



Marine Macroalgae Anaerobic Digestion for Resource Recovery

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Our Vision

A Zero Organic Waste Future

Wastewater
Biosolids



Source
Separated
Organics



Municipal
Solid Waste



Food
Processing
Waste



Agricultural
Waste



Integrated
Solutions



Renewable
Power



Renewable
Gas



Recyclables



Fertilizer



Clean Water

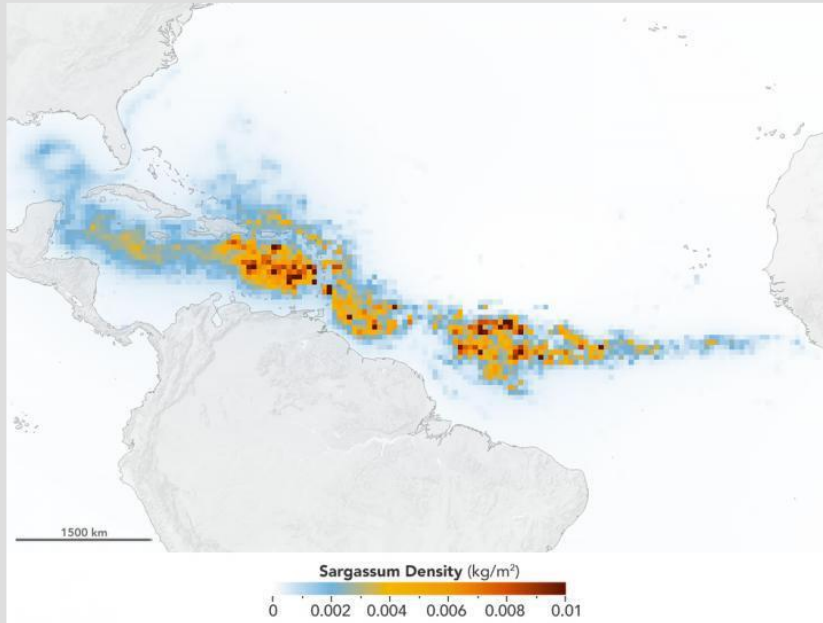
Anaerobic Co-digestion of Sargassum

- Project in Punta Cana, Dominican Republic developed by Y.A. MAOF Holdings from Israel
- Plant is sized for 1 MW of electric power from biogas co-digesting 30k tpy of Sargassum and 10k tpy of food waste
- Anaergia provides process design and supplies pre-treatment and high-solids wet digestion technology
- Extensive Sargassum pre-treatment, digestion and co-digestion tests have been conducted
- Presentation summarizes findings and plant design basis

The Sargassum Problem

The Great Atlantic Sargassum Belt (GASB)

- Extends from West Africa to the Gulf of Mexico
- In 2018, the 9000-kilometer GASB contained >20 million tons of Sargassum biomass



AlgaeNova Floating Barriers and Algae Harvesting in Punta Cana



- Seasonal April to October
- 2.5 mi oceanfront with barriers harvest 500 to 600 tpd
- Algae drained and ensilaged for year-round digestion
- Ensilages well with no major loss of VS due to high salinity



Sargassum Characteristics and Anaerobic Biodegradability

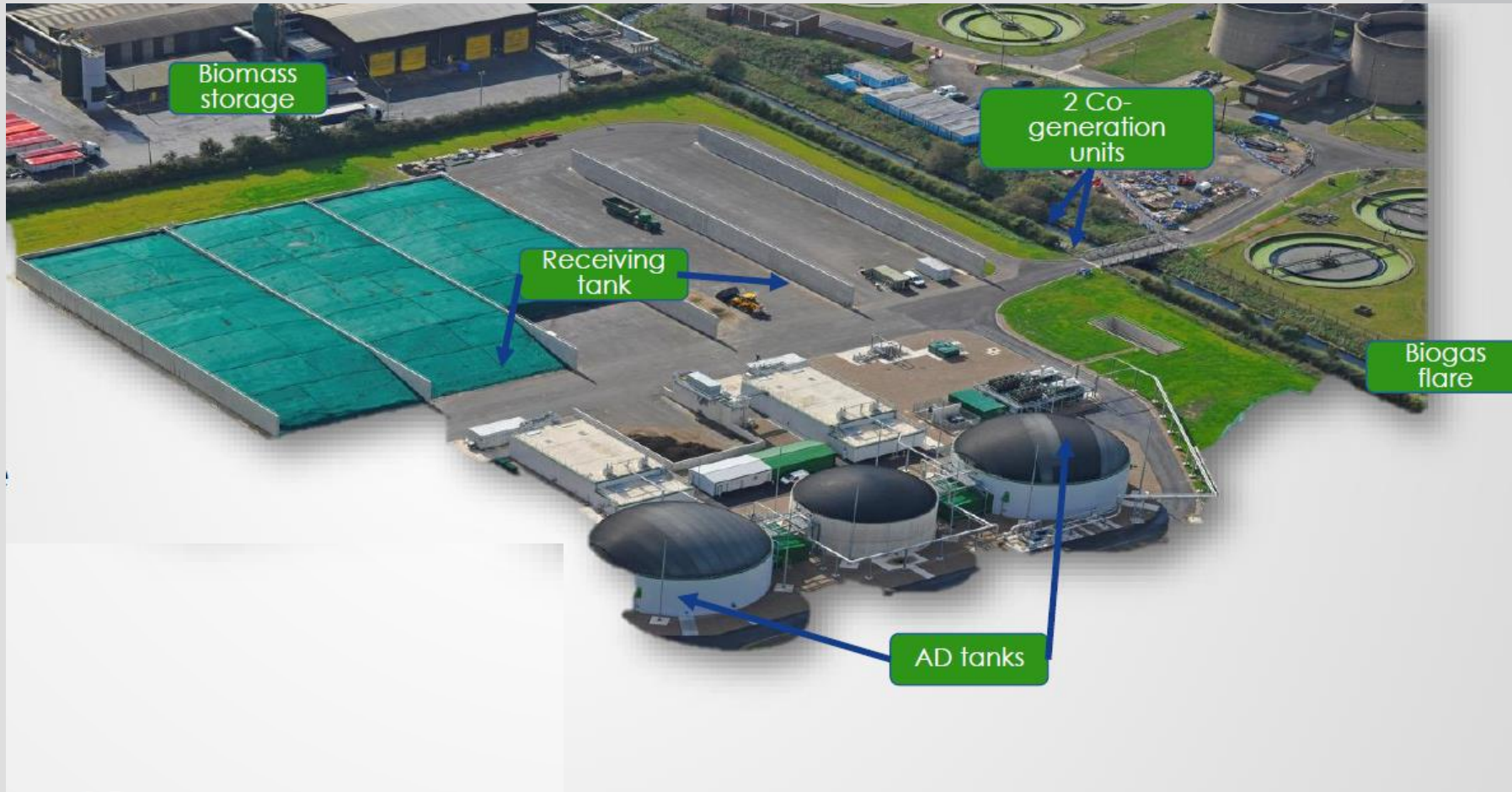
Dry Matter (as harvested)	% wet	16
VS/TS	% DM	65
Fat	% DM	0.9
Fiber	% DM	1.8
Protein	% DM	15
Nitrogen	% DM	1.2
Phosphorous	% DM	0.47
Potassium	DM	0.6
Salinity	g/L	52
Chloride	g/L	32

- Transported in nets on board drains to 26% TS, after ensilaging TS goes to 32%
- Sargassum Biomethane Potential
 - As received (drained): 180 Nm³/ton VS, 54% CH₄
 - Shredded and co-digested 70/30 w/w with food waste (28%TS algae/12%TS food waste), micronutrient and enzyme addition: 470 Nm³/ton VS
 - Theoretical biogas potential based on composition and Weende: 770 Nm³/ton VS, 55% CH₄
- Washing and draining reduces salt to 20 g/L but does not significantly improve mono or co-digestion
- BMP of 70/30 co-digestion, not washed is 60% of theoretical due to salinity partial inhibition
- Further work required with acclimated bacteria to realize higher biomethane potential

Co-Digestion Plant Design Basis

- Process 120 tpd of combined substrate fed at 26%TS with approximately 22 g/L salinity
 - 84 tpd of ensiled algae at 32%TS
 - 36 tpd of pre-treated food waste slurry at 12%TS
- Combined VS reduction 56%
 - 47% Sargassum VSR
 - 75% Food waste VSR
- Two 2,500 m³ (0.6 MG) high solids mesophilic digesters operated at 4.3 kg VS/m³-d OLR
- Generate 460 Nm³/h of biogas with 55% CH₄ content
- Operate digester at 9%TS after dilution with digestate filtrate
- Produce 60 tpd of digestate cake at 25%TS and about 10 g/L of salt

Sargassum Ensilaging and Anaerobic Digestion Plant





**Thank You
Questions?**