Sustainable Fuels from Waste Residues

PEP Report 278C

Girish Ballal, **Director, Process Economics Program**

Table of contents

Tables

Figures

Appendix C Figures

Glossary

atm	atmospheres
ASTM	ASTM International (formerly known as the American Society for Testing and Materials)
ATJ	alcohol-to-jet
BFD	block flow diagram
BLI	battery limits investment
Btu	British thermal units
CO	carbon monoxide
cP	centipoise
CW	cooling water
DCS	distributed control system
FOG	fats, oils and greases
ft	feet
ft^3	cubic feet
FT	Fischer-Tropsch (synthesis)
g	grams
GHG	greenhouse gas
GTL	gas-to-liquid
h	hour
HVO	hydroprocessed vegetable oil (renewable diesel)
kg	kilograms
kJ	kilojoules
kPa	kilopascals
kWh	kilowatt-hour
L	liters
lb	pounds
m	meters
MDEA	methyldiethanolamine
MGal	thousand gallons
Mlb	thousand pounds
mm	millimeters
MMBtu	million British thermal unit
MMt/y	million metric tons per year
mol	moles
mol%	molar percent
mol wt	molecular/molecule
MPa	megapascals
NNF	normally no flow
PEP	Process Economics Program
PFD	process flow diagram
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PSA	pressure swing adsorption
ROI	return on investment
s	second(s)
SAF	sustainable aviation fuel (biojet fuel)
scf	standard cubic feet
scm	standard cubic meter
t/y	metric tons per year
TFC	total fixed capital
vol%	volume percent
w/w	weight for weight
wt%	weight percent
y	year

Abstract

In support of abatement of environmental carbon emissions, several countries have set zero carbon goals with target dates ranging from 2050 to 2070. There is a concerted effort to reduce these emissions in a timely manner via ambitious decarbonization goals in industrial and transportation sectors. Due to ever-growing consumption, modern societies are generating increasing waste products in municipal, agricultural and forestry sectors. The use of such waste products for biofuels production combines the dual sustainability objectives of fuels production and waste disposal. There is also an impetus for reducing the carbon emissions in a broader sense starting with the feedstock, the so-called life-cycle carbon emissions. The use of waste residues for fuel productions can significantly reduce life-cycle carbon emissions producing very low carbon intensity fuels. When combined with sequestration, these processes can produce deeply carbon-negative fuels, resulting in net carbon capture from atmosphere.

Air transport is one of the sizable components of carbon emissions to the environment. Commercial aviation is responsible for about 2%-3% of global greenhouse gas (GHG) emissions. US airlines have set a goal to reduce CO_2 emissions by 50% in 2050 compared with 2005 levels. Other popular decarbonization strategies such as electric batteries, while popular for road transport, are considered to be infeasible for aviation due to weight limitations, especially for commercial long-haul flights. Consequently, bio-based sustainable aviation fuels (SAFs) are the only viable option, at least in the near future. This report presents the techno-economic analysis of three industrial processes to produce aviation fuels from bio-derived waste resources. These processes are:

- SAF production from waste residues via FT-SPK pathway (Fulcrum Sierra Fuels)
- SAF production from waste residues via FT-SPK pathway (Velocys Bayou Fuels)
- SAF production from waste residues via IH2-CPK route (GTI/Shell)

The technological and economic assessment of the processes is Process Economics Program's (PEP's) independent interpretation of the companies' commercial processes based on information presented in open literature, such as patents or technical articles, and may not reflect in whole or in part the actual plant configuration. We do believe that they are sufficiently representative of the processes and process economics within the range of accuracy necessary for economic evaluations of the conceptual process design.

Contacts

Girish Ballal

Director, Process Economics Program
girish.ballal@spglobal.com

Richard Charlesworth

Executive Director, Process Economics Program
richard.charlesworth@spglobal.com

CONTACTS

Europe, Middle East, Africa: +44 (0) 203 367 0681
Americas: +1 800 332 6077
Asia-Pacific: +60 4 296 1125

www.spglobal.com/commodityinsights/en
www.spglobal.com/en/enterprise/about/contact-us.html