



**POLITECNICO**  
MILANO 1863

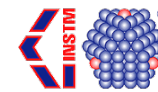
Unified CHEMICAL ENGINEERING and INDUSTRIAL CHEMISTRY team  
POLITECNICO DI MILANO – UNIVERSITÀ DEGLI STUDI DI MILANO

**Super team**  
Sustainable Process Engineering Research





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*ECOMONDO, Rimini, 20211028-PSE-CMN-03*

## **ELT selective devulcanization and conversion to advanced fuels by DES+ process technology**

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**Sergio Miele**  
**Enrica Bargiacchi**  
**Flavio Manenti\****

***Microgomma Energia Srl**, Siena  
**Acea Ambiente SpA**, Terni  
**INSTM**, Firenze  
**INSTM**, Firenze  
**Politecnico**, Milano*

***\*SPEAKER***

## **The role of Acea Ambiente**

From MSW and plastic wastes to rubbers and tyres

## **The experience of Microgomma Energia**

Mechanical recycle and environment care

## **The DES+™ technology**

Envisioning the future of EoL vulcanized rubbers

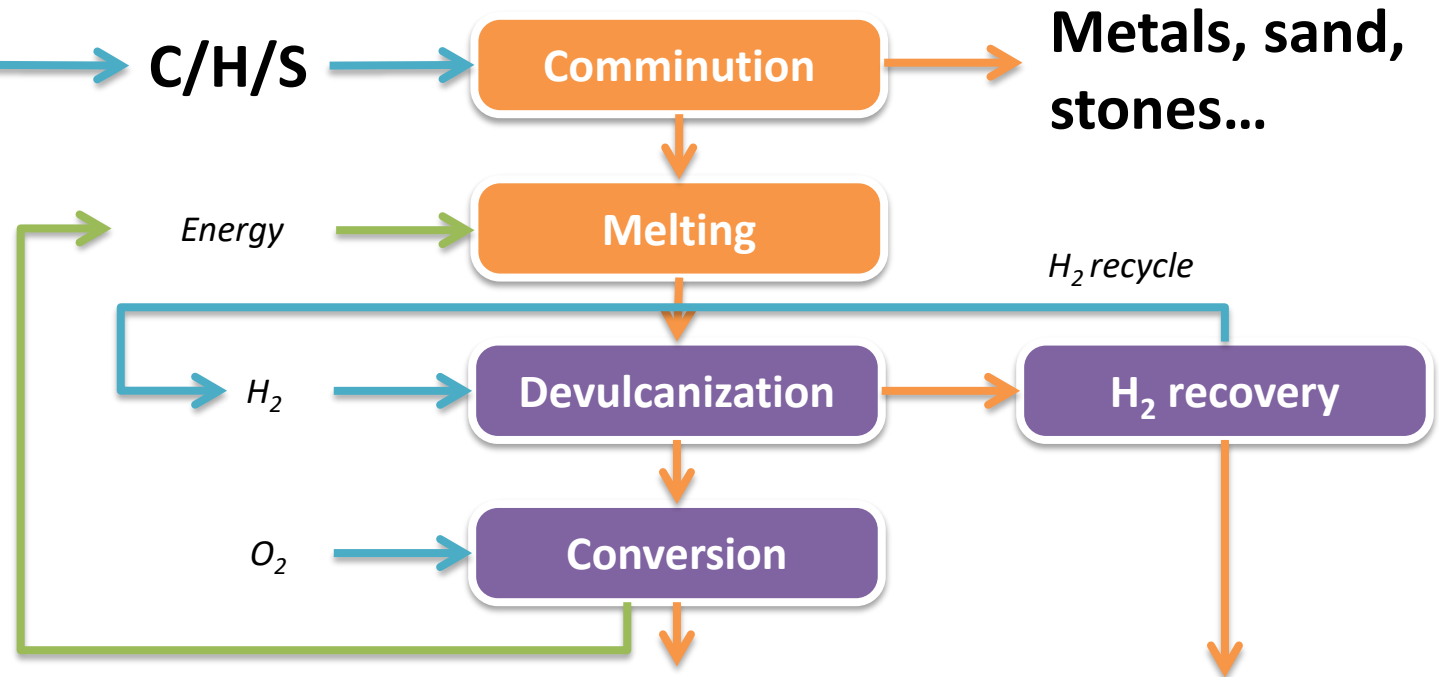


# From mechanical to chemical recycling

## DES+™ vision



**EoL  
vulcanized  
rubbers**



**Known steps**

**Dedicated steps**

**Methanol (400 €/t)**  
**DME (480 €/t)**  
**EU incentives**

**S<sub>2</sub> (90 €/t)**



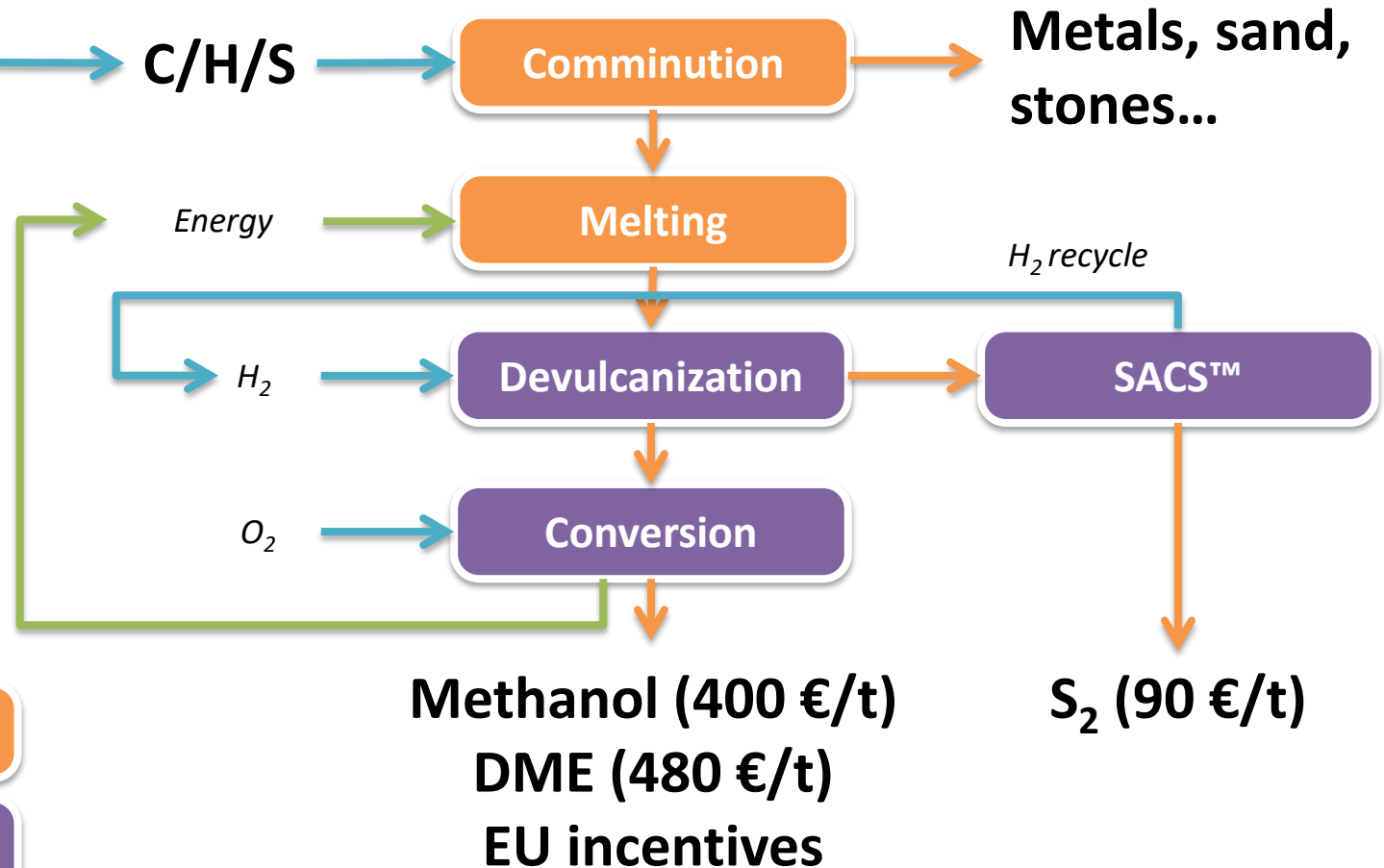


# From mechanical to chemical recycling

## DES+™ vision



**EoL  
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rubbers**

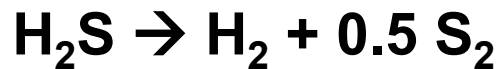


# SACS™ unit for hydrogen recovery

(Manenti, Piccioni, 2018, WO granted)



Just hydrogen production:

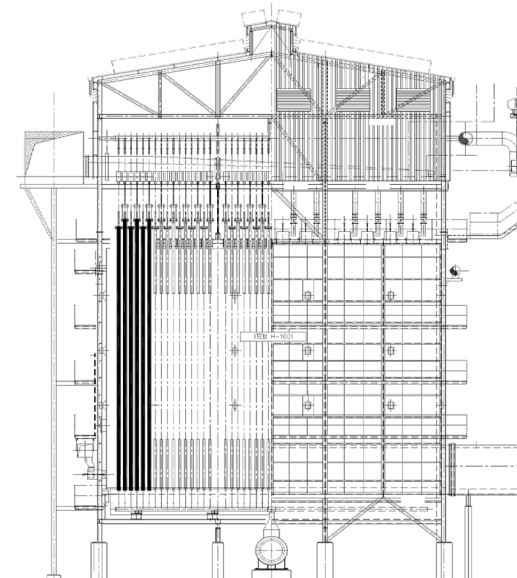


No by-products

Total conversion

Low CAPEX

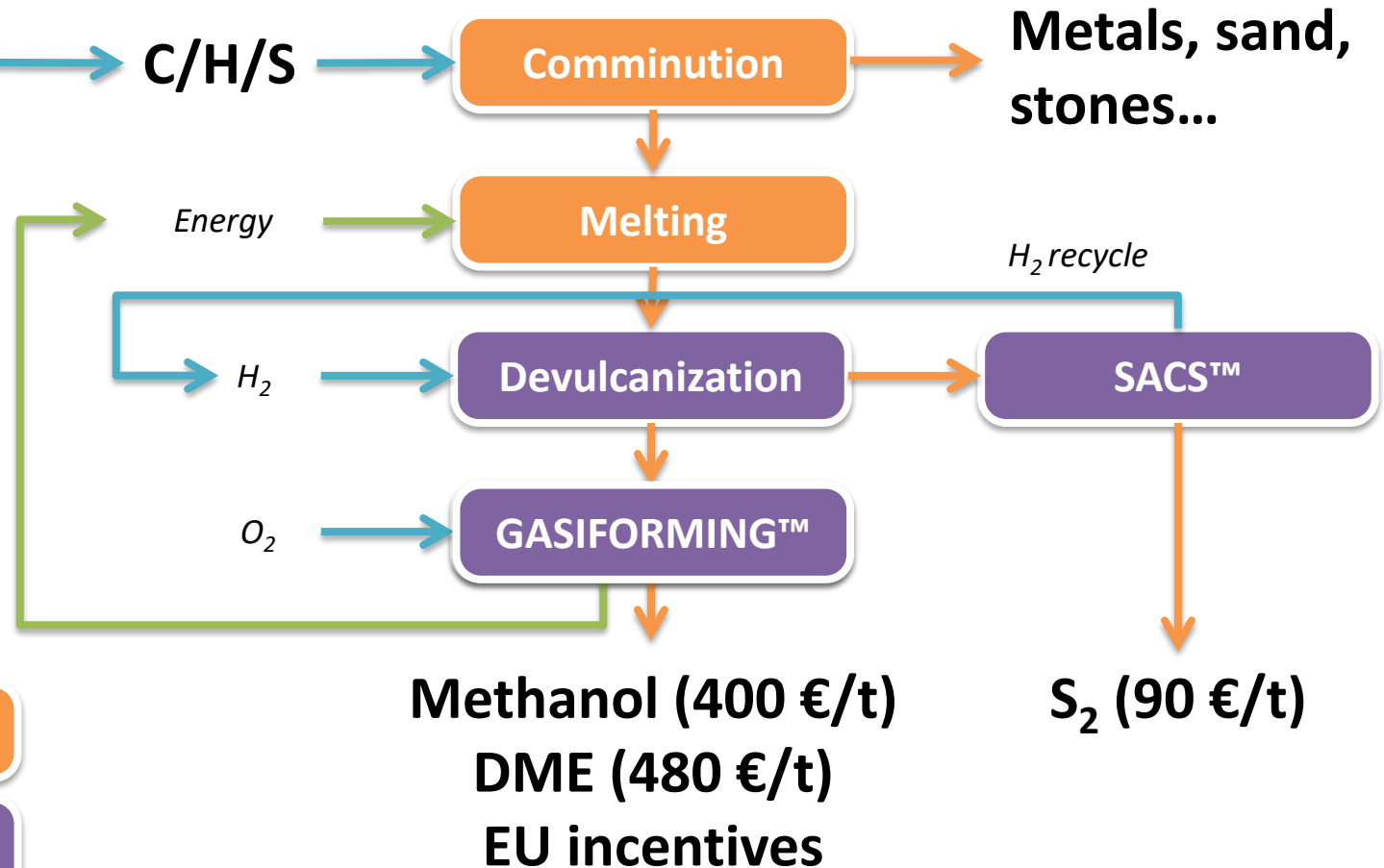
Low OPEX



# From mechanical to chemical recycling DES+™ vision



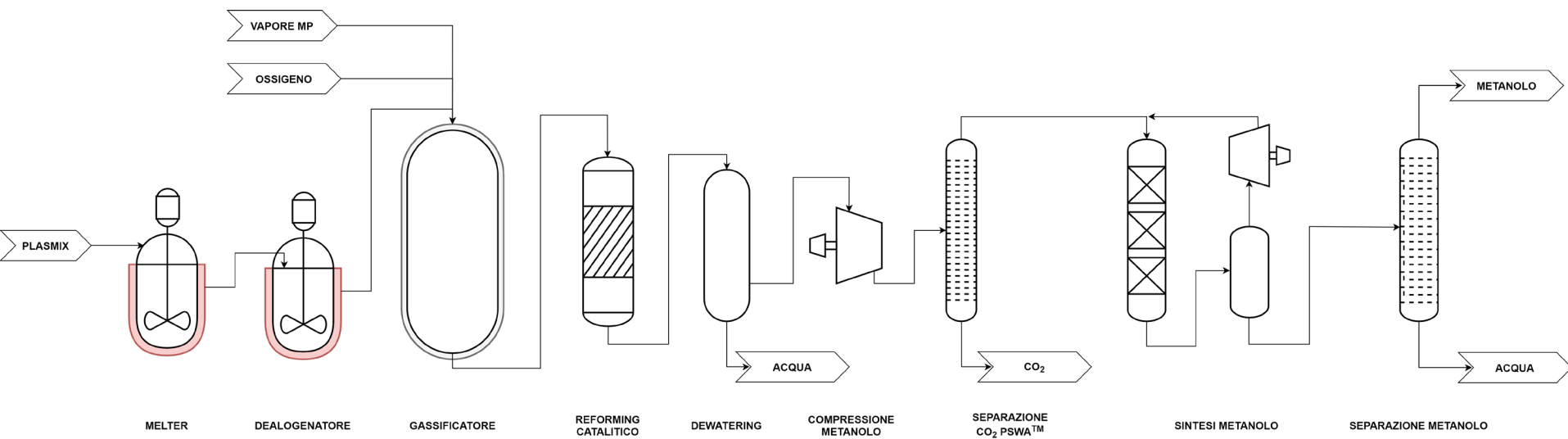
**EoL  
vulcanized  
rubbers**



# GASIFORMING™ technology

## From plastic wastes to adv. biofuels

15y agreement presented yesterday (Oct.27th) at Ecomondo  
(stand: Acea) – Acea, INSTM, Politecnico di Milano





# Vulcanized rubbers → plastic wastes



**EoL  
vulcanized  
rubbers**

**C/H/S**

**Comminution**

**Metals, sand,  
stones...**

**Melting**

**Non-vulcanized  
plastic wastes**

**De-halogenation**

*H<sub>2</sub> recycle*

**Devulcanization**

**H<sub>2</sub> recovery**

**Conversion**

**Methanol (400 €/t)**

**S<sub>2</sub> (90 €/t)  
Cl (200 €/t)**

**DME (480 €/t)**

**EU incentives**

**Known steps**

**Dedicated steps**

CO MILANO 1863

Prof. Flavio Manenti

SUPER Centre, Politecnico di Milano

## ***Chemical recycle of vulcanized rubbers:***

***FEASIBLE!***

*EoL vulcanized rubbers are transformed into plastic wastes ready for high-yield conversion in established technologies*

*Combination of expertise in:*

*Waste management (Acea Ambiente)*

*Tyres mechanical recycling (Microgomma Energia)*

*Technology development / industrialization (INSTM-POLIMI)*

*Techs for process/energy self-sustainability and carbon neutral are available to achieve the target by Q3/2023*





# Thanks for the kind attention

**Flavio Manenti**

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