



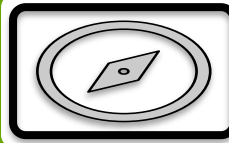
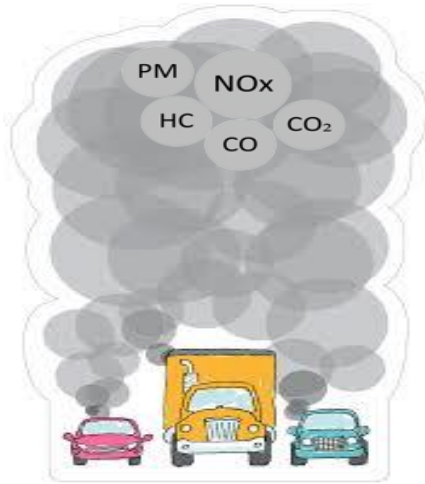
National Transport Decarbonization Council

Workshop on Biodiesel as Fuel

24 August 2022 | 2:00 p.m. to 4:00 p.m.

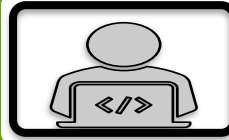


National Transport Decarbonization Council



Need of Council

To build synergies between stakeholders through exchange of ideas on a common platform



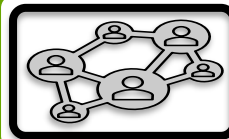
Stakeholder Benefit

Provide an opportunity to discuss or exchange ideas outside the formal government mechanisms



Outcome of Council

Improved land transport productivity, environmental outcomes, and effective policy-making



Role of TERI

Act as the secretariat and provide intellectual and other support in formulation of NTDC

Objectives

To **build consensus among the policy-makers** through **informed discussion** on selected policy tools and topics

To **initiate the feedback mechanism** for supporting decarbonization strategies/policies of the ministries **through the council**



Members





**National Transport
Decarbonization Council**

Biodiesel as Fuel

Contents

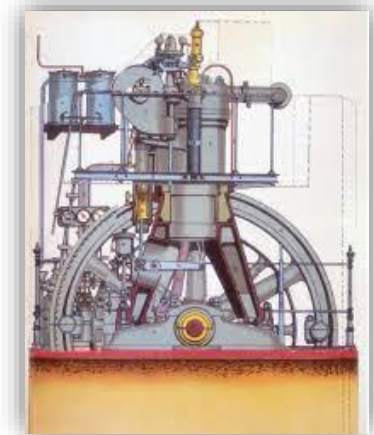
- What is Biodiesel?
- Why Biodiesel?
- Production of Biodiesel
- Storage, handling and transportation
- Biodiesel related Policies in India
- Biodiesel market in India
- International Cases
- Discussion Points



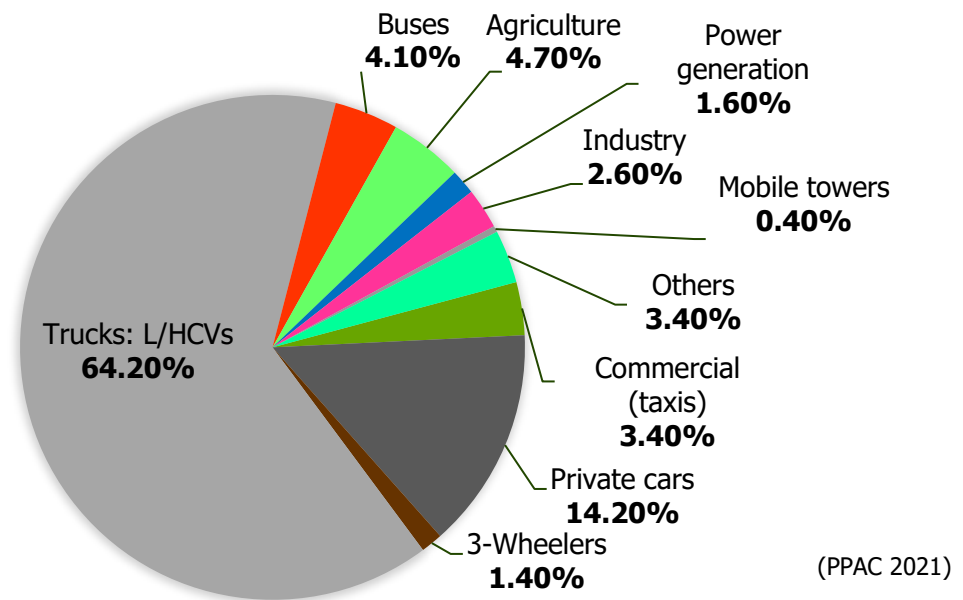
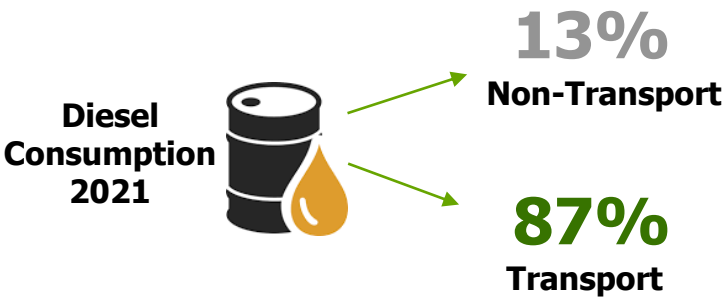


What is Biodiesel?

- A renewable alternative fuel generated from vegetable oils, animal fats and greases through various chemical processes
- Rudolph Diesel developed biodiesel in 1890
- Used pure vegetable oils in diesel engines for agricultural purposes
- The conversion of vegetable oils into fatty acid alkyl esters was done by a very broadly used process known as Transesterification



Why Biodiesel?



Biofuels are one of the relatively cleaner options and could have higher penetration in the medium/heavy duty vehicles, SUVs, tourist vehicles, taxis, buses, etc.

Biodiesel emissions compared to conventional diesel

Some salient advantages:

- Renewable & energy efficient and reduces dependency on imports
- Can be used as blend in most diesel equipment with no or only minor modifications
- Reduces tailpipe emissions, including air toxics
- Reduces GHG emissions

Emission Type	B100
Total Unburned Hydrocarbons	-93%
Carbon Monoxide	-50%
Particulate Matter	-30%
Sulphates	-100%
PAH (Polycyclic Aromatic Hydrocarbons)	-80%
nPAH (nitrated PAH's)	-90%
Ozone potential of speciated HC	-50%

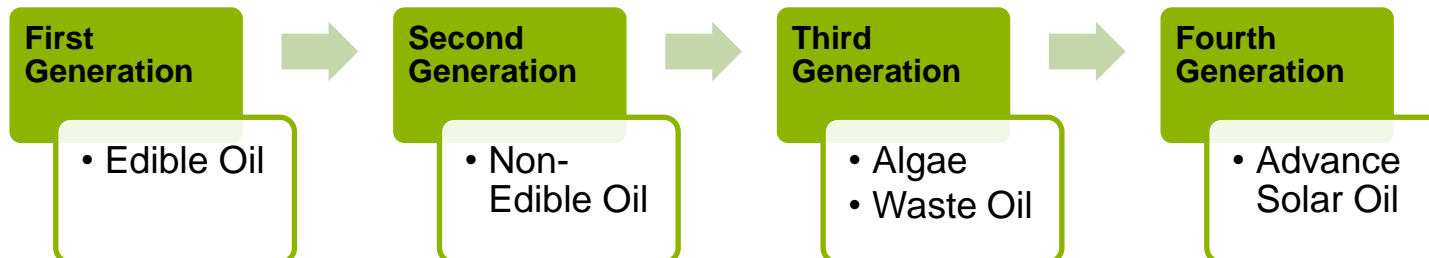
Production of Biodiesel

Common Feedstock and technology used

Feedstock	Technology Used
Palm Stearin	Transesterification
Jatropha and other non-edible oils	Transesterification
Palm Fatty Acid Distillate (PFAD)	Multistage Acid Esterification/Enzyme
Animal Oil/Waste oil and others (UCO)	Pre-treatment, Multistage Esterification- Transesterification-Glycerolysis
Animal Fat/Tallow	Pre-treatment, Multistage Esterification- Transesterification-Glycerolysis- finishing by Sulphur removal

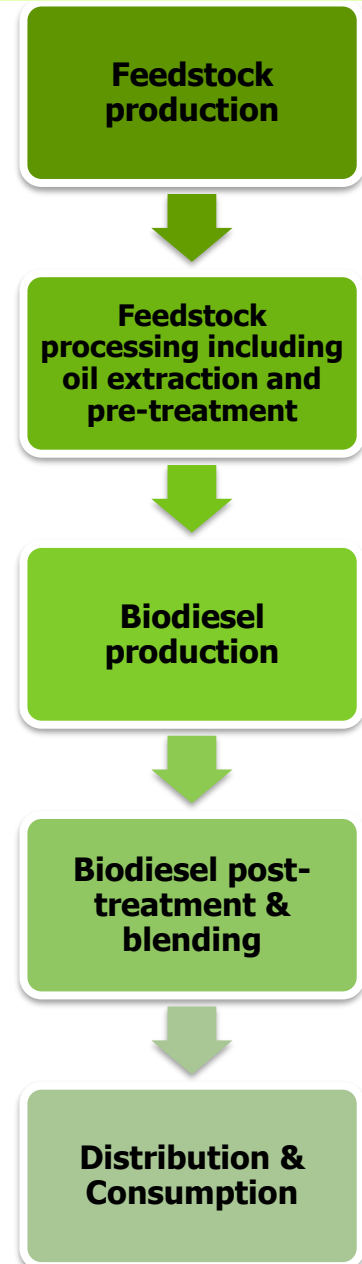
Source: BDAI

Generations of Biodiesel w.r.t different feedstock



(Singh, et al., 2019)

Stages of biodiesel production



Source: (Mata & Martins, 2010)



Benefits and limitations of Generations of Biodiesel w.r.t different feedstock

	First generation	Second generation	Third generation	Fourth generation
Benefits	<ul style="list-style-type: none"> • Easy biodiesel conversion process • Easy availability of crops 	<ul style="list-style-type: none"> • No effect on food supply • Feedstock can be grown on non-arable land • Lower production cost 	<ul style="list-style-type: none"> • Waste food oil can be used for biodiesel production • Growth rate of algae is high • No effect on food supply • Can be use seawater or waste water for algae growth 	<ul style="list-style-type: none"> • More lipid content • More CO₂ absorbing ability • High energy content, rapid growth rate of feedstock
Limitations	<ul style="list-style-type: none"> • Affect food supply • Low crop yield • Limited area of cultivation • Less adaptability of crop to environmental conditions 	<ul style="list-style-type: none"> • Less cost-effective conversion technology • Low crop yield for some feedstock 	<ul style="list-style-type: none"> • High energy consumption for algae cultivation • Low lipid content in open pond system • Expensive oil extraction process from algae 	<ul style="list-style-type: none"> • High initial investment • Research at infancy level



Storage, Handling and Transportation of Biodiesel



Blending tanks



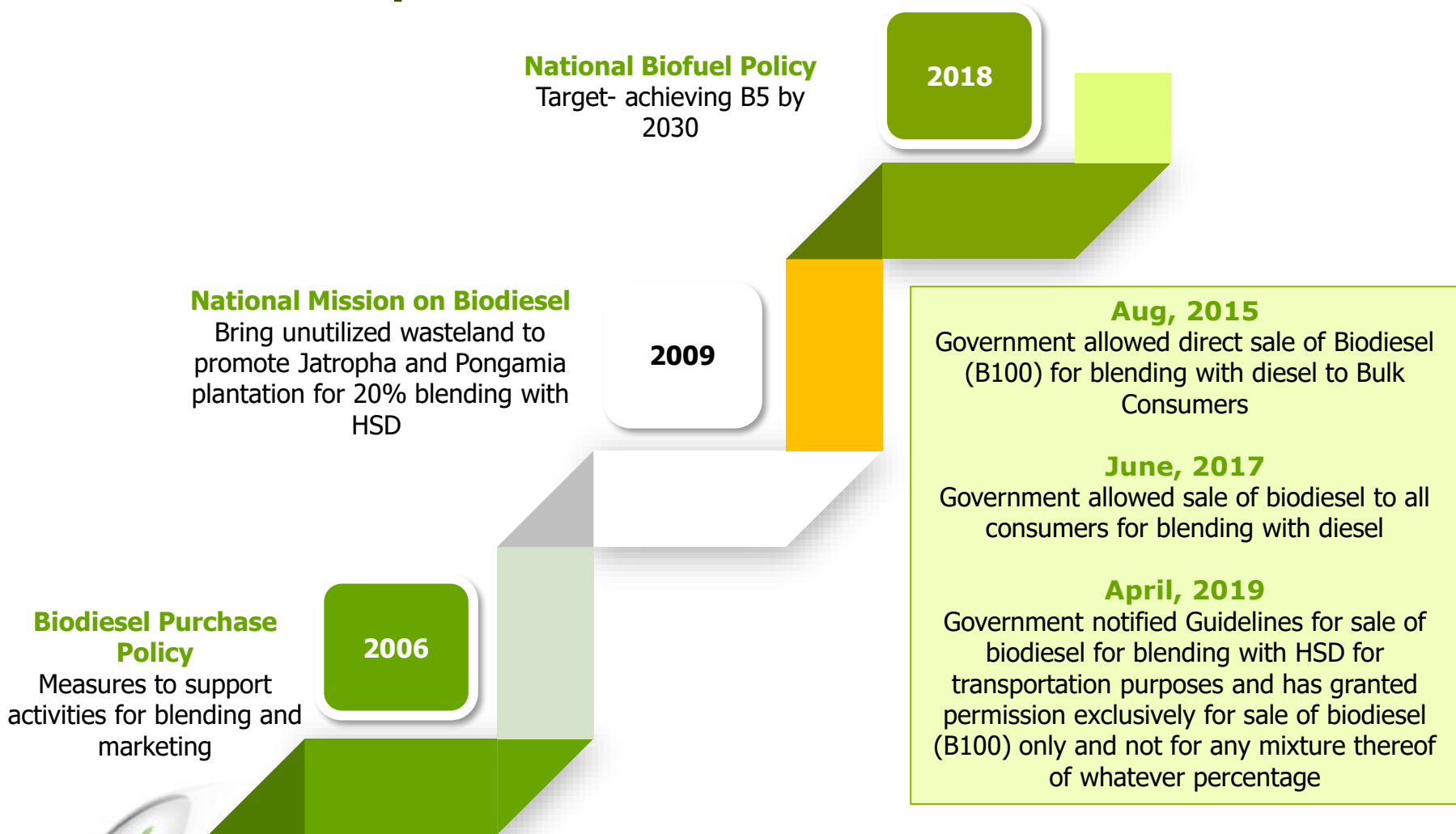
Transportation tanks



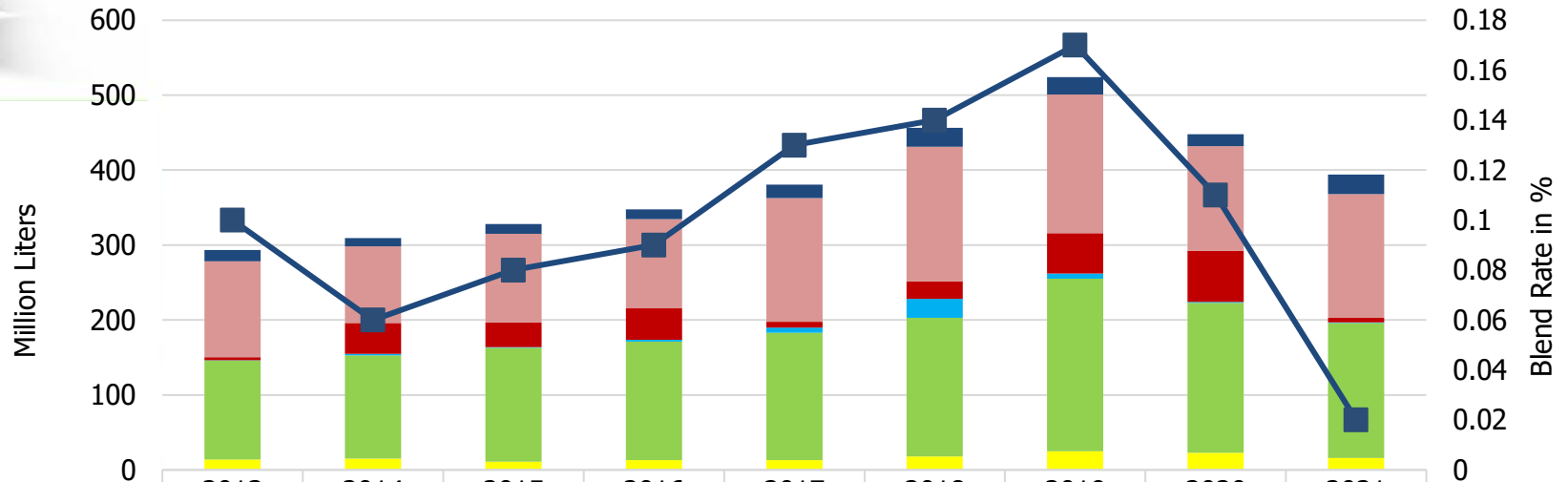
Mild steel tanks

- Only approved tanks are recommended
- Possible to store bio-diesel for an extended period of time in closed containers
- Biodiesel can become jelly at low temperatures
- Bacteria can grow and use bio-diesel as food in case of water condensation inside the tank
- Biodiesel blends tend to have more stability when compared to its neat nature (B100)

Biodiesel related policies in India



Biodiesel Market Trends in India



	2013	2014	2015	2016	2017	2018	2019	2020	2021
Ending Stocks	15	11	13	13	18	25	23	16	26
Consumption	128	102	118	119	165	180	185	140	165
Exports	3.9	41.5	33.1	41.7	7.6	23.1	54	68	6
Imports	0.3	1.7	0.8	2.7	7.1	25.2	7	1	1
Production	132	138	152	158	170	185	230	200	180
Beginning Stocks	14	15	11	13	13	18	25	23	16
Blend Rate (%)	0.1	0.06	0.08	0.09	0.13	0.14	0.17	0.11	0.02

Source: (USDA, 2022)

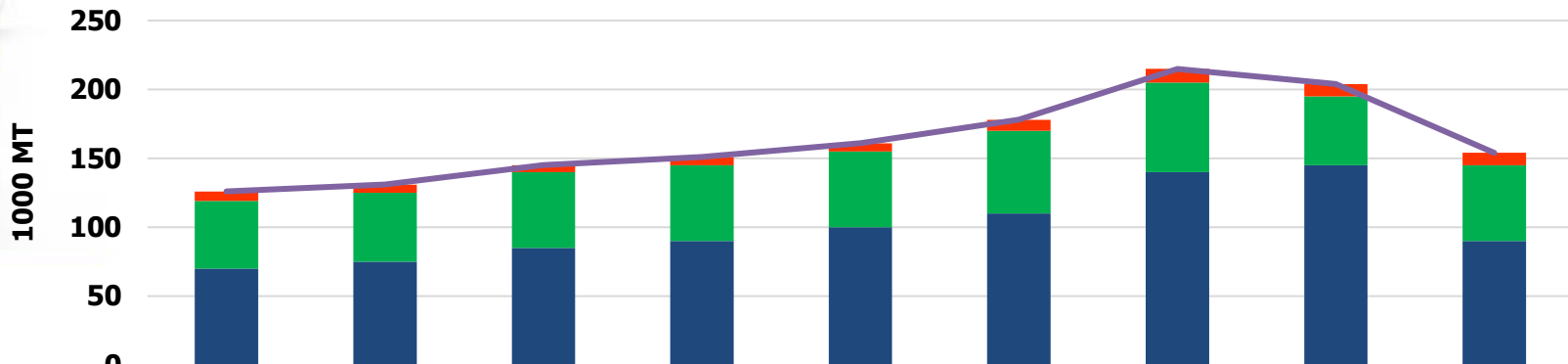
Blend rates is linked with Production

Covid impact

Production and Consumption increasing gradually



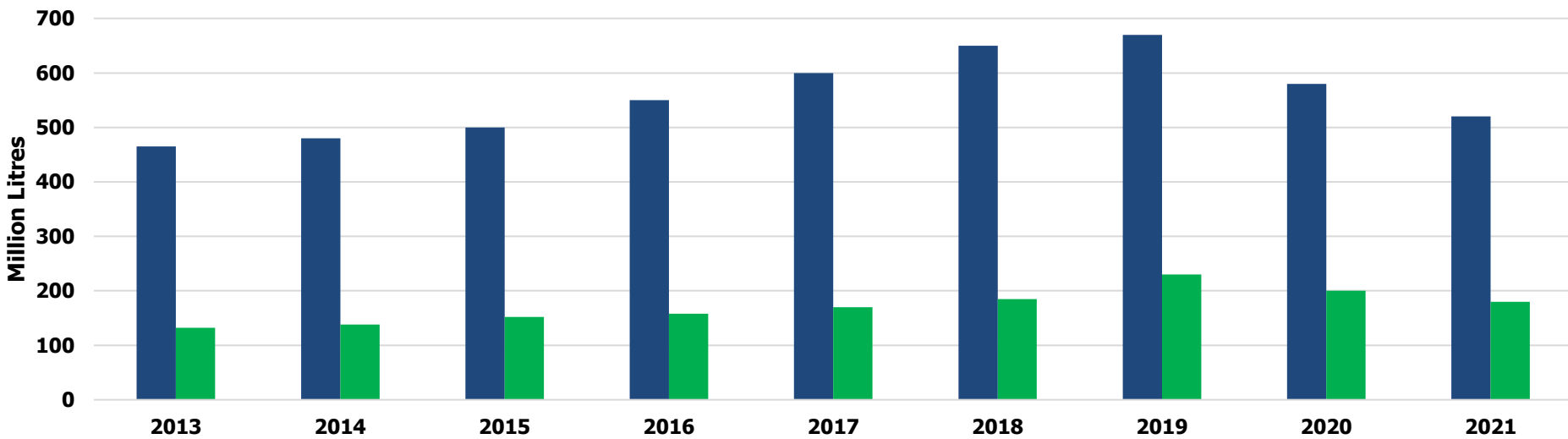
India Biodiesel Production from Multiple Feedstocks



	2013	2014	2015	2016	2017	2018	2019	2020	2021
Animal Fats & Tallow	7	6	5	6	6	8	10	9	9
Used Cooking Oil	49	50	55	55	55	60	65	50	55
Non-edible Industrial	70	75	85	90	100	110	140	145	90
Total	126	131	145	151	161	178	215	204	154

■ Non-edible Industrial
 ■ Used Cooking Oil
 ■ Animal Fats & Tallow
 — Total
 Source: (USDA, 2022)

Nameplate Capacity vs Actual Production of Biodiesel



■ Nameplate capacity
 ■ Production
 Source: (USDA, 2022) and Statista



Biodiesel's underperformance in the country due to...

Limited availability of feedstock

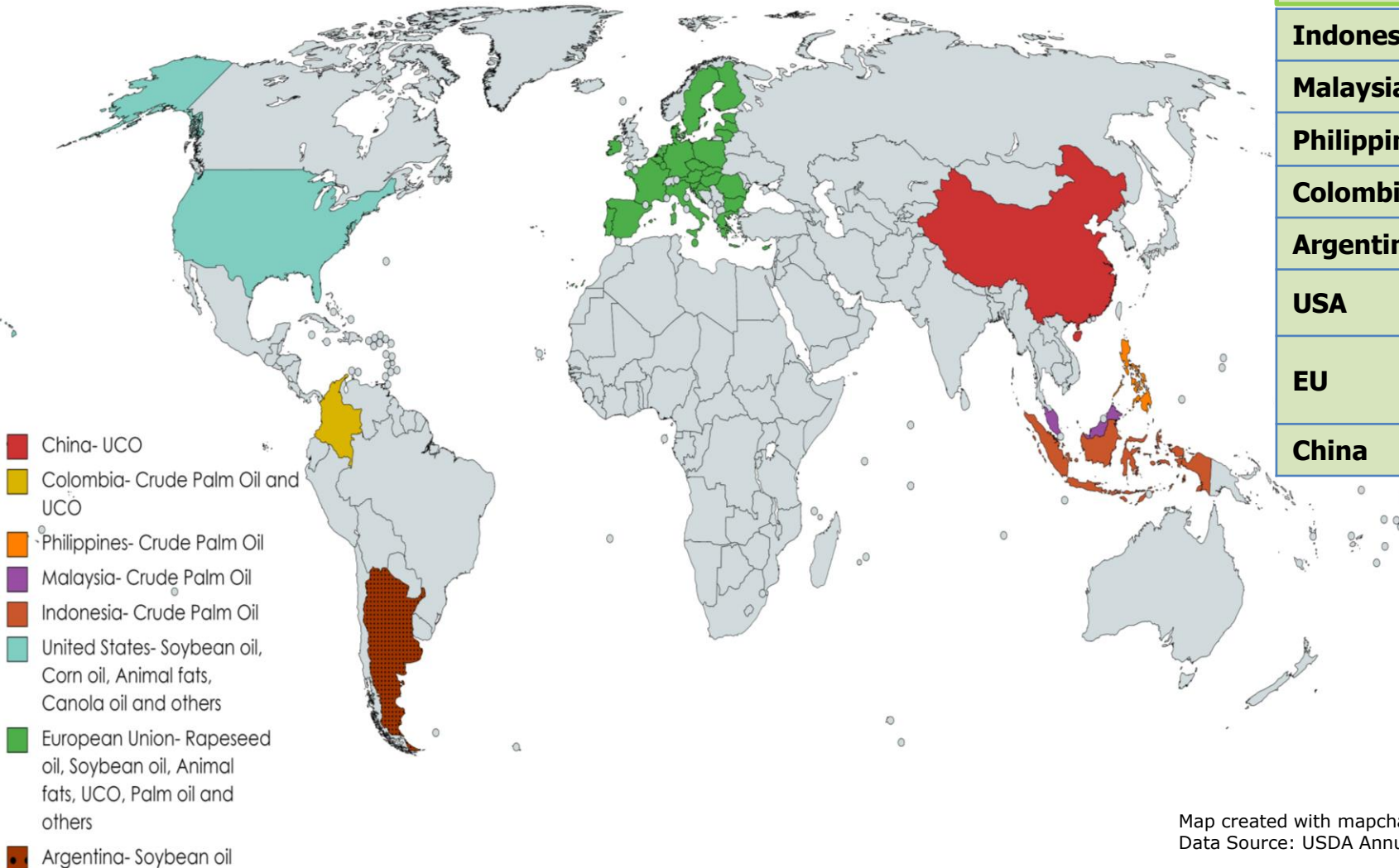
Lack of an integrated and dedicated supply chain

Dependence on imported feedstock



International Cases

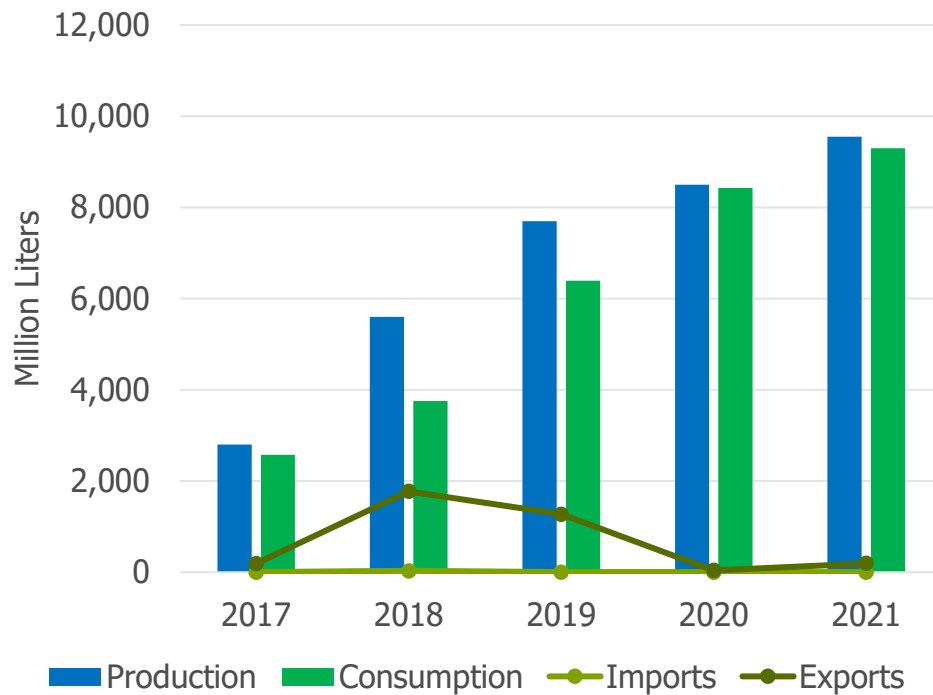
Countries with type-wise feedstock for Biodiesel production



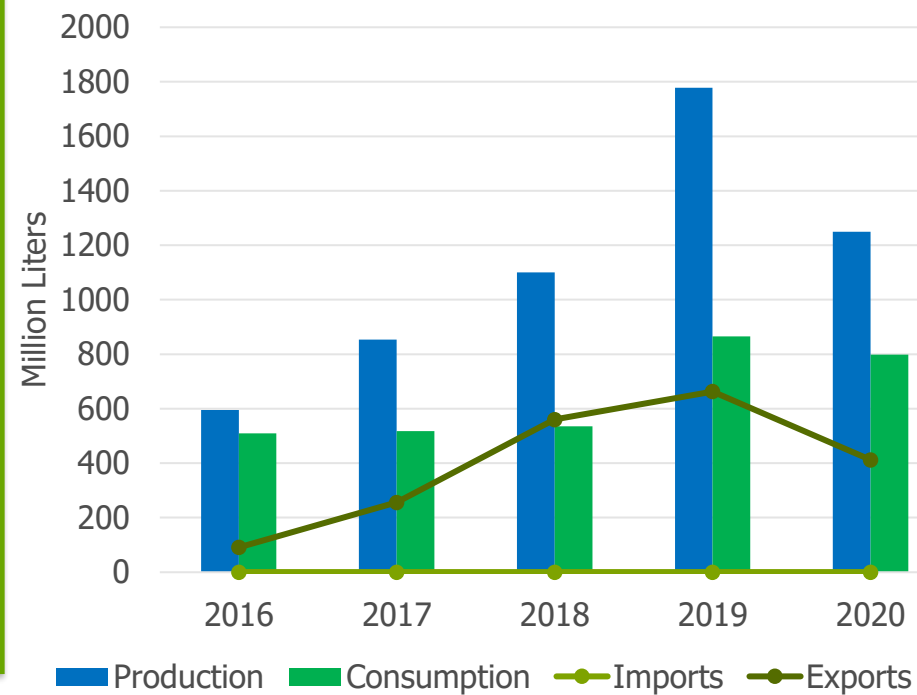
Current Blend rates	
Indonesia	28.6%
Malaysia	10%
Philippines	3%
Colombia	11%
Argentina	5%
USA	6%
EU	7-8%
China	0.2%

Map created with mapchart.net
Data Source: USDA Annual Biofuel Reports

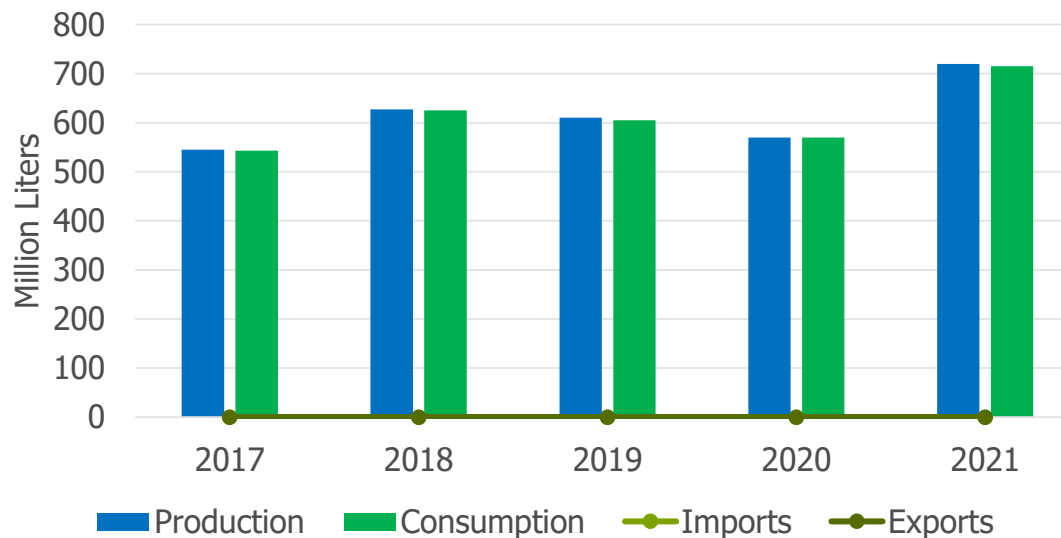
Biodiesel market in Indonesia



Biodiesel market in Malaysia



Biodiesel market in Argentina



Discussion Points



Biodiesel blending targets/mandates

- Major challenges in achieving B5 target
- Why are we witnessing a low blend rate in India?
- Does the target seem too ambitious based on the current infrastructure?
- Challenges regarding technical issues and modifications in the automobile sector with higher biodiesel blend



Feedstocks availability production and land-use change

- Current requirements of the industry that would increase the production and use of biodiesel in India
- What are the other rapid growing feedstock options?
- What will be the impact of this high demand for feedstock cultivation on land use?
- Advance technology in the field of biodiesel like handling multiple feedstock



Costing, Pricing and Sourcing

- On what factors does the production cost of biodiesel depends?
- Using different feedstocks, how are biodiesel prices determined?
- How will dynamic pricing benefit this industry?
 - Price determining mechanism to ensure flow of UCO from organized players in the service industry to biodiesel manufacturers
 - How can biodiesel production be made more affordable?



Role of Governments and Institutes in promoting biodiesel production

- What are the inputs and supports does the sector requires in terms of policy-push, regulations, tax benefits, import/export, etc.?
- What could be done to promote optimal door-to-door waste oil collection?
- How can the production-level be promoted and enhanced with the local support (task-force, farmer committee, etc.)?
- Is there a need of a National-level feedstock Programme to support optimum production?



Thank you

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