



Final Report

Mid Size Sustainable Energy Financing Facility (MidSEFF) Babadere Geothermal Electric Power Plant: Non Technical Summary (NTS)

January 2015

Final Report

European Bank for Reconstruction and Development

**Babadere Geothermal Electric Power Plant:
Non Technical Summary (NTS)**

January 2015

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 billion in loans through 7 Turkish banks for on-lending to private sector borrowers.

This report has been prepared by MWH S.p.A., D'Appolonia S.p.A., GFA and Frankfurt School of Management and Finance (hereinafter the "Consortium") for the European Bank for Reconstruction and Development (EBRD) in relation to the above-captioned project and is confidential to the client. Neither the Consortium nor any person acting on their behalf, including any party contributing to this report, makes any warranty, expressed or implied, with respect to the use of any information disclosed in this report; or assumes any liability for direct, indirect or consequential loss or damage with respect to the use of any information disclosed in this report. Any such party relies upon this report at their own risk.

This publication has been produced under the Mid Size Sustainable Energy Financing Facility which received a financial assistance from the European Union. The content of this publication is the sole responsibility of the Consortium and can in no way be taken to reflect the views of the EU or the EBRD.

This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval to fulfil a legal requirement.

Babadere GEPP - Non Technical Summary (NTS)				Controlled Copy	
Rev. N.	Date	Description Amendment	Edited by	Revised by	Approved by
00	Jan 2015	Final Report	S. Ergeneman Öztuna	D. Yurtsever	M. Mancini

Table of Contents

1.	General Plant Description.....	4
2.	Environmental and Social Baseline	6
2.1	Environmental description of the project area.....	6
2.2	Social condition of the project area	7
3.	Social and Environmental Impact	8
3.1	Land use.....	8
3.2	Water	8
3.3	Wastes	8
3.4	Top Soil and Soil removal	8
3.5	Landslides	8
3.6	Emissions: Noise and Particulate.....	9
3.7	Subsidence.....	9
3.8	Landscape.....	9

1. General Plant Description

This investment project consists of construction of a binary geothermal power plant in the north-west of Turkey, in Canakkale province of Marmara Region, Ayvacık District, in the region between Babadere and Tuzla Villages.

The Babadere GEPP Project will be a binary cycle power plant using an Organic Rankine Cycle (ORC) system. The current target of the project is to install and operate a Geothermal Electric Power Plant (GEPP) with 7.0 MWe gross capacity (5.9 MWe net capacity).

Babadere GEPP is intended for energy generation purpose only. The project includes the following main items:

- 6 production wells;
- 4 reinjection wells;
- Fluid collection and reinjection system (FCRS);
- Power transmission line.

Babadere GEPP project has been granted with Energy Production License given by the Energy Market Regulatory Office (EMRA) on October 3, 2012 for 3 MW. The application has been implemented to EMRA to increase the capacity to 8 MWe. Table 1 presents the key aspects of the project.

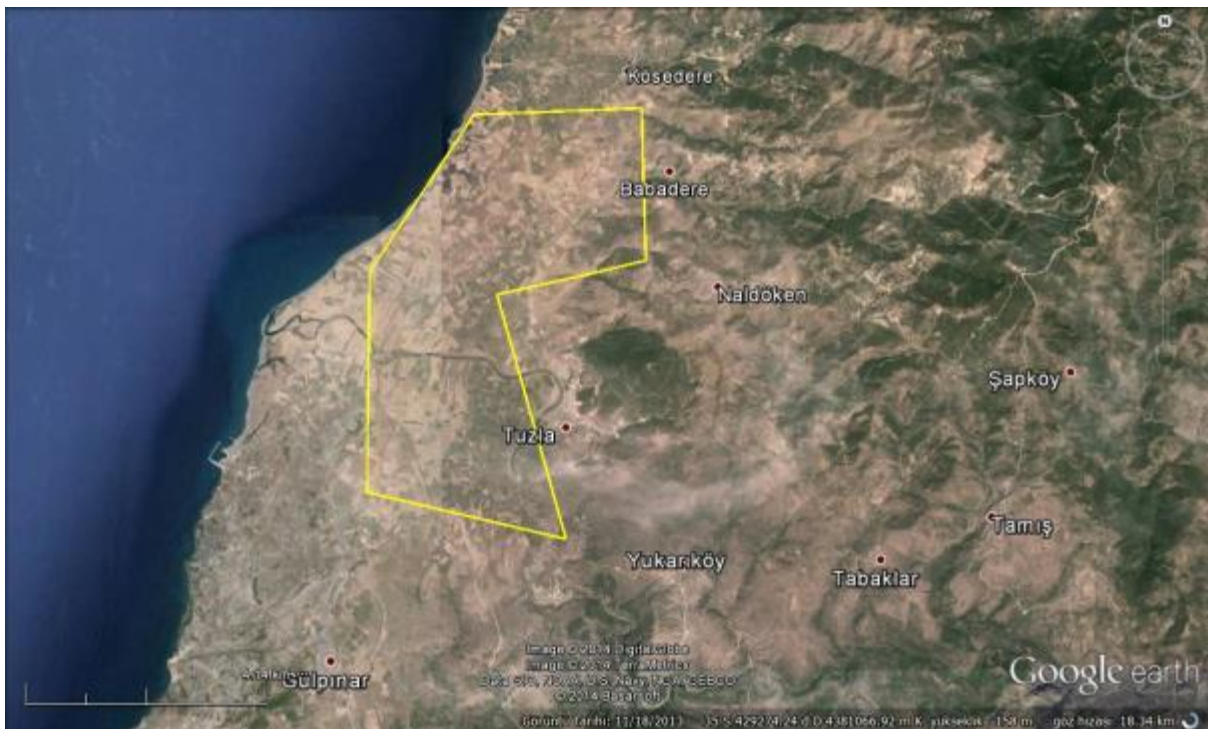


Figure 1.1: Satellite Image of the Babadere Geothermal Field

Table 1-1: Key project summary data

Project Name	Babadere Geothermal Electric Power Project
Project Borrower	Mtn Enerji Elektrik Üretim San. ve Tic. Ltd. Şti., the Borrower was established in 2007 for production and selling of electricity.
Project Sponsors	Işıl Tekstil San. Ve Tic. Ltd. Şti.
EBRD Transaction	Total Project cost is USD 32,618,020 including VAT, investment period interest, premiums and arrangement fees. The proposed financing scheme includes debt financing of USD 22,046,297 (all financed through MIDSEFF) and borrower's contribution of USD 10,571,723. The debt to equity ratio is approximately 68:32. The investment will be completed in the first quarter of 2016.
Project Description / Business Purpose:	<p>The location of the proposed GEPP is in the north-west of Turkey, in Canakkale province of Marmara Region, in the south-western side of Biga peninsula, westward and very close to Tuzla town, few kilometres northward of Gulpınar town and few kilometres westward Babadere town.</p> <p>The GEPP project will produce on average 41,680,000 kWh of renewable electricity per year. The energy will replace the conventional electricity from the national grid and enable reduction of 22,174 tCO₂/year.</p>
Installed Power	7 MWe gross / 5.9 MWe net
Annual Electricity Production	41,680,000 kWh/year

2. Environmental and Social Baseline

2.1 Environmental description of the project area

The project will be carried out within the borders of the licensed area of 2395.25 h. The powerhouse and wellhead facilities will be located in this area. It is stated that the project site consists of agricultural and forest lands. All the lands were private and used by the owners for agriculture. Privately owned lands had been purchased by mutual agreements. Just two parcels are not bought yet because the owners are not available for an agreement, so the Sponsor is authorized to proceed with expropriation. During site visit, it was observed that the project area is not situated on a forest land. But, the project area is surrounded by private lands used for agriculture that are encircled by trees. In accordance with the specified land use types, necessary permits will be taken from the relevant institutions.

There is no designated area within the project site, such as natural, protected and sensitive areas. The nearest protected areas to the project area is Trojan Ancient National Park in the north with an approximate distance of 30 km and Kazdağı National Park in the east with an approximate distance of 47 km. and thermal-tourism centers are presence. There is no cultural goods/heritage are found in the project area. The nearest cultural protected areas to the project site borders are Larissa Ancient City and Temple of Apollo Smintheus which are in the west with an approximate distance of 3 km. No physical interaction between project activities and this protected site is expected.

The most important surface water source near the project area is the Tuzla River, which is inside the project area. The PC suggested a desk study for assessment of flora and fauna, especially for the aquatic habitats in the nearby Tuzla River and monitoring of biota during construction and operation phases could be considered as not strictly necessary.

According to the other documents supplied by the Sponsor do not mention about flora and fauna species that are found at the project site. Thus, PC suggests a biota desk study at the project area to determine the existence of endemic or threatened species protected under national or international regulations.

Table 2-1: Environmental characteristic

ENVIRONMENTAL ASPECTS	PRESENCE/DISTRIBUTION	COMMENTS
Land Use	The project area consists of private, agricultural and forest lands	Rented and purchased
Surface Water Resource	Tuzla River (in the project site)	-
Cultural Protected Area	Larissa Ancient City and Temple of Apollo Smintheus (app. 3km far to the Project site border)	will be in communication with Çanakkale Provincial Directorate of Culture and Tourism
Natural Protected Area	Trojan Ancient National Park is 30 km far from project area and Kazdağı National Park is 47 km far from project area.	-

2.2 Social condition of the project area

The main economic activity in Çanakkale Province is agriculture (Palabiyik, 2006). Industry of the province is mainly based on the agricultural activities. The main economical income of more than 70% of the villages in Çanakkale Province is agricultural products. Wheat, sunflower, tomato, horsebean, apple and olive are the products with highest contributions to the economy of the province (Palabiyik, 2006). Çanakkale Province, particularly Biga, Çan, and Ezine has significant potential in terms of stockfarming, meat, and dairy products. Ceramic products, seafood, construction iron and steel are the other foremost industrial products of the province. In recent years, energy generation (by natural gas cycle, wind and thermal power plants) occupies an important place in the economy of the province (MoSIT, 2012).

Geothermal energy resources found at Ayvalık-Tuzla and Ezine-Kestanbol have a certain thermal energy capacity; however, there exists no activity in the region towards production of energy. The geothermal resources at these areas are fully served for spa tourism (Palabiyik, 2006).

The nearest settlement areas are Kösedere Village, Babadere Village, Naldöken Village, Tuzla Village, Yukarıköy Village, and Gülpınar District. The approximate distance of these settlement areas to the borders of the project site, for which operation license is taken, and the population of these settlement areas are as follows:

Settlement Areas	Approximate Distance	Population (TUİK, 2014)
Kösedere Village	700 m	881
Babadere Village	400 m	151
Naldöken Village	1,35 km	403
Tuzla Village	600 m	637
Yukarıköy Village	2 km	630
Gülpınar District	2,5 km	6868

3. Social and Environmental Impact

3.1 Land use

The project will be carried out within the borders of the licensed area of 2395.25 h. The project site consists of agricultural and forest lands and in the surrounding some natural protected areas and thermal-tourism centers are presence. All the lands were private and used by the owners for agriculture. Privately owned lands had been purchased by mutual agreements. Land acquisition process is ongoing for some of the parcels within the project area. The powerhouse location and project layout are not defined yet. Thus, land acquisition process will go on for piping routes.

3.2 Water

Drinking water will be purchased from nearby settlements and delivered to the project site. Based on the assumption that the daily domestic water requirement is 150 liters per person, considering 15 employees during the construction phase and 25 employees during the operation phase, the domestic water requirement are estimated to be 2.25 m³/day and 3.75 m³/day, respectively.

Domestic wastewater generated by project workers will be collected in impermeable septic tanks constructed in line with Turkish regulation. During the operation, the air cooled-binary system design of the Babadere GEPP, will not result in any liquid emission as this system allows the geothermal fluid to circulate in a closed loop.

According to the above information the GEPP project will not affect the water component.

3.3 Waste

As a result of construction activities there will be domestic waste, construction waste, excavated materials and demolition waste, hazardous waste and special waste. These will be managed according to related Turkish regulations.

Domestic solid waste will be produced by construction workers on-site. The domestic waste produced will be 17.25 kg/day in construction phase and 28.75 kg/day in operation phase, respectively. The recyclable waste will be displaced in separate waste containers.

Potentially hazardous waste will be segregated from non-hazardous construction site waste and domestic waste. This will be accomplished by training of the project personnel on the types of waste.

The drilling mud, which is used during the drilling activities, will be reused. However, there is no clear explanation for the final disposal of the drilling mud. The Sponsor should manage this kind of waste and when the lifetime ends, the waste characteristics should be evaluated and disposed in accordance with the provisions of the "Hazardous Waste Control Regulation".

Excavated material will be used for landscaping and remaining amount will be stored off site. Separate temporary storage areas, having impermeable bases, will be designated for the storage of waste oils, fuels, hazardous substances, etc.

3.4 Top Soil and Soil removal

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

The total amount of topsoil to be stripped is estimated to be around 1,600 ton. The stripped topsoil will be used in the future landscaping works.

3.5 Land Stability

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. According to the reports, there isn't any slope instability and the landslide at the Project site.

3.6 Emissions: Noise and Particulate

Noise emissions will be generated during construction due to earthmoving works, construction of power plant, FCRS, drilling, production and reinjection wells and operation of construction machinery and equipment. Assessments within PIR shows that estimated noise emissions are at acceptable levels and also the sponsor has stated to work according to related regulations and all precautions will be taken into account by the sponsor before and during construction. The monitoring of noise emissions during drilling, construction and operation phases is suggested in consideration of the nearest settlement areas in the vicinity.

Dust formation from earthmoving activities and other exhaust gas emissions from construction machinery will be the main sources of impacts on air quality during the construction phase of the project. There will be some minor non-condensable gaseous (NCGs) emissions from the well drillings. The dust emission value is expected to be under legal limits.

During operation, steam from geothermal fields has a content of NCGs that may be released to the atmosphere. In closed-loop system, which will be used in Babadere GEPP Project, the condensed steam is re-injected into the well without any contact with the atmosphere. These systems are therefore almost free from emissions.

In conclusion, it can be easily said that no relevant critical aspects (both for construction and operation phase) are expected related to emissions to air.

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. The monitoring of the subsidence and seismic is suggested during the operation phase.

3.8 Landscape

During the operation phase in the project area there will be some vertical structure as cooling tower or other facilities. The Sponsor will assess of visual impact with a photomontage in accordance with National Regulation.

3.9 Summary Impact Quantification

In the following table, the impact quantification of the project (main relevant items) is shown.

Table 3-1: Impact Quantification

COMPONENT	IMPACT	QUANTIFICATION
Land use	<u>Different use of the land</u>	2,395.25 h
Water	<u>Utilization and Discharge</u>	3 m ³ /d during construction activities, 4.5 m ³ /d during operation
Waste	<u>Production of solid waste</u>	1.15 kg/person/day (20 workers for construction, 30 workers for operation)
	<u>Excavation waste</u>	1,600 ton
Top Soil and Soil	<u>Stripping top soil</u>	5,000 m ²
Land Stability	<u>Landslide</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)
Subsidence	<u>Change of the ground level</u>	-
Landscape	<u>Changing in the aspect of the area</u>	a photo simulation study to assess visual impact of the plant

MidSEFF Office

Asmadalı Sokak, No. 27

Kosuyolu

34718 Kadikoy, Istanbul

TURKEY

www.midseff.com