



CELLANA
ALGAE TECHNOLOGY. NATURALLY.

Algae to Fuel and Feeds: *the Cellana Pathway*

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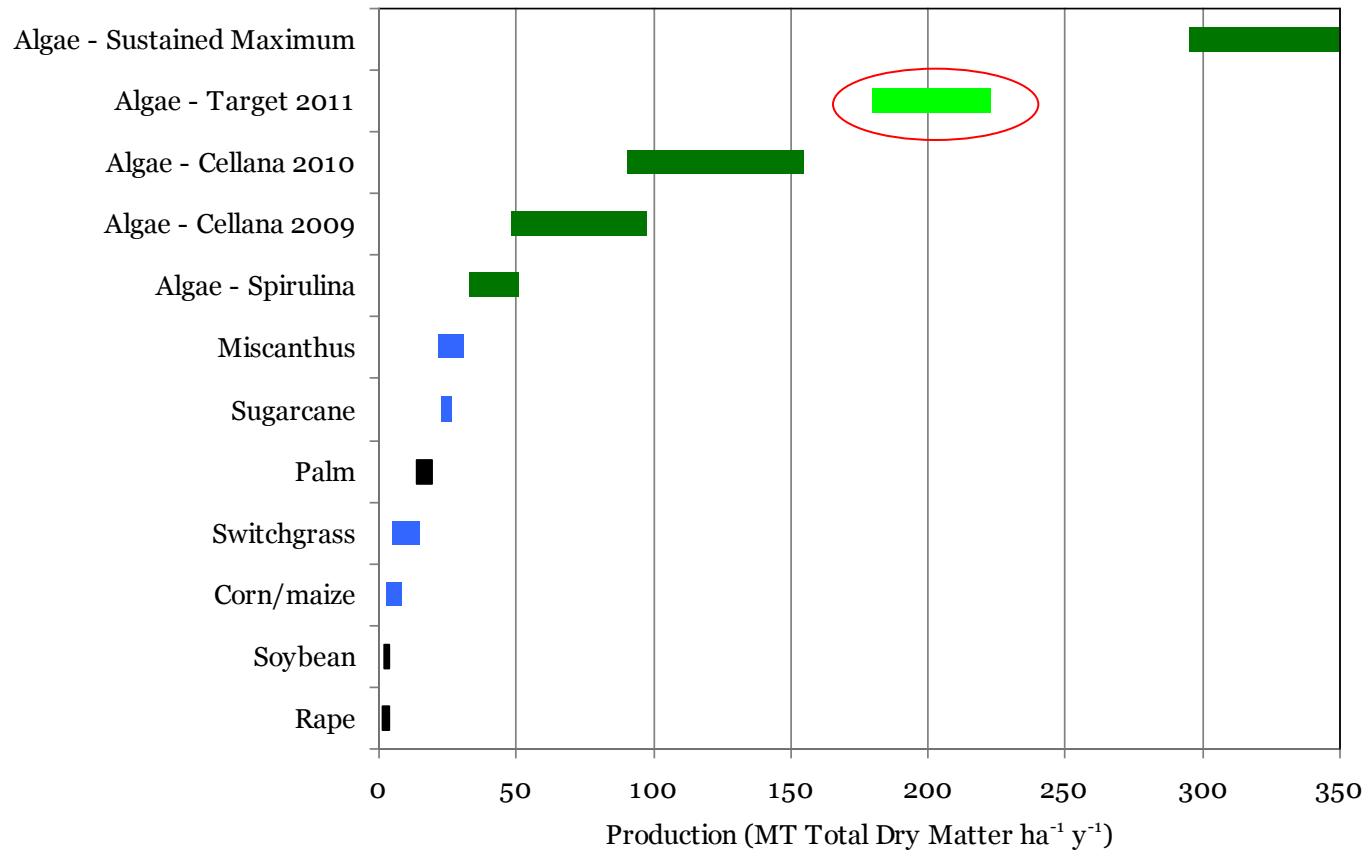
*Cellana is a joint venture of
HR Biopetroleum and Royal Dutch Shell*

ASIA PACIFIC CLEAN ENERGY SUMMIT & EXPO
1 September 2010

What we like about marine algae



Algae are 10 to 100 times more productive than terrestrial energy crops



What we like about marine algae



Algae use less land

| Bioenergy Crop | Total Land in Cultivation (km ²) | Algae Land Required (km ²) |
|-------------------|-------------------------------------------------------|-------------------------------------------------|
| Sugarcane | 227,250 | 22,700 |
| Oil palm | 138,547 | 9,896 |
| Maize | 1,580,300 | 26,338 |
| Rapeseed | 308,053 | 2,282 |
| Total | 2,254,150 | 61,216 |
| Total (%) | 100% | 2.7% |

Land now in production could be reduced >95%

Source: FAO – 2007 data

What we like about marine algae



Algae make the right kinds of oils

| Fatty Acids | Weight % | | | | |
|-------------|----------|---------|-------------|-------------|-------------|
| | Palm Oil | Soy Oil | Algae Oil 1 | Algae Oil 2 | Algae Oil 3 |
| C12:0 | 0.2 | | | | |
| C14:0 | 1.1 | | 19.7 | 14.3 | 14.5 |
| C16:0 | 44.0 | 6.5 | 29.9 | 36.2 | 22.0 |
| C16:1 | 0.0 | 0.0 | 41.2 | 31.9 | 42.8 |
| C18:0 | 4.5 | 4.2 | 2.0 | 2.4 | 3.7 |
| C18:1 | 39.2 | 28.0 | 0.0 | 6.9 | 4.6 |
| C18:2 | 10.1 | 52.6 | 0.0 | 1.5 | 2.5 |
| Other | 1.1 | 8.7 | 7.2 | 6.8 | 9.9 |

Shorter chain lengths are generally favorable

Source: Cellana

What we like about marine algae



Agricultural land is not needed, and

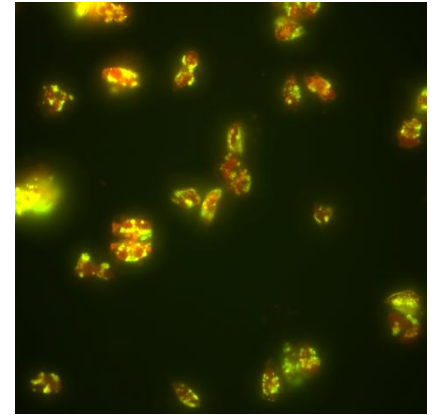
for Cellana's process...

No herbicides needed

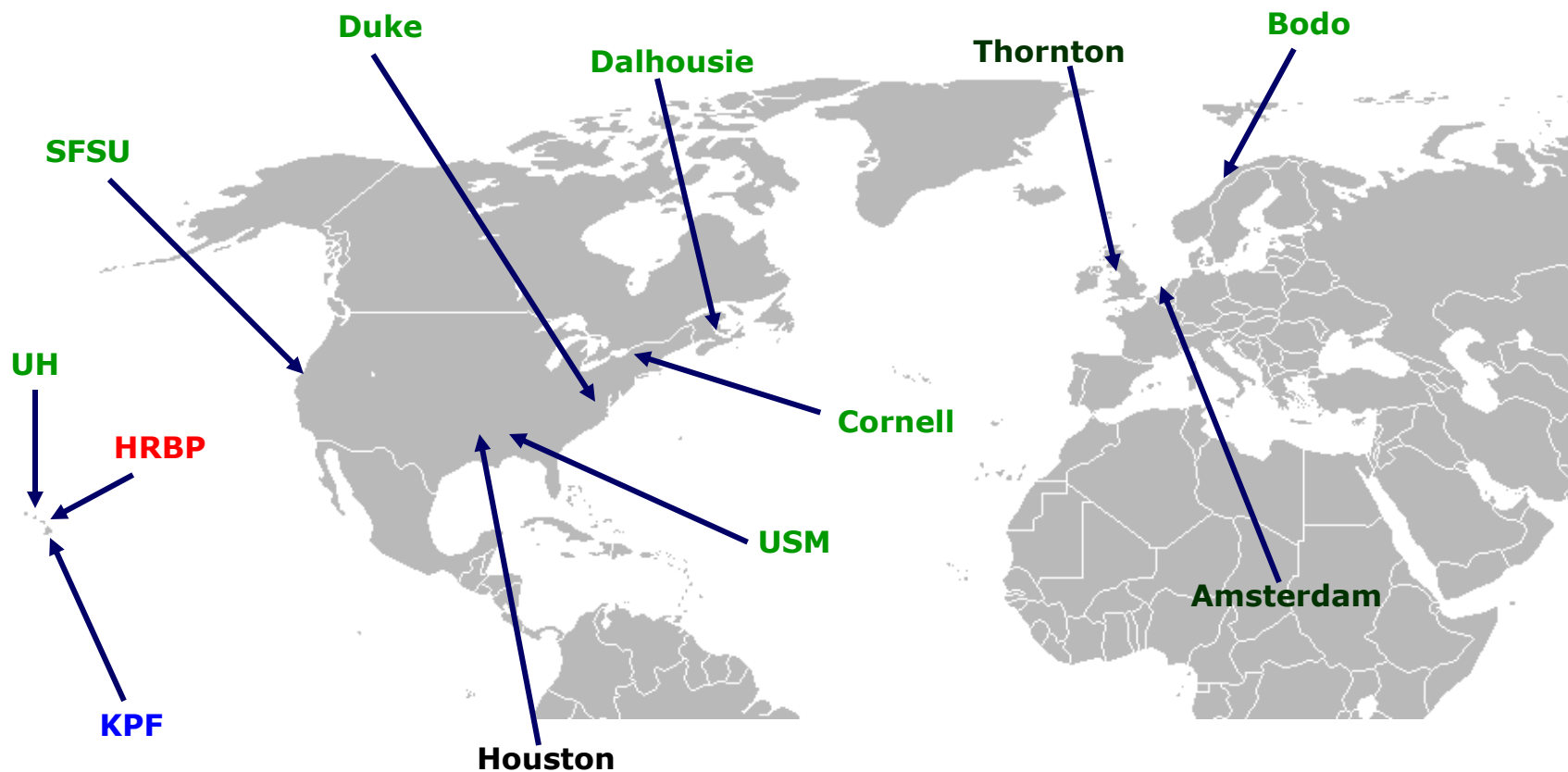
No pesticides needed

No GMOs needed

No freshwater needed - we use seawater



Our team



- University research
- Shell research
- HR Biopetroleum research
- Cellana Kona Pilot Facility



The Cellana algae-to-product pathway

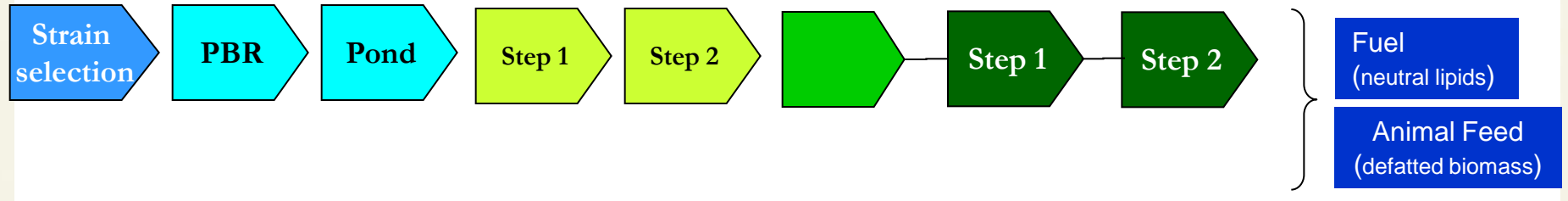
CULTIVATION

HARVESTING

DEWATERING

PROCESSING

PRODUCTS



Kona Pilot Facility

Producing 1 MT dry weight per month

Status

- Integrated production system operating 1 yr
- World-class pilot facility (KPF)
- Fuels demonstrated
- Feeds demonstrated
- Unique strain collection
 - >500 strains newly isolated from nature
 - comprehensively screened



The Cellana algae-to-product pathway

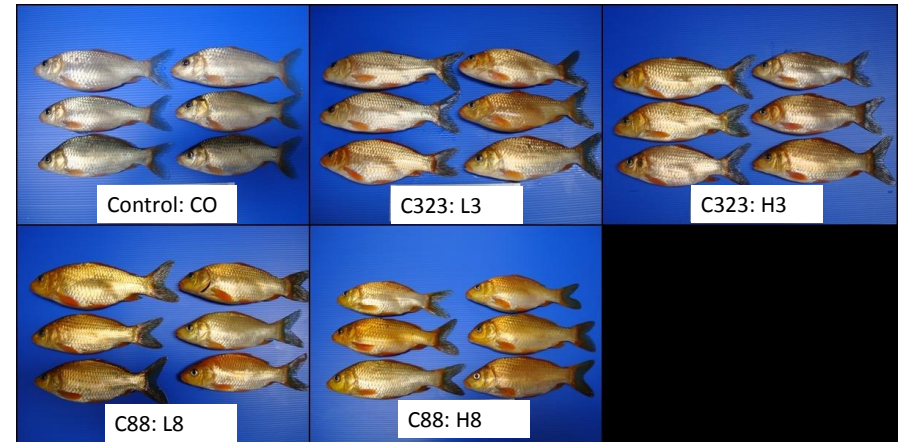
Low energy consumption

Net energy production is highly positive

Carbon intensity is 2x lower than sugarcane ethanol
under the California Low-Carbon Fuel Standard

Sustainable co-products

Feed production is more
sustainable than fishmeal



Carp grown on algae meal instead of fishmeal



The Cellana algae-to-product pathway

First commercial facility timeline

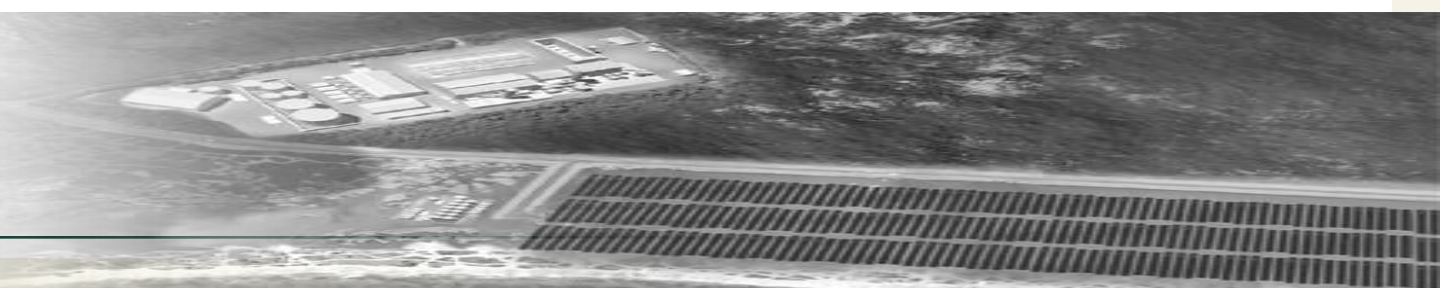
100 hectares

Project engineering: 2011

Construction: 2012-13

Production: 2014

Profitable



Summary



Integrated Cellana pathway demonstrated at pilot scale

Now producing ton quantities of feedstock

Available for product development – open to collaborations

Prepared for commercial deployment

HR Biopetroleum plans the first commercial plant in Hawaii

Financing in development

