BUSINESS UNITS

Breeding
- Specie selection
- Broodstock breeding
- Cross breeding
- Hatchery
- Seeding techniques

Marine Technology
- Cultivation structures
- Anchoring
- Deployment & Harvest
- Maintenance
- Logistics

Bioconversion
- Biogas
- Ethanol / Butanol
- Co-products
- Yield improvement
- Sales & Distribution
The Move is Offshore!
## Seaweed vs. Land Plants

<table>
<thead>
<tr>
<th></th>
<th>Semi-Flutuante</th>
<th>ENERGIA GASTA Por Gravidade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Buoyancy</td>
<td>FORCES Gravity</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th></th>
<th>Estável</th>
<th>TEMPERATURA Instável</th>
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<tbody>
<tr>
<td></td>
<td>Stable</td>
<td>TEMPERATURE Unstable</td>
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<table>
<thead>
<tr>
<th></th>
<th>Rápido</th>
<th>CRESCIMENTO Devagar</th>
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<tbody>
<tr>
<td></td>
<td>Fast</td>
<td>GROWTH Slow</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Toda Planta</th>
<th>ABSORÇÃO DE NUTRIENTES Apenas Raiz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whole plant</td>
<td>NUTRIENT UPTAKE Root</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Não Utiliza</th>
<th>ÁGUA POTÁVEL Necessário</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Need</td>
<td>FRESH WATER Need</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Elevado</th>
<th>EFFICIENCIA FOTOSSINTÊTICA Baixa</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>PHOTOSYNTHETIC EFFICIENCY Low</td>
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General overview

Ocean seaweed farm

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Traditional Farming

- 14 Million tons per year
- Labor intensive
The Seaweed Carrier

- Inspired by nature's own design development (bio-mimicry)
- Basically a giant seaweed plant moving freely in the water, adjusting itself naturally to the strong forces of the sea
SES growth tests in Norway
And now in Portugal
Norway July 2011…
Example - Potential in Europe

5 locations in Europe:
- 5 farming clusters = 2,500 km$^2$ (250,000 ha)
- 50 mill tons seaweed (200 T/ha)
- 2.1 billion L Ethanol or 1 billion m$^3$ Biomethane
- 2.1 billion L Ethanol = ca. 26 % of Europe’s bioethanol production

12.6 TWh from the size of Luxembourg
PORTUGAL

- Largest EEZ in European Union
- Current EEZ = ca. 1,720,000 km²
- Claim submitted to extend EEZ to ca. 3,000,000 km²
- Madeira Archipelago current EEZ = ca. 446,000 km²
PORTUGAL – Example Madeira

- 10 Farm units of 50 km$^2$ = 1 Farm Cluster
- 500 km$^2$ farmed area (0.11 % of Madeira EEZ)
- Total 10 million tons seaweed (200 T/ha)
- 426 mill L Ethanol or 200 mill m$^3$ Biomethane

- Energy equivalent = 2.5 TWh
- 2.5 TWh is **6 times** the electricity demand in Madeira Archipelago in 1997 (418 GWh)

1997: Only 8 % of Madeira Island’s Energy sources come from local renewable sources, mainly from biomass (firewood and forest residues) and hydroelectric

- 2.5 TWh from an area 0.03 % of Portugal EEZ
- 5.4 % of Portugal’s total energy consumption
Seaweed...

- Seaweed cultivation can give something BACK to the environment!!
Ecological, Social and Economic Benefits

- Enhanced biodiversity.
- Increased fish biomass
- CO$_2$ uptake (carbon sinks)
- Bio-filter
- IMTA / Integrated Aquaculture
- Defence against coastal erosion
- Help combat climate change and ocean acidification
Cooperation with SES