# Biomass conversion via thermochemical route

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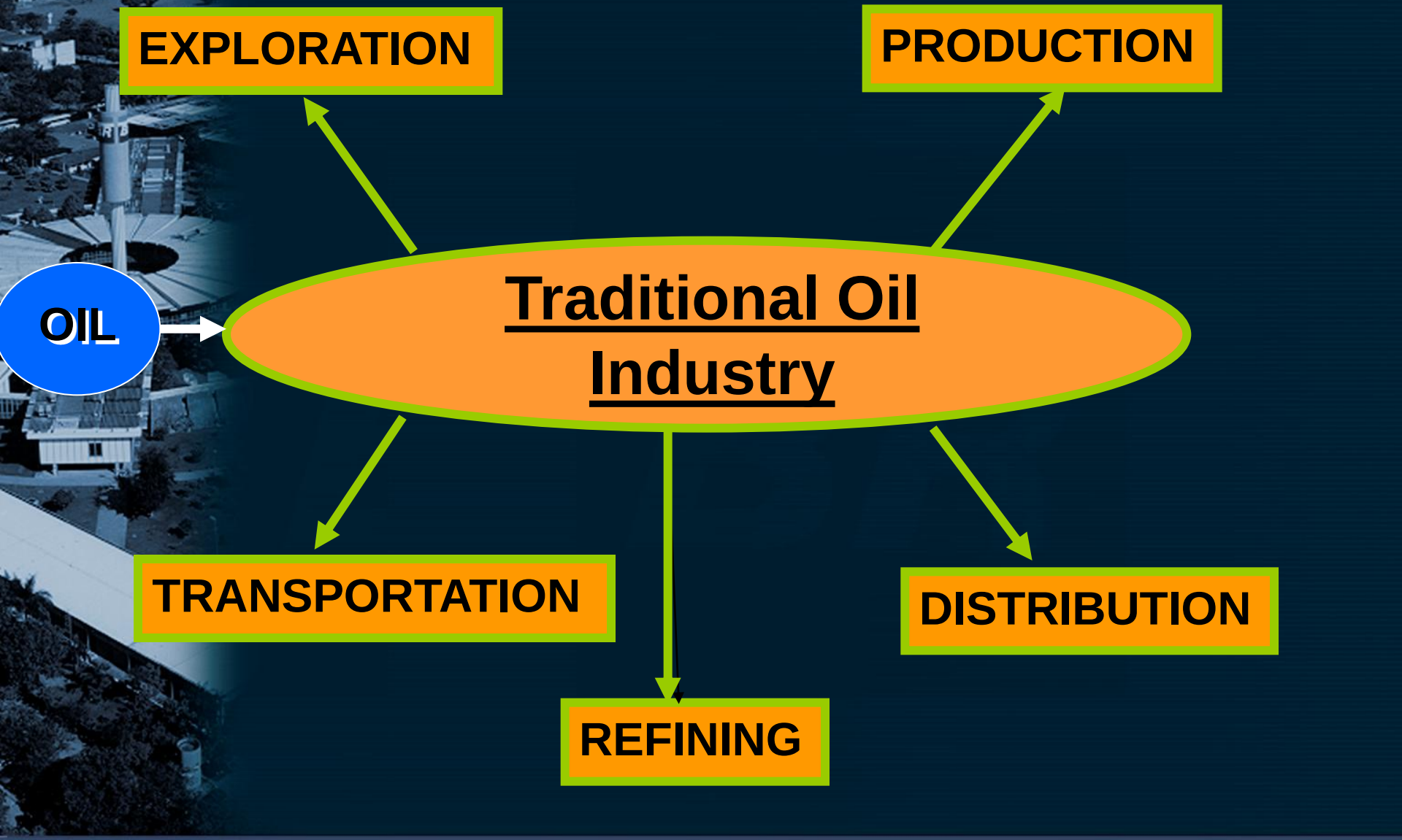
## The main segments of the Traditional Oil Industry



# Introduction

The survival of the oil industry will depend on many factors . Indeed, the refiner of the future will have to face multiple challenges.

# Introduction

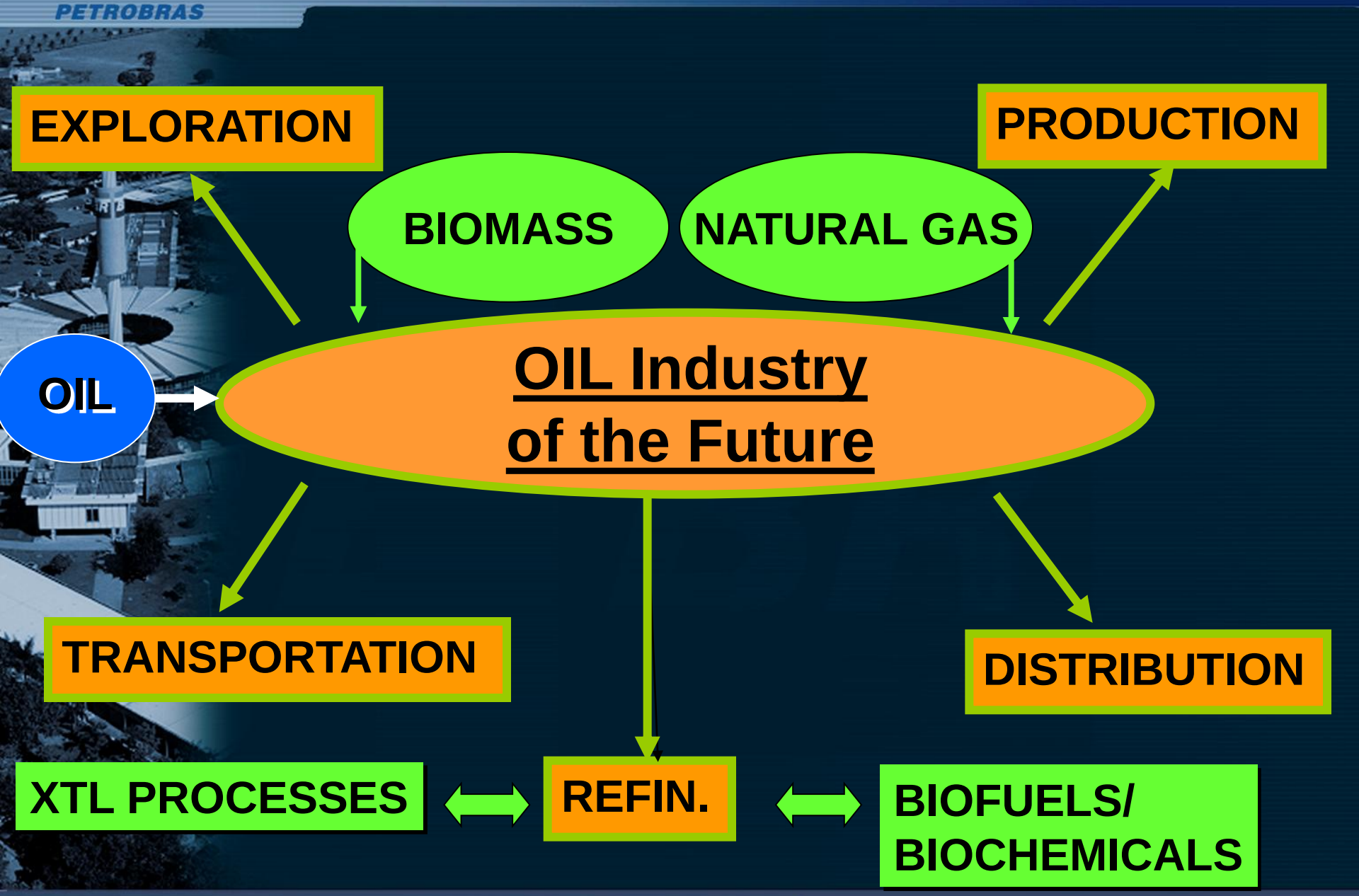
The main challenges of the refinining industry in the future are the following:

- ✓Increasing stringent environmental regulation
- ✓Growing demand for cleaner fuels
- ✓Globalisation
- ✓Increase in the production of derivatives from declining quality oil
- ✓Uncertainty about the consumer's choice
- ✓ Growing pressure of several segments of the society aiming at the reduction of GHG
- ✓ Maintenance of its profitability
- ✓ Search for alternative raw materials such as biomass and coal

# Introduction

**The refinery must search for intelligent alternative solutions to meet all those requirements.**

**Therefore, the search for alternative feedstock such as biomass has become a must in order to cope with more stringent regulations. Also, alternative refining routes such as synthetic fuels are striking back.**


EXPLORATION
PRODUCTION
BIOMASS
NATURAL GAS
OIL
OIL Industry of the Future
TRANSPORTATION
DISTRIBUTION
XTL PROCESSES
REFIN.
BIOFUELS/ BIOCHEMICALS

# Introduction

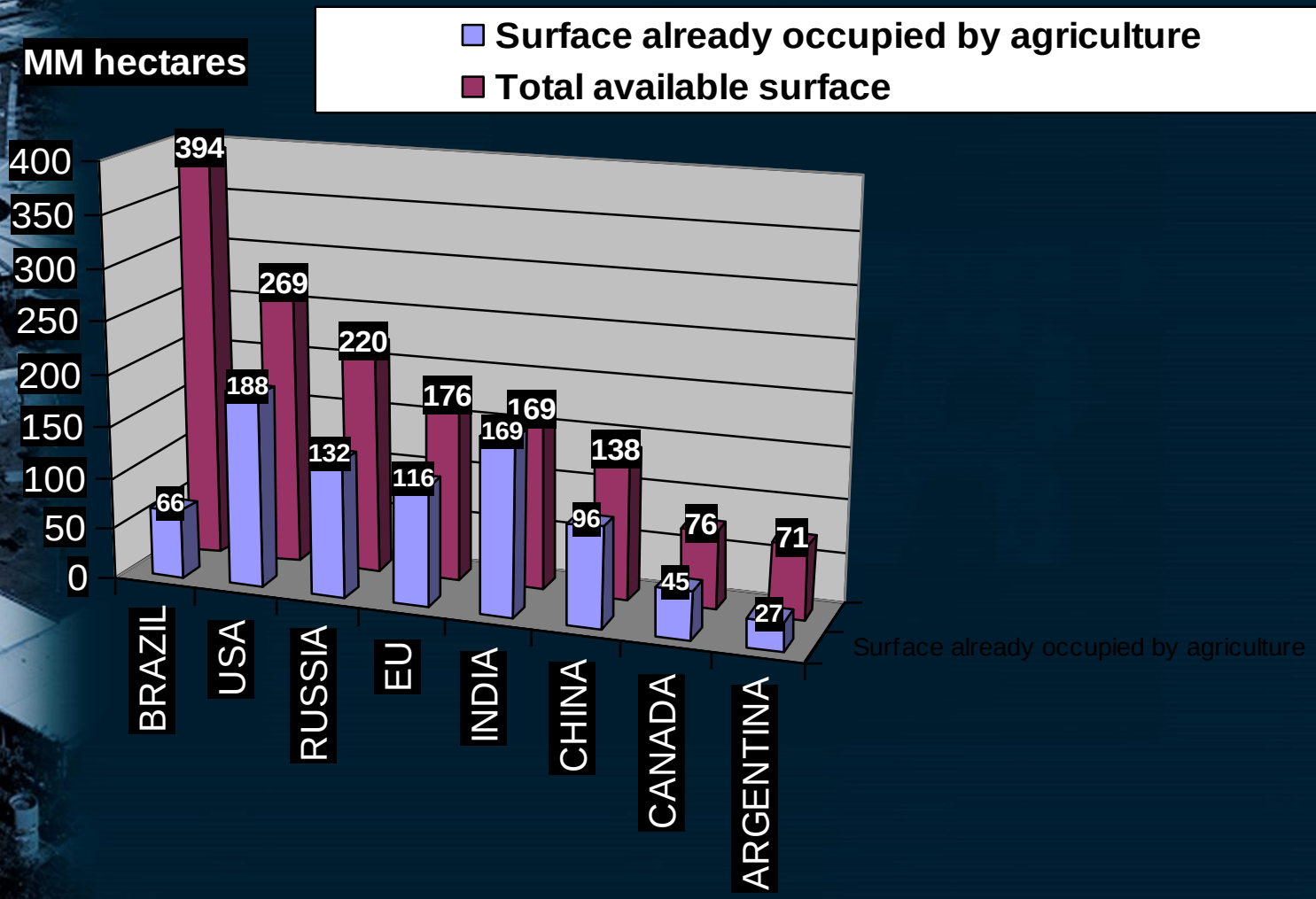
**Hence, the refining of the future will encompass the concept of BIOREFINERIES.**

**According to the 2008 Farm Act, the term means a facility (including equipment and processes) that converts renewable biomass into biofuels and biobased products, and may produce electricity.**
**www.ers.usda.gov/Briefing/bioenergy/glossary.htm**

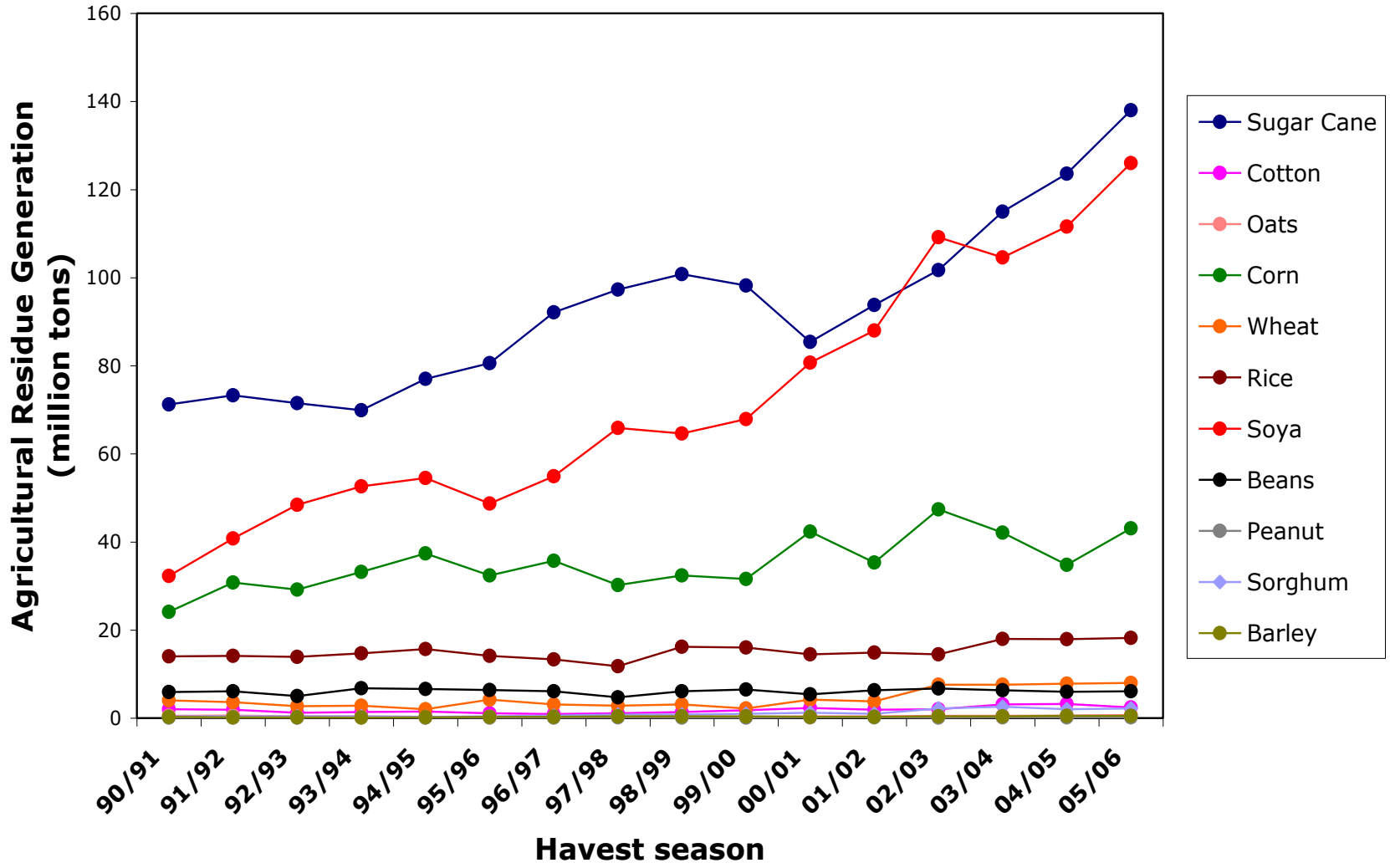
# Introduction

Regarding biomass, Brazil is undoubtedly one of the greatest world's biomass producer. Nevertheless, such agricultural production implies an enormous generation of residues

# Brazilian agribusiness: increasing opportunities due to low land occupancy

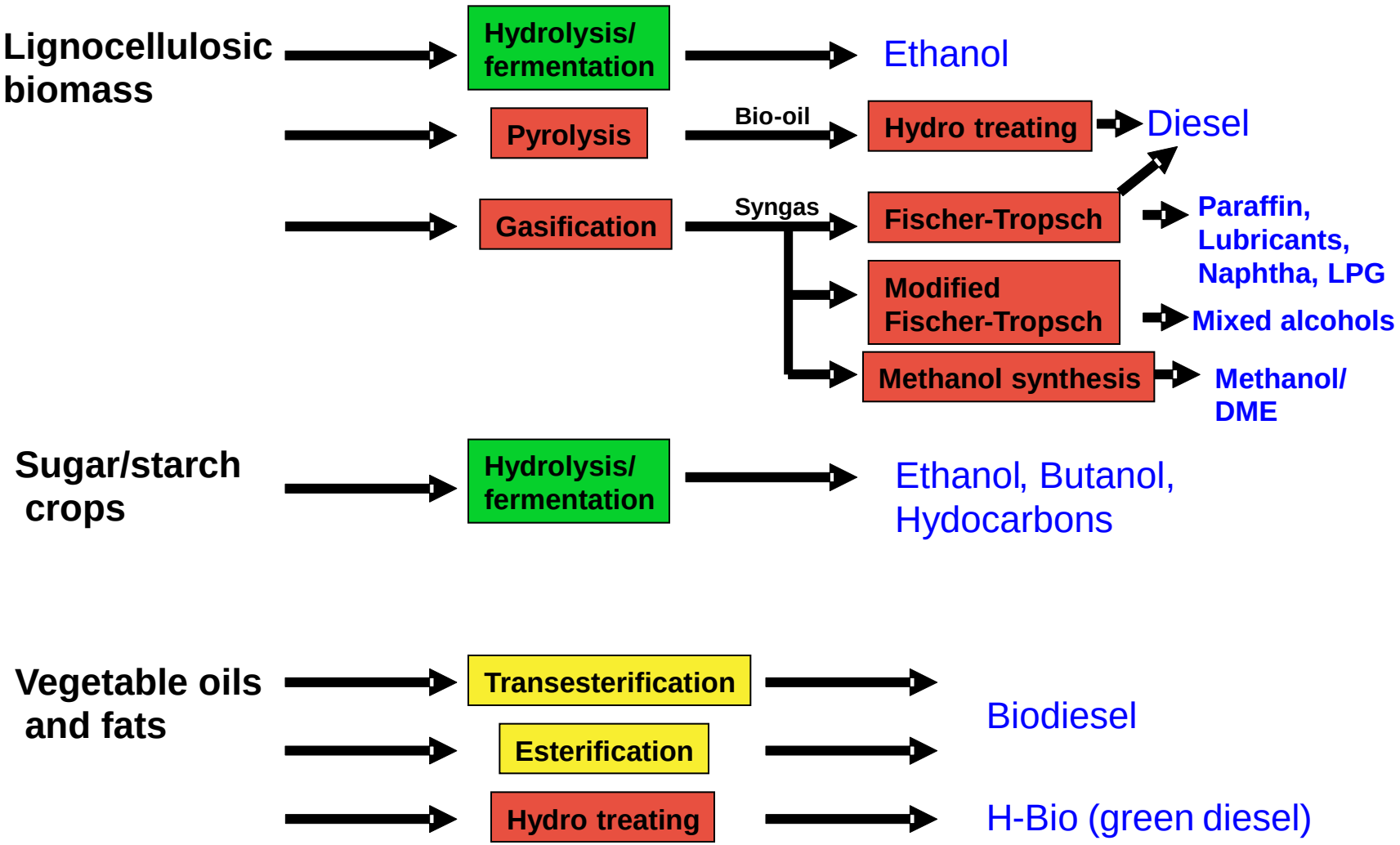


# Production of Residues from the Main National Cultures



# Introduction

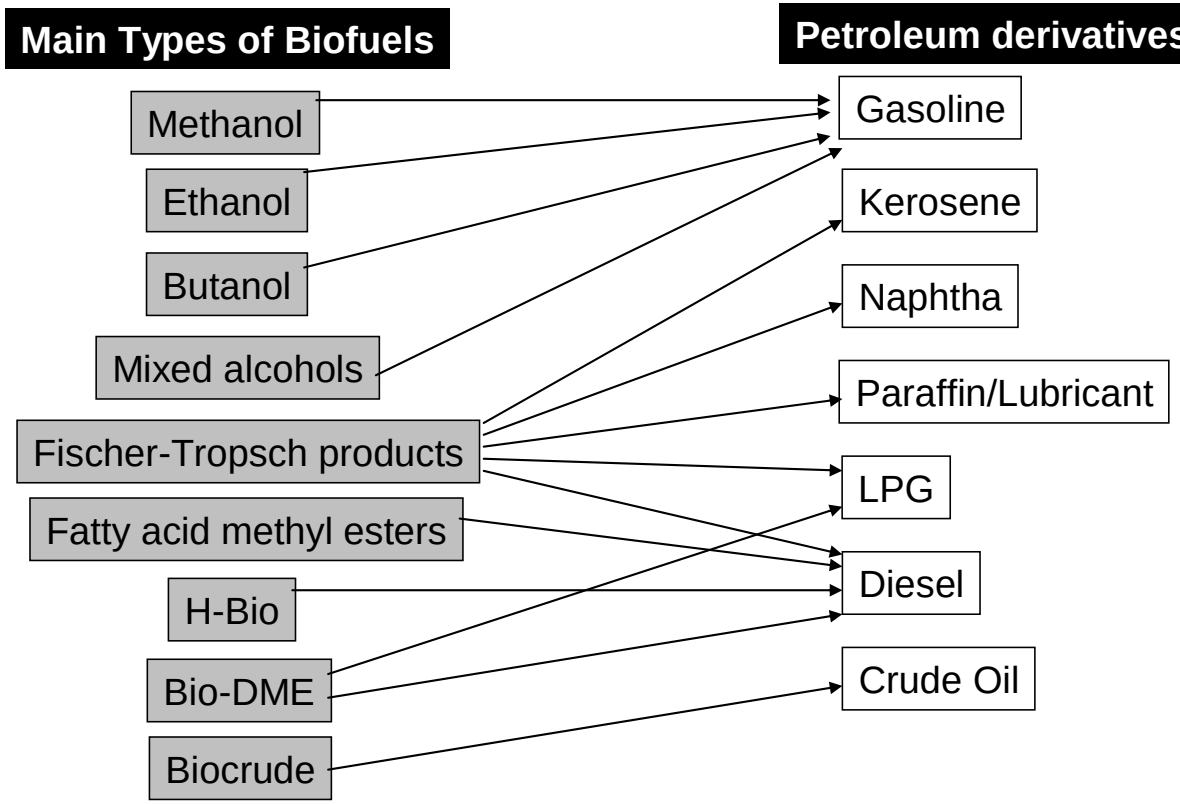
**Biomass conversion is surely the solution not only for the requirements of the refinery of the future, but also to solve the problem of agricultural residues.**

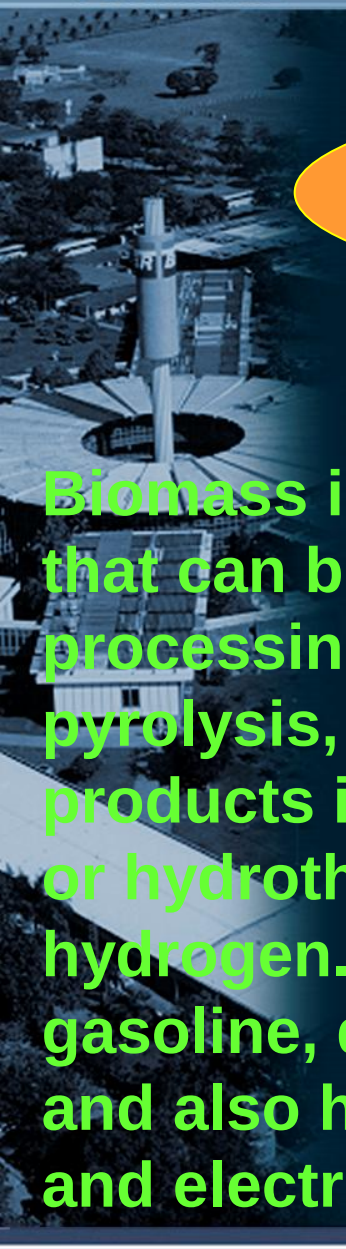

Biomass feedstock
Fuels/Chemicals
Lignocellulosic biomass
Hydrolysis/ fermentation
Ethanol
Pyrolysis
Bio-oil
Hydro treating
Diesel
Gasification
Syngas
Fischer-Tropsch
Paraffin, Lubricants, Naphtha, LPG
Modified Fischer-Tropsch
Mixed alcohols
Methanol synthesis
Methanol/ DME
Sugar/starch crops
Hydrolysis/ fermentation
Ethanol, Butanol, Hydocarbons
Vegetable oils and fats
Transesterification
Esterification
Hydro treating
Biodiesel
H-Bio (green diesel)

# Introduction

**Actually, biofuels and bio-based products may replace several fuels obtained via traditional oil refining.**

# Introduction

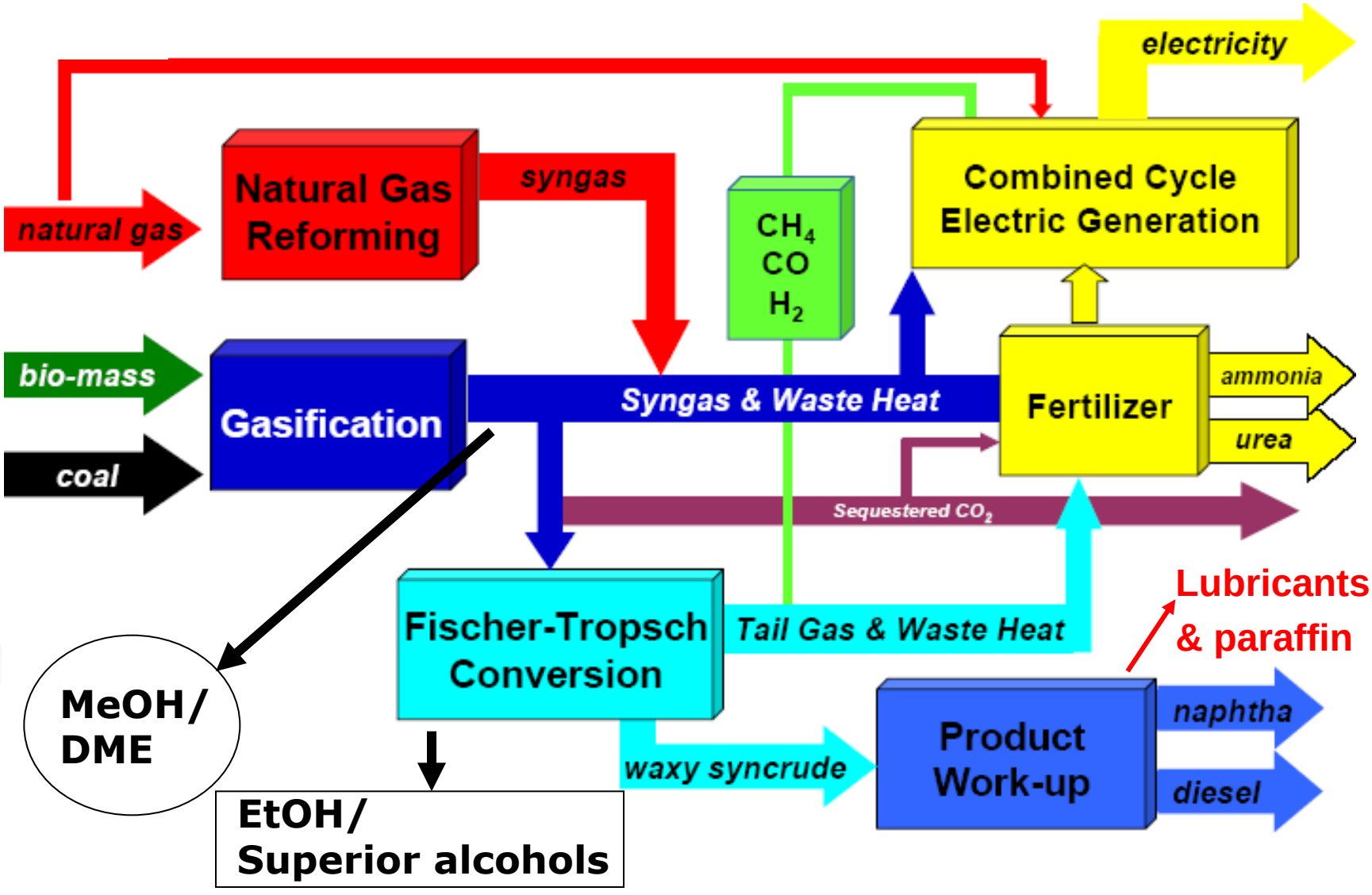




# Thermochemical route

Biomass is converted thermo-chemically into intermediates that can be used for fuels and chemical synthesis. The processing technologies can be categorized as gasification, pyrolysis, or hydrothermal processing. Intermediate products include clean syngas (CO + H2), bio-oil (pyrolysis or hydrothermal product), and gases rich in methane or hydrogen. These intermediates can further be converted into gasoline, diesel, alcohols, ethers, synthetic natural gas etc. and also high-purity hydrogen, which can be used as fuels and electric power generation.

# XTL (BTL, CTL, GTL) – the integrated concept

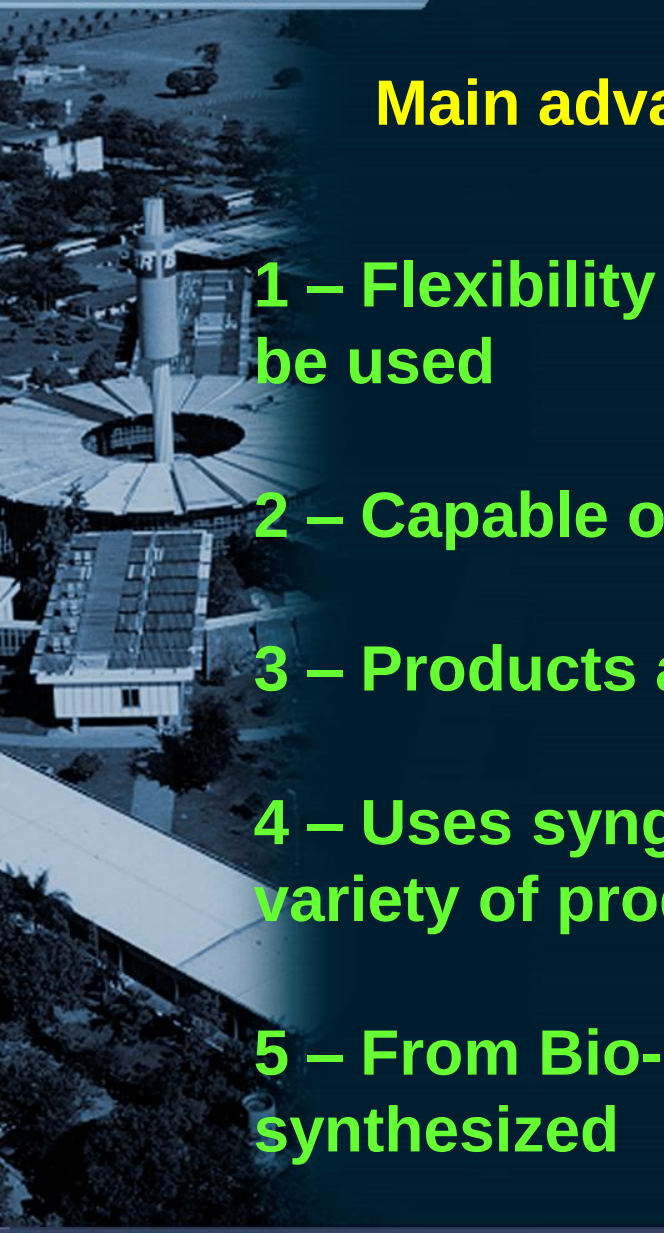


# Thermochemical route

## Main products that could be obtained via thermochemical route

1 – CO + H2 (syngas)
2 – Methanol
3 – Dimethyl ether
4 – Formic acid
5 – Naphtha
7 – Hydrogen
8 – Formaldehyde
9 – Traditional refining products
10 – Fine chemistry

# Thermochemical route



## Main advantages of the thermochemical route

1 – Flexibility – several types of raw materials could be used

2 – Capable of using residues

3 – Products are synthetic, hence clean

4 – Uses syngas as platform, hence an enormous variety of products could be synthesized

5 – From Bio-oil, fine chemicals could also be synthesized

# Thermochemical route

## Main drawbacks of the thermochemical route

1 – Rather expensive

2 – Gasification of biomass still requires improvement

3 – Catalysts are still a matter of secrecy

4 – Syngas for Fischer-Tropsch requires cleaning

5 – Most upgrade technologies are still under development ( pilot plant or demonstration plant)

Atom
Place yourself at our service
And instead of the fatal ashes
Instead of the unleashed infernos of your wrath
Instead of the menace of your terrible light
Deliver to us your amazing rebelliousness for our grain
Your unchained magnetism to found peace among men
And then your dazzling light will be happiness, not hell
Hope of morning, gift to earth…

**Ode to the atom**
**Pablo Neruda**