

***African Caribbean and Pacific Group of States  
(ACP)***

***Science and Technology Programme***

***Production of non-food, bio-oil supply chains for  
renewable energy in Ghana:  
Needs, Challenges and Opportunities***

***Production of Third  
Generation Sources of  
Biofuel for Renewable Energy***

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# Introduction

- **Topical Nature**

- **Definition**

**Extensive range of fuels that are derivatives of biomass.**

**The term is inclusive of solid biomass, liquid fuels and several biogases.**

# **Why are Biofuels Topical?**

**Enhanced general global and scientific attention in particular are:**

- Oil price spikes,**
- Imperatives for energy security, and**
- Anxiety over anthropogenic emission of greenhouse gases emissions from fossil fuels.**

# **First Generation Biofuels**

- **Derived from sugar, starch, vegetable oil or animal fats using conventional technology.**
- **Primary feedstocks are usually seeds or grains like sunflower seeds that are processed to yield vegetable oil that can be used in biodiesel, or wheat, which yields starch that is fermented into bioethanol.**

# **Criticisms Against 1G Biofuels**

- **Feedstocks could also be in the animal or human food chain,**
- **The public dislike stems from the need to find food for the ever-increasing global population**
- **Occasional food shortages and the concomitant hike in food prices.**

# Second Generation Biofuels

- **Supporters of biofuels claim that workable solution is to increase political and industrial support for second-generation biofuel implementation from non-food crops.**
- **2G B/Fuels include: waste biomass, the stalks of wheat, corn, wood, and special-energy-or-biomass crops (e.g. Miscanthus).**
- **Second generation (2G) biofuels use biomass to liquid technology, including cellulosic biofuels.**

# 3G Biofuels

- **Algae fuel or oilgae is a biofuel from algae.**
- **Lab experiments claim algae can produce 30 times more energy per acre than land crops such as soybeans**
- **These yields have yet to be produced commercially.**

# **Algae Fuels: Prodn. Drivers**

- **Higher prices of fossil fuels (petroleum) promote interest in algaculture (farming algae).**
- **Biodegradable,**
- **Relatively harmless to the environment if spilled.**

# **Difficulties of Algae Fuel**

**For producing algae fuels**

- **It must be mixed uniformly,**
- **If done by agitation, could affect biomass growth.**

# **Algae in the Contemporary World**

- **Algae one of the fastest growing plants in nature**
- **Ability to convert large amounts of carbon dioxide into oxygen**
- **Interesting in contemporary more environmentally conscious world.**

# 3G Biofuels Yield

- **Whole organism converts sunlight into oil**
- **Algae can produce more oil in an area the size of a two-car garage than a whole football field of soybeans.**

# Sources of CO<sub>2</sub>

- **Algae consume CO<sub>2</sub> for normal growth during Photosynthesis**
- **1 kilowatt-hour of electricity, produces 2.1 pounds of CO<sub>2</sub> as flue gas from the coal-fired power plants.**
- **1.5 and 3 pounds of CO<sub>2</sub> are required for every pound of algae cultivated**

# Algae Cultivation

- **Algae cultivation as a carbon sink is trendy among those in power generation.**
- **In the U.S. the algae projects are often sited near or at the CO<sub>2</sub> source.**
- **The type of Algae cultured has to be carefully selected around the power plant with small or no flue gas purification.**
- **CO<sub>2</sub> from fermentation sources are relatively rich**

# Algae Sources - Ponds

- **Most common forms of algae in ponds planktonic algae and filamentous algae.**
- **Planktonic algae - Type that gives pond that unique pear green, soupy color.**
- **Planktonic algae is the base of the food chain in a pond.**
- **Filamentous algae grows on rocks and floats on the surface in mats.**

# Where do Algae Grow? - Algae Growth Environments

- **Algae are some of the most robust organisms on the surface of the earth.**
- **Algae has the ability to grow in a varied range of conditions.**
- **Algae are normally found in moist places or bodies of water. They are common in terrestrial and aquatic environments. Terrestrial *algae* are normally subtle, and found more in moist, tropical regions than dry ones, as they are devoid of vascular tissues and other adaptations for living on land.**

# Sources of Algae (1)

## Non-marine habitats

- ***Animals***: Substrates include turtles, snails, rotifers, worms, crustacean, alligators, three-toed sloths, aquatic ferns, freshwater sponges.
- ***Aquatic plants***: Algae grow on and inside water plants (including other algae)
- ***Artificial substrates***: Habitats include wooden posts and fences, cans and bottles, etc.
- ***Billabongs & lagoons***: Rich microalgal habitats, particularly for desmids.

# Sources of Algae (2)

- ***Bogs, marshes & swamps***
- ***Farm Dams***
- ***Hot Springs***
- ***Lakes***
- ***Mud and sand***
- ***Ponds (transient), puddles, roadside ditches and rock pools***

**The End**

**Thank You**