

# Smart Grids & Cleanpower Conference

## 24/25 June 2010

### Biomass

## Innovation and Commercial Opportunities

Marie Francis | Chair | InCrops Ltd



- **Biomass and feedstocks**
- **Algal biomass**
- **Bio-photovoltaics**
- **Gasification and biochar**

- Wholly owned UEA company
- Added value from agricultural crops

Not just the Energy sector

**Innovative uses in non food  
and alternative food**

**EEDA and ERDF**

- Build networks across world class research centres
- Help researchers and businesses exploit commercial opportunities
- International collaboration – Europe, India, China

**New companies  
New products  
New supply chains**

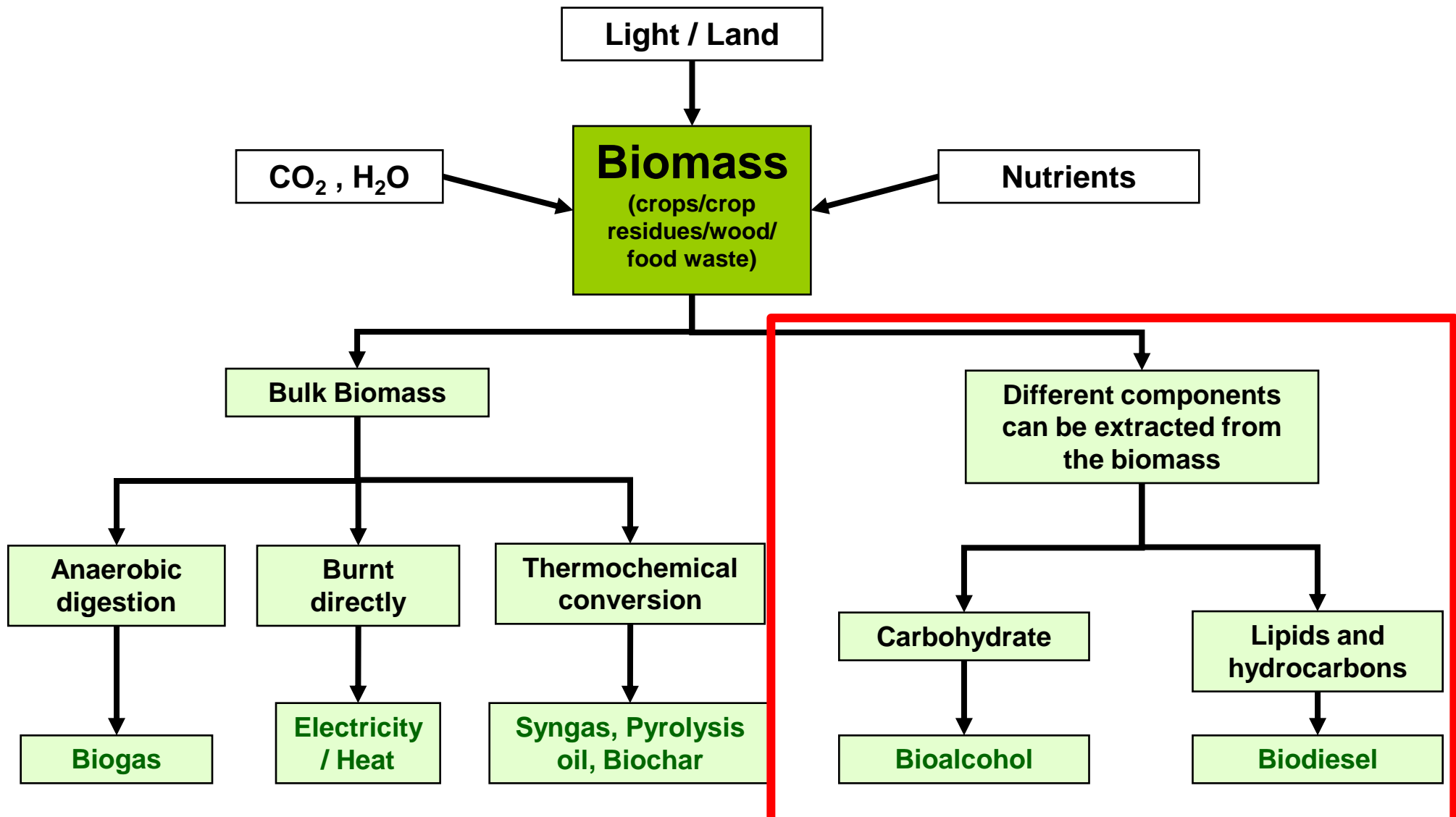
**6 Business Managers located in Research Centres**

**Experts in their own fields**

- **Biomass**
- **Algal biomass**
- **Bio-photovoltaics**
- **Gasification and biochar**

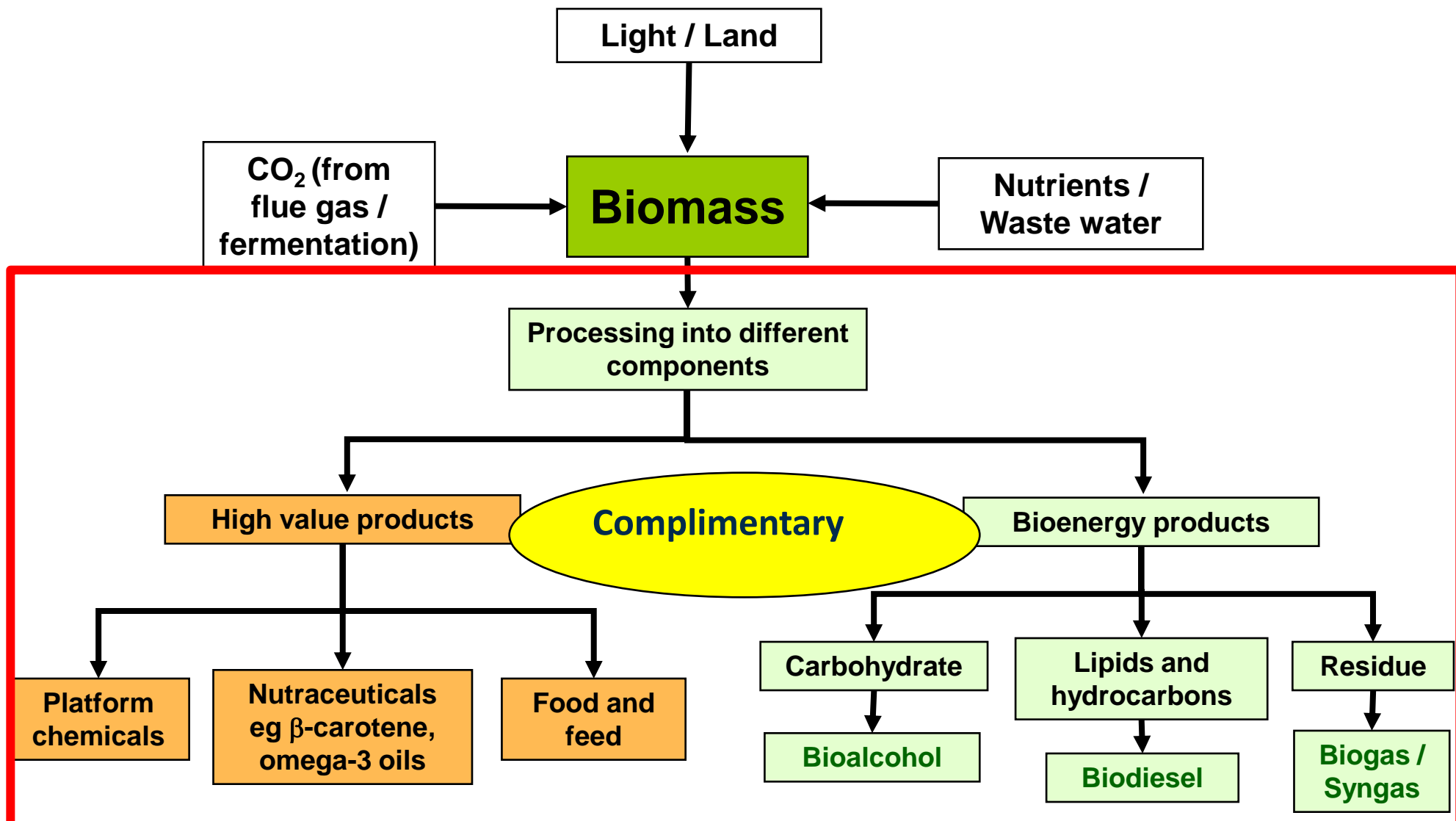
# Biomass

## Pathways to Bioenergy



# Biomass

## Integrated Biorefinery



## Feedstocks

- Selective breeding
- Development of alternative crops
- Genetically engineered feedstocks
- Directives govern authorisation of GMOs:
  - Directive on the Deliberate Release into the Environment of Genetically Modified Organisms (2001);
  - Regulation on Genetically Modified Food and Feed (2003).

**Increase efficiency  
and profitability**

**Eliminate, combine or  
simplify steps in  
production process**

- **Biomass**
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# Alternative feedstocks - algae

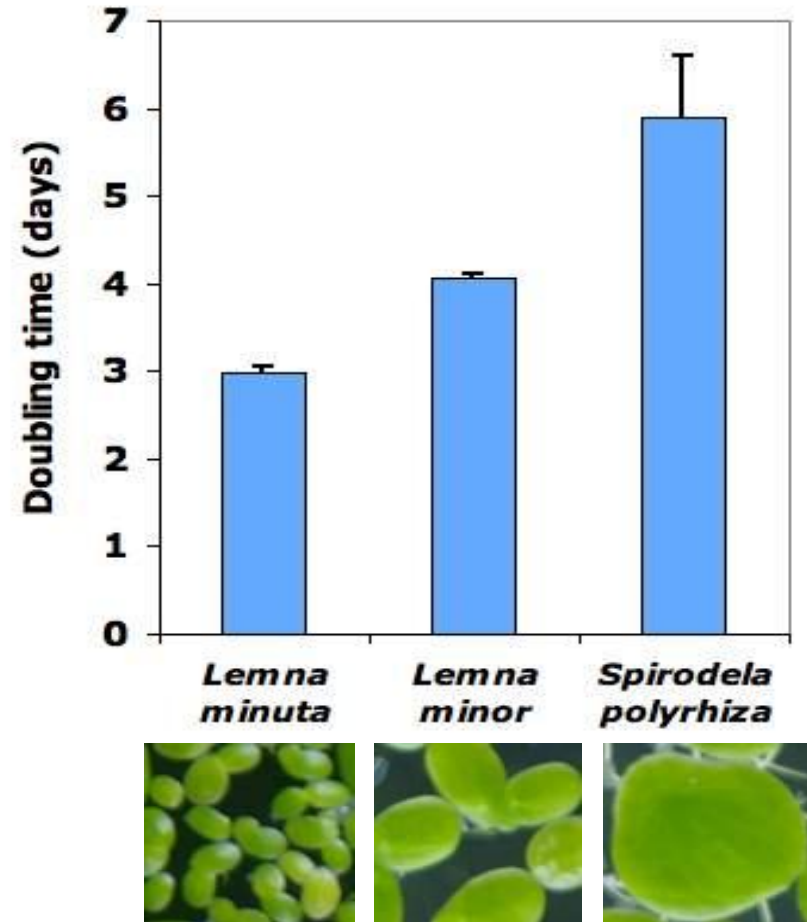
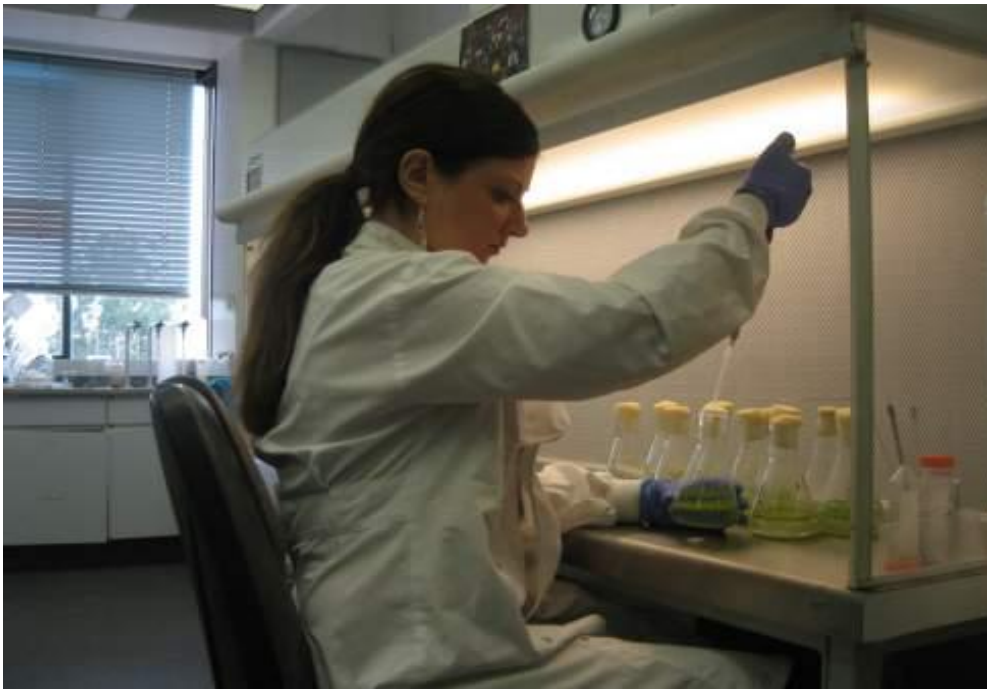


- The algal industry is one of the most fragmented in the biofuels sector: many players developing different approaches.
- But extensive R&D underway worldwide

## Algal biomass

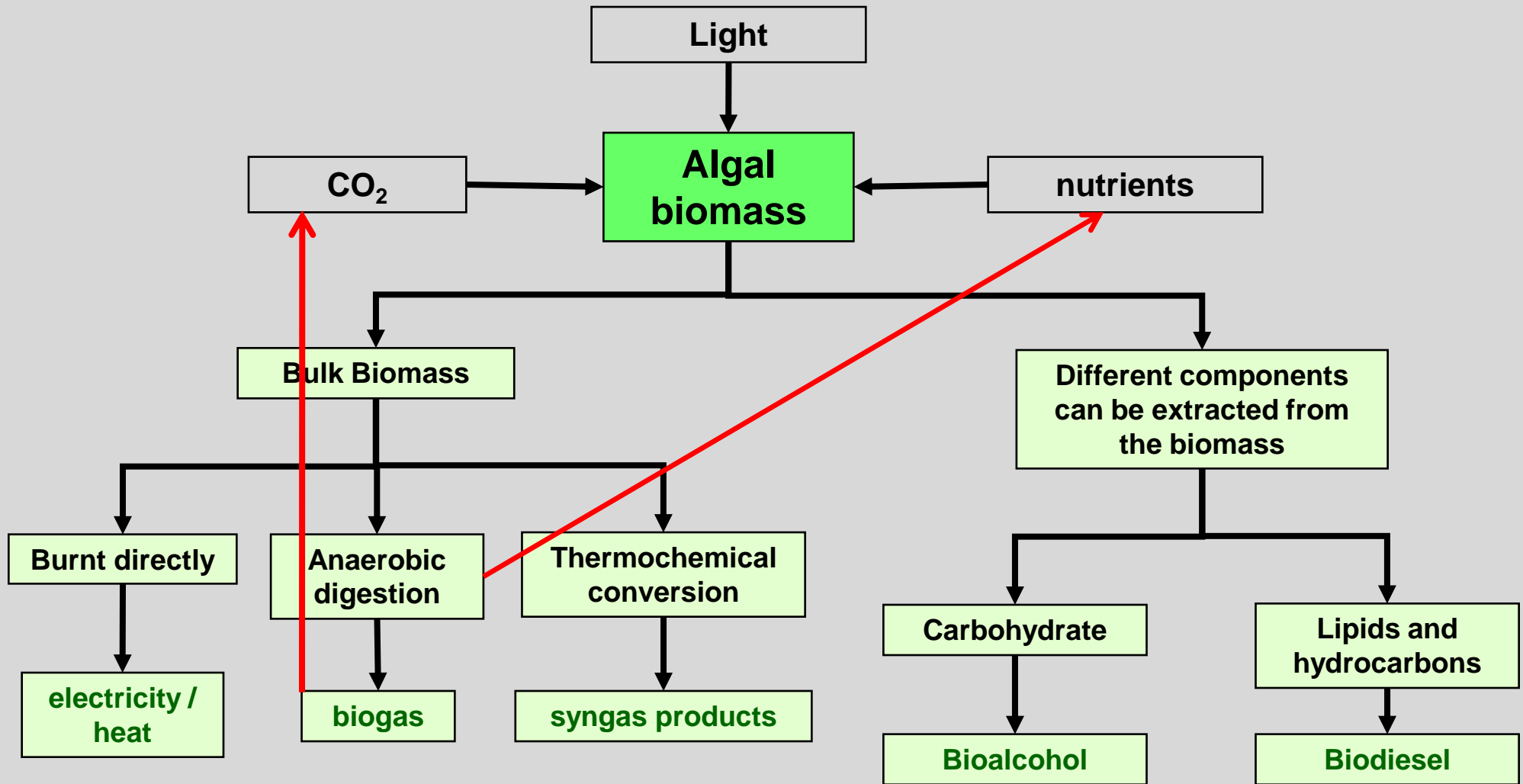
Micro-plants grow very quickly  
Work on duckweed (lemna) at UEA

Yields up to 100x conventional crops



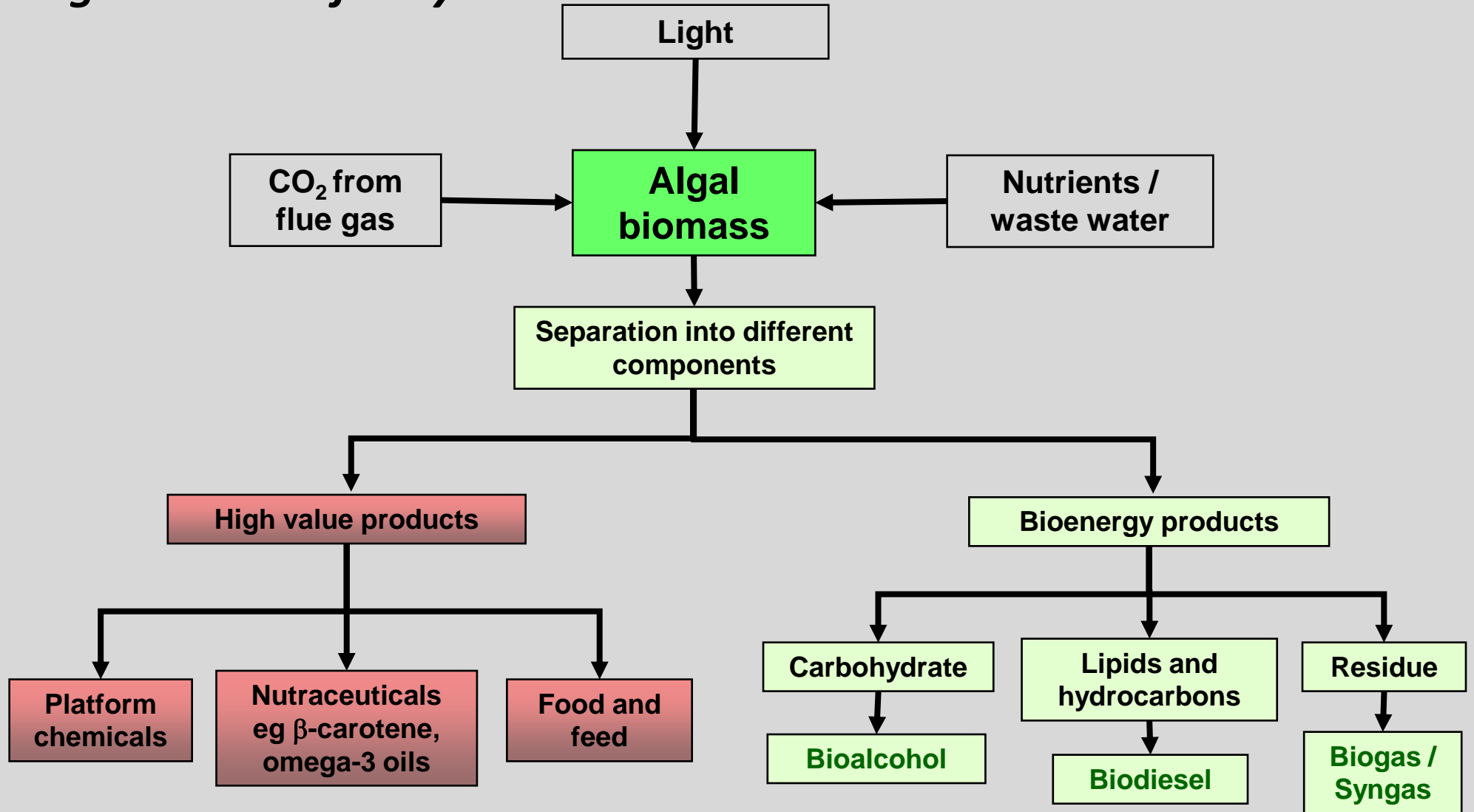
# Algal biomass

## Algal Biomass: Energy Products



# Algal biomass

## *Integrated Biorefinery*



## Algal biomass

### *Increase in interest in algal bioenergy in last 2-3 years*

- More than \$1 billion investment since
- Exxon Mobil \$600M in partnership with
- BP \$10M investment in Martek
- Shell partnership with Cellana
- Sapphire Energy >\$100M investment



#### **Continental airlines press report:**

**Making algae oil in quantity remains a huge challenge - from perfecting the growth of the organism and its oil production to extracting the product in a cost-effective manner.**

**Sapphire Energy (Cyanotech) plans production of 300 barrels of algae oil by 2011 and 10,000 barrels a day within 5 years. It will cost between \$60 to \$80 per barrel.**

# Commercial development of algae

## **Algal Innovation Centre**

**InCrops** in conjunction  
with INTEREG NW  
Europe Strategic  
Programme on  
Energetic Algae

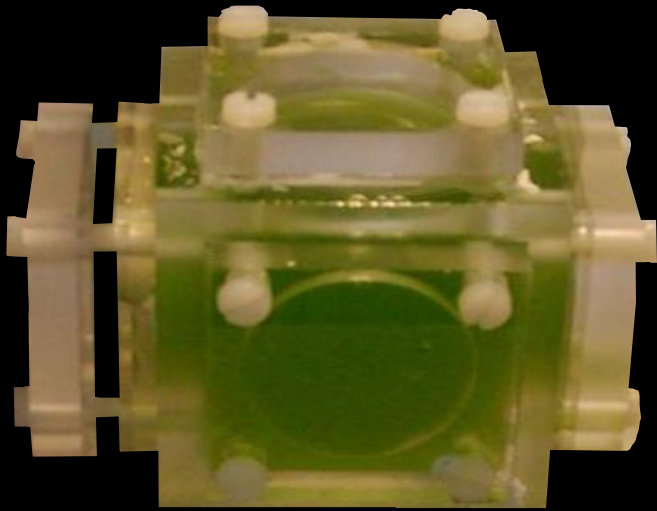
- **Life cycle analysis**
- **C footprint**
- **Digestate composition**
- **Identify strains and growth conditions**
- **Efficient harvesting and extraction**

- **Biomass**
- **Algal biomass**
- **Bio-photovoltaics**
- **Gasification and biochar**

# Bio-photovoltaics

## *Biophotovoltaics*

photosynthesis to produce a light driven electrical current in semi-biological devices



*In collaboration with H+Energy, ABC:*

Developing improved biological materials for use in biophotovoltaic cells

Investigating improved electrode design

Government funding for continued development



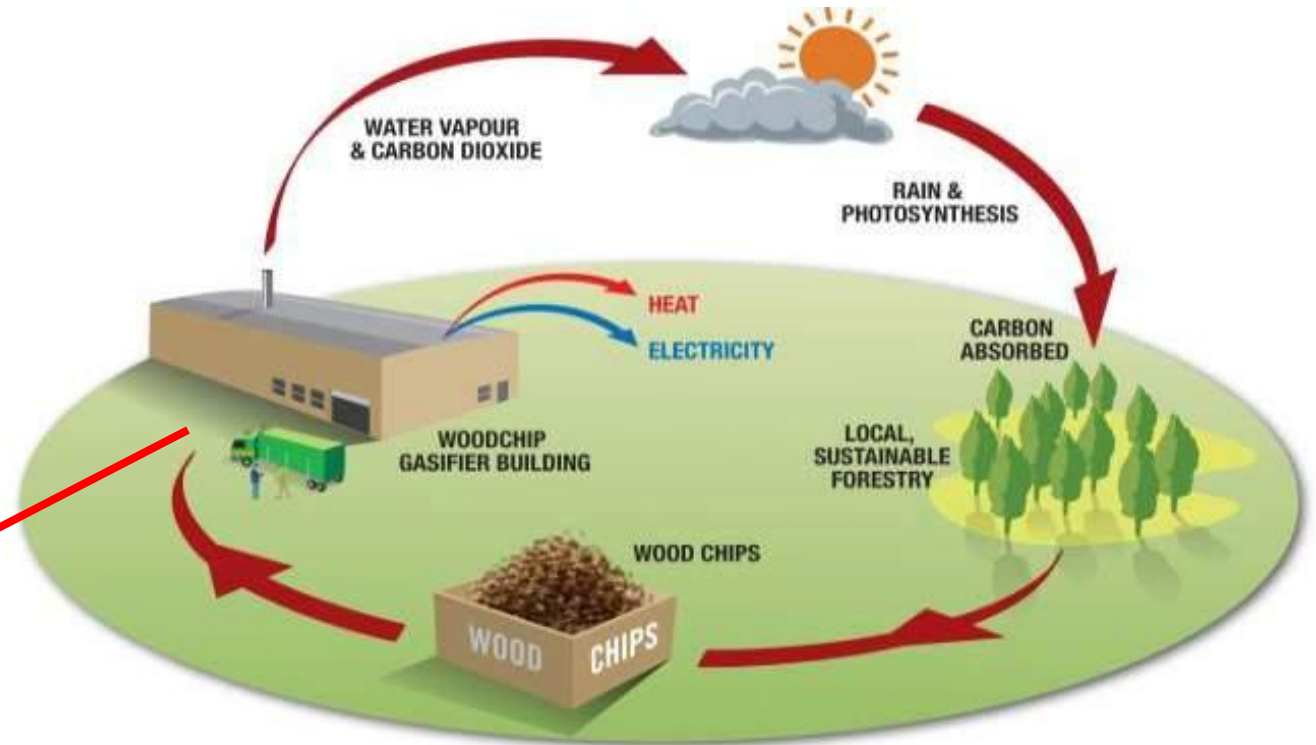
- **Biomass**
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# Gasification and biochar

## Biomass gasifier at UEA

Typically eighty per cent efficient - the heat will be used

Reduces UEA carbon footprint by 35 per cent



Also 300 tonnes pa  
biochar

## Gasification and Bio-char

Electricity generating biomass power stations in the region include

- Ely: 38MW, 200,000 tonnes per annum straw
- Thetford: 38.5MW, 42,000 tonnes chicken litter per annum
- Eye: 12.7MW, 140,000 tonnes chicken litter per annum
- Thetford proposed: 40MW, 300,000 tonnes waste wood per annum

**Efficiencies probably forty per cent or less depending on operating conditions**



Eye Power Station

# Gasification and Bio-char

## Sequestration: a role for biochar?



Biochar from UEA pilot  
plant



“Black is the new gold”  
Financial Times, Feb 28,  
2009

# Biochar – major potential

- carbon rich product from heating biomass in the absence of air

Remain in soil for  
100s of years

Adding to soils can remove  
several % annually of manmade  
CO<sub>2</sub>

- major positive impact on productivity –enhanced nutrient retention
- Improved soil quality
- Reduction in N<sub>2</sub>O emissions

InCrops leading activity on biochar for East of England Soil Strategy

## InCrops Ltd – partners or joint working



**InCrops assists development of new plant based products, supply chains and companies.**



**It supports business innovation and the commercialisation of research**



**Partners interested in international collaboration**





[www.incropsproject.co.uk](http://www.incropsproject.co.uk)

Marie Francis  
Chair InCrops Ltd

Bianca Forte  
Business Innovation Manager

Email: [b.forte@uea.ac.uk](mailto:b.forte@uea.ac.uk)

Mobile: +44 (0)7749 942 521

