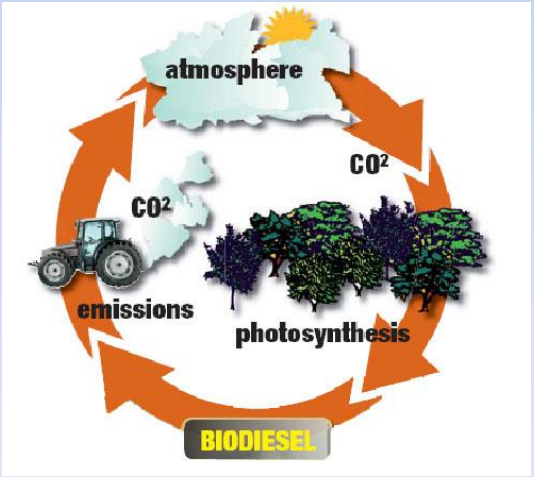
“100% Biodiesel (EU Stage V) Combine Cooling, Heat and Power (CCHP) Plant” for Existing Buildings

Difficult to generate renewable power in High Rise Buildings

- *Lack of roof area to place enough solar PV panel*
- *Typhoon in summer that might not suit all wind turbines*
- *Global legislations towards net zero carbon*
- *Require high energy density renewable solution*
- *Requirement for Super Low NOx emission even for Net Zero Carbon distributed power plant.*
- *Grid connection requirements.*
- *High efficiency shall be achieved to mitigate cost of renewable fuel.*
- *Shall prepared for carbon tax in the future.*

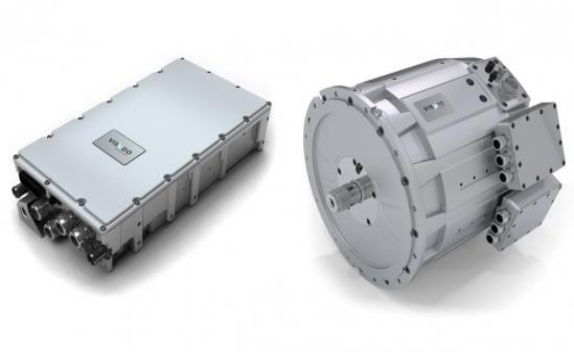
Why 100% biodiesel has close to net zero carbon emission

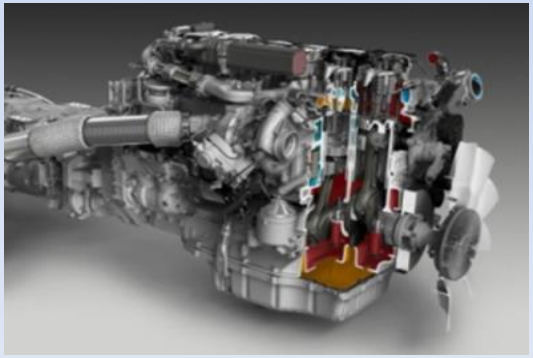
- Biodiesel is fatty acid with similar properties with diesel and could operate in special diesel engine with much less emission.
- Local biodiesel is manufactured from waste cooking oil of restaurants with methanol.
- Carbon in waste cooking oil come from animal fat and from plants ; carbon in plants come from the atmosphere due to photosynthesis.
- If carbon is captured; will becomes a carbon negative cycle.



OUR SOLUTION IS: "100% Biodiesel, EU Stage V, Combine Cooling, Heat and Power (CCHP) Plant"

- *Completed with 100% biodiesel engine generator that*
- *Comply latest EU Stage V emission standard with Selective Catalytic Reduction (SCR) emission after treatment system.*
- *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*
- *Urea injection that generate clean flue gas that could feed into a GREEN HOUSE to assist plants growing*





System Schematic with Options

CHIMNEY RECUPERATOR

#1. HIGH TEMP
SOLAR COLLECTORS

HIGH TEMP.
WATER

WASTE HEAT SILCA GEL
ADSORPTION CHILLER

COOLING
TOWER

CHILLED WATER
FOR AIR-COND

340 deg C FLUE GAS

HOT WATER
LOOP

ELECTRICAL
POWER

BIO-DIESEL GENERATOR

BIODIESEL
INPUT

DRY AIR

FRESH AIR
INTAKE

#2. WASTE HEAT
DESICCANT DRYER

FRESH WATER

SEA/SALT WATER

#3. WASTE HEAT WATER
DESALISALTNATOR

ELECTRICAL
POWER
FOR CHILLER

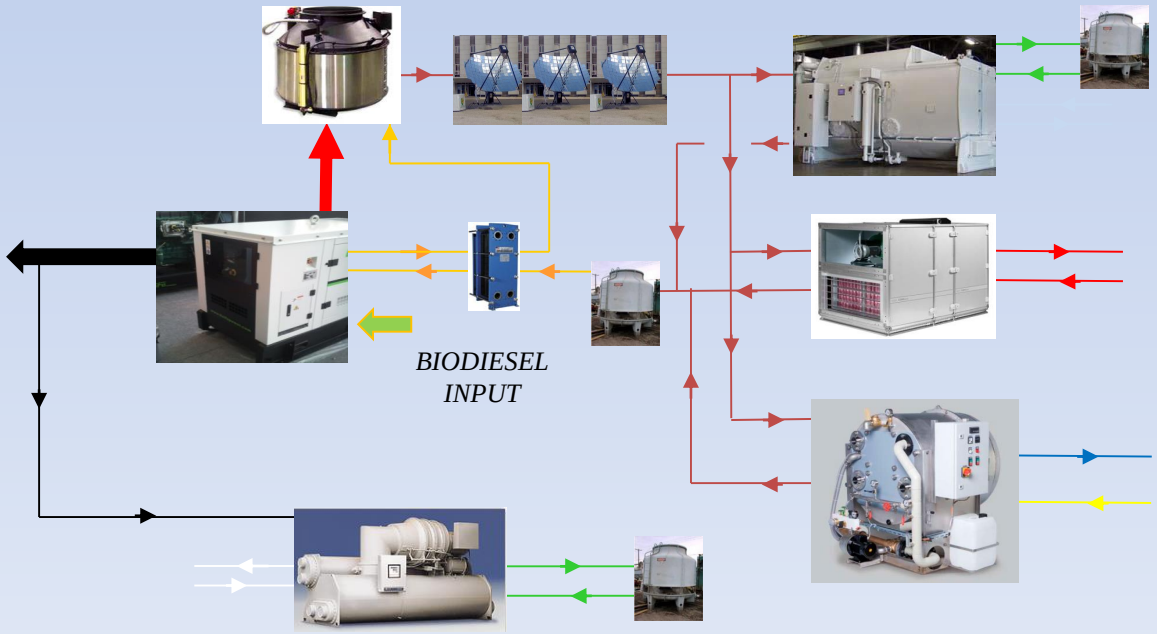
CHILLED WATER

WATER COOL CHILLER

COOLING
TOWER

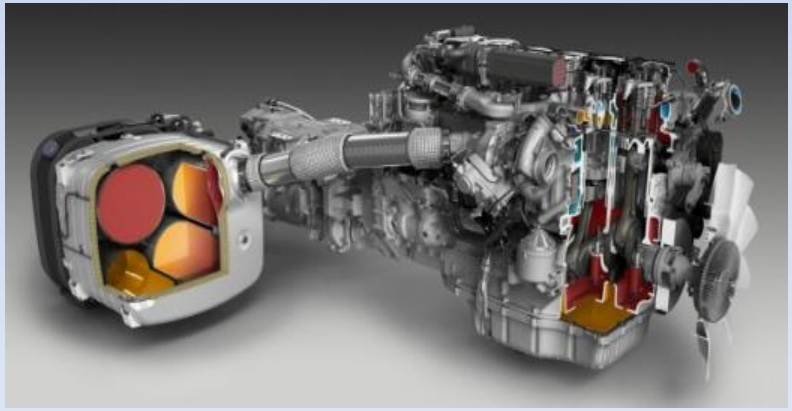
Various Configurations

- *100% biodiesel combine heat and power unit*
- *Waste heat adsorption chiller*
- *Heat pipe solar assist cooling*
- *Optional waste heat dehumification system*
- *and waste heat powered water desalination purification system*



Advanced 100% biodiesel combine heat and power unit

- *Operate on 100% biodiesel EN14214 standard.*
- *Comply latest EU Stage V emission standard with Selective Catalytic Reduction (SCR) emission after treatment system.*
- *Variable Speed engine operate from 600 to 2100 rpm*
- *Recover the waste heat from jacket water and flue gas to feed Adsorption Chiller*
- *Proposed Power : 800kW electricity + 400kW free cooling*
- *Upgraded Inverter grid connection system*



Waste Heat Power Adsorption Chiller

- *The chiller system is waste heat driven Silica Gel Adsorption Chiller*
- *High temperature solar panel could be installed to form a solar assist cooling system.*
- *Electrical consumption < 2kW, cooling power up to 400kW*
- *Driving temperature is the lowest amount different technologies at 70 deg C*
  - *Water as refringent (non toxic, 0 = ODP, 0 = GWP)*
  - *non-crystallise*
  - *long life*





System Advantages

- ***Operate on practical and safe 100% Biodiesel***
- ***Reduce carbon emission between 90%****
- ***Reduce NOx emission by up to 98% *****
- ***Thermal efficiency approach 85-90%***
- ***Reduce fuel consumption by 20-30% due to Variable Speed, especially in partial load.***
- ***100% power increase compare with last generation biodiesel engine.***
- ***Utilize clean flue gas for green house to assist plants growing.***

* Depends on fuel source

** Compare with normal direct emit standby generator

OPEX Estimation

Green carbon dioxide to feed Green House

Clean Flue gas feed into Green house to assist plants growing

Generate free cooling

100% Biodiesel cost $9/L

EU Stage V Emission

Cost of zero carbon electricity $2.16/kWh

Due to variable speed 20-30% saving on fuel

Reduce carbon emission by 93%

Reduce NOx emission by 95%

EUI REDUCTION PERFORMANCE

- *Base on GFA of 46,568 sqm*
- *Assume annual power need of 3,366,866kWh*
- *Generate 3,307,500kWh of zero carbon power*
  - *System of 800kW biodiesel electricity and 400kW of free cooling*
- *Reduce EUI by 71.03kWh/sqm/year*
- *Resulting building EUI = 1.27kWh/sqm/year*
- *Reduce carbon emission by 2348 ton annually*

Thank You !