



PETROCHEMICAL INDUSTRY

Braskem 

## FORWARD-LOOKING STATEMENTS

This presentation includes forward-looking statements. These forward-looking statements are not solely historical data, but rather reflect the targets and expectations of Braskem's management. The terms "anticipate," "believe," "expect," "foresee," "intend," "plan," "estimate," "project," "aim" and similar terms are used to indicate forward-looking statements. Although we believe these forward-looking statements are based on reasonable assumptions, they are subject to various risks and uncertainties and are prepared using the information currently available to Braskem.

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## Introduction

Feedstocks

Ethylene-PE

Propylene-PP

Vinyls

Cyclical characteristic of the petrochemical industry

# Braskem is a petrochemical company with Basic Chemicals and Polymers operations

## Petrochemical Industry Overview

### EXTRACTION/ REFINING Oil/Gas



- Oil/Gas Production
- Oil Refining and Gas Processing
- Ethanol (Renewables)

### BASIC CHEMICALS



- Separation
- Conversion

### POLYMERS/ ELASTOMERS/FIBERS



- Polymerization

### CONVERSION

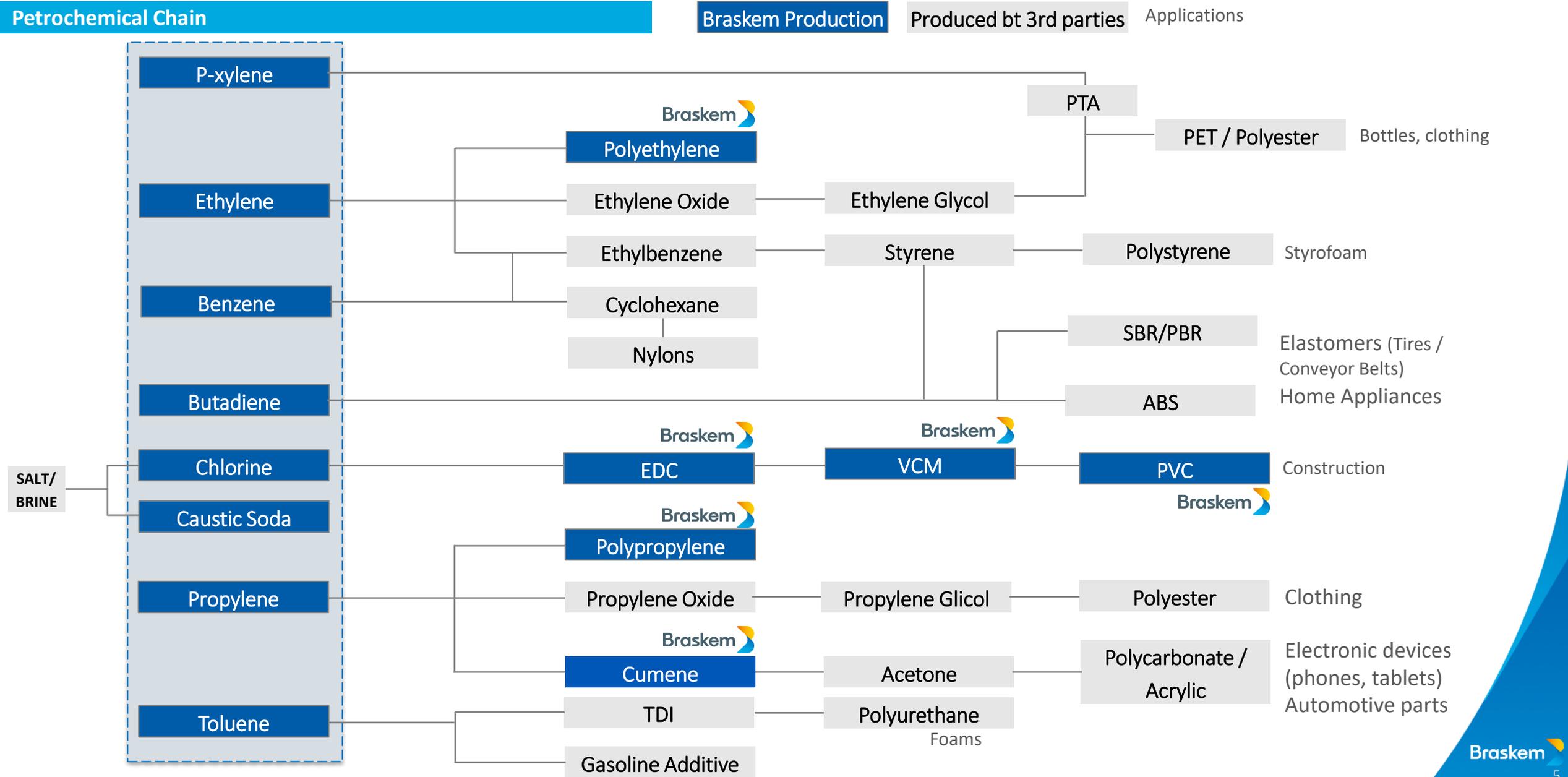


- Converters: Pellets to bags, film, bottles or fiber



**The petrochemical industry is based on molecules with carbon and hydrogen, which derived primarily from petroleum (crude oil) and gas**

# Ethylene and propylene are the most relevant basic chemicals for the petrochemical chain



# Agenda

Introduction

**Feedstocks**

Ethylene-PE

Propylene-PP

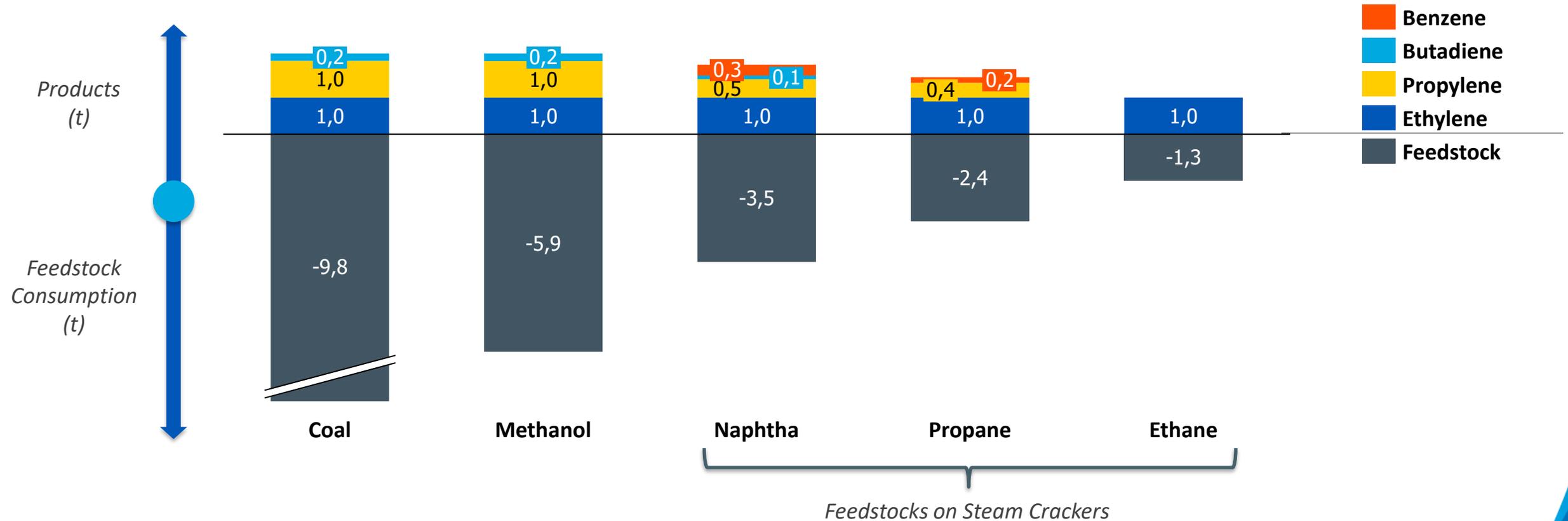
Vinyls

Cyclical characteristic of the petrochemical industry

# Each feedstock generates a different amount of co-products when cracked

## Feedstocks

### By-Products Yield when producing 1 unit of ethylene via several feedstocks



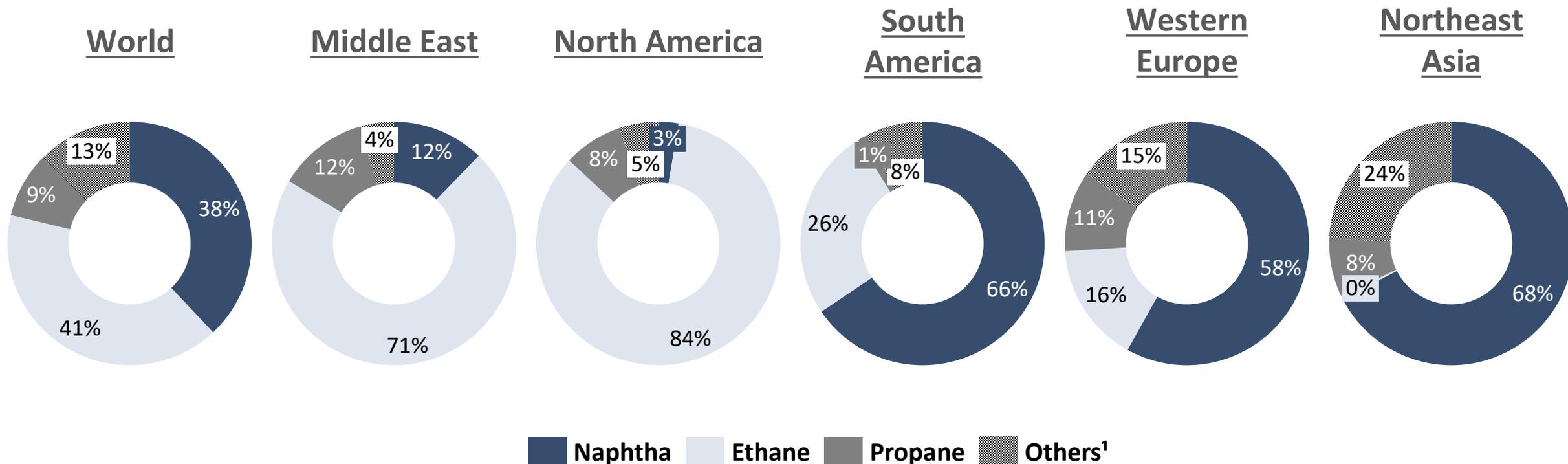
The composition of the products depends crucially on the feedstock used. Heavier feedstocks will produce more products than lighter feedstocks on steam crackers

# Feedstock profile for ethylene production changes according to the region

## Feedstocks

### Ethylene Production by Feedstocks

% - 2020e



**Middle East and North America are mostly ethane-based ethylene producers.  
In South America, Western Europe and Northeast Asia, most ethylene crackers are naphtha based.**

Source: External Consultants. Note (1): Butane, Diesel, Methanol for Olefins, Coal for Olefins and others.

# Feedstock pricing is given internationally and mainly impacted by changes in oil and natural gas prices

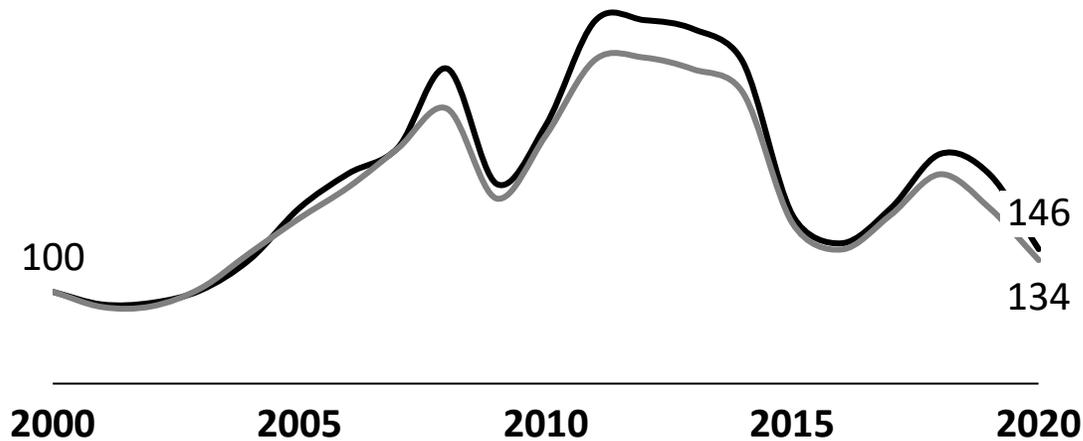
## Feedstocks

### Crude Oil (\$/bbl) and Naphtha (\$/ton)

Base 100 – 2000

International market is the price maker

— Brent — Naphtha ARA

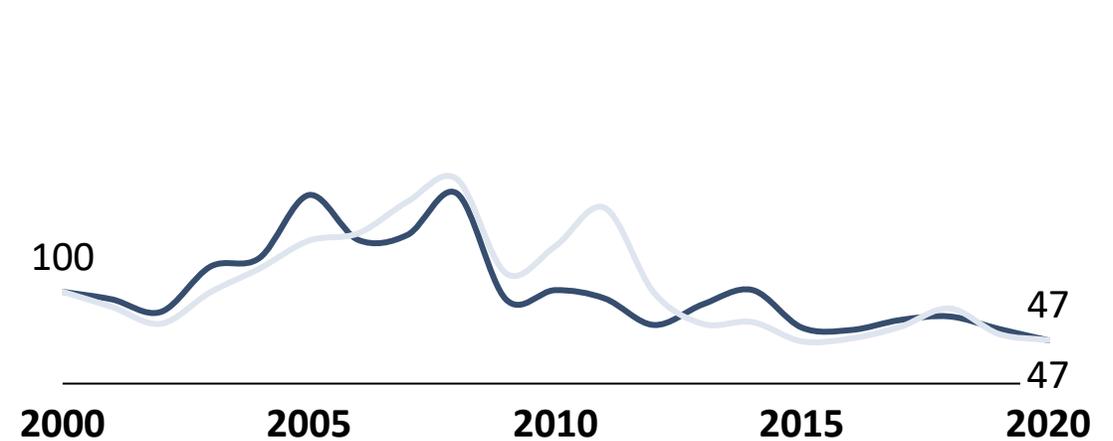


### Natural Gas (\$/MMBTU) e Ethane (\$/ton)

Base 100 – 2000

International market is the price maker

— Natural Gas — Ethane USG



Naphtha prices are highly correlated with crude oil prices, as the price of ethane follows natural gas fluctuations, yet sporadic detachments may occur, due to specific market conditions

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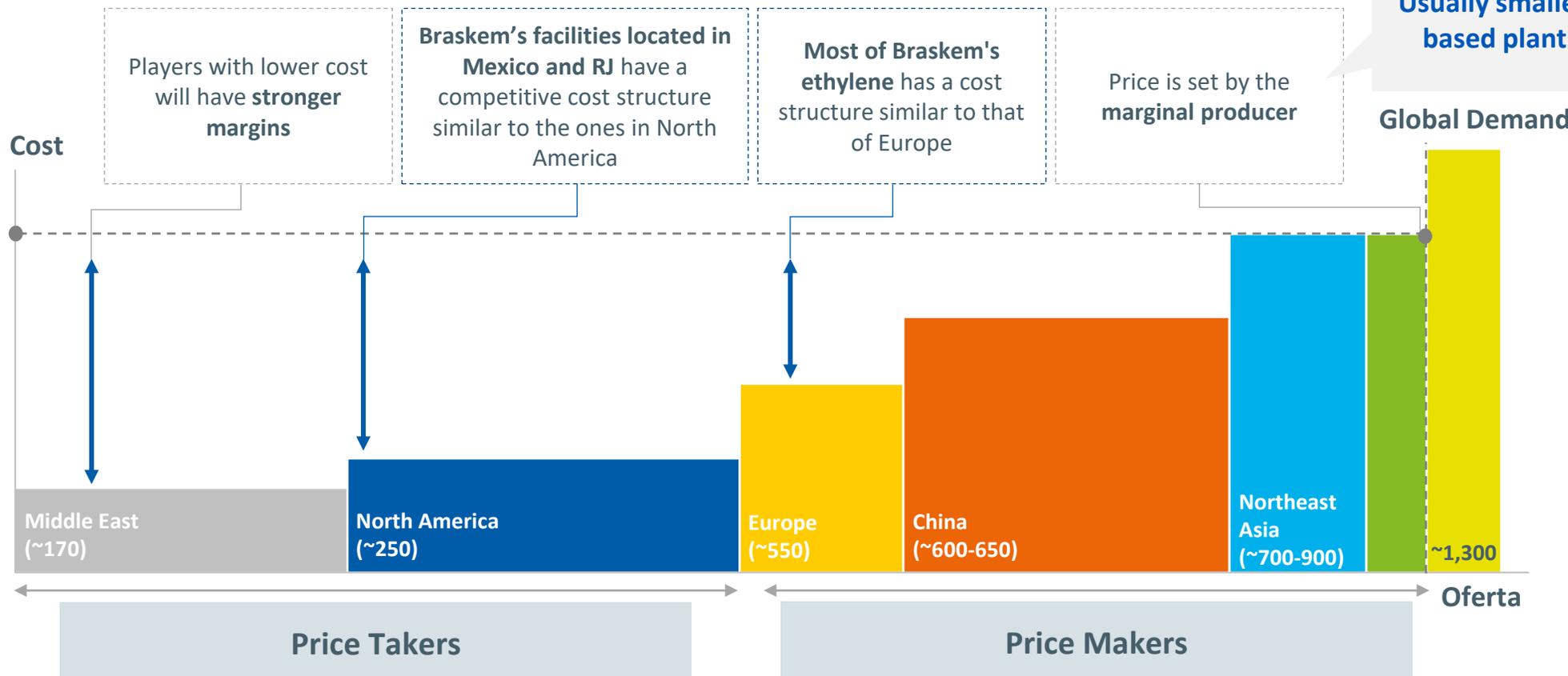
# The ethylene price is set by the marginal producer, the one with the highest cash cost

Feedstocks

CONCEPTUAL

## Ethylene Cash Cost by Region

US\$/t



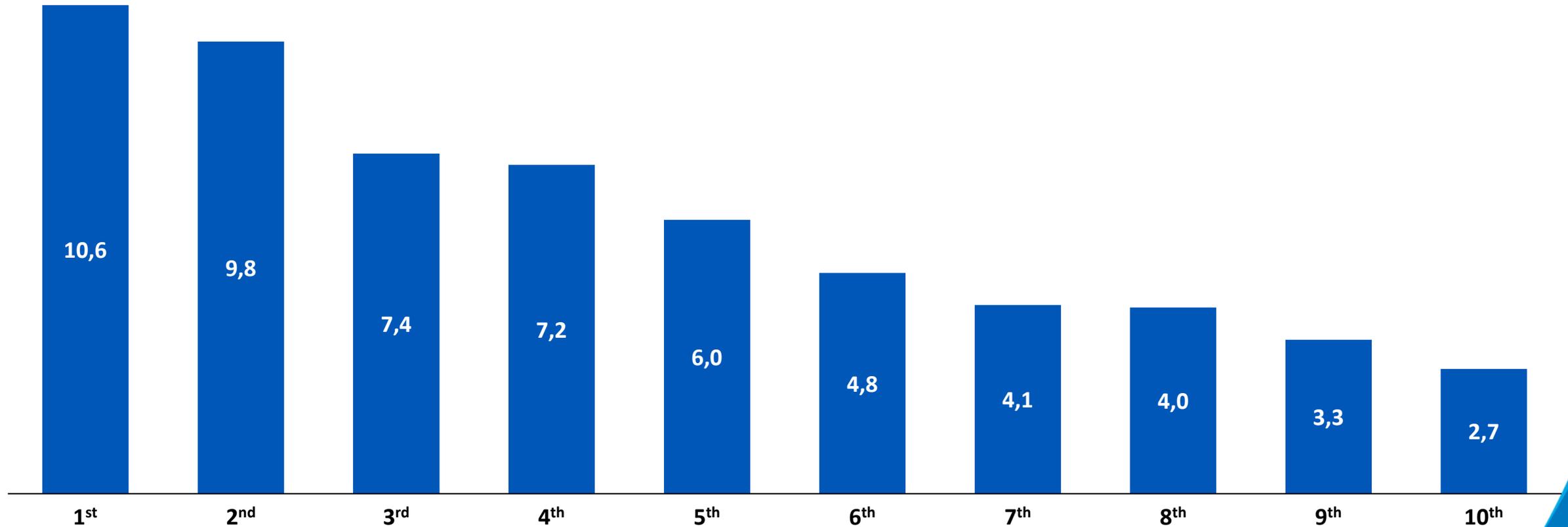
As ethylene is considered a commodity, competition is given by the cash cost and, thus, the market price maker is the marginal producer, which operates at the limit of the profit margin in its operation.

# The top 10 PE producers are responsible for ~50% of the global production

## PE Ranking

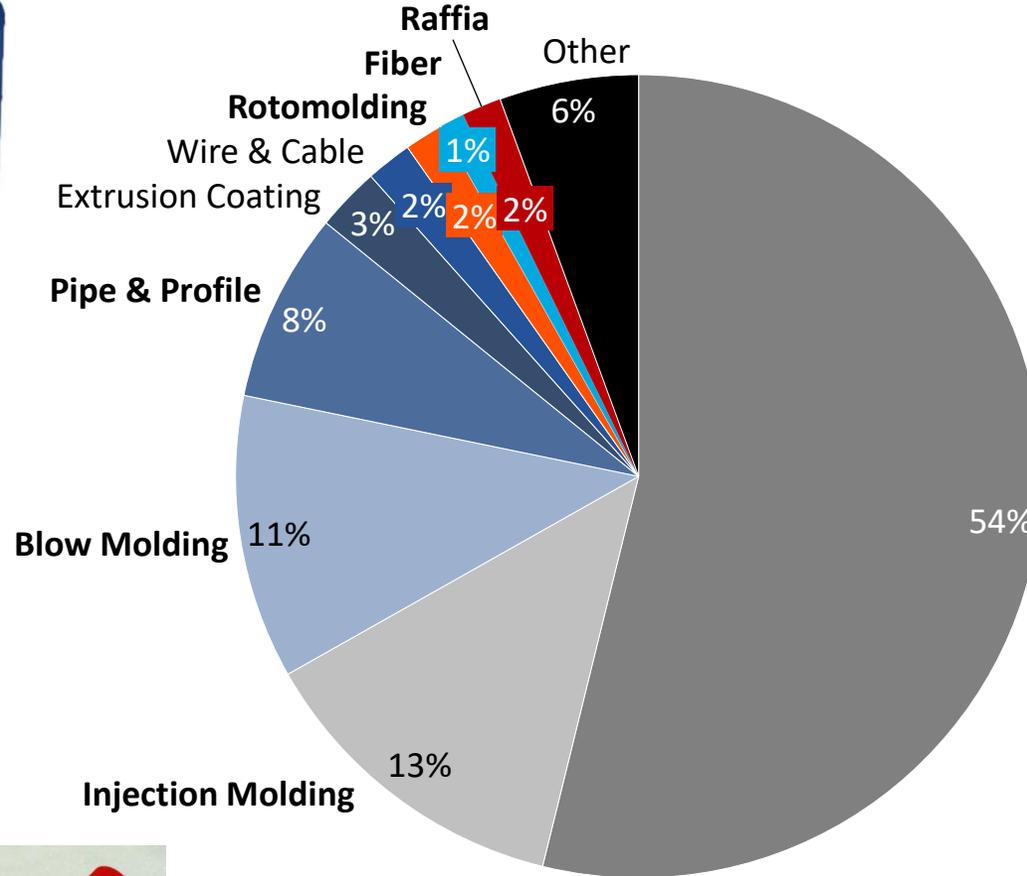
### PE: TOP 10 PLAYERS

(MMt, 2021 Capacity)



# Polyethylene (PE) is a thermoplastic resin and is used in various applications in several sectors of the economy

## PE Applications



Film & Sheet



# Agenda

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Feedstocks

Ethylene-PE

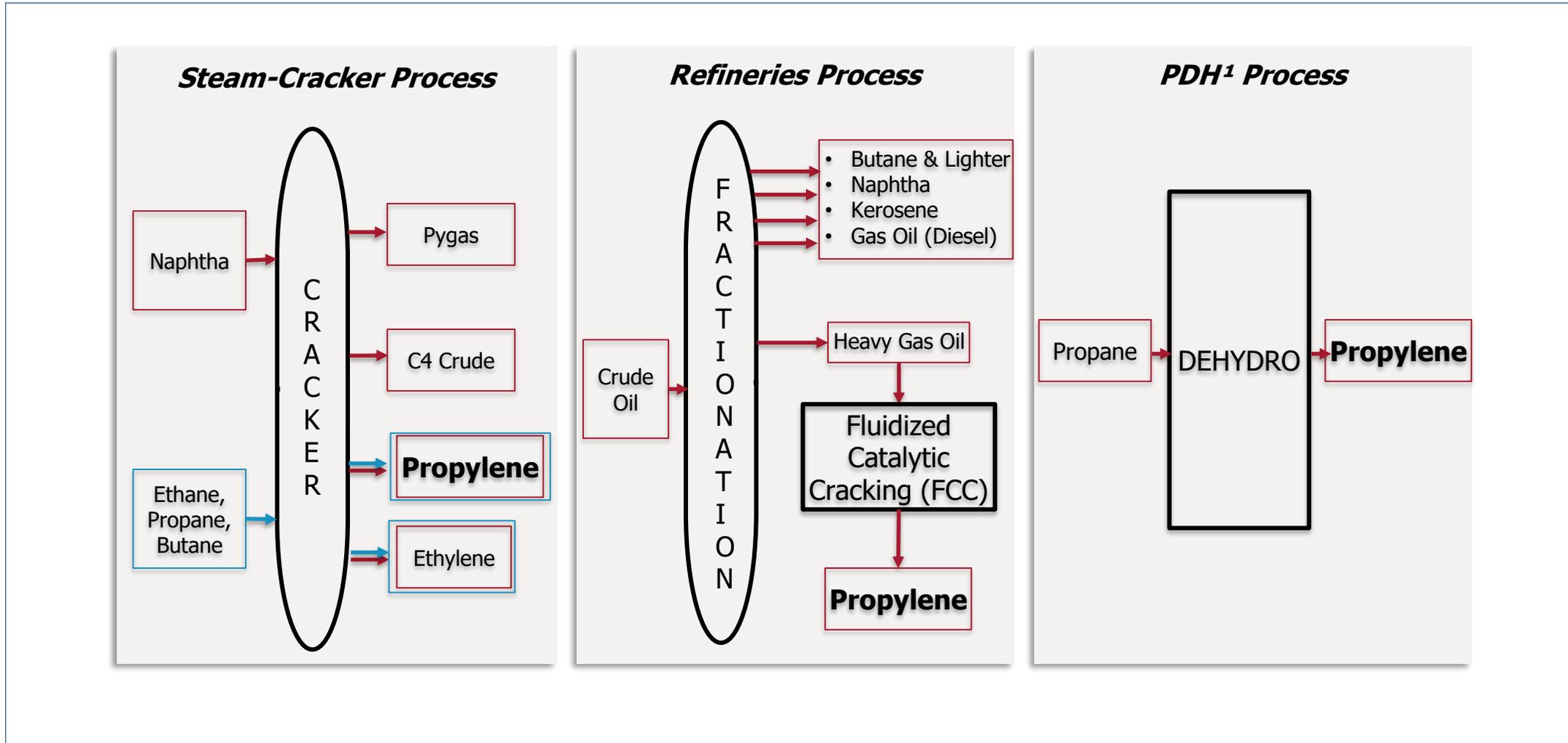
**Propylene-PP**

Vinyls

Cyclical characteristic of the petrochemical industry

# Propylene is a product that can be produced by different production processes

## Propylene Production Process

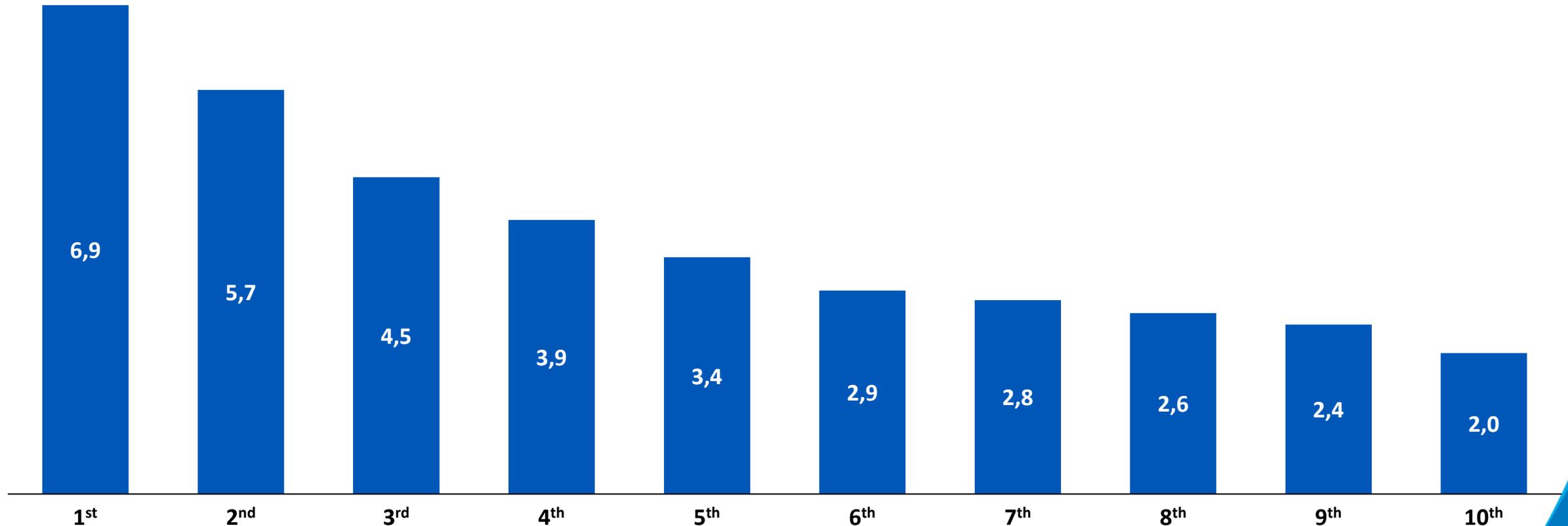


# The top 10 PP producers are responsible for ~45% of the global production

PP Ranking

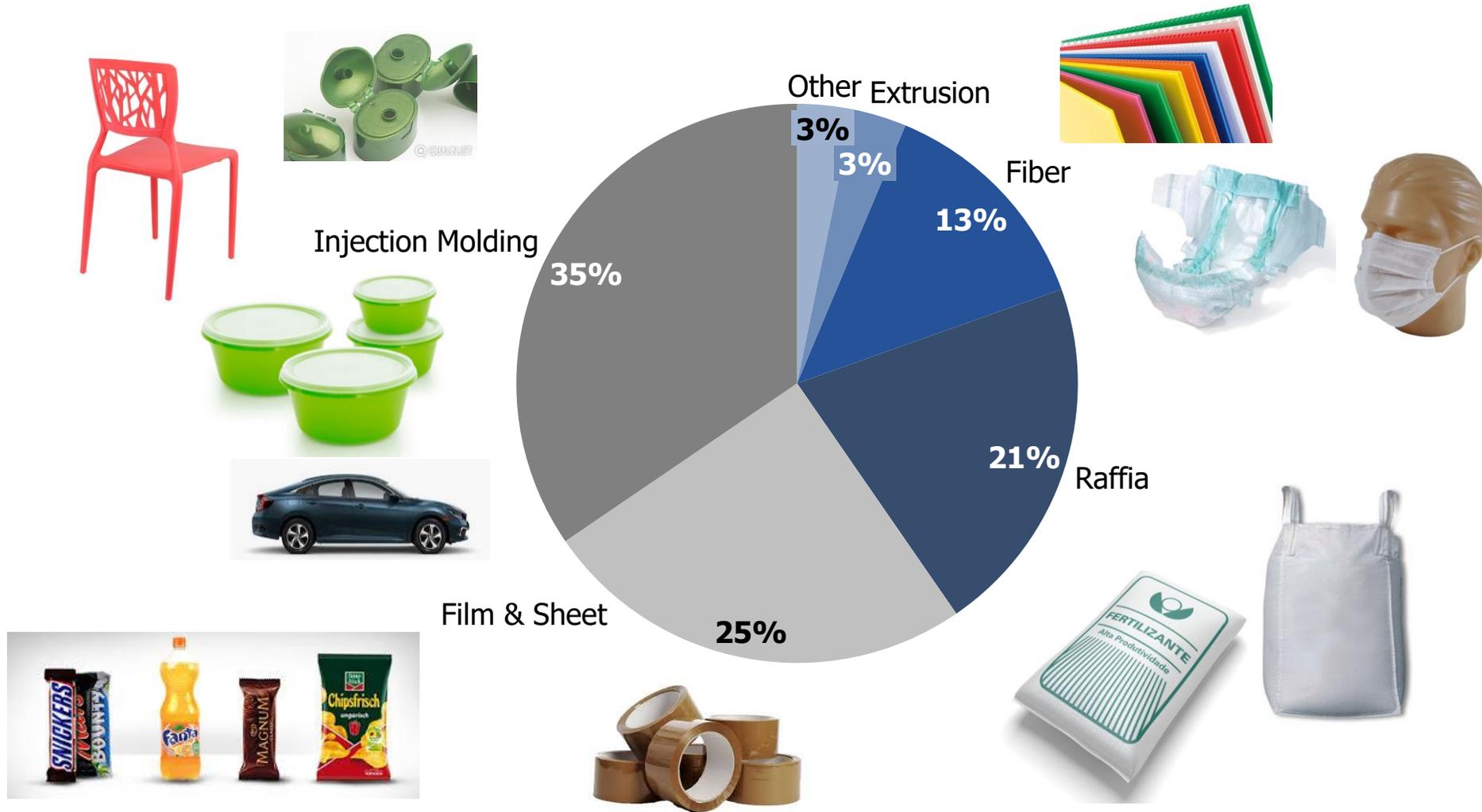
## PP: TOP 10 PLAYERS

(MMt, 2021 Capacity)



# Polypropylene (PP) is a thermoplastic resin and is used in various applications in several sectors of the economy

## PP Applications



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**Vinyls**

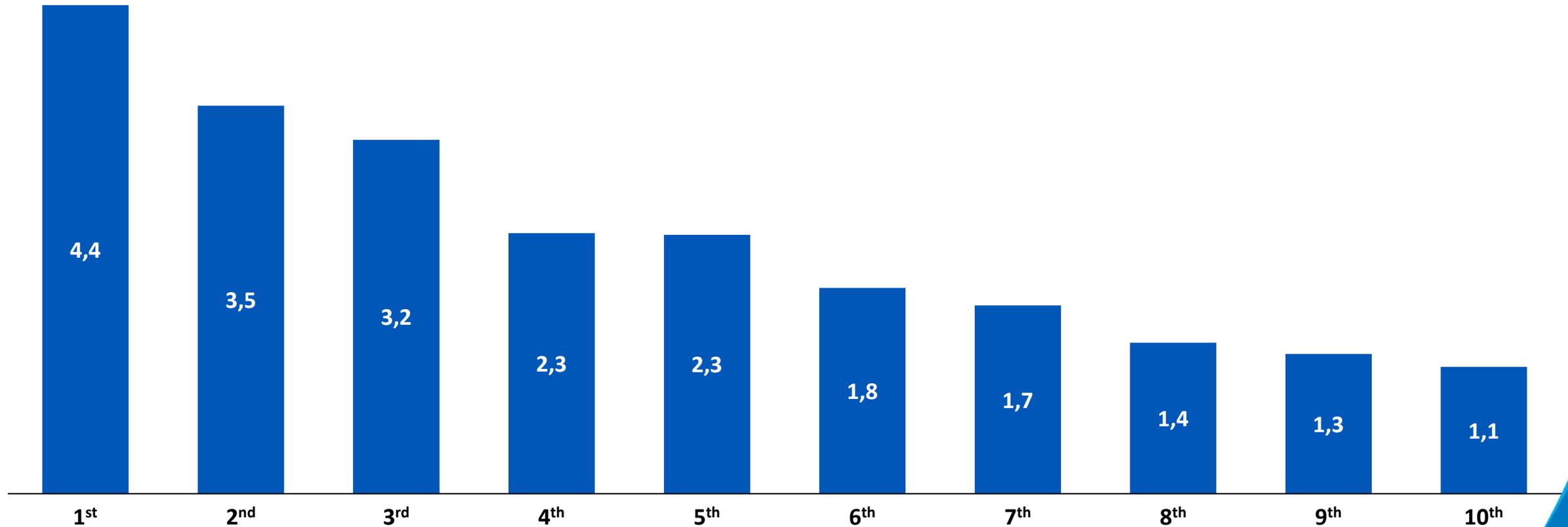
Cyclical characteristic of the petrochemical industry

# The top 10 PVC players represent less than half of global capacity installed (~39%)

## PVC Ranking

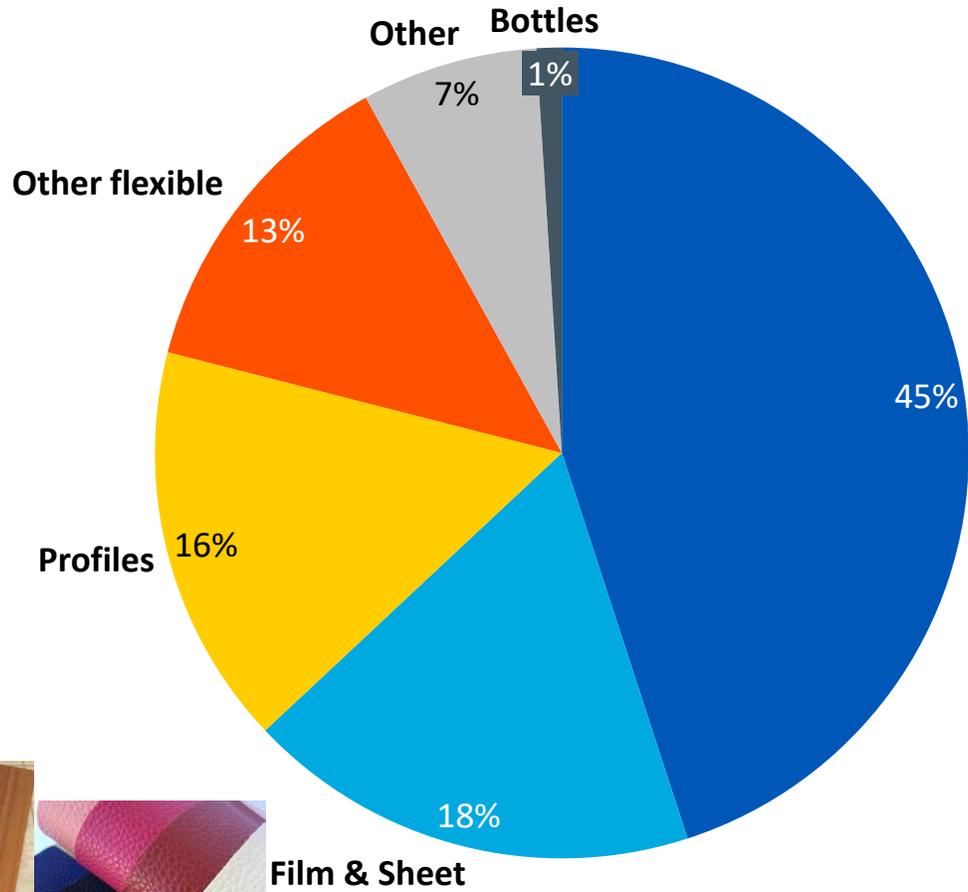
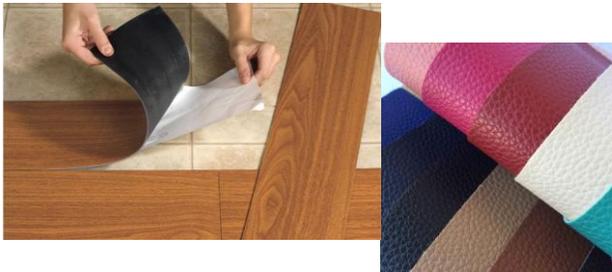
### PVC: TOP 10 PLAYERS

(MMt, 2021 Capacity)



# PVC is known as the durable good polymer and used in long lasting end-uses: pipe, siding, construction and some consumer materials

## PVC Applications



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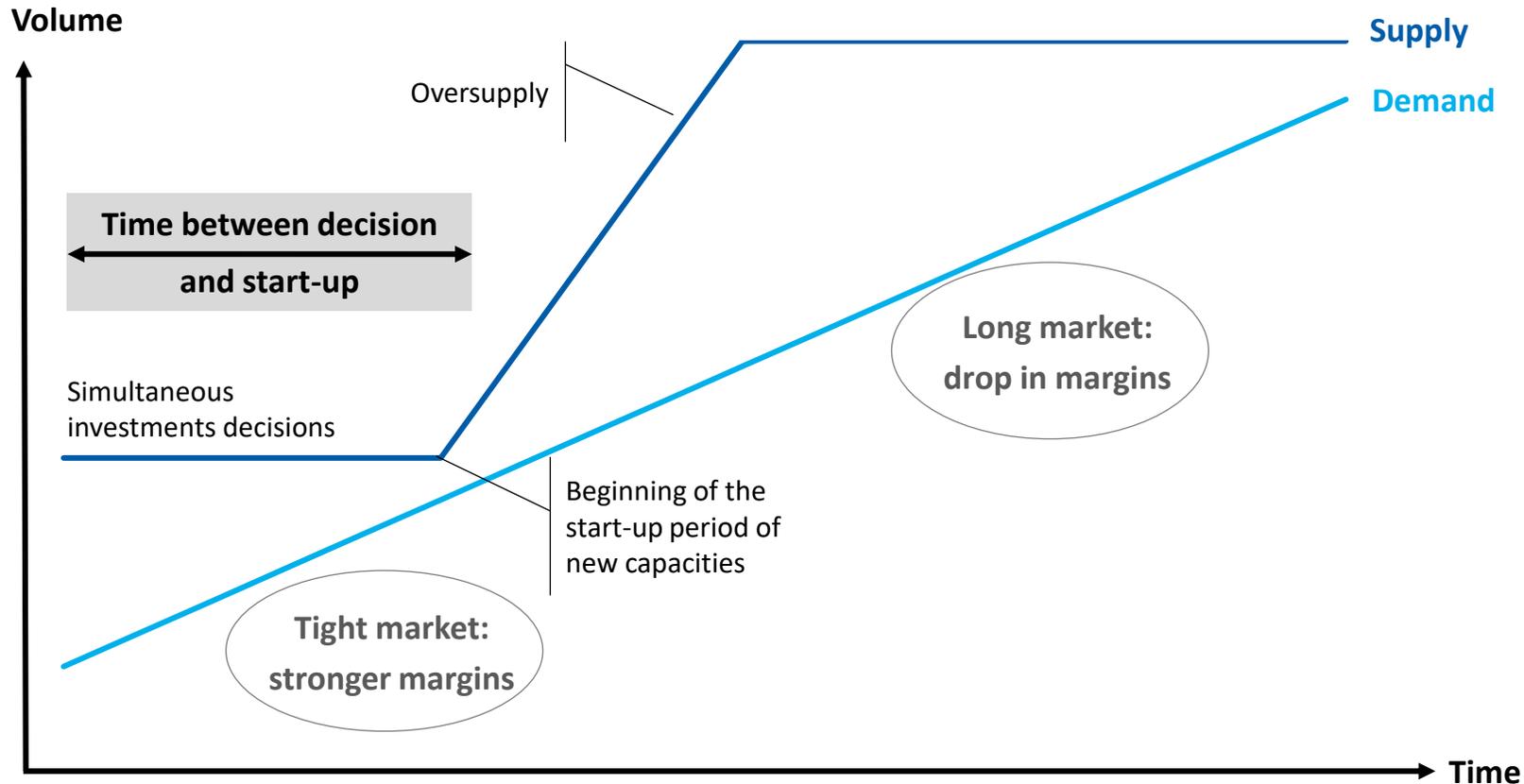
**Cyclical characteristic of the petrochemical industry**

# Profitability in the petrochemical industry behaves cyclically

## Profitability in the petrochemical industry

### Supply and Demand Dynamics of the Petrochemical Industry

CONCEPTUAL



### Highlights:

- Investment decisions are usually taken simultaneously and **at times when the market is tight – with strong spreads**
- However, when the new capabilities come into operation, **there is an oversupply of products**
- The oversupply pressures prices down and then **the market is "long", with reduced spreads**

**Investments in the petrochemical industry do not occur in a linear fashion with demand, which results in significant excesses of capacity at certain moments.**

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