# *Success Stories of Advanced Biofuels for Transport*

## 2G ETHANOL TECHNOLOGY DEVELOPMENT

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| **Year of plant start-up:** | 2012 |
| **Location:** | Indian Oil R&D Centre, Faridabad, India |
| **Technology:** | 2G Ethanol technology from Agricultural wastes |
| **Plant capacity** | 250 kg/day |
| **Operational experience achieved** | 6 years |
| **Total Capital Expenditure** | 1.5 Million US dollars |
| **Principle feedstocks:** | Agricultural residues like Rice straw, Wheat straw, Bagasse |
| **Feedstock Capacity** | 10-12 kg/hr biomass |
| **Products/markets:** | Ethanol |
| **Technology Readiness Level (TRL):** | **TRL 7** – system prototype demonstration in operational environment |

### DESCRIPTION

Department of Biotechnology, Ministry of Science and Technology, New Delhi and the Research and Development Centre, Indian Oil Corporation Limited, Sector-13, Faridabad, Haryana established Bioenergy Research Centre (DBT-IOC Centre) for the development of 2G ethanol and other value added chemicals. For this purpose a pool worth Rupees 53 Crores[1] was created with the contribution of 51% by DBT and 49% by IOC. The centre started functioning from May 2012. Besides this, the centre roped in various institutes like NREL, USA and the Lund University, Sweden to develop 2G-Ethanol technology as both of these organisations are pioneer across the world in this area.

A group of researchers started working in the laboratory with almost no prior experience in this area. Within a year, with the help of NREL, USA a pilot plant having processing capacity of 250 kilograms per Day was commissioned indigenously. Thereafter, by exploiting this pilot plant facility, a large amount of database was generated using various catalysts and agricultural residues like rice straw, wheat straw, bagasse, etc. The data was related to all the steps involved in the process of biomass to ethanol, i.e. pretreatment, enzymatic hydrolysis and fermentation followed by distillation and purification of ethanol was generated.

[1] 1 Crore INR = 10,000,000 INR = 130 kEUR

All sorts of studies were conducted like carbon mass balance; component based mass balance, life cycle assessment and life cycle costing using this pilot plant in a span of about 4 years. Thereafter, the process flow diagram of technology was firmed up in order to scale it to 10 tons per day processing unit. Basic Design Engineering package (BDEP) of the technology was firmed up with the help of process design and engineering cell of IOC. Now, mode of execution of the project, necessary approvals and the allocation of the funds is being finalized.

Simultaneously, vendor development work is underway for the fabrication and integration of the plant. It is anticipated that this demo-scale plant of 10 tons biomass per day processing capacity will be functional by the end of 2019 at panipat. Once the technology is demonstrated at 10 ton per day unit, it will be ready for deployment in the country.

In the nutshell, the project was conceived and processes are being scaled up indigenously which itself explains a very successful and exemplary success story of the efforts made by the Department of Biotechnology, Ministry of Science and Technology, New Delhi and the Research and Development Centre, Indian Oil Corporation Limited, Faridabad, Haryana.


*Lignocelulosic Ethanol (2G) pilot plant facility at IndianOil R&D Centre, Faridabad*

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| **Stakeholders involved & financing:** | Indian Oil Corporation Limited<br>Department of Biotechnology, Government of India |
| **Contribution to Sustainable Development Goals:** | All sorts of studies were conducted like carbon mass balance; component-based mass balance and life cycle assessment. |

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| **Contribution to GHG emission reduction in transports:** | High GHG reduction potential by blending ethanol with gasoline |
| **Employment:** | The plant employs 10 engineers, chemists, biotechnologists, project assistant |
| **Replicability and scale-up potential:** | Demo plant on indigenous technology is coming by 2019. Commercial plant on this technology plants has been planned in future in India. |
| **Success factors:** | The project was conceived and processes are being scaled up indigenously which itself explains a very successful and exemplary success story of the efforts made by the Department of Biotechnology, Ministry of Science and Technology, New Delhi and the Research and Development Centre, Indian Oil Corporation Limited, Faridabad, Haryana |
| **Constraints:** | High CAPEX, highly efficient enzyme for lower OPEX |
| **Info provided by:** | Dr S K Puri, Chief General Manager, Indian Oil R&D Centre, Faridabad |
| **More information:** | www.iocl.com |