

# ReCap

## Understanding the cost of Retrofitting CO<sub>2</sub> Capture in an integrated oil refinery

ETS Innovation Fund expert workshop , 23rd March 2017

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ENVIRONMENTAL SCIENCE FOR THE EUROPEAN REFINING INDUSTRY

# Partners

## Project Participant



Energy Research – Project Owner



## Sub-Contractor



## Main Funding body



Connected to the  
Research Council  
of Norway

[IEAGHG = IEA Greenhouse Gas R&D Programme, an organisation having an implementing agreement with the International Energy Agency or "IEA"]



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# The ReCap project: a bottom-up approach

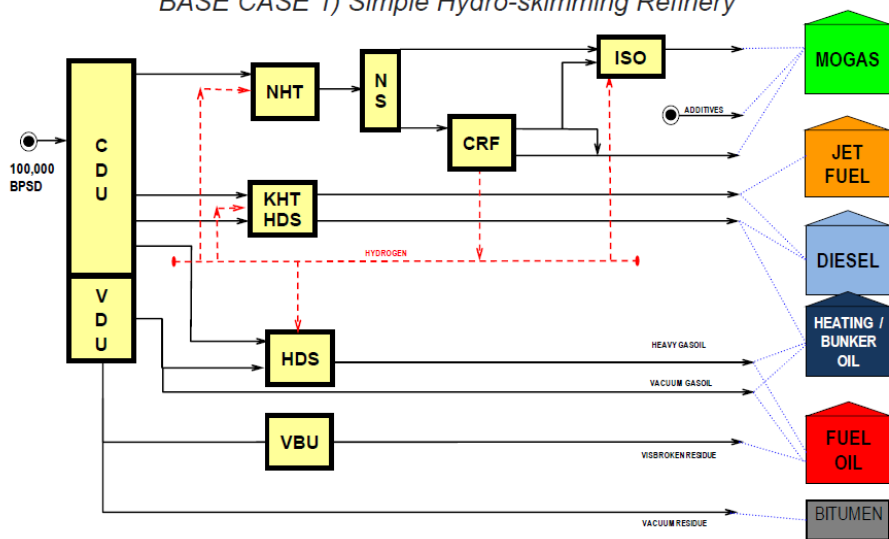
Cost of retrofitting CO<sub>2</sub> capture technologies in integrated oil refineries

4 generic refineries defined (100-350 kbbbl/d ; 4.7-16.7Mt/y)

16 post-combustion capture cases (using MEA) investigated (3-6 per refinery)

Ongoing: sizing and costing of the capture cases

BASE CASE 1) Simple Hydro-skimming Refinery

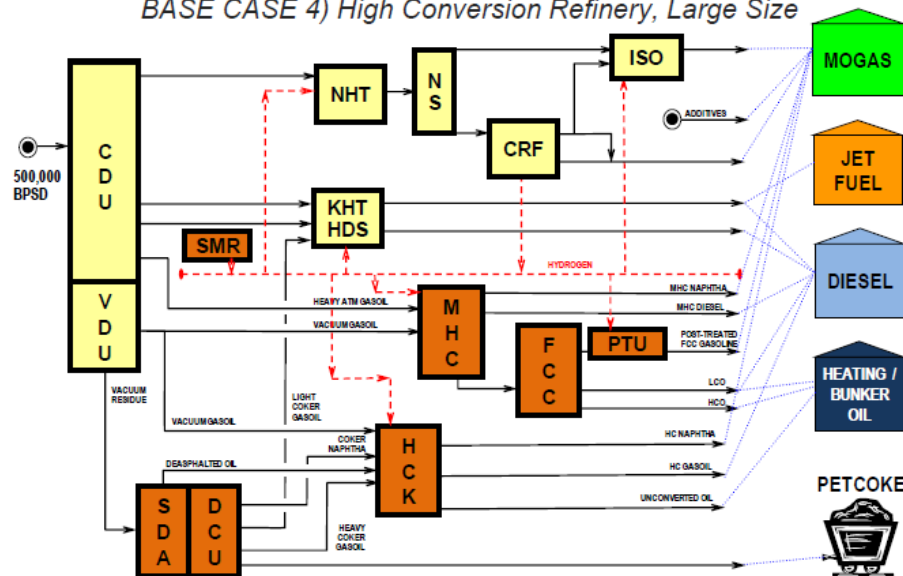


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BASE CASE 4) High Conversion Refinery, Large Size



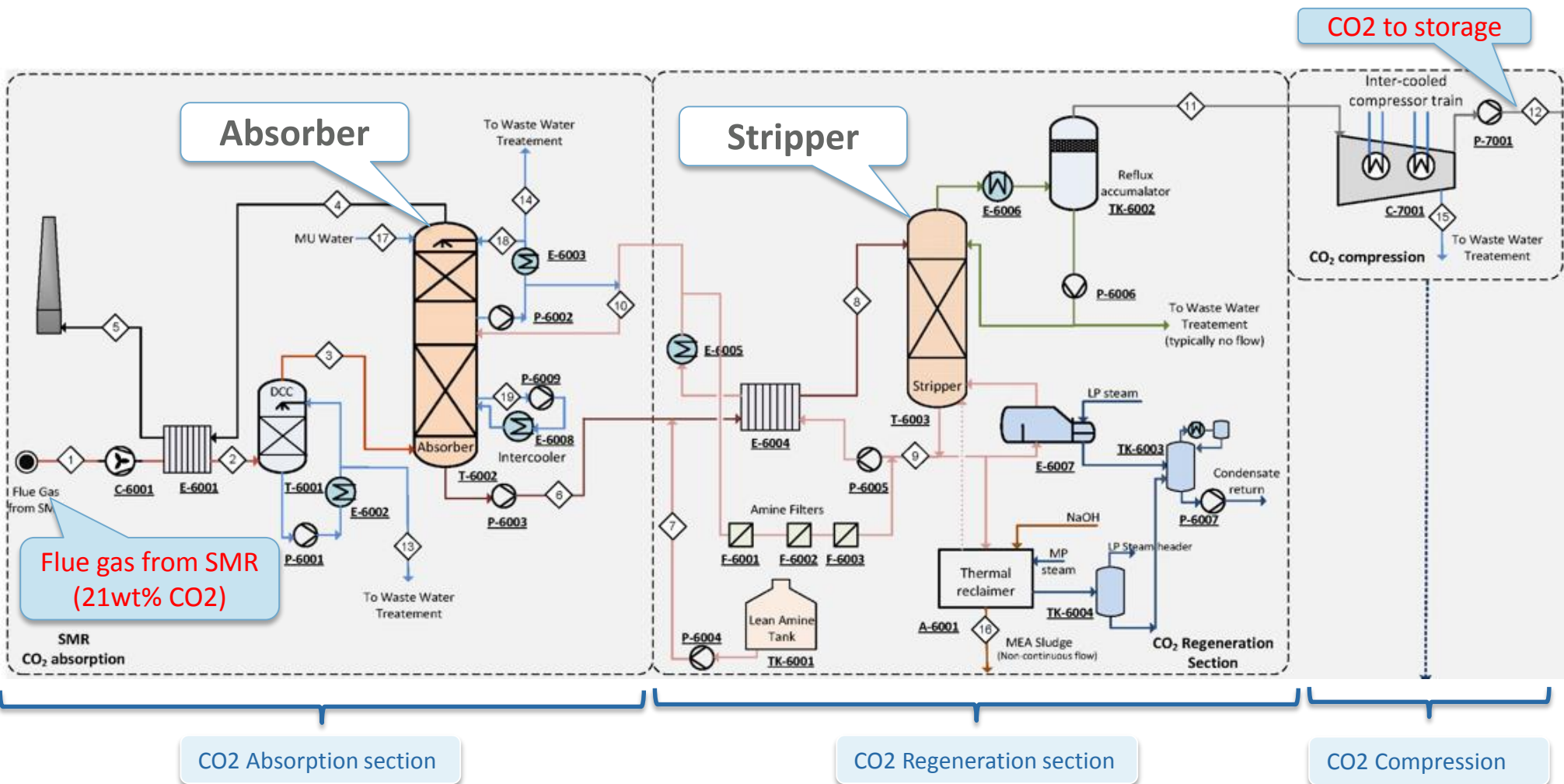
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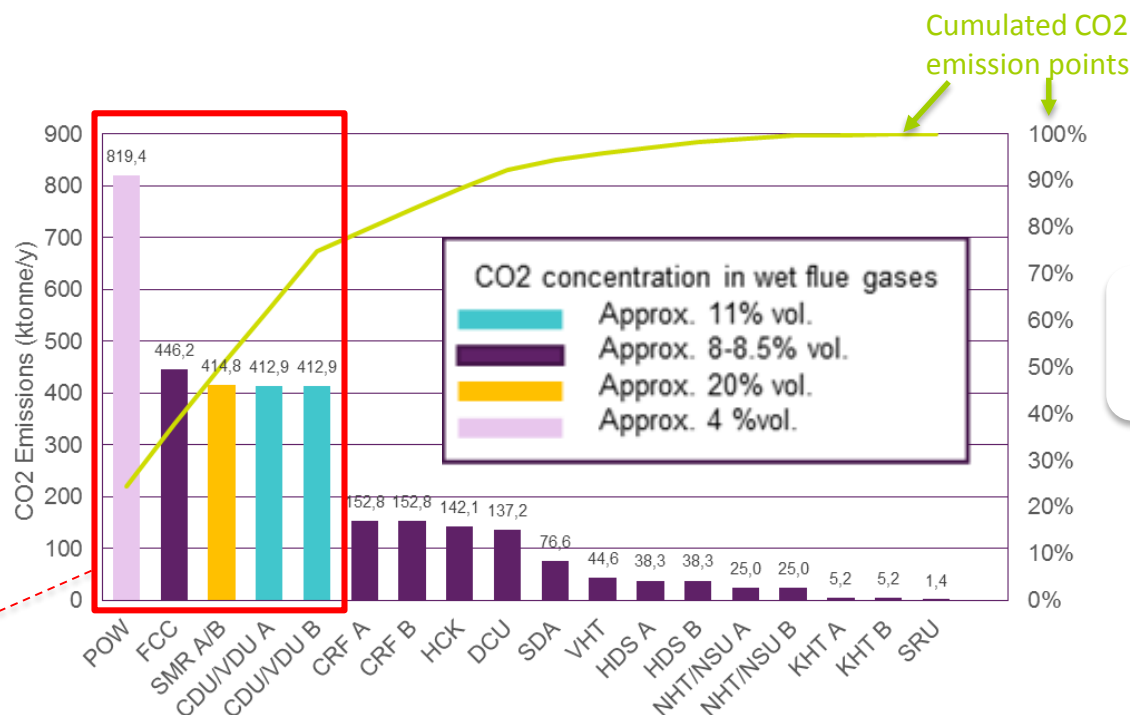


# Process flow diagram of MEA process for post combustion CO2 capture



# Refineries: numerous CO2 emission points

Highly complex (generic)  
refinery with a nominal  
capacity of 350,000 bbl/d

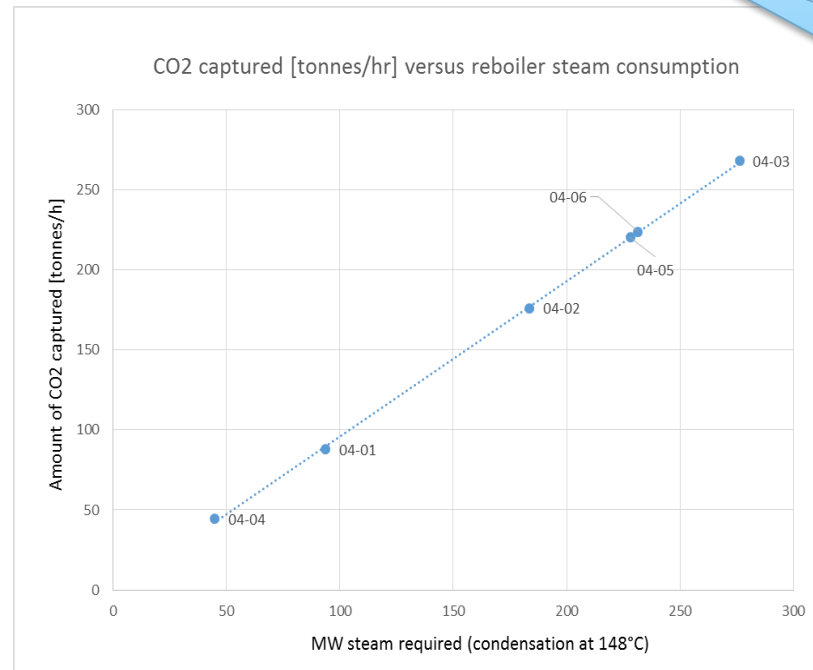


Total CO2 emitted  
= **3.9 Mt/y**  
234 kgCO2/tcrude

5 streams selected = 75% of CO2 emitted by the refinery

# Findings (technical) for 90% CO2 capture

Heat requirement is proportional to amount of CO2 captured (figure)



Net capture ~60%  
(energy required for capture taken into account)

Other parameters increase proportionally to the amount of CO2 captured

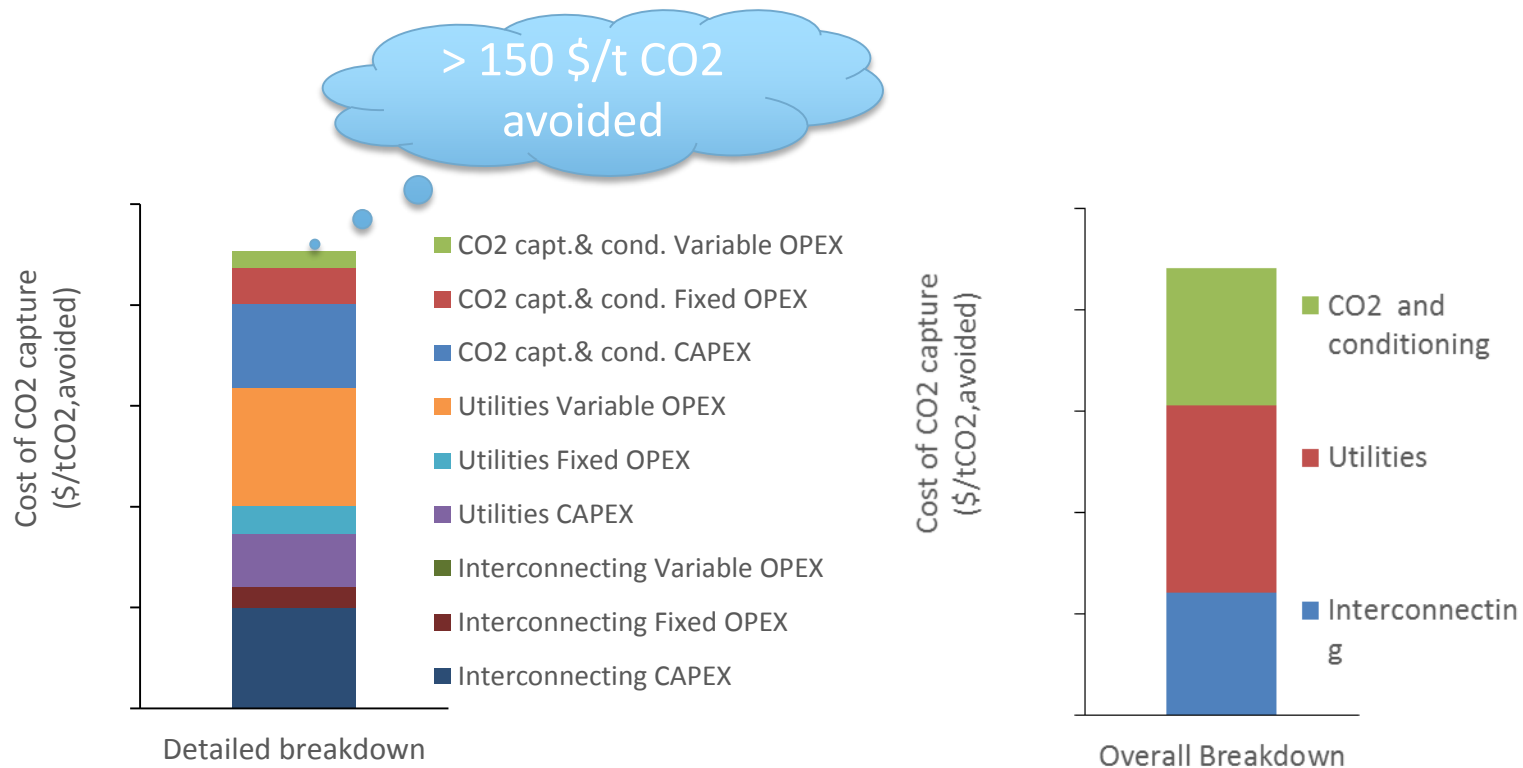
Fresh water consumption: +1 to +7%

Cooling requirement: +10 to +66%

Electric power consumption (incl. CO2 compression): +5 to +34%

# Typical cost results from ReCap

Illustration of the preliminary results (1 emission source, SMR)



Generation of additional steam and power, as well as interconnection of the CO<sub>2</sub> capture and the refinery may contribute significantly to the cost of capturing CO<sub>2</sub>

One project output will be an excel sheet with which refineries can estimate their costs for retrofitting CO<sub>2</sub> capture

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