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The Exploration of the Role And Benefits of Solar Photovoltaic Energy Production in the Diversification of Jamaica's Energy Mix

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Concentrated Solar Power or CSP is a Renewable Energy Technology (RET) approach with little research and impact in Trinidad and Tobago beyond rudimentary applications in food preparation and water purification schemes. The driving force behind this Solar Thermal Concept is direct and uninterrupted sunlight. This forms the basis of Solar Irradiance - measured solar energy hitting the surface of the earth per unit area. The latitudinal location (close to the equator) gives Trinidad and Tobago an uncanny advantage over temperate and polar regions.

The ability to harness this energy over a given area into a focal point can be accomplished by the unique shape of a parabolic dish. A repurposed parabolic solar cooker formed the backbone of the apparatus to test the suitability and scalability of a system to generate hot water for typical single-family households. Key measurements and readings include solar irradiance, ambient temperature, temperature of heated receptacle, time taken to boil and evaporate water etc which were taken over a 23-day period (17th November to 9th December 2021) during peak solar hours (10am to 2pm) for maximum effectiveness.

Several observations were made and key trends were established for this Design-Build post graduate thesis. The greater the solar irradiance the higher the temperature of the receptacle containing a specific volume of water at the focal point. The water would ultimately reach boiling point faster and evaporate quicker as well. The best day resulted in an efficiency calculation of 17.63%. Low solar irradiance from cloudy or rainy days rendered the experiment useless.

Still, the CSP hot water generator can potentially reduce or eliminate the use of conventional tank based electric water heaters where a typical 30 gallon heater accounts ~2.3 tons CO₂ emissions annually and takes on average \$1418 TTD per year to operate using 2021 TTEC electricity rates.