# ELECTRIC ENERGY PLANT FROM BIOMASS OF OLIVE IN THE INDUSTRIAL AREA OF KALAMATA IN THE MUNICIPALITY OF MELIGALAS

Location of factory

The unit was supposed to function in the Industrial Area of Kalamata in Meligala which is in the South Western part of Messinia.

Carrier of work

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Budget of work: 105.000.000€

The investor had received authorisation to begin production and installation from the Ministry of Development. The decision had been made in regard to the environmental terms of operation from the Peloponnesian Regional office. In addition, a research program had begun that was supposed to be financed by the European Union and its main purpose was the application of new technologies for the production of biomass from olives that are produced in the Messinia region. The thermal output of the steam generator was forecasted to reach 115MW and the steam turbine would have maximum output at 26,2MW (average 25 MW).

## Operation of Production Plant

The unit would utilise as solid fuel, the dry Oil-Core that remains after a centrifugative process and desiccation, down to a 35% content in water, of waste of oil factories. The raw material would be stored in 2 big reservoirs with a total capacity of 190.000 m3 covered by a geo-membrane as thick as 4 mm. From there, utilising underground pumping (65 t/h), it would be led in the 4 centrifugators and 4 wringers, which would decrease the percentage of water material down to 48%. A production rate of 36 t/h of dry oil-core with liquidity 35% is expected, and that will be used for combustion and production of steam at the boiler. The liquid waste from the centrifugation would be diverted for biological cleaning, which would produce clean water that would be reused. The combustion would be done in a boiler with mobility technology ($5^{th}$ generation technology) at a temperature between 870 & 1050°C and it would produce high pressure thermal steam at 458°C. which via a steam-turbine generator would produce electric current at an average output of 25 MW. After the usage of the turbine the steam would be condensed in a closed circuit and the water would be vaporized once more with a rate of 90$m^3$/h. This way the consumption of water at the Production Plant would be only 10$m^3$/h with no steam emissions in the environment. The annual production was estimated to reach

195 GWh, which would be absorbed entirely from the NATIONAL ELECTRICAL COMPANY. The remaining heat energy could be used from adjacent industries of VIPE, such as greenhouses, or from the residents of Meligala for heating (free of charge). The Production Plant would be operational 11 months during the year on a 24hour basis. It would occupy 56 workers on permanent basis and 45 workers seasonally.

During the processing of the raw material there was no production of fume gasses because the desiccation of the fuel is done with steam produced by a turbine and not by burning core elements, as is done currently in Spain (Baena). At the combustion no soot was produced due to the total combustion and the carbon dioxide would not be released in the atmosphere. The 80% of dioxide of nitrogen would be withheld. The liquid waste would be processed by a biological cleaning system and special filters would retain the dust of oil-core from the dryers. The water from the deionization had an increased consistency in salt and would be led to a reservoir where the salt would be separated and removed.

All of the above satisfies the provisions the current legislation. The operation of this unit would acquit the region in Messinia from the serious problem of liquid wastes' disposal of liquid from olive processors in streams and coastal waters. The factory's main product is electric energy and as secondary products we will have heat, core elements from the centrifugation and earth ameliorative for the olive groves in the region (by an existing expert opinion of the Ministry of Agriculture). Part of the liquid waste could be utilised for the production of marketable products (cosmetics, soaps). Scents would not occur due to the implementation of pioneer methods of this matter.

**Positive impacts of the investment**

- ✓ Evolvement of both local and national economy (contribution in the energy sufficiency of Messinia and of all the Peloponnese).
- ✓ It provided a solution to the most serious environmental problem in the region, which is the discharge of 500.000 tons of liquid waste, that are currently being dumped in streams and coasts from the oil factories. Messinia would be exempted from the liquid waste and their consequences (scents, ground pollution- streams and coasts) with big profits for the environment, the agriculture, the tourism and the investments in the region.
- ✓ Employment of the unemployed workers in the manufacturing phase and approximately another 100 individuals in the operational phase of the factory (drivers, craftsmen, workers, office personnel, guardians, cleaners, scientists, etc).
- ✓ Creation of new activities adjacent to the factory (production of soil ameliorative, oil-core, manufacturing of soaps and cosmetics, etc).
- ✓ Heating power at the service of residences and green houses in the region of Meligala.
- ✓ Trades support in the region (building materials, consumables, chemical, bodies, equipment, foods, plastic, metals, etc).
- ✓ Preservation and improvement in the income for farmers and olive processing units in S.W. Peloponnese. The farmers would be receiving additional bounties for assisting in recycling the liquid waste and olive processors would increase their income by both selling the biomass to the factory and also by reducing their expenses from fines they once had in order to get rid of their wastes.
- ✓ Improvement of current fertilizers in agriculture benefiting from the ecological soil ameliorative, ash produced during the combustion.

- ✓ New know-how and technologies in Greece. It would be the first factory in Greece that would operate on the combustion of biomass and the most pioneer in Europe. It would attract the interest of University and school students from all over Greece.
- ✓ Production of energy with no negative side effects for the environment. New technologies for important reduction of the emissions in the exhausts would be implemented as well as in the treatment of liquid wastes. No solid wastes would be produced in the process (the ash would be used as a soil ameliorative).

**Metres of antilittering**

1. Biological treatment operation for the liquid waste with organic residues (liquids from centrifuge, water with oil-core dust from the dryers, toilets, sinks, vehicle maintenance, filter cleaning).

2. Cleaning of exhaust fumes

a. A special treatment of exhaust fumes would be utilized in this project (cloth filters sprayed with solution of urea) aiming at the complete limitation of nitrogen dioxides emissions, an increase in the abidance of the fumes inside combustion chamber etc.

b. The exhaust treatment unit for the chimney is consisted of a bag-filter combined with a multi-cyclone. This would allow the application of a dry absorption system for reducing $SO_2$ and HCl and this would also achieve very low expulsions of pollutants (< 5 mg / $Nm^3$).

c. SNCR system for $NO_2$ control:

This method removes nitrogen oxides (NOx) by spraying the exhaust with solution of urea in the combustion chamber. Thus the oxides of nitrogen are changed in molecular nitrogen, coal dioxide and water vapours, according to the following chemical reaction: $CO(\mathbf{NH}_2)_2$ (urea) + 2NO + ½ $O_2$ ------> $2\mathbf{N}_2 + CO_2 + 2H_2O$

This reaction produces elements of the atmosphere reducing by 80% the amount of nitrogen dioxides that would be released in the atmosphere.

d. Carbon dioxide:

The combustion of olive biomass at a high temperature (870-1070 °C) is considered neutral to $CO_2$ because it does not affect the balance of $CO_2$ in the atmosphere. The olive tree binds $CO_2$ via the photosynthesis. The dry oil-core is burned and $CO_2$ is released, closing the circle of $CO_2$ in atmosphere. Thus the percentage of $CO_2$ in atmosphere is not increased with the combustion of biomass. Also no soot is produced, due to the high temperature the combustion takes place at. The emissions of the factory will be much lower than the current limits of the European and National legislation.

3. Air system for the deliquescence of the turbine generated steam

The steam from the turbine would be guided through a closed loop where it would be cool in order for it to transform back to water and then be used again. Therefore no cooling tower would be used for this process.

4. Steam quality control

Due to the importance of maintaining the pureness of the steam, constant checks of the conductibility at 25°C would take place within a special sampling unit, located after the exchange of acid cations.

5. Water treatment unit

A deionization unit would function as a result of which, the water containing salts would be sent to a tank at which the salt contents would be removed.

6. Sand filter

Sand filters would be used for cleaning the water used in the installation, water that has either been collected from some regional source and therefore has a questionable quality, or occurs from some processing stage of the Unit.

7. Membranes for the desalination of the water

After the water treatment at the device used for the $CO_2$ removal, cations and anions exchange, the water is still not up to the quality standards. Membranes are used for this matter, in order to improve the pureness of the water.

8. Segregation of salts

Water that contains big amounts of inorganic salts, collected after the water process above, would be led into a tank where all salts would be gathered together and released by the VIPE.

9. Noise

The size of the lot proposed to fit the Unit (550m x 232.5m) is so big that the sounds generated from the works are eliminated not more than 50-70 metres from the source. Therefore no Noise issues would be of any problem for the adjacent industries.

10. Aesthetics of landscape

For the good aesthetic picture of the factory and the reservoirs, cypresses would be planted all around the factory every 2m and grass and other greens would be planted wherever that was possible.

11. Odurs

No odurs were expected from the reservoirs, regardless of the fact that this liquid substance would remain in the open for a long time. This is because shortly after it would be dumped there, a solid brown crust would begin to covet the surface, which would not allow any scents to emerge from there. This is currently the status at the pioneer factory in Baena- Spain, at which not even the visitors realize or complain of such a matter.

12. Monitoring the repercussions

At the points that gas and liquid wastes exit the factory, special devices would test all outcomes of the factory in order to preserve the environment from any type of pollution. These devices would provide information about both the quality and quantity of the wastes and all this would be submitted to local authorities and the Municipality of Meligalas, in order to provide constant status reports and equivalent time to react to any transgression of the limits.