Advanced Biofuels

Alok Sharma, ED-CHT

Different Energy Scenario

- **Stated Policies Scenario** (STEPS): Provides a balanced assessment of the direction in which India's energy system is heading, based on today's policy settings and constraints and an assumption that the spread of Covid-19 is largely brought under control early.

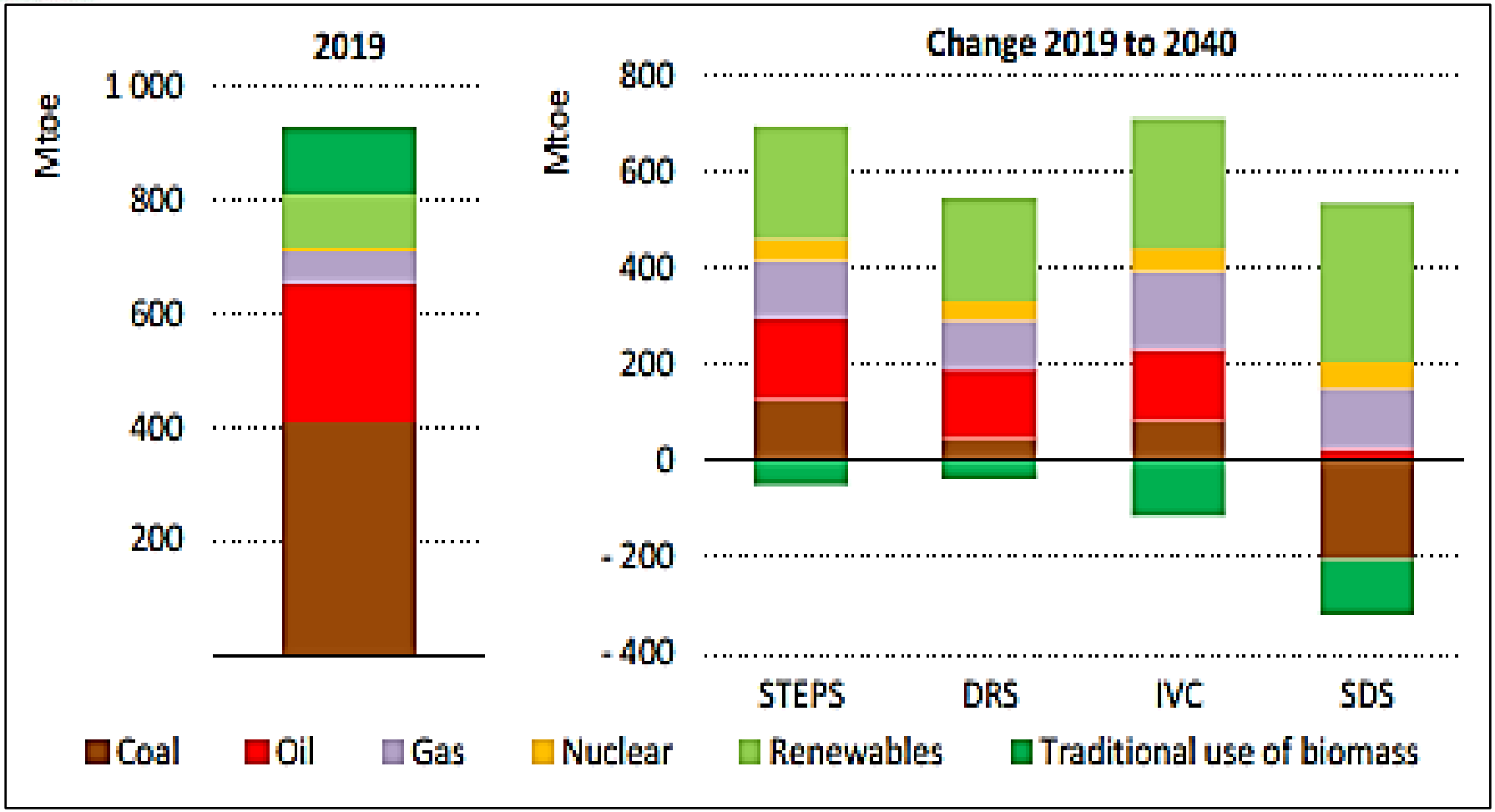
- **Delayed Recovery Scenario (DRS)**

- **India Vision case (IVC): B**ased on a rapid resolution of today's public health crisis and a more complete realization of India's stated energy policy objectives, accompanied by a faster pace of economic growth than in the STEPS.

- **Sustainable Development Scenario (SDS): E**xplores how India could mobilize an additional surge in clean energy investment to produce an early peak and rapid subsequent decline in emissions, consistent with a longer-term drive to net zero, while accelerating progress towards a range of other sustainable development goals.

India Energy Outlook 2021" by IEA

Total primary energy demand in India by fuel and scenario



Energy demand depends on the interaction of policies, technologies and market forces

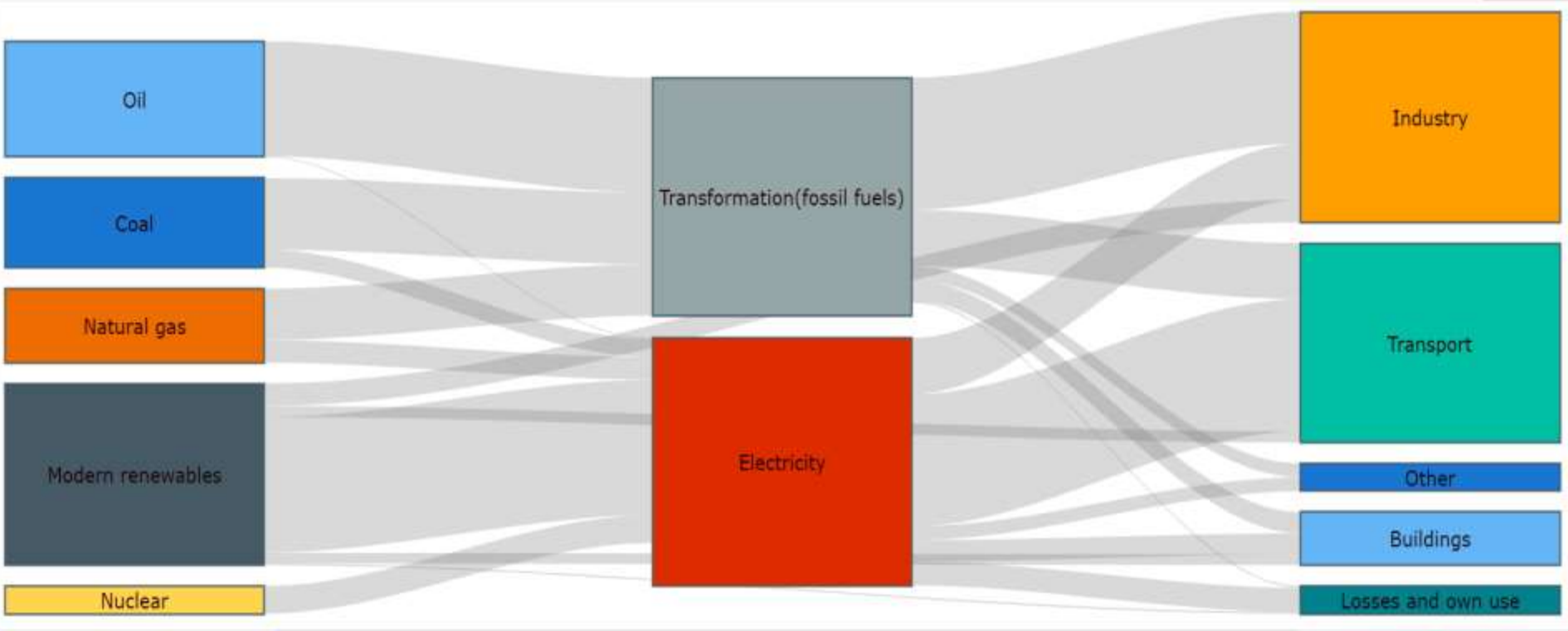
Source: “India Energy Outlook 2021” by IEA

Sector Wise Energy Consumption,2019 (Mtoe)

Sector wise Energy Consumption

Primary Energy	Transformation	Electricity	Industry	Transport	Buildings	Other	Conversion_losses	Losses_and_own_use	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oil	324	4.05	0	0	0	0	0	0	328.05
Natural gas	54	20.25	0	0	0	0	0	0	74.25
Nuclear	0	13.5	0	0	0	0	0	0	13.5
Modern Renewables	0	66.15	44.5	1.35	10.8	0	0	5.4	128.25
Traditional use of biomass	0		0	0	152.55	0	0	0	152.55
Electricity	0	0	263.25	141.75	72.9	41.85	0	39.15	558.9
Transformation (fossil fuels)	0	0	55.35	2.7	56.7	24.3	295.65	43.2	477.9

Sector Wise Energy Consumption, 2040 in SDS (Mtoe)



Primary Energy Balance

Primary Energy	Transformation	Electricity	Industry	Transport	Buildings	Other	Conversion_losses	Losses_and_own_use	Total
Coal	166	42	0	0	0	0	0	0	208
Oil	266	2	0	0	0	0	0	0	268
Natural gas	119	52	0	0	0	0	0	0	171
Nuclear	0	64	0	0	0	0	0	0	64
Modern Renewables	0	314	52	26	25	0	0	4	421
Traditional use of biomass	0		0	0	0	0	0	0	0
Electricity	0	0	41	2	42	18	219	32	354
Transformation (fossil fuels)	0	0	306	130	49	32	0	33	530

Advanced Bio-Fuels

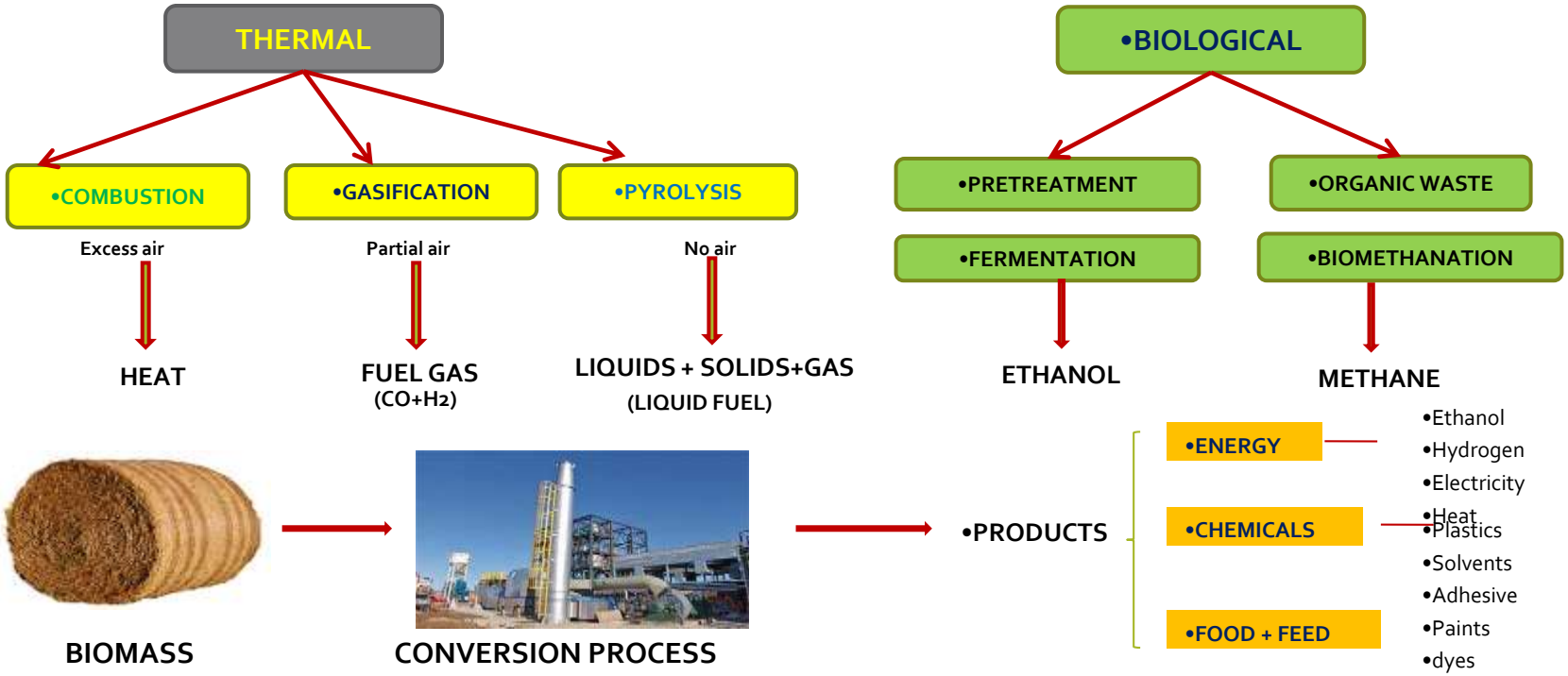
Advanced Biofuels

- **Cellulosic ethanol** can be produced by hydrolysis and fermentation of lignocellulosic agricultural wastes such as straw or corn stover or from energy grasses or other energy crops.
- **Hydrotreated Vegetable Oils (HVO) / Hydroprocessed Esters and Fatty Acids (HEFA)** do not have the detrimental effects of ester-type biodiesel fuels, such as increased NOx emission, deposit formation, storage stability etc.
- **BioSynthetic Natural Gas (BioSNG)** is produced via an initial gasification step followed by gas conditioning, SNG synthesis and gas upgrading. BioSNG can be used in a similar way to biomethane (biogas)
- **FT-liquids / Biomass to Liquid (BtL)** is generally produced via gasification (heating in partial presence of oxygen to produce carbon monoxide and hydrogen). Feedstocks include woody residues or wastes or energy crops. It has also been approved as an aviation fuel.
  - High temperature plasma gasification can be used to convert a wider range of feedstocks to syngas, which can then be cleaned and converted into fuels.

Advanced Biofuels

- **Methanol** Biomethanol can be produced from a wide range of biomass feedstocks via a thermochemical route similar to the Fischer-Tropsch process for BtL.
- **BioDME** can be produced via catalytic dehydration of methanol or directly from syngas.
- **Biobutanol** Novel fermentation techniques are being developed to convert sugars into butanol using modified yeast strains.
- **Biohydrogen** Hydrogen can potentially be produced from biomass via various routes and can be used as a vehicle fuel.
- **Algal biofuels** A number of projects and pilot plants are now identifying the best types of algae to use and the best production technologies.

Biomass Conversion Pathways



SATAT

SUSTAINABLE ALTERNATIVE TOWARDS AFFORDABLE TRANSPORTATION

- **'SATAT' scheme on Compressed Bio Gas (CBG) encourages entrepreneurs to set up CBG plants, produce & supply CBG to Oil Marketing Companies (OMCs) for sale as automotive & industrial fuels.**

•Developmental effort to benefit vehicle-users as well as farmers and entrepreneurs.

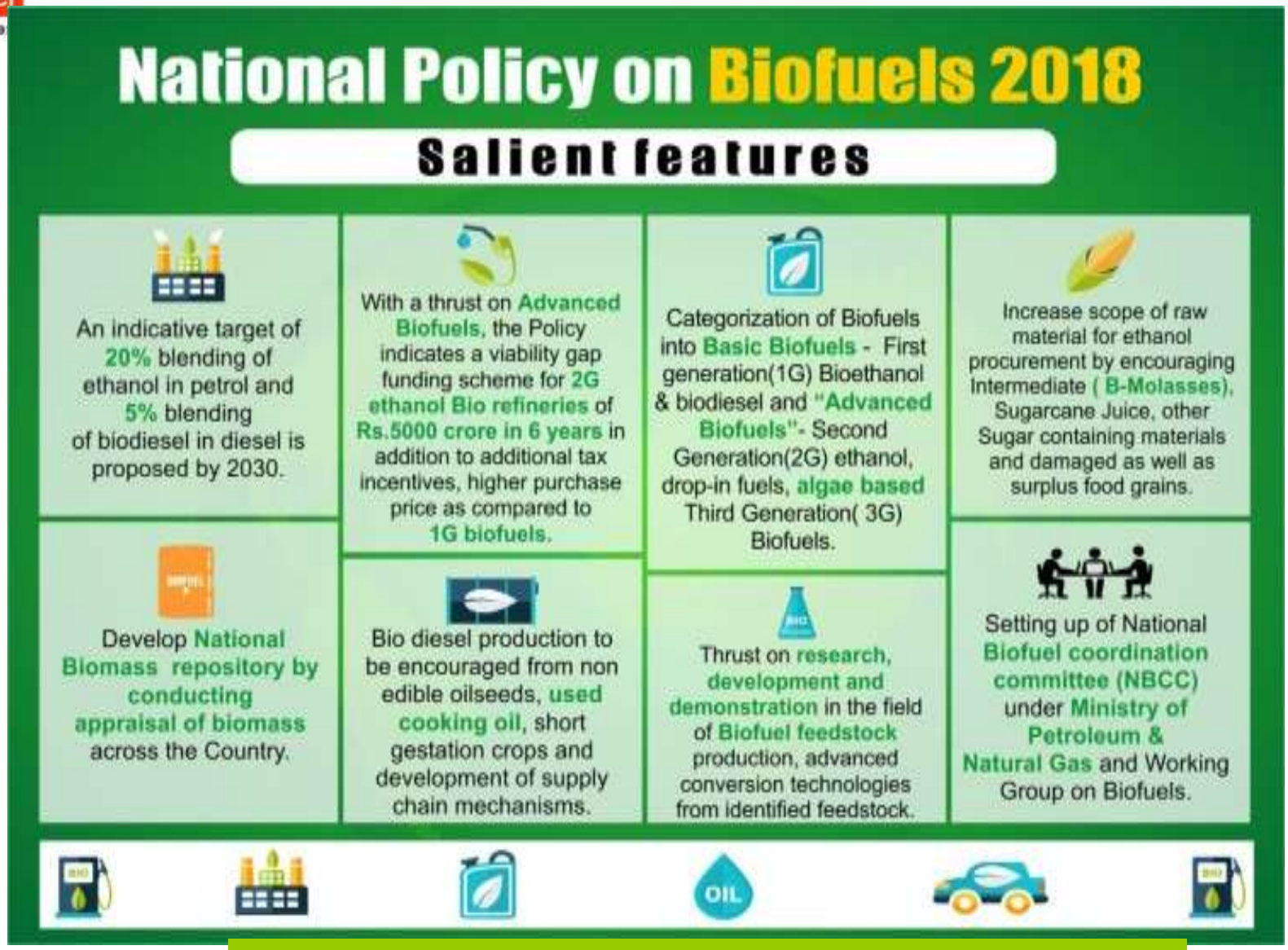
•Efficient tackling of urban air pollution due to farm stubble-burning and carbon emissions.

•**Reduce dependency on crude oil imports** and realize our Hon,ble PM's vision of enhancing farmers' income, rural employment and entrepreneurship

•Efficient treatment and disposal of municipal solid waste

•Promotion of organic farming by using Fermented Organic Manure (FOM) produced from CBG plants

Biofuels Policy



Targets Timeline reduced from 2030 to 2025

Pradhan Mantri JI-VAN Yojna

- National Policy on Biofuels-2018 launched in June,2018,
- Pradhan Mantri JI-VAN Yojna, announced by GOI in Feb,2019 to support 12 Commercial scale 2G Ethanol Projects and 10 demonstration scale projects based on lignocellulosic biomass.
  - Rs 1800 crore for 12 commercial Projects
  - Rs 150 crore for 10 Demonstration Projects

Procedure for selection of the Projects

- CHT invites the Request for Selection (RFS) for Short-listing of Projects for development of Bioethanol Projects under this scheme. RFS IV is going on.
- SAC will recommend the eligible projects.
- Projects will be approved by Steering Committee of CHT under the chairmanship of Secretary, MoP&NG for disbursal of funds under the grant.

Objective

- Setting up of 2G Ethanol bio-refineries in India and bring in economic viability in the projects.
- To kick start the development by setting up commercial projects and setting benchmarks for development and indigenisation of technologies used for the commercial projects.
- Developing reliable Indian Vendors / Sub Contractors for Cellulosic Ethanol Plants & Co-Products Plants.
- Establishing sustainable collection & transport systems, for crop residues (e.g. paddy straw, cane trash) along with Biomass Depots management systems, to be operated by entrepreneurs (utilizing NABARD & MNREGA schemes, where applicable)
- O&M systems (customized for Indian conditions – ambient, labour, etc.) & Manpower Training
- For efficiently transporting biomass from Depots to Bio-Refineries, to optimize biomass cost.
- Facilitate Indian production of Enzymes through economies of scale & establishing techno-economic viability of producing Cellulosic Ethanol, in India, from wastes related to Rice, Sugarcane, Cotton & Maize cultivation
- Bioethanol produced from these projects may earn carbon credits.

Objective

- Scaling up of sizes of projects thereby leading to economies of scale.
- Provide long-term visibility and road map for development of bio-ethanol technologies enabling creation of India as manufacturing hub in the Biomass to Bioethanol.
- MSW based projects will also address the problem of MSW & landfills which causes soil and water pollution.
- To create good business model and systems for various State Governments and indigenous investors and technology developers.
- Mitigate carbon emissions

Fuel	CO2 Emission g CO2 e/MJ **
Gasoline	84
1G Ethanol	55
2G Ethanol	33

6 Commercial plants and 3 Demo plant are under Implementation

Issues with 2G Ethanol

- **Cost of production is significantly higher** than 1G ethanol, even after financial Assistance
- **Lack of experience with any of the companies** as of now on full commissioning. The technology and operation may take time to get into full-scale operation.
- **Water Availability**: Availability of about 3000 Kl of water throughout the year will be required per day for 100 Kl of Ethanol production will be a challenge.
- **Disposal of about 150 MT** of ash/mud/sludge every day and there may be intermittent problems at least initially
- Establishing the **Biomass supply chain** for consistent operation.

Conclusions

- Develop strategies to produce **CBG to meet needs of green cooking fuel** in rural and urban residential areas as well as **supplement the energy needs in agriculture**.
- Ethanol from **2G process** and **Industrial waste gases/ Biomass Gasification** through fermentation process
- **Sustainable Aviation Fuels (SAF)** from non edible vegetable oil/ used cooking oils and surplus green ethanol using AtJ (Alcohol to Jet) pathway to prepare India meet CORSIA guidelines
- Promote various bio-fuel production technologies on a level playing basis and in **a technology agnostic manner to accelerate biofuel development**.
- Multiple pathways for biofuels production required

सीएचटी
ISO 9001:2015

सत्यमेव जयते

Thank you

Ready For Future