



Final Report

Mid Size Sustainable Energy Financing Facility (MidSEFF)

Gümüşköy Geothermal Electric Power Plant: Non Technical Summary (NTS)

April 2012

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European Bank for Reconstruction and Development

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The European Bank for Reconstruction and Development (EBRD) launched in January 2011 a financing facility aimed at scaling up Renewable Energy and Energy Efficiency investments in Turkey, to increase the country's energy savings and decrease its carbon emissions. The Turkish Mid Size Sustainable Energy Financing Facility (MidSEFF) launched by the EBRD with support from the European Investment Bank (EIB) and European Commission (source of the Technical Cooperation funds) will provide a total of EUR 1,050 million in loans through 5 Turkish banks for on-lending to private sector borrowers.

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1. General Plant Description

The planned Gumuskoy GEPP Project will be a binary power plant utilizing Organic Rankine Cycle (ORC) system with a 13.2 MWe electric capacity, which is planned to be constructed in two phases. The project is planned to include 5 production wells (one is optional), 2 reinjection wells, a power plant and a Fluid Collection and Reinjection System (FCRS). The FCRS will have a total length of 3 km. It will have 3 lines, which are all parallel to the ground and each other and positioned at different elevations.

The project is located in the Aegean Region of Turkey, in the Aydin Province, Germencik District at a distance of 2.3 km to Gumuskoy village, which is the closest settlement to the project area, and at 4.5 km to the closest building in Ortaklar town.

Table 1 presents the key aspects of the project.

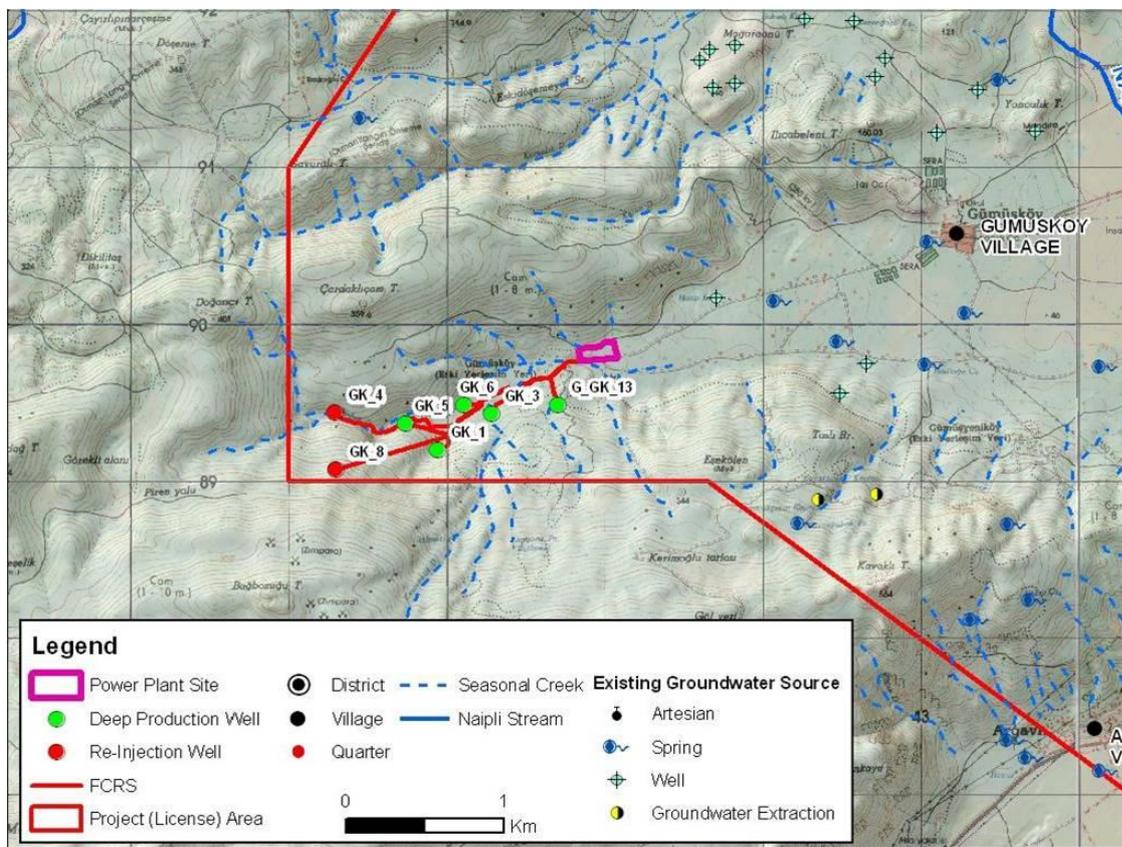


Figure 1.1: Overview of the Gümüşköy project area

Table 1-1: Key project summary data

Project Name	Gümüşköy Geothermal Electric Power Project
Project Borrower	Gümüşköy Jeotermal Enerji Üretim A.Ş. was founded by the Kuyumcu family in April 2010 as a project company for the operation of the proposed Gümüşköy Geothermal Power Plant.
Project Sponsors	BM Holding
EBRD Transaction	Total project cost is USD 49,582,991 including VAT, investment period interest, commitment fees and working capital requirement. The proposed financial scheme includes EBRD MidSEFF debt financing in the amount of USD 24,900,000, other loan in the amount of USD 9,600,000 (which is planned to a lease contract) and the borrower's own contribution in the amount of USD 15,082,991. The debt to equity ratio is 70:30%.
Project Description / Business Purpose:	<p>The Project area is located in the Aegean Region of Western Anatolia, in Aidin Province, about 30 Km West of the Aydin city centre, about 2-4 Km west/south-westward from the village of Gümüşköy.</p> <p>The project foresees the installation and operation of a geothermal power with total capacity 13,264 MW divided in two units 6,632 MW (gross capacity) each. The first unit will be fed by the existing production wells GK-1 and GK-3 with GK-4 for reinjection. In the second module, with the additional unit, will be operative in total 5 extraction wells (ones optional) and 2 reinjection wells.</p> <p>The technologic solution of the plant is the binary organic cycle (ORC). With a load factor of 8,330/year (average value), each unit of the plant should produce yearly 42,480,600 kWh (84,960,000 kWh both units).</p> <p>The design of GEPP connection to the national grid is made through approximately 13 km, 34.5 kV, overhead transmission line that will connect Gümüşköy GEPP to Germencik Transformer Station. The step-up transformer to 34.5 kV is included in the project boundaries.</p>
Installed Power	13.264 MW (gross), 10.2 MWe (net)
Annual Electricity Production	84.96 GWh/year

2. Environmental and Social Baseline

2.1 Environmental description of the project area

Project area will be located on Menderes Massif and the site and wells locations have elevations between 80 m and 300 m. Steeper slopes are dominant on southern side of the project area whereas the slopes on western and northern parts are lower.

The location of the project area can be classified as rural area and the agriculture soils suitable for cultivation compose the 43.5% of the licence area and the agricultural lands which are not suitable for soil cultivation compose the 56.5% of the license area. These percentages are due to the slope degree of the license area that is less than 12% (limit to perform agricultural activities) for the 50.1% of the licensed area.

The olive orchards occupied the 40.8% of the licensed area following by the forestry with 21%.

The project location is far away from natural protected/valuables areas such as Dilek Peninsula National Park (abt. 25 km) and Buyuk Menderes River Delta (abt.35 km).

As a result of Flora studies carried out in the study area, 5 species endemic of Turkey were identified; among these, 1 specie “*Microscadium minutum*” is a regional endemic species and the other 4 species are widespread within the study area.

As result of Fauna studies carried out in the study area the result is:

- according to the Bern Convention, 2 mammal species in the study area are covered under Annex 2 (Strictly Protected Fauna Species), and 12 mammal species are included under Annex 3 (Protected Fauna Species). According to IUCN only *Sciurus anomalus* (Caucasian squirrel) is listed under the category of “NT: Near Threatened”. The rest of the mammal species are all considered under the category of “LC: Least Concern”;
- according to the BERN Convention, 12 of these bird species are listed under Annex 2 (Strictly Protected Fauna Species) and 12 of these species are under Annex 3 (Protected Fauna Species). All of the identified bird species are listed under the category of “LC: Least Concern” according to IUCN;
- according to the BERN Convention, 8 out of 12 reptile species is included in Annex 2 of the BERN Convention, which lists “Strictly Protected Fauna Species”. The other 4 species, on the other hand, are covered by Annex 2 of BERN, which categorizes them as “Protected Fauna Species.

2.2 Social condition of the project area

The total population in Aydin province is 979,155 according to the Addresses-Based Population Registration System (ABPRS) 2009. Both the province and the district are behind Aegean region and Turkey in terms of rate of urbanization and rate of population increase. Both the province and the district have higher population densities than Aegean region and Turkey.

The closest settlement to the GEPP site is Gumuskoy village located at a distance of 2.3 km northeast to the project area. Other settlements in the proximity of the project area are Gumusyenikoy (at about 4.5 km on the northeast), Tekin (at about 5.8 km on the east), Argavli (at about 3.9 km on the southeast) and Naipli (at about 3.1 km on the north).

The two dominant sectors composing the economy of Aydin Province are agriculture and tourism. Thanks to Greater Menders River, irrigating generous plains, and the suitable climatic conditions, a very wide range of plants can be produced in the province. Olive, fig, chestnut and cotton are the products with highest contributions to the economy of the province.

Geothermal energy is the most important underground treasure of the province. The Strategic Plan (2010-2016) published by the Aydin Special Provincial Administration states that projects of private companies aiming at energy production from geo-thermal sources shall be provided incentive and support.

For Germencik District as well the main economic activity is agriculture. Fig is the mostly produced product. It is followed respectively by olive and cotton. Greenhouse vegetable production is also important for the economy of the district. Animal husbandry is another source contributing to the economy of the district. In terms of manufacture industry, there are ginneries, facilities producing construction materials such as tiles as well as fig and olive processing facilities. As above anticipated, there are also potential tourism activities, with Magnesia, the ancient city and thermal springs

3. Social and Environmental Impact

3.1 Land use

A large part of the project area is classified as forestry area and the related Forestry Permit has been obtained by the sponsor.

For the wells locations the sponsor has purchased the needed areas. The transmission line has yet to be designed and the design will be finalized in few months, the land taking for its construction will be done by EMRA in case.

3.2 Water

During the construction activities, any significant adverse impact on water use and water quality will not occur in the project area and its vicinity.

Drilling will be the major water consuming activity during the construction phase. There will be no water withdrawal from the nearby Naipli Stream or Nesatiye Creek in the scope of construction activities. During drilling and construction works, required water will be provided from the wells existing in the geothermal reservoir and/or mobile tankers delivering water from Ortaklar town.

Drinking water will be purchased/supplied from nearby settlements and delivered to the project site. Based on the assumption that the daily per capita domestic water requirement is 150 liters, domestic water requirement of 30 workers to be employed in the construction phase is estimated to be 4.5 m³ per day.

Furthermore, the water to be used in dust suppression activities will also be supplied from the drilling water wells. Amount of water to be used in dust suppression is estimated to be maximum 10 m³/day.

During the drilling operations, cuttings/sediment from the drilled media will reach to the surface together with the drilling fluid. This sediment originating from the well will be collected in a mud pit at the surface, which has appropriate dimensions and design characteristics compatible with the chemical and physical properties of the sediment to be trapped and stored in.

By collecting residual sediments from the mud pit and disposing them of in line with the national regulations in force, the impact of cuttings/sediment is anticipated to be at an insignificant level.

3.3 Wastes

Domestic solid wastes will be produced by construction workers on-site. Based on the statistical average of Turkey, daily domestic solid waste production is 1.34 kg per capita (TurkStat, 2002). Accordingly, amount of domestic solid wastes to be produced by 30 project workers to be employed in the construction phase of the project is estimated to be 40.2 kg/day.

These domestic solid wastes will also include recyclable wastes such as glass, plastic, paper, cardboard, metals, etc. that will be systematically collected and all types of waste will be separated for (lumber, scrap metal, etc.) proper handling and disposal.

Potentially hazardous waste will be segregated from non-hazardous construction site wastes and domestic wastes and after temporary storage, will be collected by a licensed company and disposed of in accordance with relevant legislation and all records will be kept.

3.4 Top Soil and Soil removal

The construction works will include site clearing/levelling, slope stabilization works, construction of project units including powerhouse, FCRS, electric power transmission lines and wells.

The total volume of topsoil to be stripped is estimated to be around 3,000 m³. To minimize the impacts on the topsoil, soil at any construction site the stripped material will be carefully removed and stored in a manner to avoid deterioration due to the weather conditions. During the topsoil stripping, the impurities will be removed from the soil. In order to preserve soil fertility, the piles will be slightly compacted and covered with organic material or green seeding with pioneer plant species. The stripped topsoil will be used in the future landscaping works.

3.5 Landslides

Destabilization of rock masses due to occurred cuts during the site clearing, and uncontrolled surface run-off during storms, can be listed as the possible causes of potential landslide occurrences.

In general, the project site where the GEPP and the ancillary structures will be located, has plain ground conditions and no landslide events are expected; while the mountainous sections where some of the wells and some sections of the FCRS will be located are affected by the risk of landslide. Taking into account that the wells area will be affected by minor construction works and that in this area the presence of mountain vegetation is a support to prevent the landslide activities, the landslide risk can be considered very low.

3.6 Emissions: Noise and Particulate

Noise generation will be a concern during the construction phase of the GEPP Project due to the works to be performed during the earthmoving works, construction of power plant and FCRS and drilling and completion of production and reinjection wells, construction of ETL components and operation of construction machinery and equipments.

Gümüşköy, which is the closest settlement to the GEPP site and drilling wells, will be the only potential receptor of noise emissions. The background noise level of Gümüşköy village is 55.1 dBA, considering the worst case conditions, the noise level in Gümüşköy village is elevated up to 55.2 dBA in any case below the limit value of 70 dBA permitted by RAMEN.

Potential impacts of the Gümüşköy GEPP on air quality would be a concern basically during the construction phase of the project as no significant emission sources will be present at the facility during the operation phase.

Trace amounts of gas, mainly in the form of H₂S, may be encountered during drilling operations. However, as such releases would be minor in volume and occur in short periods; the impact would be limited to the working area. Drilling crews will be provided with safety devices and trained for emergency cases.

During construction phase the necessary measures to mitigate the impacts on air quality will be taken in respect of the Turkish and International regulation.

3.7 Subsidence

Subsidence occurs as a result of internal loading and/or extraction or alteration of material below the surface, the reinjection could represent a solution to avoid the subsidence but on the other hand this action can increase the fluid pressure and induce micro-seismic activities. The pressure increase, however, is not expected to be significant since geothermal fluids will be withdrawn simultaneously from nearly the same horizon. During the operation phase a subsidence and seismic monitoring campaign will be implemented.

3.8 Landscape

An assessment of visual impact will be implemented and any compensative measures (for example tree replantation) should be taking into account in case.

Table 3-1: Impact Quantification

COMPONENT	IMPACT	QUANTIFICATION
Land use	<u>Different use of the land</u>	--
Water	<u>Utilization and Discharge</u>	4.5 m ³ during construction activities, 10 m ³ for dust suppression.
Waste	<u>Production of solid waste</u>	1.34 kg/person/day (30 workers for construction)
	<u>Excavation waste</u>	3,000 m ³
Subsidence	<u>Change of the ground level</u>	--
Emissions	<u>Noise</u>	Construction phase < 70dBA (law limit) Operational phase: no disturbance for the nearest receptors
	<u>Particulate</u>	< 1.5 kg/h (law limit)

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