Success Stories of Advanced Biofuels for Transport

THE DBT-ICT 2G-ETHANOL TECHNOLOGY

Year of plant start-up:	March 2016
Location:	Kashipur, Uttrakhand, India
Technology:	DBT-ICT 2G Ethanol Technology is a feedstock agnostic process which uses a two-step fractionation of biomass into separate streams of glucose, xylose and lignin. Glucose and xylose are co-fermented to ethanol and lignin can be burnt into boiler for steam/power generation. The technology is Zero-Liquid Discharge where >95% of water is recycled.
Plant capacity:	10 tons biomass per day for production of 3000 L ethanol
Operational experience achieved:	Continuous flow plant operated up to 7 days non-stop with feedstocks including bagasse, rice straw, cotton stalk and wheat straw, with alcohol yield in the range of 240-300 L/ton biomass. A total of 5000 hours of operating.
Total Capital Expenditure:	USD 6 million
Principle feedstocks:	DBT-ICT Technology is feedstock agnostic. However, as per the biomass availability survey in Bathinda region, Rice Straw and Cotton Stalk will be used as raw material in Bathinda plant.
Feedstock Capacity:	450 tons biomass processing per day
Products/markets:	Technology capable of producing ethanol, silica (with rice straw), inorganic mineral fertilizer, and, food-grade Carbon Dioxide
Technology Readiness Level (TRL):	TRL 8 – system complete and qualified Front End Engineering done for 450 ton/day rice straw plant being erected at Bathinda, Punjab, India. Unit to start operating in Jan 2020.

DESCRIPTION

The DBT-ICT 2G-Ethanol Technology has been validated and demonstrated at a scale of 10 ton biomass/day at India Glycols Ltd. site at Kashipur, Uttrakhand, India. The technology and plant design are feedstock flexible i.e. any biomass feedstock from hard wood chips and cotton stalk to soft bagasse and rice straw can be processed. The technology employs continuous processing from biomass size reduction to fermentation; and converts biomass feed to alcohol within 24 hours compared to other technologies that take anywhere from 3 to 5 days. The plant design with a low footprint also has unique features such as advanced reactor design and separation technologies with slurry-flow rapid reaction regime operations.

Achievements: The technology has several novel features and achievements that marks it apart from other globally promoted technologies.

- Two-Step alkali soda-nitric acid fractionation
- Slurry flow systems with recycle and reuse of water, alkali and acid
- Feedstock agnostic technology i.e. any biomass feedstock from hard wood chips and cotton stalk to soft bagasse and rice straw can be processed
- Lowest enzyme dosage on account of enzyme reuse over weeks
- No fancy metallurgy and hence low capital expenditure
- Low cost of production with recycling of enzymes, chemicals and water.
- Low consumption of power and water
- Demonstration plant ran smooth from the first run without any problems related to solid handling and other issues that plague other technologies

Challenges addressed: Scalable technology to a wide range from 100 ton biomass/day to 500 ton/day the technology can find decentralized deployment in Indian agricultural heartland not only providing biofuel options for India but positively impacting farm revenues for farmers, creation of jobs, net reduction in import of crude oil, and reductions in carbon emissions thereby fuelling India's green economic growth engine.

Based on the data generated at the 10 TPD plant, basic and detained engineering has been carried out for a 450 ton/day rice straw processing plant to produce 100 KL/day fuel grade ethanol. This plant shall come up and start operations in Jan 2020.

The 10 ton biomass/day Lignocellulosic ethanol plant at India Glycols Ltd., site at Kashipur, Uttrakhand, India built with the DBT-ICT 2G-Ethanol Technology

Stakeholders involved:

1. India Glycols Ltd. (technology user)
2. L&T Hydrocarbon Engineering (engineering partner for building commercial scale plants)
3. Hindustan Petroleum Corporation Ltd. (technology user building 100KL ethanol/day plant to start operation Jan 2020)

Respective sites:

1. Kashipur, Uttrakhand, India
2. Mumbai, India
3. Bathinda, Punjab, India

Respective Financing:

1. Self + Ministry of S&T
2. Self
3. Self + Federal VGF

Respective Project Developers:

1. Vidyan Biocommerce Pvt Ltd, Mumbai, India
2. L&T Hydrocarbon Engineering, Mumbai, India
3. Technip FMC, Delhi, India

Financing Support:

The 10 ton/day demonstration plant received 50% soft loan from BIRAC, a venture funding enterprise under Department of Biotechnology of Government of India.

According to the National Biofuel Policy 2018, the Government of India has targeted ethanol blending of 10% by 2020. To achieve this target and to reduce the dependency on fossil fuels, several OMC are putting up ethanol biorefinery plants in India. At the present a VGF of 40% of capital cost with a cap of 20 million USD has been offered to new cellulosic ethanol plants. A marked-up price for 2G-Ethanol is on the anvil.

Gasoline blending companies have been obligated to buy whatever ethanol industry can offer at regulated price (marked up for 2G-Ethanol).

Contribution to Sustainable Development Goals:

The availability of agri-residues in India is approximately 250-300 million tons. The Government of India, through the National Biofuel Policy 2018 has set a mandate to blend ethanol in gasoline at more than 10%, depending on the ability to produce ethanol from the surplus agricultural biomass/residues.

Use of these surplus agricultural residues and other renewable sources of energy can lead to partial or full replacement of petro-derived fuels with renewable fuels ensuring energy security for the country.

This technology when commercialized would lead to the following sustainable

development goals (SDG)

- Reduced emission of carbon,
- Conversion of renewable carbon to value-adds
- Net reduction in import of crude oil
- Revenue generation for farmers
- Prevention of wasteful and hazardous burning of agro-residues on farms

Contribution to GHG emission reduction in transports:

High GHG reduction potential by blending ethanol with gasoline.

Employment:

The 10 tpd/day plant employs 10 people.

The commercial plant shall employ approximately 500 people.

Set in rural background a lot many indirect jobs shall be created engaged in biomass collection, storage and transport.

Replicability and scale-up potential:

The 10 ton biomass/day plant was scaled up in one go from a 1 ton biomass/day plant. The scale up went without any hitch and the plant could be operated end-to-end from size reduction to fermentation (all continuous flow systems) in week 1.

The technology has now been scaled up to 450 on biomass/day plant and complete engineering has been carried out. Engineering companies are confident that the plant shall run without issues anywhere in the processes.

Success factors:

It is important to have support from government bodies for rapid translation of the developed technologies to pilot/demonstration scales and successful commercialization as well as replication of the developed technologies.

Constraints:

The major constraint for the technology is setting up the initial few plants which would involve high CAPEX. It is estimated that with the development and improvement in technologies the cost of subsequent plants/ biorefineries, would be reduced. With the DBT-ICT Technology the scale up or sale down are not technology challenges

Features of the DBT-ICT 2G-Ethanol/Sugars Technology

Info provided by: DBT-ICT Centre for Energy Biosciences, Institute of Chemical Technology, Mumbai, India

More information: www.ictmumbai.edu.in

The ART Fuels Forum brings together 100 experts and leaders representing the alternative transportation fuels Industry to facilitate discussions, elaborate common positions on policy issues and identify market penetration opportunities and barriers for these fuels. The Forum is established and financed by the European Commission under the project name "Support for alternative and renewable liquid and gaseous fuels forum (policy and market issues)".

www.artfuelsforum.eu

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