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food-production-greenhouse-hydroponics-by-salgenx

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Salgenx

Food Production Using the Salgenx
Saltwater Battery



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Discover the Salgenx Food Production Scale Battery System, an innovative agricultural solution combining solar power, advanced grow lights, and water management to maximize crop yields. Explore our sustainable approach to farming with vertical, hydroponics, and fogponics systems designed for efficient tomato, pepper, lettuce production and more. Revolutionize your farming with our eco-friendly, energy-efficient technology.

PDF Version of the webpage (first pages)

<https://salgenx.com/food-production-greenhouse-hydroponics-by-salgenx.html>

Revolutionizing Agriculture: The Salgenx Food Production Scale Battery System

The vegetable production module process is designed to optimize the cultivation of various vegetables using advanced vertical fogponics systems within the controlled environment of hi-cube shipping containers. This innovative approach leverages the precision and efficiency of fogponics, a method that uses nutrient-rich fog to hydrate and feed plants, ensuring optimal growth conditions without the use of soil. The integration of solar photovoltaic (PV) power for lighting and fog generation makes the process sustainable and energy-efficient.

Each module, encapsulated in a hi-cube shipping container, is meticulously configured to maximize space utilization and light distribution, ensuring that crops such as tomatoes, leafy greens, peppers, and microgreens thrive. The system's design facilitates year-round production, irrespective of external climate conditions, by maintaining ideal temperature, humidity, and light levels.

The process begins with the selection of crops based on their profitability, energy requirements, and compatibility with the fogponics system. Containers are then outfitted with LED lighting, fogponic irrigation systems, and solar PV panels to create a self-sustaining environment. Crop production is closely monitored and managed, focusing on optimizing yield and ensuring high-quality produce.

Finally, the Salgenx saltwater battery provides PV energy storage to power the LED lighting and pumps, while simultaneously desalinating seawater during charging.

The vegetable production module process represents a fusion of agricultural innovation and environmental stewardship, offering a scalable solution for urban farming and the production of fresh, locally sourced vegetables.

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Revolutionizing Agriculture: The Salgenx Food Production Scale Battery System

In the quest for sustainable and efficient food production, the Salgenx Food Production Scale Battery System emerges as a groundbreaking solution, promising to revolutionize the agricultural sector. This innovative system combines advanced technologies in lighting, energy storage, and water management to maximize the production of essential crops such as tomatoes, peppers, lettuce, and more. Let's delve into the components that make this system a game-changer for modern agriculture.

Harnessing the Power of Light and Energy

One of the cornerstone features of the Salgenx system is its 16-hour plant grow light regime, which can operate using a blend of natural sunlight and grow light assistance or exclusively through grow lights. This flexibility ensures that plants receive the optimal amount of light for growth, regardless of external weather conditions or geographical location.

The integration of Solar PV (photovoltaic) panels, specifically bifacial panels, is another critical aspect of the system. These panels power the pumps, grow lights, and heating mechanisms necessary for plant growth. Bifacial panels are particularly efficient, as they can capture sunlight from both sides, increasing energy production. This feature is crucial for sustainable operations, reducing reliance on non-renewable energy sources.

Moreover, the Salgenx system employs bifacial mirrors to enhance natural sunlight exposure for the crops. These mirrors are strategically angled to capture and reflect the most intense morning and afternoon sunlight, optimizing light availability for photosynthesis. This method is especially beneficial in northern or southern latitudes, where sunlight can be scarce during certain seasons.

Thermal Energy Storage and Water Management

The Salgenx system addresses the challenge of maintaining optimal temperature conditions for plant growth through an innovative energy storage solution. The Sand and Salt Battery (Saltgenx) stores thermal energy, which can be distributed to provide heat during the night. This storage capability ensures that plants remain in an ideal growing environment around the clock, enhancing growth rates and crop yields.

Water management is another critical component of the system, particularly given the increasing scarcity of freshwater resources worldwide. The Salgenx system incorporates near seawater or brine desalination processes to meet the hydration needs of plants. This approach not only conserves freshwater but also enables the establishment of agricultural operations in areas with limited access to conventional water sources.

Vertical Farming: Maximizing Space and Yield

Central to the Salgenx Food Production Scale Battery System is its use of vertical grow tower systems. These systems represent the pinnacle of space-efficient farming, allowing for the cultivation of crops in layers stacked vertically. This method significantly increases yield per square meter compared to traditional farming techniques.

The system is designed to support various advanced farming methods, including hydroponics and fogponics. Hydroponics involves growing plants in a water-based, nutrient-rich solution, eliminating the need for soil. Fogponics, a variation of hydroponics, uses a fine mist to deliver water and nutrients to the plants' roots. Both methods are highly efficient in terms of water and nutrient use, further enhancing the sustainability of the Salgenx system.

Salgenx Unveils Groundbreaking Food Production Scale Battery System for Sustainable Agriculture

Salgenx, a pioneer in sustainable agricultural technology, is thrilled to announce the launch of its revolutionary Food Production Scale Saltwater Battery System. Designed to redefine the standards of food production, this cutting-edge system integrates solar energy, advanced lighting, and water management technologies to significantly enhance the efficiency and sustainability of crop cultivation.

The Salgenx Food Production Scale Saltwater Battery System is a comprehensive solution tailored to meet the growing global demand for food in an environmentally friendly manner. By harnessing the power of bifacial solar panels, innovative grow lights, and thermal energy storage, the system ensures optimal growth conditions for a variety of crops, including tomatoes, peppers, lettuce, and more, regardless of external environmental conditions.

Key Features of the Salgenx Food Production Scale Saltwater Battery System:

- **16-Hour Plant Grow Light Regime:** Utilizes a combination of natural sunlight and grow lights to ensure plants receive sufficient light for optimal growth.
- **Solar PV with Bifacial Panels:** Powers essential systems such as pumps, grow lights, and heating to facilitate year-round production.
- **Bifacial Mirrors:** Maximize natural sunlight exposure, crucial for locations with limited direct sunlight.
- **Thermal Storage using Sand and Salt Battery (Saltgenx) :** Maintains ideal temperature conditions for plant growth during nighttime.
- **Desalination for Water Management:** Utilizes near seawater or brine desalination to provide a sustainable water source for hydroponics and fogponics systems.
- **Vertical Grow Tower Systems:** Maximizes space efficiency and crop yield through advanced vertical farming techniques.

Salgenx is committed to pushing the boundaries of what's possible in the agricultural sector, said Greg Giese, CEO of Salgenx. Our Food Production Scale Saltwater Battery System is more than just a technological innovation; it's a step towards a more sustainable and food-secure future. By optimizing resource use and maximizing crop yields, we aim to support farmers worldwide in meeting the increasing demand for food without compromising the planet's health.

The Salgenx system is designed for versatility and scalability, making it suitable for a wide range of agricultural settings, from small-scale local farms to large-scale commercial operations. Its integration of renewable energy sources and efficient water usage also positions it as a leading solution for combating the challenges of climate change and water scarcity in agriculture.

Salgenx invites stakeholders in the agricultural industry, including farmers, investors, and environmental advocates, to explore the potential of its Food Production Scale - Battery System. Together, we can transform the future of farming, one crop at a time.

Salgenx is at the forefront of agricultural innovation, specializing in the development of sustainable farming technologies. With a focus on solar energy, advanced lighting solutions, and efficient water use, Salgenx aims to empower farmers worldwide to increase productivity while reducing environmental impact.

Multihull Flotation Food Production Module

Combine the concepts above with a multi-hull design for over-the-water food production.

Since the Salgenx Battery uses saltwater, it's the perfect combination for power storage and desalination simultaneously while charging.

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Most profitable greenhouse and indoor vertical growing vegetable crops

When it comes to greenhouse or indoor vertical farming, selecting the right crop is crucial for maximizing profitability. This innovative farming approach offers numerous advantages, including year-round production, efficient use of space, and reduced water usage. However, the profitability of such ventures largely depends on the type of vegetables grown. Here, we explore some of the most profitable greenhouse or indoor vertical growing vegetable crops, based on factors such as yield per square foot, market demand, and overall return on investment.

Leafy Greens

Leafy greens, such as lettuce, spinach, kale, and arugula, are among the top choices for indoor farming. Their popularity stems from their fast growth cycle, high yield, and constant demand in the market. These crops can be harvested multiple times a year, ensuring a steady income stream. Leafy greens are also lightweight and have a relatively low nutrient requirement, making them ideal for vertical farming systems.

Herbs

Culinary herbs like basil, cilantro, parsley, and mint are highly profitable for indoor growers. They have a high market value, especially for organic and locally grown varieties. Herbs can be grown densely and have a quick turnaround time from seeding to harvest, allowing for multiple cycles within a year. The demand for fresh herbs is robust in both retail and culinary markets, contributing to their profitability.

Tomatoes

Tomatoes are a versatile crop with a significant market demand, making them a profitable choice for greenhouse cultivation. While they require more space and support compared to leafy greens and herbs, the higher market price of tomatoes can make them worth the investment. Specialty varieties, such as cherry and heirloom tomatoes, can fetch higher prices, enhancing profitability.

Peppers

Similar to tomatoes, peppers—including bell peppers and hot peppers—are highly profitable when grown in controlled environments. They benefit from the extended growing season that greenhouses and indoor farms offer. Peppers have a relatively high yield per plant and can be marketed fresh or processed. Their popularity in diverse cuisines contributes to their strong market demand.

Microgreens

Microgreens are young vegetable greens that are approximately 1–3 inches tall. They are incredibly profitable due to their high nutrient content and gourmet appeal in restaurants and among health-conscious consumers. Microgreens can be harvested just 7 to 14 days after germination, allowing for rapid turnover and high productivity in a small space. Their premium price point in the market makes them one of the most profitable crops for indoor farming.

Cucumbers

Cucumbers are another high-yield, high-demand crop suitable for greenhouse cultivation. They grow well in trellised systems, making efficient use of vertical space. The fast growth cycle of cucumbers enables multiple harvests in a season, and their popularity in salads and as a fresh snack ensures a steady market.

The Most Profitable Indoor Growing Technique: Hydroponics vs. Vertical Grow Towers

Indoor farming has revolutionized the way we think about agriculture, allowing for year-round production, reduced water usage, and the ability to grow crops in areas with limited or no arable land. Among the many techniques that have emerged, hydroponics and vertical grow towers stand out as two of the most innovative and potentially profitable methods. But which one offers the best return on investment? Let's delve into the intricacies of both to determine the most profitable indoor growing technique.

Hydroponics: Efficiency Meets Versatility

Hydroponics is a method of growing plants without soil, using mineral nutrient solutions in an aqueous solvent. This technique allows plants to grow faster and healthier since they receive a well-balanced diet directly to their roots. Hydroponics can be implemented in various systems, including NFT (Nutrient Film Technique), DWC (Deep Water Culture), and ebb and flow systems.

Pros:

- **Efficient Water Use:** Hydroponics uses up to 90% less water than traditional farming methods since water in the system is recirculated.
- **Higher Yield:** Plants grown hydroponically mature up to 25% faster and produce higher yields due to the controlled environment and direct nutrient uptake.
- **Space Saving:** Since soil is not required, more plants can be grown in a smaller space, making it ideal for urban areas.

Cons:

- **Initial Investment:** The start-up costs can be high due to the need for pumps, nutrient solutions, and growing mediums.
- **Technical Knowledge:** Successfully managing a hydroponic system requires a good understanding of plant nutrition and system maintenance.

Vertical Grow Towers: Maximizing Space and Accessibility

Vertical grow towers are a form of vertical farming where crops are grown in vertical layers, often incorporating hydroponics, aeroponics, or aquaponics. This method is particularly beneficial in urban settings or places with limited land space.

Pros:

- **Maximized Space Use:** Vertical towers use vertical space efficiently, allowing for a high density of crops in a small footprint.
- **Accessibility:** Towers can be designed for easy access, reducing labor costs and making them suitable for a wide range of settings, including home gardens and commercial operations.
- **Aesthetic Appeal:** Beyond their functionality, vertical towers can be aesthetically pleasing, adding greenery to urban environments.

Cons:

- **Lighting Requirements:** Depending on the setup, artificial lighting may be necessary to ensure all plants receive enough light, which can increase energy costs.
- **System Complexity:** Like hydroponics, vertical towers can be complex to set up and maintain, requiring a balance of nutrients, water, and light.

Lighting the Way: Essential Light Requirements for Thriving Hydroponics and Vertical Grow Towers

Indoor farming, through hydroponics and vertical grow towers, has paved the way for growing plants year-round, irrespective of external weather conditions. A pivotal aspect of ensuring the success of such indoor gardens is understanding and implementing the correct light requirements. This guide explores the essential lighting needs, focusing on watts per unit space, for hydroponics and vertical grow towers, aiming to optimize plant health and productivity.

The Role of Light in Plant Growth

Light serves as a primary energy source for plants, facilitating photosynthesis, the process by which plants convert light energy into chemical energy to support their growth and development. The intensity, spectrum, and duration of light exposure directly influence plant health, affecting everything from germination to fruiting.

Measuring Light Intensity: The Basics

Light intensity for indoor plants is typically measured in watts per square meter (W/m^2) or, more commonly in indoor gardening, micromoles per square meter per second ($\mu mol/m^2/s$) under the PPFD (Photosynthetic Photon Flux Density) metric. While we often refer to watts in terms of energy consumption by the light source, PPFD measures the amount of light that actually reaches the plant, providing a more accurate depiction of the usable light for photosynthesis.

Hydroponics: Light Requirements

Hydroponic systems grow plants in a water-based, nutrient-rich solution, without soil. These systems can vary from simple setups to sophisticated, climate-controlled environments. The light requirements in hydroponics depend on the type of plants being grown:

- **Leafy Greens and Herbs:** These plants generally require lower light intensities, around 150-250 $\mu mol/m^2/s$, equivalent to approximately 20-40 watts per square foot, depending on the efficiency of the light source.
- **Fruiting Vegetables:** Tomatoes, cucumbers, and peppers need higher light intensities to produce fruits, typically around 600-800 $\mu mol/m^2/s$, which translates to about 50-80 watts per square foot.

Vertical Grow Towers: Maximizing Light in Minimal Space

Vertical grow towers utilize vertical space to grow plants, often integrating hydroponic principles. These systems are especially popular for urban farming and small-space gardening. Light distribution is critical in vertical setups to ensure each plant receives adequate light:

- **Uniform Distribution:** LED grow lights are favored for their ability to provide uniform light intensity across a spectrum tailored for plant growth. They're also energy-efficient, a crucial factor in maximizing profitability and sustainability.
- **Side Lighting:** In addition to top lighting, some vertical systems may benefit from side lighting to reach the lower tiers of plants, ensuring even growth throughout the tower.

Lighting Efficiency and Selection

When selecting lighting for hydroponics or vertical grow towers, consider the light's efficiency—how well it converts electrical energy into useful plant light. LED lights are among the most efficient and effective for indoor gardening, offering a full spectrum of light, minimal heat output, and lower energy consumption compared to HID (High-Intensity

Fogponics: Revolutionizing Indoor Vegetable Growth with Mist and Light

In the dynamic world of indoor farming, fogponics emerges as a cutting-edge method that promises to enhance the growth of vegetables by optimizing nutrient delivery through mist. As a subset of aeroponics, fogponics utilizes a fine fog to deliver water and nutrients directly to plant roots, offering a highly efficient and water-conserving approach to indoor agriculture. This article delves into the basics of setting up a fogponics indoor vegetable grow tower system, focusing on crucial aspects such as light wattage requirements and water needs.

Understanding Fogponics

Fogponics operates on the principle of creating a micron-sized nutrient-rich fog, which is then directed to the root system of plants. This method allows roots to absorb nutrients and oxygen more efficiently than traditional hydroponics or soil-based gardening. The increased oxygen absorption significantly enhances root health and plant growth.

Setting Up a Fogponic Grow Tower

A fogponic grow tower system is typically a vertical setup that allows for the cultivation of multiple plants within a small footprint, making it ideal for urban settings or limited spaces. The system consists of a tower structure with multiple growing sites, a fogger or ultrasonic mister to generate the nutrient fog, a nutrient reservoir, and a pump to circulate the solution.

Light Wattage Requirements

Proper lighting is essential for photosynthesis and overall plant health, especially in an indoor setting where natural sunlight is limited or absent. The light wattage required in a fogponic system depends on the types of vegetables grown and the system's scale. Here's a general guideline:

- **Leafy Greens:** These plants, such as lettuce, spinach, and herbs, require lower light intensities. LED grow lights with a power output of 20-40 watts per square foot are sufficient to meet their needs.
- **Fruiting Vegetables:** Plants that bear fruits, like tomatoes, peppers, and cucumbers, demand higher light intensities for proper development. A wattage range of 40-60 watts per square foot is recommended, using high-efficiency LED lights to ensure deep penetration and even coverage across the grow tower.

Water Requirements

Fogponics systems are remarkably water-efficient, using up to 70-90% less water than traditional soil-based gardening. The exact water requirements vary based on the system size, the number and type of plants, and environmental factors such as temperature and humidity. However, the fine mist ensures that water and nutrients are delivered directly to the roots, minimizing waste and maximizing absorption.

- **Recirculating System:** Most fogponics setups are recirculating, meaning the nutrient solution that is not absorbed by the plants is collected and returned to the reservoir for reuse. This method conserves water and nutrients.
- **Monitoring and Adjustments:** Regular monitoring of the nutrient solution's pH and electrical conductivity (EC) levels is crucial to ensure that plants receive the optimal balance for growth. Adjustments to the nutrient concentration and water pH may be needed based on these readings.

Advantages of Fogponics

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illuminating Growth: The Economics of Fogponics with Solar PV Power

In the innovative world of indoor farming, fogponics has emerged as a cutting-edge method that leverages the efficiency of fog to deliver nutrients and water directly to plant roots. This technique, when combined with the sustainable power of solar photovoltaics (PV), opens new avenues for eco-friendly and cost-effective agricultural production. This article explores the production, profit, and costs associated with using fogponics for growing tomatoes, leafy greens, peppers, and microgreens, powered by 1,000 kW of solar PV for 16 hours of light daily, including 6 hours of direct solar power and an additional 10 hours from battery-stored solar energy.

Solar PV and Fogponics: A Sustainable Pair

The integration of solar PV power with fogponics represents a stride towards sustainable agriculture by reducing the carbon footprint and energy costs associated with traditional farming methods. A 1,000 kW solar PV system can generate a significant amount of energy, enough to power an extensive fogponic setup. Assuming an average of 6 hours of peak sunlight per day, such a system could produce approximately 6,000 kWh of energy daily, with surplus energy stored in batteries to extend the lighting period to 16 hours, ensuring plants receive adequate light for optimal growth.

Production Potential

- **Tomatoes:** Known for their high light and nutrient requirements, tomatoes can thrive in fogponic systems with ample lighting. With 16 hours of light per day, tomatoes can reach full production faster, leading to multiple harvests within a year. Each square meter can produce approximately 40-50 kg of tomatoes annually under optimal conditions.
- **Leafy Greens:** Including species like lettuce and spinach, leafy greens require less light than fruiting vegetables. They can be densely planted in fogponic systems, yielding up to 20-25 kg per square meter annually, with the advantage of short growth cycles allowing for multiple harvests.
- **Peppers:** Similar to tomatoes, peppers benefit from extended light hours, enhancing both fruit size and plant yield. A well-managed fogponic system can produce about 30-40 kg per square meter annually.
- **Microgreens:** These require the least amount of light and grow quickly, making them highly profitable. Microgreens can yield approximately 1-2 kg per square meter per harvest, with the potential for multiple harvests each month.

Costs: Lighting and Water

- **Lighting:** LED grow lights are the most efficient for indoor farming, with an average consumption of about 32 watts per square foot for high-light plants (tomatoes, peppers) and 20 watts for low-light plants (leafy greens, microgreens). For a 1,000 kW PV system, the energy produced can support a substantial area of indoor farming, significantly reducing operational costs.
- **Water:** Fogponics is highly water-efficient, using up to 90% less water than traditional soil farming. The costs associated with water in fogponics are minimal, primarily related to initial system setup and occasional nutrient solution replenishment.

Profit Analysis

The profitability of a fogponics system powered by solar PV hinges on several factors, including crop choice, market

Unveiling the Wholesale Value of Tomatoes, Leafy Greens, Peppers, and Microgreens

In the realm of agricultural production, understanding the market dynamics and wholesale value of crops is crucial for farmers and agribusinesses aiming to maximize their returns. Tomatoes, leafy greens, peppers, and microgreens represent a significant segment of the vegetable market, each with its unique demand and pricing structure. This article delves into the current wholesale value of these crops, providing insights into their market positioning and potential profitability for producers.

Tomatoes: The Versatile Staple

Tomatoes are a cornerstone of global cuisine, making them a staple in both retail and wholesale markets. The wholesale value of tomatoes can vary widely based on variety (e.g., beefsteak, cherry, heirloom), quality, and season. On average, wholesale prices for tomatoes range from \$0.75 to \$2.00 per pound. Factors such as organic certification and local sourcing can command higher prices, with premiums of up to 20-30% over conventional tomatoes.

Leafy Greens: The Green Gold

Leafy greens, encompassing varieties like lettuce, spinach, kale, and arugula, are in constant demand due to their health benefits and versatility. The wholesale value for leafy greens typically ranges from \$1.00 to \$2.50 per pound, with organic and specialty varieties (e.g., baby spinach or kale) fetching higher prices. Seasonality plays a significant role, with prices peaking during off-season periods due to reduced availability.

Peppers: A Spectrum of Flavors and Prices

Peppers, from sweet bell peppers to hot chilis, offer a wide range of flavors and uses, reflected in their market prices. Wholesale prices for bell peppers average between \$1.00 and \$3.00 per pound, with variations based on color (red, yellow, and green) and origin. Hot peppers, due to their lower volume but specialized demand, can see even greater price variability, often exceeding \$3.00 per pound for exotic or particularly spicy varieties.

Microgreens: The Premium Niche

Microgreens have surged in popularity as a premium product, prized for their intense flavors and nutritional content. Due to their labor-intensive cultivation and short shelf life, microgreens command higher wholesale prices, typically ranging from \$10 to \$30 per pound, depending on the variety (e.g., radish, pea shoots, arugula). Their high value makes them an attractive crop for producers focusing on niche markets and direct sales to gourmet restaurants and health-conscious consumers.

Market Trends and Considerations

While these price ranges offer a snapshot of the current market, several factors can influence the wholesale value of these crops:

- **Seasonality and Availability:** Prices can fluctuate significantly with changes in supply and demand, particularly for crops grown in outdoor conditions subject to weather variations.
- **Quality and Certification:** Premium prices are often associated with higher quality standards, organic certification, and sustainable farming practices.
- **Market Channels:** Direct sales to restaurants, specialty stores, and farmers' markets can yield higher returns compared to traditional wholesale channels.

Model per 1,000 kW Solar PV

To develop a simple model for calculating the amount of power needed for each pound of production per year using a fogponics system powered by 1,000 kW of solar PV, we need to consider several variables:

1. Energy Consumption: This includes the energy used by LED grow lights, foggers (for nutrient delivery), and other system components like pumps and control systems.
2. Light Requirements: Different plants have varying light needs, measured in Daily Light Integral (DLI), which impacts the energy usage for lighting.
3. Growth Cycles: The time it takes for each crop to reach harvest and the yield per square foot or per plant.
4. Solar PV Output: Considering 1,000 kW of installed capacity with 6 hours of direct sunlight and 10 hours of operation using stored power.

Let's make some assumptions to simplify our model:

- LED Grow Lights: Average efficiency of 2.3 $\mu\text{mol}/\text{J}$ (a typical value for high-efficiency LED grow lights).
- Daily Light Integral (DLI) Needs:
 - Tomatoes: 22 $\text{mol}/\text{m}^2/\text{day}$
 - Leafy Greens: 17 $\text{mol}/\text{m}^2/\text{day}$
 - Peppers: 22 $\text{mol}/\text{m}^2/\text{day}$
 - Microgreens: 12 $\text{mol}/\text{m}^2/\text{day}$
- Yield (per square meter per year):
 - Tomatoes: 40 kg
 - Leafy Greens: 25 kg
 - Peppers: 30 kg
 - Microgreens: 20 kg (considering multiple cycles)

Given these assumptions, we can calculate the power needed for each pound of production by first determining the daily energy requirements for lighting, then annualizing those numbers and dividing by the yield.

Step 1: Daily Energy Requirements for Lighting

See chart to the left.

Step 2: Annualize Energy Requirements

See chart to the left.

Step 3: Calculate Power per Pound of Production

See chart to the left.

Let's calculate this for each crop type assuming a 1 m^2 area for simplicity, and then adjust for the 1,000 kW solar PV system's capacity and operational hours.

Implementation

We'll start by calculating the daily energy requirements for lighting for one square meter of each crop type, then

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What is the solar panel requirement per square foot and meter for the vegetables

To determine the solar panel requirement per square foot and per square meter for growing vegetables using fogponics under artificial lighting powered by solar panels, we need to consider the energy needs of the lighting system for optimal plant growth and how these needs translate into solar panel area requirements.

Let's summarize the previous findings on power requirements for different vegetables grown using fogponics:

- Average Power per Pound of Production: Taking an average from the earlier calculations, we found values around 12 to 15 kWh per pound of production annually for different crops. For simplification, we'll use an average power requirement for lighting of 13 kWh per pound of production as a reference for our calculation.

The next step involves translating these energy requirements into the area required by solar panels, taking into account their efficiency and the average amount of sunlight they can convert into usable electrical energy.

Given:

- Solar Panel Efficiency: We'll use the JA Solar 545W panels as a reference, with an additional 10% energy gain from their bifacial design, making them effectively 599.5W panels under optimal conditions.
- Daily Sunlight Hours: Assuming an average of 6 hours of effective sunlight per day for solar energy production.
- Annual Sunlight Days: For simplicity, we'll consider 365 days of sunlight availability per year.

Calculation:

1. Annual Energy Production per Solar Panel:

$$[\text{Annual Energy Production}] = [\text{Panel Power}] \times [\text{Daily Sunlight Hours}] \times [\text{Annual Sunlight Days}]$$

2. Solar Panel Requirement per Square Foot/Meter for Vegetables:

To calculate how many square feet or meters of solar panels are needed per pound of vegetable production, we'll divide the annual energy requirement for the crop by the annual energy production per panel, then relate this to the panel's physical area.

Implementing the Calculation:

We'll calculate the annual energy production per solar panel first, then determine how much panel area is required to support the energy needs for growing a pound of vegetables annually, translating this into the required panel area per square foot and per meter squared of growing space.

Based on the calculations:

- Annual Energy Production per Solar Panel: Approximately 1,312.91 kWh per year, given the effective power of the panels and average sunlight conditions.

For growing vegetables using fogponics, powered by these solar panels:

- Panel Area Required per Pound of Vegetable Production:

- Approximately 0.28 square feet
- Approximately 0.026 square meters

Cost Per Solar Panels

For each JA Solar 545W Solar Panel measuring 90 x 44.65:

- Panel Area:
 - 27.91 square feet
 - 2.59 square meters
- Power per Square Foot:
 - 21.48 W/ft² (with the 10% bifacial gain considered)
- Cost per Square Foot:
 - \$9.17
- Power per Square Meter:
 - 231.24 W/m² (with the 10% bifacial gain considered)
- Cost per Square Meter:
 - \$98.67

These calculations provide insights into the efficiency and cost-effectiveness of utilizing JA Solar 545W Solar Panels for large-scale installations, offering a precise metric for evaluating investment in solar energy infrastructure per unit of area.

How bifacial solar panels are needed for 1,000 kW per hour

To determine how many bifacial solar panels are needed to achieve a total capacity of 1,000 kW (or 1 MW) per hour, several factors must be considered, including the efficiency and power rating of the panels, as well as the specific conditions under which they will operate. Bifacial solar panels are unique because they can capture sunlight from both their front and back sides, potentially increasing their energy yield compared to traditional monofacial panels.

Let's break down the calculation with a typical scenario:

Power Rating of Panels

The power rating of a solar panel is typically given in watts (W). For this example, let's assume we are using bifacial solar panels each with a power rating of 400W under standard test conditions. This is a common rating for high-efficiency commercial panels as of my last update.

Efficiency and Yield Enhancement

Bifacial panels can produce more electricity than their rated power under ideal conditions due to their ability to capture reflected and diffused light on their rear side. The actual yield increase depends on many factors, including installation height, ground albedo (reflectivity), and the mounting system. For simplicity, we'll assume an overall yield enhancement of 10% over the nameplate rating due to the bifacial gain, which is a conservative estimate.

Calculation

To find out how many panels are required, we first need to adjust the panel's rated power to account for the bifacial gain. Then, we'll calculate the number of panels needed to reach 1,000 kW.

1. Adjusted Power Rating per Panel: If a 400W panel has a 10% yield enhancement from its bifacial design, its effective power output could be considered as 440W (400W + 10% of 400W).

2. Total Panels Needed: To achieve 1,000 kW (or 1,000,000W), we divide the total desired capacity by the adjusted power rating per panel.

$$\text{Total Panels Needed} = \frac{\text{Total Desired Capacity (W)}}{\text{Adjusted Power Rating per Panel (W)}}$$

Let's calculate this.

To achieve a total capacity of 1,000 kW (or 1 MW) per hour with bifacial solar panels that have a 400W rating and an estimated 10% yield enhancement from bifacial gains, you would need approximately 2,273 panels.

This calculation provides a ballpark figure, highlighting the importance of considering specific panel efficiencies, installation conditions, and bifacial gain factors when planning a solar project. Actual requirements may vary based on detailed project specifications and environmental conditions.

JA Solar 545W Solar Panel for 1,000 kW per hour

Using the JA Solar 545W Solar Panel (144 Cell Bifacial JA-JAM72-D30-545MB), with an estimated 10% yield enhancement from bifacial gains, you would need approximately 1,668 panels to achieve a total capacity of 1,000 kW (or 1 MW) per hour. The cost for these panels would be approximately \$426,688.91.

This calculation provides a more specific scenario based on the characteristics of the JA Solar 545W panels, including the cost per panel, highlighting the investment needed for such a capacity in solar PV infrastructure.

Fogponics Production in Hi-Cube Shipping Containers

An innovative approach to sustainable agriculture, utilizing fogponics within hi-cube shipping containers to maximize yield and efficiency.

Understanding Fogponics

Fogponics is a cutting-edge hydroponic system that uses a fine mist to deliver water and nutrients directly to plant roots. This method is particularly efficient in confined spaces, such as shipping containers, allowing for high-density, high-yield production of various crops.

Why Hi-Cube Shipping Containers?

Hi-cube shipping containers offer a versatile and scalable environment for indoor farming. Their standardized sizes and robust structure make them an ideal choice for setting up controlled, secure, and mobile agricultural systems.

Production and Profit Analysis

By integrating fogponics with hi-cube shipping containers, farmers can achieve significant production levels of tomatoes, leafy greens, peppers, and microgreens.

Maximizing Sustainability and Efficiency

Utilizing solar power to meet energy needs, this fogponic system is not only productive but also sustainable, significantly reducing the carbon footprint of agricultural production.

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