

## Task 44 Flexible Bioenergy and System Integration: Best Practices

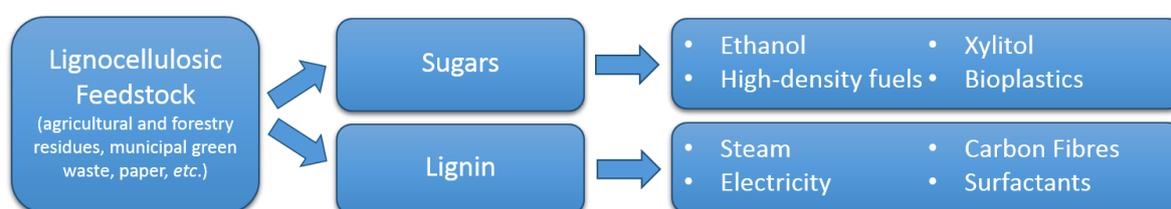
### *The Ethtec Lignocellulosic Bioethanol Pilot Plant*

May 2021

Muswellbrook, Australia

#### THE ETHTEC LIGNOCELLULOSIC BIOETHANOL PILOT PLANT

Production initially of sugars and lignin from lignocellulosic feedstocks, then flexible use of the sugars for production of ethanol, other liquid biofuels, food additives, bioplastics precursors and other biochemicals. Biofuels are flexibly used for transport, agriculture, forestry, mining and electricity generation. Lignin is used for electricity generation and production of biochemicals.



Base information	
Link for more information	<a href="http://www.ethtec.com.au">www.ethtec.com.au</a>
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Location	Muswellbrook, Australia
Owner/Operator	Ethanol Technologies Pty Limited
Technology supplier	Multiple international suppliers
Construction year	2021-2024
Status	Pilot
Feedstock	Wide range of lignocellulosic materials including agricultural and forestry residues
Products	Lignocellulosic sugars, lignin, ethanol, xylitol, lactic acid
Size	Feedstock feed rate up to 80 kg/hr
Type of flexibility provided	Process is insensitive to the type of lignocellulosic feedstock enabling flexible use of mixed feedstocks. Flexible co-production of biofuels and biochemicals. Flexible electricity co-generation output.
Flexibility characteristics	
Minimum load	n.a.
Load change rate	n.a.

Start-up time	Continuous operation
Investment cost of the plant	>AUD\$30M (USD\$23.2M) 2019

### Technical and Commercial Details

Around 70% of plant fibre is comprised of structural “lignocellulosic” sugars. Micro-organisms can convert these sugars to:

- biofuels (e.g., “second generation” or “cellulosic” ethanol; higher density biofuels)
- platform chemicals (e.g., ethanol, lactic acid, succinic acid) for the production of bioplastics and other renewable chemicals
- pharmaceuticals

The IEA has identified more than 90 chemicals that can be produced from lignocellulosic sugars.

In a scalable pilot plant project, Ethanol Technologies Pty Limited (Ethtec), in partnership with the Australian Renewable Energy Agency (ARENA), the New South Wales State Government, the University of Newcastle and Muswellbrook Shire Council, is developing and commercialising a new technology environmentally sustainable process (the Ethtec Process) for the production of ethanol from the structural sugars component of lignocellulosic materials.

The Ethtec Process Pilot Plant is not intended to be a commercial cellulosic ethanol production plant. Rather, it is a bankable demonstration facility and centre for research and development to aid in the roll-out of cellulosic ethanol production at commercial scale.

The Ethtec Process is being developed based on detailed economic modelling of the sensitivity of the internal rate of return (IRR) of an Ethtec Process Plant to a wide range of variable factors including feedstock cost, capex, opex, ethanol selling price and the value of a flexible range of co-products, including electricity.

A key objective of the project is to enable the production of ethanol in volumes that are significant in the context of meeting liquid fuel demand, at a price without subsidy that is competitive with the price of petroleum fuels derived from crude oil, after having paid a reasonable price for the lignocellulosic feedstock.

Ethtec is engineering flexibility into the Process by initially also enabling the co-production of xylitol with ethanol or, alternatively, the production of lactic acid. This provides an economic buffer against low energy prices.

### Market Opportunities

There are a number of market opportunities for the Ethtec process. Bioethanol is a flexible energy source capable of being transported and stored for on-demand energy use for transport and stationary power generation. Bioethanol is also a starting material for alternative jet fuel. In addition, the Ethtec process has co-products, which offer additional revenue opportunities and also provide a feedstock for energy generation from the lignin.

### Lessons to Industry

Ethtec is highlighting the value-adding opportunities for owners of lignocellulosic materials, development opportunities for regional and rural communities and the unsubsidised cost-competitiveness of the ethanol produced as key elements of the cellulosic ethanol commercialisation programme.

In Australia there are technical and market challenges for the commercialisation of lignocellulosic ethanol. Ethtec has overcome technical challenges by developing novel approaches for the separation of lignin from the cellulose as well as for ethanol recovery. The market challenges for

bioethanol are withstanding in Australia however the production of co-products enables the business to incorporate alternative revenue streams.

An ethanol fuel industry based on production from lignocellulosic materials is unique in that no other alternative fuel industry results in substantial reductions in greenhouse gas emissions from the transport and industrial sectors while simultaneously providing solutions to rural unemployment and land degradation through enhancing the economics of crop and forest production.

When production and use of the most practical and potentially economically viable alternative fuels are compared, value enhancement of existing biomass resources, re-forestation and synergistic treatment of land degradation are important wider benefits uniquely associated with ethanol produced from lignocellulosic materials.

### **The Ethtec Lignocellulosic Bioethanol Pilot Plant in Muswellbrook, Australia**







## Process flow chart

