Repsol Polímeros, S.A.

Excellence Petrochemicals in the Portuguese Industrial Cluster

Ordem dos Engenheiros – 21Nov2018

Site general description

INDEX

Site history

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1. Historical summary

1972-1976
Decision

- Government decision to create a Petrochemical Complex at Sines in the Early '70s
- Foundation of two companies:
  CNP, olefins
  EPSI, polyolefins

1976-1980
Construction

- Olefins plants
- Polyolefins plants
- Utilities plants

1981-1988
Star-up. First running years

- Test-runs
- Performance tests
- Improvements in product quality
- Feedstock adjustments

1989-2004
Acquisition & merging

- NESTE acquires polyolefins and rents olefins
- BOREALIS succeeds NESTE
- Construction of MTBE
- HDPE revamping
- Decommissioning PP
- ISO certifications
- REPSOL acquires the Site late 2004

2005- 2017
Modernization and competitiveness

- Cracker capacity increase
- EBA grades
- DCS in all process plants
- NG in steam boilers
- REPSOL acquires MTBE
- Extensive use of LPG in Cracker
- Cable grades in HDPE and LDPE

Site and surrounding area overview

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2. Site and surrounding area overview

Site location

2. Site and surrounding area overview

Industrial Cluster

2 Site and surrounding area overview

Site general view

2. Site and surrounding area overview

Petrochemical port facilities general view

Site integration

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3. Site Integration

From Crude Oil to Polymers

RAW MATERIAL	PROCESS I	PRODUCTS & RAW MATERIAL	PROCESS II	PRODUCTS & RAW MATERIAL	PROCESS III	PRODUCTS
Crude Oil	**Refinery:** Distilation and cracking process	**Nafta & LPG** (C3, C4)	**Steam Cracker:** Thermal Cracking process	**Olefins:** Ethylene Propylene	**Polymerization:** Catalytic process	**Poliolefins:** HDPE LDPE / EBA







3. Site integration

Site production plants

Olefins

Butadiene 52 kt/a

Steam Cracker

Etileno	410 kt/a
Propileno	200 kt/a
PyGas	200 kt/a
FOPY	40 kt/a

M/ETBE 53 kt/a

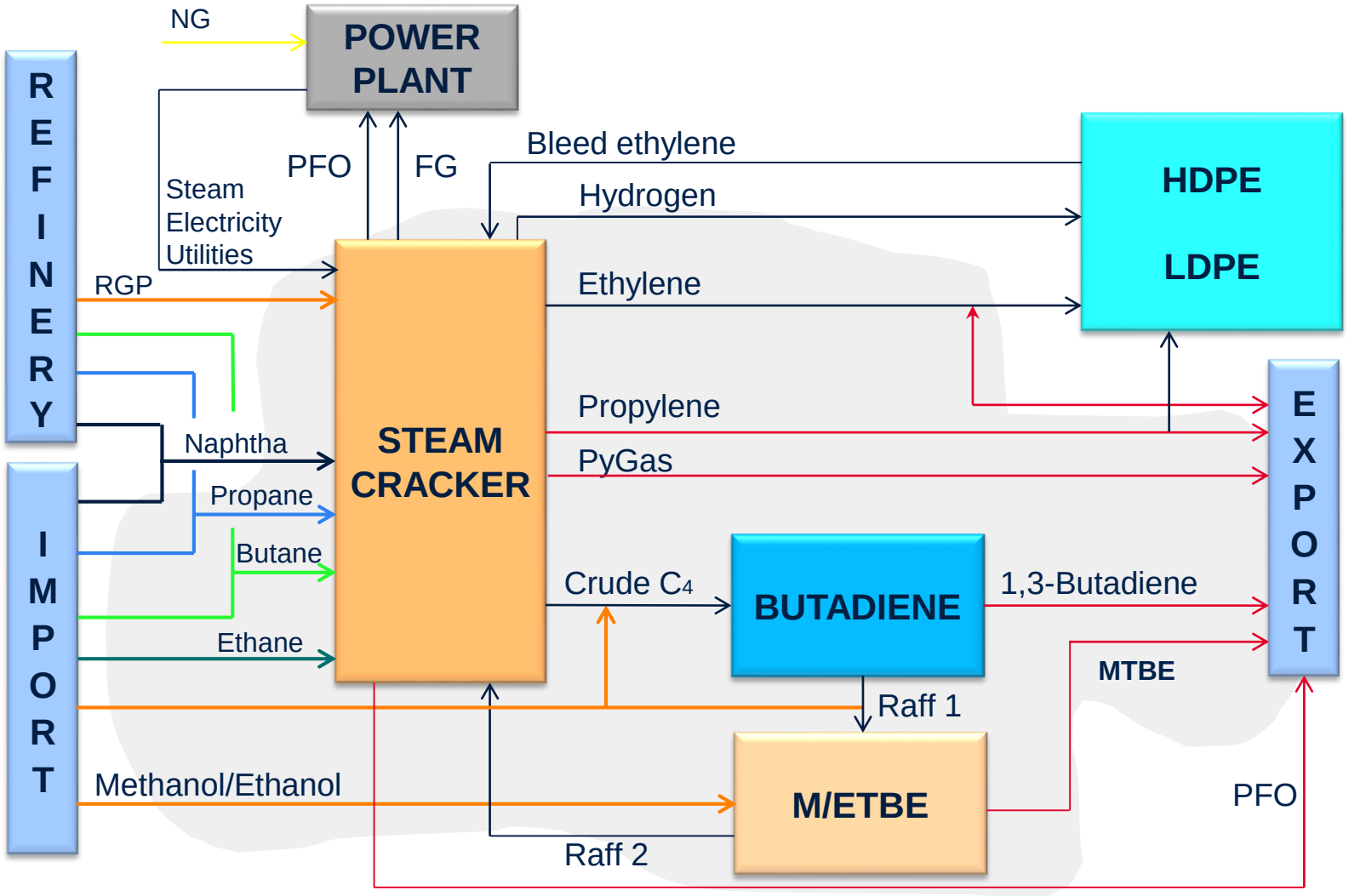
HDPE 145 kt/a

Poliolefins

LDPE 150 kt/a

3. Site integration

Interconnections



3. Site integration

Licensing technology and design capacities

Steam Cracker	HDPE	LDPE
• Linde Engineering	• Mitsui Petrochemical Industries	• CdF Chemie
• Front end deethanizer	• Bimodal Slurry Process Ziegler-Natta Catalyst	• HP Autoclave Reactors up to 2000 bar
• Startup in 1981	• Startup in 1981	• Startup in 1981
• Design capacity of 410kta C_2=	• Actual capacity of 145kta (mix dependent)	• Actual capacity of 150kta (mix dependent)

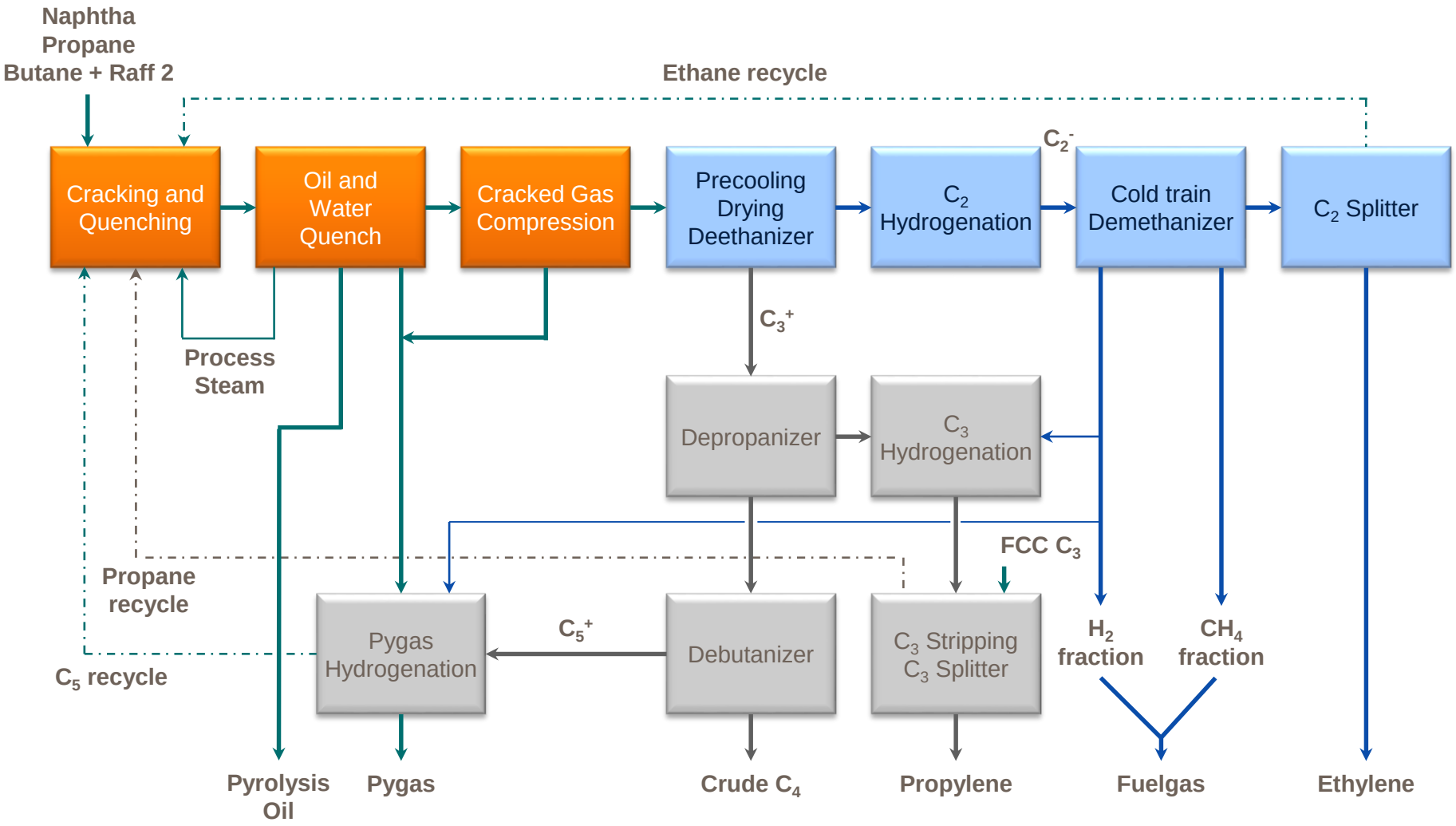
3. Site integration

Licensing technology and design capacities

Butadiene	MTBE	Power Plant
• Nippon Zeon	• UOP/Huels	• Electrobel
• DMF extractive distillation	• Acidic cationic resins	• Combined Heat & Power Cycle
• Startup in 1982	• Startup in 1991	• Startup in 1981
• Design capacity of 52kta 1,3-BD	• Design capacity of 48kta MTBE	• Design capacity of 3x190 t/h HPS

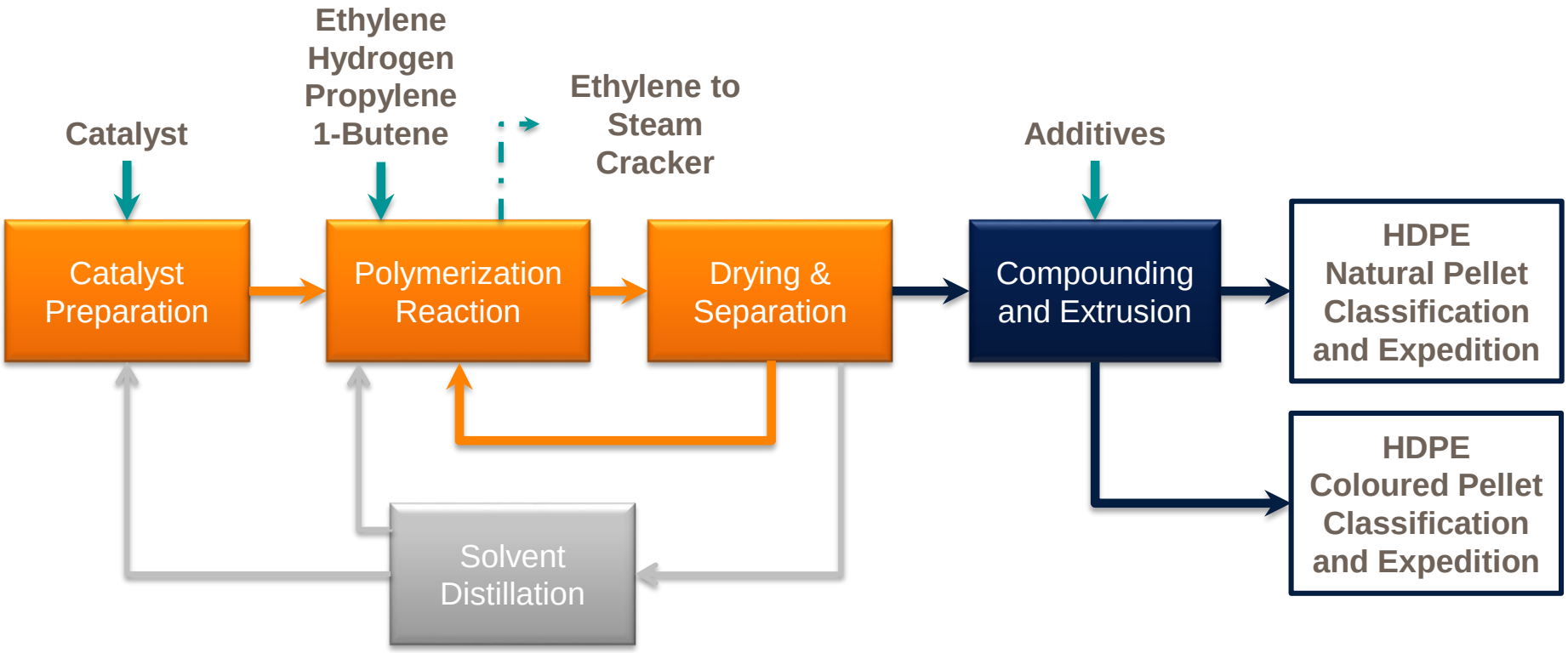
3 Site integration

Steam Cracker block diagram



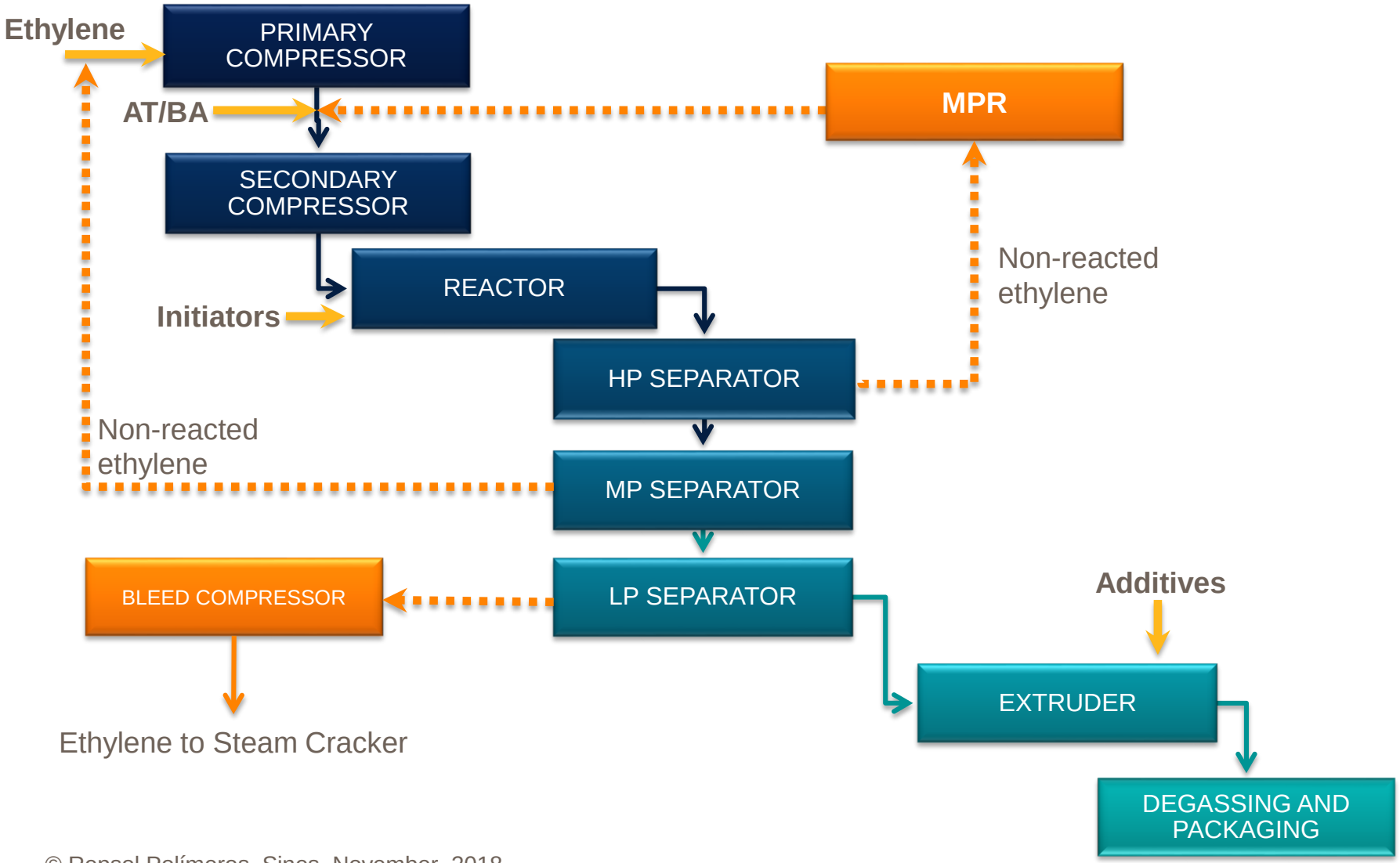
3. Site integration

HDPE block diagram



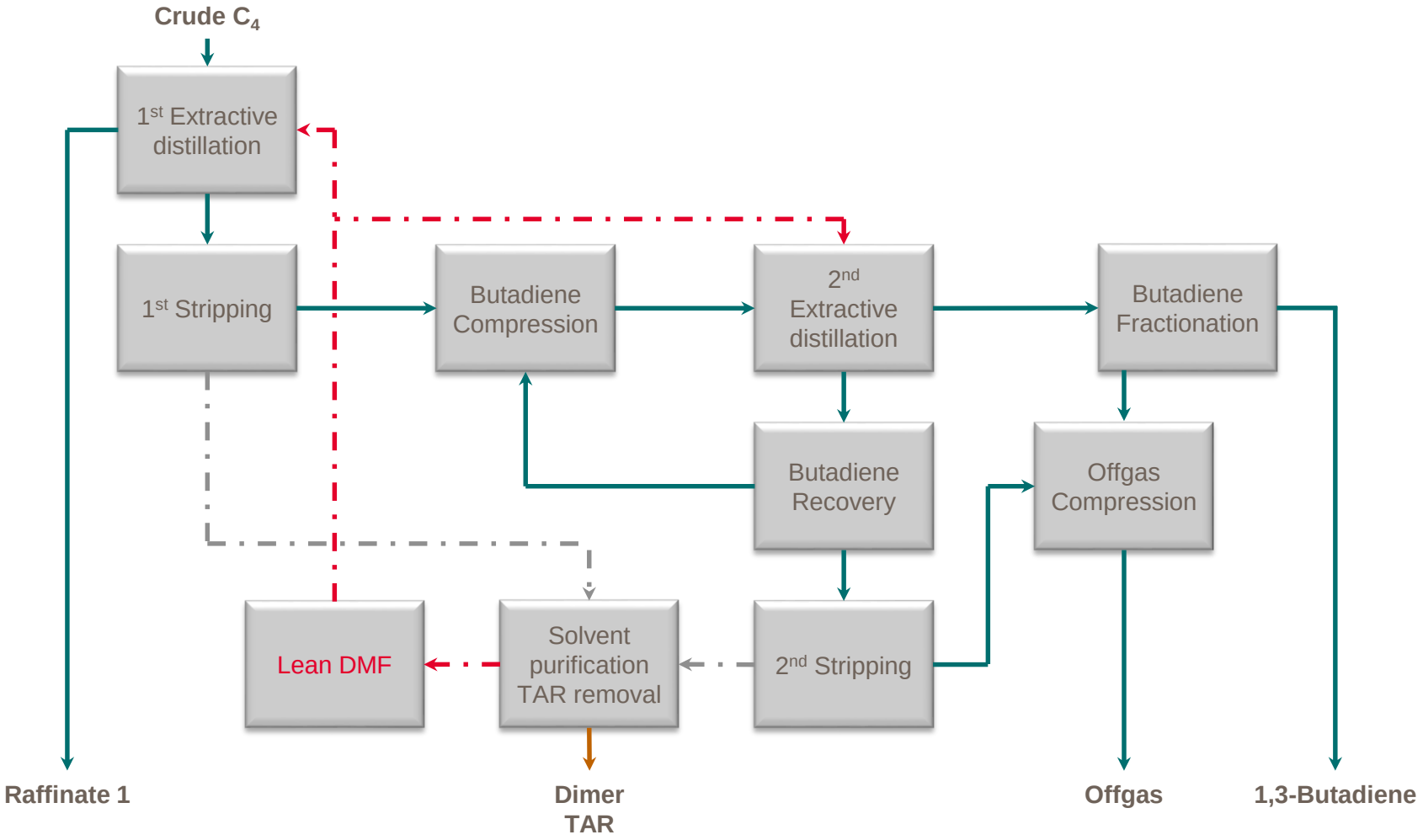
3 Site integration

LDPE block diagram



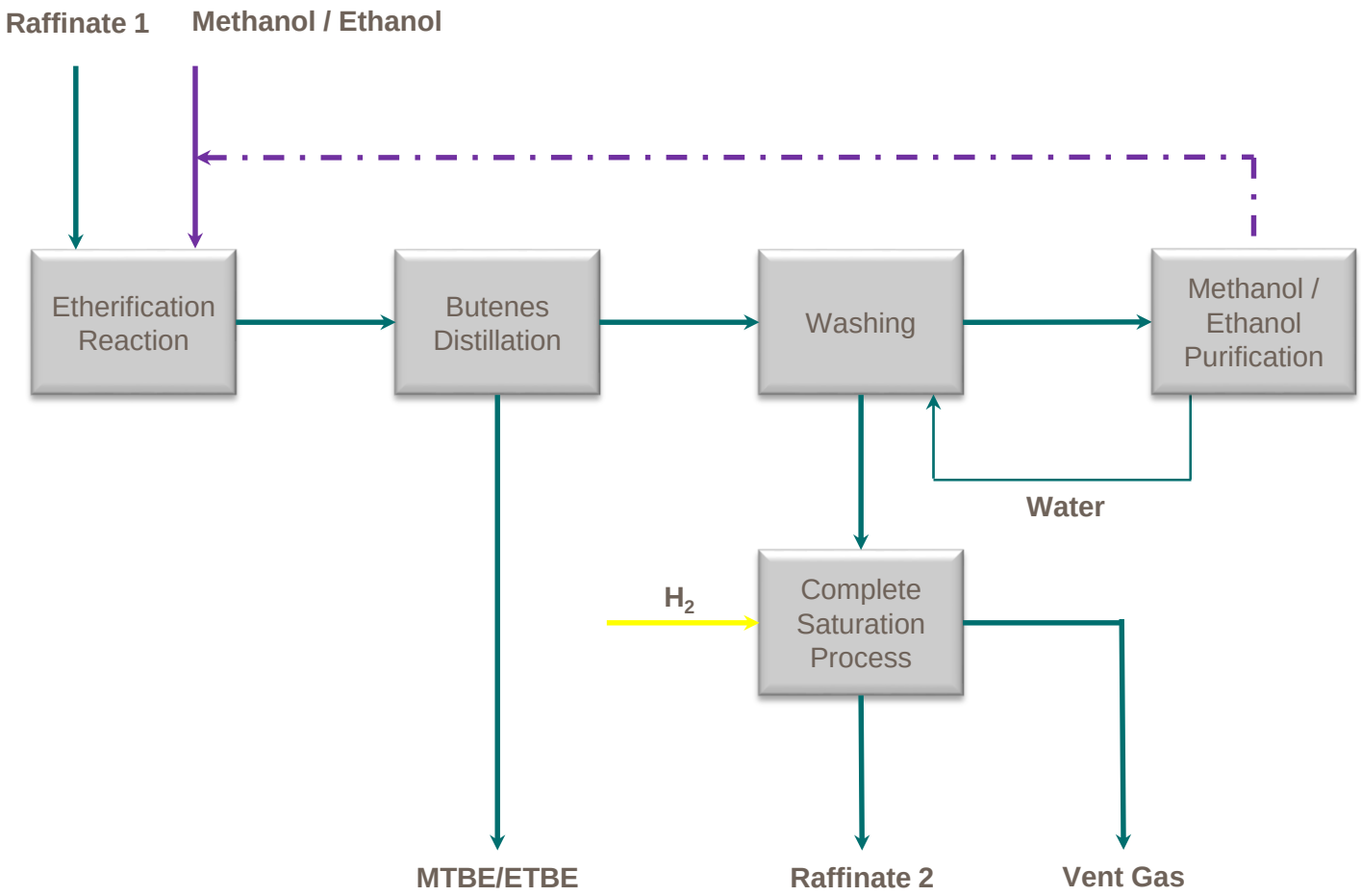
3. Site integration

Butadiene block diagram



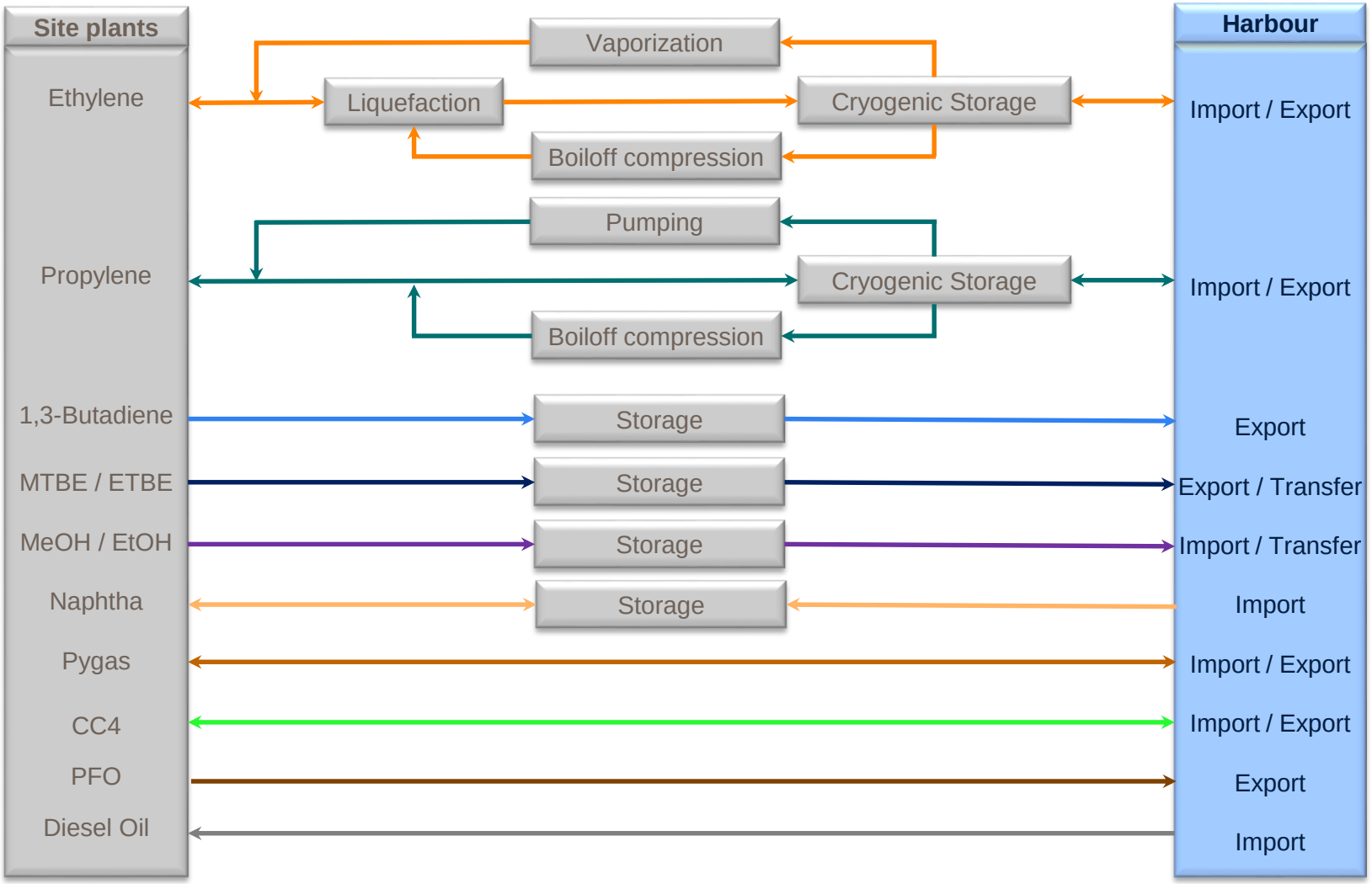
3. Site integration

MTBE block diagram



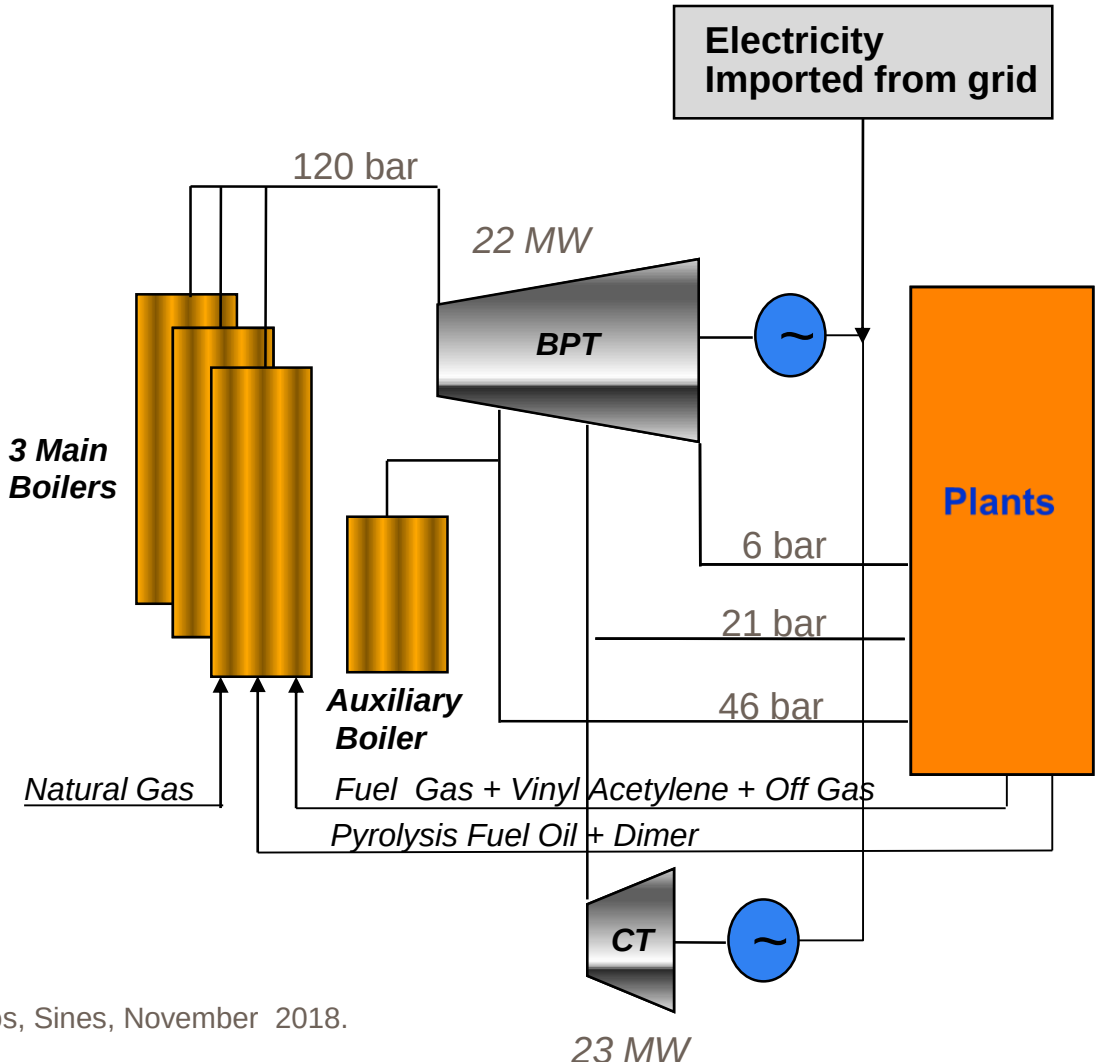
3. Site integration

Harbour block diagram



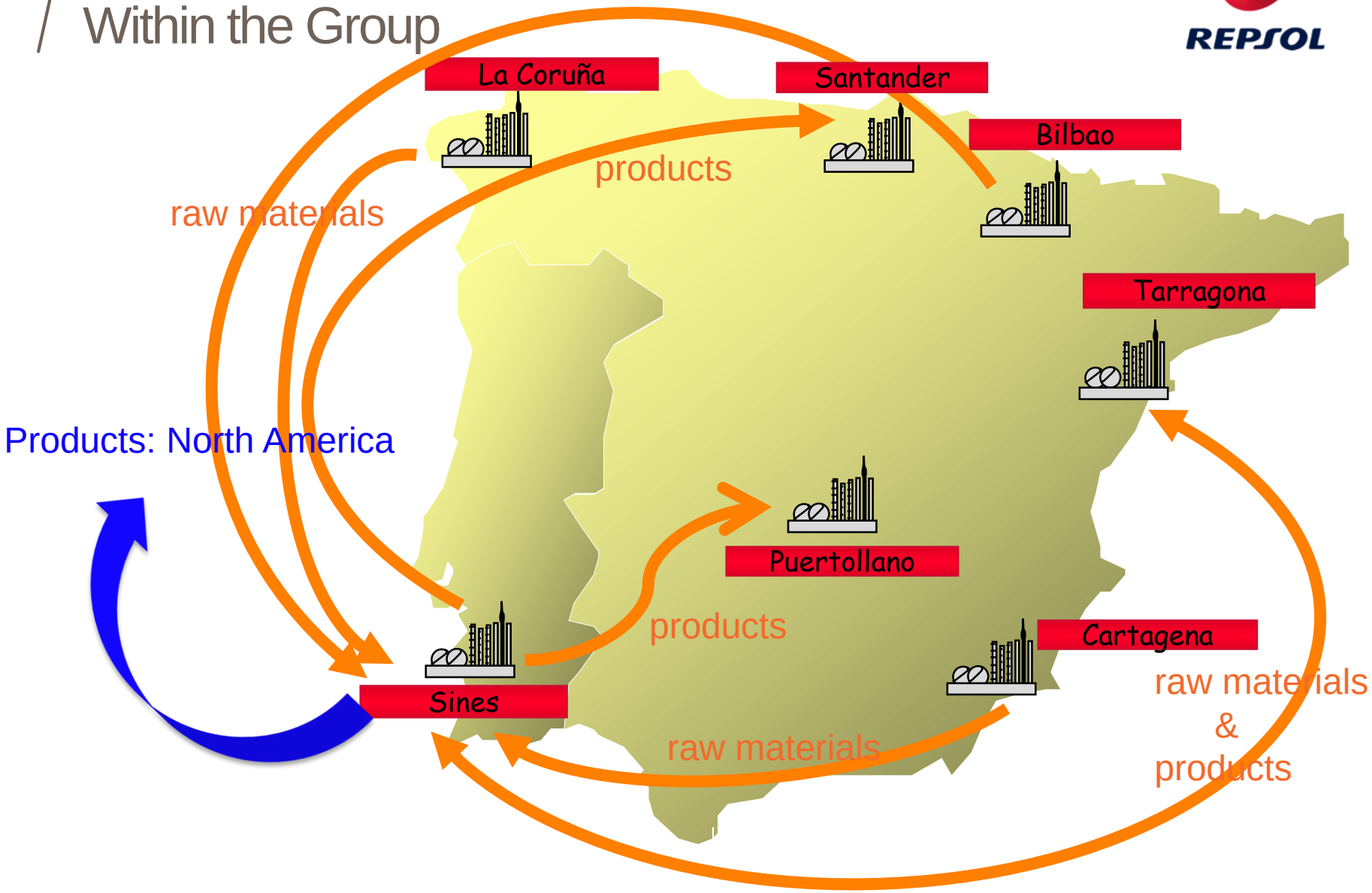
3. Site integration

Power plant block diagram



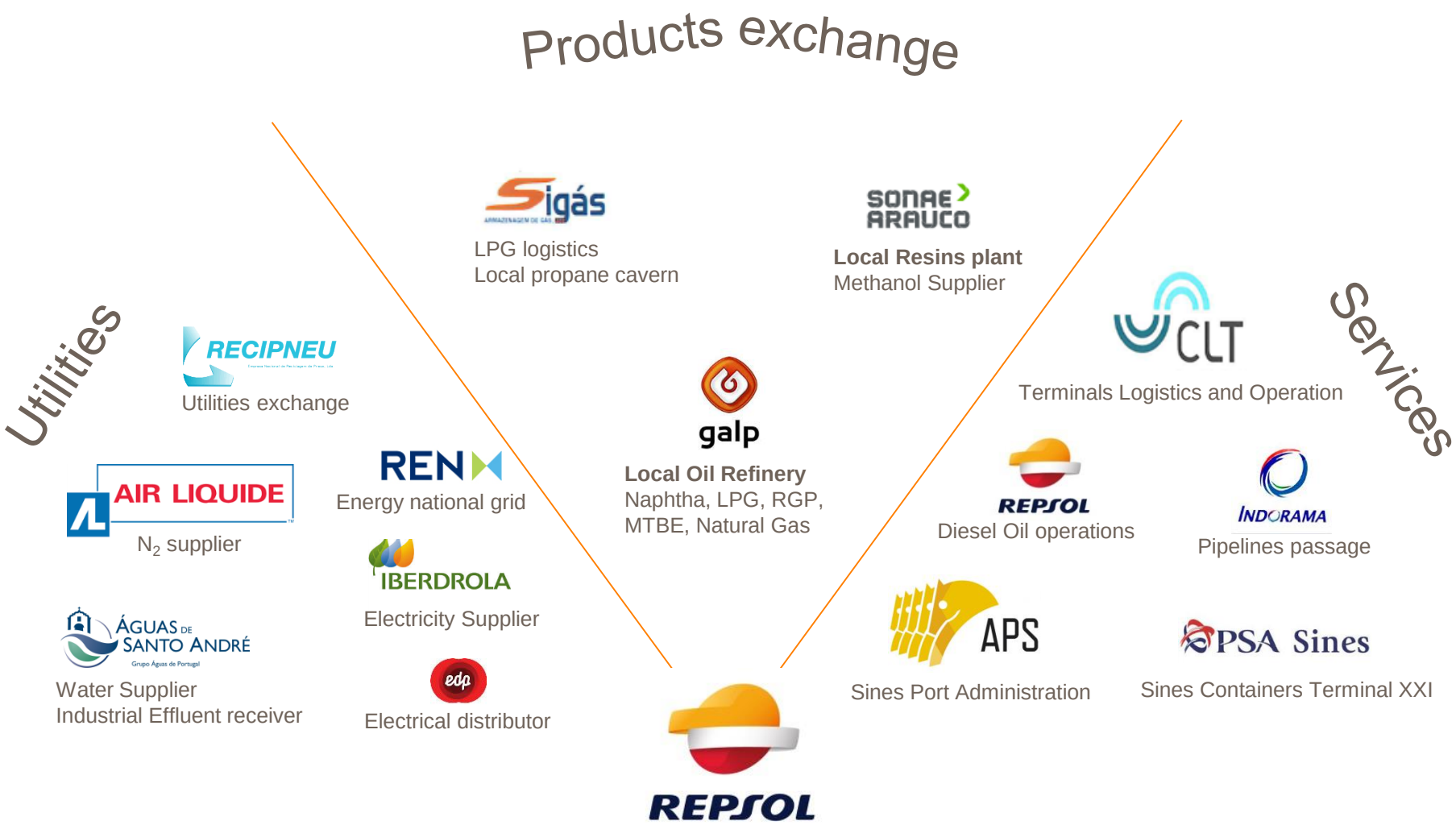
3. Site integration

Within the Group



3 Site integration

Within Sines Industrial Cluster



Site main figures

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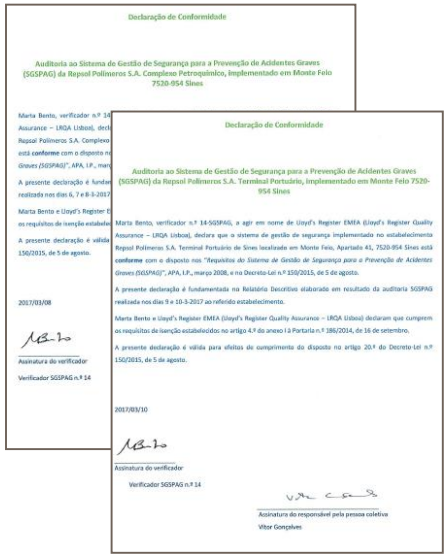
4. Site main figures

General

- 440 employees and an average of 450 contractors
- Production around 1.000.000 t/y of Olefins and Polyolefins
- Exports 85 - 90% of its production for over 60 countries
- In the top 10 major Portuguese exporters
- 60 - 70% of raw materials import and products export is made by sea

4. Site main figures

Certificates



ISO 9001-2015
ISO 14001- 2015
OSHAS 18001:2007

ISO 50001-2011

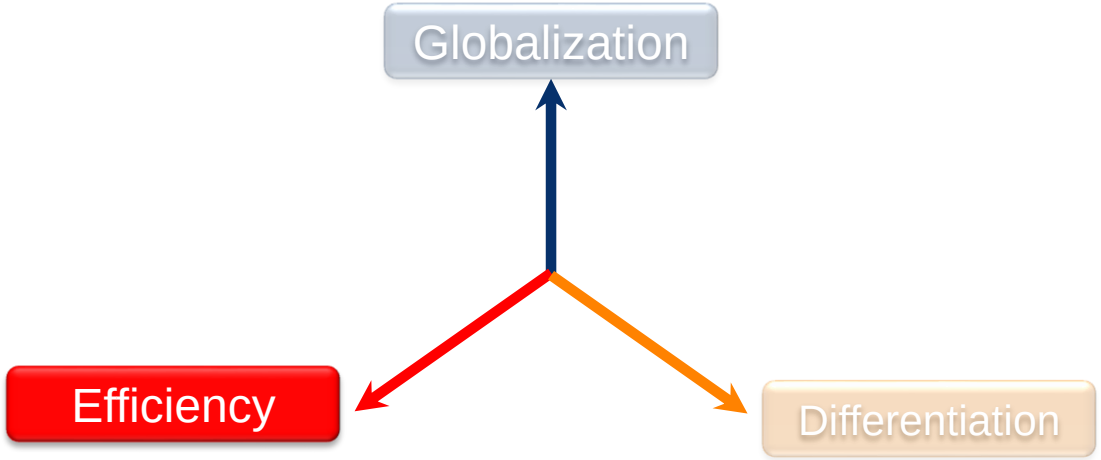
SEVESO III
(DL 150/2015)

ISCC EU
MTBE & ETBE

4 Site main figures

Repsol Química Competitiveness Plan

Química 2018



- **Feedstock flexibility**
  Ability to take advantage of the business opportunities in an easy mode
- **LPG cracking**
  Modulate the ratio between liquid/gas feedstock based on the market
- **Energy efficiency**
  Minimize energy costs and take advantage of the LPG cracking yields
- **Differentiation**
  New products and specialty applications for demanding markets

4. Site main figures

Repsol Sines highlights

- *Steam Cracker*

- Increase in production rates and utilization rate levels
- High LPG feedstock processing (20-60% ratio market prices optimized)
- Longest plant running period in history: 691 days (previous of 204 days)
- Reliability index above 98%
- Energy consumption 4% decrease (2013 baseline)
- Process Losses 35% reduction (2013 baseline)

- *Butadiene*

- Moderate rates and occupation levels due to Cracker CC4 unavailability & market shortage
- Longest plant running period in history: 893 days
- Plant production records in 2016 due to spot CC_4 availability
- First time in history plant follows site turnaround period (2012-2018)

- *bio-ETBE / MTBE*

- Low rates and occupation levels due to Butadiene Raffinate unavailability & market shortage
- Longest plant running period in history: 647 days
- Very high reliability index
- Operation mode switch from/to MTBE to/from bio-ETBE in 2015 and 2017

4. Site main figures

Repsol Sines highlights

- *HDPE*

- New cable grades development and production
- Last 12 years continuous on stream period record without plant shutdowns – 125 days
- Increase in production rates
- Energy consumption 5% decrease (2013 baseline)

- *LDPE / EBA*

- Record of 133 days continuous on stream period of both LDPE L_1 and L_2
- Record of 157 days continuous on stream period of both LDPE L_1
- Record of 97,1% plant utilization rate (best ever)
- High reliability indexes

- *Power Plant and Utilities*

- Cracker-Power Plant integration in steam/fuels due to LPG cracking
- Increase of internal electrical production – change to self-producing regime
- Backpressure turbine derating – efficiency increase

Reliability Improvement

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4. Reliability Improvement

Reliability programme

Common project to all Repsol production sites

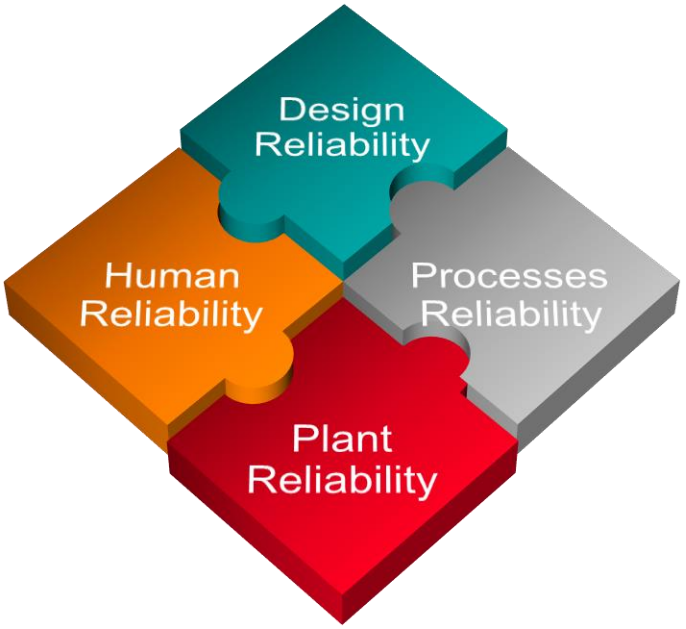
It started in Sines in 2015

Multidisciplinary Cells lead by Operations

Root Cause Analysis based in Lean Methodology

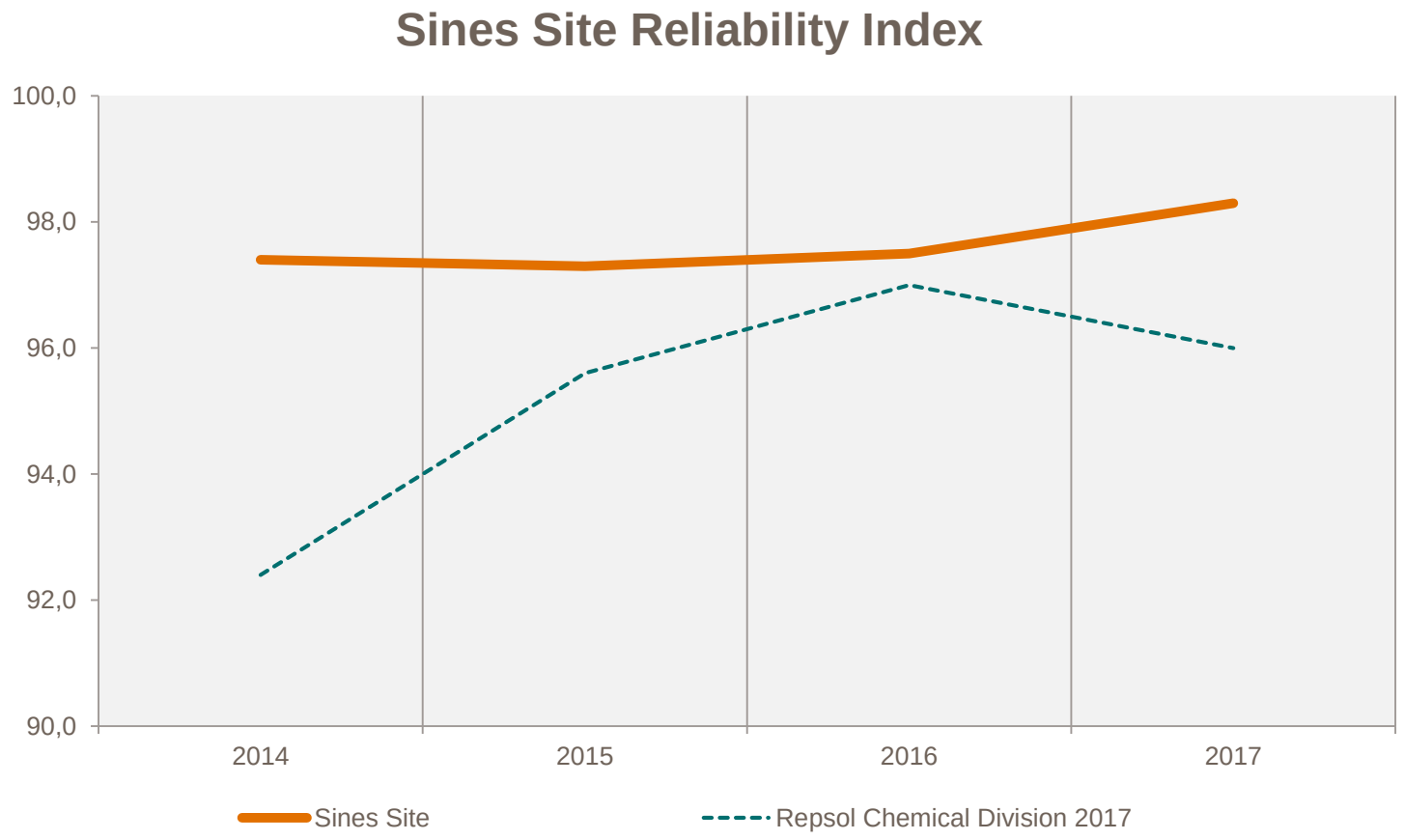
Safety enhancement by knowing the failure mechanisms and acting proactively

DailyFlow just started onsite



4. Reliability Improvement

Reliability Sines Site



Polyolefins products

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6. Sines polyethylene grades

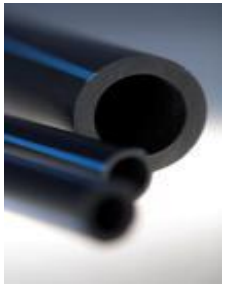
Polyethylene pellets

- Polyethylene is the most important final product from Sines Complex

- ✓ High chemical stability material
- ✓ Easy to sterilize and manipulate
- ✓ Can be easily recycled and reused

6. Sines polyethylene grades

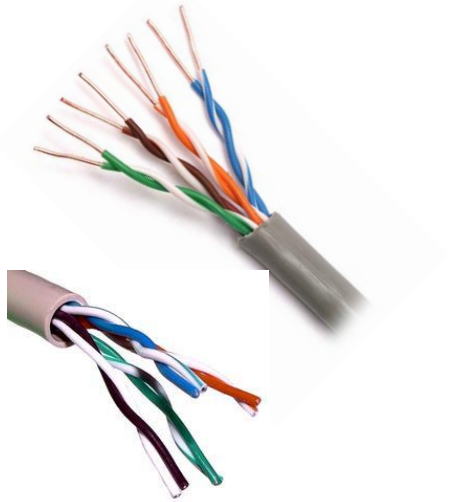
Applications for High Density Polyethylene (HDPE)









Family grades:

- **Pipe:** piping for water, gas and effluents
- **Fibers:** ropes, fishing nets, packaging for agro-products
- **Moulding:** packaging for hygiene, cleaning products and lubricants
- **Film:** food package and bags
- **Electrical cables:** isolation for LV and communication cables

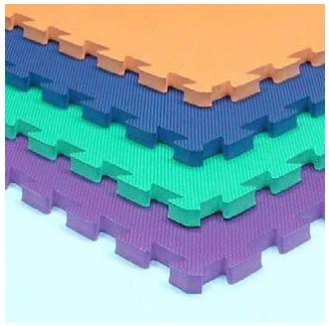
6. Sines polyethylene grades

Applications for Low Density Polyethylene (LDPE)



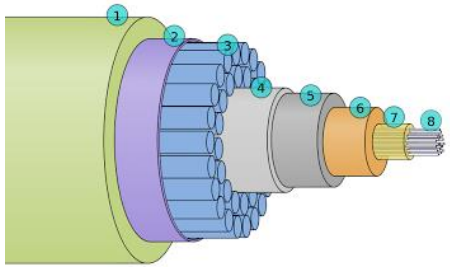







Family grades:

- **Film:** food package, bags and coating/lamination
- **Injection:** food package
- **Retractable film:** packaging (EBA)
- **Foams and profiles:** household and footwear (EBA)
- **Electrical cables:** coating for HV and VHV power cables (EBA)



Olefins other products

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7. Olefins products and markets

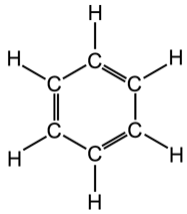
Products

- **Olefins** are another important family of products exported by the Site

  - **Propylene,** raw material to polypropylene

  - **1,3-butadiene,** raw material for synthetic rubber.

  - **Pyrolysis gasoline,** for benzene extraction



  - **M/ETBE,** to improve octane rating in commercial fuels.

Sines Olefins and Polyolefins Markets

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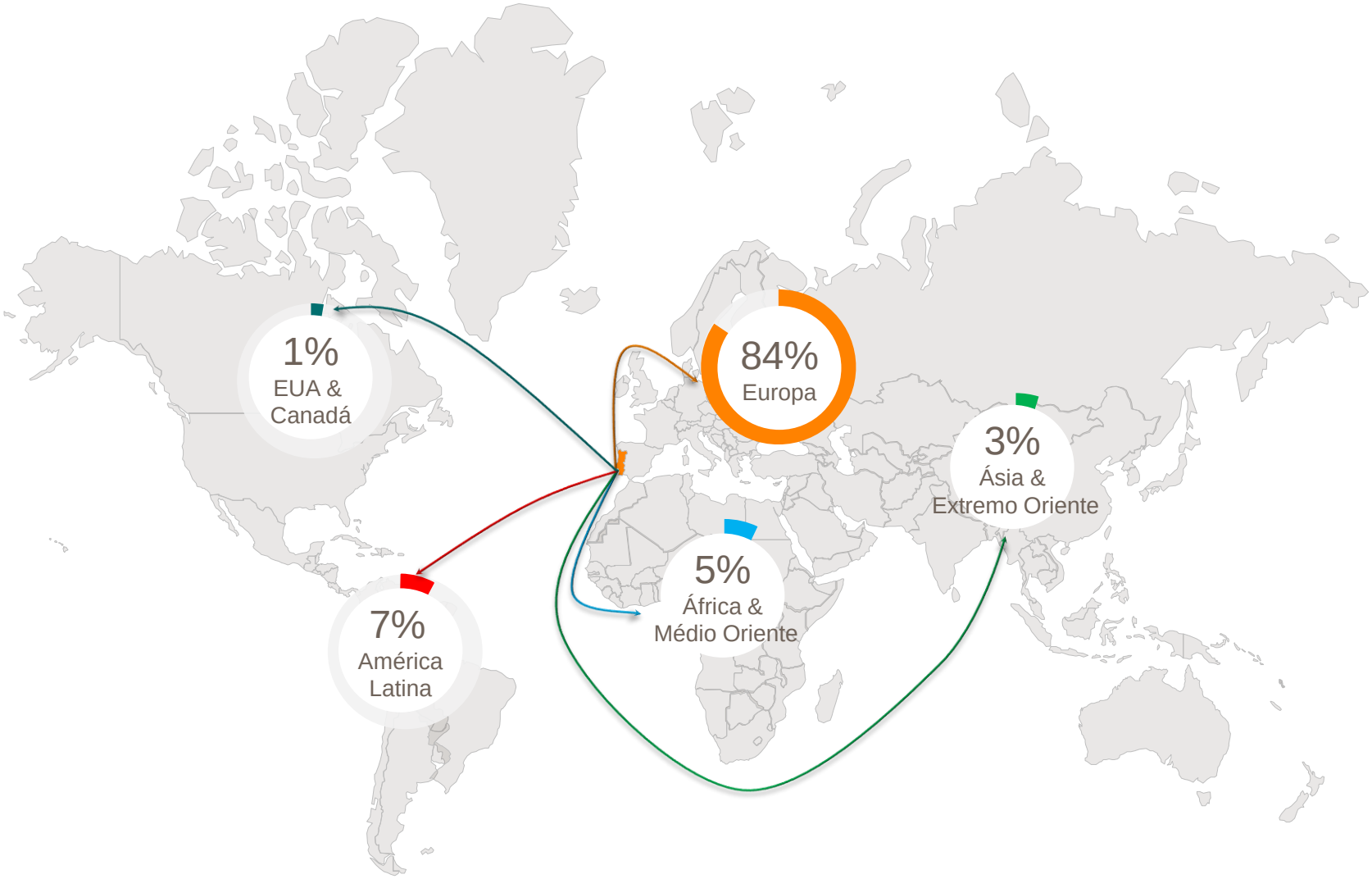
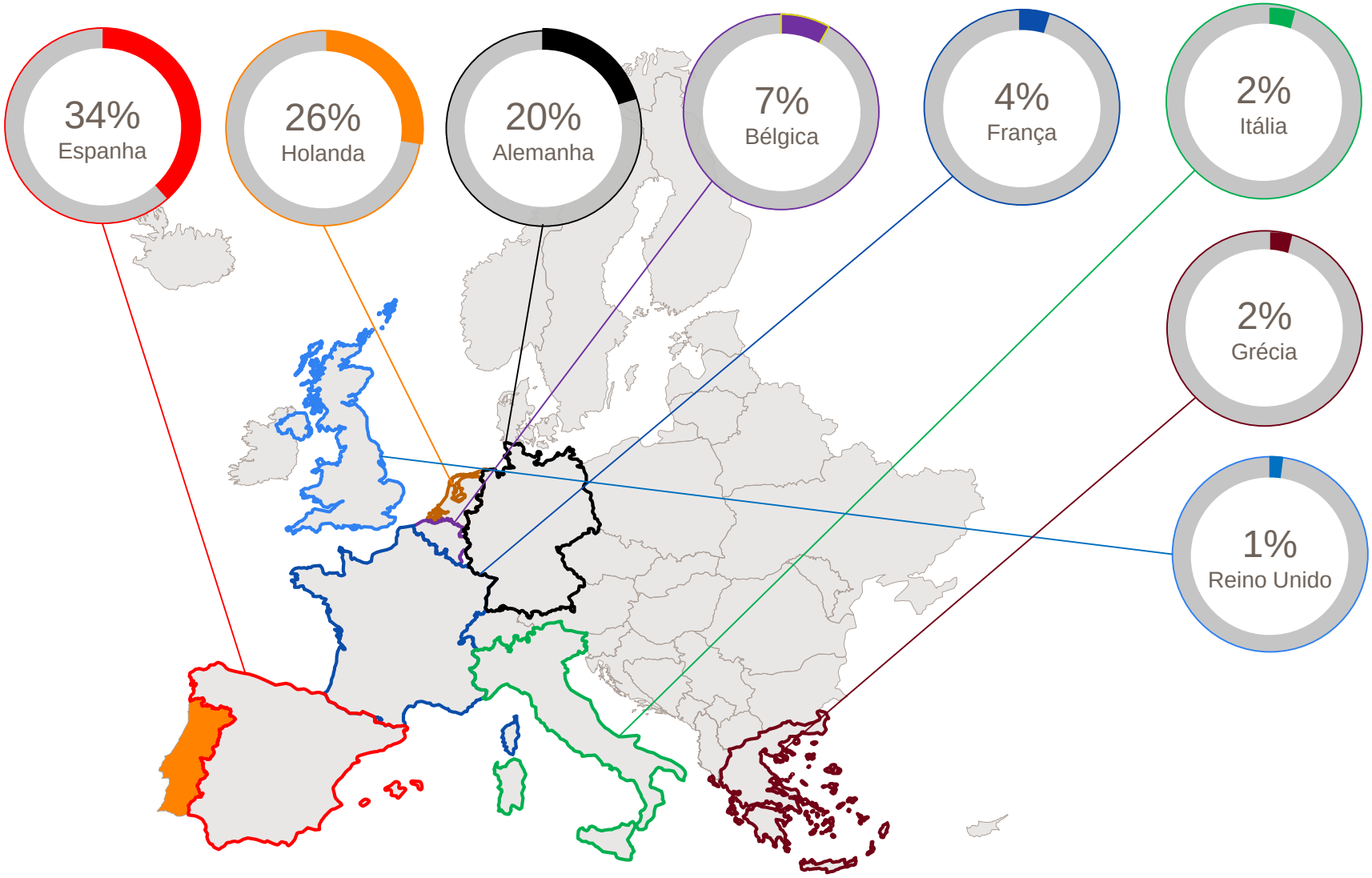
8. Markets

2013-2017 worldwide (Olefins + Polyolefins)



8. Markets

2013-2017 Europe (Olefins + Polyolefins)



Significant investments in recent years

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9. Significant investments in recent years

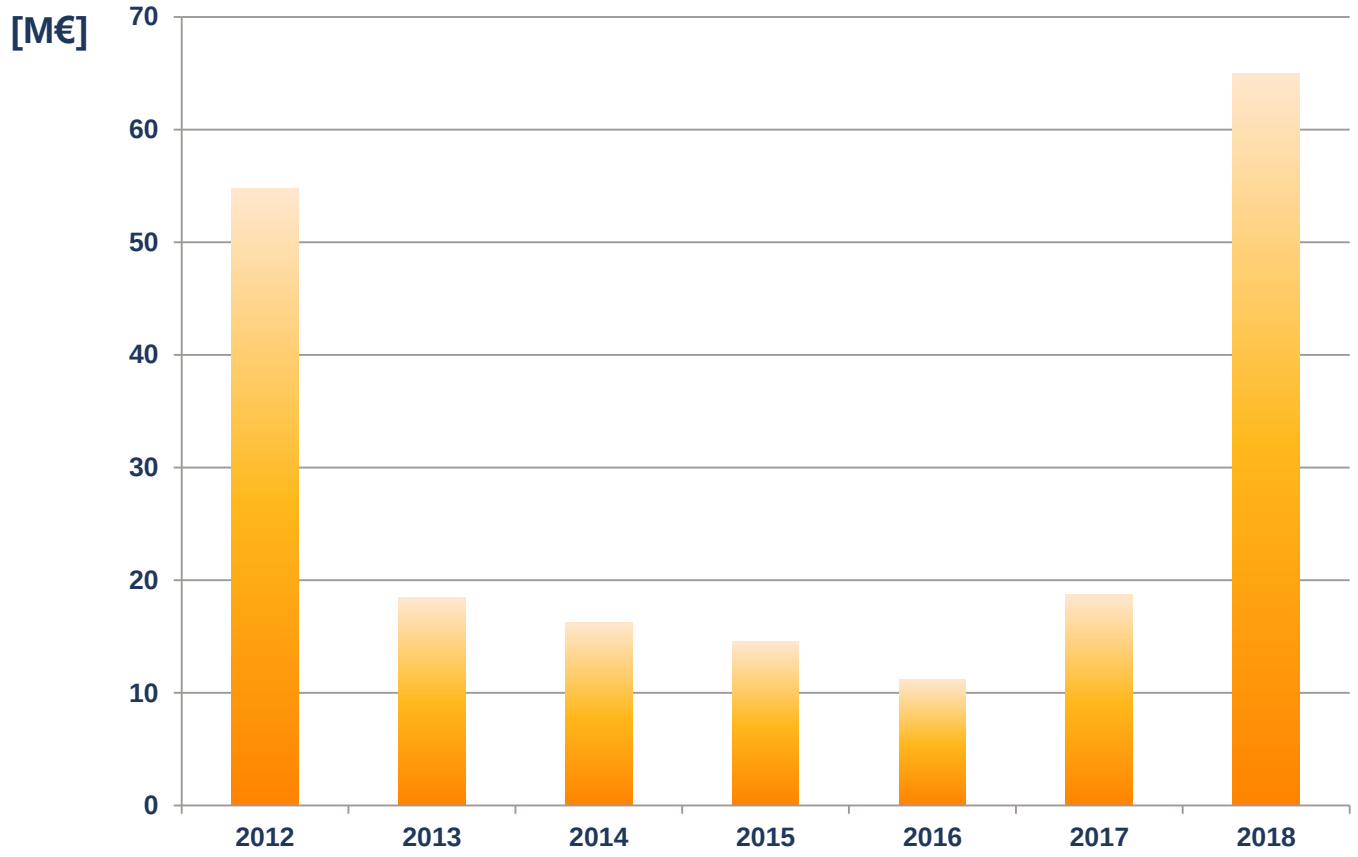
Raw gas turbine and condenser
16 M€

Furnaces convection revamping
12,7 M€

Electrical grid and substations
10,3 M€

Motor Hypercompresor L2LDPE
3,6 M€

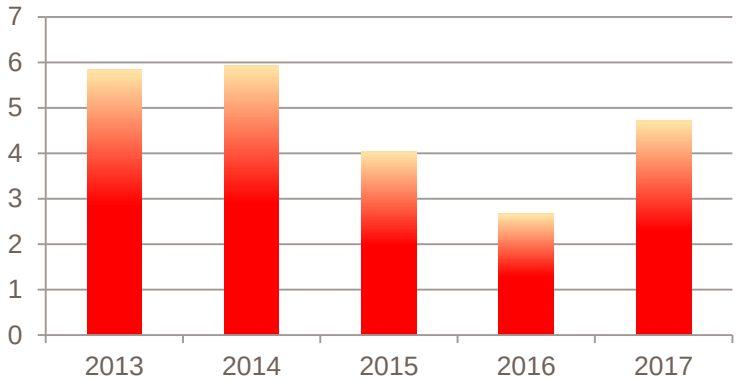
9. Significant investments in recent years



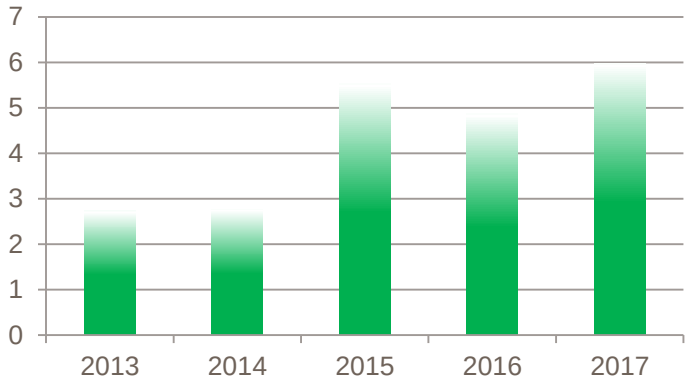
Total 80M€ between site turnarounds

9. Significant investments in recent years

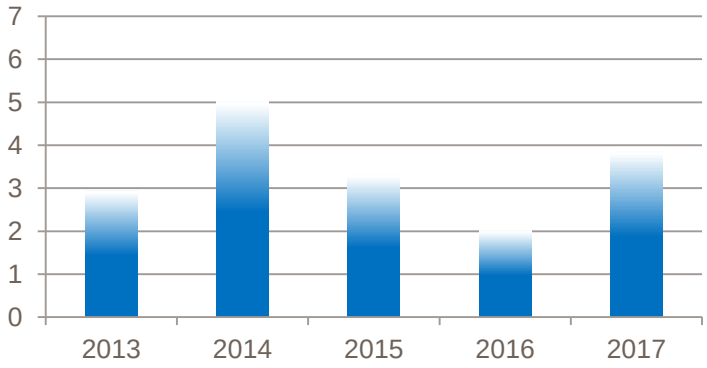
Safety and Environment [M€]



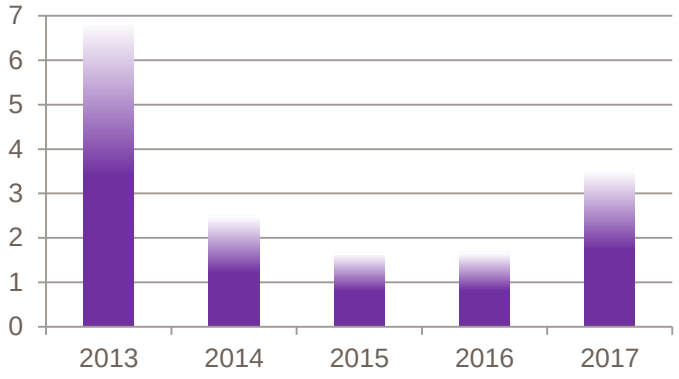
Renovation [M€]



Development & Efficiency [M€]



Infrastructures & Other operational improvements [M€]



Ethylene worldwide market outlook

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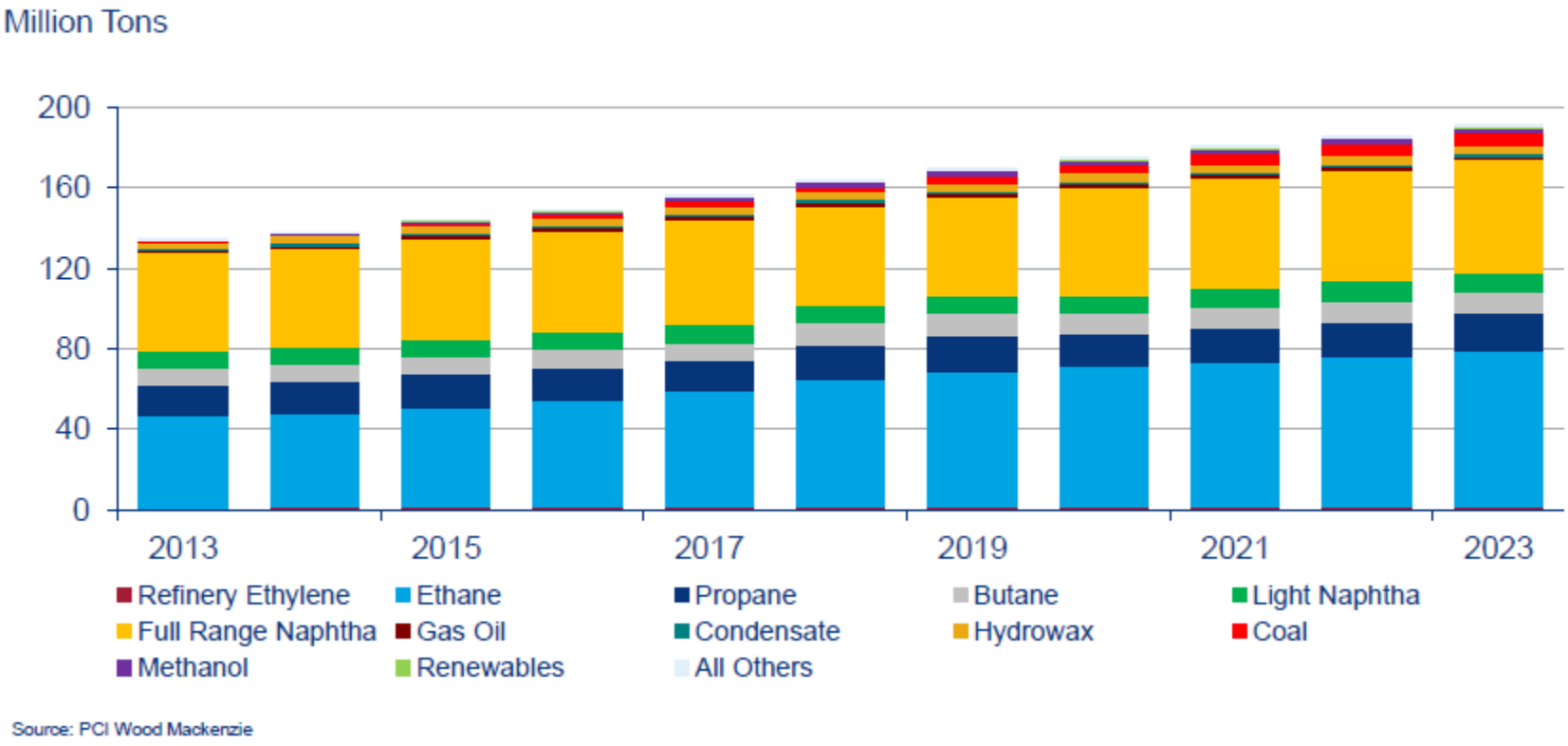
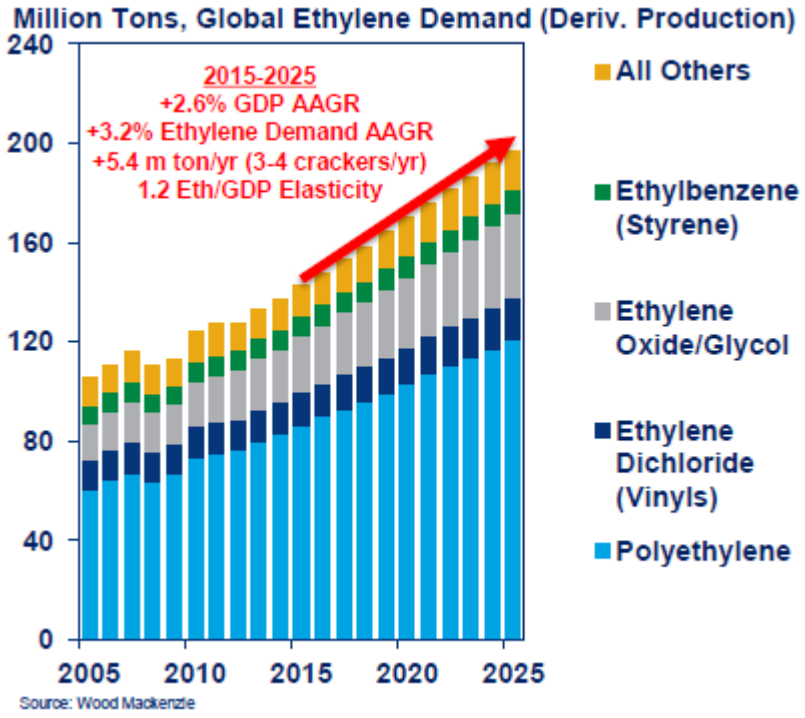
10. Ethylene market outlook

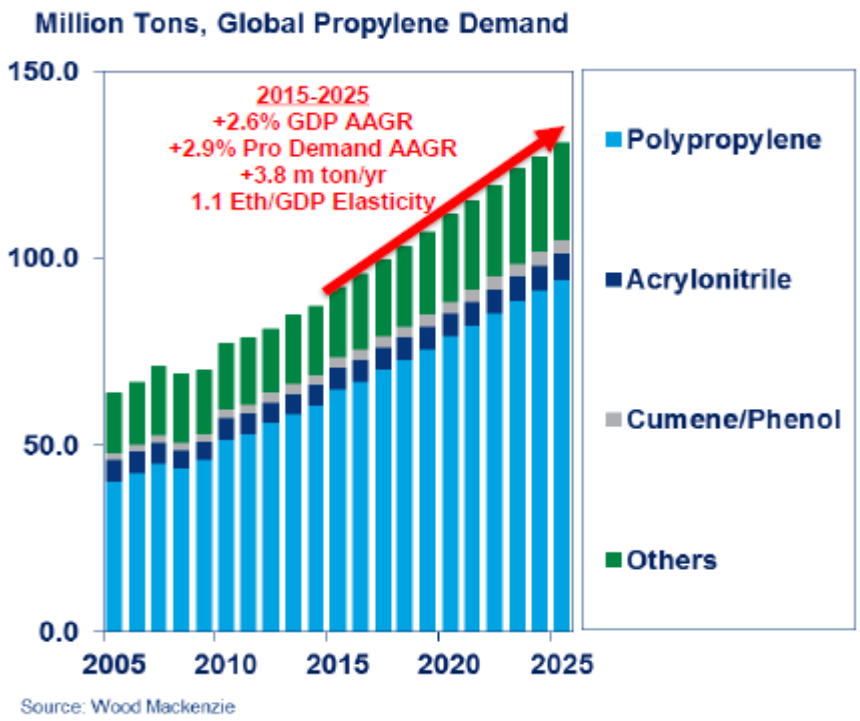
Ethylene production by feedslate



Source: PCI Wood Mackenzie

10. Ethylene market outlook





What’s next?

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11. What's next?
Competitiveness, flexibility and resilience…

Thank you