

Erskine Waste Water Treatment Works

Secondary Treatment Algae Rercreation and Laboratory education centre is located at South Street on

the north part of River Clyde. While the Algae cultivation and biofuel extraction centre is located at Govan Road and Holmfauld road.

Dalmuir Waste Water Treatment Works

Serve: 600,000 People

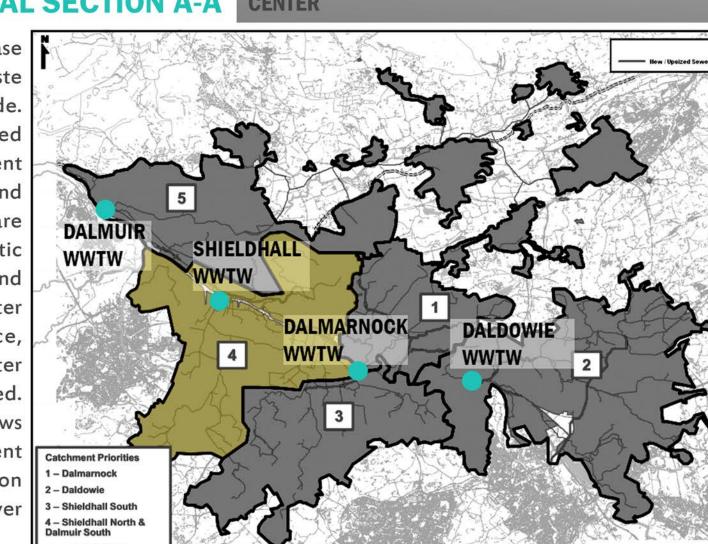
Secondary Treatment

Treat: 378,000m3 water per day

CONCEPTUAL SECTION A-A CENTER

water into River Clyde. However, the treated content several nutrients and pollutants that are harmful to the Aquatic life of the river and water envinroments.Hence, tertiary water treatment is needed. Figure on left shows Priorities and location of WWTW along River

Clyde in Glasgow

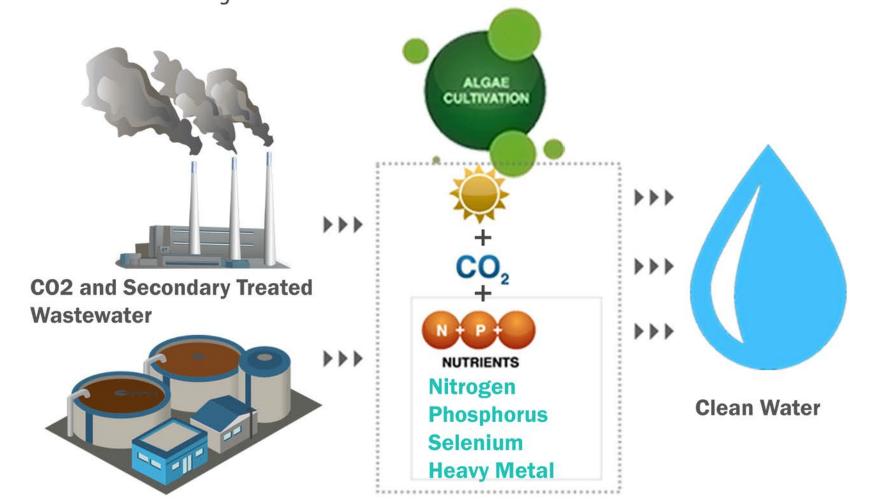


ALGAE CULTIVATION.

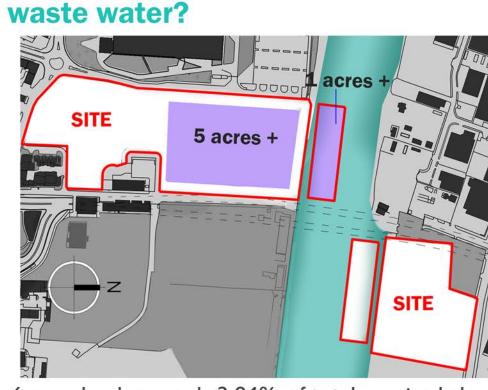
HARVESTING AND BIOFUEL

TERTIARY WASTE WATER TREATMENT

Wastewater provides both water and fertilizer for algae cultivation and algae provide desirable treatment for the secondary treatedwastewater. When provided with untreated wastewater, sunlight and carbon dioxide (CO2), green algae and associated microbes rapidly convert nutrients and organic carbon from wastewater into renewable biomass.



How much land needed for algae facilities to treat public secondary



An Algae Cultivation centre (using OMEGA system) in Alabama suggested that this system can treat 40,000 gallons of waste water per acre per day. To locate an algae production facility using OMEGA system in the vicinity of the Wastewater Treatment Works (WWTW), for instance: in Dalmuir WWTW, which average treat about 250,000m³ of wastewater per day, an area of approximately 152.4acres (616,760.5m²) of algae plant facilities is required.

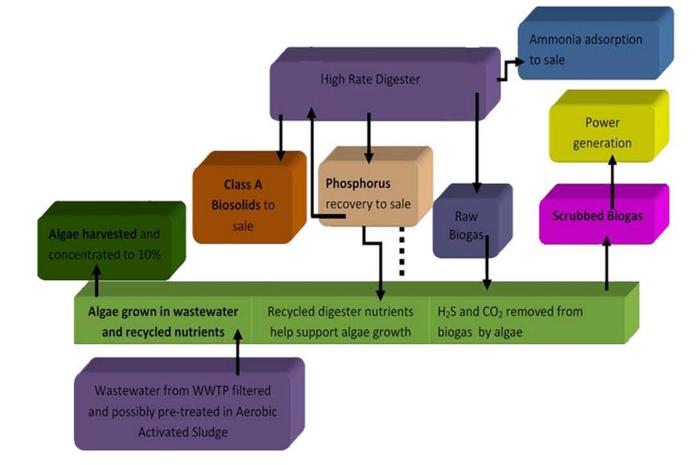
6 acres lands are only 3.94% of total required algae facilities areas to treat 250,000m3 of water. To achieve the desired areas, vertical areas through multistorey and walls bioreactor system has to be



ntegration bioreactor to the wall system add more algae volumes and this wall system could act as shading and thermal insulation.

Accordion photobioreactor BIQ Building's Bioreactor Facade algae cultivation What do Algae removed from wastewater?

Algae could remove more than 90% Nitrogen (N) and 80% Phosphorus (P), and other contaminants such as Biochemical oxygen demand (BOD); Total suspended solids (TSS); Nutrients that cause eutrophication; Metals (including toxic heavy metals); Organic contaminants, surfactants, phenols and hydocarbons from the secondary-treated municipal water without adding any other chemical



Laighpark (Paisley) Sewage Treatment Works Serve: 74,000 Peoplet Secondary Treatment

Shieldhall Waste Water treatment Works Serve: 585,000 People **Secondary Treatment**

OMEGA System

Dalmarnock Waste Water Treatment Works Area

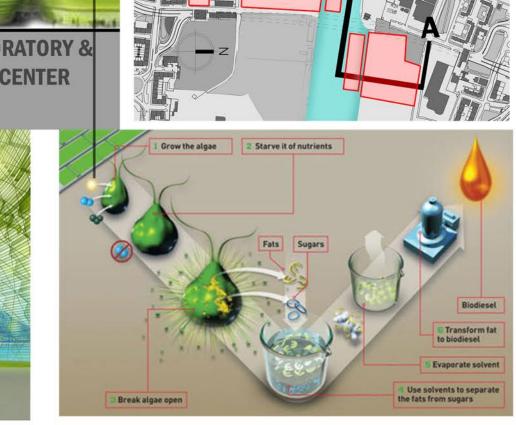
Serve: 370, 000 People Secondary Treatment

SWIMMING POOLS

ALGAE LABORATORY & **RECREATION CENTER EDUCATION CENTER**

Daldowie Sewage treatment Works Serve: 1 Million People

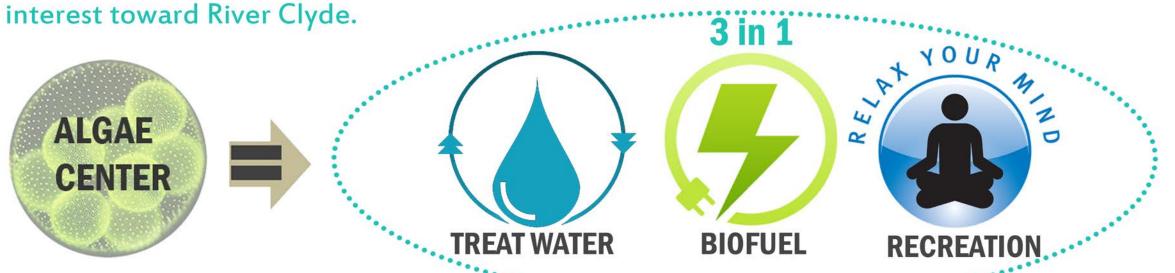
Treat: 540000 sludges m² Sludge Treatment



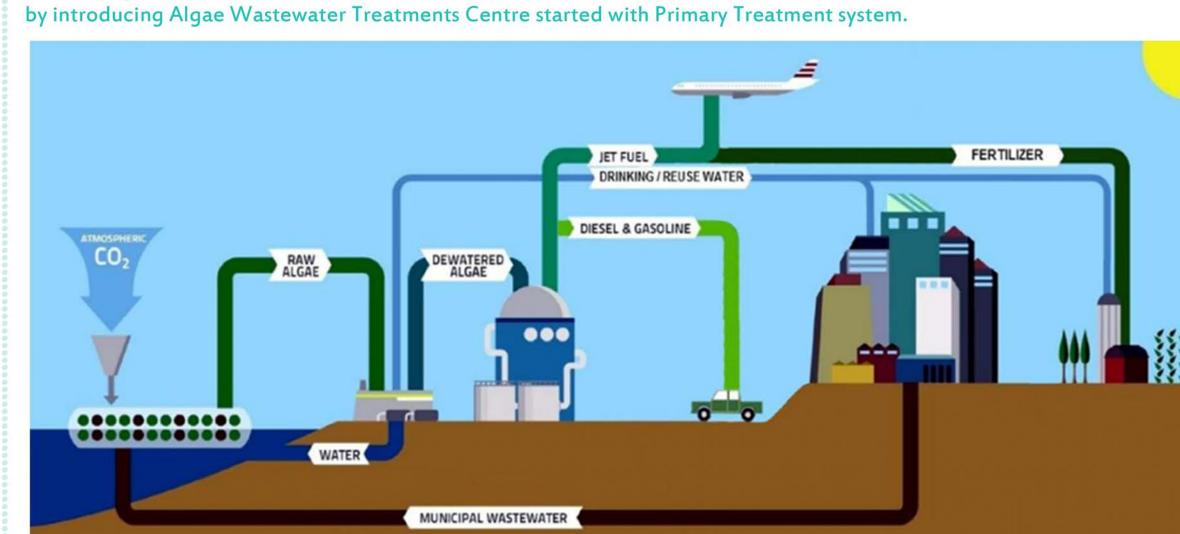
STRATEGIES & OBJECTIVES

ALGAE CULTIVATIONS PLATFORM

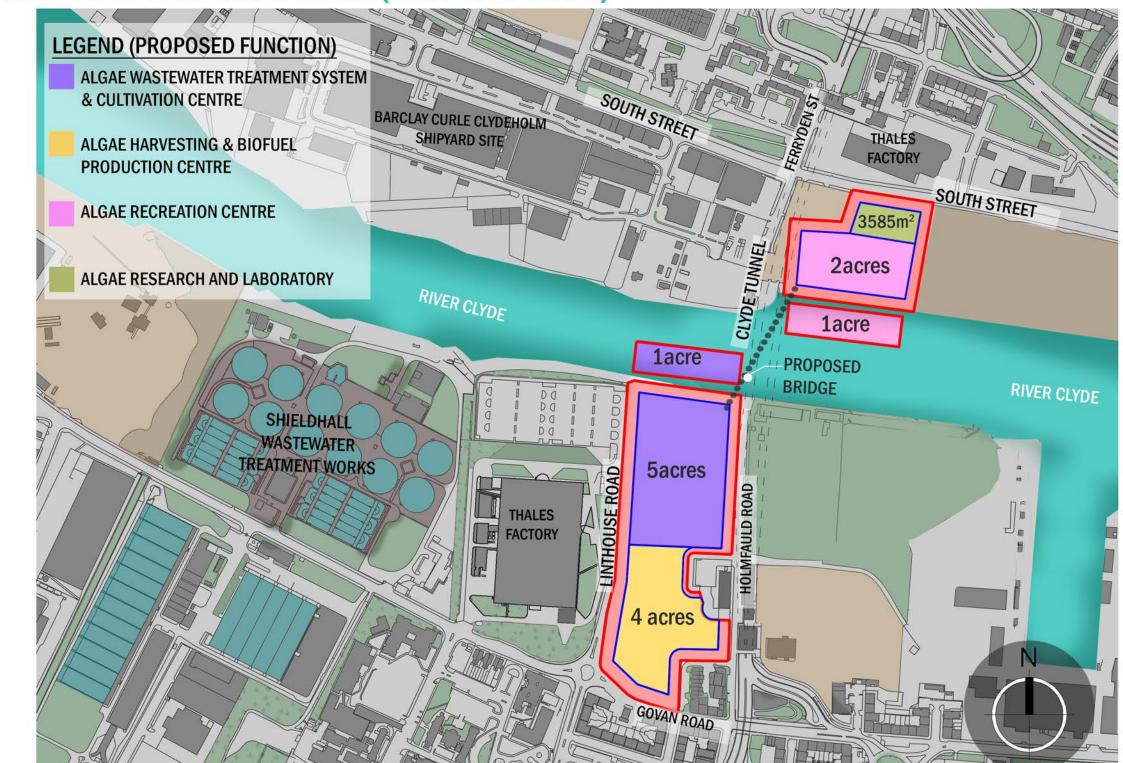
Algae Prototype Center have 3 main benefits: An advanced sustainable wastewater treatment, to produce biofuel and as a place recreation activities that generate the people's



This prototype is proposed in vicinity to Shieldhall Waste Water treatment as an initial stategy to cope with point source pollution. The intention is to develop this system all along River Clyde near to WWTW. If the system is successful, it could further treat sewage from Combined Sewer Outlets



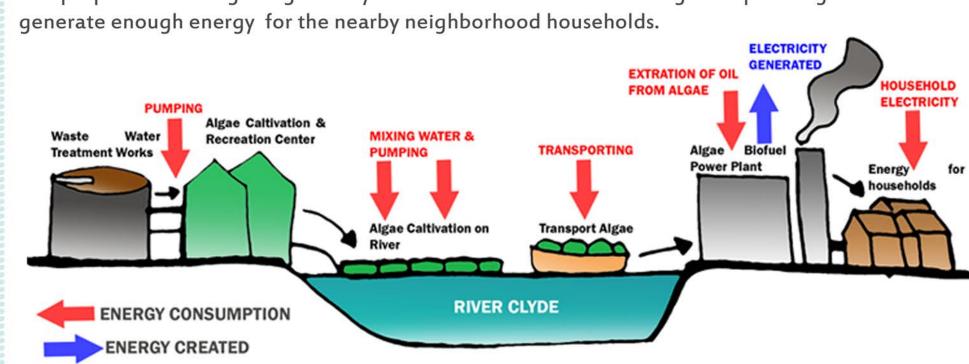
PROPOSED LOCATION PLAN (SCALE 1: 5000)



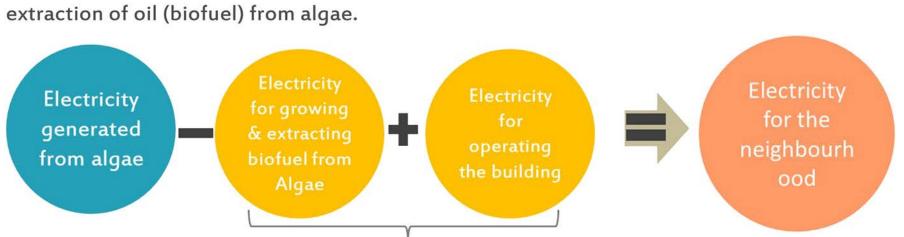


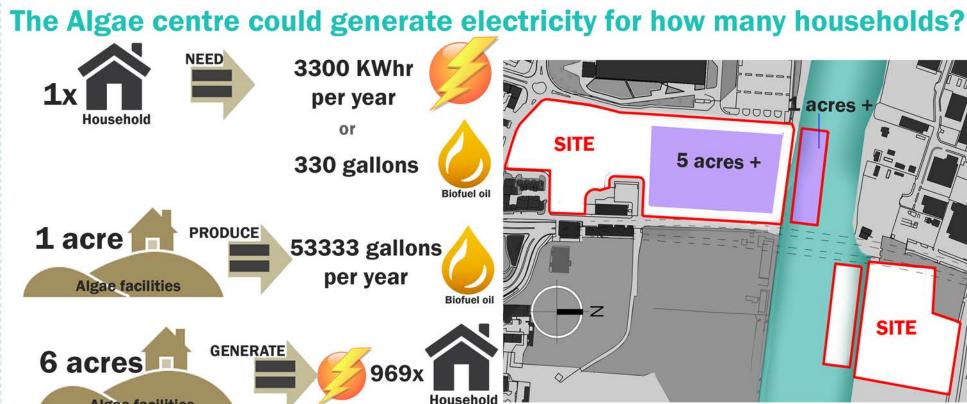
BIOFUEL ENERGY

The proposal of having integrated system is to test whether this integrated planning is feasible to



The main requirements to be considered are the energy used for operating the algae harvesting and



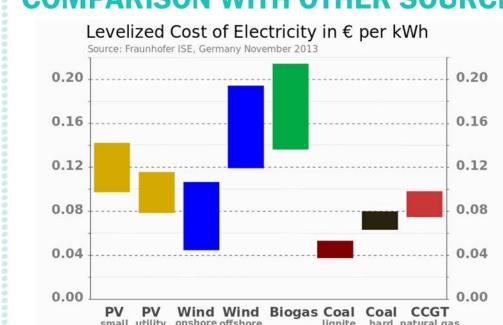


* Excluding electricity operating the Algae center and facilities and energy to extract oil from Algae.



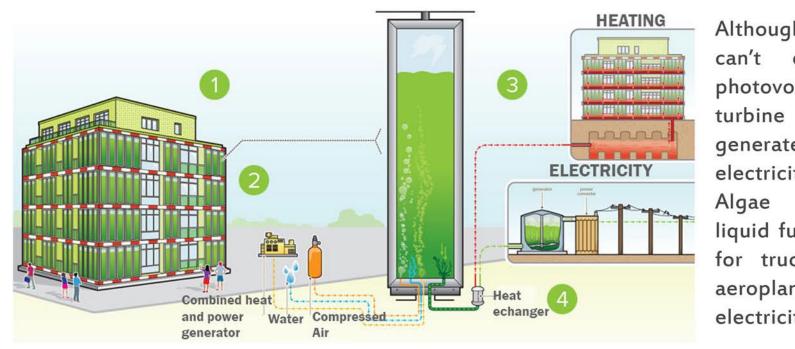
Wastewater Treatment Works with the Algae cultivation centeris main distances exceed a few ten of kilometers, the energy required for exceed negates the energy benefit from growing algae.

COMPARISON WITH OTHER SOURCES OF RENEWABLE ENERGY



Producing biofuel commercially required large amount of land areas. Hence, cultivating algae on River clyde and building facade could save on land areas. Recent study shows that most favarable options would require 360m² of algae facilities for 1 kW of output, However, the same area could generate 10-20kW using available solar thermal or photovoltaic technologies. Figure on the right shows biofuel cost the most in the levelized cost of electricity in Europe.

PROPOSED ENERGY SOLUTIONS



Although Algae biofuel can't compete with photovoltaic and wind energy to generate large scale electricity in Scotland, Algae is producing liquid fuel, which is vital for trucks, trains and aeroplanes (cars use electricity in the future).