











Funded by the European Union

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## TECHNO-ECONOMIC ASSESSMENT OF BIZEOLCAT NEW PROPANE AND BUTANE DEHYDROGENATION AND PROPANE AROMATIZATION

Vittoria Cosentino 16 March 2023





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(1) A. Ricca, F. Montella, G. Iaquaniello, E. Palo, A. Salladini and V.Palma, "Membrane assisted propane dehydrogenation: Experimental investigation and mathematical modelling of catalytic reactions," Catalysis Today, no. Elsevier, 2017. (2) Z. Nawaz, "Light alkane dehydrogenation to light olefin technologies: a comprehensive review," Rev. Chem. Eng., vol. 31, no. 5, no. 5 vol. 31 2015.

### **Process technologies overview**

### Benchmark



#### **Process technologies overview Innovative processes** PDH **BDH** PAR BIZEOLCAT process • BIZEOLCAT process BIZEOLCAT process • BIZEOLCAT catalyst Commercial catalyst • BIZEOLCAT catalyst Pt(0.75)Sn/ 18-20 wt% CrOx/Al2O3, GaiBu/meso-40 1-2 wt% Na or K Li(0.45)Al2O3 No membranes • Double skin Pd-alloyed • Double skin Pd-alloyed membranes membranes H2 H2 To burners 1.3 butadiene To burners Benzene H2 1.3 Light Memt Fresh C3H8 compound butadiene Pre-feeding Light/heavy BTX Reac Fresh C3H8 Pre-heating Reactors MP recycle separation separation separation compound separation ➡ Toluene sect separation section separation section To burners C3H8 recycle Fresh NMP Xylene C3H8 recycle **BiZeolCat** NEXTCHEM Confidential Information

### **Techno-economic assessment**

### Cost of Production (COP) 1/2



- VOC calculated on feed basis: propane cost of 430 Euro/ton PDH and PAR; butane cost of 440 Euro/ton for BDH
- Depreciation: 10% Fixed Capital Investment
- O&M plant: 3% Fixed Capital Investment

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### **Techno-economic assessment**



### Analysis of main parameters on COP

Feed cost



Cost of production versus feed cost for a) PDH, b) BDH and c) PAR





### Analysis of main parameters on COP

Catalyst cost



Cost of production versus catalyst cost for a) PDH at propane cost at 430 Euro/ton, b) BDH at butane cost of 440 Euro/ton and c) PAR at propane cost at 430 Euro/ton





## Analysis of main parameters on COP

### Membrane cost and life



Cost of production versus membranes cost for a) PDH at propane cost of 430 Euro/ton and 3years of membrane-life, and b) BDH at butane cost of 440 Euro/ton and 3years of membrane-life Influence of membranes life for a) PDH at propane cost of 430 Euro/ton and b) BDH at butane cost of 440 Euro/ton





### Conclusions

- The lower is the price of feedstock and catalyst and the lower is the gain derived from deployment of BIZEOLCAT technology.
- The more is reduced the cost of the membrane and the more is increased the lifetime, the higher is the gain showed by BIZEOLCAT innovative technology.
- PDH is favourably influenced using innovative catalytic membrane reactor since a reduction in COP of 14% can be achieved.
- BDH is favourably influenced using innovative catalytic membrane reactors since a reduction in COP of 10% can be achieved.
- PAR is negatively influenced using innovative catalytic membrane reactors. Without membranes and with BIZEOLCAT catalyst, a reduction in COP of 50% can be achieved.







# THANK YOU FOR THE ATTENTION!

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