

First Sugar™ - A cost efficient and de-risked route to 2G sugar



Introduction

BioGasol's FirstSugar™ concept enables the extraction of hemi-cellulosic sugar during the manufacture of fuel pellets, in particular wood pellets.

The manufacture of wood pellets is a well proven business, growing at a compound annual growth rate (CAGR) of about 20%, primarily driven by the conversion of coal fired power stations into renewable fuels plants in both Europe and increasingly the rest of the world.

Wood pellets can be transported efficiently over significant distances, stored for months without degradation, and handled in existing coal fired power stations with minimum plant conversion, making them well suited for the production of renewable fuels. However, standard wood pellets also lead to more ash and slag formation and lower calorific density compared to coal.

In the FirstSugar™ concept, the BioGasol proprietary Carbofrac® technology is introduced in the wood pellet plant to treat the wood and separate the soluble hemicellulose fraction from the insoluble cellulose & lignin fraction. This enables a non-enzymatic extraction of 2G hemi-cellulosic sugars – a new source for biochemicals, while the remaining insoluble fraction of the biomass is used for the continued production of higher quality wood pellets.

The Carbofrac® technology's hemi-cellulosic sugar yield exceeds 90%, ensuring the economic feasibility of the FirstSugar™ concept.

Advantages of FirstSugar™ include:

- Low cost/large volume sugar platform for biochemicals
- Reduced risk from costly and unproven enzyme technology otherwise applied for 2G sugars production
- De-sensitized sugar cost structure compared to the typical price volatility of the industrial sugar
- Wood pellets with higher calorific density
- Wood pellets with less ash and slag formers
- Stronger and more weather resistant wood pellets

Process configuration

The FirstSugar™ concept can be applied either at a greenfield site, or as a bolt-on plant expansion at an existing wood pellet facility.

The fastest and easiest implementation of FirstSugar™ is as an add-on to an existing facility (retrofit). This configuration does not provide the full range of advantages, but the risk is reduced and a demonstration facility will be profitable even at modest plant size. The greenfield installation results in the best integration, resulting in more competitive overall CAPEX and OPEX. See both configurations compared side by side overleaf.

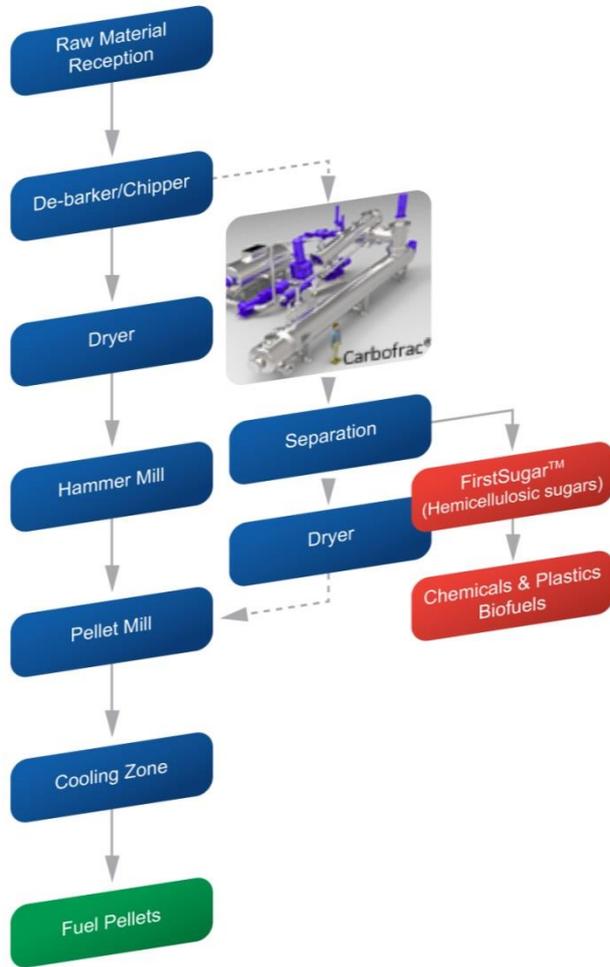
With the retrofit configuration, the additional throughput is typically modest (less than 20% by weight) compared to the original wood pellet capacity, and key functionalities of the wood pellet plant will be unaffected.

The typical performance for an add-on FirstSugar™ unit based on a BioGasol CarboFrac® 400 is listed in the table overleaf.

Note: performance figures are significantly better for a higher throughput CarboFrac® 1200 add-on, or in the case of a greenfield installation.

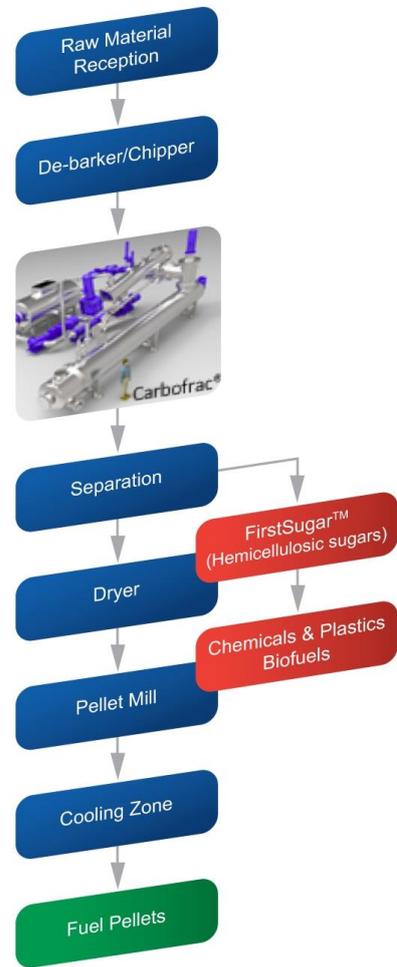
FirstSugar™ Add-on

Side stream installation/retrofit for existing fuel pellet production



FirstSugar™ Greenfield

Greenfield installation for new fuel pellet production



Typical performance figures for a FirstSugar™ add-on unit

OPEX based on add-on of a Carbofrac™ 400:	Ton dry/hr	EUR/ton	Mill EUR/yr
Extra woody biomass consumed	4,0	40	-1.3
Utilities consumed	-	-	-1.9
Operation & maintenance	-	-	-0.3
Hemi-cellulosic sugar produced	0,9	330	2.3
Extra wood pellets produced	3,0	143	3.3
Net OPEX	-	-	2.2

Total installed cost	6.3 mill EUR
Payback time	2.2 years
ROI (10 years)	232%