finally to reservoir. The reservoir will be near at Γ point and will be constructed on nature and artificial cavity. The penstocks will be built along of the Γ-Σ -T lines (plots 2). Ducts can be built in two ways: a) underground or surface ducts will be mounted by road help (the roads will serve and other purposes); (b) the ducts can be mounted without roads and the excavation will become with use of picks. Transportations will become with helicopters. When the ducts are underground the system will be similar with city drains For the calculation of the watershed area, has been used the squared diagram (Plots 3), which has 1,392 squares and each one, with a 5mm length of side, so: 0.005•50,000• 0.005• 50,000 = 62,500 m^2 surface area (scale: 1:50,000). Therefore, the watershed will be of a 87 km^2 surface area. When 2,500mm annual precipitation [8], power stations at 925m, 200 m altitudes, so a 1450 m head [9] and then, the yielded annual energy will amount to: E= 731 GWh (E = 9,810 N/m^3•87,000,000 m^2▪ 2.5 m• 0.85•1,450m =2,629,754,438 MWs, where 2.5m runoff without loses and 0.85 execution factor. In the event that there is no lining in basin, due to infiltration and small evapotranspiration, at least the generated energy third may be taken, i.e., 244GWh and 72.5hm^3 available water. These projects will have minimum impacts with huge profits and could bring environmental renewal.



PLOTS 3

Package B) complements the package A) and should be developed by new coordinator. This refers in the following: a) all the valuable substances that could be obtained through the wastewater treatment and reuse process; b) stimulating efficient and multiple use, recycling and reuse of water; recovery of energy and materials (such as nutrients, minerals, chemicals and metals) from water; managing water demand and efficient allocation; …