



Final Report

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

August 2013

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

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Pamukören GEPP - Non Technical Summary (NTS)				Controlled Copy	
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1. General Plant Description

This investment project consists of construction of a binary geothermal power plant in the Aegean Region of Turkey, Aydın Province within the boundaries Kuyucak Borough.

Pamukören GEPP is intended for energy generation purpose only. This binary power plant will be utilizing Organic Rankine Cycle (ORC) system, which is planned to be constructed in two phases. The project includes the following main project items:

- 13 production wells;
- 2 reinjection wells;
- fluid collection and reinjection system (FCRS);
- power transmission line.

Pamukören GEPP project has been granted with Energy Production License given by the Energy Market Regulatory Office (EMRA) on May 26, 2011. Table 1 presents the key aspects of the project.

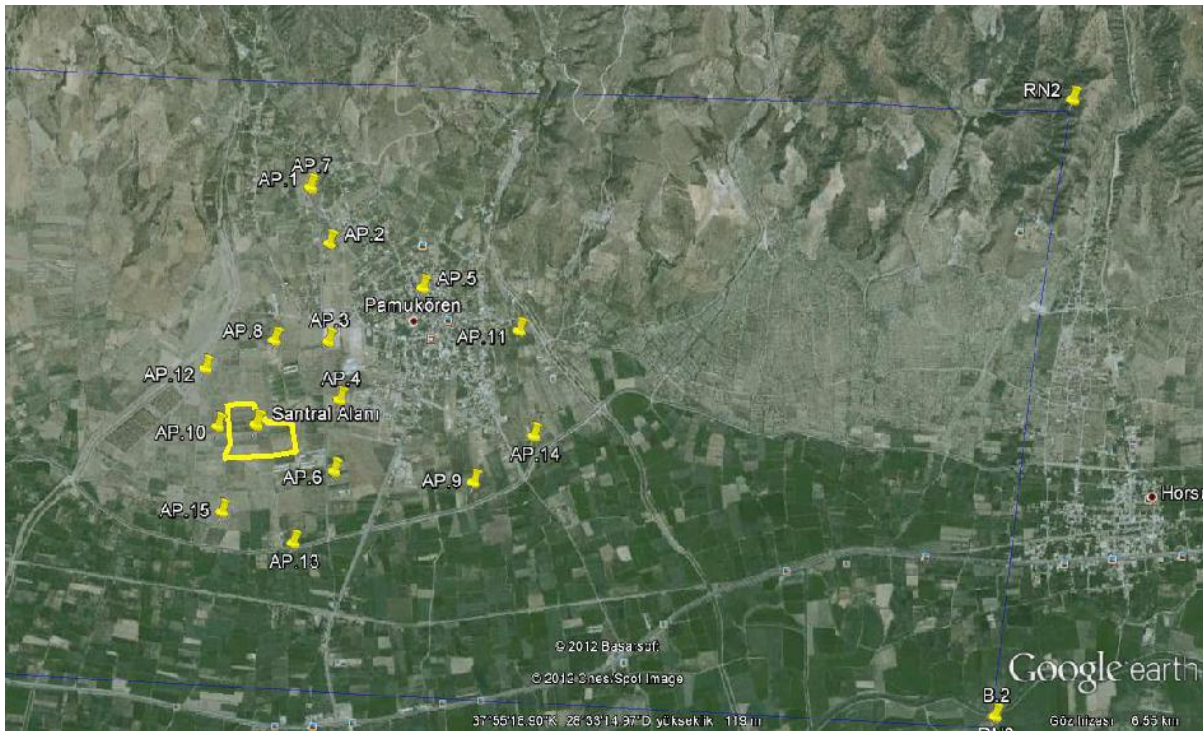


Figure 1.1: Satellite Image of the Pamukören Geothermal Field

Table 1-1: Key project summary data

Project Name	Pamukören Geothermal Electric Power Project
Project Borrower	Çelikler Jeotermal Elektrik Üretim A.Ş., the Borrower, was established on 25 August 2010 in Ankara to build and operate power plants for production and selling of electricity.
Project Sponsors	Çelikler Taahhüt İnşaat ve Sanayi A.Ş - Çelikler Group
EBRD Transaction	Total project cost is USD 62,920,000 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 50,000,000, the borrower's own contribution in the amount of USD 12,920,000. The debt to equity ratio is 73:27%.
Project Description / Business Purpose:	The Pamukören plant will have the size of 45 MWe capacity and will adopt the binary organic cycle (ORC) technology. The facility will produce 306.27 GWh per year. The generation of electricity from renewable sources will replace electricity from the national grid and enable reduction of 163,879 t CO ₂ /annum carbon savings (base case scenario).
Installed Power	45 MW (gross)
Annual Electricity Production	306.27 GWh

2. Environmental and Social Baseline

2.1 Environmental description of the project area

The license area of the project is spread on to an area of 4,655.01 h. as the blocked area is spread on to an area of 6,295.20 h. The project site consists of lands which belong to the municipality and to individuals. Within the scope of the project, an area of 4000 m² which belongs to the Pamukören Municipality has been rented. Privately owned lands had been purchased by mutual agreements.

The most important surface water source near the project area is the Great Menderes River, which is approximately 2,125 m south of the plant.

The closest cultural site to the project area is Antiocheia which is approximately 4 km (air distance) away from the Project area. No physical interaction between project activities and this protected site is expected.

As a result of Flora studies carried out in the project area, there are not any species that are endemic, rare or under protection by national or international agreements.

According to findings of the faunistic studies conducted for mammals, birds, reptiles and amphibians in the study area, two species were identified in the region under CITES Columba livia (rock dove) (Annex III) and Falco peregrines (born wanderer) (Appendix I). The dedicated study for fauna and flora were carried out in the project area and presented on the ESIA Report.

Table 2-1: Environmental characteristic

ENVIRONMENTAL ASPECTS	PRESENCE/DISTRIBUTION	COMMENTS
Land use	The project area consists of private and municipality lands	Rented and purchased
Surface water resource	Great Menderes River (approximately 2 km far)	-
Protected area	Cultural site Antiocheia (approximately 4 km far)	-
Flora and Fauna	More than 57 flora species, 32 bird species and 33 amphibian, mammals and reptile species in total	None of which is identified endemic or under protection. two fauna species identified in the region under CITES (listed at Annex I and Annex III)

2.2 Social condition of the project area

The total population in Aydın province is 999,163 according to the Addresses-Based Population Registration System (ABPRS) 2011. The closest settlement to the Pamukören GEPP site is Pamukören Township located at 0.5 km distance to the Project area.

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

The economy of Pamukören Township is based on agriculture. The mountain districts produce olive oil, while the lowland plain of the Büyük Menderes River produces high quality oranges, figs and cotton.

3. Social and Environmental Impact

3.1 Land use

The project site consists of lands which belong to the municipality and to individuals. Within the scope of the project, an area of 4000 m² which belongs to the Pamukören Municipality has been rented. The privately owned lands were bought by mutual agreements.

3.2 Water

There will be household waste water both during construction and operation phase. This is generally employees' daily waste. The pollution is biological and physical. According to the Project information Report the household waste water amount is calculated 4.5 m³/day during construction phase and 3 m³/day during operation phase (30 employees during construction and 20 employees during operation are assumed).

3.3 Waste

The hazardous waste is expected in negligible level due to used oils from construction machines, waste batteries and accumulators etc. These will be handled according to the related regulation as stated in the PIR. The amount of household waste caused by employees is calculated about 34.5 kg/day during construction phase and 23 kg/day during operation phase. Recyclable waste such as wood and plastic will be collected in separate boxes and will be delivered to licensed companies. All these activities related to waste management will be carried out according to the related regulations such as Solid Waste Control Regulation.

About the management of excavated material during construction phase, closed to the main construction yard there is a concreting area used also as a collecting point for the excavated material.

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 12,160 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 technical assessment report, 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 ESIA shows that 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.

Dust formation from earthmoving activities and other 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, the main issue is the possible release to the atmosphere of NCGs contained in the steam. In the current Atlas-Copco design, the non-condensable gases (NCG) that are produced together with steam from the geothermal well are vented to the atmosphere. The brine measurement shows that the NCG consist of almost pure CO₂.

CO₂ is a greenhouse gas, but is non-toxic and its venting will not result in exceeding any air quality emission limits.

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.

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.

Table 3-1: Impact Quantification

COMPONENT	IMPACT	QUANTIFICATION
Land use	<u>Different use of the land</u>	6,295.20 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>	12,160 ton
Top Soil and Soil	<u>Stripping top soil</u>	38,000 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

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