TRAXXYS Innovation & Sustainability

OPSCHALING EN KOSTENSCHATTINGEN VAN NIEUWE INNOVATIEVE TECHNOLOGIEEN

Presentatie voor **DACE,** Soestduinen, 24 November 2022

INHOUD

- Introduction TRAXXYS
- Case 1. Scale up and Estimate of a 20 kton/yr **CO_2 to CO Plasma Plant**
- Case 2. **Circular Methane Unit** / 3 scales / margin / Business Focus on R&D

CONTACT DATA

- Henk.akse@traxxys.com
- Phone +31 (0) 348 42 44 62
- Mobile: +31 6 41 23 76 95

ACKNOWLEDGEMENTS / DISCLAIMER

Acknowledgements

A. Project CO2 to CO plasma plant
Traxxys thanks all members of the Solar Fuels Team at DIFFER, specifically Richard van de Sanden (Managing Director @DIFFER), Waldo Bongers (Senior Plasma Scientist @DIFFER), Gerard van Rooij (Senior Plasma Scientist @DIFFER) for their active participation in the Workshops and their valuable contributions and remarks in the course of the project.

B. Project Circular Methane Unit
Traxxys thanks all members of the Board of TKI Nieuw Gas, specifically Leendert Florusse (e-Butler), Richard van de Sanden (EIRES), Jörg Gigler (TKI Nieuw Gas), Ulco Vermeulen (Gasunie) and Maarten Abbenhuis (TENNET) for their valuable contributions and remarks in the course of the project.

Disclaimer

In both projects Traxxys has pursued the highest quality in each stage of the project including technology choice, process design, scale up/down, cost estimating and overall assessment of the concept. Given scopes and timeframes of the projects, level of detail is limited and accuracies of estimates vary between 20-80%.

TRAXXYS / MISSION

Speed up innovation and enhance sustainability in the Process Industries by bridging the gap between idea and application

TRAXXYS / BACKGROUND

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Rijksdienst voor Ondernemend Nederland

5 yrs
governmental

PAQUES

KONINKLIJKE vemw

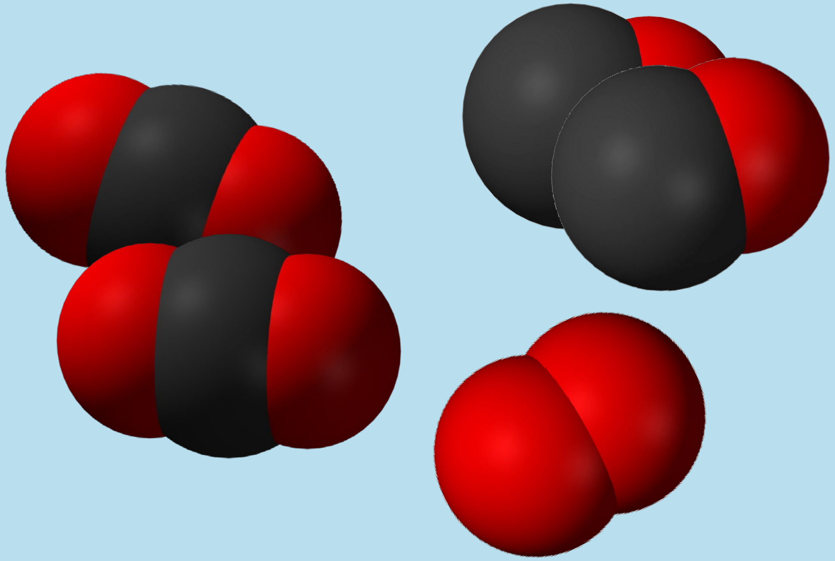
NUON

ARCADIS

15 yrs industry/business

18 yrs Traxxys consultancy

CASE 1. SCALE UP AND ESTIMATE OF A 20KTON/YR CO2 TO CO PLASMA PLANT

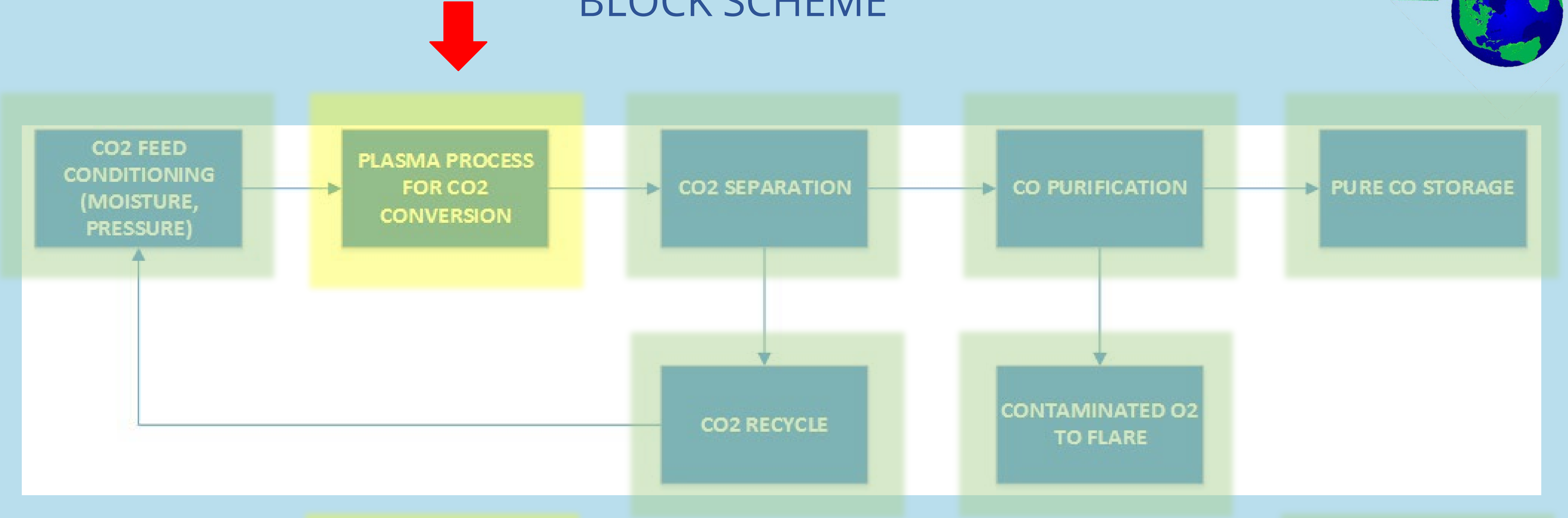


CHEMISTRY

$2\ CO_2 \rightarrow 2\ CO + O_2$

Residence time 1 ms
Pressure 0.2 - 1 bara
Temperature 3500 - 8000 K

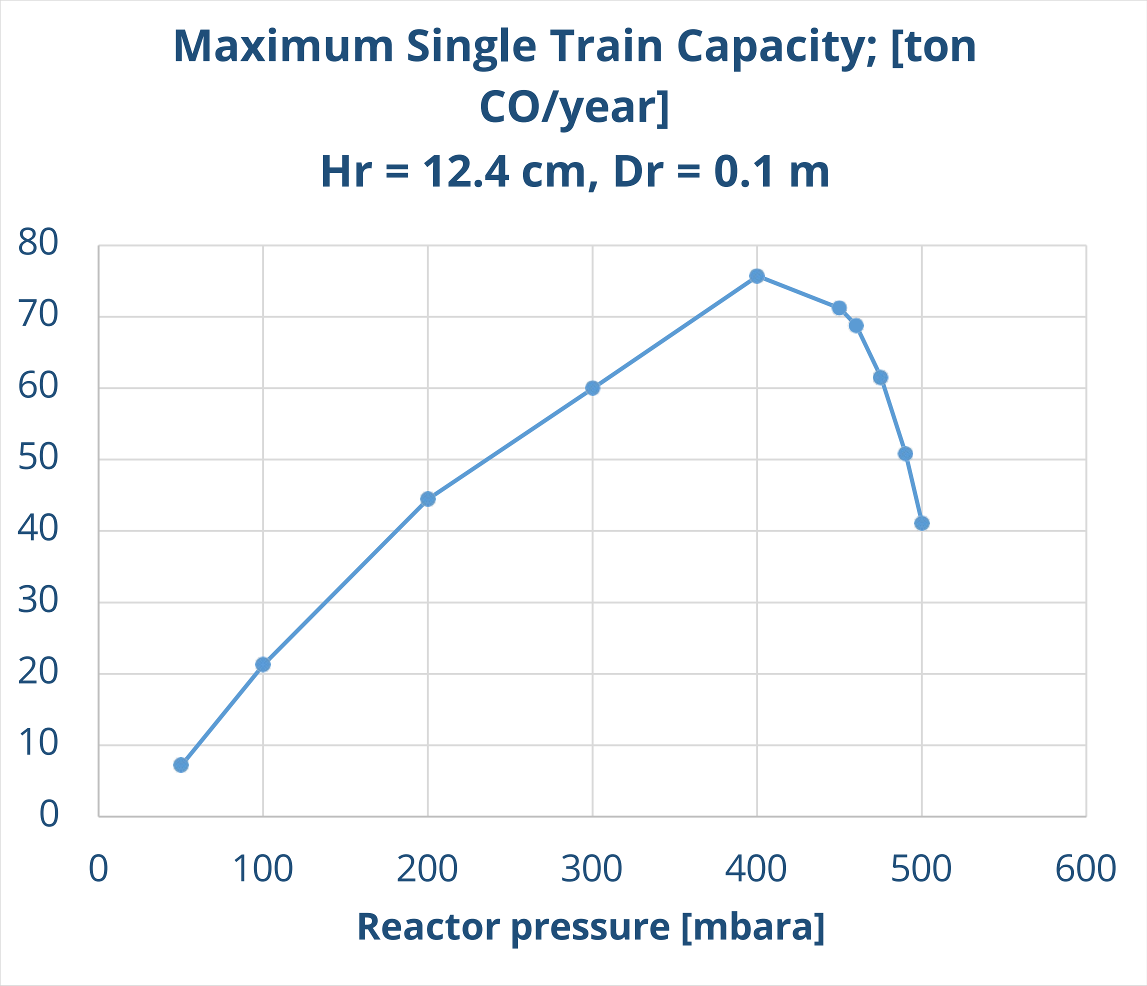
BLOCK SCHEME

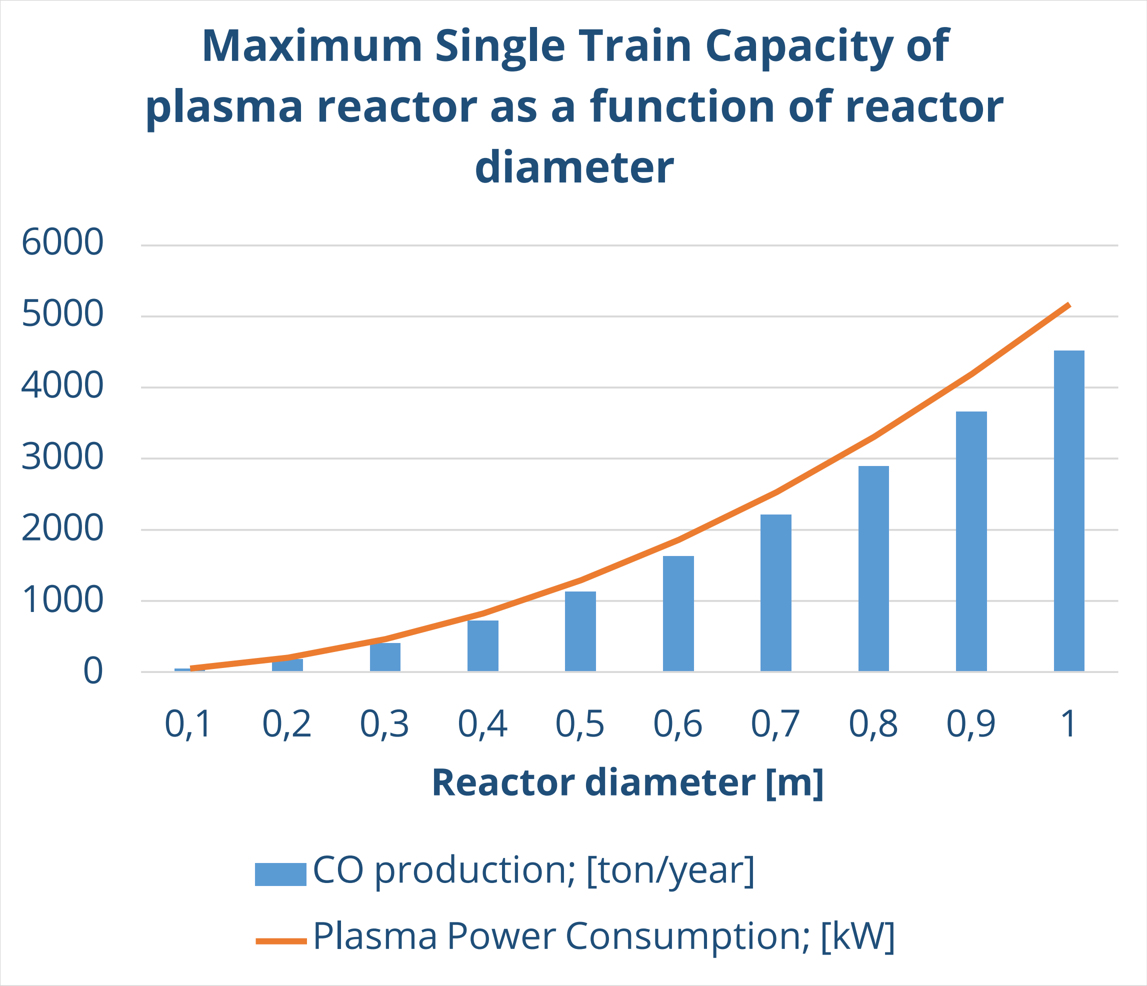


NO PRIOR CAPEX DATA AVAILABLE

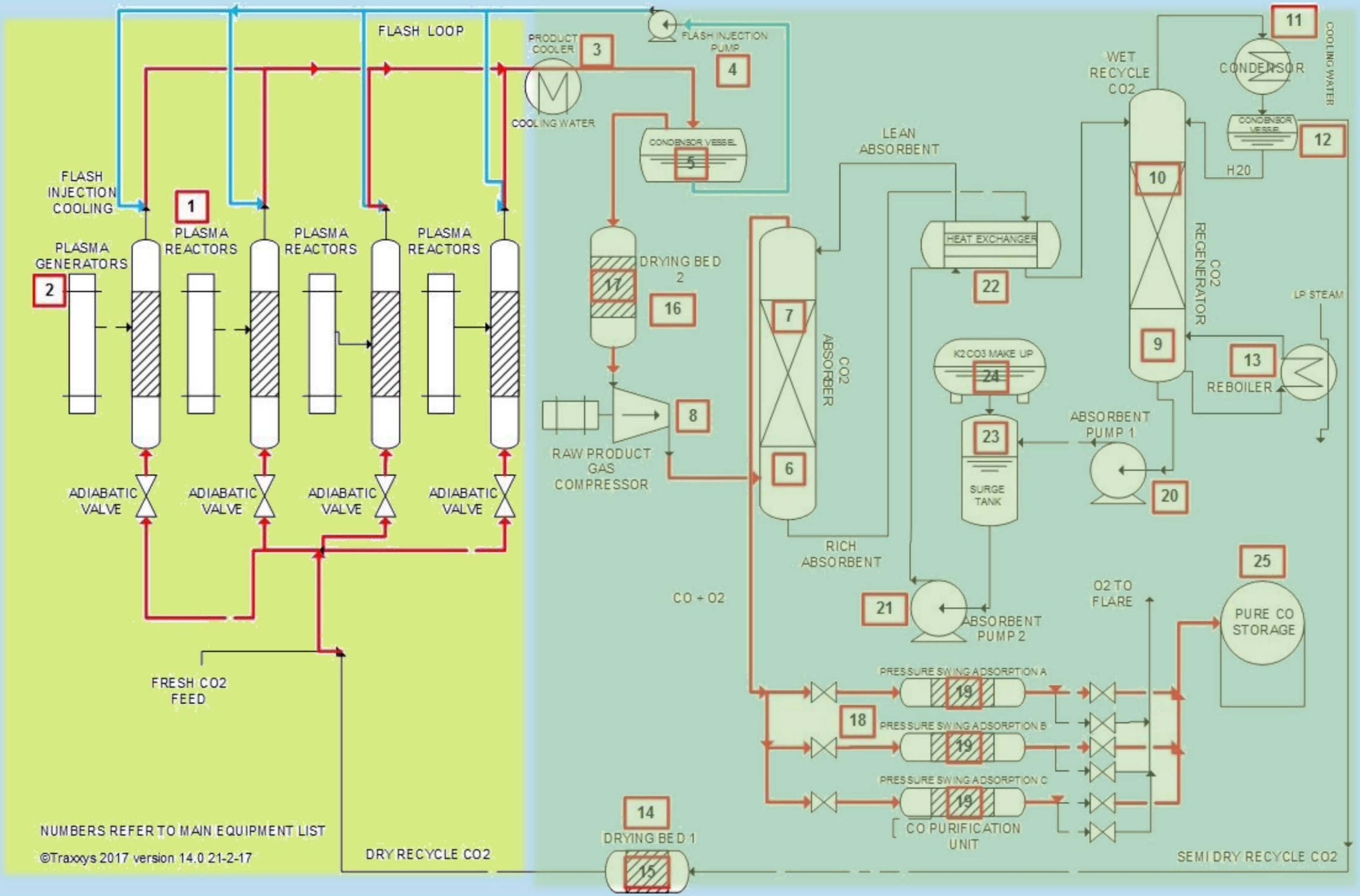
PRIOR CAPEX DATA AVAILABLE

CHEMICAL ENGINEERING CORRELATIONS

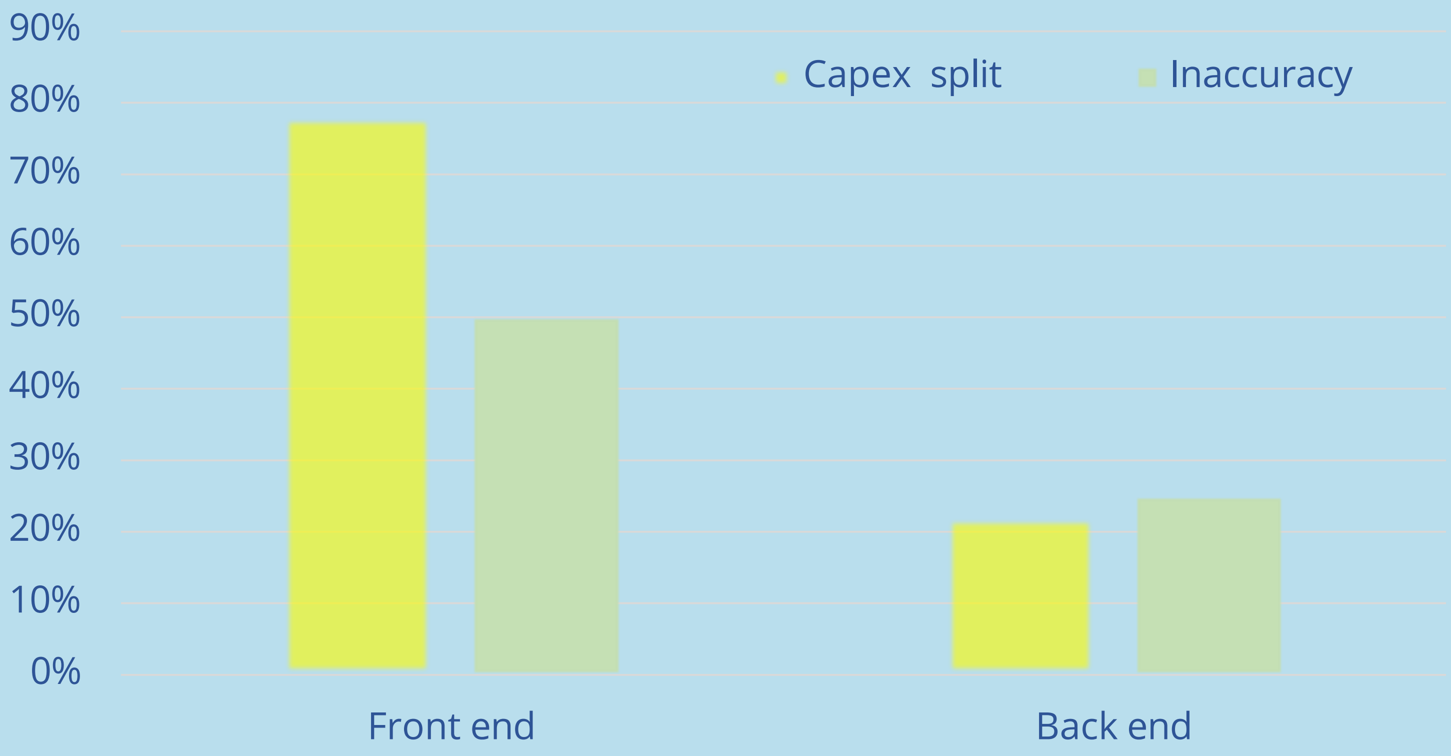




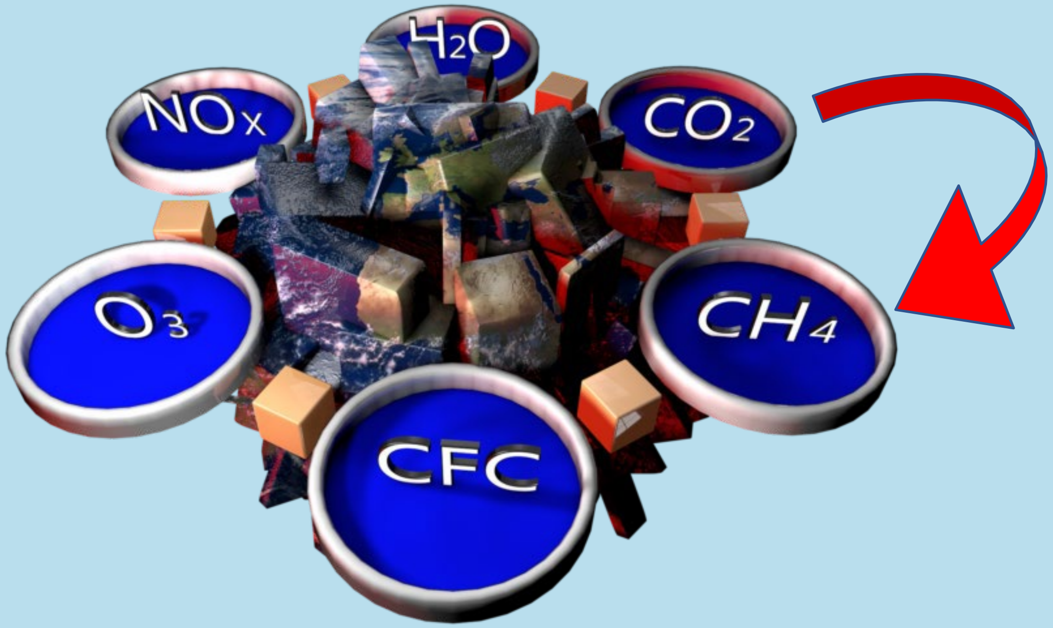
PROCESS FLOW DIAGRAM



CAPEX SPLIT / INACCURACY



CASE 2. CIRCULAR METHANE UNIT



QUESTIONS

CIRCULAR METHANE MARGIN @ 3 SCALES

BUSINESS FOCUS OF R&D

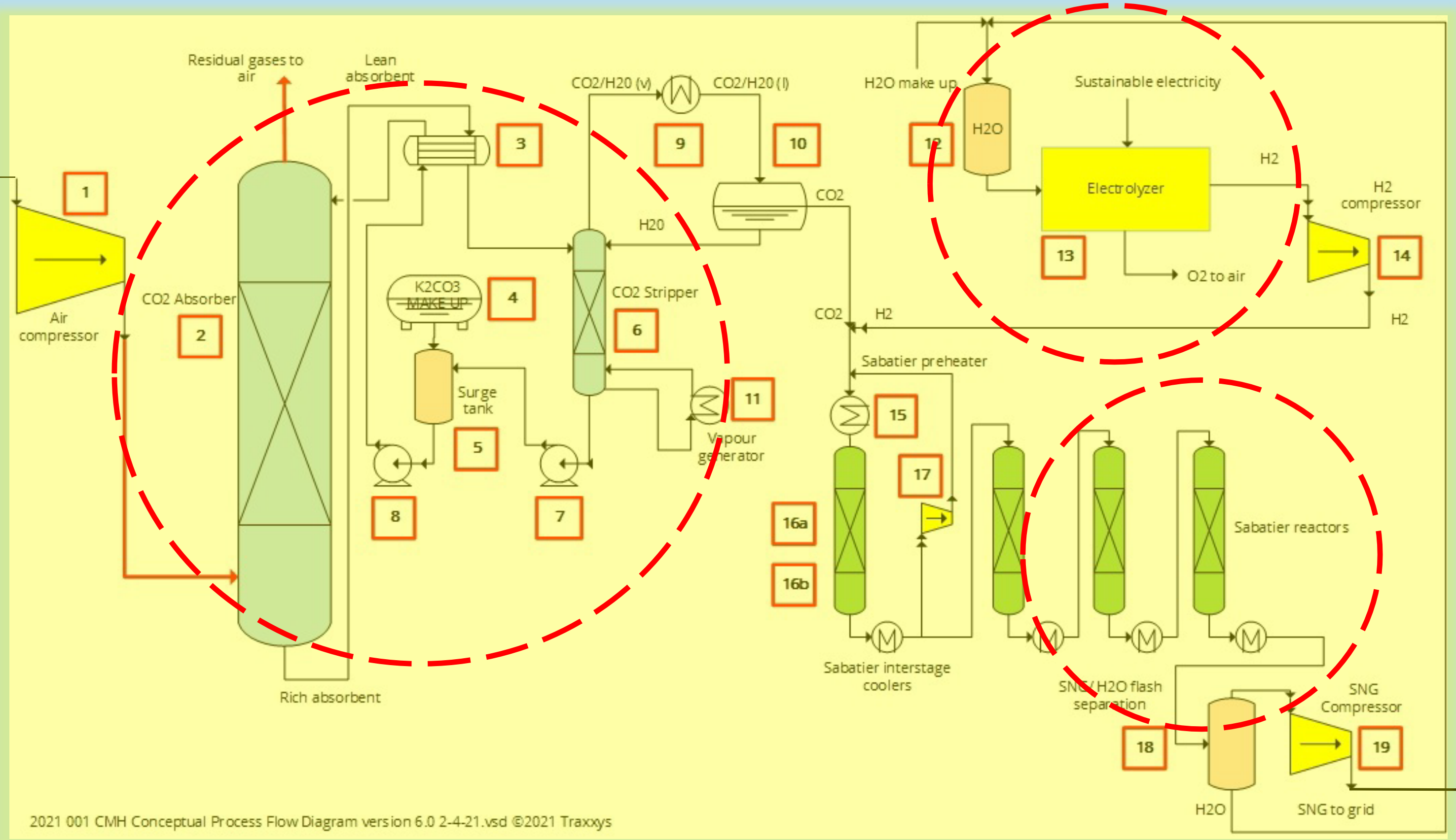
ASSUMPTIONS

Cost of making one household 100% sustainable = € 40k

Only use TRL = 9 technology

PROCESS FLOW DIAGRAM

AIR IN

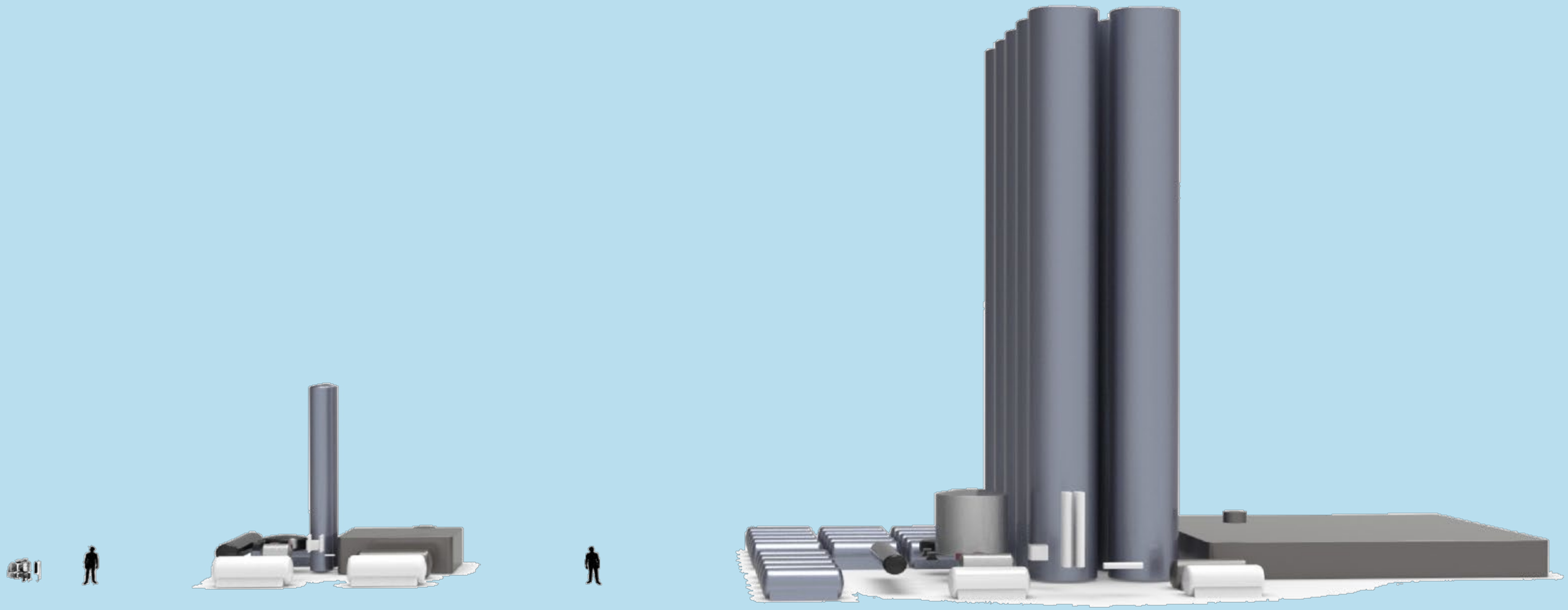


CIRCULAR METHANE OUT

NO PRIOR CAPEX DATA AVAILABLE OF COMBINATION

TES Hydrogen for life

3 DIFFERENT SCALES / 3D design



SINGLE HOUSE
1 hheq = 1.340 m3/yr
“CV size”

APP. COMPLEX
14 hheq

MID SIZED CITY
8.448 hheq (~34.000 inhabitants)

3 DIFFERENT SCALES / capex

		Single house	App. complex	City of 34.000 inhabitants
SNG production	Hheq	1	14	8448
Actual/a priori cost ratio		**3,0**	**1,0**	**0,4**
Capex	MM€	0,12	0,56	134
Footprint	m2	1,0	55	2.500
Power in	MW	0,021	0,30	179
SNG out	Nm3/yr	1.340	18.760	11.320.320

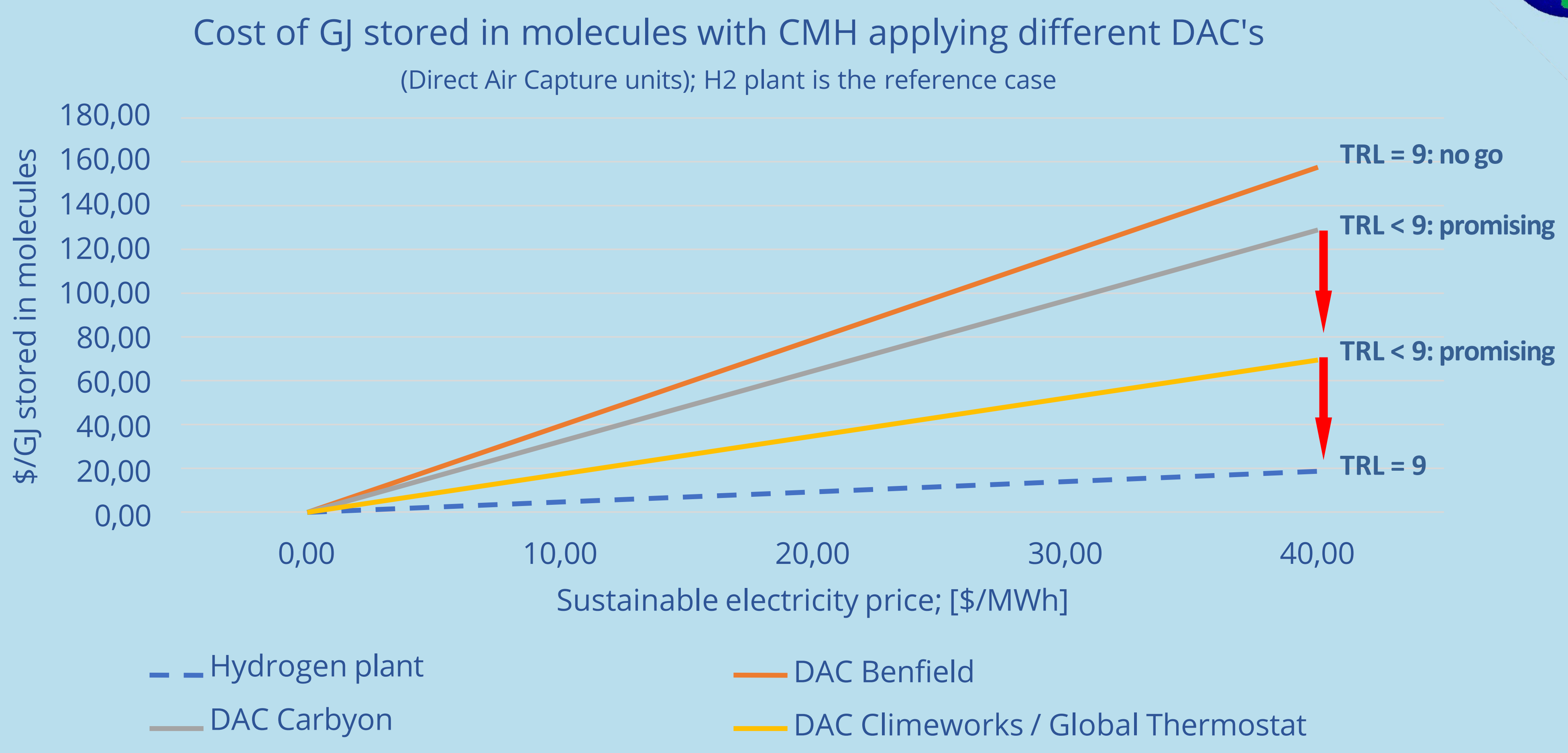
Note: a priori assumed cost of making 1 household 100% sustainable = € 40.000,-

CIRCULAR METHANE MARGIN

Margin; [$/Nm3]	Low Sust. Electricity price	Average Sust. Electricity price	High Sust. Electricity price
Low price of SNG/CH4	-0,73	-4,19	-9,04
Average price of SNG/CH4	0,58	-2,88	-7,72
High price of SNG/CH4	1,89	-1,57	-6,41

Price scenario's	low	average	high
Sustainable electricity price; [$/MWh]	10	35	70
SNG price; [$/Nm3]	0,4	1,2	2

BUSINESS FOCUS ON R&D



CONCLUSION

Cooperation of Cost Estimators and Chemical Engineers may prove useful when:

- estimating novel technologies
- assessing profitability of novel concepts
- creating business focus on R&D