

# CARBOFEX OY - SUSTAINABLE INDUSTRIAL PRODUCTION OF BIOCHAR

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WASTE TO VALUABLES

24.11.2017

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# CARBOFEX OY - THE MAKER OF CARBON INC - EST. 2016

- ▶ CEO Sampo Tukiainen, carbonisation and biorefining since 1995
- ▶ Carbonizer technology developed in 2007, supporting technologies 2003-2007
- ▶ Carbofex was established primarily as a biochar manufacturer
- ▶ At a later stage will offer biochar production technology and act as a distributor for biochar produced by partners

# CARBONISER

- ▶ In French to carbonise
- ▶ In english a machine used to produce carbon
- ▶ Carbonisation = dry distillation = slow pyrolysis
- ▶ Torrdestillation ellär pyrolysis på Svenska



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# BIOCHAR PRODUCTION WITH THE CARBONIZER

- ▶ Is made by processing biomass at 600-700 C in an air free environment
- ▶ Char is the quenched / “fractured “, activated, neutralised and fertilised
- ▶ By-products are gas and oil - oil can be separated and stored for later use
- ▶ Possibility to optimise the form and timing of energy sold to the highest rate

# BIOCHAR APPLICATIONS

- ▶ Carbon insulation materials, especially vacuum insulation, graphene and diamonds
- ▶ Growing media for greenhouses, nurseries, orchards
- ▶ Replacing perlite, peat and rockwool
- ▶ Amending peat and coco coir
- ▶ Cascade use, re-used 2-6 times i.e. 1. cow feed- methane reduction, 2. bedding-ammonia loss reduction, 3. composting aid->4 topsoil amendment

# BIOCHAR APPLICATIONS

- ▶ Looking to substitute energy intensive products with carbon negative (energy positive) products,
- ▶ Also looking to find ways to fix carbon from the short rotation in a quantifiable and certifiable way
- ▶ 1 ton of biochar carries an equivalent amount carbon as 3.5 tons of CO<sub>2</sub>
- ▶ Co-generated energy will reduce the use of fossil fuels in the city heating system

# INTEGRATED THERMAL GENERATION

- ▶ The Carboniser can co-generate
  - ▶ Heat or steam
  - ▶ Bio-oil, wood vinegar (currently not recovered)
  - ▶ Clean CO<sub>2</sub> and pyrolysis gas
- ▶ Flue gas is ultra clean, good for greenhouse applications
- ▶ NO<sub>x</sub> emission comparable to low-NO<sub>x</sub> lpg combustion (50 ppm), CO below 1 ppm (normally not detectable)
- ▶ Particle emissions >1 mg m<sup>3</sup>)



# INTEGRATED THERMAL CONTINUED

- ▶ Annual theoretical production
- ▶ 600 tons of oil -> 5000 MWh (practical (350 tons))
- ▶ 700 tons of biochar - 6000-7000 m<sup>3</sup>
- ▶ Additionally ca. 2000 MWh excess gas and heat
- ▶ Woodchip input 14.000 m<sup>3</sup> per annum

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# INTEGRATED THERMAL CONTINUED

- ▶ Carboniser can be integrated for production of process or district heat
- ▶ Ag residues with low ash sintering temperature also suitable in a pelletised form
- ▶ With manure feedstocks the control of NO<sub>x</sub> is easy and the EU waste incineration directive is fulfilled in terms of temperature and residence time (but manure is not a preferred feedstock)

# INTEGRATED THERMAL CONTINUED

- ▶ Pyrolysis oil can be separated and stored for later use
- ▶ Thermal output can be minimised when there is no heat load
- ▶ The bio-oil is easy to draw from a tank for peak and auxiliary use, during highest energy demand.

# INTEGRATED THERMAL CONTINUED

- ▶ Nominal thermal capacity approx. 1 MW of which 250 kW is used for process and drying of the chips
- ▶ When oil is separated, thermal output is reduced to 100 kW
- ▶ Bio-oil burner and tube boiler can be fired up in seconds if necessary to produce 2 MW of additional capacity

The infographic features a central illustration of a green plant with three leaves growing from a dark grey biochar chip. To the left, a large green arrow points right, containing the text '100% WOODCHIP'. To the right, a grey arrow points right, containing '50% BIOCHAR'. Below this, a stack of three colored arrows (dark grey, blue, and purple) points right, representing '25% PYROLYSIS OIL', '20% PYROLYSIS GAS', and '5% VOLATILES' respectively. A red arrow on the far right points right, labeled '1 MW HEAT'.

**100%**  
**WOODCHIP**

**50%**  
**BIOCHAR**

25% PYROLYSIS OIL

20% PYROLYSIS GAS

5% VOLATILES

1 MW HEAT

THANK YOU

WWW.CARB

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