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Situation and perspectives of the Bouillante geothermal power plant in Guadeloupe, French West Indies

(F.Demarcq, R.Vernier, B.Sanjuan)

The Bouillante geothermal plant is the only installed capacity in the Caribbean volcanic islands, harnessing for almost 30 years a high enthalpy geothermal field located along the coast of western Guadeloupe. Exploration by BRGM and EURAFREP began in the 1960s and four wells were drilled in the 1970s. EDF and EURAFREP decided in the early 1980s to build a first 4MWe unit, Bouillante 1. Due to various difficulties in the operation of the plant, Geothermie Bouillante, a subsidiary of BRGM and EDF, was created in 1995 to take it over. Three new wells were drilled in 2001 and a new 11 MWe unit, Bouillante 2, started in 2005, in addition to the first unit. After four years of good operation that covered 6 to 7% of the demand of the island, the plant had to face various technical and social issues. 2013 represents the full end of these events, with an availability of Bouillante 2 that exceeded 90 %.

In a context of steady increase of the population and of energy demand in the Caribbean islands, the development of geothermal energy can provide base load and relatively cheap electricity. Due to the fact that the power generated by Geothermie Bouillante is purchased at a lower price than the one produced by oil-fuelled plants, it is estimated that the geothermal plant has enabled a saving of around € 60M in the electricity bills paid by French customers over 9 years.

The Bouillante geothermal field has also been the playing field for research, development and innovation of BRGM group, which developed tools to be applied in Bouillante but also in other overseas territories and abroad: one can mention, *inter alia*, the successful thermal stimulation of the BO-4 well in 1998, the development of exploration methods in geology, fluid geochemistry and geophysics adapted to the overseas specificities, the exploration of other parts of the Bouillante area itself, the realization of several tracer tests and the modeling of the reservoir and of the wells. BRGM has recently been able to apply a part of this know-how in Martinique and Dominica islands.



Figure: overview of Bouillante 1 new rotor

BRGM has thus continuously supported the development of the Bouillante field and its exploitation in a sustainable way. GeothermieBouillante has enhanced the safety of its installations by reinforcing the well-heads and replacing the pipes on the well platform in 2010 so that they now resist to seism. It has reduced the noise generated by the plant through a full action plan that has been implemented in 2011-2013 and is now planning the reduction of H₂S emissions. It has implemented a partial reinjection of the brine to maintain the pressure in the reservoir. In 2013 the Bouillante 1 unit was refurbished after a € 5M investment : most major mechanical parts and the control systems were changed. It has also developed communication with the local community, inter alia through the setting up of a local committee (CLIC).

GeothermieBouillante has been granted in 2009 a concession which covers a large part of the territory of the Bouillante commune, and it develops additional projects in this area. Existing data suggest other areas of interest, notably in the northern part of the Bouillante bay. The company has therefore started preparation for the Bouillante 3 project, for which it has a license to drill exploration wells; it also considers launching a magneto-telluric survey. The stimulation of existing wells and additional brine reinjection are also being considered on the existing site, prior to the possible construction of an additional power generation capacity. Private or public, industrial and financial investors will be needed to help financing and developing these projects. In addition, as a stepping-stone for the development of geothermal energy in overseas territories and the Caribbean islands, BRGM and GeothermieBouillante are also involved in several partnerships as the Geodenergies project of scientific institute, which aims at developing new underground technologies for decarbonated energies and will have an office in the French West Indies dedicated to geothermal power.