CO_2 Value Chain Analysis

The influence of Technology improvement from the $BIGCO_2$ research

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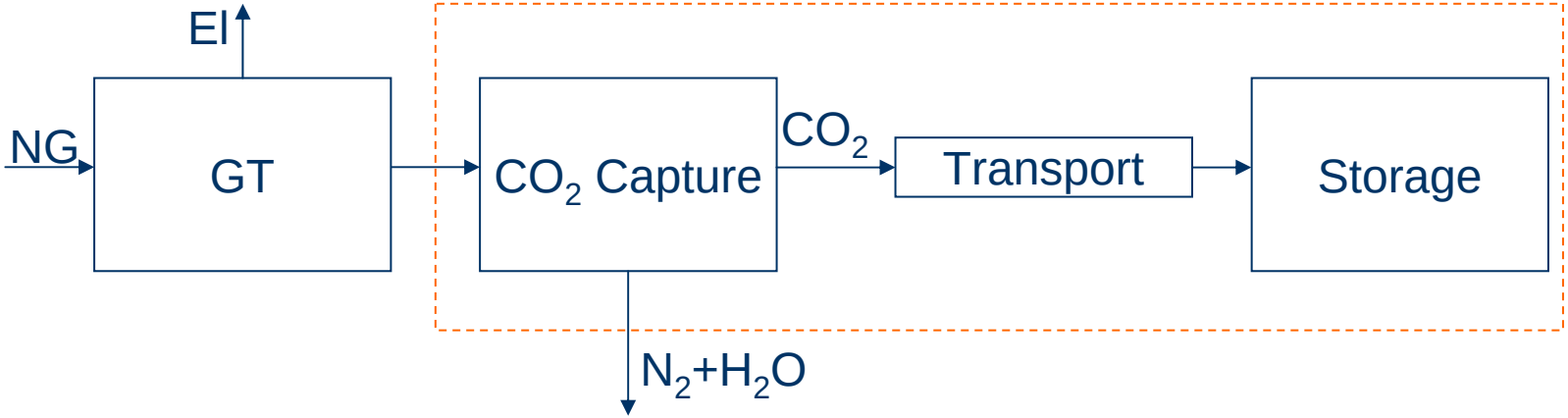
Value chain analysis

	Possibility	Economics
OD (2005)		
Bellona (2005)		
Gassco (2006)		

- Why?
  - Different parameter values
  - Different boundary conditions
- Reproducibility?
  - Low (Parameter secrecy and disorderly parameter presentation)

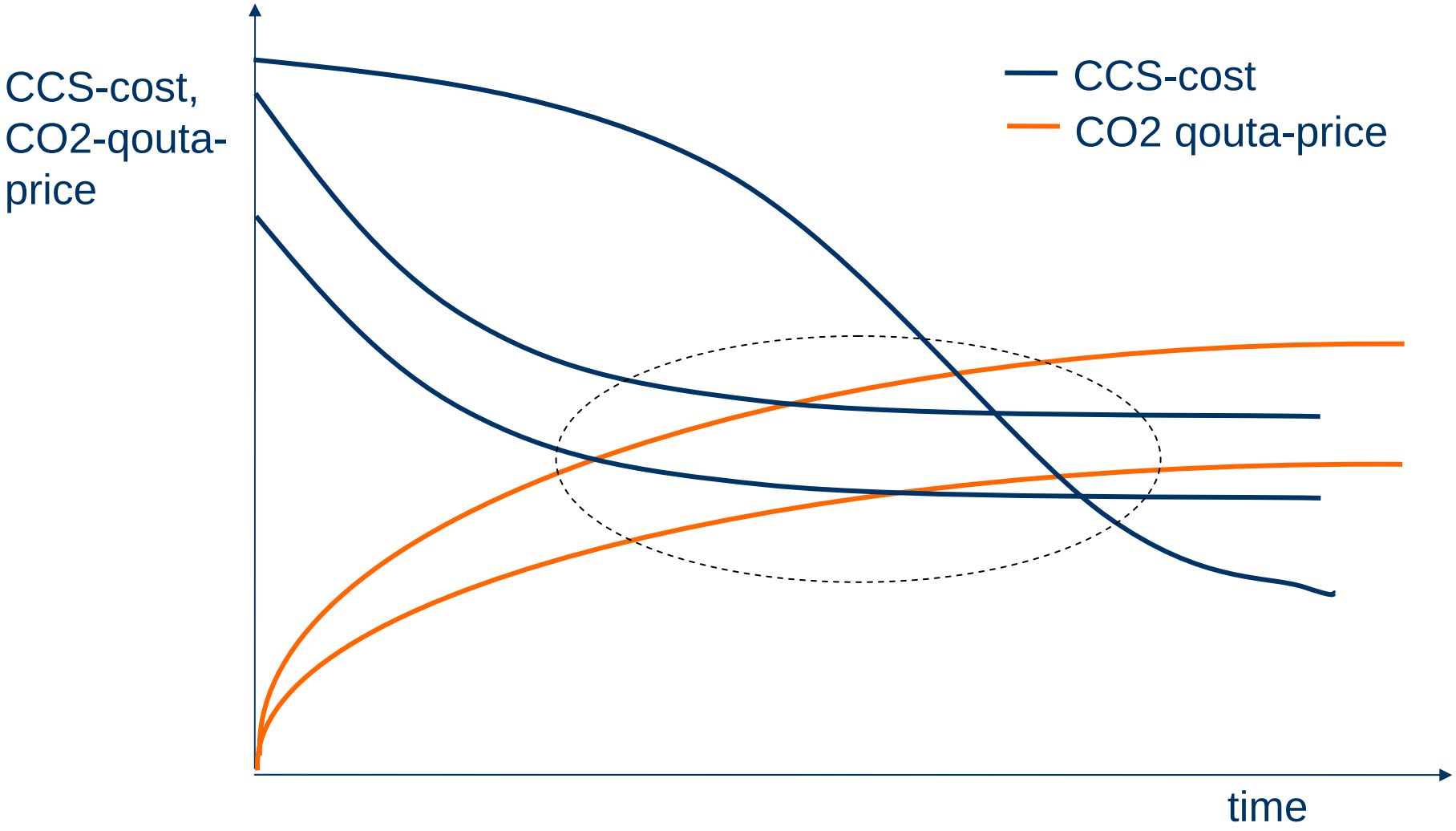
Value chain analysis

- Net present value analysis - pure economical analysis
- In house tool - Expand
- Incremental analysis – pure effects of CCS



- Elements that we want to understand
  - Technology improvements
  - Market and regulations
  - Infrastructure and logistics

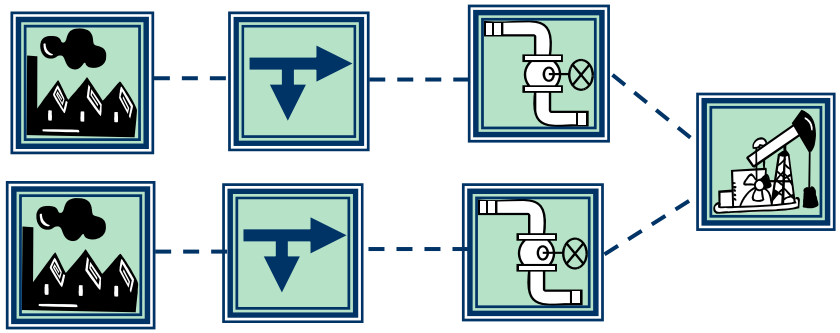
CO_2 Capture and Storage



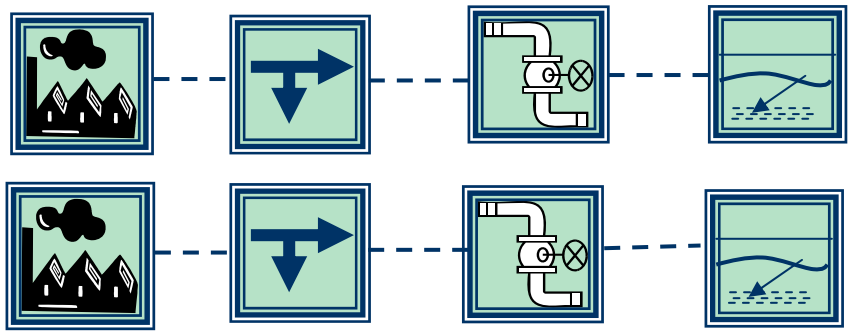
Base case

- Exhaust stream containing 5 Mt/year CO_2
- Corresponds to two 700 MW GTCC
- CO_2 is captured, transported and injected

EOR storage basecase



Aquifer storage basecase



Technology improvements

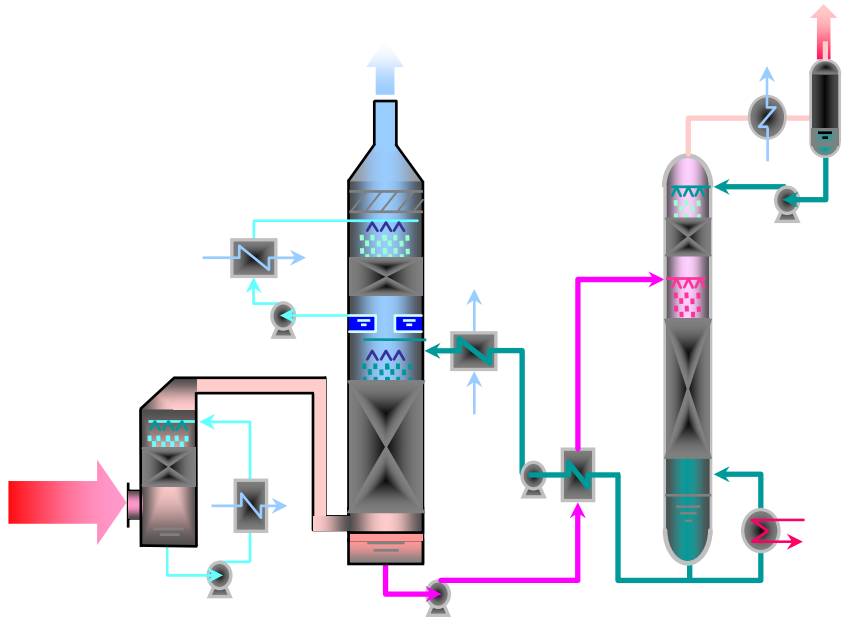
What are the research goals/focus in the different tasks in BIGCO2? Excpert consultation:

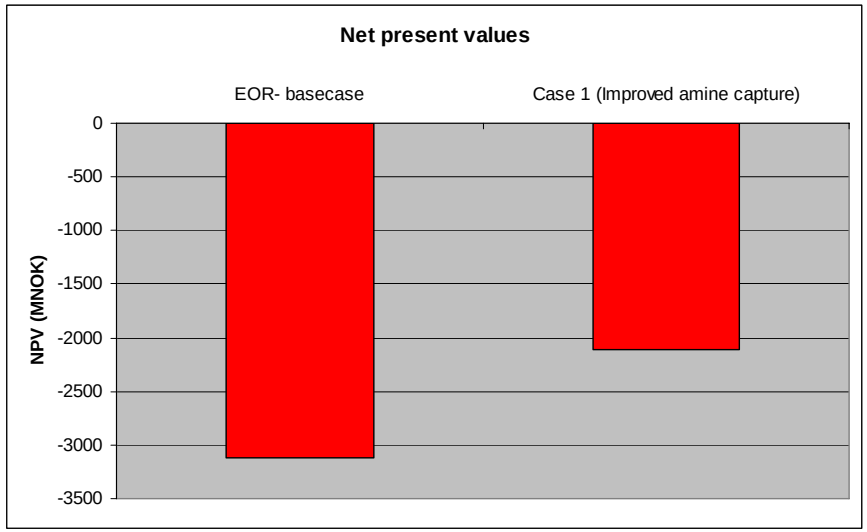
- Task A: High temperature oxygen and hydrogen membranes
- Task B: Postcombustion CO_2 capture
- Task C: Pressurized combustion of enriched fuels
- Task D: Power integration and analysis
- Task E: CO_2 chain analyses
- Task F: Enhanced oil and gas recovery with CO_2 and safe underground storage of CO_2
- Task G: Chemical looping combustion

Improved capture process with amines

Based on input from Task B.
Research focus/goals

- Development of new chemical solvent with an energy consumption for regeneration which is 50 % of todays commercial solvent
  - -> OPEX for capture reduced with 25%
- New design of the adsorption column is improved (simplified constructions and cheaper absorption materials.) Absorption column investment reduced with 30%
  - -> CAPEX for capture reduced with 10%

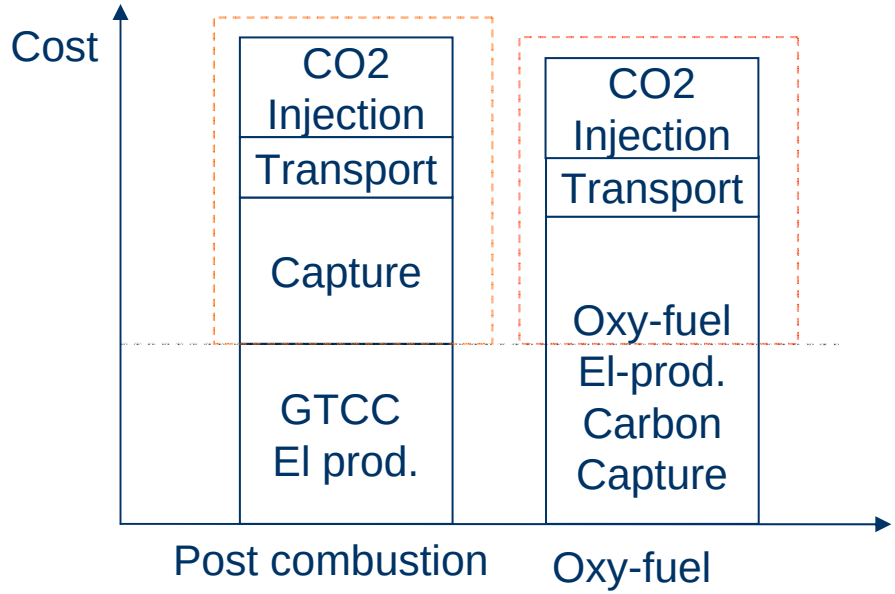


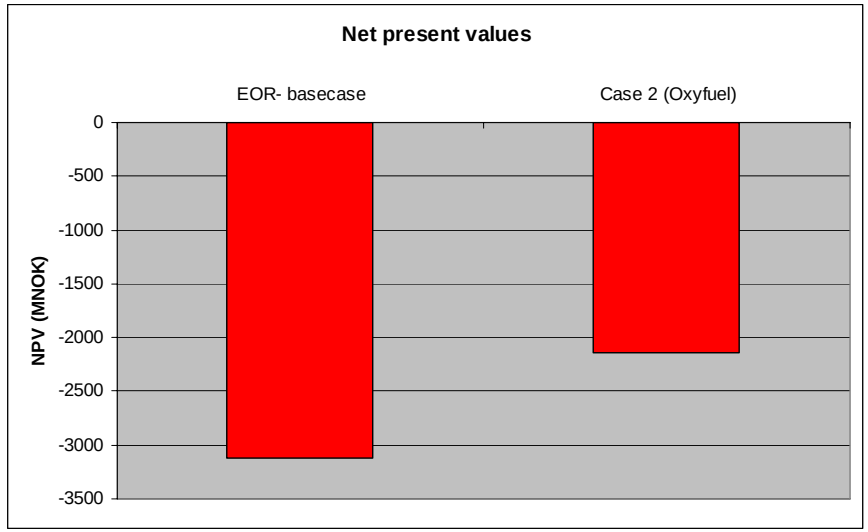


Cost competitive oxyfuel power cycles

Based on input from Task C.
Research focus/goals

- Cost competitive oxyfuel power cycle is developed.
  - -> CAPEX capture reduced with 20%
  - -> Capture rate is increased to 95%

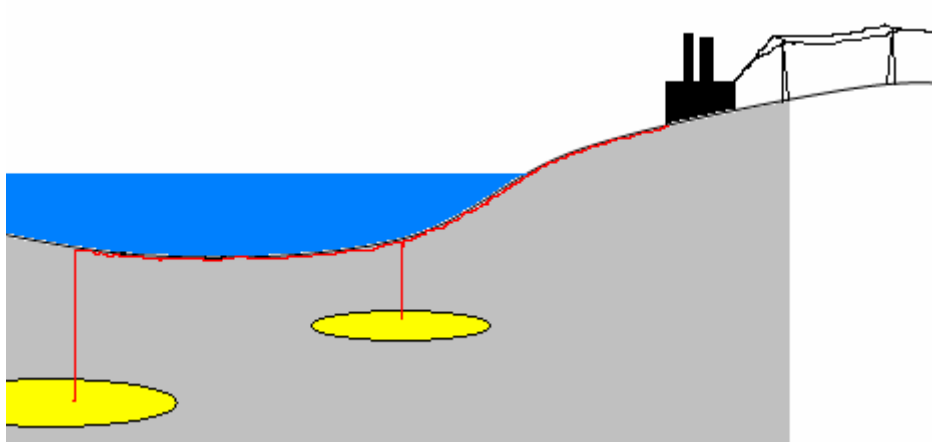


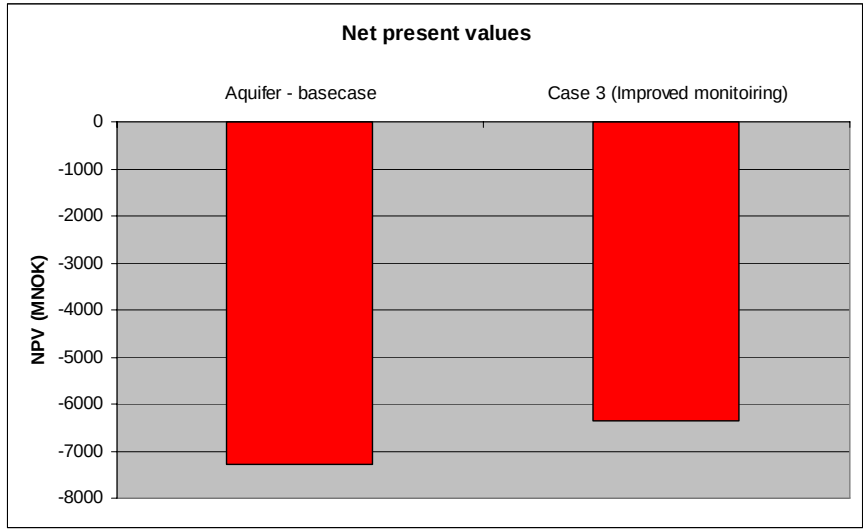


Storage monitoring is improved

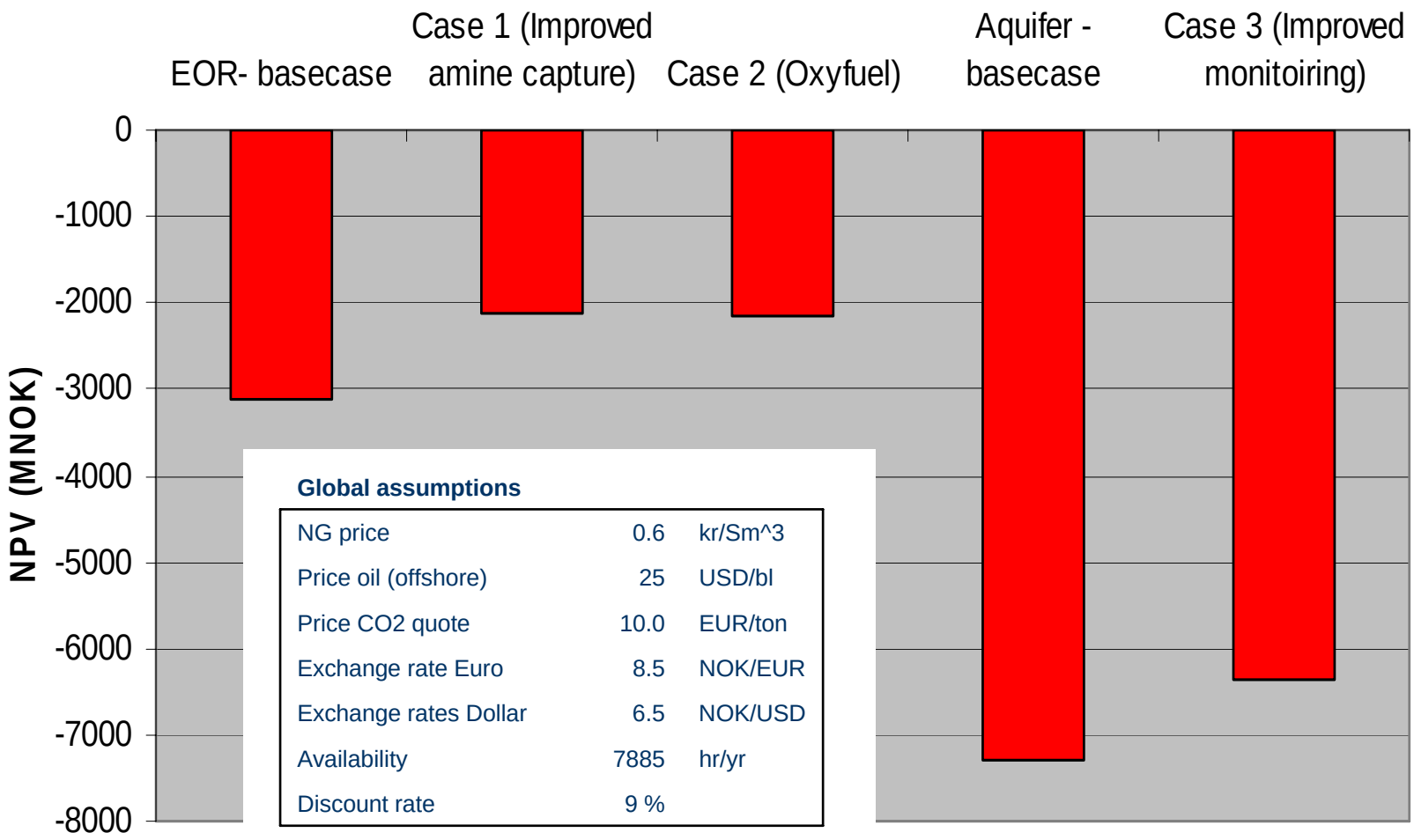
Based on input from Task F.
Research focus/goals

- Improve storage monitoring: Knowing the exact location of CO_2 and its displacement within the reservoir minimizes the risk for leakage. Aquifer that are closer to land or less deep become than candidates for CO2 storage.
  - -> Injection CAPEX and OPEX are reduced with 30 %
  - -> Transport CAPEX and OPEX are reduced with 50 %



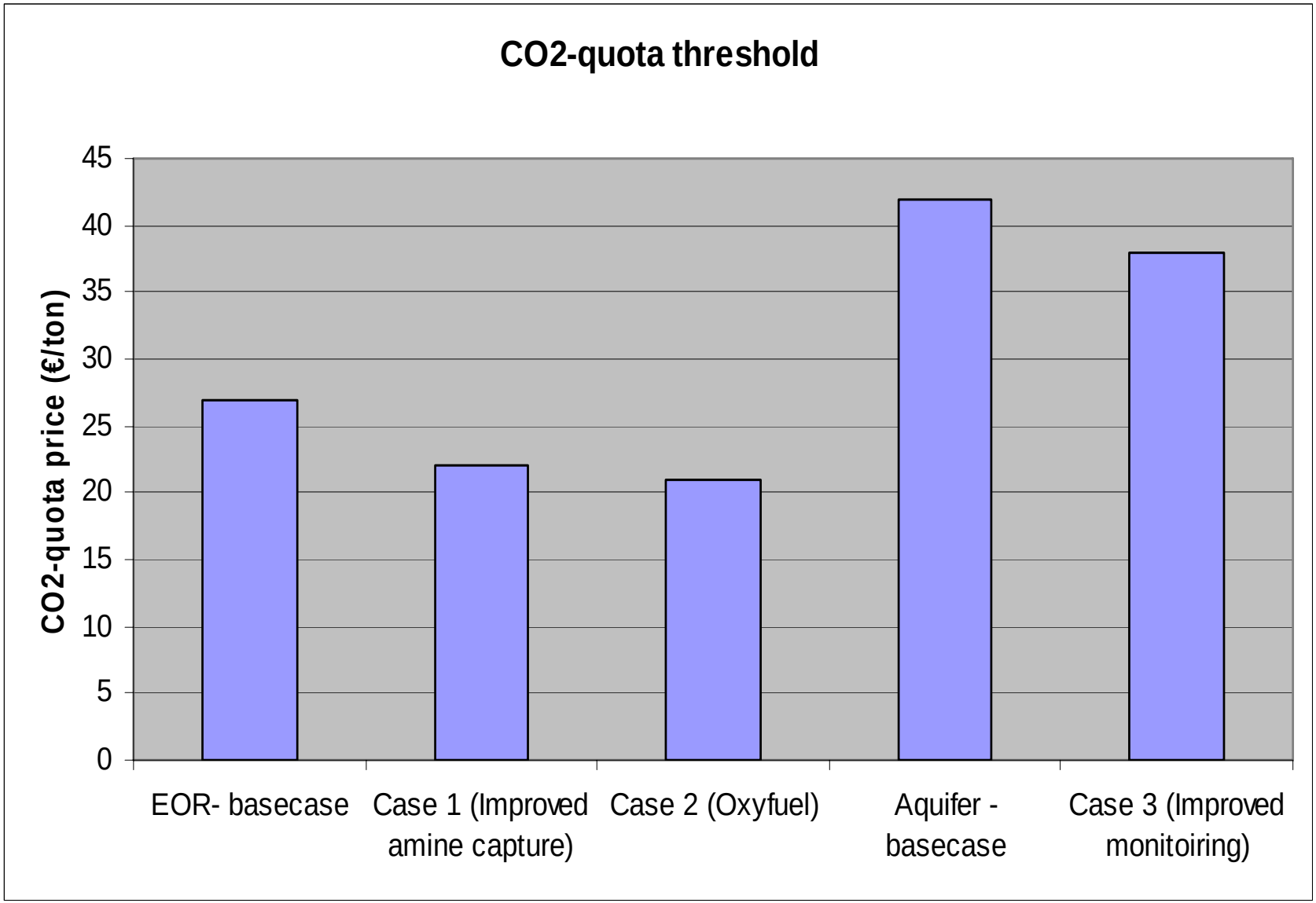


Net present values



Global assumptions

NG price	0.6	kr/Sm^3
Price oil (offshore)	25	USD/bl
Price CO2 quote	10.0	EUR/ton
Exchange rate Euro	8.5	NOK/EUR
Exchange rates Dollar	6.5	NOK/USD
Availability	7885	hr/yr
Discount rate	9 %	


CO2-quota threshold
CO2-quota price (€/ton)
45
40
35
30
25
20
15
10
5
0
EOR- basecase
Case 1 (Improved amine capture)
Case 2 (Oxyfuel)
Aquifer - basecase
Case 3 (Improved monitoiring)

Conclusions

- With our tool ”Expand”, we can do useful value chain analyses that can better our understanding of effects of technology improvements, market and regulations, infrastructure and logistics on the whole chain economy.
- Technology improvements can reduce the costs of the value chain, but regulation mechanisms has to be used for large scale CO_2 value chain realization.