

Geothermal Energy Potential in the Caribbean Region

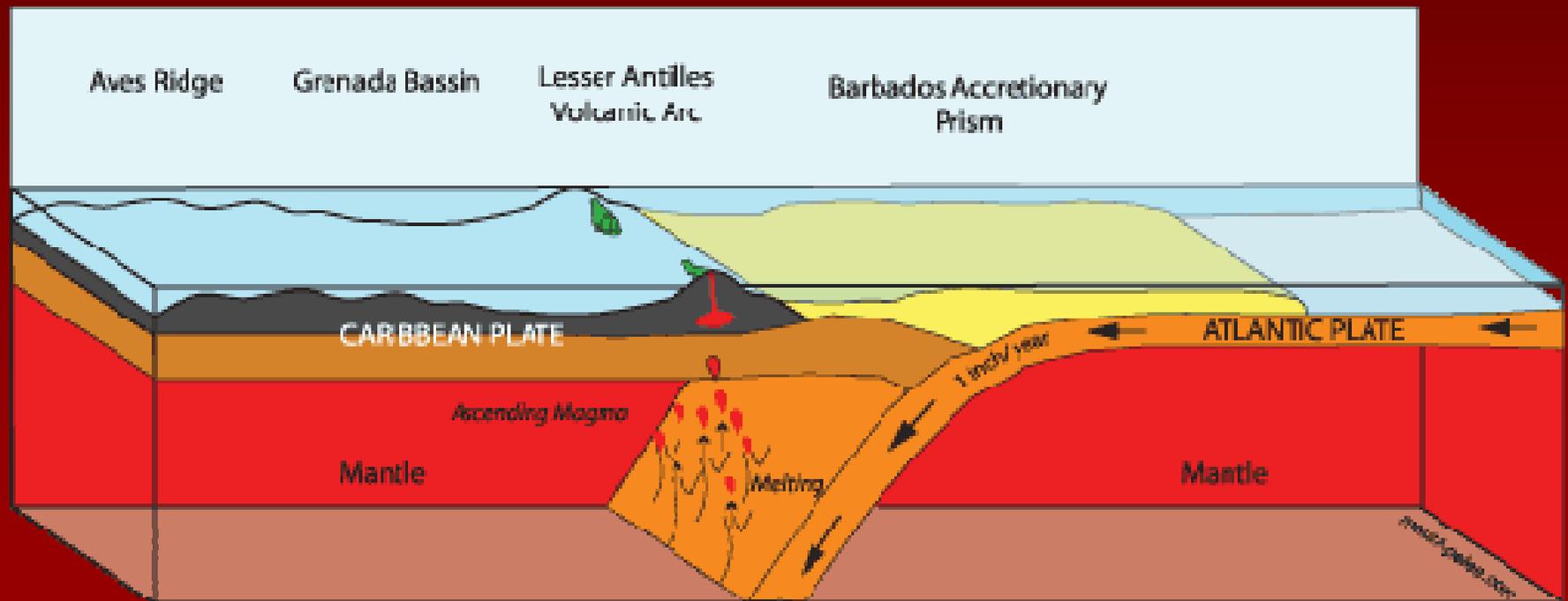


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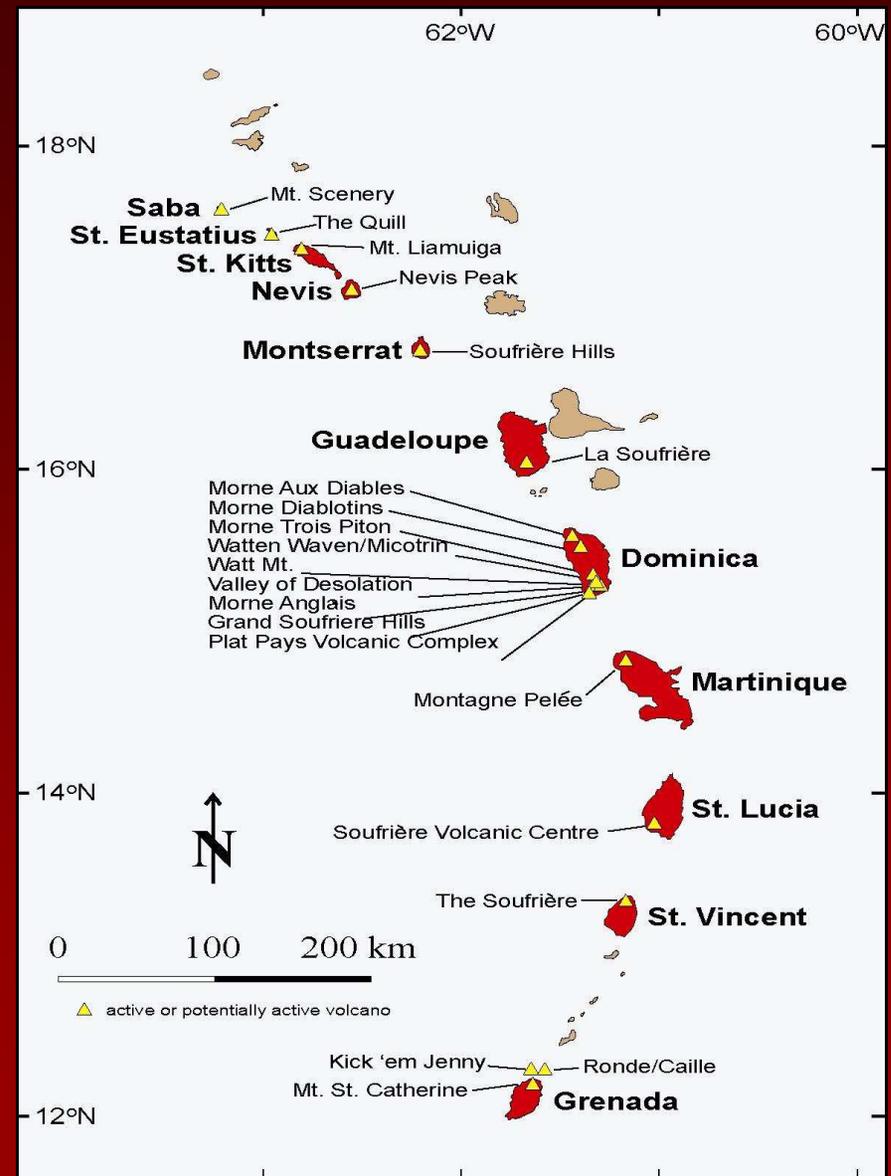
Regional Tectonic Setting

- The Lesser Antilles island arc extends 850 km along the eastern edge of the Caribbean Plate
- The islands of the arc have been largely built by volcanism above a subduction zone, as the Atlantic Plate is being subducted under the Caribbean Plate



Active Volcanic Centers of the Lesser Antilles

- There are 19 potentially “active” volcanoes in the Lesser Antilles
- Six (6) volcanoes have erupted in the past 400 years
- Eleven (11) volcanoes:
 - have had severe earthquake swarms
 - have surface hydrothermal activity associated with them
 - have deposits dated within the past 10,000 years
 - have experienced all of the above
- The thermal energy of these volcanic islands makes them of interest for geothermal exploration



Overview

Although geothermal resources are abundant on several of the islands, apart from Guadeloupe which has a 4.5 MWe binary plant, geothermal development is still in the early stages for several reasons:

1. Geothermal development is not a priority in the energy policies of the island governments. Traditionally, the islands have depended on diesel generation, with the exceptions of Dominica and St. Vincent which use hydroelectric power.
2. None of the countries have geothermal laws; many do not have laws for the regulation of the electricity sector in particular.
3. Limited financing and the high cost of geothermal exploration has held back the projects in the feasibility stage.
4. There are no economic incentives for geothermal development.
5. The population, and consequently the markets, of the islands are small.



Geothermal Energy Potential

Huttrer ranks the islands, in order of development potential, as follows:

1. Guadeloupe
2. St. Lucia
3. Dominica
4. St. Vincent
5. Nevis
6. Saba
7. St. Kitts
8. Grenada
9. Martinique
10. Montserrat
11. Statia

Geothermal power could almost surely be sold to the utilities for less than the 12 -15¢/kWh cost of generation now estimated by the various utility companies, and the prospect of initiating significant savings is appealing to government officials as well as the citizens-on-the-streets (Huttrer, 1998).



Dominica

Geothermal Sites / Projects:

- Dominica has an estimated 1,390 MWe of geothermal power potential. Geothermal development is important as a substitute for diesel generation and to supply Dominica's increasing base load demand.
- The French institute of geological investigations and mines, Bureau de Recherches Géologiques et Minières (BRGM), began the first integrated exploration of Dominica's geothermal resources in 1977, identifying three areas of interest: Watten Waven, Boiling Lake, and Soufrière.
- 13th March 2008, Government launched a 250 Million Euro Geothermal Project titled "Preparations of a geo-thermal based cross border electrical interconnection in the Caribbean."



Grenada

Geothermal Sites / Projects:

- Grenada has an estimated 1,110 MWe of geothermal power potential. OLADE observed a possible resource of high enthalpy in the area of Mount Saint Catherine in 1981 which was later confirmed in 1992 as part of the UN/DTCD program.
- Prefeasibility studies have revealed one small solfatara on Mount Saint Catherine, several small thermal springs in ravines radial to the central volcano, and numerous relatively young phreatic explosion craters. Additionally, the sub-sea volcano “Kick-em-Jenny” lies only five miles off Grenada’s north coast suggesting that the zone between it and the central northeastern part of the island may be of geothermal interest.



Guadeloupe

Geothermal Sites / Projects:

- Guadeloupe has an estimated 3,500 MWe of geothermal power potential. Guadeloupe has the only geothermal power plant in the Caribbean, a 4.5 MWe double flash power plant at Bouillante which came online in 1984 and supplies the leeward coast of Basse-Terre with electricity.
- The plant has been generating at an average rate of 4.7 MWe. The Bouillante plant had intermittent problems caused by relatively high amounts of non-condensable gases and associated H_2SO_4 , which seem to have been mitigated by Compagnie Française de Géothermie (CFG) (Huttrer, 1998).
- There are plans to expand the Bouillante plant.



Martinique

Geothermal Sites / Projects:

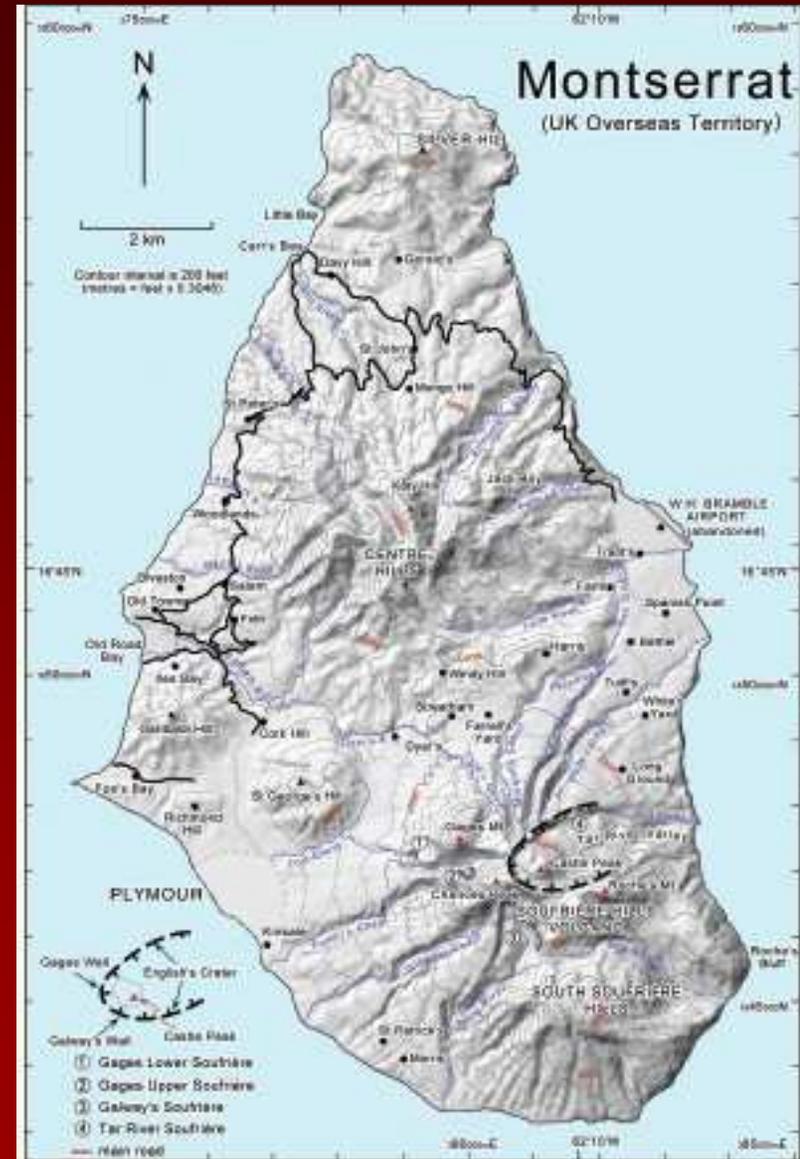
- The very active Mt. Pele comprises an obvious locus for geothermal resources. There are solfataras, hot springs, underlying earthquake activity, and well developed fracture systems (Huttrer, 1998).
- Martinique has an estimated 3,500 MWe of geothermal power potential.
- There are plans to set up a geothermal plant in Martinique (Lawrence, 1998).



Montserrat

Geothermal Sites / Projects:

- Montserrat has an estimated 940 MWe of geothermal power potential.
- Even before the 1995 eruption, the southwestern flank of the Soufrière Hills Volcano was the site of solfataric activity and of numerous thermal springs.
- There was also significant seismic activity, and several well developed fracture systems transecting the volcano (Huttrer, 1998).



Netherland Antilles

Geothermal Sites / Projects:

- The Netherlands Antilles have an estimated 3,000 MWe of geothermal power potential. Saba is a small island comprising a central volcano with at least 15 andesitic domes on its flanks. There is a record of volcanic eruption(s) less than 1000 years ago and there are numerous hot springs along the shoreline and just off shore.
- The island is highly fractured, some hot springs temperatures have risen in the last 40 years. INEEL, GMC, and USGIC prepared a preliminary assessment of the potential for the development of geothermal resources of Saba and Statia under a DOE sponsored program.



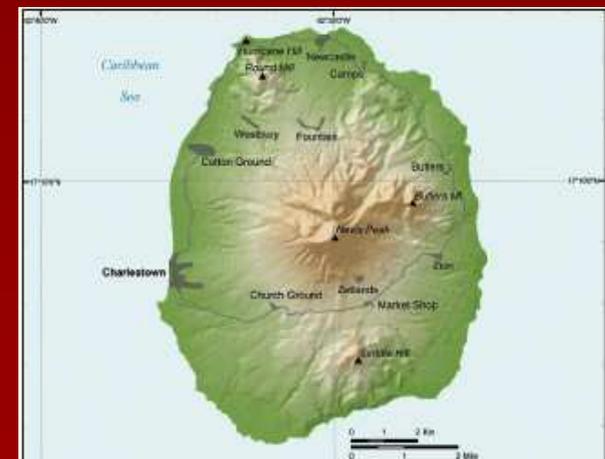
- While some heat probably remains beneath The Quill on Statia there are no known hot springs or paleo-thermal areas on the island (Huttrer, 1998).



Saint Kitts & Nevis

Geothermal Sites / Projects:

- St. Kitts and Nevis have an estimated 50 MWe of geothermal power potential. INEEL, GMC, and USGIC prepared a preliminary assessment of the potential for the development of geothermal resources of St. Kitts and Nevis under a DOE sponsored program.
- There are encouraging geothermal indicia at five places on Nevis. On Nevis's western and southern sides there are two solfataras, numerous thermal wells, and a large area of hydrothermal alteration.
- On St. Kitts, though there are moderately large areas of steaming ground in the crater of Mount Liamuiga, as well as thermal springs along the western shoreline, the geothermal indicia are less well-defined than on the other islands (Huttrer, 1998).



Saint Lucia

Geothermal Sites / Projects:

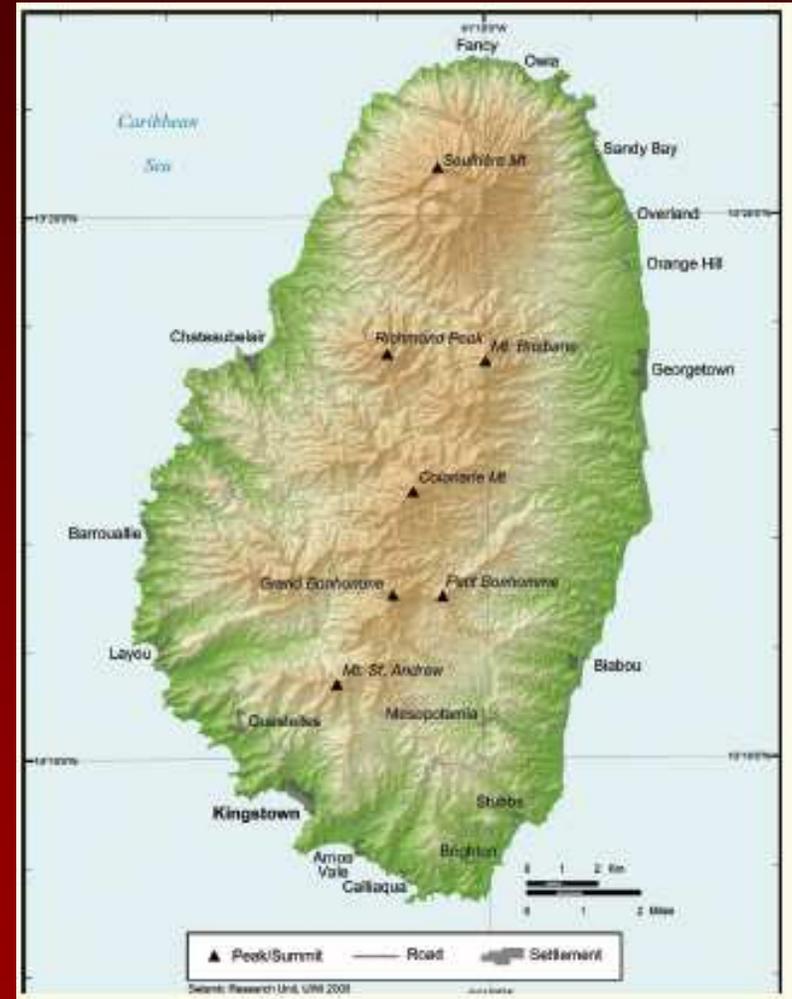
- St. Lucia has an estimated 680 MWe of geothermal power potential.
- In the 1980s, Aquater (Italy), Los Alamos National Laboratory (funded by USAID), and the UN Revolving Fund for Natural Resources Exploration (UN/RFNR) conducted prefeasibility studies which included drilling production-size exploratory wells.
- The second of two wells drilled by a team led by Italian geothermists found what appeared to be an economically exploitable resource. Unfortunately, this well suffered mechanical failures and the produced steam was never harnessed to generate power.
- More recently, INEEL, GMC, and USGIC prepared a preliminary assessment of the potential for the development of geothermal resources of St. Lucia under a DOE sponsored program.
- Geothermal indicia on St. Lucia comprise a very large solfatara near the village of Soufrière, numerous thermal springs, and very recent volcanic activity including both phreatic and pyroclastic eruptions (Huttrer, 1998).



Saint Vincent & the Grenadines

Geothermal Sites / Projects:

- St. Vincent and the Grenadines have an estimated 890 MWe of geothermal power potential.
- St. Vincent's geothermal potential has not been formally studied. INEEL, GMC, and USGIC prepared a preliminary assessment of the potential for the development of geothermal resources of St. Vincent under a DOE sponsored program.
- La Soufrière volcano has erupted three times since 1902, there is a steaming resurgent dome in the crater and there are numerous hot springs in river valleys on the western side of the volcano (Huttrer, 1998). Of additional interest are three striking features near Wallibou Beach, in an area locally known as "Hot Waters," and a circular feature near Morgans Wood near Trinity Falls (Huttrer, 1995).



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