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Executive summary

There is no better place for solar energy than an eco-luxury island resort.
More than 80,000 m² can generate four times the energy needed.
Annual financing costs are one-fourth the cost of fuel for generators.
And today's solar tiles replace conventional roofing, while their appearance fits perfectly into a high-end resort.

Source: tesla.com

In a perfect world, the entire roof area acts as a covert power generation facility, feeding the building's own battery storage, all interconnected with a central storage and control unit, forming a zero-emission virtual power plant.

While on the mainland, solar power competes with the price of grid electricity, on our island, 120 km away, it becomes a more expensive and challenging proposition.

Besides, no one wants to hear the noise or smell the fumes from a diesel generator.

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Power Generation vs. Consumption Overview

This provides an overview of the potential solar power generation and the estimated energy consumption for a high-end residential project consisting of 150 units (50 bungalows and 100 villas) on a tropical island.

1. Power Generation

Based on an analysis of the available roof area and solar irradiance near the equator, the project has the potential to generate approximately 9,562,500 kWh annually through solar power. This calculation assumes that 50% of the gross roof area of 85,000 m² is suitable for solar tile installation, with an average efficiency rate of 15%.

2. Power Consumption

The estimated annual energy consumption for the 50 bungalows, adjusted for 9 hours of nightly A/C usage, is 876,000 kWh. For the 100 villas, taking into account half-year occupancy and reduced A/C usage when unoccupied, the adjusted annual consumption is approximately 1,843,250 kWh. The total annual consumption for the project amounts to 2,719,250 kWh.

3. Conclusion

With a significant annual energy surplus of 6,843,250 kWh, the solar energy project not only meets the residential energy needs but also offers potential for energy storage and additional load support. This highlights the project's sustainability and its contribution to renewable energy utilization.

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Cost calculation and comparison

Tesla Solar Roof: The cost varies, but for a rough estimate, let's assume an average cost of $21.85 per square foot (a midpoint in the range for Tesla Solar Roof installations). This cost includes both solar and non-solar tiles and the installation. With the decision to cut the area of solar tiles by half, we'll adjust our calculations accordingly.

Tesla Powerwall: Each Powerwall has a listed price of approximately $11,000, including installation. This price can vary based on local installation costs and additional hardware requirements.

Tesla Megapack: Pricing for the Megapack is not publicly listed due to the customized nature of large-scale energy storage solutions. However, industry estimates suggest costs around $1 million for a 3 MWh unit, including installation and supporting infrastructure. This is a rough estimate and actual prices can vary.

Sample Calculation

- Solar Roof: With the adjusted area, let's assume a total solar-effective area of 21,250 m^2 (half of the initially usable 42,500 m^2). Converting to square feet (1 m^2 = 10.7639 ft^2) and applying the average cost:
- Powerwall:
    - 50 bungalows: 1 Powerwall each.
    - 100 villas: 2 Powerwalls each.
- Megapack: Assuming the need for at least one Megapack to manage the community's overflow energy and ensure distribution.

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Here's the estimated cost breakdown for the scenario:

- Tesla Solar Roof Installation: Approximately $4,997,813, based on the adjusted solar-effective area and the average cost per square foot.
- Tesla Powerwall:
    - Total for 50 bungalows and 100 villas: Approximately $2,750,000.
- Tesla Megapack: For one unit with a capacity of around 3 MWh, the estimate is $1,000,000.

Total Estimated Cost: About $8,747,813 for the entire project, encompassing the solar roof installation, Powerwalls for individual residences, and a centralized Megapack for energy management.

This estimate provides a general financial framework for planning. It includes significant renewable energy infrastructure, capable of meeting the project's needs sustainably and efficiently. However, actual costs can vary based on detailed project specifications, location, and changes in market prices or technology. It's also important to factor in potential operational savings, incentives, and the long-term benefits of renewable energy when evaluating the overall financial viability of the project.

To evaluate the financing structure for the solar and energy storage project over 20 years and compare it with the costs associated with diesel/gas generation, including fuel and transport costs, we'll make some assumptions and perform a simplified analysis.

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Financing the Solar and Storage Project

- Total Project Cost: Approximately $8,747,813 as estimated.
- Financing Terms: Assuming an interest rate of 5% per annum over a 20-year term.
- Let's calculate the annual payment for this financing scenario using the annuity formula.

Diesel/Gas Generation Costs

To compare, we need to estimate:

- Initial Setup Costs: Cost of purchasing and installing diesel/gas generators.
- Operational Costs: Include fuel consumption, transportation of fuel, maintenance, and potential environmental compliance costs.
- Fuel Consumption: Depends on the generator size and efficiency, typically measured in gallons per kWh.
- Fuel Price and Transport Costs: Can vary widely based on location, but we'll assume an average cost.

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Assumptions for Diesel/Gas

- Fuel Price: Assuming an average price of diesel/gas (including transport) at $3 per gallon.
- Fuel Efficiency: Assuming a generator efficiency of 0.4 gallons per kWh, a rough average for diesel generators.
- Annual Energy Consumption: Based on earlier calculations, approximately 2,719,250 kWh.

Let's first calculate the annual payment for the solar project financing and then estimate the annual operational costs for diesel/gas generation.

Financing Structure vs. Diesel/Gas Generation Costs

- **Annual Payment for Solar Project Financing:** Approximately **$701,947** over a 20-year term, based on a 5% annual interest rate.
- **Annual Operational Costs for Diesel/Gas Generation:** Approximately **$3,263,100**, calculated based on the assumed fuel price, efficiency, and annual energy consumption.

Comparison and Conclusion

- The financed solar and storage project offers a lower annual cost compared to the operational costs of diesel/gas generation. This comparison highlights the long-term financial benefits of investing in renewable energy, even when considering the significant upfront costs and ongoing financing.

- Beyond the financial comparison, solar energy significantly reduces environmental impact, offers stability against fuel price volatility, and aligns with sustainability goals.
- It's also worth noting that the solar project costs could potentially decrease further with government incentives, tax credits, or rebates for renewable energy, which were not factored into this simplified analysis.

This analysis suggests that, from a financial standpoint, investing in a solar and storage solution is not only viable but also potentially more cost-effective over a 20-year period compared to relying on diesel/gas generators. This advantage is in addition to the environmental and sustainability benefits associated with reducing fossil fuel consumption.

Last, but not least: The use of only a quarter of the available roof area allows for the easy integration of the buildings into the surrounding greenery and natural shading.

Disclaimer: The information provided herein is intended for general informational purposes only and is based on assumptions and estimates that may not be fully accurate or applicable to specific projects. The figures, calculations, and recommendations should not be taken as definitive financial, technical, or legal advice. Actual costs, savings, and financial viability can vary significantly based on project specifics, location, market conditions, technological advancements, and changes in regulatory frameworks. It is strongly recommended to consult with professional advisors, including financial analysts, engineers, and legal experts, to obtain tailored advice and conduct a thorough due diligence process before making any investment or project decisions based on this information.