

WORLD'S FIRST REFINERY OFF GASES TO ETHANOL PRODUCTION AT INDIANOIL

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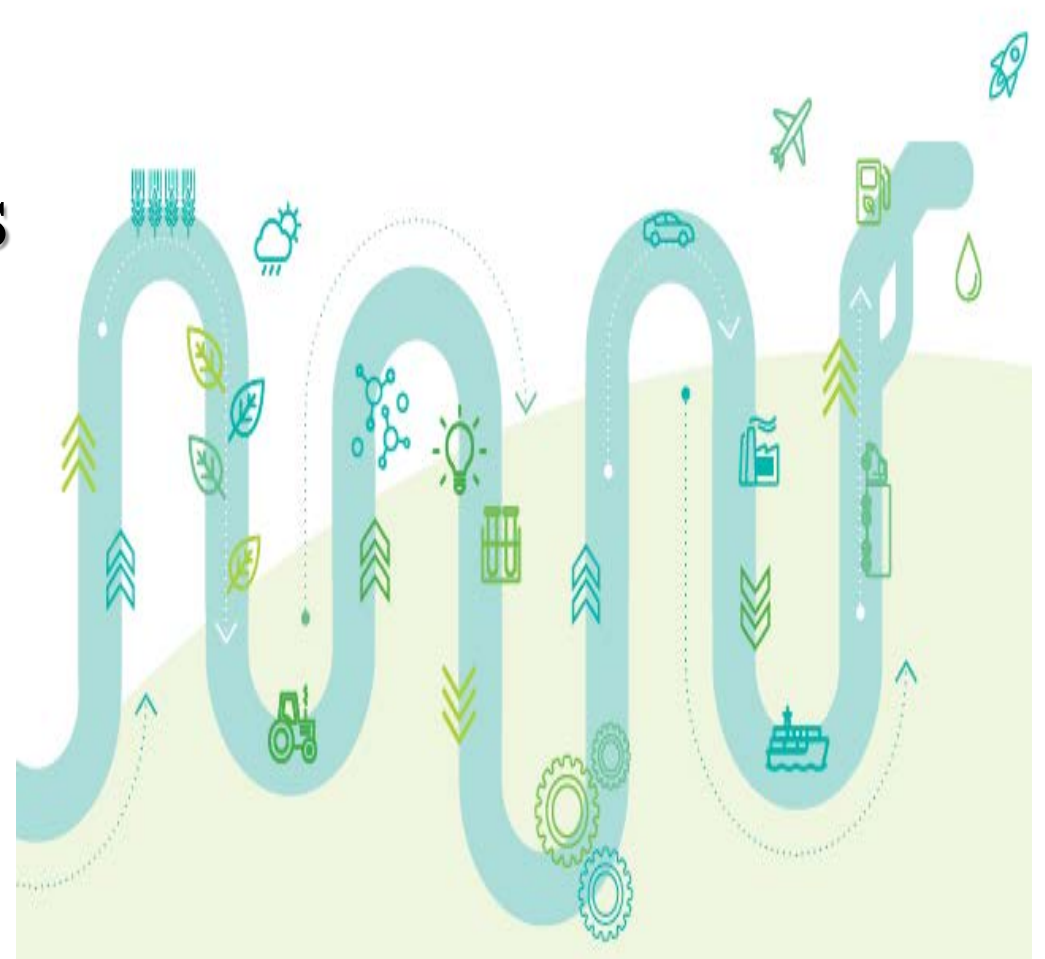
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**3rd EU-INDIA
Conference On
Advanced Biofuels**

**NEW DELHI
02-04 MARCH 2020**



- **INTRODUCTION**
- **TECHNOLOGY/ SOURCES OF OFFGASES**
- **TECHNOLOGY DUE DILLIGENCE**
- **PROJECT DETAILS**
- **EXPECTED BENEFITS**



ETHANOL BLENDING PROGRAMME (EBP)

- **National Policy on biofuels**
 - **Phase-wise implementation** ethanol blending Programme (EBP) in Gasoline in various states
 - **The objective** of the EBP programme under National Biofuel Policy is to encourage domestic production of ethanol.
 - **Policy-2008** - Directed the Oil Marketing Companies (OMCs) to sell 5% Ethanol Blended Petrol
 - **Policy-2018**- the government intends to raise ethanol blending in petrol to **10% by 2022 & 20% by 2030** to cut dependence on energy imports promote the use of environment-friendly fuel .

Current Blending achieved ~ **6.2 %** (due to low availability of Ethanol for meeting blending targets)



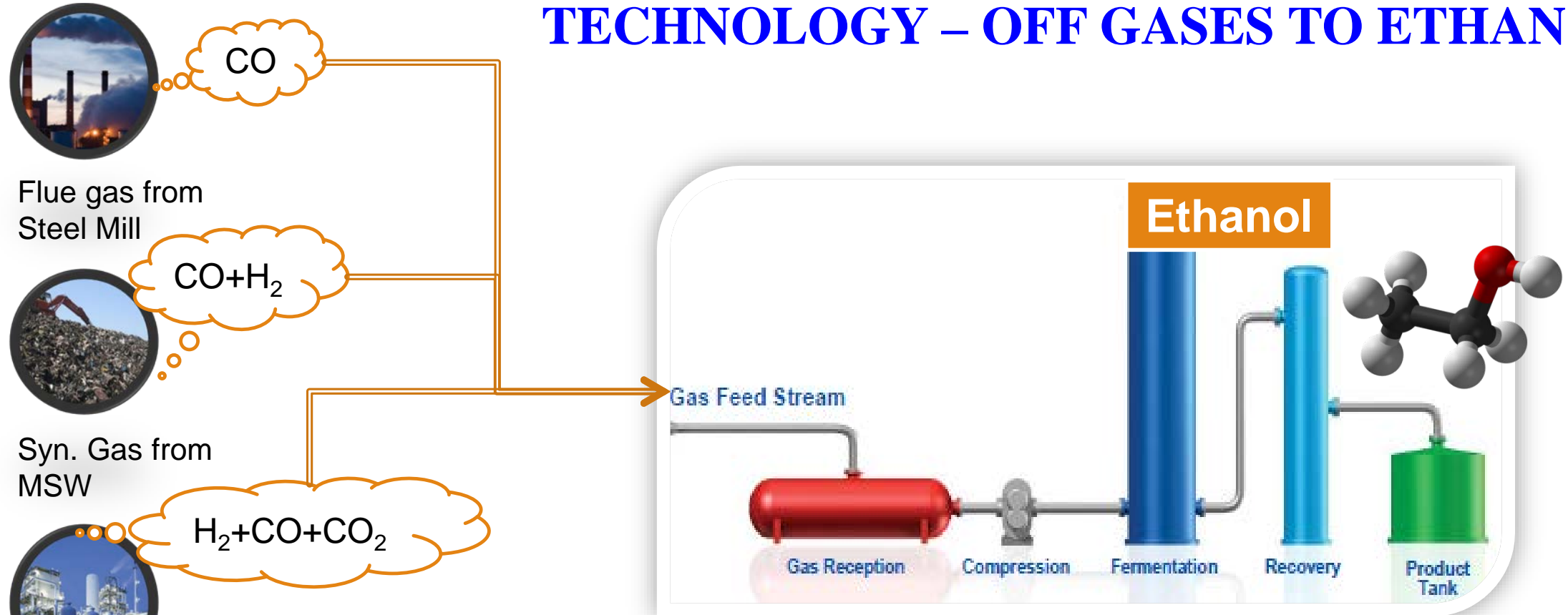
NEED FOR ÉTHANOL PRODUCTION

- **IndianOil** - exploring various technologies to develop capabilities of Ethanol generation and to increase the availability of Ethanol.
- **LanzaTech, USA, Carbon Recycling Company** - Gas fermentation technology based on Feedstock having CO/CO₂/H₂.
- **Ethanol production** using LanzaTech Process can be implemented at Refineries having Off gases with CO concentration >3.0 mol%.
- **Hydrogen Generation unit PSA** Off-gases contains CO, H₂, CO₂ suitable for the LanzaTech process.

*On July 2017, Statement of Intent Signed between IndianOil & LanzaTech to construct the **world's first refinery off gas-to-bioethanol production facility in India (Panipat Refinery)***



TECHNOLOGY – OFF GASES TO ETHANOL



**Off Gases from Refinery
(Hydrogen Plant)**

LANZATECH GAS FERMENTAION PROCESS

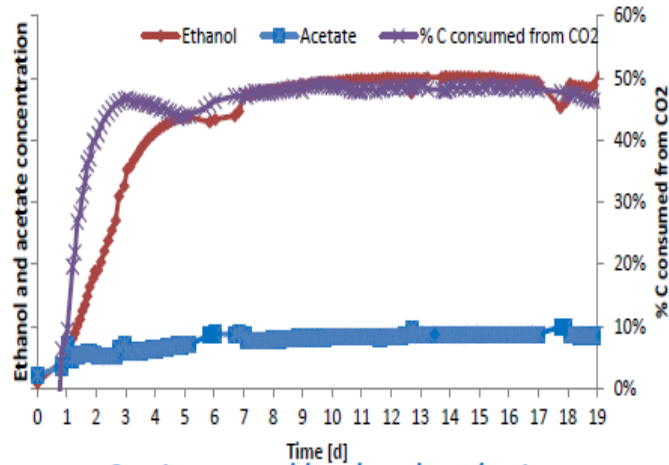
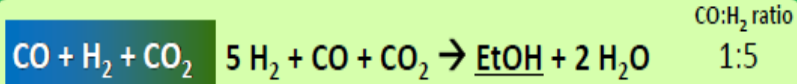
Ethanol from Industrial Waste Gases / Off gases

S.No.	Source	Gases	CO:H ₂ Ratio
1	Steel Mill Off Gases	CO	1:0
2	Municipality Waste SynGas	CO, H ₂	1:1-1:2
3	IOCL – Refinery Off gas (PANIPAT Refinery)	CO, CO₂ , H₂	1:5



**50% of C in
Ethanol is
from CO₂**

High H₂ Case: Direct CO₂ Conversion



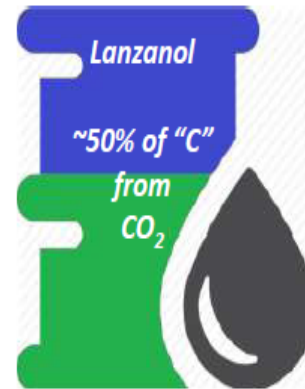
Continuous, stable ethanol production

H ₂ :CO uptake ratio	5.2
% C from CO ₂	58%

Potential: Global 5B gallons/year based on Refinery PSA TG

PSA Tail Gas

Demonstrated in the Lab, allows CO₂ fixing in products



Theoretical Ethanol yield as per stoichiometric conversion ~ 0.342 kg ethanol / NM³ (CO+H₂)

~33600 TPA (128 KL/D)
Ethanol Production at PR

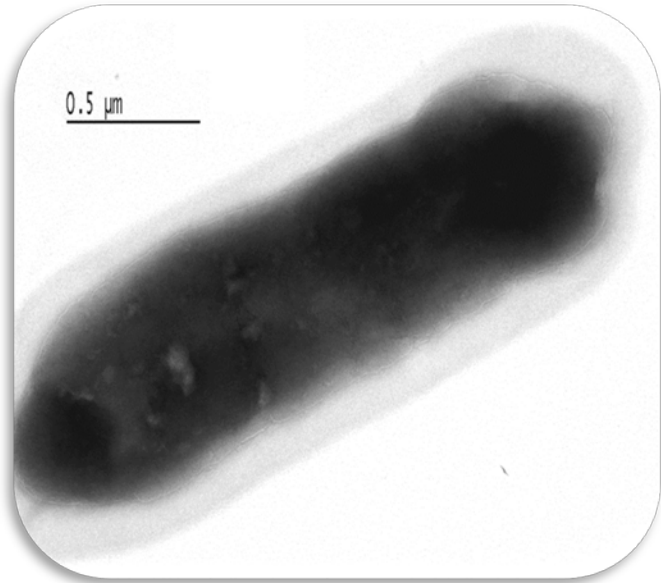
PROJECT CAPACITY & SCHEUDLE

- Capacity of Plant : **33500 TPA (tonnes per annum)**
- Cost of the Plant : **82 millon USD\$**
- Mechanical Completion : **Dec-2020**
- Commissioning : **Jan-2021**

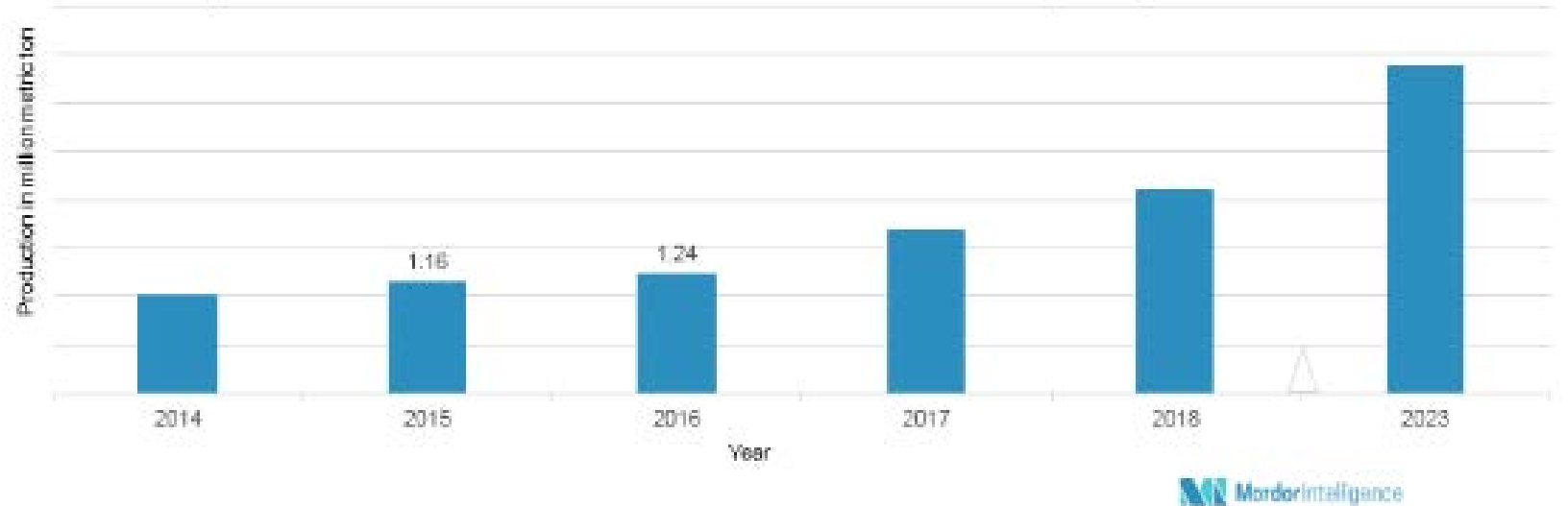
IMPORTANT MILESTONE ACHEIEVED

- Basic Design of Project (IOC+LT)* : **March 2018**
- Investment Approval : **October 2018**
- OIDB Grant : **22 millon USD\$**
- Environment Clearance(EC) : **November 2019**
- Construction : **Started in Dec 2019**

**IOCL and LanzaTech(LT) have signed MoU for Development of BDEP for Industrial Off Gases to Ethanol Projects on global basis.*



Aquaculture Feed Market: Production in million metric ton, India, 2014 - 2023



***Potential for positive impact on fuel supply and food production.
Nutritional feed co-product which is 90% protein by weight. Demonstrated as aquaculture feed in China.***

EXPECTED BENEFITS

- **Increasing the Availability** of Ethanol from other sources
- **Utilization of off gases /Waste gases** for Ethanol Production.
- Ambient Process Conditions & Clean Process
- Process Selectivity to produce Ethanol (95% selectivity towards ethanol)
- **Fixes CO₂ apart from ethanol production** – sustainable technology
- Low Water footprints as compared to other conventional 1st and 2nd Generation process for Ethanol production.
- Less Plot area requirement compared to 2G Technologies for similar capacities
- **Biomass generated in the process** out of Microbes is rich in protein contents that can be utilized for Animal feed (fish , Chicken & Cattles etc).

Thank You!

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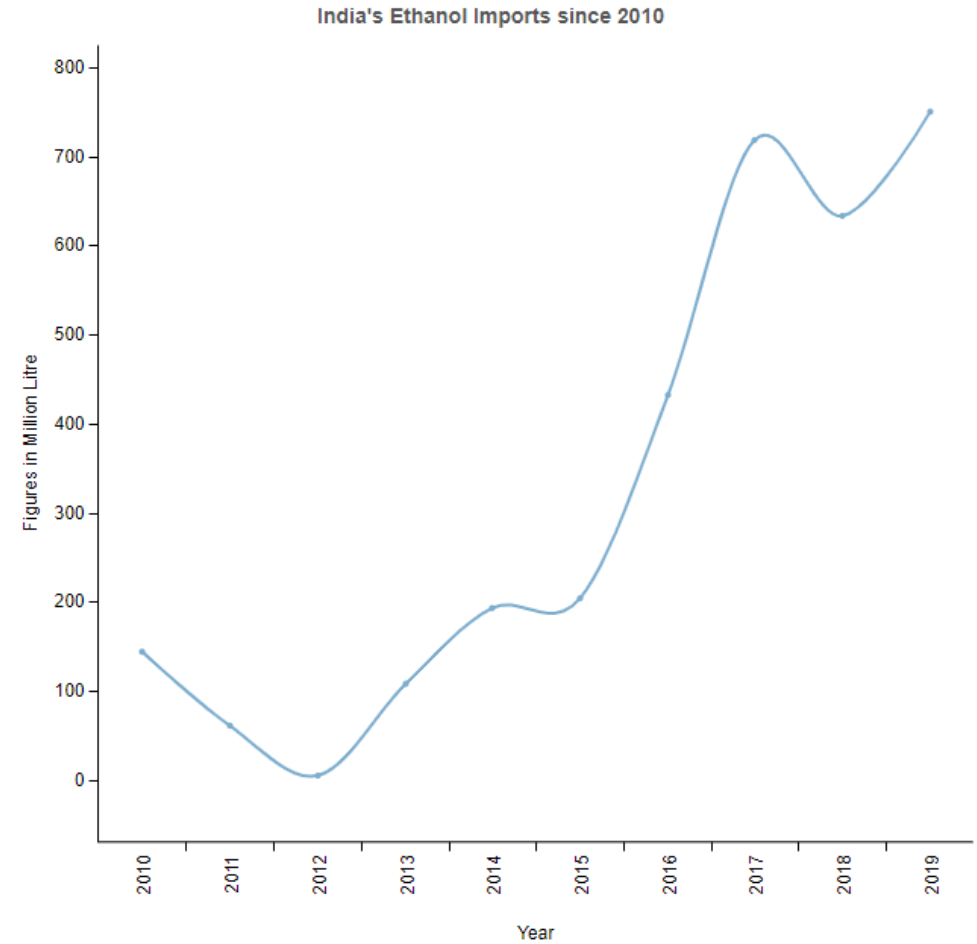
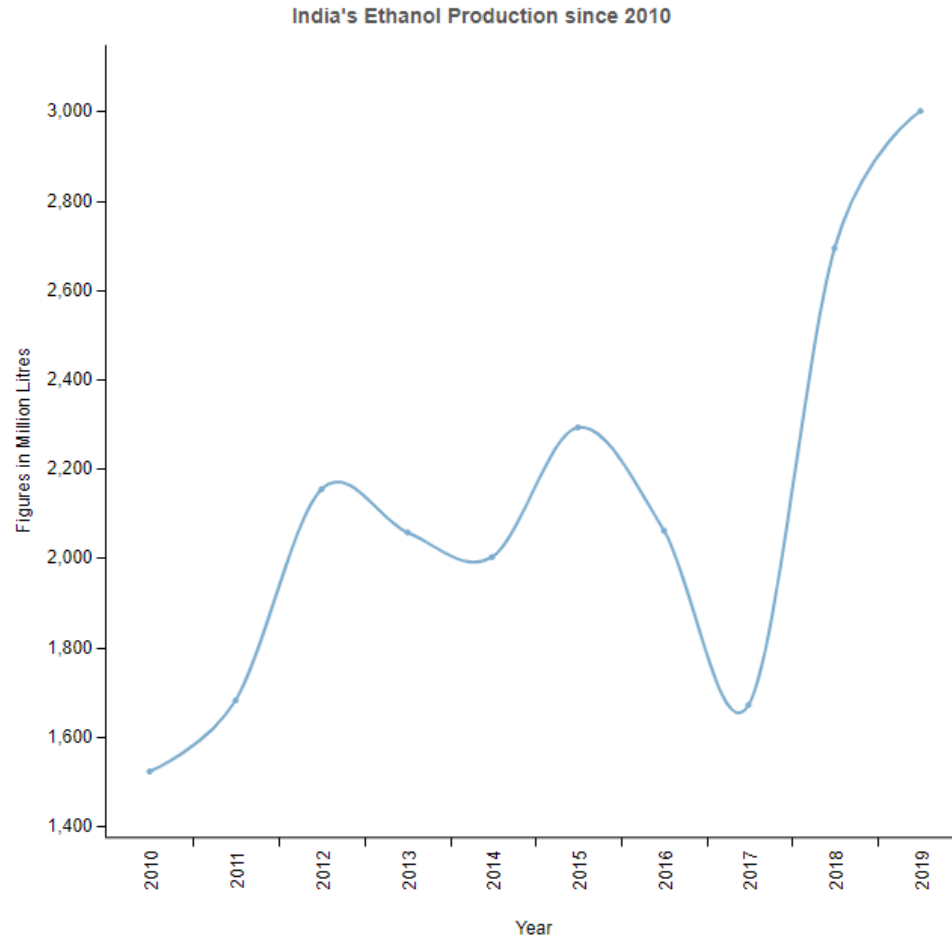
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<https://energy.economictimes.indiatimes.com/news/oil-and-gas/india-to-achieve-highest-ever-ethanol-blending-in-petrol-this-year/70766013>

Increasing demand. Domestic ethanol production without any impact on food resources.