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SUSTAINABILITY THROUGH DIVERSIFICATION

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What we know - 1
The Global Context

Global Issues (Also affecting India)

- Dependence on the Fossil Economy
- Need to reverse Climate Change

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What we know - 2
The Indian Context

India

- Energy Security & Geopolitics
- Climate Change and Green Transition
- Income Security for the Farmers

What we know - 3

What India is doing in the Sugarcane & Ethanol Sector

Green Transition

- Ethanol Blending Programme
- 2G Demonstration
- Flex Fuel Cars
- Compressed Biogas - SATAT

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What we can and must do
Set a Vision for India – Viksit Bharat

- Bolder Targets
- Green Hubs
- Soil Carbon & Regenerative Agriculture

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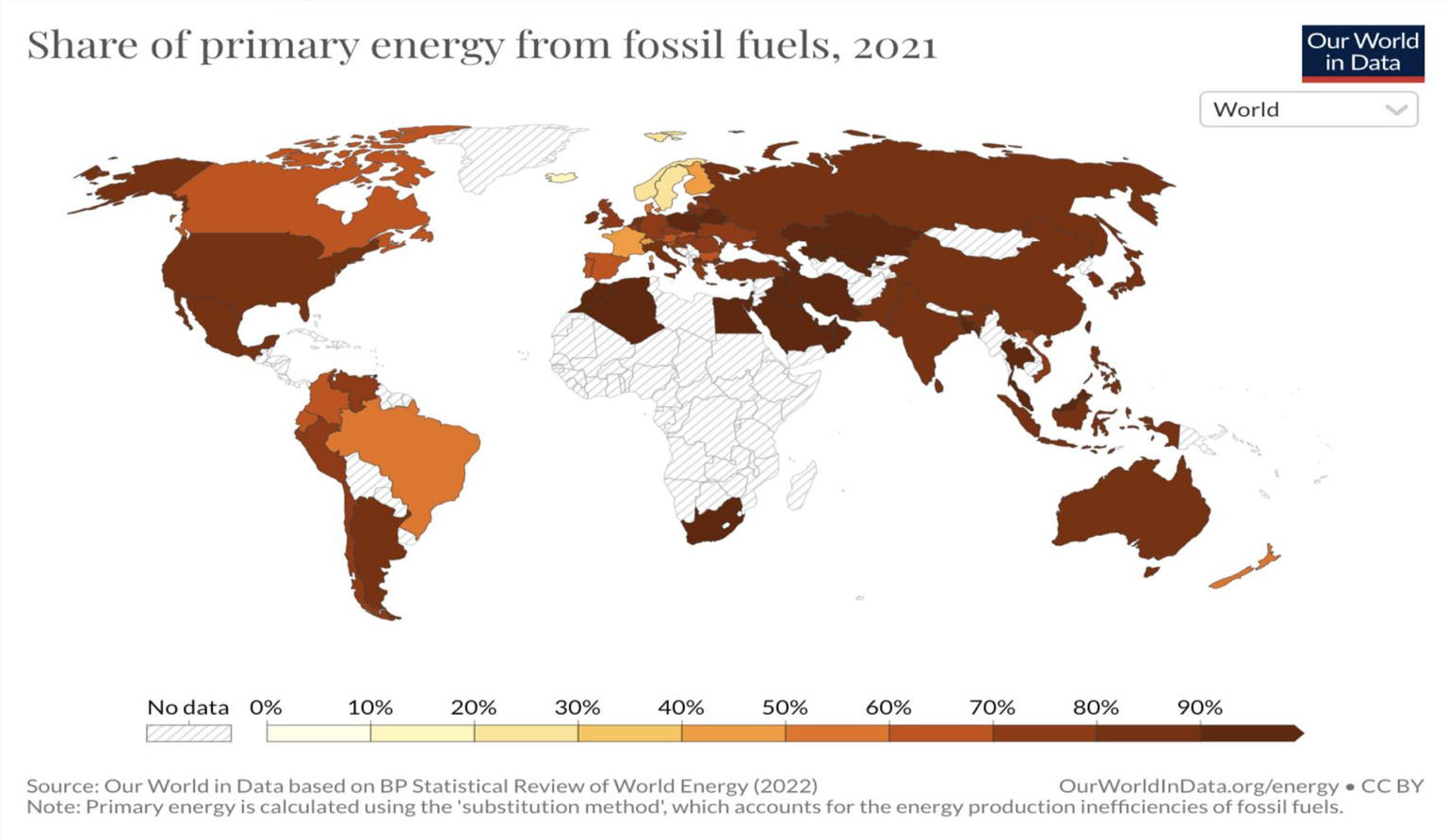
RELIANCE ON FOSSIL FUELS

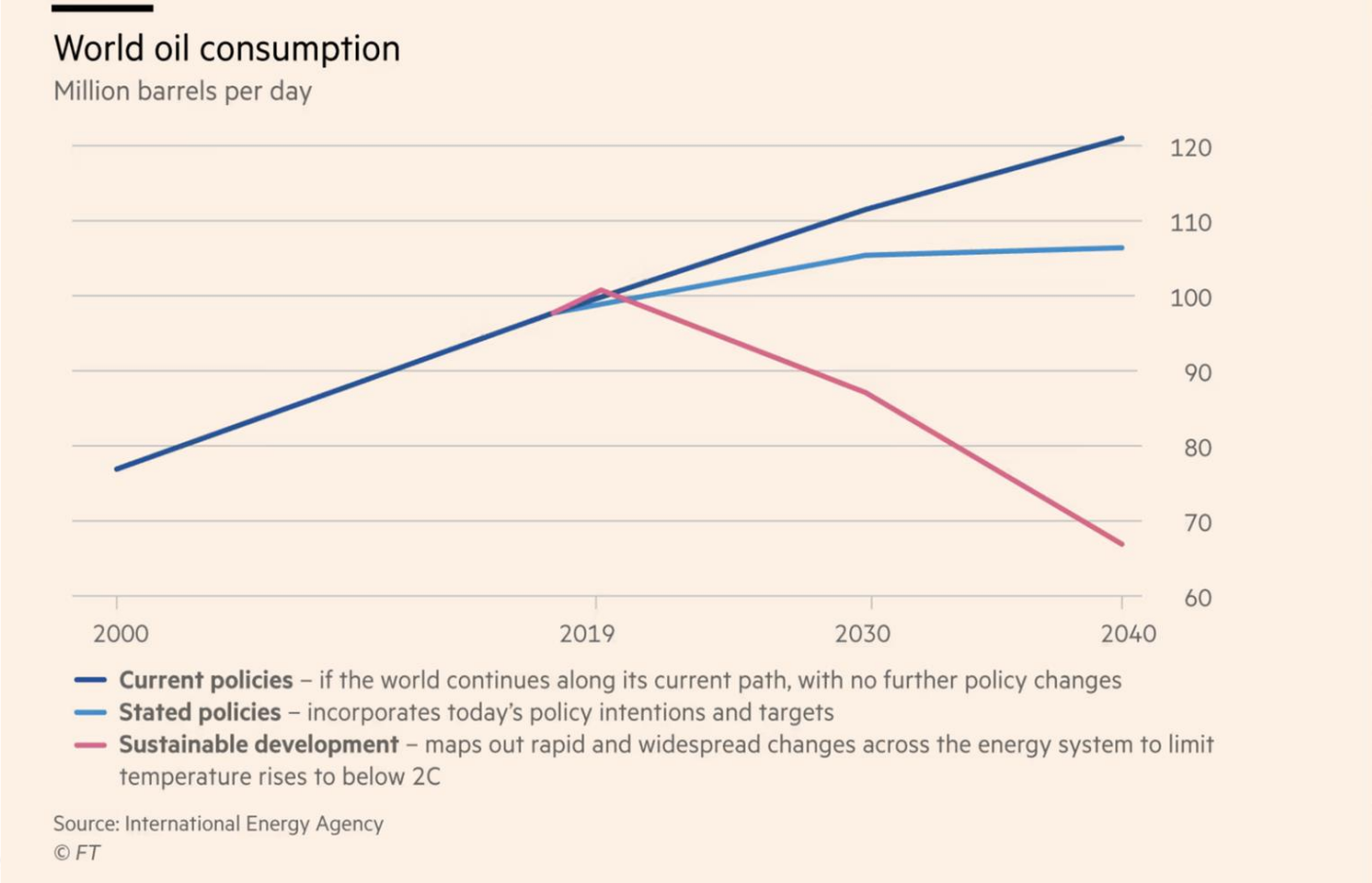
- Greater about 85%
- 34% Oil
- 27% Coal
- 24% Gas

(Breakup – FT)



DAILY OIL CONSUMPTION

- 1986: 61.6 MBD
- 2020: 100 MBD
- 2040: 121 (Business as Usual)
- 2040: 67 MBD (<2C)



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PER CAPITA ENERGY CONSUMPTION

- 1986: 61.6 MBD
- 2020: 100 MBD
- 2040: 121 (Business as Usual)
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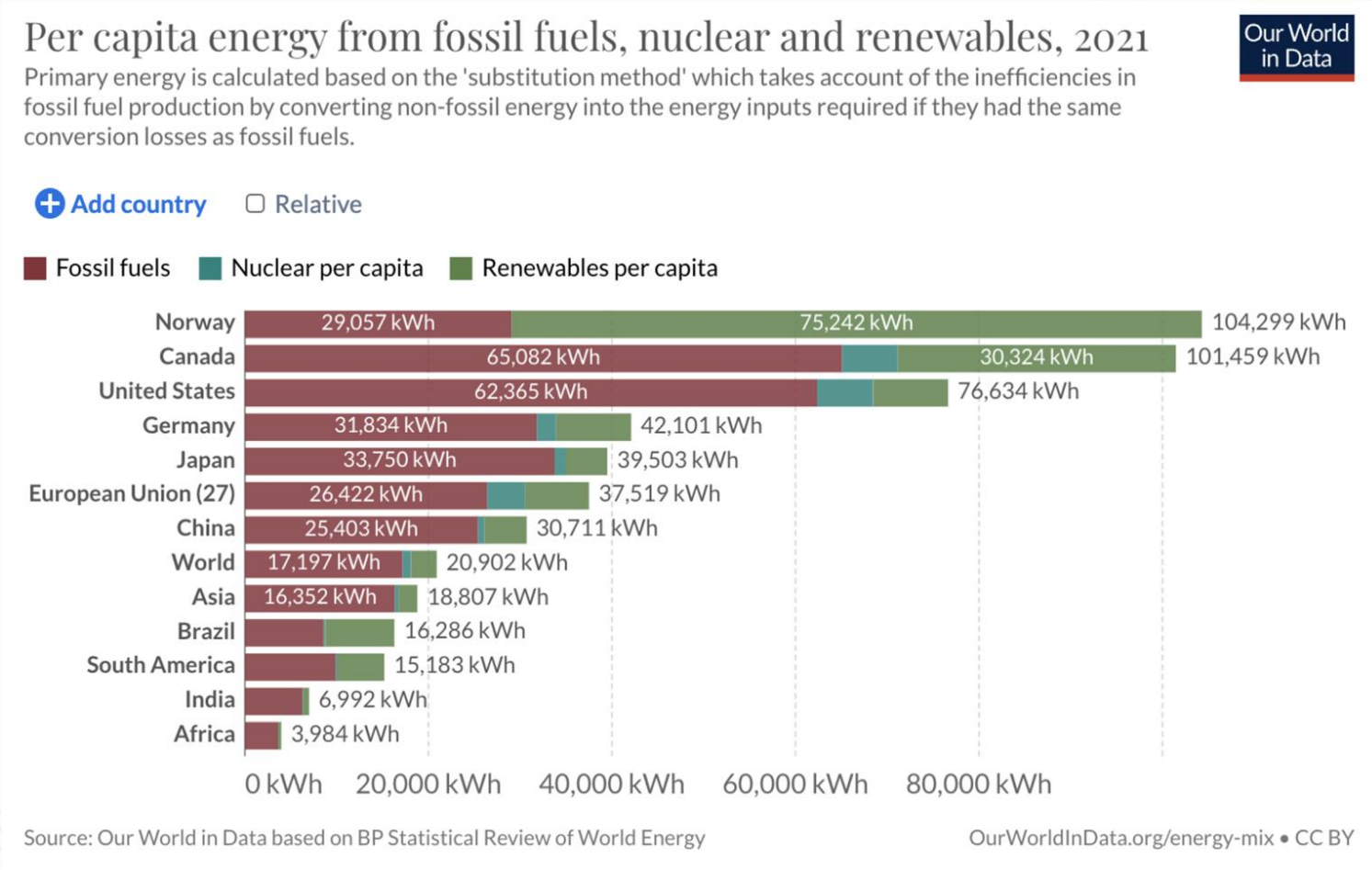

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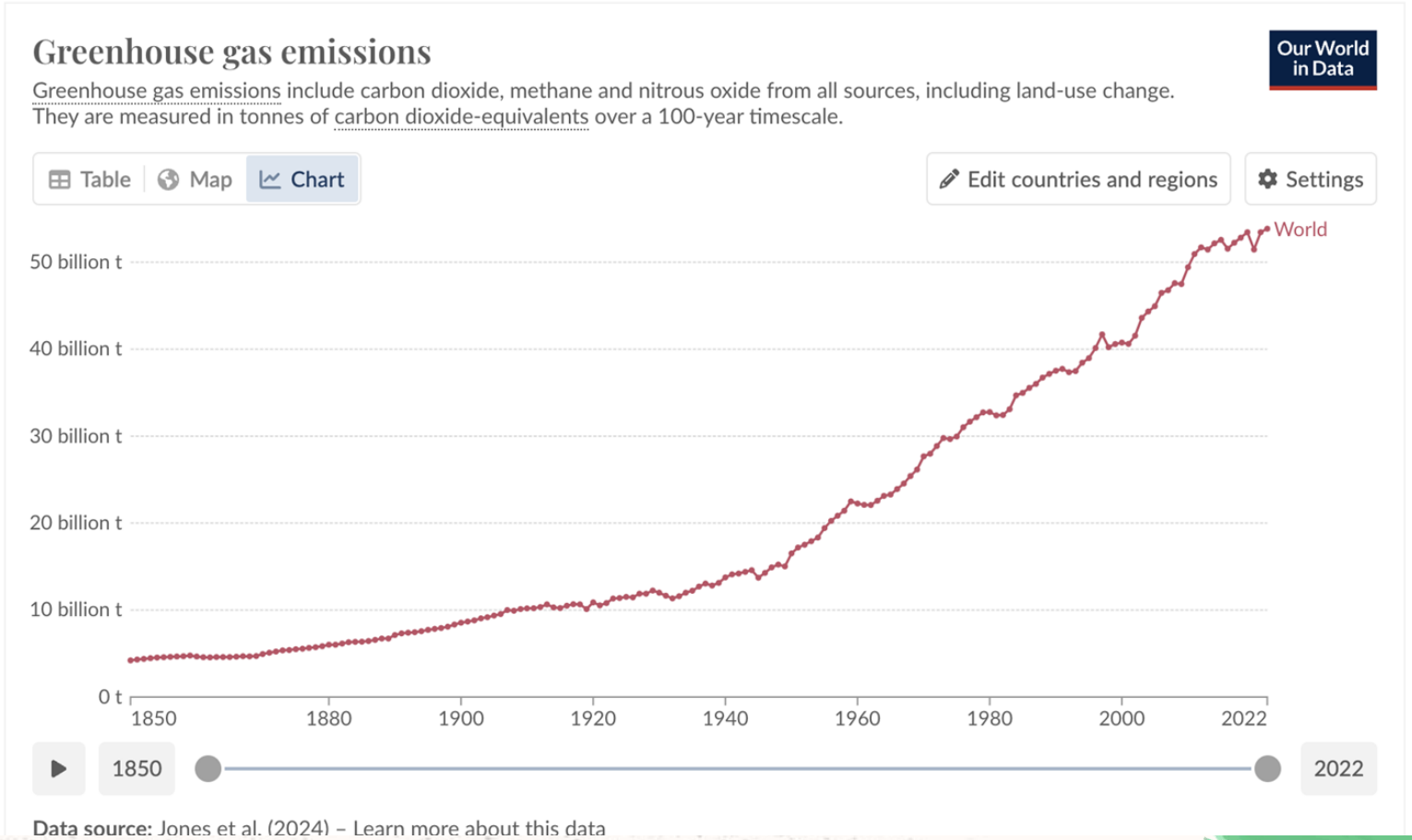
ANNUAL CO2 EMISSIONS

- Net zero will need a dramatic reversal



THE INDIAN CONTEXT

India in the World; India and the World

- Energy Security
- Climate Change
- Farmer Income Security

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OUTLINE – SUSTAINABILITY THROUGH DIVERSIFICATION

- Diversification on the Farm
- Diversification in the Mill
- Diversification in Markets
- Further Policy Directions

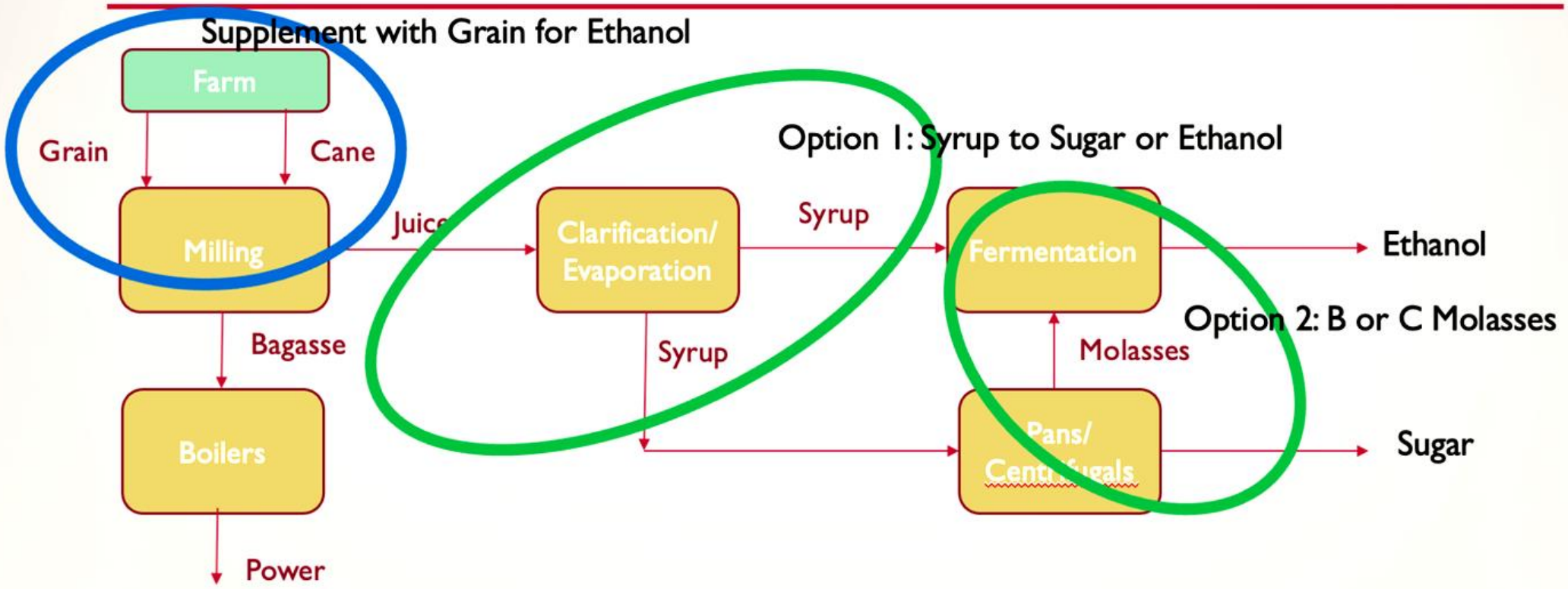
ETHANOL: CREATING A LARGE NEW MARKET

- Enabling Ethanol Production from B Heavy Molasses and Juice (2018)
- Roadmap for Ethanol Blending in India (announced June 2021)
  - 20% Blend by 2025
  - Will need capacity of 15 Billion Litres
  - 10+ Billion Litres for Ethanol Blending Programme
- Multiple Feedstocks

  Sugarcane: 7.6 Billion Litres

  Grain: 7.4 Billion Litres
- 2G Demonstration Plants
- Flex Fuel Cars and Ethanol Pumps

DIVERSIFICATION – FEEDSTOCK & PRODUCT



SUSTAINABILITY THROUGH DIVERSIFICATION IN THE FACTORY

- Feedstock for Ethanol (Sugarcane Juice vs B Molasses vs C Molasses)
- Other Feedstocks for Ethanol
    - Bagasse (2G)
    - Grain/Damaged Rice
    - Sweet Sorghum/Tropical Sugar Beet
- Press Mud to Compressed Biogas
- Other Products - CO

BIOFUELS – ETHANOL STAND ALONE AND BOLT-ON

- Sugarcane
  - 5 million ton surplus sugar – additional 3 billion litres (In a normal year)
- Maize/Grains/Damaged Rice
  - Government has targeted 7.5 billions from damaged rice/maize - additional 6 billion from current levels
- 2G (Cellulose)
  - Crush 350 million tons of cane. Bagasse saved at 9%
  - 31.5 million tons of bagasse – Estimate another 3.1 billion litres of ethanol
  - India burns 92 million tons of crop residue. If this were converted to 2G ethanol – this would convert to another 9.2 billion litres of ethanol

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ENERGY SECURITY

- Energy Transition
  - Ethanol
  - CBG
  - Electricity

ETHANOL SUPPLIED FOR BLENDING

12% Currently

Year of Supply	C Heavy	B Heavy	Juice	Surplus Rice	Damaged Grain	Total
2017-18	150.5	0	0	0	0	150.5
2022-23	6.52	242.77	144.27	147.32	26.17	569.76

- Enabling Ethanol Production from B Heavy Molasses and Juice (2018)
- 10% Blending Achieved
- Target: 20% by 2025 – Need 10.5 billion litres – To double current supply
- **How can we do more?**

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BIOFUELS – ETHANOL POTENTIAL: 50%

- Current: 5.6 Billion Litres
- Addition
  - Sugarcane: 3 Billion Litres
  - Maize/Grains/Damaged Rice: 6 Billion Litres
  - 2G (Cellulose): 12.3 Billion Litres
- **Total existing + Potential: 27 Billion Litres**
- **If 10.5 billion is 20% blending in petrol, then 27 billion litres is more than 50%**

BIOFUELS – 2G ETHANOL
WHAT WE NEED TO DO

- Capital Expenditure
    - Bolt-on
- Enzymes
    - Opex

BIOFUELS - ELECTRICITY

- Power export per ton crushed: 95 kwhr
- 350 million tons x 95 kwhr = 33.25 billion kwhr - Can we achieve 95 kwhr/ton crushed?
- Assuming 10 km/kwhr – this equates to 332.5 billion km travelled
- **If petrol gives an average of 10 km/litre, saving of 33.25 billion litres of petrol**
- **Previous Page: Ethanol potential: 27 billion litres per year @50%**
- **Does this mean that we can meet 100% of our Petrol Requirement**

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BIOFUELS – CBG SATAT PROGRAMME

- India imports close to 50% of its Gas requirement (34 MMSCM in 2022-23 equals 22.8 million tons)
- Total demand in 2022-23 was 40 million tons
- A 5% mandate for Gas will help incentivize creation of capacity.
- India is targeting 15 million tons of CBG
    - 40 % of requirement
    - Mandate will spur investment
- India aims to increase Gas to 15% of its energy mix by 2030

BIOFUELS – CBG SATAT PROGRAMME MANDATE WILL ENABLE GROWTH

- Pressmud
  - 4% on cane
  - CBG is 5% on Pressmud
- 350 million tons crushed
  - 700,000 tons gas
  - 1 Billion m3 of gas
  - 5% of Indian imports

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GREEN HUBS - CARS, TRACTORS & BUSES

- EVs
- CBG
- Ethanol
    - Flex Fuel
    - Hybrids

GREEN HUBS – IMAGINE

In addition to Blending - Demonstrate Fully Green Distribution

- One National Company
  - Franchise with Sugar mills
- Selling only
  - Ethanol
  - CBG
  - Renewable Electricity
  - Future - Green Hydrogen

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SUSTAINABILITY THROUGH DIVERSIFICATION

- Diversification in the Farm
  - Feedstocks
  - Farm Inputs
  - Crops

CARBON DEPLETION

- Gas
- Oil
- Coal
- Forests
- **Soil**

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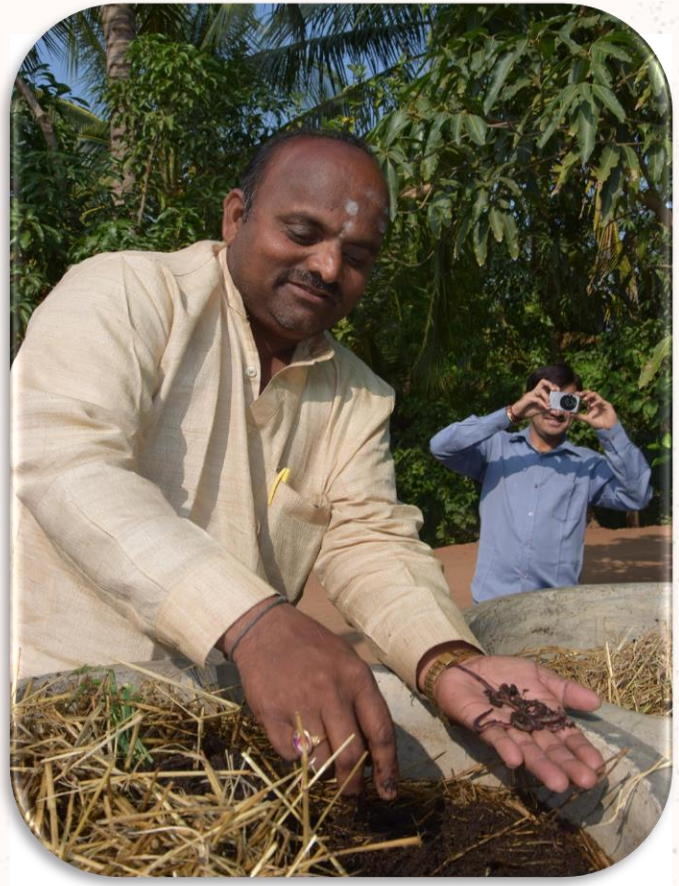
CIRCULAR ECONOMY ON THE FARM

- Low Carbon Farming
- Intercropping
- Drip, Remote Sensing and Agroecology
- **Regenerative Agriculture**



DISRUPTION ON THE FARM

1. Bhumilabh, Vermicompost, Panchagavya (CowDung, Cow urine, Curd, Ghee, milk), Jeevamruth and Panchamruth.

2. Fertilizers 250:75:187 kg N, P_2O_5, FYM, $FeSO_4$, $ZnSO_4$, Borax, and other stuff.

INTERCROPPING

- Intercropping to improve farmer incomes.
- Range of intercrops. At this time, French Beans show addition of $3,373 per hectare.

Treatment	Beetroot	Cabbage	Sweet Potato	Knol Khol	Japanese Mint	Garlic	French Bean
1.2M x 0.5M	2,444	2,281	623.81	2,137	1,656	523	3,373

CARBON

- By increasing our Soil Carbon
- Calculating Footprint
- Reducing Fossil inputs

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CARBON

- Need to Learn LCA
- Carbon Footprint
- Path to Net Zero

GODAVARI BIOREFINERIES

- Foods
- Fuels
- Chemicals
- Biomaterials
- Social and Environmental Sustainability

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THANK YOU

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