### Annex 3

# CHP small-scale CHP Unit examples build for charcoal production October 2018

The following examples are especially designed and build CHP plants for the by product charcoal. Syncraft and Xylowatt are so far the only known companies which are promoting this type of by product concept.

## Implemented CHP units in operation

### **Syncraft Austria**

http://www.syncraft.at/index.php/en/



Hauptkategorie: Referenzen | in Referenzen Holzgaskraftwerk

#### SYNCRAFT®Werk CW1200-400 / Stadl / AT

Erolfgreiche Inbetriebnahme des SYNCRAFT®Werk 1200-400 in Stadl Anfang November 2016.

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Hauptkategorie: Referenzen | in Referenzen Holzgaskraftwerk

#### SYNCRAFT®Werk CW1000-300 / Innsbruck / AT

Das turboaufgeladene BHKW mit 8 Zylindern und 16,7 Liter Hubraum hat bereits in der ersten Woche nach Inbetriebnahme im November 2016 eine elektrische Leistung von 300kW erreicht.

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Hauptkategorie: Referenzen | in Referenzen Holzgaskraftwerk

#### SYNCRAFT®Werk / Dornbirn / AT

SYNCRAFT  $^{6}$ Werk in Dornbirn wurde 2014 mit einer Bauzeit von nur  $^{3}$  Monaten errichtet und ging Ende 2014 erfolgreich ans Netz.

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http://www.syncraft.at/index.php/de/referenzen-menu/referenzen-holzgaskraftwerk-menu

By product is charcoal for soil improvement grill char and animal food etc. see also Annex 2 for specification of charcoal.

#### **Xylowatt**

http://www.xylowatt.com



# **Biochar valorization**

Production of high quality char in Xylowatt's NOTAR® technology

Thibaut André<sup>1</sup>, Shiyanand Wasan<sup>1</sup>, Michaël Haube<sup>1</sup>

<sup>1</sup>Xylowatt SA, Product dev. Department, Centre Monnet, Avenue Jean Monnet 1; 1348 Louvain la Neuve; Belgium

#### Introduction

The NOTAR® Gasifier is an industrial multi-stage downdraft Gasifier that produces a Tar Free syngas. The technology developed by Xylowatt since 2007 has as a consequence that the char produced is a very high quality product as it's also tar free.

As long as the carbon conversion is not complete, every gasifier will produce char. This byproduct, mainly composed of carbon can have various uses in several context. To promote this potential market, Xylowatt led a test campaign in order to highlight the process parameters impacting the char's quality and amount and to define optimized set-up regarding to several char's characteristics.

#### **Experimental Setup**

Tests were performed on a proto-scaled 1MWh gasifier referred as Industrial Test Platform. The selected process parameters for variation were the **pyrolysis temperatu** and the **residence time** of solid material in the gasifier.

Each recorded set point consists in a full mass and energy balance and sampling of every by-products. Each parameter changes were followed by 12 to 24 hours of stabilization to ensure the recording of steady states.

Samples were analyzed by external and independent laboratories about the following parameters (standard methods): LHV/HHV (NEN-EN-ISO 18125), ultimate analysis (NEN-EN-ISO 16948 and 16994), iodine number (ASTM D4607), BET specific surface (ISO 9277), PAH content.

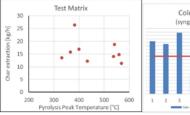
Char extracted from the gasifier and fly ashes were analyzed separately to highlight potential variations that could impact the most exacting uses

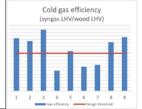


Char characterisation

Data presented here are an extract of the main observations that were done. We focused our analysis about 3 potential uses of the char which are:

- As activated carbon: requires a good activity (through EBT and iodine number);
- As combustible: requires a good LHV;
- · As soil amendment or animal food: requires low pollutant content. Nine set points were tested with different pyrolysis temperature and/or residence time.





The following table shows the results for the main characteristics of char.

Set point	Unit	1	2	3	4	5	6	7	8	9
LHV	MJ/lig	25,8	24,7	24,3	27,4	28,2	27,9	28,1	29,7	29,8
lodine number	mg/kg	711	813	775	940	953	1003	775	1133	1140
PAH content	mg/kg	0,6	1,1	0,6	0,5	0,3	0,3	1,4	n.a.	na.
BET surface	m <sup>1</sup> /g	n.a.	n.a.	326	n.a.	546	n.a.	na.	n.a.	na.

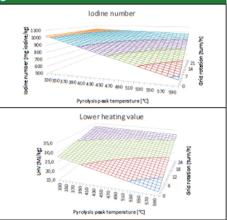
#### **Parameters correlations**

Models of extrapolated behavior have been computed to highlight to global trends in parameters correlation. The X and Y-axis are respectively the pyrolysis temperature and the char extraction (expressed in "turn/h" what is related to the extracting device). The Z-axis is the studied parameter.

lodine number is illustrated by the graph on the right. The greater impact on iodine number is caused by the variation of the pyrolysis temperature. We can suppose that the pyrolysis is completed in any case but increasing the temperature lead to consummation of carbon, and so of activated sites. This also explained the stronger impact of temperature when residence time is high (rotation = 0). The BET surface can't be compared because only 2 values are available.

The LHV of char follow the same correlation shape as the activity, meaning the maximal value is obtained for a minimal temperature and residence time. It's a logical behavior as the gasification reaction are using carbon, increasing the relative amount of mineral matter.

Not significant correlation was found about the PAH content but in every cases, the value is largely below the "premium blochar" threshold of 4 mg/kg as defined in the Biochar European Certification. The PAH content considered is the sum of the 16 EPA PAH.



The Walloon Region supports Xylowatt through a "technical support" convention



"Biomass gasification for CO2 emissions reduction and bio-waste recovery in energy-intensive industries.

### http://www.xylowatt.com/references/

# CHP operating on syngas

#### **BELGIUM** – Gedinne

### Demo NOTAR® plant connected on district heating

Location	Gedinne – Belgium	
Owner	Gedinne City	
Application	Combined Heat Power (MTU G12).	
Capacity	300kWe + 600kWth	
Technology	NOTAR v.1	
Feedstock	Woodchips	
Periode	2007-2011	

