



Seminário Combustíveis Alternativos para a Aviação

29 e 30 de novembro de 2011

Realização



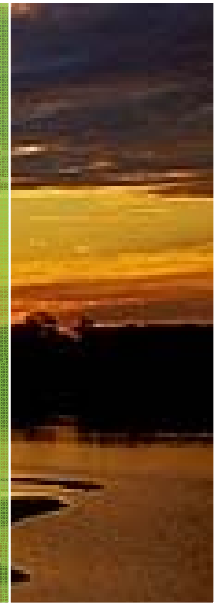
**Organização Brasileira
para o Desenvolvimento
da Certificação Aeronáutica**

Apoio



Integration of Microalgae Based Biofuels Into Ethanol Mills in Brazil

Sergio Goldemberg
Algae Biotecnologia Ltda



ALGAE

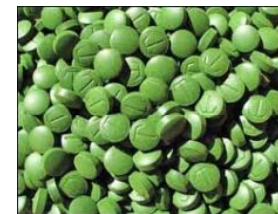
5th Algae Biomass Summit
Minneapolis

October 26th, 2011



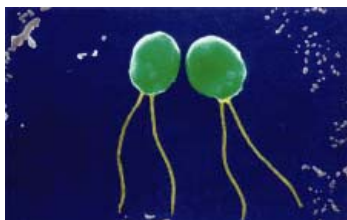
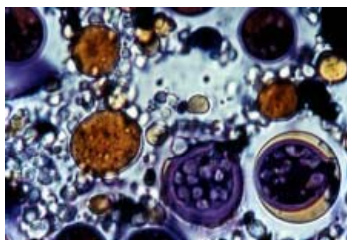
Microalgae History

- Novidade ?
- Anos 50 / 60 : Nutracêuticos / “High Value Added”



National Renewable Energy Laboratory

A Look Back at the
U.S. Department of Energy's
Aquatic Species Program:
Biodiesel from Algae



Close-Out Report (1998)



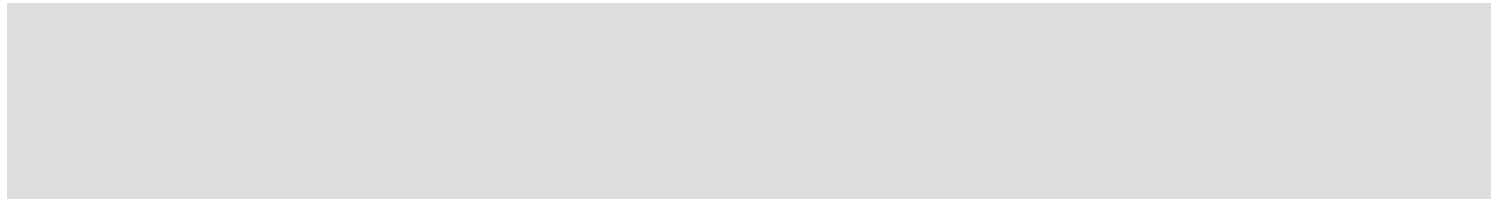
Gold rush for algae

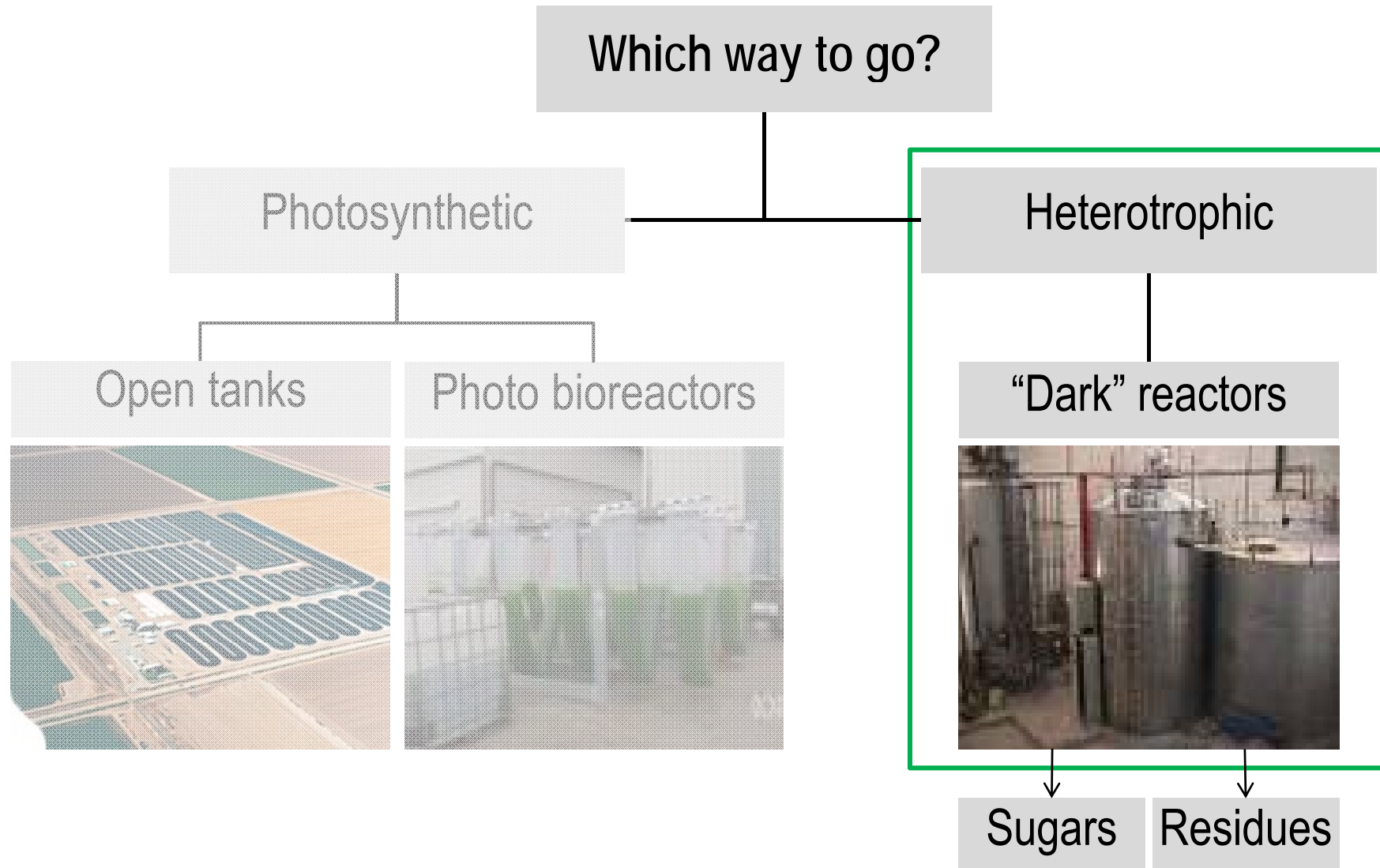
The second of four weekly articles on biofuels describes how oil giants and others are placing their bets on algae.

Percentual de lipídios em algumas
microalgas em relação à massa seca







<u>Microalga</u>	<u>% de Lipídios</u>
<u>Scenedesmus dimorphus</u>	<u>16-40</u>
<u>Prymnesium parvum</u>	<u>22-38</u>
<u>Chlamydomonas reinhardtii</u>	<u>21-35</u>
<u>Porphyridium cruentum</u>	<u>09-14</u>
<u>Chlorella vulgaris</u>	<u>14-22</u>
<u>Dunaliella tertiolecta</u>	<u>64-71</u>

ALGAE

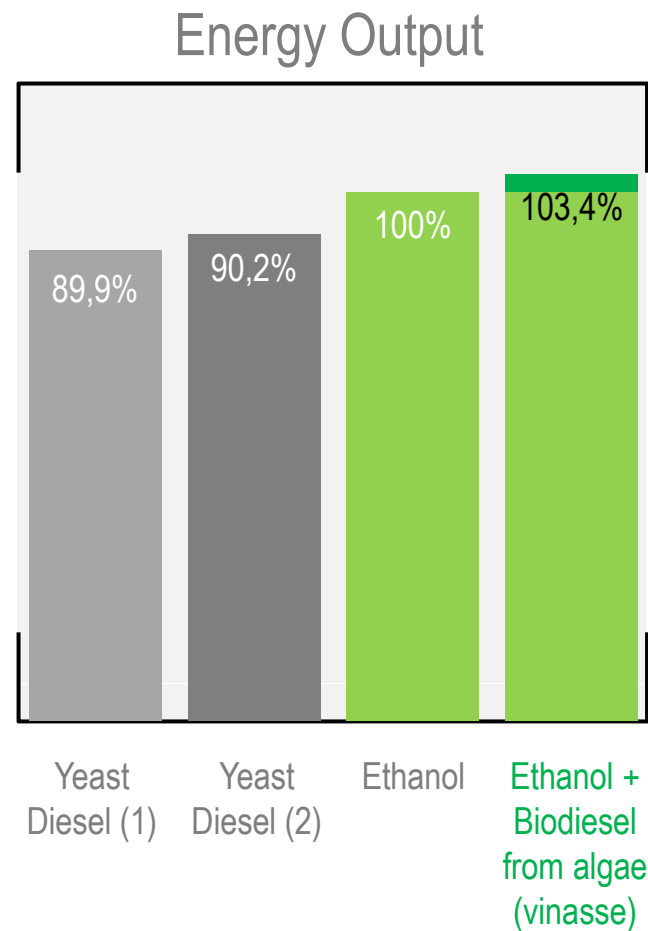
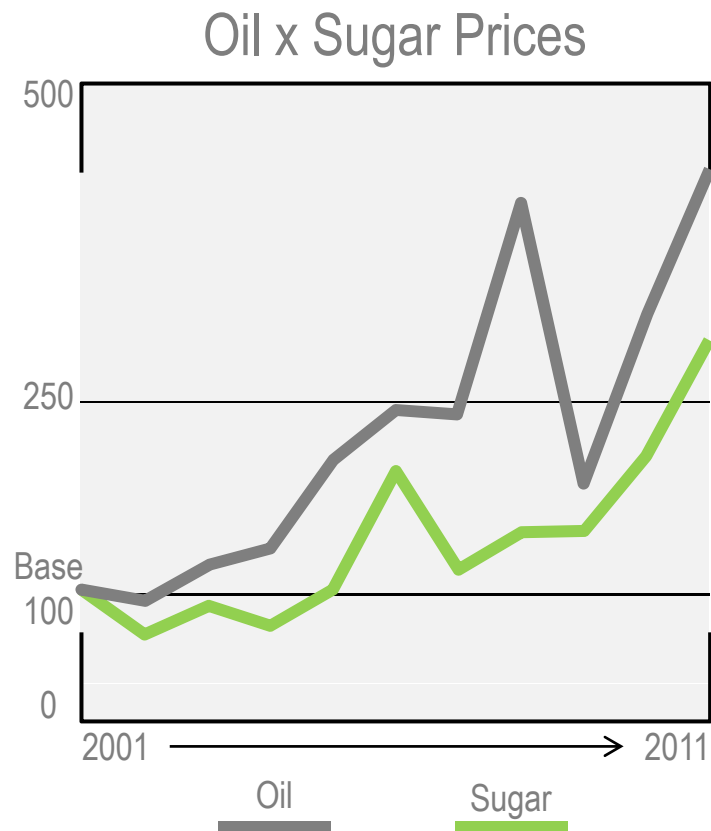




Why Heterotrophic?

Characteristics	Photoautotrophic	Heterotrophic
Potential	Unlimited 	Limited
Solar energy conversion	Direct 	Indirect (uses organic carbon)
Main issues to be solved	Light penetration (open ponds and PBR) Water use (most likely to use saline) Solar conversion rate by microalgae	Grow on available residues Microalgae screening 
G.M.O.	Needs improved solar conversion rate	Won't be necessary 
Will work most likely in	10 to 15 years	3 to 5 years 
Additional advantages	—	High growth rates (10x) High final concentrations (easy harvesting) 
Algae Biotechnology point of view	Research, research, research....	Rapidly evolve from R&D to commercial use

Why not Sugar?



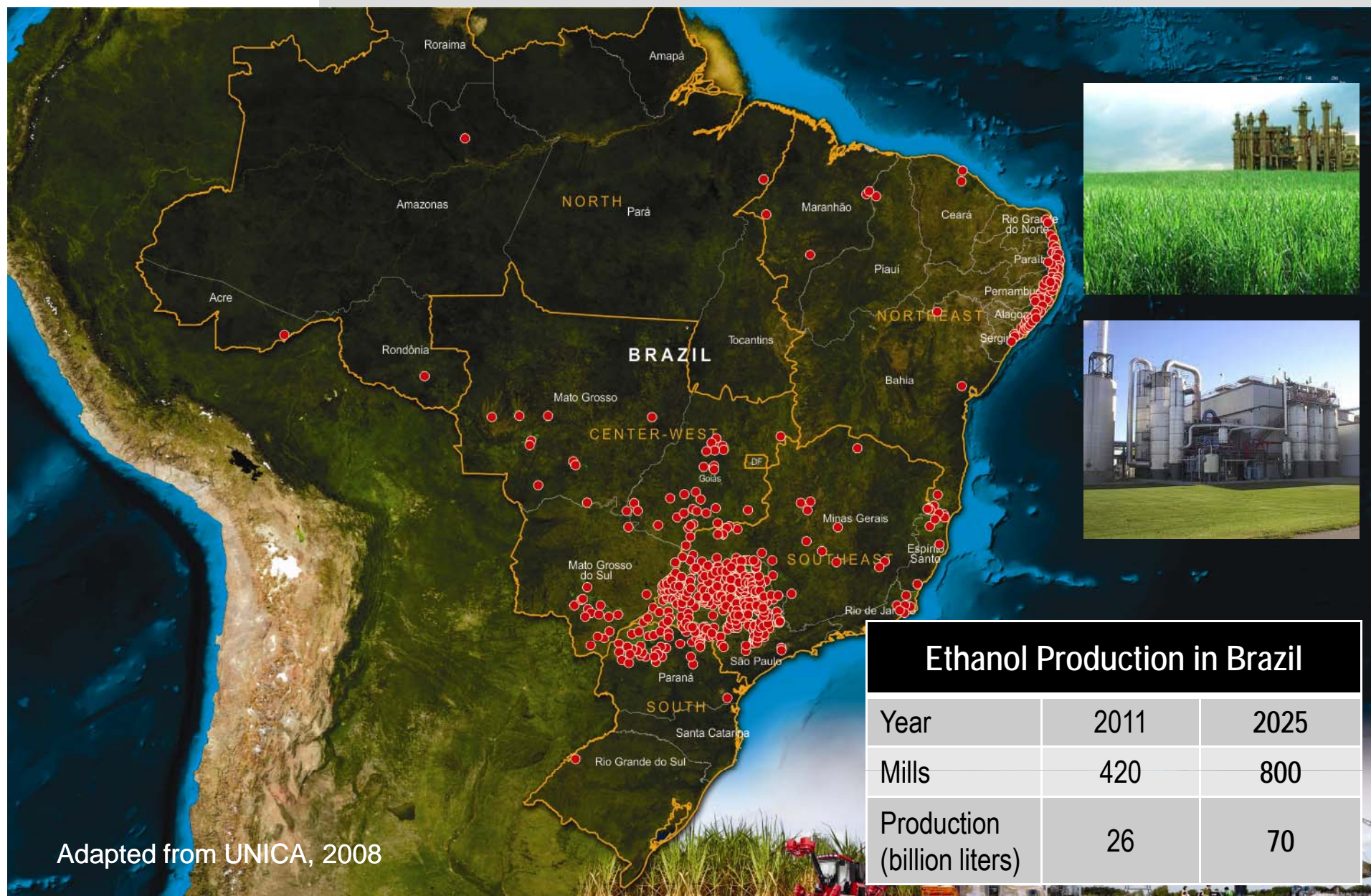
Source: (1) (2) New microbial fuels: a biotech perspective

Mathew A. Rude and Andreas Schirmer

Current Opinion in Microbiology 2009, 12:274-281



Which Residue?





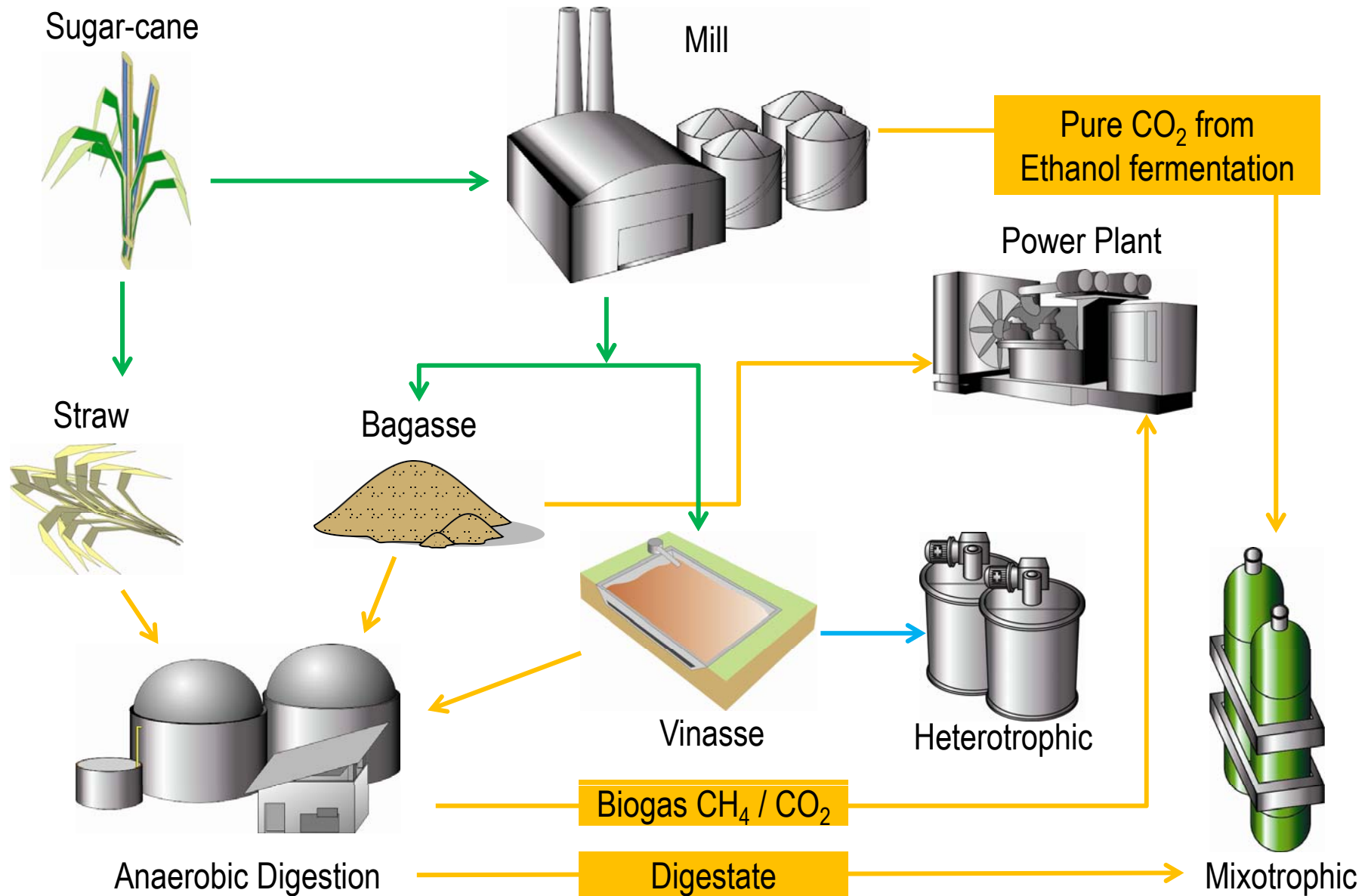
- ▶ Vinasse: wet stillage from ethanol production
- ▶ Currently distributed via trucks or irrigation in the fields
- ▶ High nutrient content, specially potassium
- ▶ Very high biochemical oxygen demand → potential pollution

1 Ethanol barrel = 12 Vinasse barrels



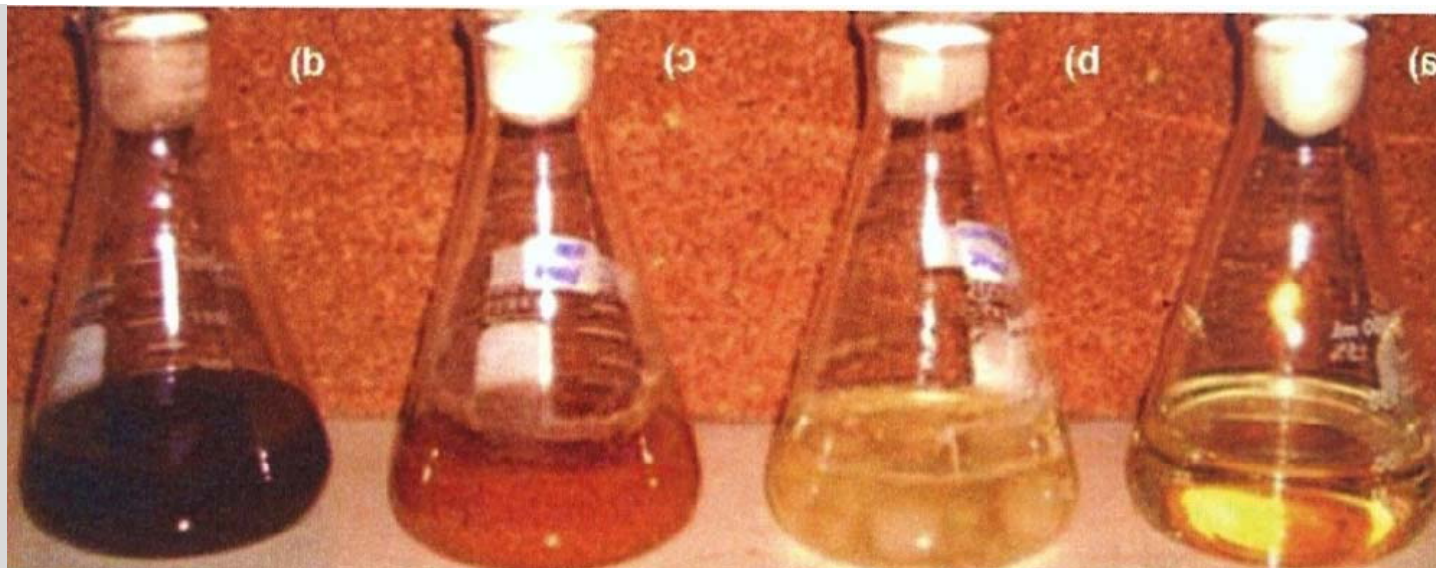
Vinasse Production in Brazil (billion liters)

Year	2011	2025
Ethanol	26	70
Vinasse	320	840



Project	Photosynthetic	Heterotrophic
Location and conditions	Desert area, saline water, CO ₂ source (?)	Ethanol mill using vinasse as substrate for microalgae cultivation
Installation size	300 hectares	Average size ethanol mill with 3 MM tons of cane crushing capacity / year
Data considered	80% area use (240 hectares) 25 grams/m ² /day 300 days/year 25% oil content	Vinasse = Ethanol x 12 Biodiesel = Vinasse/600
Total biomass production (dry matter)	18.000 tons / year	18.000 tons / year
Oil production (liters)	5.0 MM liters / year	5.0 MM liters / year
Equivalent to		2% more liquid fuels, 3.5% more energy, 5% more income

Vinasse clarification trials

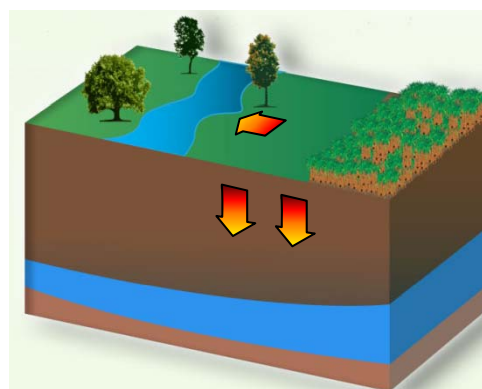


UH Hawaii tests ethanol waste as animal feed

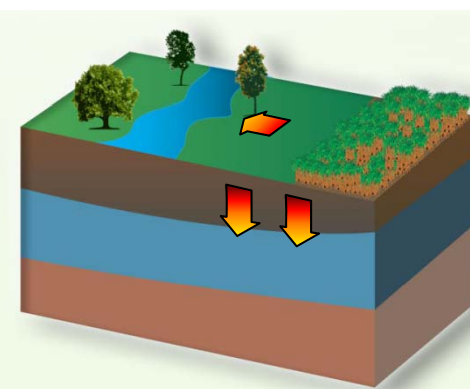
“Research at the University of Hawaii could hold the key to turning a profit in producing ethanol fuel from sugar cane in Hawaii”.

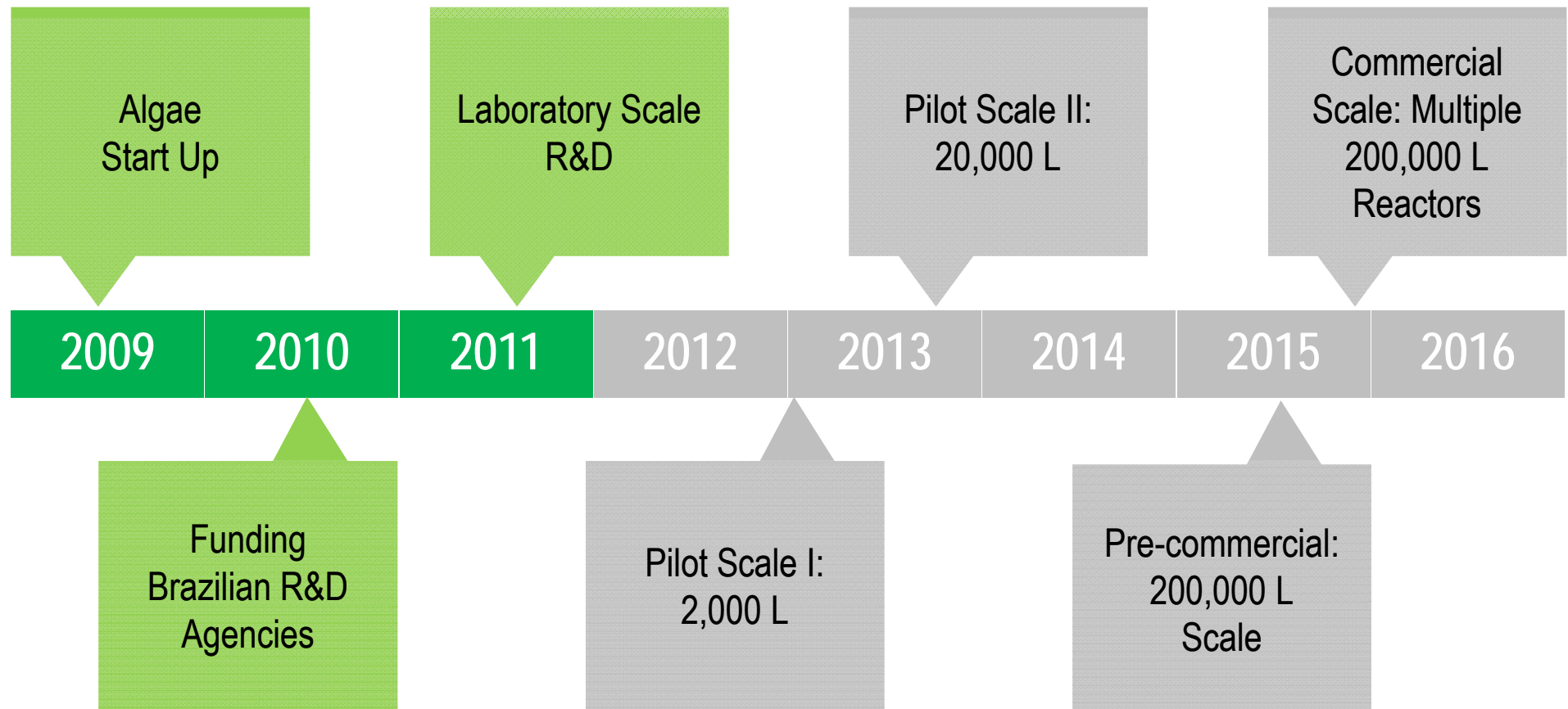
“Hawaiian Commercial and Sugar Co. says the results could help **whether the company goes into ethanol production here**”.

Deep Aquifers



Shallow Aquifers





ALGAE

Algae Biotecnologia Ltda.



Traditional Business

GEOKLOCK



Consulting, planning and realization of environmental projects

BIO SOL



Environmental geotechnics & installation and operation of remediation systems

BACHEMA



Environmental chemistry and laboratory assays

ECOGEO



Holding of companies and investments in environment and renewable energies

EKOS BRASIL



NGO for biodiversity protection and promotion of sustainable development

New Business

BIOLATINA



Energy and biofuels from agricultural waste

ALGAE



Research and development of microalgae

SWISSWATERSYSTEMS



Modular systems for solar energy and water purification

Thank you!



Algae Biotecnologia Ltda.

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