





Government House Montserrat

RENEWABLE ENERGY OPPORTUNITIES IN MONTSERRAT, THE EMERALD ISLE OF THE CARIBBEAN

Investing in Montserrat's growth as a pioneering smallscale renewable and blue economy centre of excellence in the Eastern Caribbean.



GREENCROWD IN MONTSERRAT

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INTRODUCTION

Montserrat, known as the "Emerald Isle of the Caribbean" for its lush landscapes, is a British Overseas Territory located in the Lesser Antilles (Eastern Caribbean), between Antigua to the Northeast and the French island of Guadeloupe to the Southeast. With a population of around 4,500 on a land area of 39 square miles, Montserrat is the smallest state in the Organisation of Eastern Caribbean States (OECS), yet as a full member of The Caribbean Community and Common Market (CARICOM), offers unique opportunities for commerce and investment, particularly in renewable energy.

In March of this year, I had the privilege of visiting Montserrat alongside Atam Sandhu, CEO of DMA Invest, at the invitation of the Governor's Office and the Office of the Premier. We were warmly welcomed by the Ministry of Communication, Works, Labour, and Energy (MCWLE). We visited the 750 kilowatt (kW) solar photovoltaic power plant near the airport and explored Montserrat's geothermal production wells at Cork Hill. These wells, located a few kilometres from Plymouth, the former capital before the 1996 volcanic eruptions and now a tourism attraction, highlight the island's significant geothermal potential, an essential resource in Montserrat's future energy strategy.

Montserrat wants to attract UK businesses to invest in the island's renewable energy and other sectors. To that end, I recently returned to Montserrat as part of the FCDO-funded UK-Montserrat Trade and Private Sector Investment Project, for which greenCrowd is tasked with elaborating a detailed Renewable Energy Roadmap for Montserrat.

I visited the Montserrat Port Development Project, funded by the UK Government through the UK Caribbean Infrastructure Fund (UKCIF) and administered by the Caribbean Development Bank, the Brades power plant, the two operational solar PV plants, the geothermal wells, and various sustainable agriculture and blue economy initiatives. I met with numerous stakeholders and participated in a Town

Hall meeting to present the project and engage with the island's residents.

The week I spent in Montserrat was inspiring. The many people I met and talked with demonstrated vividly how real the daily energy challenges are and how compelling the opportunities are.

Montserrat is undoubtedly a special place. If you would like to learn more about any of the projects highlighted in this publication, please contact the team at greenCrowd via team@greencrowd.energy or visit our website for updates.

Best wishes Rick and the greenCrowd Team November 2024





Welcome to Montserrat, a land of unique opportunity, where nature and innovation converge to create a foundation for sustainable growth and investment.

We are pleased to present this investment brochure on renewable energy and the blue economy—two sectors that are central to our island's vision for a resilient, prosperous future.

Montserrat's strategic focus on renewable energy and the blue economy reflects our commitment to sustainable development and environmental stewardship. With proven geothermal resources and opportunities in solar, wind energy and other renewable energy sources, Montserrat is positioned to become a model for green energy in the Caribbean.

Our ambitious renewable energy initiatives are designed to reduce dependency on imported fuels, lower energy costs, and ensure energy security for generations to come. This transition to clean energy creates significant investment opportunities and aligns with our goals of climate resilience and sustainable economic development. Our blue economy offers equally promising avenues for growth. With Montserrat's pristine coastal waters, rich marine biodiversity, and unspoiled volcanic landscapes, the island presents an ideal environment for eco-tourism, sustainable fisheries, and marine conservation ventures.

We are committed to responsible development of these resources, prioritising the health of our marine ecosystems while fostering job creation and local enterprise. These investments will play a vital role in protecting our natural heritage and supporting our communities, making the blue economy a cornerstone of Montserrat's sustainable future. This brochure provides an overview of Montserrat's vision for development in these sectors, supported by a transparent regulatory environment, strategic infrastructure projects, and a pro-investment climate. We invite UK investors who share our commitment to sustainable progress to explore the exciting opportunities that await in Montserrat.

Together, let us forge a path to a cleaner, greener, and more resilient future for Montserrat.

Mrs Sarah Tucker Her Excellency The Governor Honourable Reuben Meade The Premier of Montserrat



As described in this publication, one of Montserrat's greatest strengths is its renewable energy potential. Investors interested in green energy can participate in the island's transition to a low-carbon economy by investing in the transmission and distribution grid, a proven geothermal resource, undoubted solar resource, resilient battery storage and, in specific sites, onshore wind projects.

These investments will support Montserrat's goal of energy independence, reduce energy costs for residents and businesses, and improve the island's environmental sustainability. In addition, the blue economy, tourism, agribusiness, and hospitality sectors offer promising opportunities, particularly as Montserrat positions itself as a leader in green growth and eco-friendly tourism.

The Governor's Office in Montserrat actively encourages private-sector investment to drive the island's development forward. In line with its strategic goals, the UK Government is committed to supporting this phase of growth, with an emphasis on reducing external dependency and fostering sustainable revenue generation.

PRIVATE-SECTOR INVESTMENT: OPPORTUNITIES AND BENEFITS

The UK Government supports Montserrat's development, providing over 60% of the island's recurrent budget.

Montserrat's membership in CARICOM offers investors and businesses based on the island access to a preferential trade regime, enabling the free movement of goods, capital, and people across 20 member countries. This gives Montserrat a unique advantage as a base for regional exports, offering international businesses access to a market of up to 16 million people.



EMOTIONAL INFRASTRUCTURE: ONE OF MONTSERRAT'S CORE STRENGTHS

Beyond its natural beauty, Montserrat's other strength lies in its people's resilience, creativity, and adaptability. Despite the challenges posed by natural disasters, residents have demonstrated a remarkable commitment to learning, rebuilding and developing the island's infrastructure. The community's openness to new ideas, such as embracing renewable energy projects and diversifying the economy, positions Montserratians as essential partners in realising the island's long-term development goals.

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The collective sense of community and shared vision for economic resilience also foster a conducive environment for investment and development, with a strong focus on education and skill development. Montserratians understand that sustainable growth is not only about technological advancements but also about cultivating local human capital.

MONTSERRAT'S STRATEGIC ENERGY VISION

The development of renewable energy underpins Montserrat's vision for economic transformation. The island is positioned to capitalise on its natural resources, including geothermal, solar, and wind energy, to move away from fossil fuels, reduce sky-high energy costs, decrease carbon emissions, and enhance energy resilience.

Montserrat's electricity demand peaks between 2,000 and 2,400 kW, with a base load of 1.3 to 1.5 megawatts (MW). Montserrat Utilities Limited (MUL) meets this demand using ageing diesel generators and four high-speed models well beyond their design lifetimes. Initially intended for emergency use, these generators have been the primary power source for over two decades, resulting in inefficiencies and avoidable costs. Rising diesel prices have compounded this issue, making the status quo unsustainable.

It is estimated that diesel fuel costs account for 50-55% of MUL's annual operating expenses, and a 58% rise in fuel costs over the last five years has compounded the problem of dieselfuel dependency. The island's limited fuel storage capacity requires frequent deliveries, further driving up costs. These expenses are ultimately passed on to consumers through a variable fuel surcharge (currently levied at EC\$0.72 per kWh, equivalent to US\$0.26 per kWh on top of electricity usage charges), making electricity unaffordable to many.

As this publication highlights, Montserrat's energy landscape holds real potential for transformation through investment in renewable energy solutions. The island has already installed 1MW of solar, comprising a 250 kW rooftop solar PV system in the capital and a 750 kW ground-mounted solar PV system paired with a 1.1 megawatt-hour (MWh) battery energy storage system (BESS) located approximately 10 minutes from Brades.

These initiatives have already reduced the island's diesel-based electricity generation by 14% yearly. Adding more solar PV and battery energy storage system capacity to the grid in the short term offers a significant opportunity for the country to decrease reliance on imported fossil fuels and stabilise the energy supply before the geothermal power plant becomes operational.

LEARNING FROM OTHER ISLANDS: REGIONAL COMPARISONS

In moving away from fossil-fuel dependency, Montserrat can draw valuable lessons from other islands, such as CARICOM and OECS members, who have successfully transitioned to renewable energy.

For instance, Guadeloupe has established itself as a leader in geothermal energy. Its Bouillante geothermal plant generates 15 MW of electricity, meeting approximately 6% of the island's energy needs.¹ Guadeloupe has also integrated over 85 MW of solar energy, demonstrating how a diversified energy mix can reduce dependence on imported fuels and enhance energy security.

Similarly, Aruba has made significant strides in wind energy development. By 2020, Aruba was generating 20% of its electricity from wind, significantly reducing its reliance on fossil fuels.² On a smaller scale, in 2023, Carriacou, part of Grenada, commissioned an 856 kW solar PV project paired with a 768 kW BESS, significantly reducing its reliance on diesel imports and demonstrating how even small-scale solar initiatives can transform energy independence for island communities.

St. Barts has also integrated solar energy into its economy, particularly within the tourism sector, using solar power to reduce fuel imports and enhance energy resilience.³ Following the devastation caused by Hurricane Irma in 2017, St. Maarten focused on modernising its energy infrastructure by integrating solar energy and building a more resilient grid.⁴

These examples show how Montserrat can leverage its geothermal, solar, and wind resources to reduce energy costs, increase energy security, and support long-term economic development.



INVESTMENT IN TRANSMISSION AND DISTRIBUTION INFRASTRUCTURE



Montserrat's transition to renewable energy will require significant upgrades to its transmission and distribution (T&D) infrastructure. MUL currently manages an electricity grid comprising three feeders (North, Central, and South), which rely on ageing infrastructure, including overhead 11 kilovolts (kV) cables, transformers, and manual switches. Adverse environmental conditions such as sea blasts and high winds have accelerated the wear and tear on these components, necessitating frequent maintenance. This creates a clear opportunity for investment in modernising the grid to reduce operational costs and improve system reliability.

One of the priorities is putting Montserrat's 11 kV transmission network underground, a process that MUL has started. This work will reduce maintenance costs and provide a more stable and reliable electricity supply during and after storms.

Another needed investment area is replacing ageing ground-mounted transformers throughout the grid. Many of these transformers have suffered accelerated wear due to environmental conditions, leading to inefficient energy distribution. Replacing these transformers will reduce energy losses and operational disruptions while improving the efficiency of Montserrat's electricity supply.

Furthermore, an investment in automatic switch technology to improve grid efficiency is needed. Currently, MUL relies on manual switches, which require engineering crews to visit physical locations for maintenance and repairs, a time-consuming and costly process. Montserrat can switch remotely by upgrading to automatic disconnect switches, reducing response times for power restoration after outages and cutting operational costs.

These essential modernisation projects provide substantial opportunities for investors to contribute to Montserrat's grid development. Strengthening the island's transmission and distribution infrastructure will support the integration of new renewable energy generation sources, making Montserrat's energy transition more efficient and costeffective.

PRIORITISING RENEWABLE ENERGY PROJECTS: SOLAR AND GEOTHERMAL

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Montserrat's energy transition strategy focuses on developing scalable, cost-effective renewable energy projects. Solar and geothermal energy can meet the island's current needs, providing a reliable and environmentally sustainable supply, with onshore wind energy being a viable source of future power generation.

PRIORITISING RENEWABLE ENERGY PROJECTS: SOLAR AND BESS

Installing three 1 MW solar photovoltaic systems, paired with a 1 MW power / 2 MWh capacity battery energy storage system across the north of the island where the majority of the population lives and works, presents a transformative opportunity for Montserrat to reduce its energy costs while enhancing the reliability and sustainability of its power grid.

The first of these solar PV power plants can be readily located on government buildings and public facilities in Brades, the island's capital, thereby avoiding the costs and logistical challenges associated with land acquisition. Rooftop solar installations benefit from being closer to the end-user, reducing transmission losses and improving energy efficiency, as the energy is generated where it is most needed. The following 2 MW of solar plus BESS can be ground-mounted near the airport or located on government land.

Integrating BESS into this system is critical for addressing the intermittent nature of solar energy. Solar PV systems generate electricity during daylight hours, but energy demand often peaks in the evening or during periods of low sunlight. By co-locating BESS to new solar projects, Montserrat can store excess solar energy generated during the day and discharge it during peak demand periods or at night. This improves the reliability of solar power and ensures a more stable supply, reducing the need for expensive dieselpowered generators to meet demand fluctuations. Containerised BESS units are also flexible and can be integrated into the existing grid infrastructure relatively easily, offering a cost-effective solution for small islands seeking to improve energy reliability without extensive grid overhauls.

The financial benefits of such a system are clear. The solar PV and BESS system will help offset the cost of dieselbased generation, reducing consumer electricity tariffs. Moreover, once the initial investment is made, solar energy has near-zero marginal costs, which means that Montserrat can generate electricity at a fraction of the cost of conventional fuel-based generation.

In the long term, scaling up rooftop solar PV and BESS installations across Montserrat can further reduce energy costs and help the island achieve its 100% renewable energy generation goal. Expanding the use of solar energy and storage systems across more public and private buildings will reduce the need for additional generation capacity, optimise grid performance, and increase the resilience of the energy supply.

PRIORITISING RENEWABLE ENERGY PROJECTS: GEOTHERMAL

Montserrat's geothermal potential offers a compelling opportunity to establish a reliable and sustainable energy source for the island. The Cork Hill site, which includes two geothermal production wells (MON-1 and MON-2), has been extensively tested and shown promising results regarding temperature and output potential.



Dr Ryan, Director of the Montserrat Volcano Observatory (MVO), Rick Gambetta, Partner, greenCrowd, Ms Marissa Allen, Director of Energy, MCLWE

These wells, drilled to depths of approximately 2,298 meters for MON-1 and 2.870 meters for MON-2, have measured bottom-hole temperatures of 230°C and 265°C respectively. Longterm flow tests indicate equivalent single-phase enthalpy temperatures of around 226 °C and 237 °C with flow rates of 20.5 kg/s and 13.5 kg/s and separator pressures of 5 bar for MON-1 and MON-2. respectively. These temperatures are suitable for either flash steam power plants - where the high-pressure geothermal fluid is brought to the surface and then separated into liquid brine and steam, which drives a turbine directly connected to a generator - or a binary cycle geothermal power plant.

The binary cycle geothermal system operates using a closed-loop process in which heat from the geothermal fluid is transferred to a secondary fluid with a lower boiling point, such as isobutane or pentane. This secondary fluid vaporises and drives a turbine to generate electricity, while the original geothermal fluid can be reinjected into the reservoir.

Waste brine from both the flash plant and the binary plant can be reinjected into the reservoir. This allows for a significant reduction in any potential environmental impact, as waste geothermal brine would not need to be released into Montserrat's off-shore environment. In addition to being cleaner, the geothermal resource provides consistent baseload power, meaning it can generate electricity 24/7,

unlike other intermittent renewable sources. Geothermal plants usually have availability factors in the 90 -95% range.

The added benefit is that the extracted heat energy from the geothermal plant can be used directly for agri-processing. Using absorption refrigeration or chilling, the extracted heat from the geothermal plant can drive cooling systems, such as food processing or storage. There is also an example in Guatemala, where direct geothermal heat was used to manufacture building materials from volcanic deposits. These direct uses of geothermal energy improve efficiency by bypassing the electricity generation stage, allowing for heating and cooling solutions in various industrial, agricultural (e.g. cold storage or agri-processing), and commercial sectors (e.g. data centres).

Further testing of the Cork Hill wells has confirmed their power generation viability. Estimates suggest that Montserrat's two existing production wells (MON-1 and MON-2) are each capable of generating approximately 2 MWe, depending on the generation technology used, and could, therefore, initially support a 1-2 MW power plant without requiring further drilling or exploration.

This geothermal capacity is scalable, meaning that as Montserrat's energy demand grows, additional geothermal wells or plant expansions could be undertaken to increase capacity, significantly reducing Montserrat's reliance on imported diesel.

RENEWABLE ENERGY AND GREEN TOURISM







Adopting renewable energy is crucial to Montserrat's ambition to become the Caribbean's first 100% green destination. This goal is tightly interwoven with the island's tourism and blue economy strategies. By investing in clean energy sources such as solar, wind, and geothermal power, Montserrat reduces its carbon footprint and enhances its appeal to eco-conscious visitors.

The Montserrat Tourism Authority's vision of "Sustainable Development through Quality Tourism" aligns perfectly with this energy transition, as the island's pristine natural landscapes and thriving marine ecosystems are its primary draw for visitors. Renewable energy helps preserve these ecosystems by reducing pollution and environmental degradation, making the island a more attractive destination for soft adventure activities like turtle watching, scuba diving, snorkelling, kayaking, birdwatching, hiking, and volcano viewing.

Moreover, as Montserrat expands its renewable energy capacity, it opens up new opportunities for sustainable tourism development that can further enrich visitor experiences while safeguarding the environment. Key tourism projects could benefit immensely from reliable and sustainable energy sources, such as redeveloping hot water mineral baths

near the former Montserrat Springs Hotel and restoring historic sites like Bransby Point Fort and St. George's Hill Gun Battery. These attractions and the island's unique terrain present possibilities for new eco-tourism offerings, such as ziplining and canopy walks, enhancing the visitor experience without straining the island's natural resources or energy infrastructure.

Renewable energy also plays a vital role in the island's broader blue economy initiatives, which aim to manage Montserrat's marine resources sustainably. With its rich coastal and marine environments, Montserrat has significant potential to grow its blue economy through initiatives like sustainable fishing, coral reef protection, and marine-based tourism. Renewable energy can support these efforts by powering coastal facilities and ecofriendly marine tourism operations, reducing the environmental impact on the island's marine ecosystems.

By positioning itself as a leader in both renewable energy and the blue economy, Montserrat can create a model of sustainability that integrates environmental conservation, economic growth, and tourism, securing a resilient future for its people and its natural environment.

RENEWABLE ENERGY AND SUSTAINABLE AGRICULTURE









In Montserrat, the interdependence between renewable energy and sustainable agriculture is critical for driving down the cost of food production and ensuring the resilience of local farming. Agriculture is heavily reliant on energy, particularly for storage solutions such as cold storage, which are vital for maintaining supply during periods of fluctuating demand. However, the high energy cost of traditional fossil fuels currently makes this unsustainable. For instance, running refrigerated containers, or "reefers," on expensive grid electricity inflates operational costs to the point where local produce becomes uncompetitive compared to imported goods. Transitioning to renewable energy sources like solar, wind, or geothermal would reduce these energy costs, making more viable and competitive by lowering it possible for farmers to store their produce affordably and ensuring a more consistent supply to meet immediate and shift not only improves the resilience peak demands.

Lowering the cost of power through renewable energy also opens up new avenues for modernising agricultural practices, such as shaded production systems. These controlled environments, whether full-fledged greenhouses or simpler setups with shade cloths, allow weather extremes, and other risks. However, unreliable electricity and high

costs hinder the adoption of modern agricultural techniques that could boost yields and extend growing seasons. A switch to renewable energy would enable farmers to utilise climate-controlled environments and automated systems at lower costs, enhancing productivity while reducing their dependence on imports.

Moreover, renewable energy plays a vital role in the broader goal of food sustainability. While "food security" focuses on having enough food to feed the population, "food sustainability" takes a more holistic approach. It emphasises how food is produced, stored, and distributed, ensuring local farmers are part of the economic cycle. Renewable energy makes local food production energy costs, thus reducing Montserrat's reliance on expensive imports. This of the local food system but also aligns with regional initiatives like CARICOM's mandate to reduce food import bills by 25% by 2025. This mandate highlights the importance of storage in achieving sustainability, further underscoring the need for affordable energy solutions.

EMPOWERING MUL AND DEVELOPING LOCAL WORKFORCE CAPACITY

Empowering Montserrat Utilities Limited (MUL) and developing the local workforce capacity are critical steps in advancing the island's renewable energy goals.

MUL's role in managing and maintaining new renewable energy systems is central to ensuring the success of grid-tied solar, geothermal and wind energy generation projects. By embracing models such as Public-Private Partnerships (PPPs) or Utility as a Service (UaaS), as seen in countries like Barbados. Montserrat can accelerate renewable energy development while sharing financial risks and leveraging private-sector expertise. The example of Jamaica's Wigton Wind Farm, where private investors provided the bulk of the funding while the state utility managed operations, demonstrates how this approach can work. A similar framework in Montserrat would allow private investors to finance clean energy projects, with MUL overseeing grid integration and energy distribution.

In addition to financial investment, building local workforce capacity is essential for the long-term sustainability of Montserrat's renewable energy

infrastructure. Developing skilled workers through training programs and partnerships with regional institutions such as the University of the West Indies (UWI) will ensure that Montserratians are equipped to operate and maintain these systems. By investing in local expertise, the island can reduce its reliance on foreign contractors and create a self-sufficient workforce capable of managing its energy projects. This will ensure the smooth operation of renewable energy systems and support Montserrat's overall development goals by providing employment and building technical capacity within the community.

Strengthening local expertise will also contribute to Montserrat's broader economic self-sufficiency. As the island invests in renewable energy, having a skilled workforce will fully allow it to capitalise on its abundant natural resources. By empowering MUL and equipping the local workforce, Montserrat can ensure that clean energy projects are implemented, maintained, and optimised for the long-term benefit of the island's economy and its people.

CONCLUSION

Montserrat stands at a pivotal moment in its development. With its abundant renewable energy resources, the island has the unique opportunity to transition to a green economy. By leveraging its geothermal, solar, and wind resources, Montserrat can significantly reduce energy costs, promote food sustainability and blue economy initiatives, energy security, and support long-term socioeconomic growth.

Montserrat offers investors compelling opportunities to strategically invest in energy infrastructure, particularly in transmission and distribution modernisation, solar PV, and geothermal projects. Adopting battery energy storage systems and undergrounding key transmission lines will ensure that Montserrat's energy supply remains reliable, resilient, and sustainable despite climate-related disruptions.

The UK Government is committed to supporting this transition by partnering with Montserrat, a country that is very open to attracting private-sector investment and fostering public-private partnerships.

Harnessing the correct expertise, capital, and innovation can assure Montserrat's growth as a pioneering small-scale renewable and blue economy centre of excellence in the Eastern Caribbean.

We encourage you to participate in Montserrat's exciting energy transition.





SOURCES

- Geothermal Energy Association, Regional Renewable Energy reports
- ² Aruba Sustainable Energy Authority, International Renewable Energy Agency (IRENA)
- ³ French Overseas Territories Energy Agency, Solar Industry case studies
- World Bank, Caribbean Disaster Emergency Management Agency

GREENCROWD CONTACT DETAILS

We value creativity, resilience, independent strategic thinking and long-term partnerships.

Creativity is at the heart of everything we do at greenCrowd. To learn more about how we can support you and our market-leading services, please register at **www.greencrowd.energy** or contact Rick or Alex.

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