

**ZERO CARBON
B100 BIODIESEL
TRI-GENERATION
COMBINED COOL, HEAT AND POWER
PLANT

FOR

HIGH RISE BUILDING**

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TABLE OF CONTENT

		Page
1.0	Background	3
2.0	Advanced B100 biodiesel tri-generation CCHP Plant	3
3.0	How to accommodate the system	4

ZERO CARBON B100 BIODIESEL COMBINED COOL, HEAT AND POWER (CCHP) PLANT FOR HIGH RISE BUILDING

1.0 Background

1.1 The urgent need to reduce carbon intensity in high rise building

Current local energy mix consists of little renewable energy but there is potential to manufacture renewable biofuel or even import biofuel from across border and other countries.

- CLP Electricity – PV Panel, Coal, Nuclear, Landfill gas, Fossil Gas & oil.
- HKE Electricity – PV Panel, Wind Turbine, Coal, Fossil Gas & oil.
- Towngas – Landfill gas, Fossil with mix of natural gas and naphtha - 50% grey hydrogen content.

High power consumption in high rise building, efficiency increase helps but cannot achieve net zero carbon or negative carbon.

- Air-conditioning need
- Computing power and lighting
- High power car charging facilities
- Lift, escalator and water pumps
- Hot water, steam

1.2 Why biodiesel is selected and consider as a net zero carbon renewable fuel:

- Biodiesel is fatty acid with similar properties with diesel and could operate in special diesel engine with much less emission.
- Local biodiesel is manufactured from waste cooking oil of restaurants with methanol.
- Carbon in waste cooking oil come from animal fat and from plants; carbon in plants come from the atmosphere due to photosynthesis.
- If carbon is captured; will becomes a carbon negative cycle.
- Biodiesel is widely available locally with 2 major plants and could be imported.
- Biodiesel is safe and easy to handle
- Biodiesel has high energy density and could be combust cleanly.

2.0 Advance 100% biodiesel Tri-Generation CCHP Plant

Different from major power generation system, the advantage of distributed power system is that all the waste heat generated will be recovered to power the waste heat adsorption chiller to generate renewable/free chilled water for the central air-conditioning system.

Utilize renewable biofuel to power CCHP plant sharply reduce carbon emission and able to achieve thermal efficiency of over 85%. Compare with previous generation, our advance system ensures super low NOx emission, even better partial load efficiency due to variable speed system, power factor could be as high as 1.0.

The green CO₂ left in flue gas it could be used to feed small green house on roof top.

An 800kW system consists of 2 x 400kW CHP unit and 1 x 400kW adsorption chiller could reduce carbon emission by 2348 ton per year before considering solar assist cooling provide the following criteria are met.

- 4200 hours of annual operation
- Biodiesel is generated from waste cooking oil instead of palm oil.
- Waste heat is recovered and utilized
- NO_x emission is effectively controlled

2.1 Detail Components and Feature of the Advance biodiesel CCHP :

- 100% biodiesel engine generator that could operate on EN14214 grade with heat recovery features.
- Comply latest EU Stage V emission standard with Selective Catalytic Reduction (SCR) emission after treatment system and urea injection.
- Variable Speed engine operate from 600 to 2100 rpm
- Recover the waste heat in hot water form to feed Adsorption Chiller
- Proposed Power: 800kW electricity + 400kW free cooling
- Upgraded Inverter grid connection system
- Clean flue gas that could feed into a GREEN HOUSE to assist plants growing with CO₂ detection system.

3.0 How to accommodate the system in a high rise building:

The space require for the followings system are as follows:

One 800kW biodiesel CHP unit c/w 2 engines (Indoor or Outdoor)

Length: 4500mm

Width: 4000mm

Height: 2400mm

Dimension of one waste heat adsorption chiller that serve the system:

Length: 4900mm

Width: 2100mm

Height: 2400mm

Space allocation will also need for the above ground biodiesel storage tank to be retrofitted.