

ENGINE- *Geothermal Lighthouse Projects in Europe*

Information gathered during the ENGINE co-ordination action (ENhanced Geothermal Innovative Network for Europe)
<http://engine.brgm.fr/>

Project Name: [Geothermal Asparagus Farm](#)

Project Institute/Company Leader: Geothermica Hellas Ltd

Contact Person: Dr Paschalis Dalabakis

Web-site: www.agrecofarm.gr

Country: Greece

Location: Neo Erasmio Xanthi

Type(s) of resource [High/Low Enthalpy / EGS]: **Low Enthalpy**

Main on-site operators [Drilling, Stimulation, Monitoring, Power plant etc.]: **Farm owner**

Number of wells [w. Total Depth pr. well]: **Six (6)**

Type of wells [Exploration, Production, Injection]: **Production**

Well configuration [Single well, Doublet, Triplet]: **Single Wells**

Distance between well at Depth [Horiz. Dist at Depth]: **200 – 400 m.**

Temperature at total depth: **40-68°C**

Combination with other energy sources [Gas, Waste, Biomass etc.]: **No**

Potential of the geothermal resource [TJ/yr at Date]: **240**

Average flow rate [kg/s at Date (if expected)]: **130**

Main production [Heat or Power]: **Heat**

Installed/Expected capacity [MWe or MWt at Date (if expected)]: **1,87 MWt / 2,5 MWt**

Running/Expected capacity [MW/time at Date (if expected)]: **1,87 MWt / 2,5MWt**

Co-generated production [Heat or Power]: -

Installed/Expected capacity [MWe or MWt at Date (if expected)]: -

Running/Expected capacity [MW/time at Date (if expected)]: -

Short description of **Exploration History** (Limit this section; no more than 200 words):

Possible keywords (non-exhaustive list):

- **Objective of project:** Early crops of asparagus plantations are achieved effectively by means of geothermal waters with temperatures ranging from 32°C to 60°C. The heat energy requirements vary between 300 and 400 KWt/ha depending on the desirable period to start harvest. The site operates since 1999. In summer of 2001, an additional direct geothermal energy application was introduced in N. Erasmio, Xanthi, dealing with the dehydration of tomatoes. Low-temperature geothermal energy has been used efficiently and reliably in heating the drying air needed in the dehydration process. With geothermal dehydration the product retains the deep-red color and the nutrients and flavors of the fresh tomatoes, resulting in high-quality dried tomatoes.
- **Important dates:** April 1997, First application of heating asparagus plantations with geothermal. July 2001, Installation of the first geothermal dehydration unit in Greece.
- **Main geological context [stratigraphy, sedimentary formations, volcanism, granite intrusions, faults, graben etc.]**
- **Expected CO₂ emission saving** 2.300 tons CO₂ per year
- **Project funding [state, communities, private etc.]** Private (1.000.000€)
- **Distribution network :** 4.500 m of non insulated buried PVC and PE pipes (diameter 3” to 5”). 100.000 m of PP spiral pipes (1”) buried under the asparagus crowns.

Reservoir Characteristics (Limit this section; no more than 200 words):

Possible keywords (non-exhaustive list):

- **Type of reservoir [fractured, porous or both]:** Both
- **Hosted lithology/rock/mineralogy/fluids [composition]:** The geothermal reservoir develops in the Oligocene mollasic sediments (conglomerates and sandstones) deposited over the metamorphic (gneiss and amphibolites) substratum of the Rhodope massif. Two main types of geothermal waters have been investigated in the geothermal field of Neo Erasmio. A first group of Na-Cl-HCO₃ waters with TDS <0,6 gr/lit and a second one of Na-Cl waters with TDS in the range of 10gr/lit. The difference in chemical composition are rather due to the origin of the infiltration water (rain or seawater) and to the different composition of the hosted rocks.
- **Fracture system:** The geothermal field is under the stress of two main active faults system.
- **Stress field -**
- **Temperature range or temperature profile:** The water temperature in the roof of the geothermal reservoir depends on the vicinity from the main feeding faults and goes from 27°C to 68°C when moving from the external cold limits to the central part of the geothermal system.
- **Main reservoir characteristics [porosity, (natural) permeability etc.]** n.a.
- **Occurrence of natural brines -**
- **Stimulation types [hydraulic, thermal, chemical]** none
- **Wells characteristics [injectivity, productivity etc.]** n.a.
- **Connectivity between wells** n.a.
- **Storage capacity** n.a.

Exploitation (Limit this section; no more than 200 words):

Possible keywords (non-exhaustive list):

- **Type of exploitation/power plant [direct, binary or combined cycle]**
direct
- **Type of binary cycle [ORC, Kalina cycle etc.] -**
- **Nature of working fluid -**
- **Cooling system [water, air] -**
- **Injection fluid [water, salty water etc.] -**

- **Annual production [GWh_e or GWh_t at Date (if expected)]** 7,26 GWh_t
- **Seasonal production** 7,26 GWh_t
- **Capacity factor (%)** 33%

- **Need for special tools [pumps, turbine etc.]** none
- **Development/improvement of methods (chemical fracturing, new tracers, seismic etc..)** none
- **Monitoring and optimising of field/area using computer models** n.a.
- **Assessment of environmental impact** n.a.

On-going or future works planes (Limit this section; no more than 200 words):

Possible keywords (non-exhaustive list):

- Next important event [major hydraulic test, new geophysical measurements etc.] n.a.
- Future plans? e.g.: n.a.
 - New wells
 - Optimizing of existing or building new power plants..
 - Implementation of new tools..
 - Implementation of new methods..
 - New exploration phase..

ENGINE partners involved in the Project:

- Use list of partners from ENGINE Web-site <http://engine.brgm.fr/partners.asp>

Main References (no more than 5 references):

1. **Andritsos, N., P, Dalabakis and N, Kolios**, Use of Geothermal Energy for Tomato Drying. *GeoHeat Center Quaterly Bul.*, **24**(1), 9-13, March (2003).
2. **Dalabakis P., Ilias A., Panagopoulos A., Kolios N. & Xanthopoulos S.**, Asparagus early season production using low enthalpy geothermal energy in Neo Erasmio-Xanthi, Greece. International Congress "GEAIA 2004", Applications of Geothermal Energy in Agriculture, Athens 2004.
3. **Kolios N.**, Geothermal investigation of N. Erasmio-Magana Xanthi Area. Scientific Report of IGME, Athens 1999.
4. **Fytikas M., Andritos N., Dalabakis P., Kolios N.**, Greek Geothermal Update 2000-2004. Proceedings World Geothermal Congress 2005, Antalya.

NB: Please provide a site picture, - and if possible, a few relevant figures would be appreciated



Fig.1: Location of the geothermal asparagus farm in North Greece



Fig.2: Green asparagus plantation under transparent plastic film covering

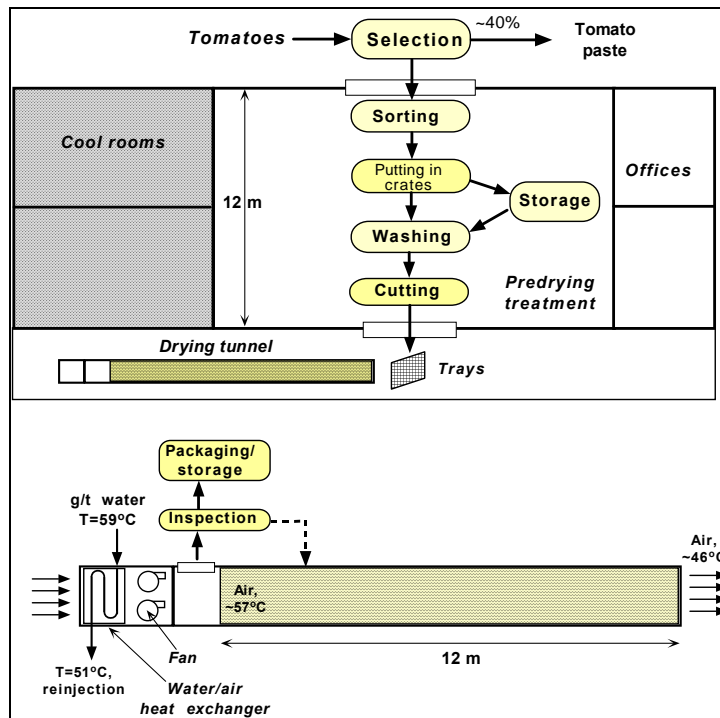


Fig.3: Schematic diagram of the geothermal tomato drier system



Fig.4: Artesian geothermal production well



Fig.5: Geothermal dehydration tunnel loaded with tomatoes

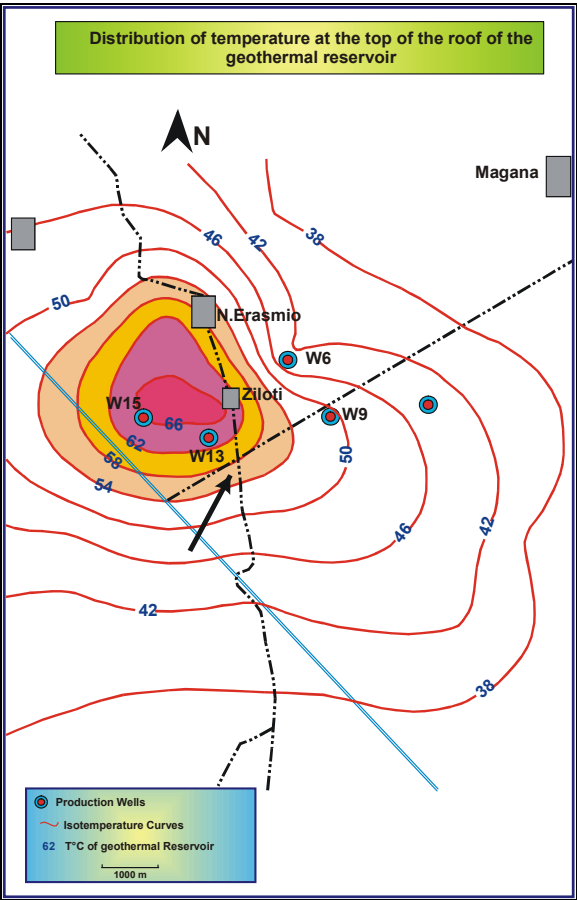


Fig.6: Temperature distribution at the geothermal reservoir