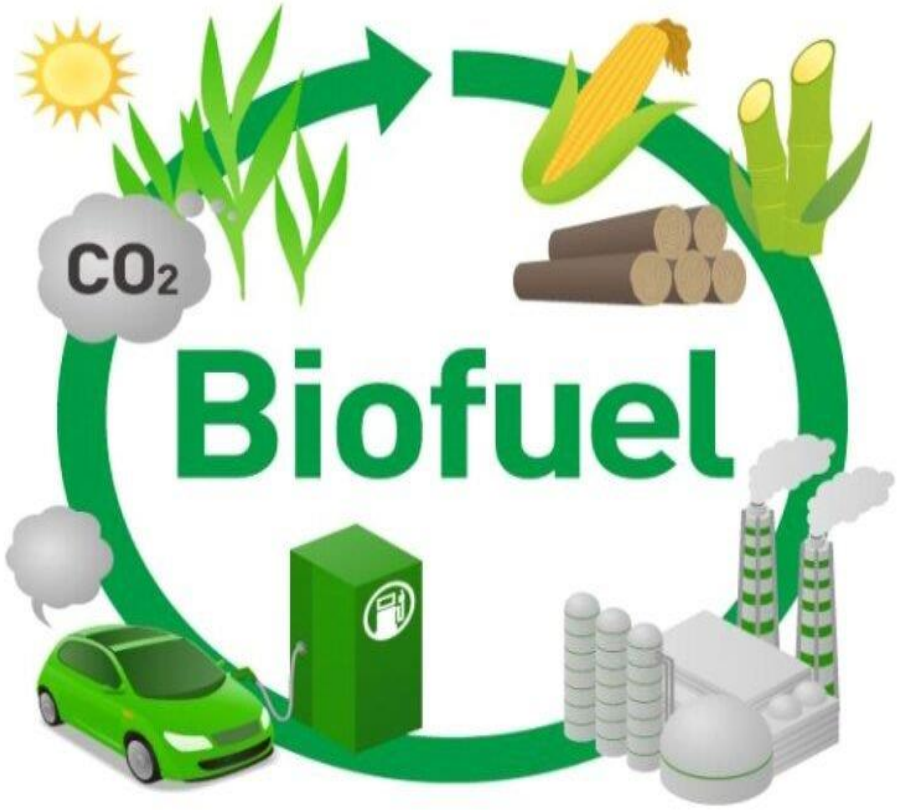
Dalmia
Bharat Sugar

RENEWABLE ENERGY RESOURCES

INTRODUCTION



1st Generation:
Grains or Sugar

2nd Generation:
Cellulose, lignin & Hemicellulose

Third Generation:
Algae & Microbe

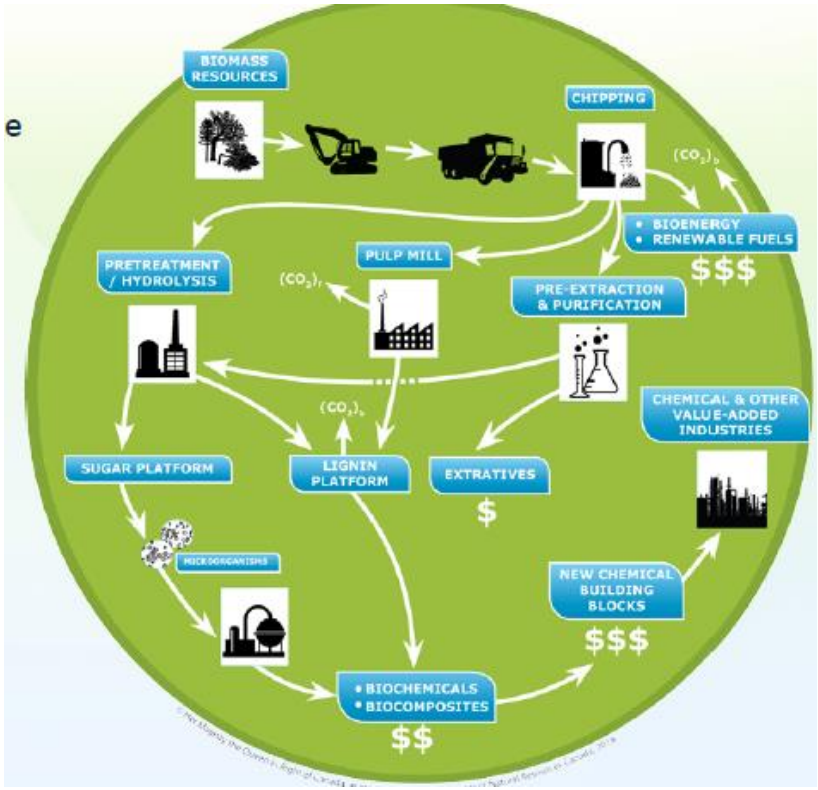
BIOREFINERY: FROM A CONCEPT TO A REALITY

Agri biomass has been used to supply useful services in the form of materials and energy since ancient times and the **forest industry of today** has developed into a **complex industry**

Biorefinery is an integrated industrial **bio complex** utilizing **all biomass assortments** to produce **multiple bioproducts** *(i.e. biochemicals, biomaterials, bioenergy and renewable crudes and drop-in fuels)*

Biorefineries should be seen in the light of a number of driving forces induced by the challenges to:

- **Mitigate climate change** by reducing fossil CO^2emission;
- **Reduce the dependence** on fossil sources such as petroleum;
- **Adjust to changes in the markets** for raw materials and traditional products



TRANSITION TOWARD A GROWING BIO ECONOMY: CRITICAL QUESTIONS

- **Sustainable Conversion:**

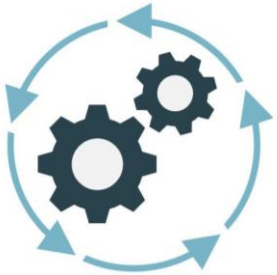
How to convert forest-based resources into value-added products using multiple biorefinery options and efficient biomass supply chains.

- **Challenges for New Biorefinery Pathways:**

Access to biomass, feedstock prices, process efficiencies, and integration with existing facilities.
Energy and bioproduct prices, market volatility, and regulatory changes.

- **Integration with Existing Setup :**

Benefits and technical impacts of integrating biorefinery technology.
Scenarios for economic and environmental viability.



BIOREFINERY: VARIOUS BIOENERGY PATHWAYS

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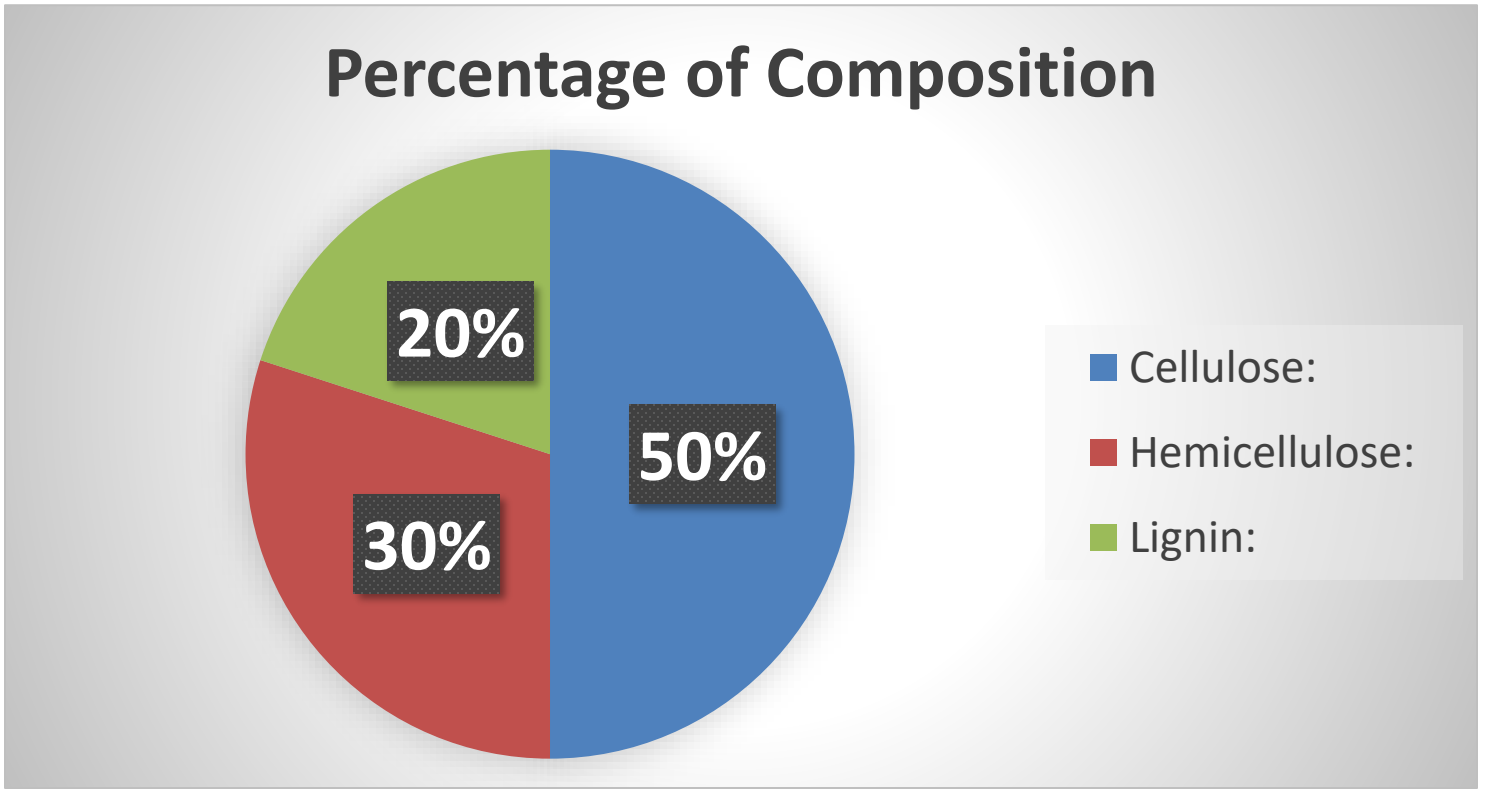
FEEDSTOCK	PRODUCTION PROCESS	PRODUCT
Sugar & Starch Crops	Transesterification	Biodiesel
Biomass from waste	Fermentation	Bioethanol
Lignocellulosic biomass from agriculture, bagasse	Pellestation	Renewable diesel
	Anerobic Digestion	Biogas
	Advance biofuel process	Pyrolysis oil
	Gasification	

END PRODUCT

COMPOSITION OF BAGASSE



- ✓ **Hemicellulose is worth more as ethanol than as energy**
- ✓ **Lignin is worth more as ethanol (syngas) than as energy from direct combustion**
- ✓ **Cellulose is worth more as pulp than as ethanol**

BIOREFINERY REVENUE STREAM

Bagasse

Cellulose

Lignin

Hemicellulose

Fermentation

Gasification

Fermentable Sugars

Fermentation

CELLULOSE TO ETHANOL AN OVERVIEW

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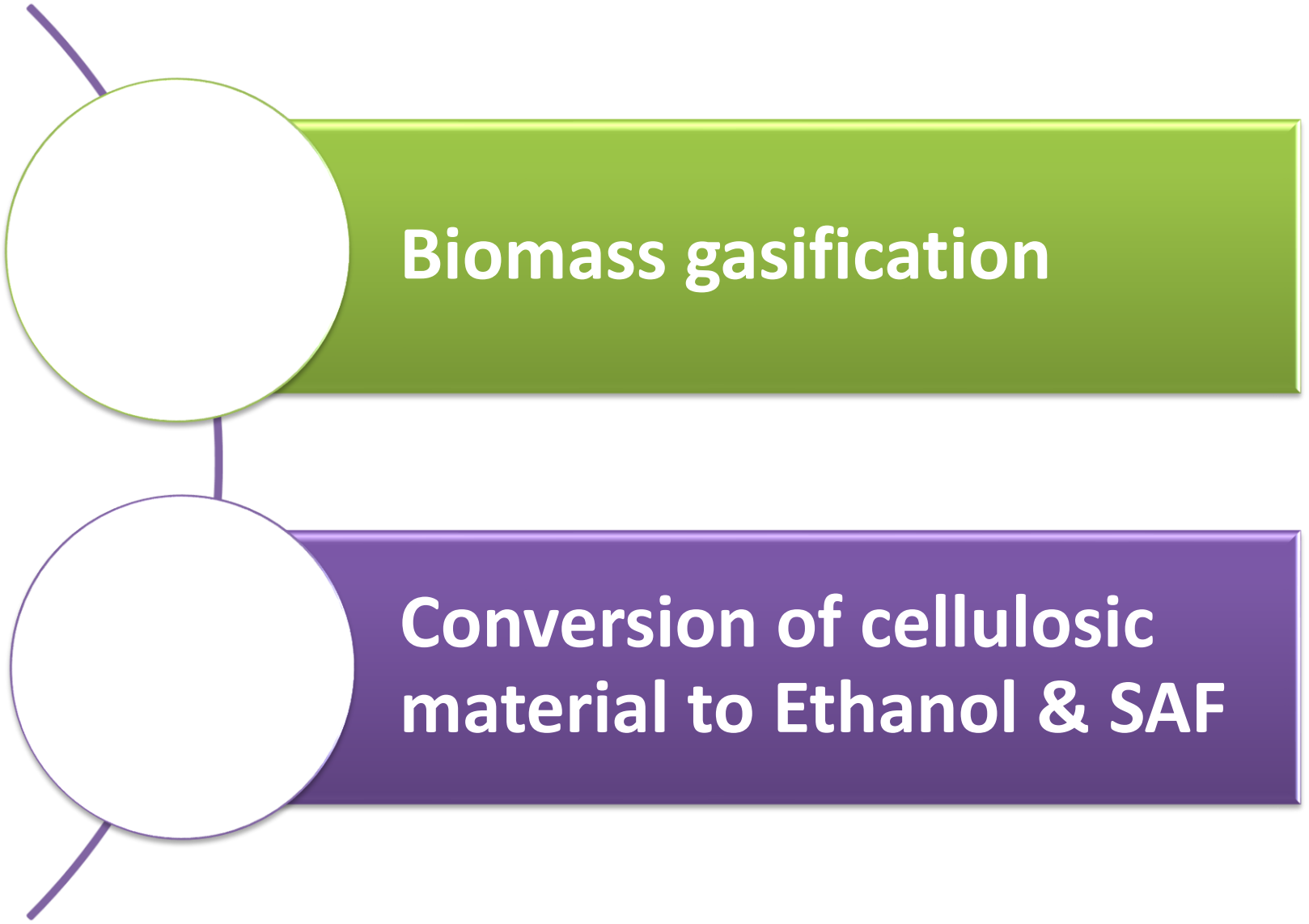
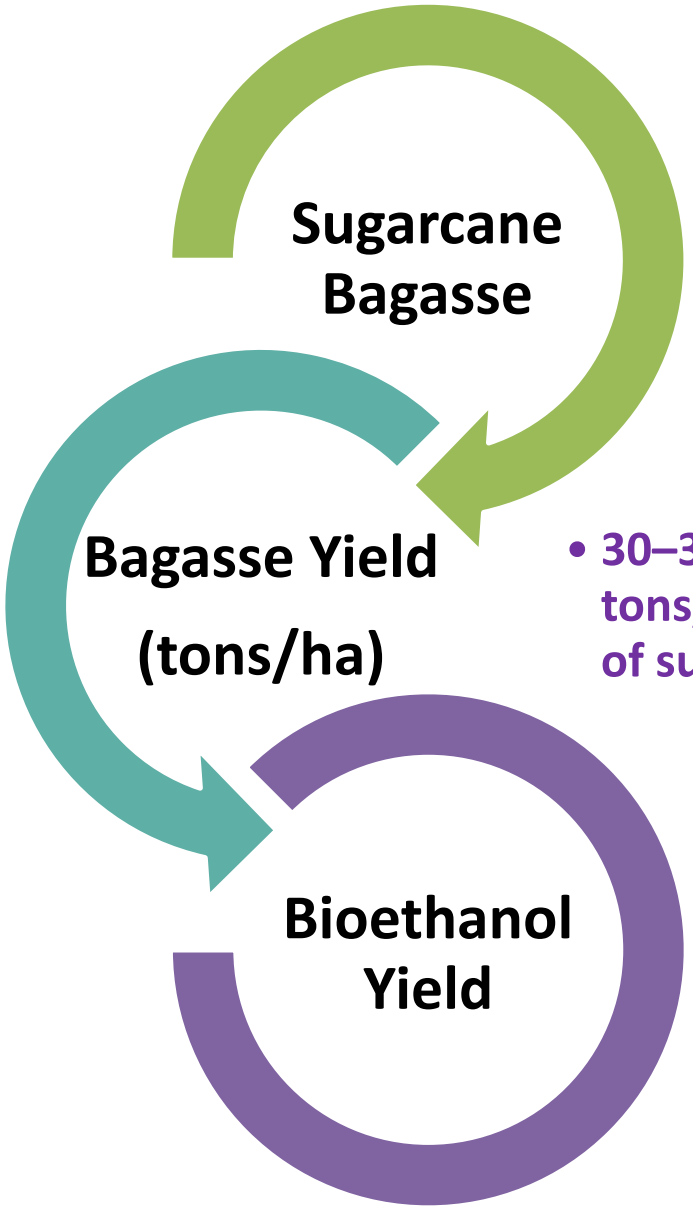


BIOETHANOL PRODUCTION

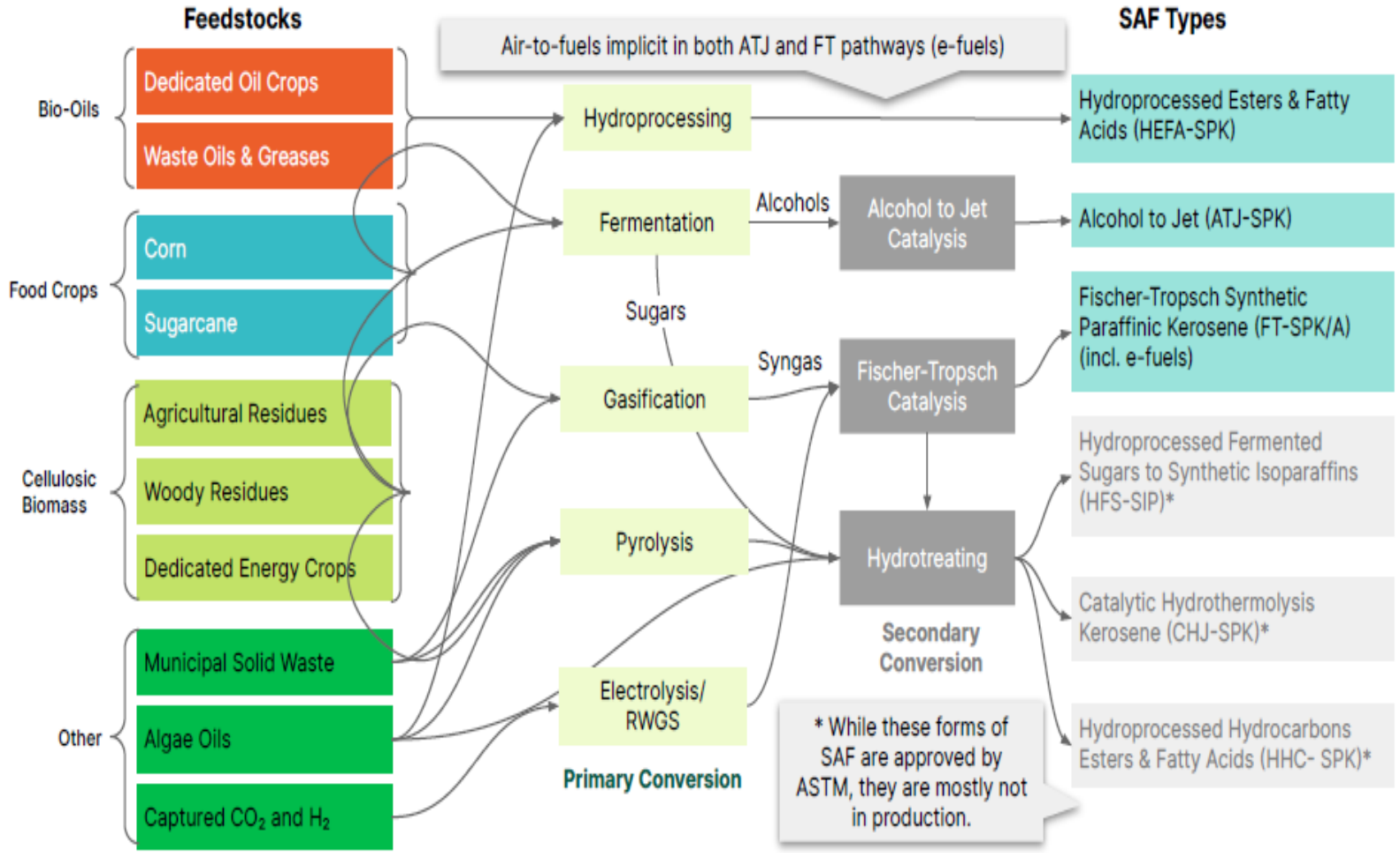


- Cellulose - 40–45 %
- Hemicellulose 30–35 %
- Lignin 20–30 %

- 30–34 tons/100 tons of sugarcane

- 170 liter./MT of bagasse

PATHWAYS BIOMASS TO SAF

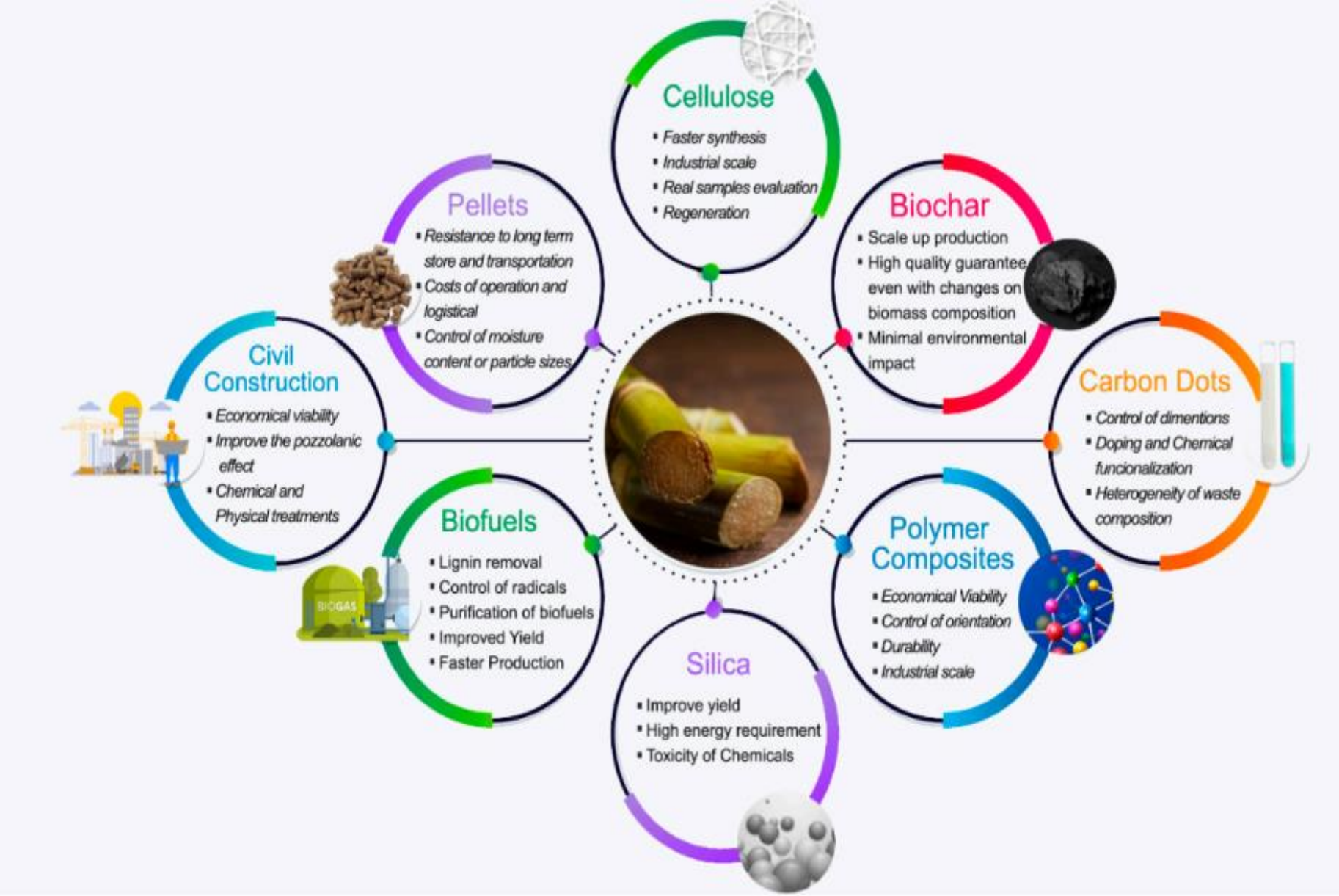


BIOMASS TO SAF - TECHONOLGY READINESS

SAF Types	Technology Readiness
Hydro processed Esters & Fatty Acids (HEFA-SPK)	7–9 (high)
Alcohol to Jet (ATJ-SPK)	6–8 (medium-high)
Fischer-Tropsch Synthetic Paraffinic Kerosene (FT-SPK/A) (includes e-fuels)	6–8 (medium-high)
Hydro processed Fermented Sugars to Synthetic Iso paraffins (HFS-SIP)	4–5 (lower-medium)
Catalytic Hydro thermolysis Kerosene (CHJ-SPK)	5–6 (lower-medium)
Hydro processed Hydrocarbons Esters & Fatty Acids (HHC- SPK)	4–5 (lower-medium)

ECONOMIC CHALLENGES

POTENTIAL


Cellulose
Faster synthesis
Industrial scale
Real samples evaluation
Regeneration
Pellets
Resistance to long term store and transportation
Costs of operation and logistical
Control of moisture content or particle sizes
Biochar
Scale up production
High quality guarantee even with changes on biomass composition
Minimal environmental impact
Civil Construction
Economical viability
Improve the pozzolanic effect
Chemical and Physical treatments
Carbon Dots
Control of dimentions
Doping and Chemical funcionalization
Heterogeneity of waste composition
Biofuels
Lignin removal
Control of radicals
Purification of biofuels
Improved Yield
Faster Production
BIOGAS
Polymer Composites
Economical Viability
Control of orientation
Durability
Industrial scale
Silica
Improve yield
High energy requirement
Toxicity of Chemicals

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THANK YOU