
GEODYN
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GEODYN SOLUTIONS 100 MW HYBRID SARGASSUM-ALGAE BIOGAS POWER & CIRCULAR BIOECONOMY PLANT – PUERTO RICO
www.geodynsolutions.com

EXECUTIVE SUMMARY

Geodyn Solutions proposes a 100 MW hybrid biogas power plant in Puerto Rico, combining seasonal Sargassum seaweed harvesting with cultivated algae systems to produce renewable baseload electricity, organic fertilizer, and high-value algae-based food and feed products. This hybrid approach leverages Puerto Rico's natural abundance of Sargassum during peak seasons while maintaining year-round energy production and product output through controlled algae cultivation.

The project supports Puerto Rico's transition to clean energy while addressing Sargassum overgrowth, improving coastal ecosystems, and generating strong multi-stream revenue with a 12-year ROI approaching 300%.

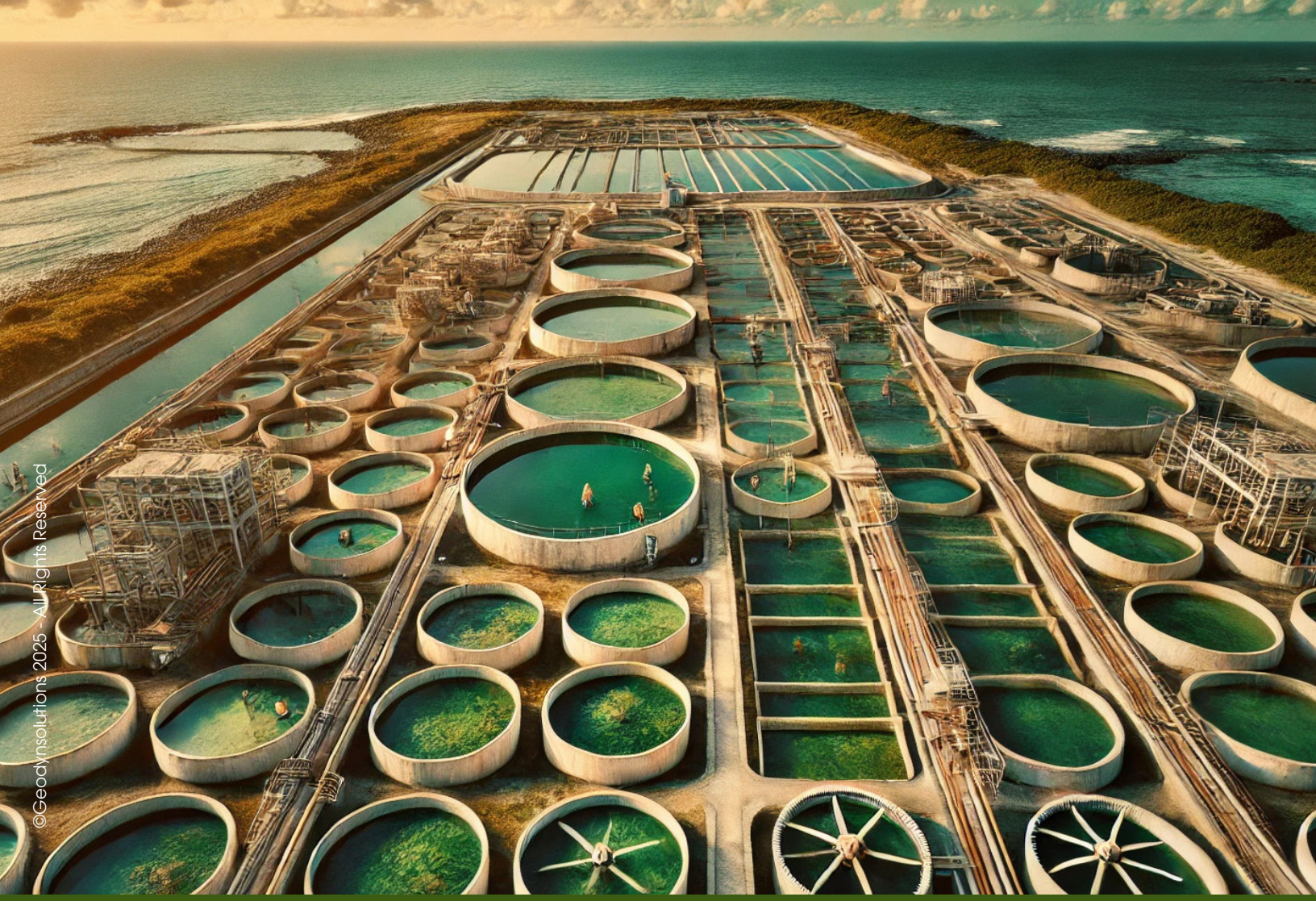
PROJECT SUMMARY

PARAMETER	DETAIL
Location	Puerto Rico (coastal/industrial zone)
Project Type	Hybrid Sargassum-Algae Biogas Power & Circular Bioeconomy
Installed Capacity	100 MW continuous baseload
Core Technologies	Anaerobic Digestion + Combined Heat & Power (CHP)
Feedstock Sources	Sargassum (seasonal) + Cultivated Algae (year-round)
Additional Products	Organic Fertilizer, Algae Protein for Food/Feed
Deployment Timeline	18–24 months
Electricity Sale Rate	$0.19 per kWh

HYBRID BIOMASS STRATEGY

A hybrid approach, utilizing Sargassum during peak seasons and supplementing with cultivated algae year-round, optimizes resource use, reduces feedstock costs, and ensures operational continuity.

- **Sargassum Seaweed:** Naturally abundant in Puerto Rico during summer months; harvesting mitigates coastal damage and odor issues while supplying low-cost biomass.
- **Cultivated Algae:** Grown in open ponds to ensure year-round feedstock availability; integrates CO_2 capture and wastewater reuse.



LAND REQUIREMENTS

- **Open Pond Cultivation:** ~5,000–7,000 acres (20–28 km²) to support ~70% of year-round biomass needs.
- **No additional land required for Sargassum:** Harvested from coastal accumulation zones.
- **Location Criteria:** Near coastal zones with access to wastewater, flue gas (for CO_2), and transmission infrastructure.

CAPITAL EXPENDITURE (CAPEX)

Component	Cost Estimate (USD)
Algae Open Pond Systems	$80 million
Anaerobic Digestion Units	$120 million
CHP Generators & Biogas Engines	$80 million
Sargassum Collection & Preprocessing	$40 million
CO□ Injection and Water Reuse Systems	$20 million
Fertilizer Processing Infrastructure	$25 million
Algae Protein Drying & Processing Plant	$35 million
Site Preparation, Civil Works	$30 million
Grid Connection & Transmission	$30 million
Contingency (25%)	$115 million
Total Estimated CAPEX	**$575 million**

OPERATING EXPENDITURE (OPEX)

Category	Annual Cost (USD)
Labor, Admin, Security	$12 million
Algae Operations (ponds, CO□, nutrients)	$12 million
Sargassum Collection (seasonal)	$6 million
Equipment Maintenance & Spares	$10 million
Biomass Processing (fertilizer/feed)	$5 million
Environmental Compliance & Monitoring	$2 million
Utilities, Water Management	$3 million
Insurance, Permits, and Taxes	$3 million
Total Annual OPEX	**$53 million**

REVENUE STREAMS

ELECTRICITY SALES

- **ANNUAL OUTPUT:** 100 MW × 85% CAPACITY × 8,760 HRS = 744.6 GWH
- **REVENUE:** 744.6M KWH × $0.19 = $141.47 MILLION/YEAR

ORGANIC FERTILIZER SALES

- OUTPUT: ~200,000 TONS/YEAR FROM DIGESTATE
- REVENUE: $100/TON = $20 MILLION/YEAR

ALGAE-BASED FOOD & FEED SALES

- DRY BIOMASS OUTPUT: ~10,000 TONS/YEAR
- REVENUE: $2,500/TON = $25 MILLION/YEAR

TOTAL ANNUAL REVENUE:

$141.47M (ELECTRICITY) + $20M (FERTILIZER) + $25M (ALGAE FEED) = $186.47 MILLION/YEAR

12-YEAR FINANCIAL SUMMARY

Metric	Value
Total Revenue (12 Years)	$2.237 billion
Total OPEX (12 Years)	$636 million
Total Net Profit	$1.601 billion
Total CAPEX	$575 million
12-Year ROI	~278.4%
Payback Period	~4.2 years

CARBON SEQUESTRATION & ENVIRONMENTAL IMPACT

Benefit Area	Detail
CO_2 Sequestration → ~280,000–300,000 tons/year	~1.8 tons CO_2 absorbed per ton of algae/Sargassum
Coastal Protection	Removes harmful Sargassum from beaches, improves tourism and marine health
Waste Reuse	Uses flue gas, wastewater, and seaweed waste
Byproducts	Clean organic fertilizer and high-protein feed
Water Efficiency	90%+ water reuse in pond systems
Net Emissions	Near-zero or potentially carbon-negative

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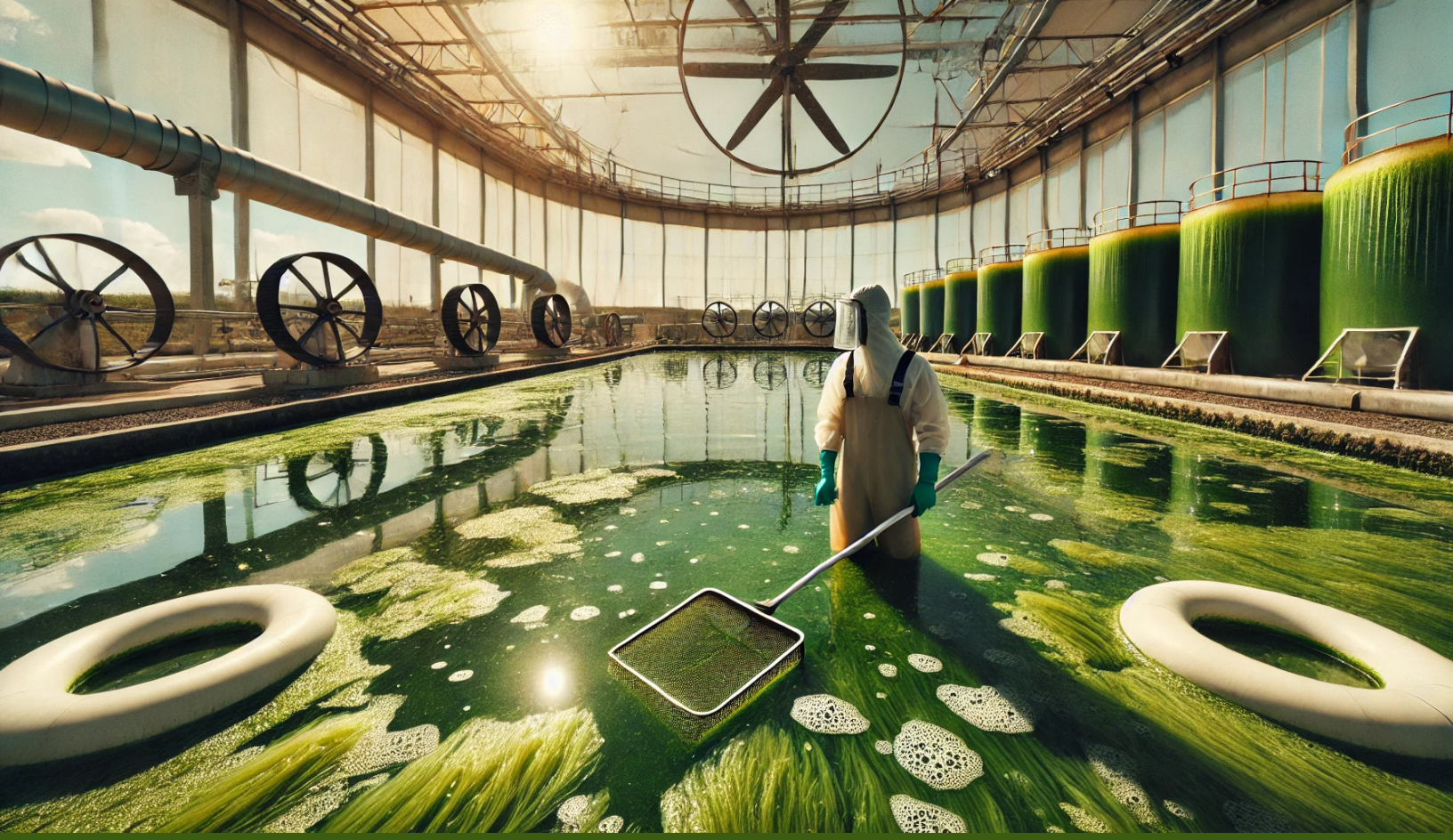

JOB CREATION IMPACT

Category	Estimated Jobs Created
Construction (18–24 months)	600–800
Plant Operations & Maintenance	180
Sargassum Harvesting Teams	100+ (seasonal, local coastal)
Algae & Product Processing	180
Logistics & Support	100+
Total Job Impact	**~1,100+ jobs**

STRATEGIC BENEFITS FOR PUERTO RICO

- **PROVIDES CLEAN, LOCAL BASELOAD ENERGY YEAR-ROUND**
- **SOLVES SARGASSUM ENVIRONMENTAL PROBLEM WHILE GENERATING REVENUE**
- **REDUCES FOSSIL FUEL DEPENDENCE AND IMPROVES FOOD AND SOIL SECURITY**
- **CREATES OVER 1,000 JOBS AND OPENS EXPORT MARKETS FOR ALGAE FEED**
- **QUALIFIES FOR GREEN FUNDING, CARBON CREDITS, AND CLIMATE RESILIENCE INCENTIVES**

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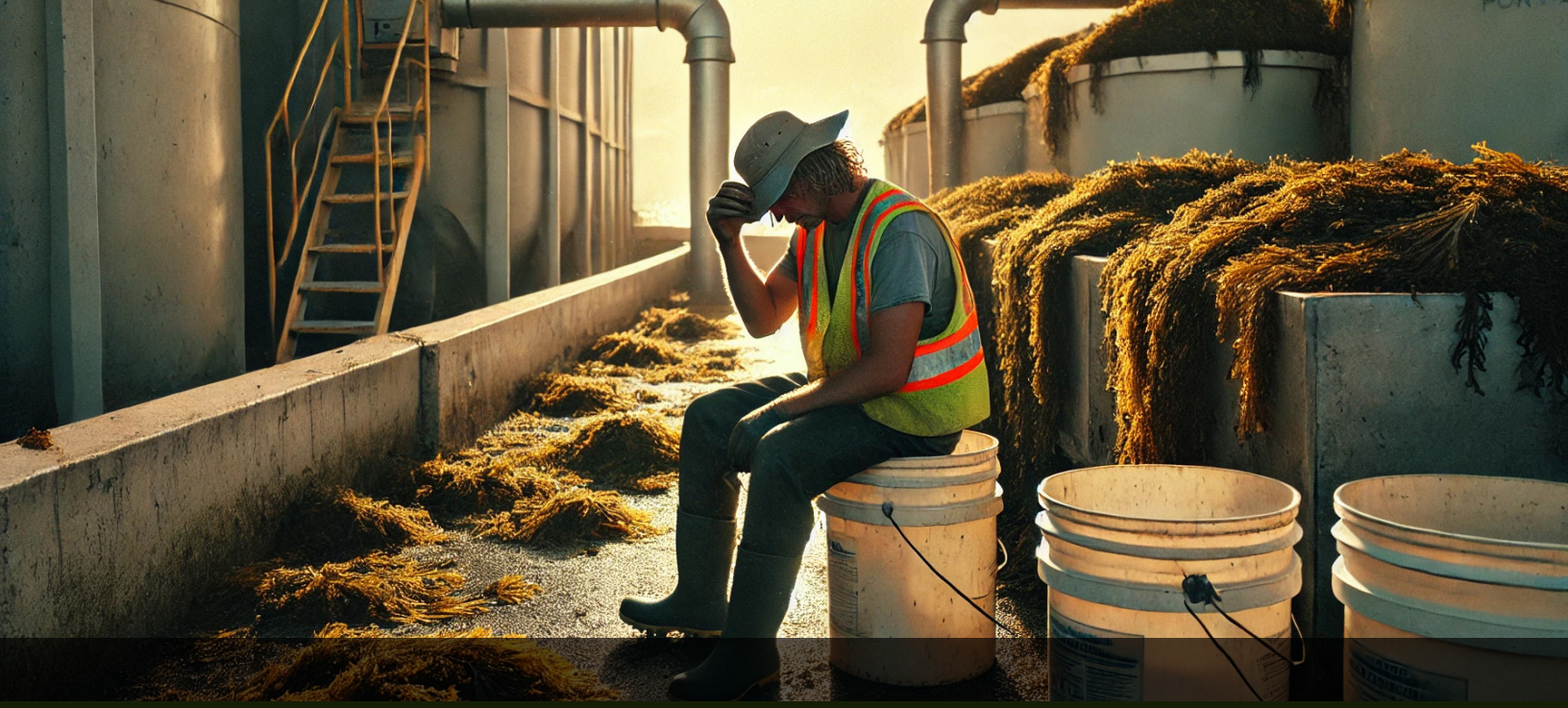

IMPLEMENTATION & BUSINESS MODEL

DEVELOPER & OPERATOR: GEODYN SOLUTIONS
BIOMASS STRATEGY: HYBRID (SARGASSUM IN PEAK SEASONS + CULTIVATED ALGAE)
REVENUE MODEL: PPA FOR ELECTRICITY + DIRECT SALES OF FERTILIZER AND FEED
FINANCING: ESG FUNDS, DEVELOPMENT BANKS, GREEN BONDS
CONTRACT FEE: 25% CONTINGENT SUCCESS-BASED DEVELOPER FEE

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This 100 MW hybrid Sargassum-algae biogas plant by Geodyn Solutions presents a triple-impact investment — solving an environmental crisis, delivering clean power, and generating valuable agricultural and nutritional co-products. With a 12-year ROI near 280%, strong job creation, and low ecological footprint, it sets a benchmark for smart, sustainable infrastructure in island economies.

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