Renewable Products from Seaweed

October 10, 2012
Seaweed Is the Future of Feedstocks

Oil is affordable, but unsustainable

The current renewable solutions are not affordable or scalable

“Lowest Cost Producer” of Renewable Chemicals and Fuels
Seaweed Is Abundant and Sustainable

**ABUNDANT**
- One of **fastest** growing plants on earth
- Available worldwide
- 2 billion MT potential

**ENVIRONMENTAL**
- No freshwater or fertilizer
- Low carbon footprint
- Cleans nutrient pollution

**SCALABLE**
- 10 million MT currently produced
- Existing 5,000 Ha commercial scale farms
- Small repeating units

**LOW COST**
- No **lignin** to degrade
- Co-product opportunities
- High sugar content
**Experienced Management Team to Build and Grow a Successful Business**

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<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Logos</th>
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<tbody>
<tr>
<td>DANIEL TRUNFIO</td>
<td>Chairman and Chief Executive Officer</td>
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<tr>
<td>DR. RICHARD BAILEY</td>
<td>Chief Technology Officer</td>
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<td>RIC LUCIEN</td>
<td>Chief Financial Officer</td>
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<td>DR. YASUO YOSHIKUNI</td>
<td>Chief Science Officer</td>
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<td>YUKI KASHIYAMA</td>
<td>General Manager, Global Biomass Sourcing</td>
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<td>AJAY KSHATRIYA</td>
<td>General Manager, Chemicals</td>
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<td>DR. CANDACE SWIMMER</td>
<td>Sr. Director, Research</td>
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<td>DR. NICK OHLER</td>
<td>Sr. Director, Engineering</td>
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**Areas of Expertise**

- Commodity and Supply Chain
- Biology and Chemistry Process Development
- Scale-Up and Commercialization
Only Bal Has Technology to Unlock Seaweed’s Full Value

Seaweed’s High Value Composition

- 85% Water
- 15% Dry Matter
- 15% Protein
- 34% Potash Fertilizer
- 25%-35% Alginate
- 15% Others

Bal is the only company with blocking IP on alginate conversion
Bal has the Technology for Simultaneously Producing Multiple Seaweed Products from a Single Process

Alginate Intermediate

Catalysis

Chemicals

Fuels

Partner Products

Co-products

Protein (Animal Feed)

Potash (Fertilizer)

Patented

Patented

Patented
An engineered microbial platform for direct biofuel production from brown macroalgae

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Abstract
Prospecting macroalgae (seaweeds) as feedstocks for bioconversion into biofuels and commodity chemical compounds is limited primarily by the availability of tractable microorganisms that can metabolize alginate polysaccharides. Here, we present the discovery of a 36-kbp DNA fragment from Vibrio splendidus encoding enzymes for alginate transport and metabolism. The genomic integration of this ensemble, together with an engineered system for extracellular alginate depolymerization, generated a microbial platform that can simultaneously degrade, uptake, and metabolize alginate. When further engineered for ethanol synthesis, this platform enables bioethanol production directly from macroalgae via a consolidated process, achieving a titer of 4.7% vol/vol and a yield of 0.281 wt ethanol/wt dry macroalgae (equivalent to ~80% of the maximum theoretical yield from sugar composition in macroalgae).
## Compelling Economic Model For a $150 Billion Market Opportunity

### PRODUCT PORTFOLIO

**ETHANOL**

**FURANICS**

**PYRIDINES**

### PRODUCTION COST

- **Cash Cost of Production ($/kg) at $60/Barrel Crude**
- **Cash Cost of Production ($/kg) at $0.08/lb-sugar**
- **BAL total COGS at scale ($/kg)**

<table>
<thead>
<tr>
<th>Product</th>
<th>Cost ($/kg)</th>
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<tbody>
<tr>
<td>Pyridine</td>
<td>$0.33</td>
</tr>
<tr>
<td>Furanics</td>
<td>$0.46</td>
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<tr>
<td>Ethanol</td>
<td>$0.50</td>
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- $2.60
- $1.20

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CONFIDENTIAL
**Bal** is partnering with the world’s largest seaweed farmer for scale-up.

### Xun Shan Group

- **Largest brown seaweed producer** in the world
- **10,000+ Ha of ocean concessions** for seaweed
- Existing commercial producer of alginate
- **1b in assets**, 3,000 employees
- Expressed interest in aquafarming beyond Chinese waters
- Existing commercial producer of alginate

### PHASE I: SEAWEED JV

### PHASE II: PRODUCTION JV
Our Strategy is to be the "Lowest Cost Producer" of Renewable Chemicals and Fuels

**STRATEGY**

- Our low cost feedstock is delivered through high yield seaweed farming and industrial best practices
- Our low cost carbohydrate is delivered through a conversion process that utilizes a bio-refinery concept to extract maximum value from the feedstock

**BUSINESS MODEL**

- Partner with Seaweed producer
- Own the conversion of Seaweed into a commercially viable product
- Sell commercially viable product through commercial partner/distributor
Thank You!

- **VALUE PROPOSITION**
  
  Bal can produce chemicals and fuels below cash cost of production which allows access to several multi-billion dollar markets.

- **BUSINESS MODEL**
  
  Bal is a conversion company that will outsource biomass supply and leverage partnerships for the production and distribution of chemicals and fuels. Bal will commercialize chemicals in 2015.

- **EXECUTION**
  
  Successfully executing on multiple components of the integrated supply chain from ‘seaweed-to-products’.

- **STRATEGIC CONTROL POINT**
  
  Bal has blocking IP (60+ patents filed in 16 countries) and has secured marquee international partners like DuPont, Statoil, and Xun Shan Group

- **WORLD-CLASS TEAM**
  
  Experienced management team and scientific advisors with the expertise and proven track records of commercially scaling the business

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