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Long term prospects for petrochemicals and its feedstocks

Session : Future of special refined products

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cefic

Petrochemicals Europe – Who we are

= the association of petrochemical producers in Europe

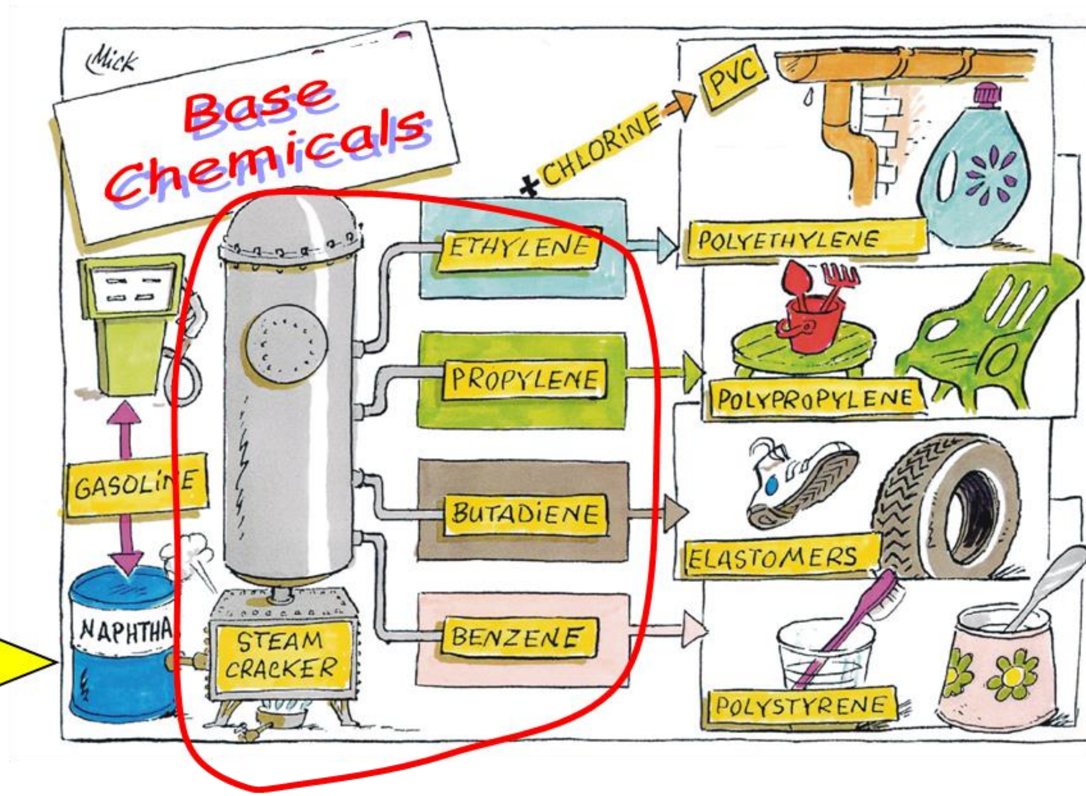
- An industry programme of Cefic
- European producers of base chemicals and derivatives
- base chemicals: 20 companies operating ~ 50 steam crackers in EU28
- derivatives ranging from acetyls, methanol, amines, etc.… to solvents
- ~ 40 units integrated with refineries
- 20% of worldwide ethylene capacity

What's Base Chemicals

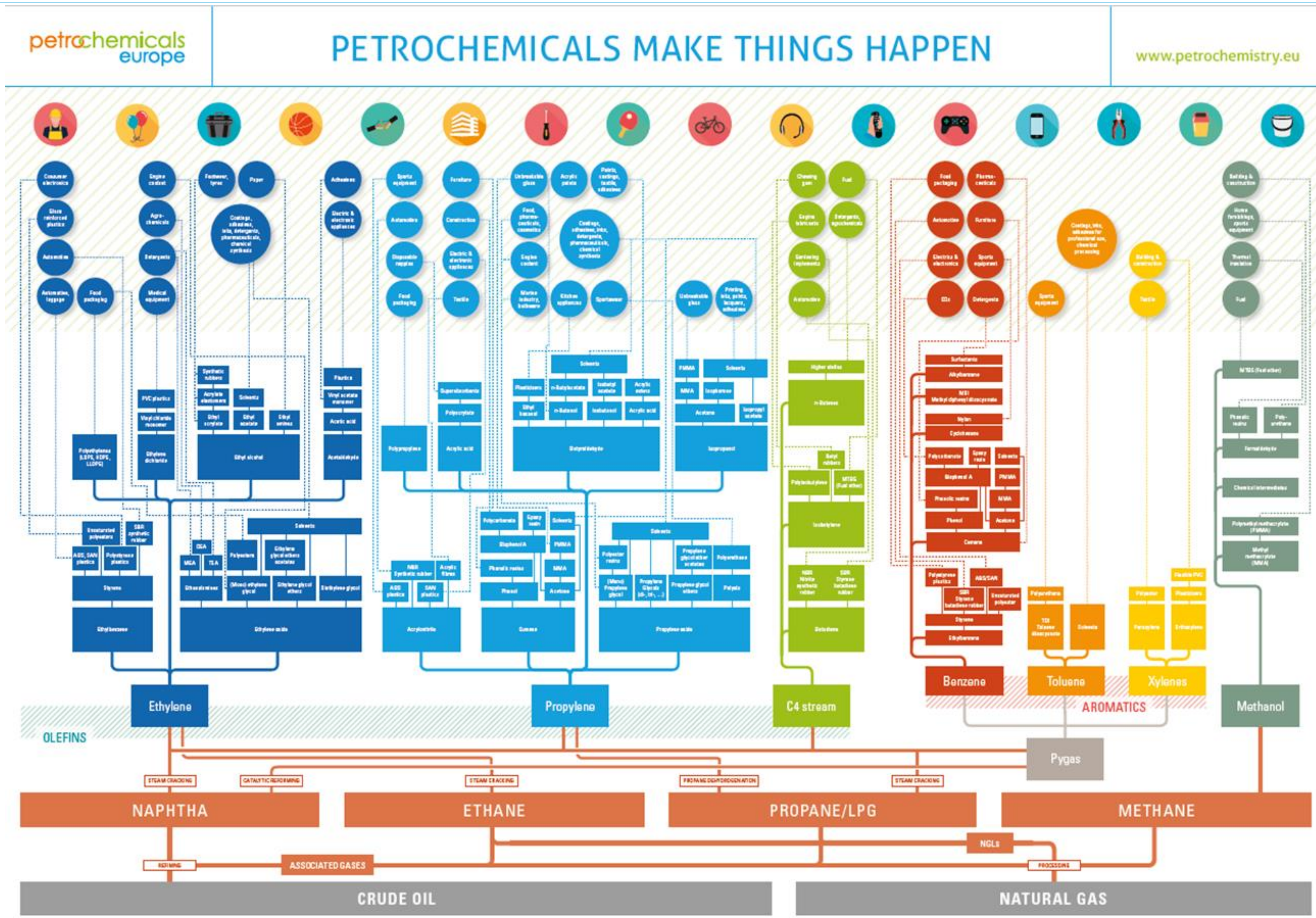
Upstream

Petrochemistry

Refining



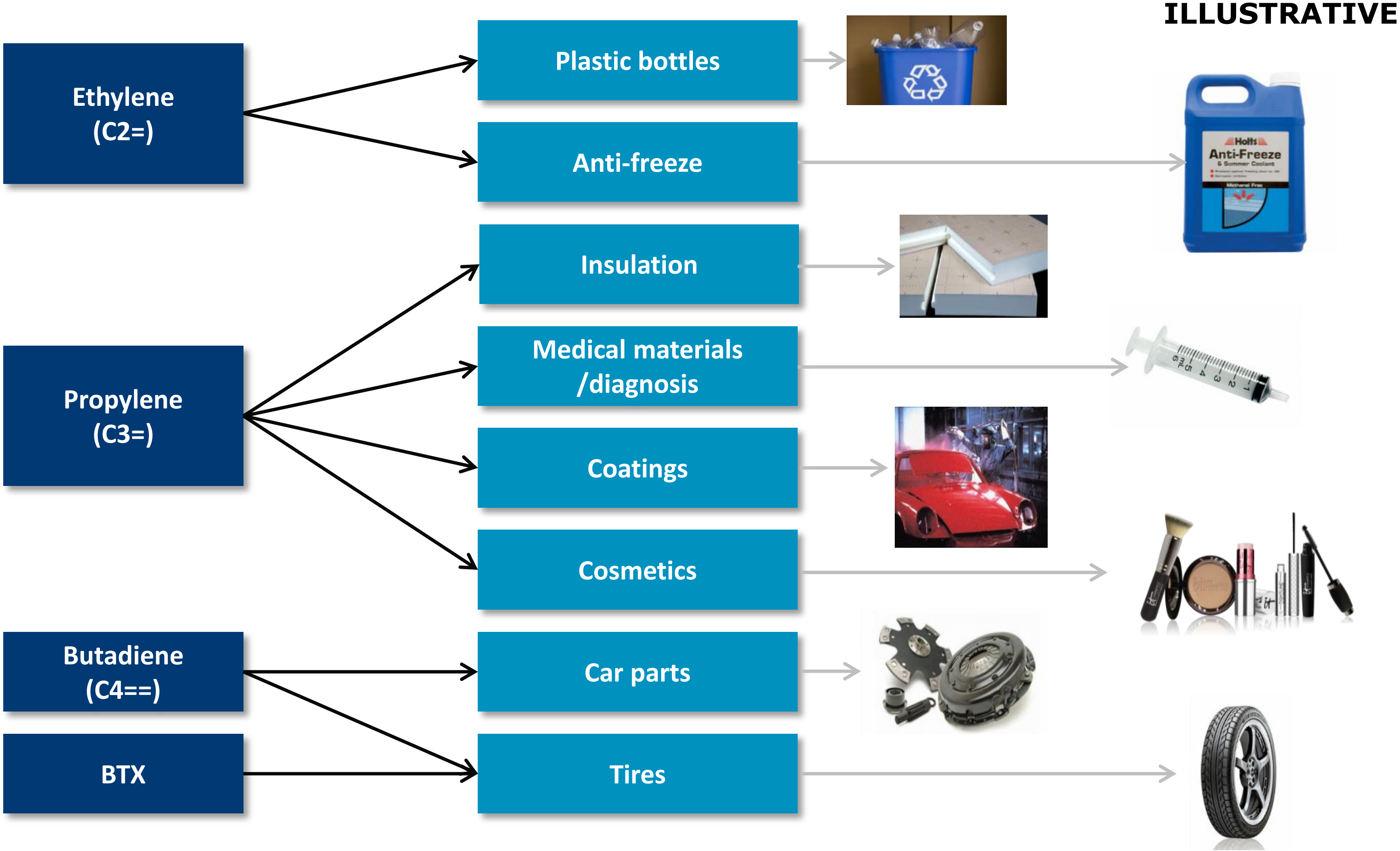
Europe – home to petrochemical excellence



Source: Petrochemicals Europe

A broad variety of products, often essential for sustainable development, are made from C2=,C3=, C4==, BTX

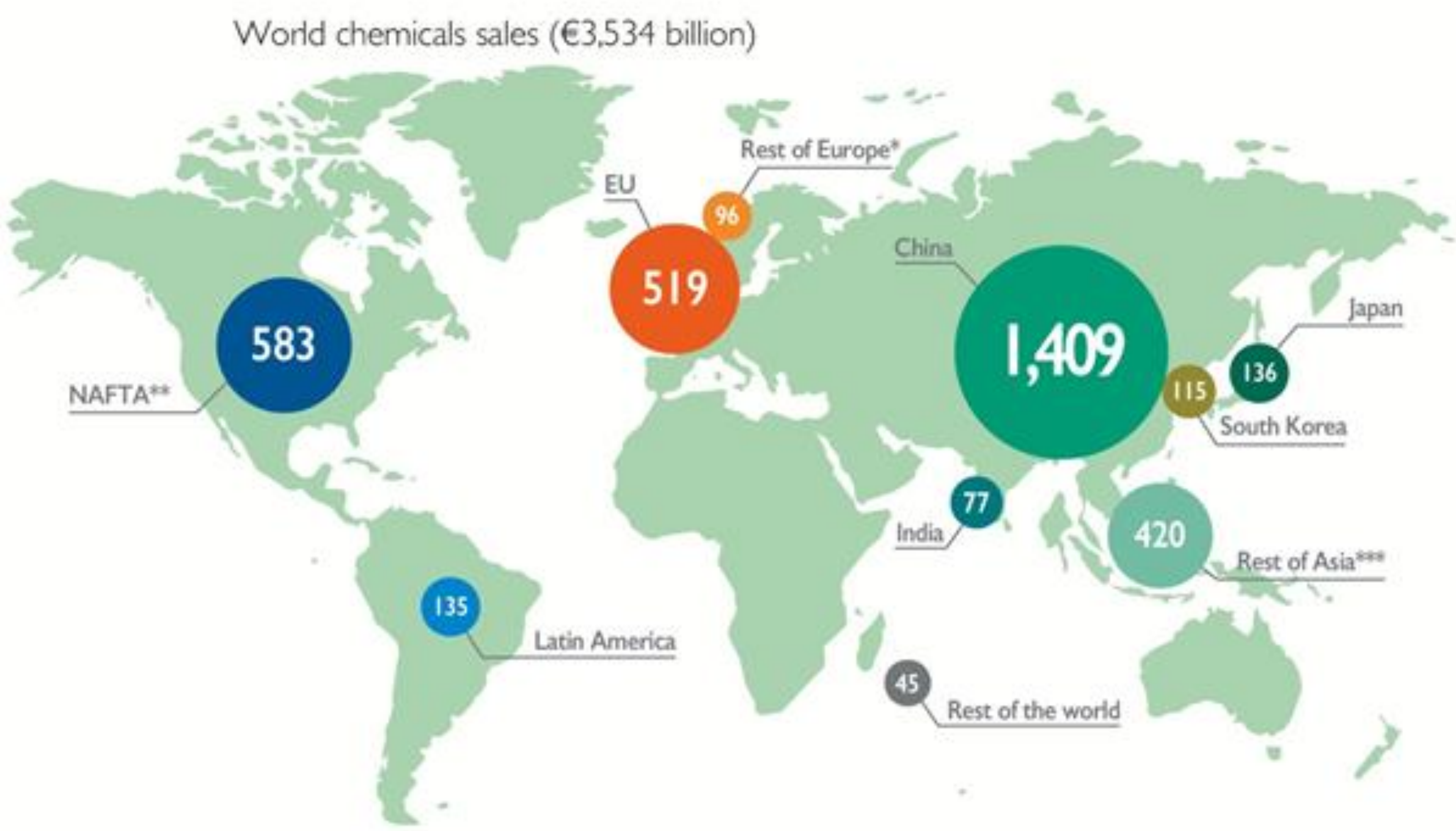
ILLUSTRATIVE



source: Essenscia; Litsearch

Asia chemicals production outpaces other regions

World chemicals sales: geographic breakdown



Source: Cefic Chemdata International 2016

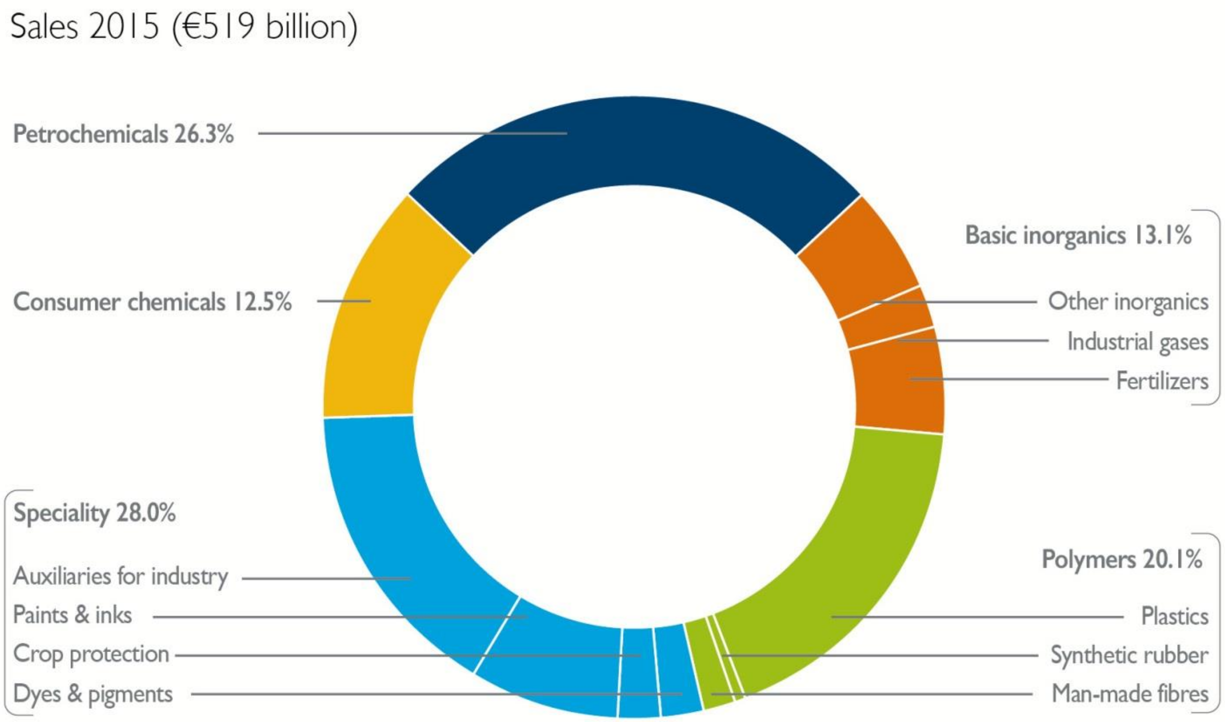
* Rest of Europe covers Switzerland, Norway, Turkey, Russia and Ukraine

** North American Free Trade Agreement

*** Asia excluding China, India, Japan and South Korea

Petrochemicals and polymers account for about half of EU chemicals sales

EU chemical industry sales by sectoral breakdown



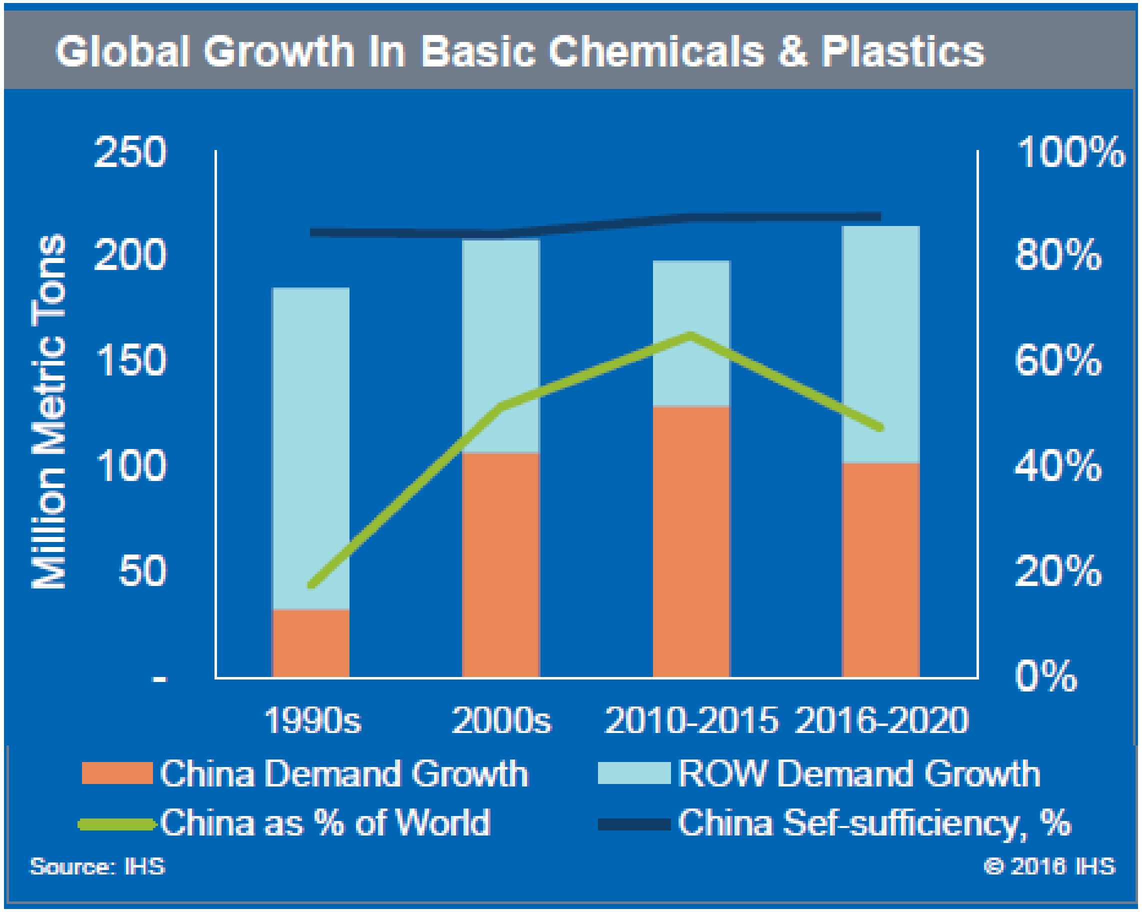
Source: Cefic Chemdata International 2016

Estimated global growth of basic chemicals and plastics

Global growth % expected to slow due to weaker economic outlook

2016 to 2020 annual volume growth similar to 2010-2015 and greater than the 2000s

Growth broadens regionally, but China remains an important driver



Source IHS

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Visible New Steam Cracker Projects

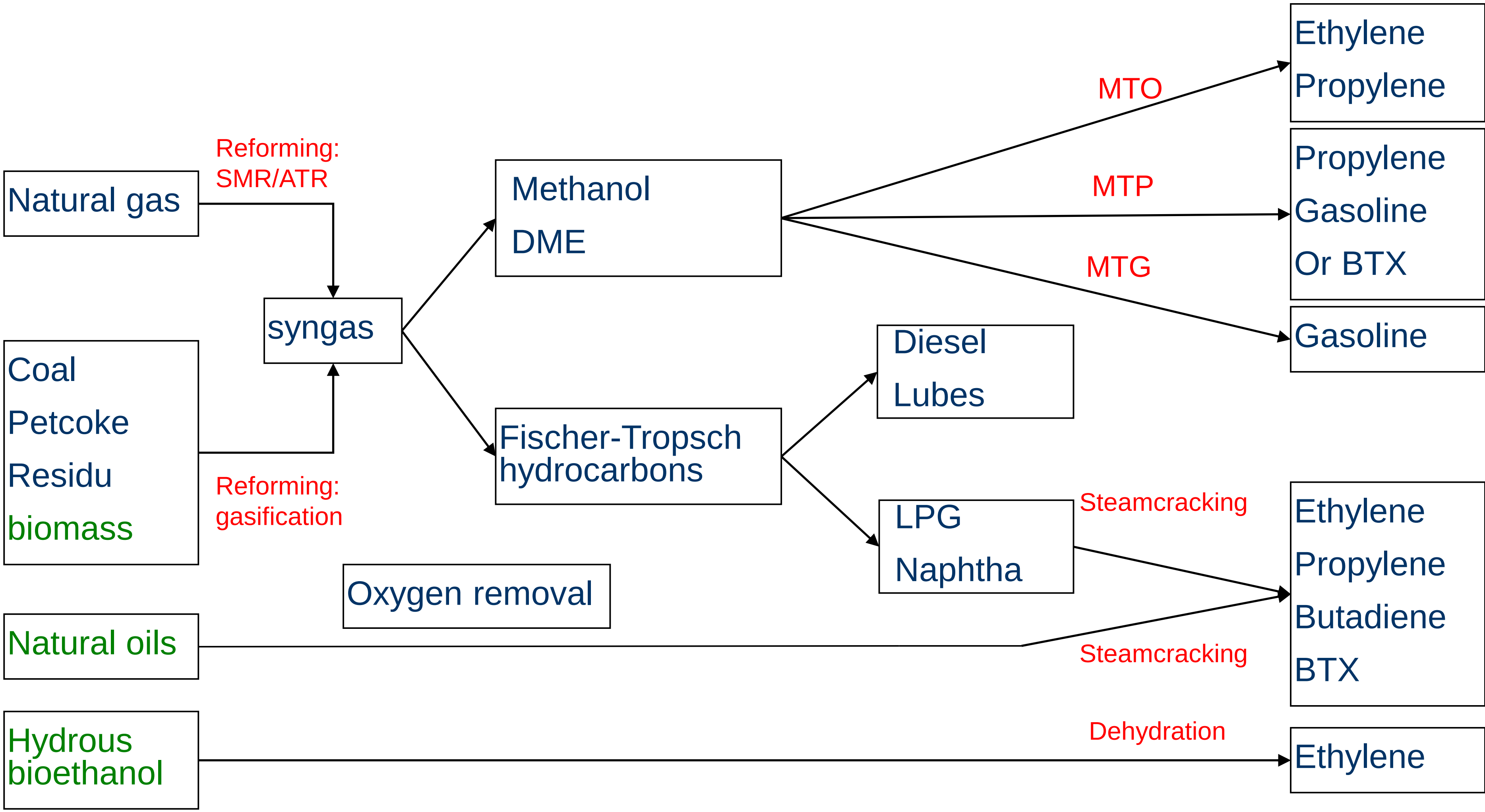
Ethylene production growth areas noticed are Russia, Middle East incl. Iran and still North Amerika.

No new steam cracker projects expected in Europe
In the next years

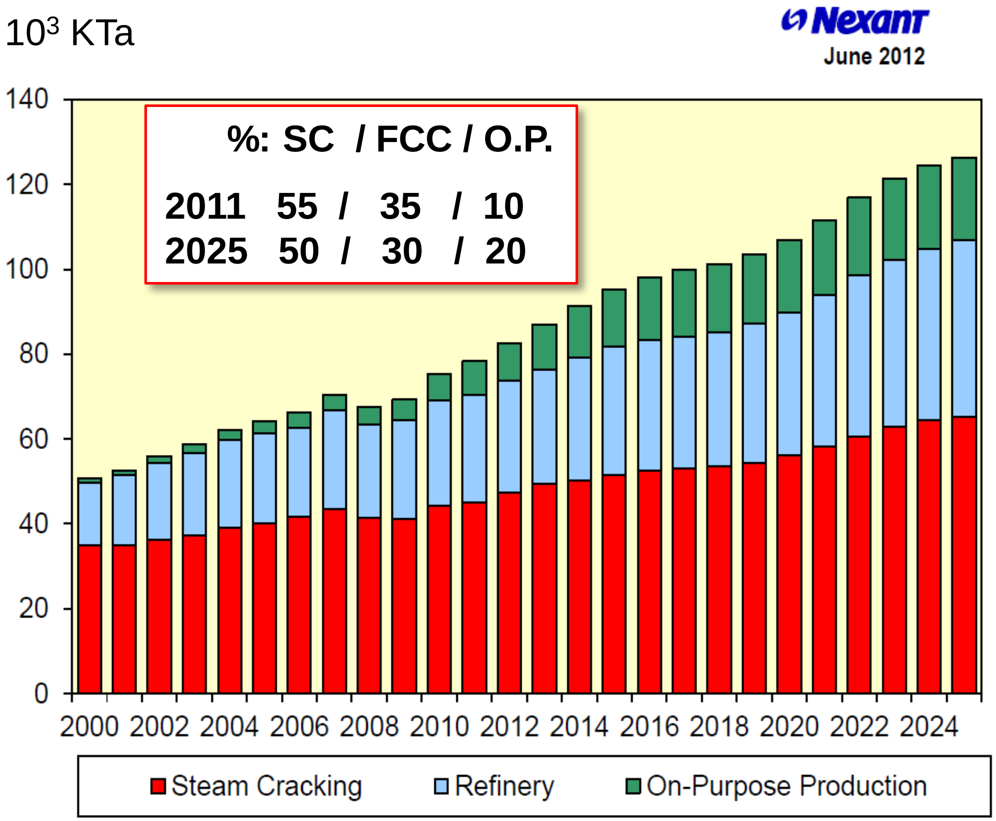
◯ = number of projects by area

(source: Linde evaluation, December 2016).

New pathways to basic petrochemicals



World propylene supply trends



Propylene mostly produced by:
- **Steam cracking (~55%),**
- **Fluid catalytic cracking (~35%).**
- **On-Purpose (~10%)**

- **Steam cracking capacity predominantly added from Ethane rather than Naphtha (lower Propylene yield):**
  - **Middle East.**
  - **US shale gas.**
- **Supplies from refineries remaining stable, or slow growth:**
  - **Fuel efficiency.**
  - **Biofuels.**
  - **Revamps costs.**

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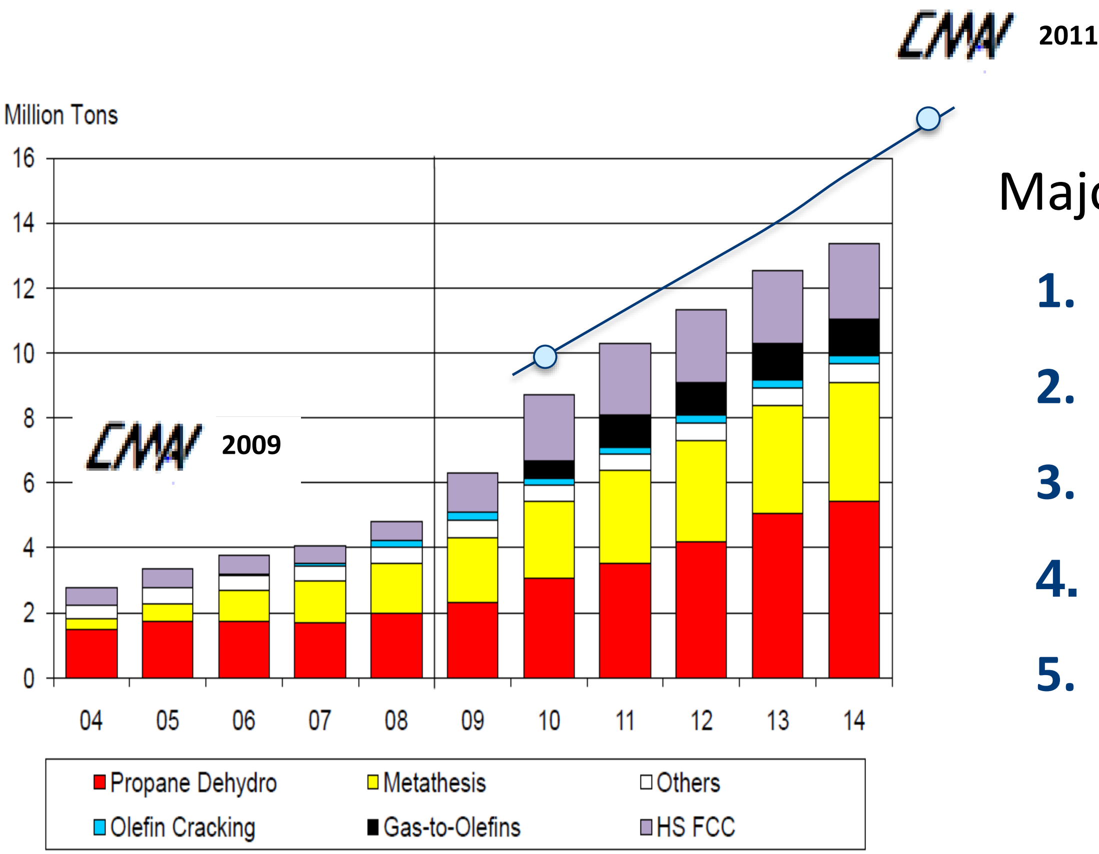
On-purpose propylene sources?



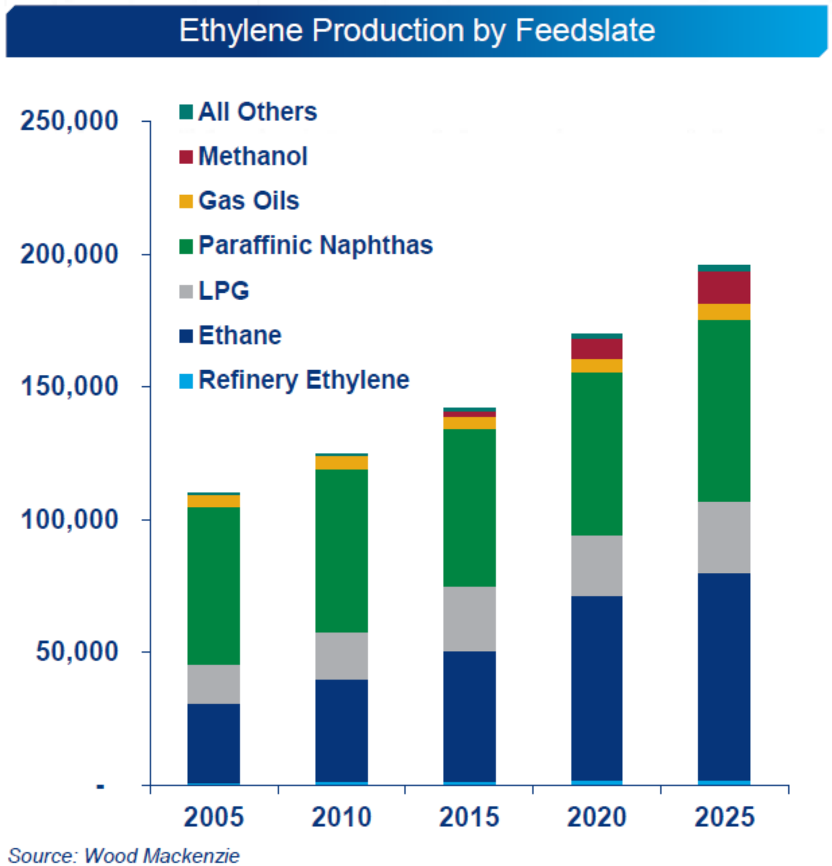
Major process technology routes:

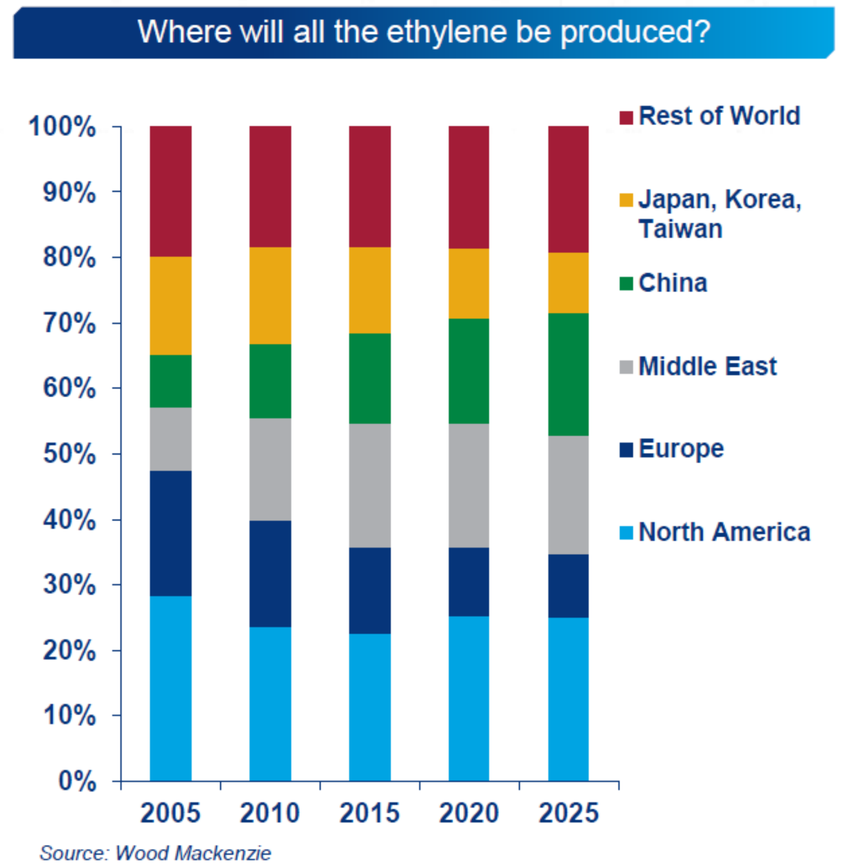
1. **PDH** – Dehydrogenation
2. **OCT** – Metathesis
3. **HS FCC** – High Severity FCC
4. **MTO** – Methanol to Olefins
5. **OCP** – Olefin Cracking

Other developments

- Several oil majors have or are developing steam cracking processes directly from crude oil. There is one running plant (1 Mton of C2=) operating since 2014. Essentially a preflash of crude oil between convection and radiant section of cracker furnaces , send the light fraction to a cracker and the heavy fraction for further treatment to a nearby refinery.
- Oxidative coupling of methane. Still in research phase. Proven yields too low for the moment.
- Circular economy. Recycling of plastics. This will reduce demand for virgin plastics, but for the first 10-20 years will not fundamentally change the increasing trend for olefins. (Quality loss during recycling limits applicability of recycled material).
- Circular economy is one of the priorities of Petrochemicals Europe.

Where and what feedstock for C2=





Units : thousands of tons

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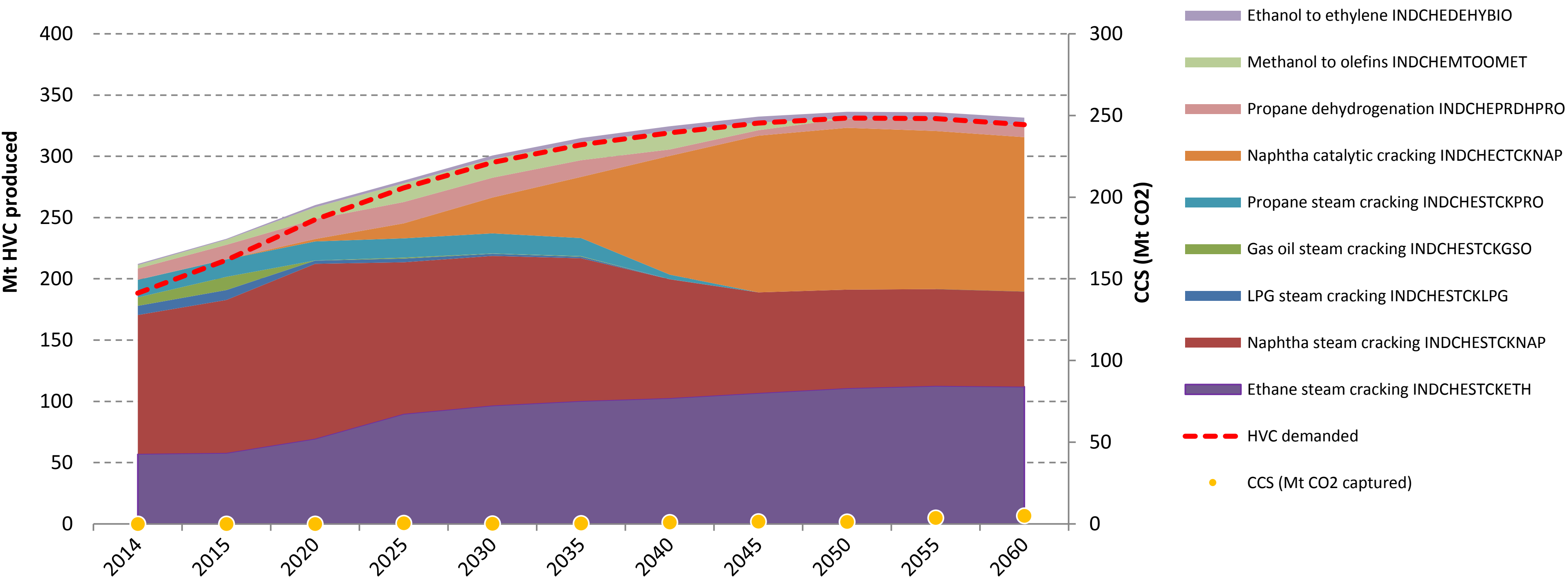
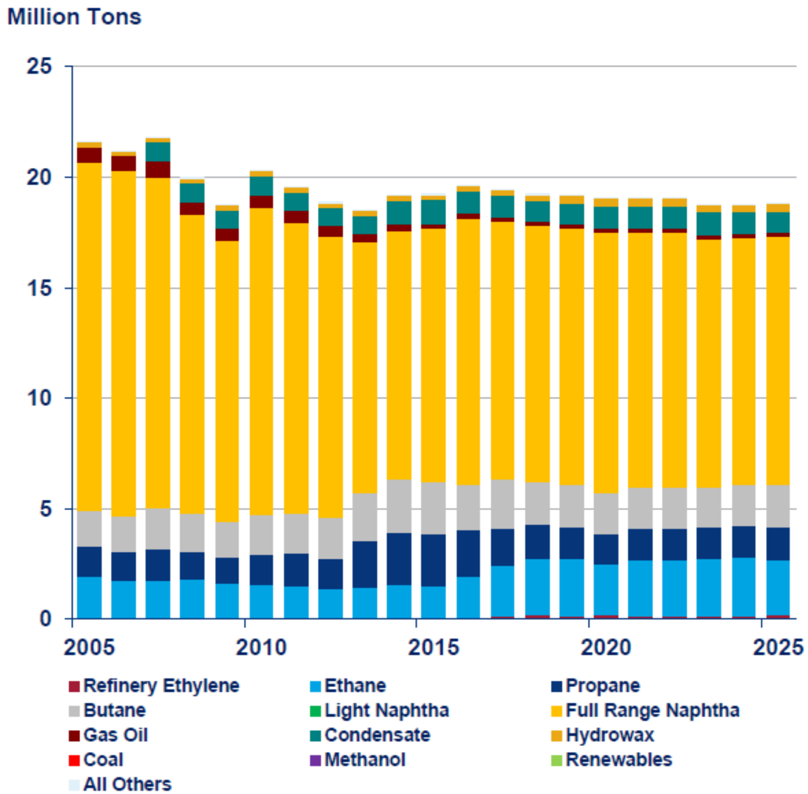
IEA view on global HVC market

- IEA carries out energy technology perspective studies to identify ways to reduce GHG emissions.
- The graph below shows their scenario for HVC growth under 2 degree temperature increase scenario. (HVC = ethylene, propylene, butadiene,BTX).
- Naphtha cracking remains dominant feedstock (growing role of catalytic cracking seen by IEA).

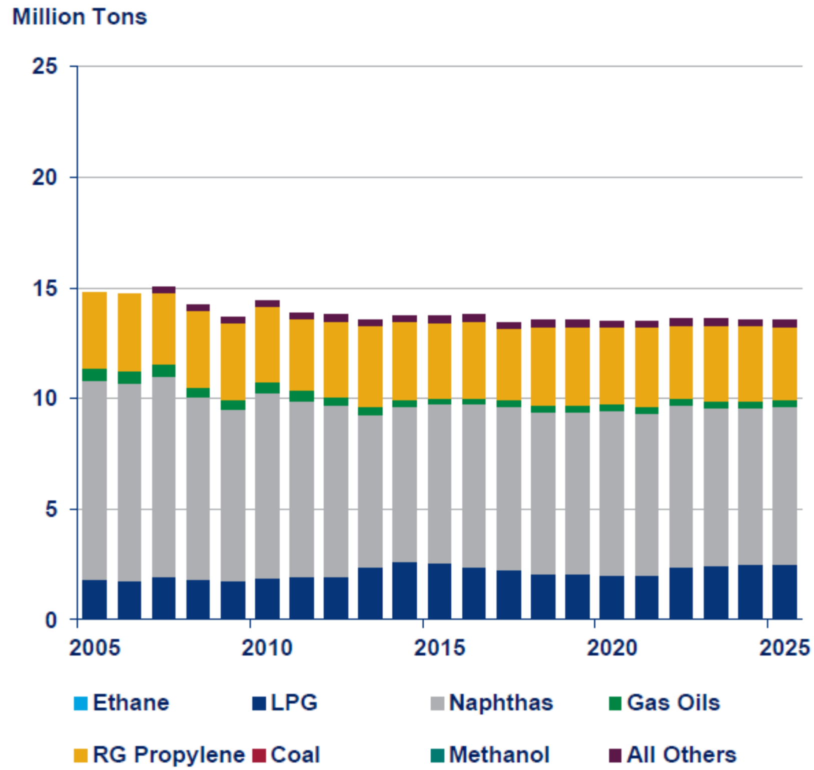


Focus on Europe

Europe ethylene production by feedstock



Europe propylene production by feedstock



Source: Wood Mackenzie

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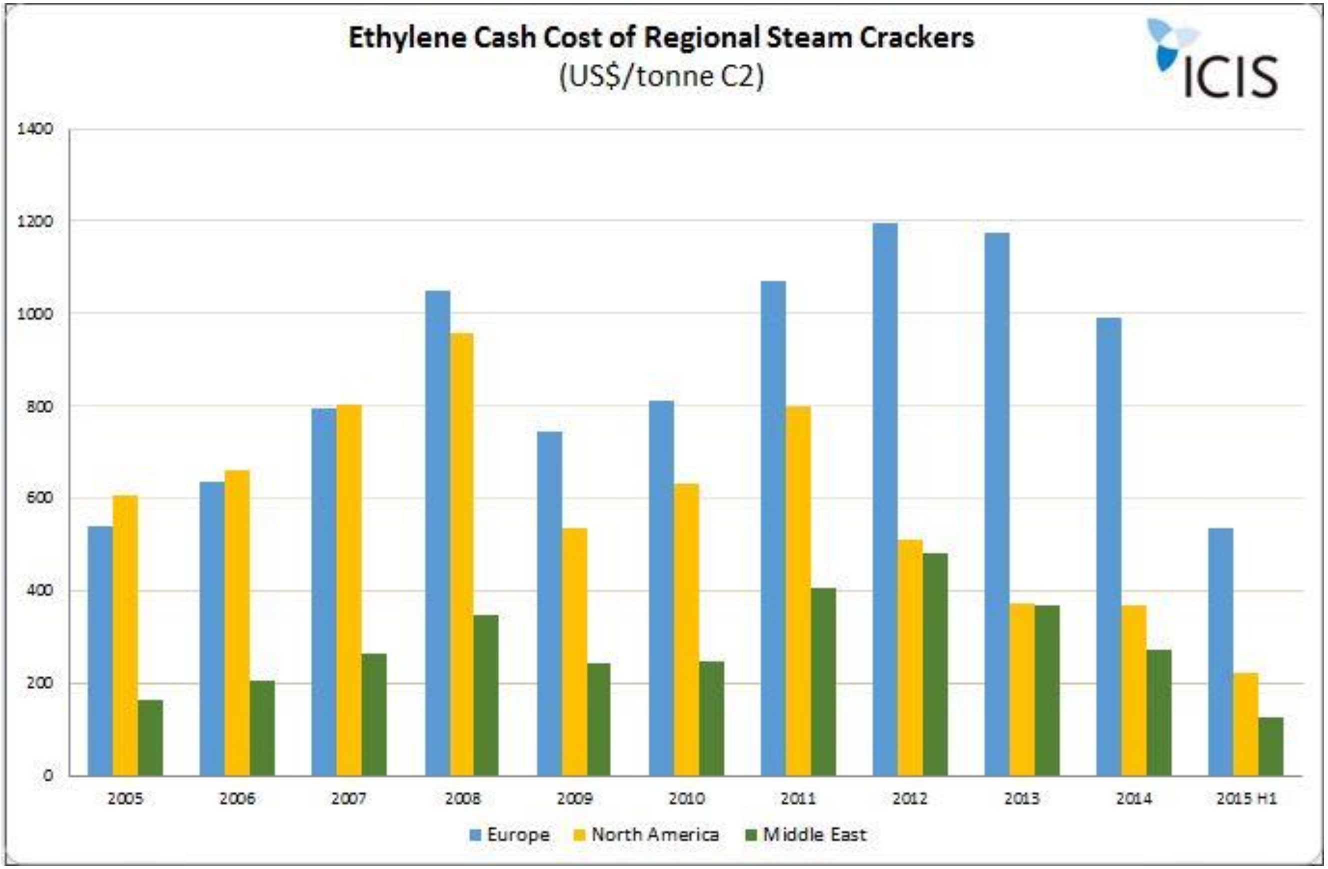
European industry's major issue

Ethylene Cash Cost of Regional Steam Crackers (US$/ton C2)



Source: ICIS Consulting