BIOPALIVA
Česká technologická platforma

CO_2
Czech Solution Group

CO2 Czech Solution Group, z.s.

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www.co2cz.com

SusChem 13.12.2022

Biofuels & ENERGY feedstock road > 2020

BIOPALIVA
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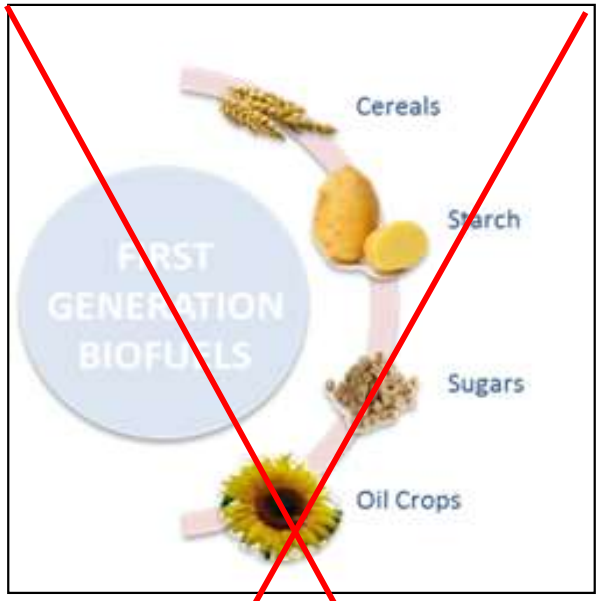
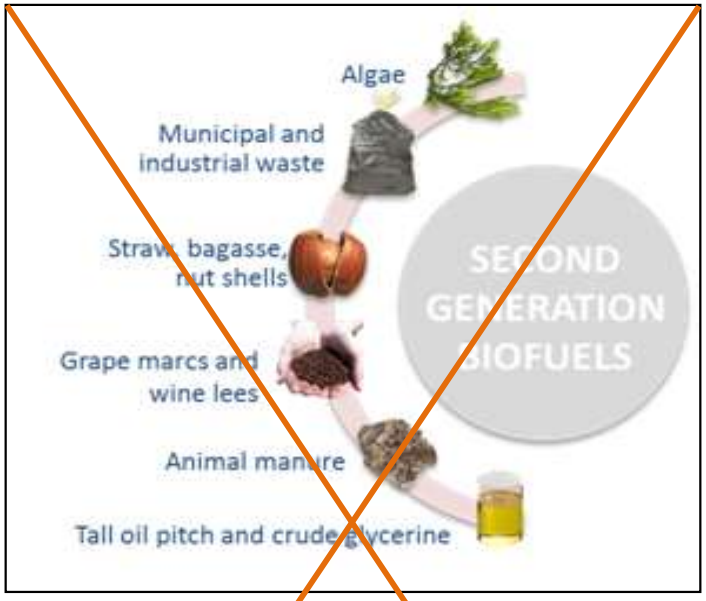
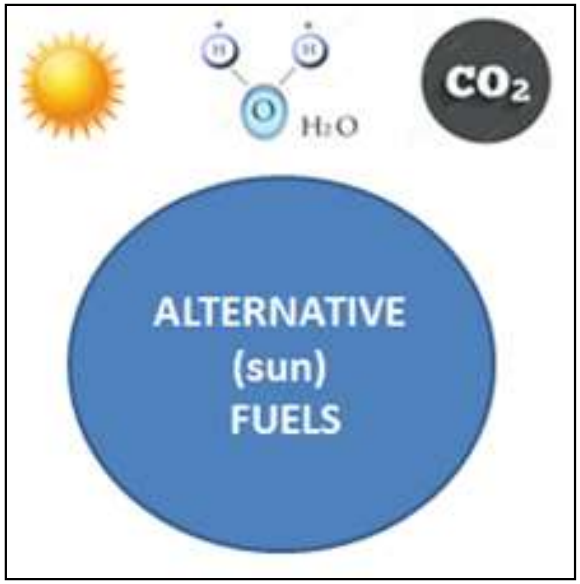
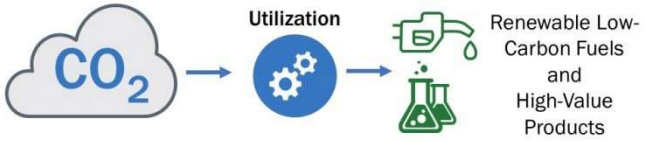






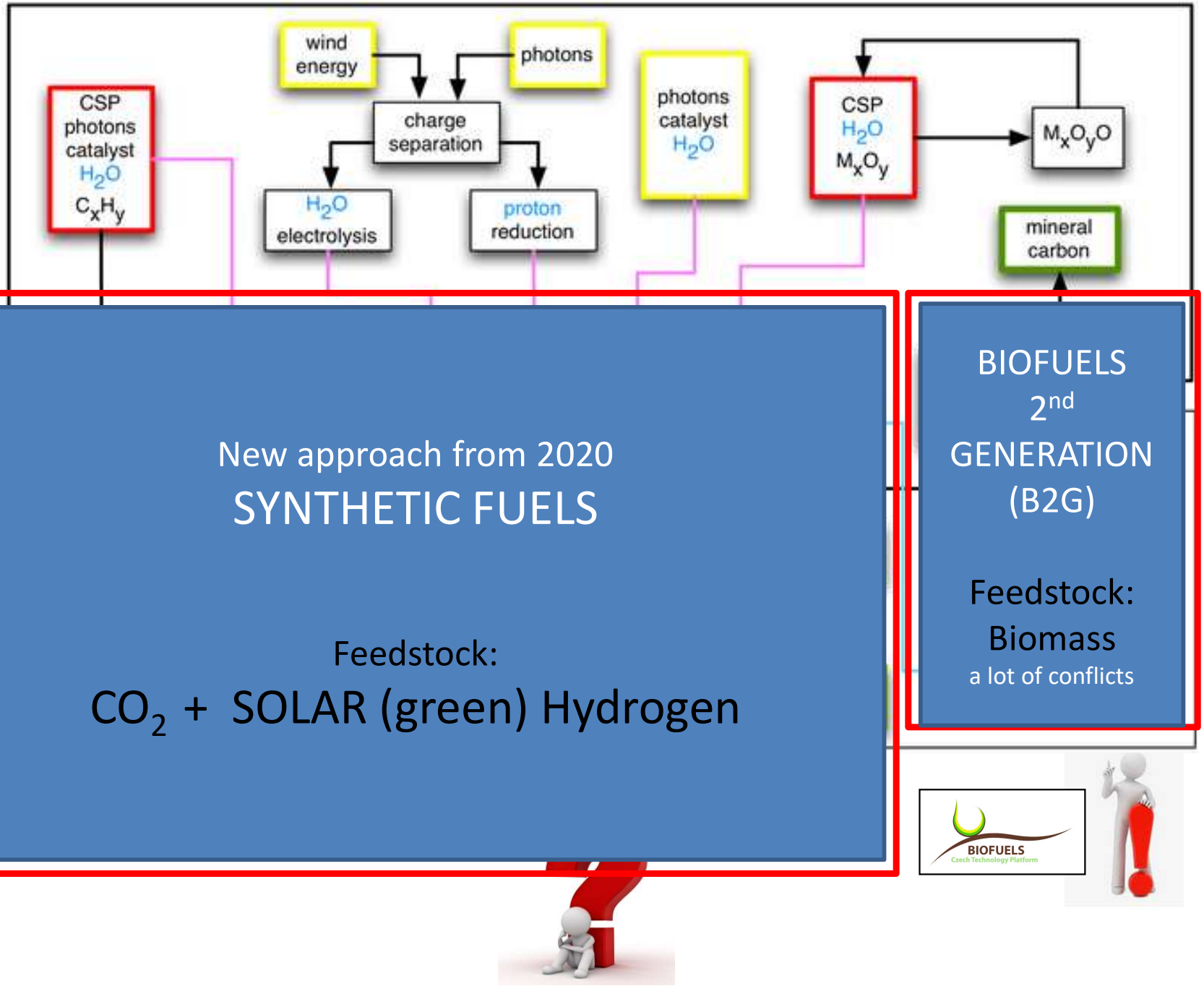
GL1

No feedstock available	Sewage sludge Biomass mix Municipal solid waste	SUN + CO_2 + H_2O
Strong Conflict : **Food-Feed-Fuel**	*Conflicts:* **Biodiversity, iLUC, LCA**	***No conflicts*** ***Unlimited sources***

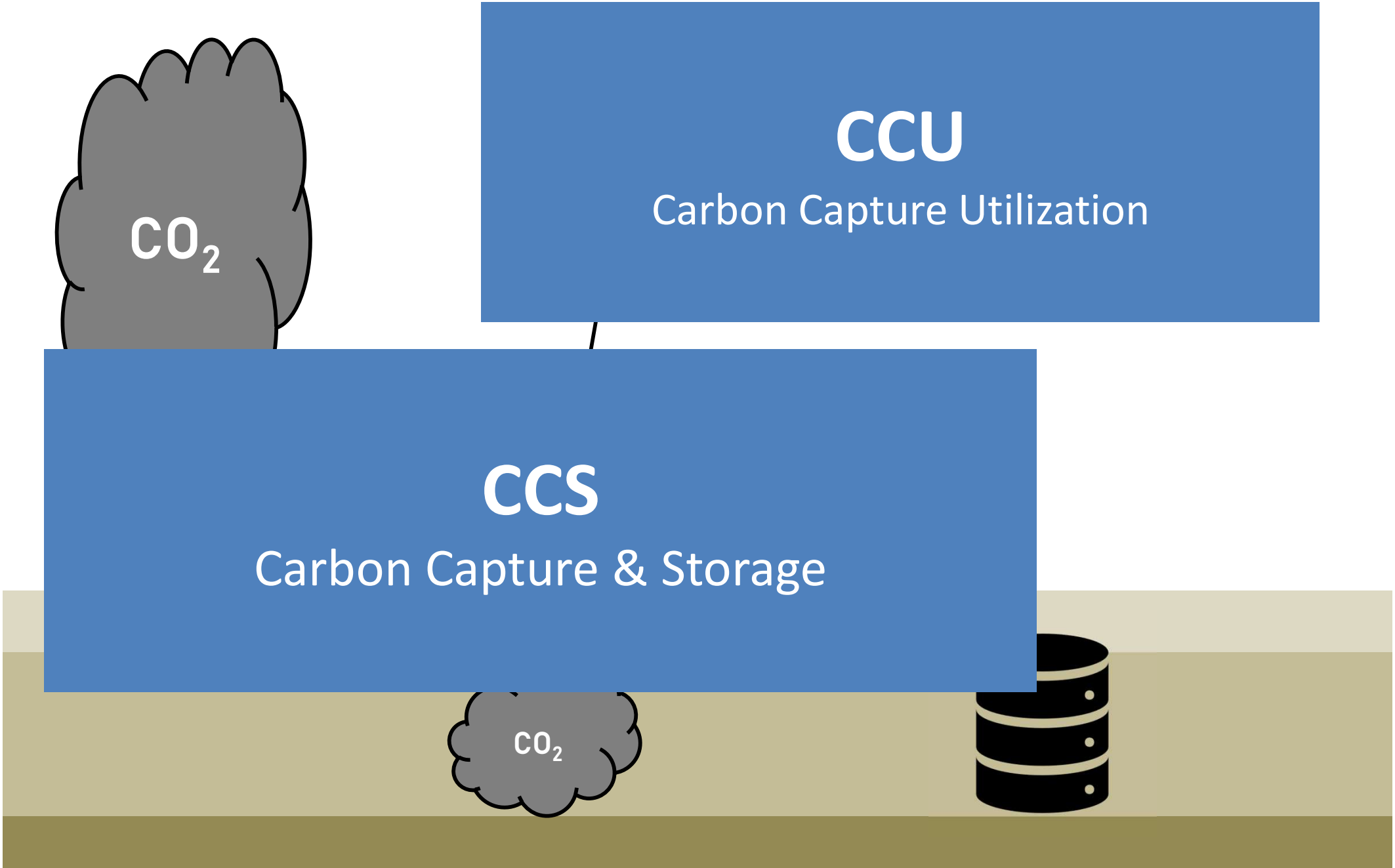


GL1 Gál Leoš; 21.04.2018

SOLAR DRIVEN CHEMISTRY



Průmyslová produkce CO2 a pojmy CCS/CCU



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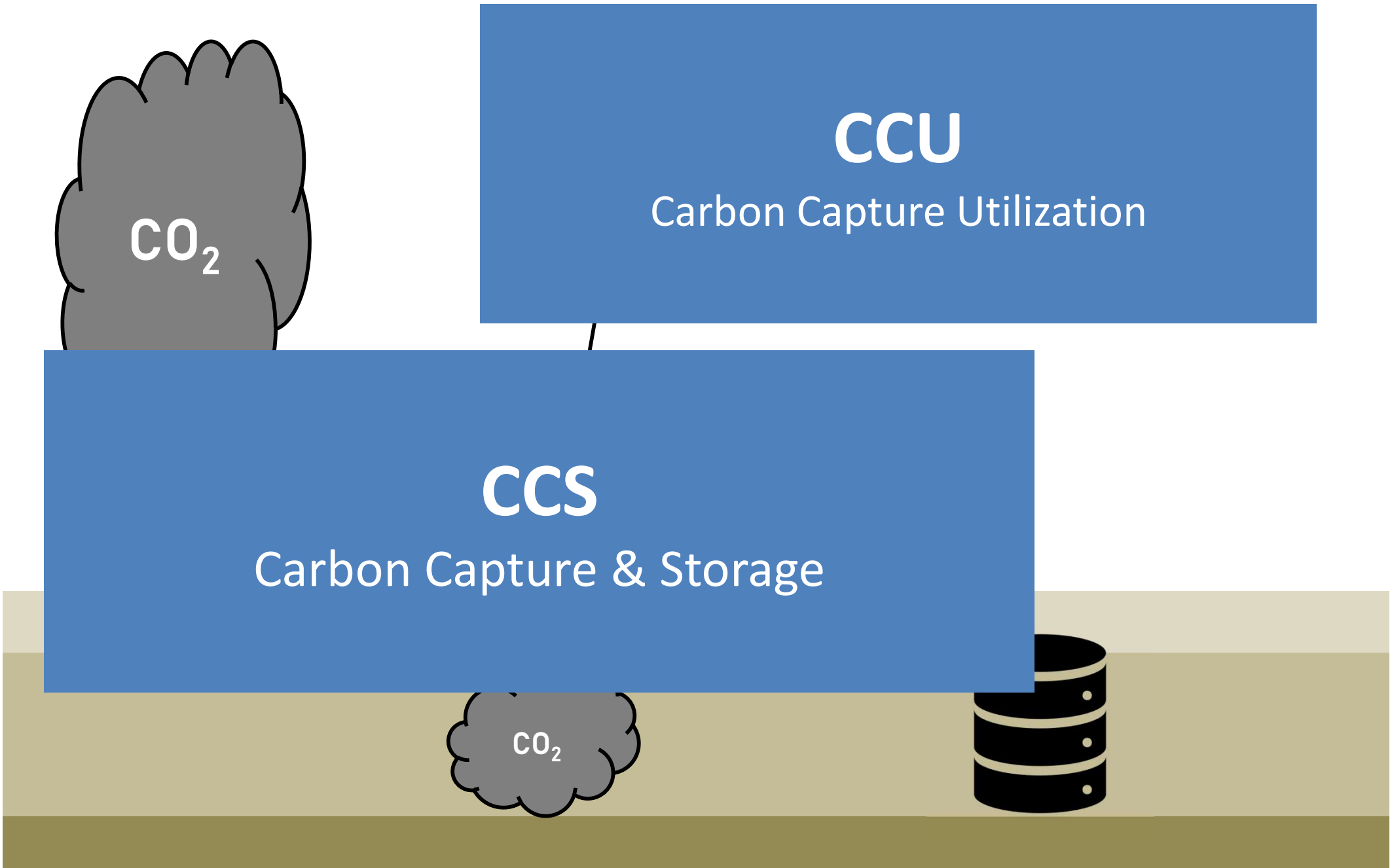
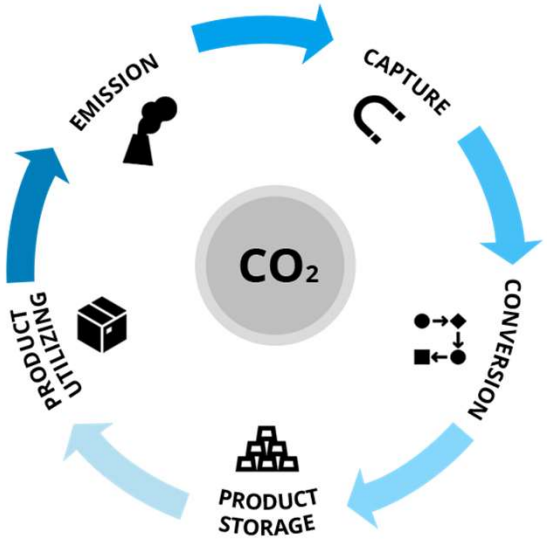


CO_2 z průmyslové produkce a CCS/CCU

CCU/CCU nebudou pouze překlenovací technologie pro redukci emisí CO_2 ale umožní **uzavřené uhlíkové cykly**.

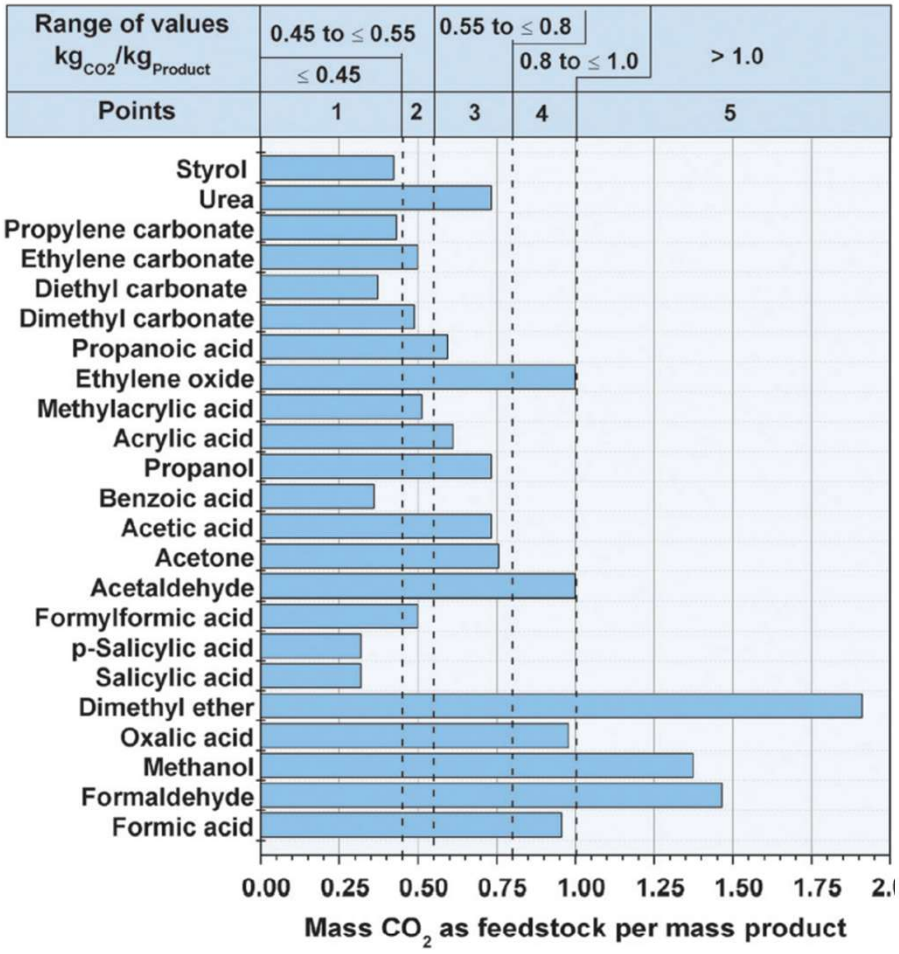


Nabízí se možnost vyrábět produkty na bázi uhlíku pomocí OZE, což umožňuje defosilizaci průmyslu.

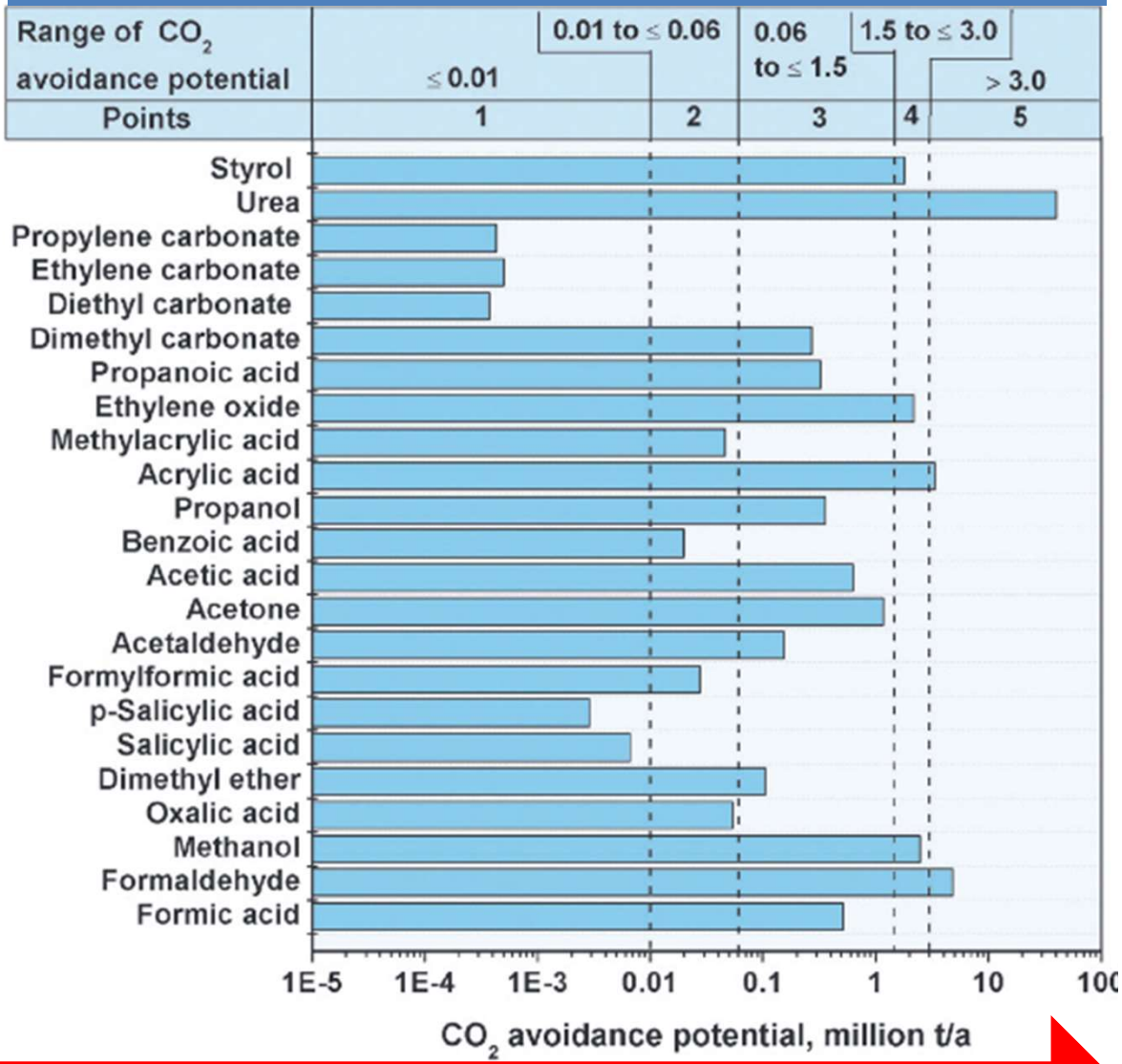
Existuje cca 10 milionu uhlíkových sloučenin z fosilních zdrojů

CO2 – vstupní surovina pro chemický průmysl

Kg CO_2/kg end product



CO_2 avoidance potential



Nefosilní cesta produkce uhlovodíků – SCHP ČR reaguje

Closing the loop: captured CO2 as a feedstock in the chemical industry (rsc.o

CO2 – vstupní surovina pro chemický průmysl, proto

SVAZ CHEMICKÉHO PRŮMYSLU ČR

15. červen 2021 SCHP ČR zakládá spolek

CO2 Czech Solution Group, z.s.

Zkráceně **CO2CZ**

CO2 Czech Solution Group

Cíle spolku

Cíl spolku CO2CZ - CCS/CCU

KOMERCIONALIZACE DEKARBONIZACE

Systémový přístup dekarbonizačních procesů 2050

1. VÝZKUM – vytvořit akční expertní výzkumné skupiny CCS/CCU

2. PODPŮRNÉ AKTIVITY PROCESU DEKARBONIZACE
podpůrné programy, legislativa, vzdělávání, PR…

3. PRŮMYSL - Efektivní vazba PRODUCENTI CO2 + VÝZKUM CCS/CCU

Začlenění ČR do **international cooperation low-carbon and circular economy**

STRUKTURA SPOLKU

Struktura CO2CZ

Czech Solution Group

Chairman
Předseda ŘV

Vice-President
Místopředseda ŘV

Chief executive officier
Výkonný ředitel

Secretary
Tajemník

Board of trustees Dozorčí rada

Scientific Council CO2 transformation
Vědecká rada - transformací CO2

1. **Carbon**

- CO_2 Capture
  Pre/Post combustion
  Oxyfuels, DAC
- Transport CO_2
- Storage CO_2
- BECCS
  Biosequestration
  C3, C4, ZPF,LPF

2. **Carbon**

- CO_2 - H_2O
  TRANSFORMATION
- Synthesis chemical products
  CO_2 - H_2
  MeOH
  EtOH
  Methan
  Etylen
  others...
- Mineralization

Education - Dissertation/Diploma Theses

Support activities for CO2 transformations
Podpůrné aktivity transformací CO2

3. **Projects**

Projects Coordinator

National International level

- Identification
- Generation
- EU partners

4. **Socio-economic factors**

Czech Republic

- Government Council for Sustainable Development
  Rada vlády pro udržitelný rozvoj
- Ministry of Industry and Trade
- Ministry of the Environment

EU

- Commission Expert groups

ERNST & YOUNG

CO_2 VALUE EUROPE

Legislation - National commitments
Legislativa - Národní závazky

Blance modules
ROAD MAP of DEKARBONIZATION

Publicity, enlightenment, PR
Publicita, Osvěta, PR

Strategy
Srategie

5. **Strategic Agenda**

Mapping of national potential for CCS/CCU

Analysis of relevant technological trends, Horizon scanning

Strategic research agenda and implementation plan

Roadmaps CCU/ P2X

TRAIDING
Komerční cíle (BUSINESS)

6. **Commercionalization**

CO_2 Producers

CZECHINVEST

HOSPODÁŘSKÁ KOMORA ČESKÉ REPUBLIKY

T A
Č R

- EU-ETS
- TAXONOMY
- CBAM Carbon Border Adjustment Mechanizm
- CSRD Corporate Sustainability Reporting Directive

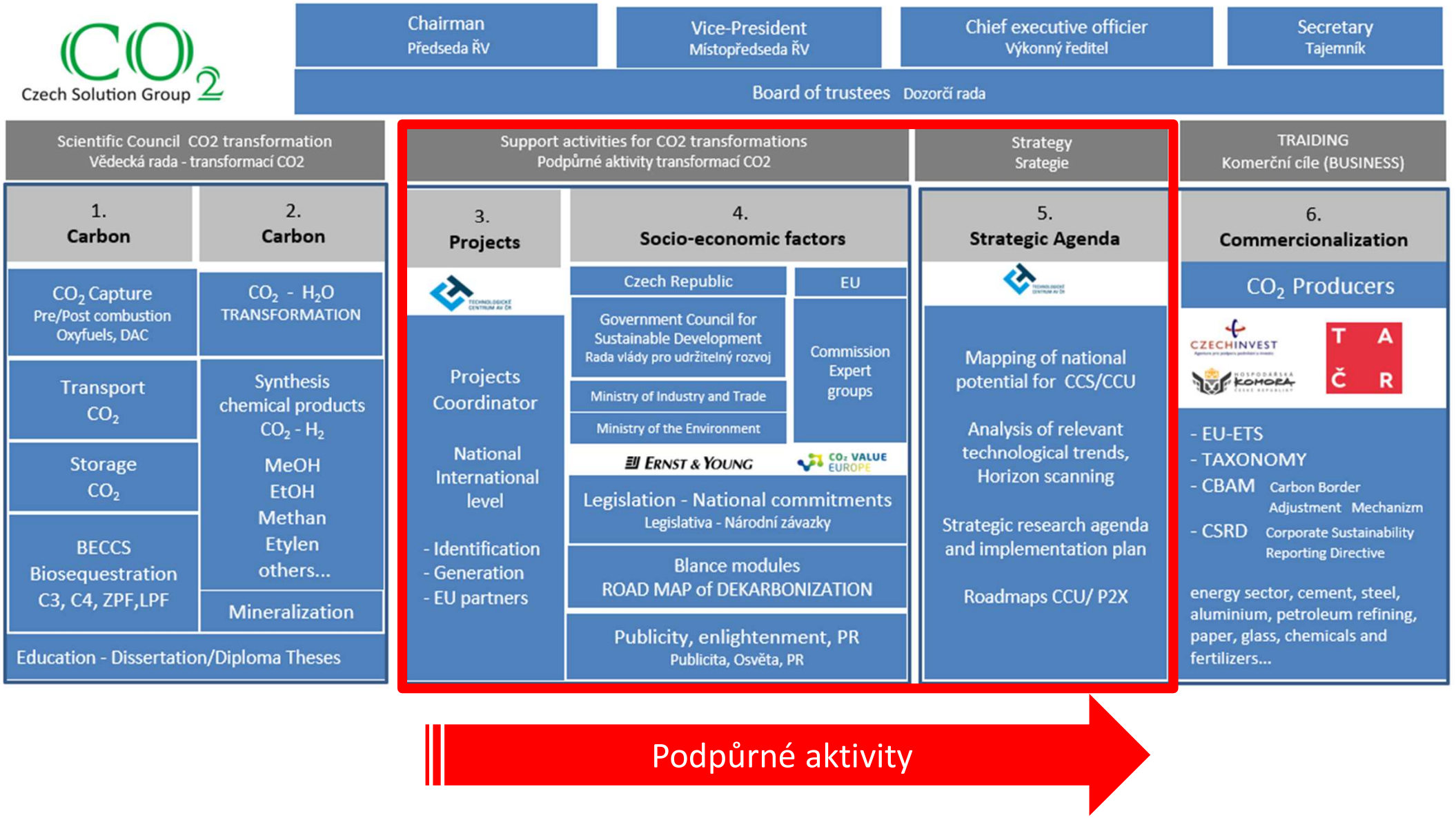
energy sector, cement, steel, aluminium, petroleum refining, paper, glass, chemicals and fertilizers...

Úkoly výzkumné rady

Vědecko-výzkumné aktivity

Projekty inicializované průmyslem

CO_2 Czech Solution Group structure



Podpůrné aktivity transformací CO2

Podpůrné aktivity

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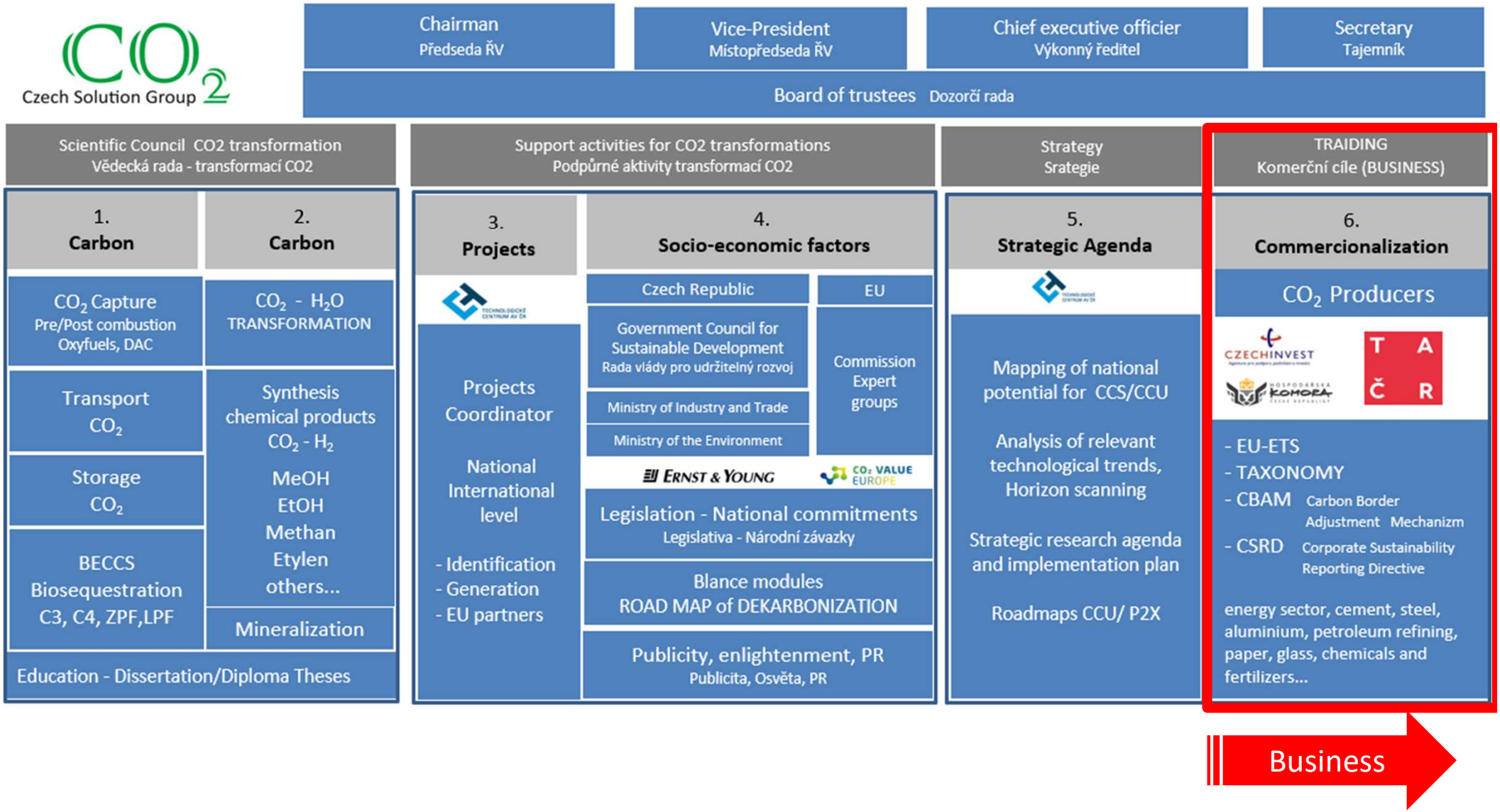
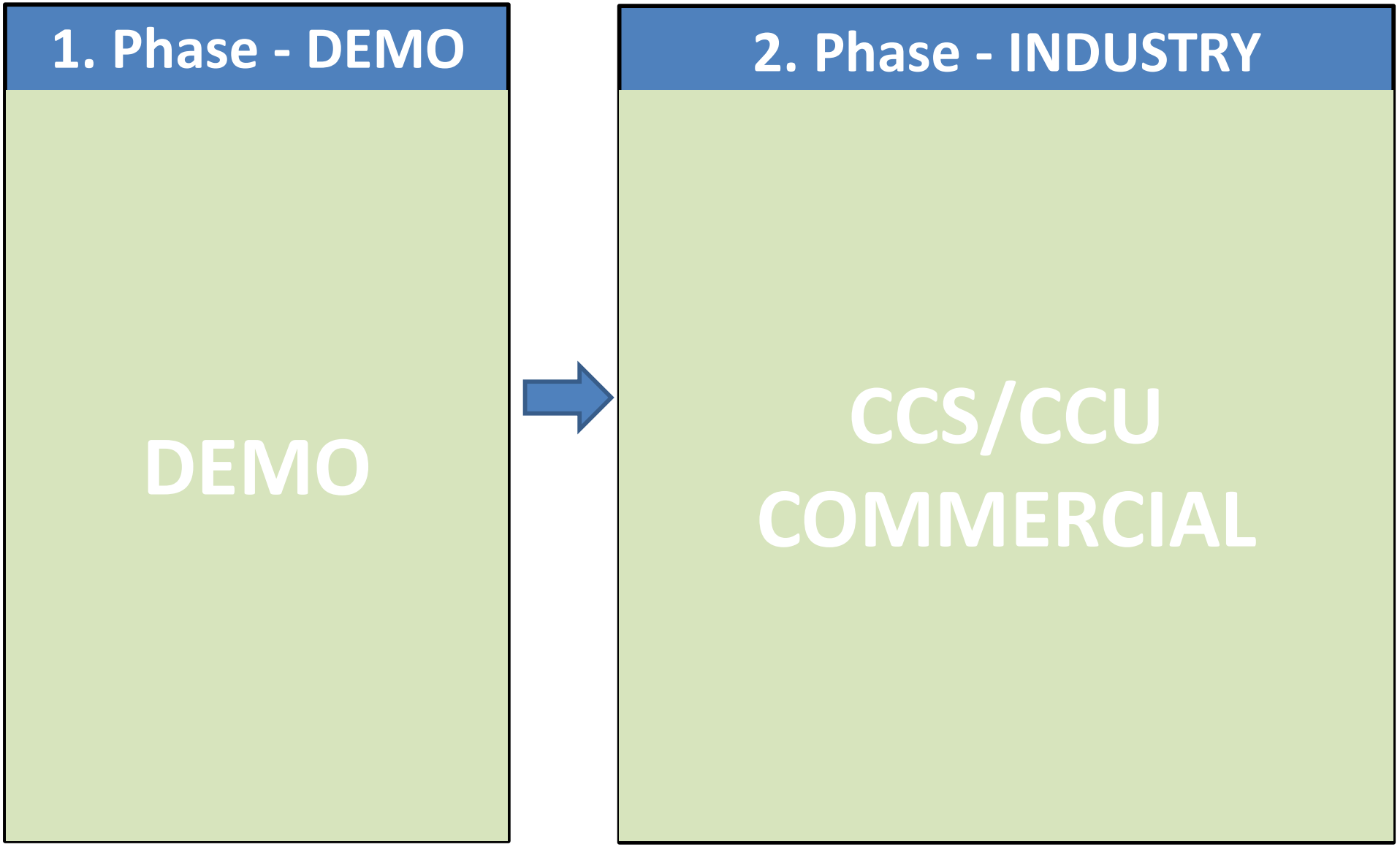


KOMERCIONALIZACE DEKARBONIZACE (BUSINESS)

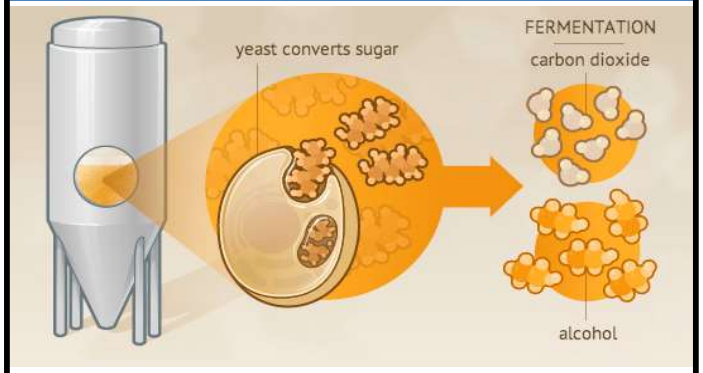
Business aktivity

Plánované fázování konkrétních projektů



Plánované fázování konkrétních projektů

1. Phase - DEMO



$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$

ethanol

DEMO PROJECT

pure CO2 from fermentation
food quality - ideal for CCSU

VERIFICATION CENTRE

2. Phase - INDUSTRY

CCS/CCU
COMMERCIAL

Plánované fázování konkrétních projektů

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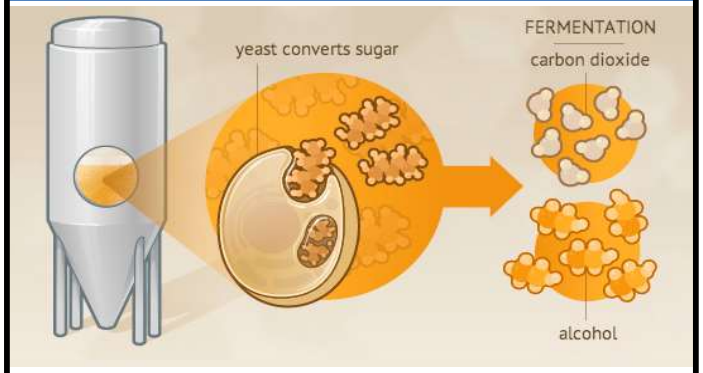

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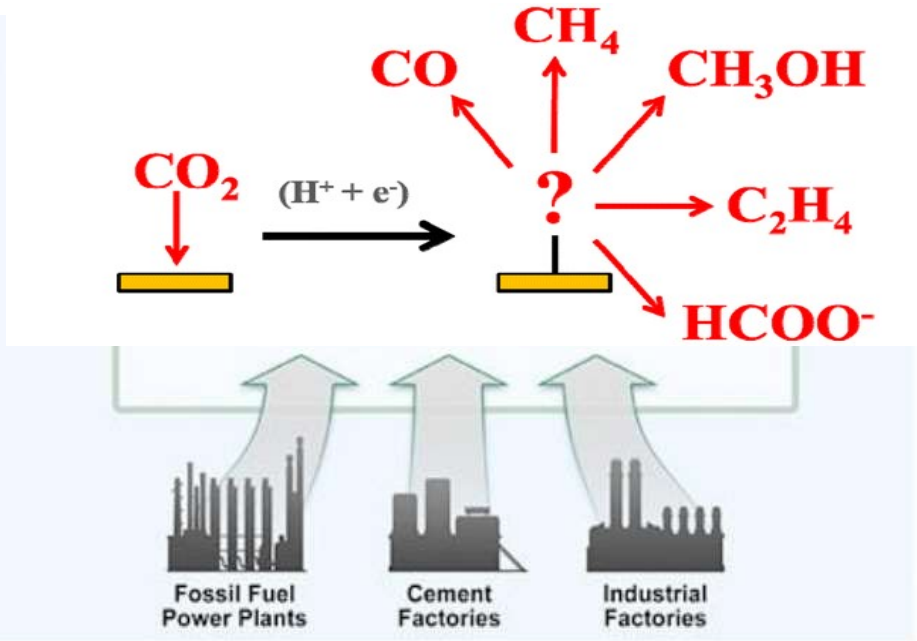

CO_2 Production in average

European Union – 8,7 t CO_2 eq./person
Czech Republic – 12,4 t CO_2 eq./person

100 MILION TONS CO_2 - YEARLY AVAILABLE

Plánované fázování konkrétních projektů

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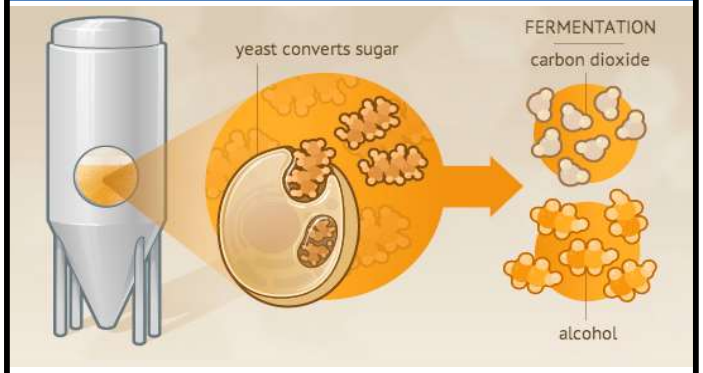

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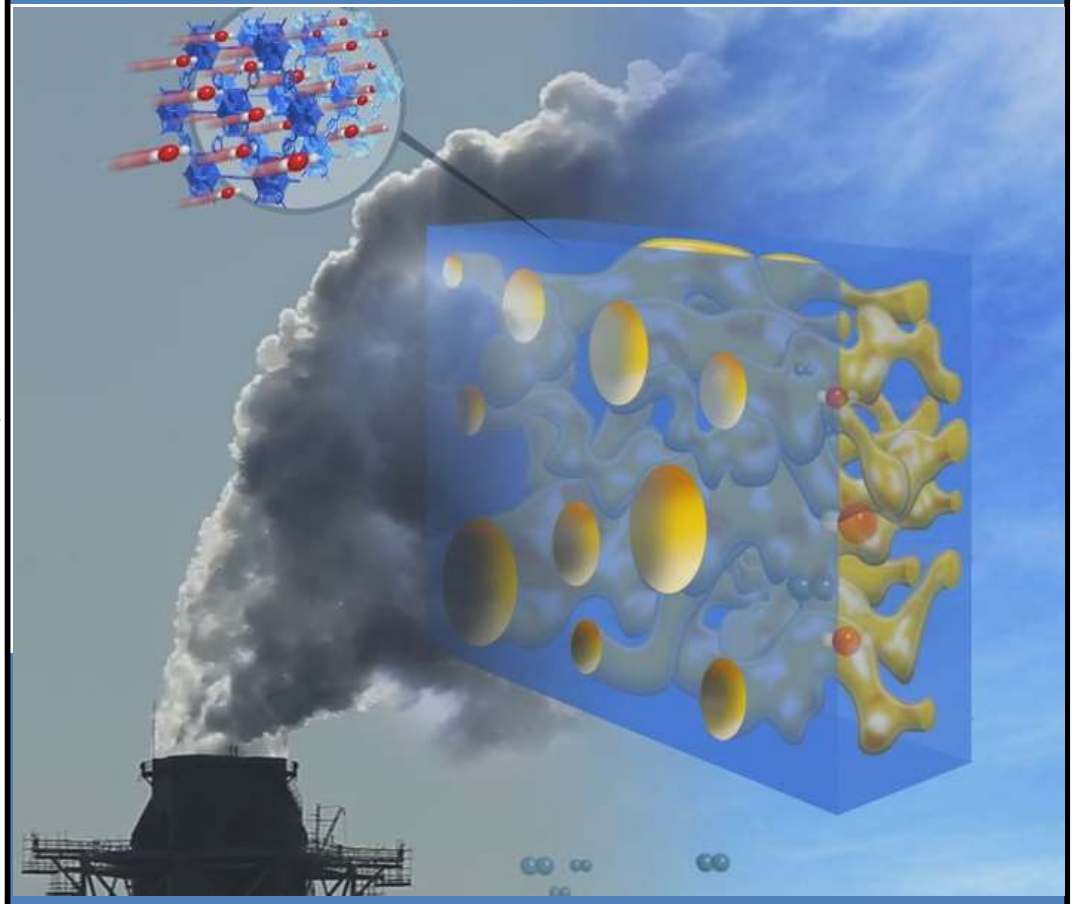

100 MILION TONS CO_2 - YEARLY AVAILABLE

Řetězec výroby uhlovodíkových komodit

ROPA ..... C_nH_{2n+2}

ZEMNÍ PLYN ...CH_4

UHLÍ..... $C_{137}H_{97}O_9NS$, $C_{240}H_{90}O_4NS$

BIOMASA ..... $C_xH_yO_z$

End produkt

MINERALIZATION
- Concretes
- Carbonates ($CaCO_3$, $MgCO_3$,..)
- Bauxit (Al_2O_3, Fe_2O_3...)
- Bicarbona $NaHCO_3$.
- NH_4HCO_3

...

BIOLOGAL CONVERTION
- BECCS Bioenergy with carbon capture and storage
- Energy storage, coupling
- Chemicals

CHEMICALS/FUELS
- CO (Syngas)
- Methan CH_4
- Methanol CH_3OH
- Formic acid CH_2O_2
- Monokarboxyl acides (... COOH)
- Aminoacids (...COOH, NH_2)
- Ethylen C_2H_4 ...plastics

FINE CHEMICALS
- Organic carbonate
- Nucleophilic additions with CO_2 (C–C a C–H)
- CO_2 on synthesis of amines, esters and

Komplexní řetězec
od produkce CO2 po uhlovodíkové komodity

CO2 VALUE CHAIN

CCS

Carbon Capture Storage

CCU

Carbon Capture Utilization

Komplexní řetězec
od produkce CO2 po uhlovodíkové komodity

CO2 VALUE CHAIN

Czech CO_2 sources

Pressure	ambient	Fermentation
Temperature	ambient	
CO2 concentration	100%	
Main inpurities	n/a	
Minir impurities	n/a	

Pressure	1 bar	Coal base energy Cement Metallurgical Refineres
Temperature	50-80°C	
CO2 concentration	3-30%	
Main inpurities	N_2, O_2, H_2O	
Minir impurities	NOx, SOx	

Pressure	15-40 bar	Natural gas Gasification Hydrogen production
Temperature	40-450°C	
CO2 concentration	15-40%	
Main inpurities	CH_4, CO, H_2	
Minir impurities	NOx, SOx, H_2S	

Pressure	1bar	OXY - Combustion
Temperature	50-75°C	
CO2 concentration	75 - 80%	
Main inpurities	H_2O	
Minor impurities	NOx, SOx	

Pressure	1bar	DAC Direct Air Capture
Temperature	ambient	
CO2 concentration	cca 420 ppm	
Main inpurities	N_2, O_2	
Minor impurities	n/a	

CO_2 capture

ABSORPTION (chemical/physical)
- Ammonia
- Ionic liquids
- Piperazin
- Alkaline solutions
- Amine solutions, AA-acides

ADSORPTION
- MOF , POP (porous polymers)
- Zeolits
- Metal oxides
- Solid sorbents (base amines)

MEMBRANES
- Organic
- Anorganic
- Composite
- Hybrids - combations

BIOLOGICAL CAPTURE
- BECCS
- Mikrobiological transfer
- Synthetic biology
- MES (microbial electrosynthesis)

OTHER WAYS
- Carbonate loops
- High-gravity (HiGee) Arc
- FLP (frustrated Lewis pairs)
- Cryogenic
- ....

CCU

Carbon Capture Utilization

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Convertion

- Thermo-chemical
- Bio-chemical
- Photo-chemical
- Electro-chemical
- Bio- electro-chemical
- Plasma /NTP

End produkt

MINERALIZATION
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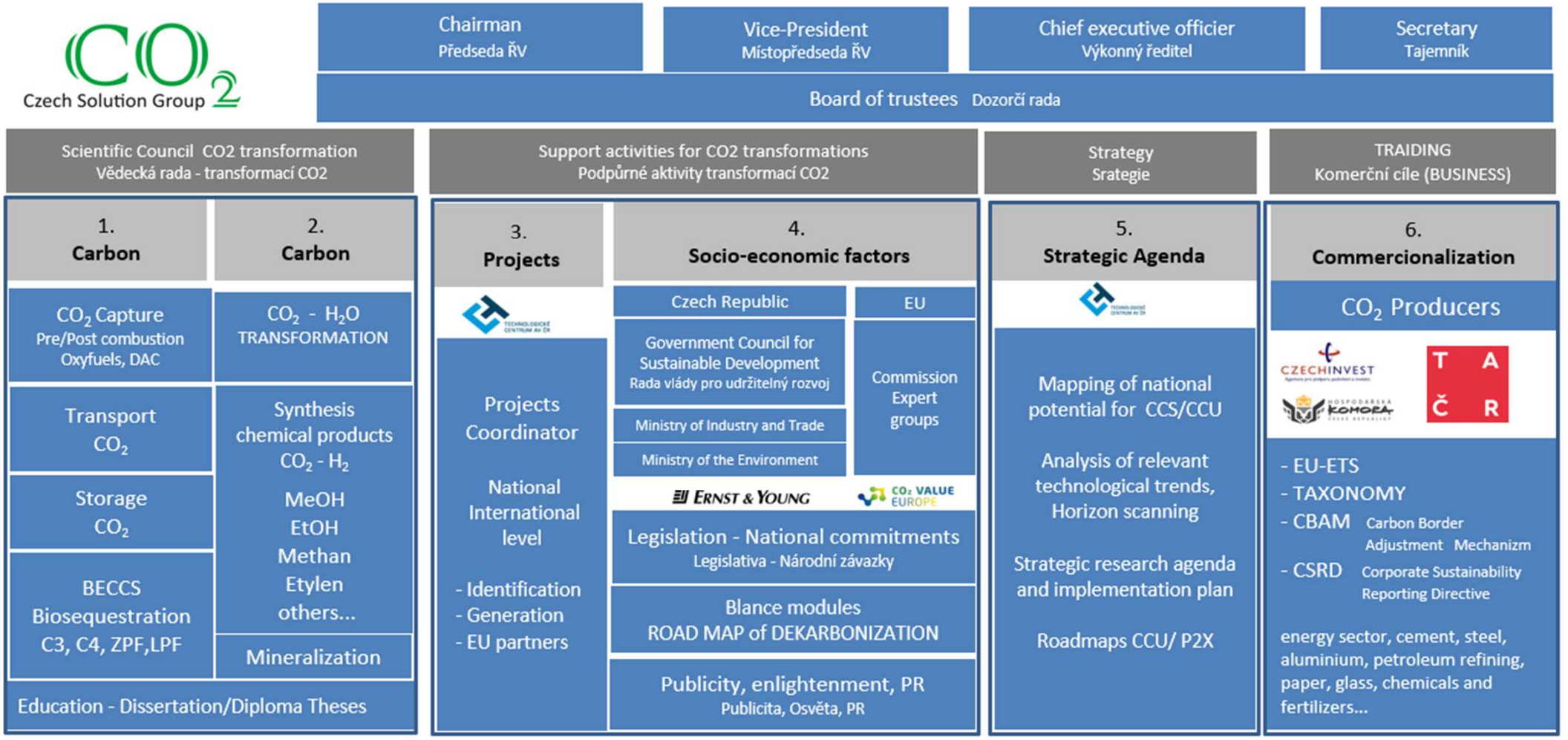
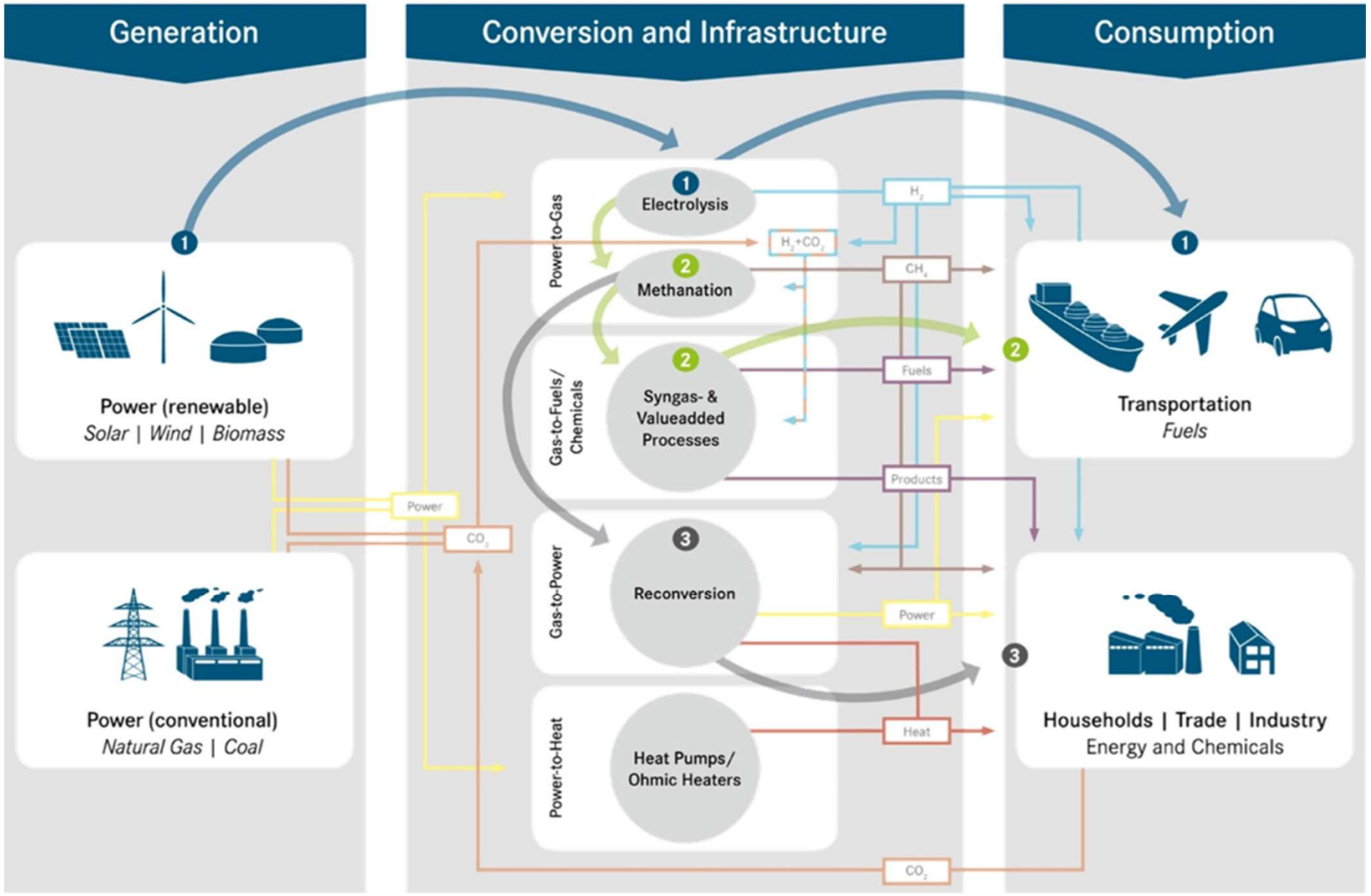
Carbon Capture Storage

CCU
Carbon Capture Utilization

CO_2 Czech Solution Group structure

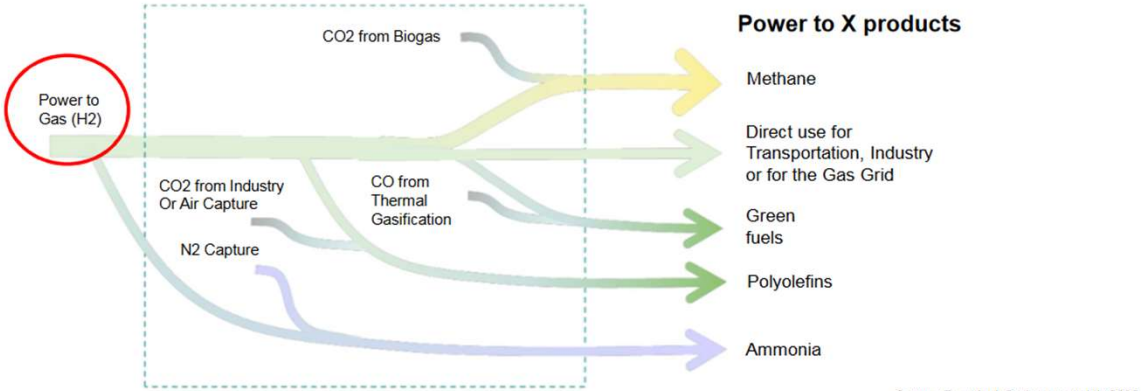


CO_2 a Power to X



file:///C:/Users/leosg/Downloads/Linking_the_Power_and_Transport_Sectors-Part_1_The.pdf

Hydrogen (H2) is the Key Component in Power to X



Source: Energinet: Systemperspektiv 2035

SIEMENS Gamesa RENEWABLE ENERGY

Different Electrolyzer Systems

PEM
Proton-Exchange-Membran

Siemens SILYZER 200
1.2 MW

Siemens SILYZER 300
Modelized

ALC
Alkaline Elektrolyse

GreenHydrogen
HyProvide™ A-Series

NEL
2.2 MW per stack

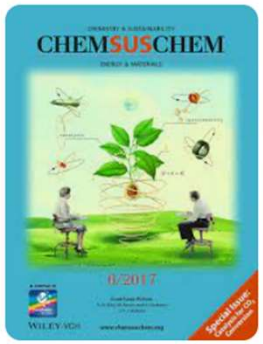
SOEC
Solid-Oxid

Haldor Topsø

SIEMENS Gamesa RENEWABLE ENERGY

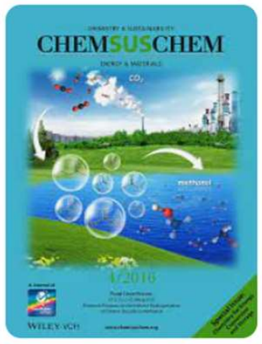
https://windren.se/WW2020/07_4_03_Madsen_Storage_of_electricity_in_molecules_Pub.pdf

Konverze CO2 je jedním z hlavních témat SusChemu

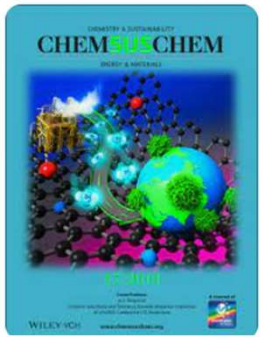


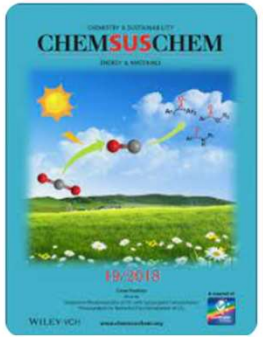
Chemistry Europe - Wiley
Catalysis for CO2...

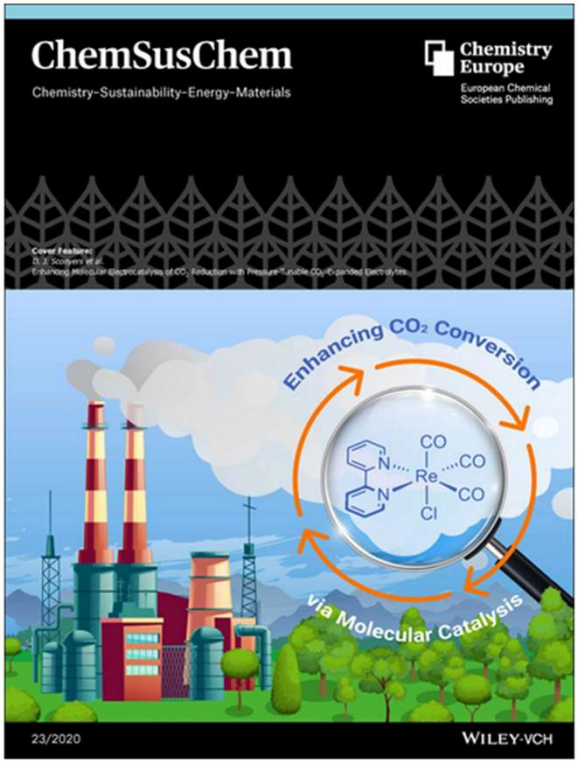
Chemistry Europe - Wiley
ChemSusChem: Vol 12, N...

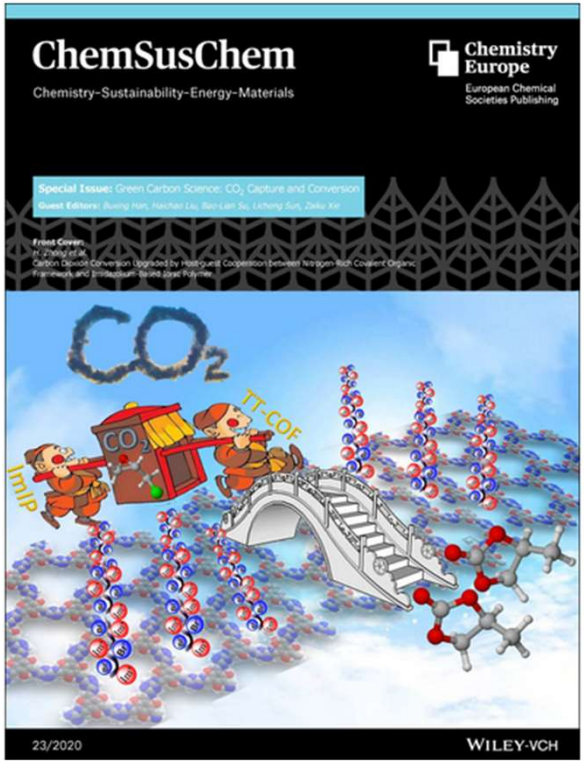


Chemistry Europe - Wiley
Theoretical Insight into the...

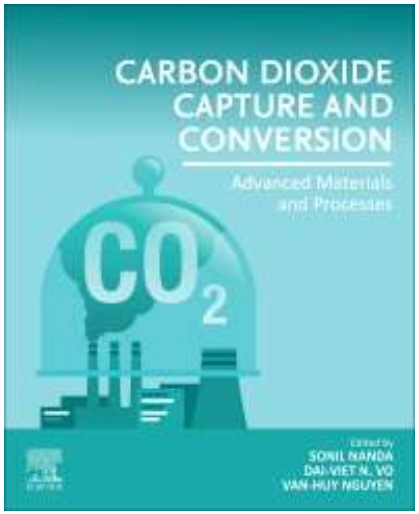


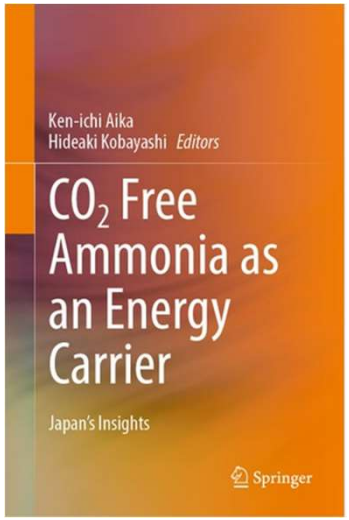


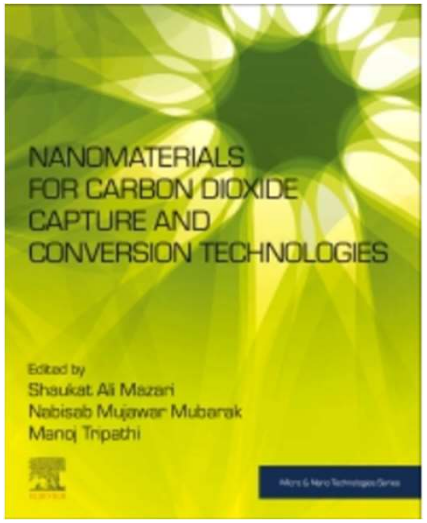


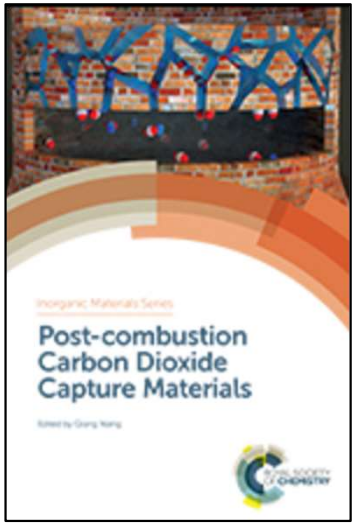


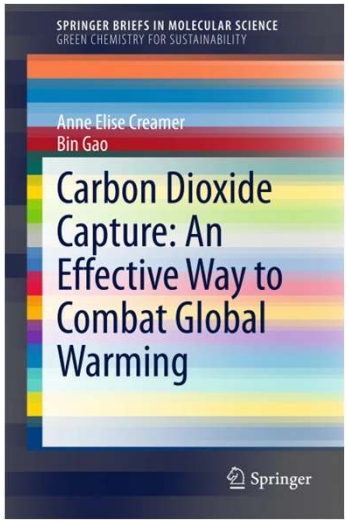
CCU je hlavní téma R&D nefosilní uhlovodíkové chemie

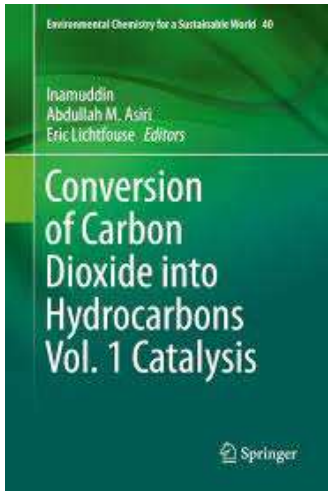


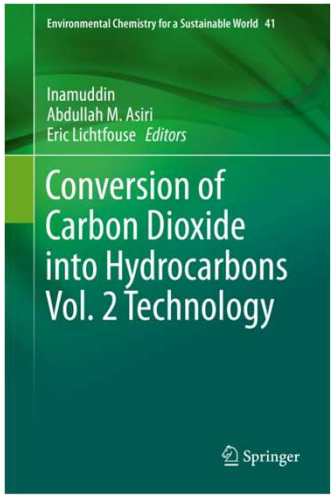


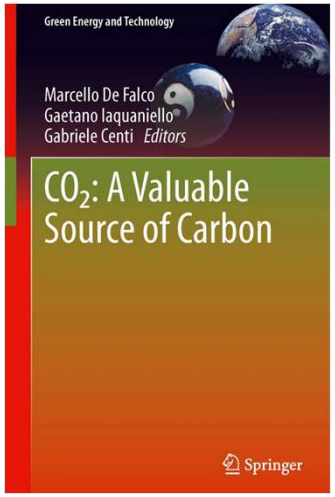


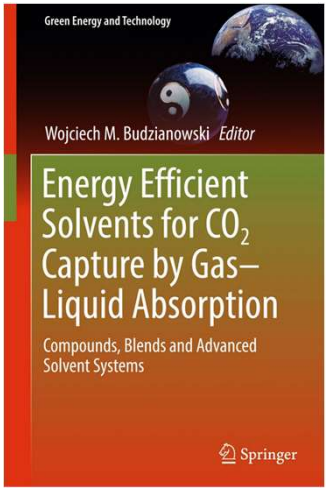


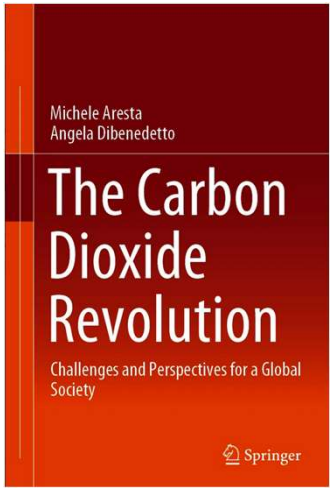


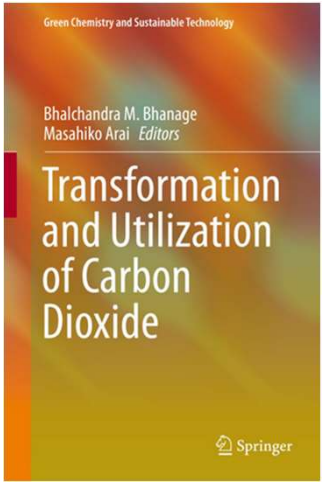




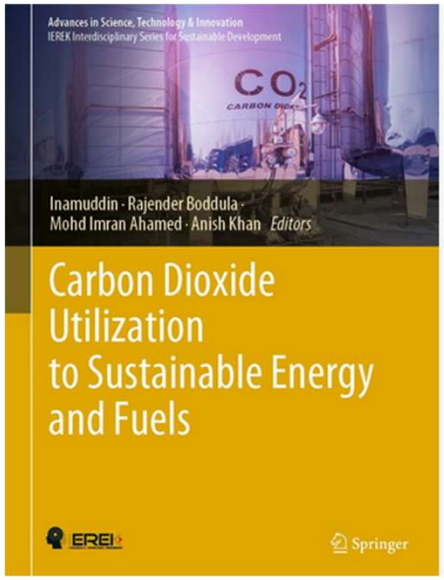


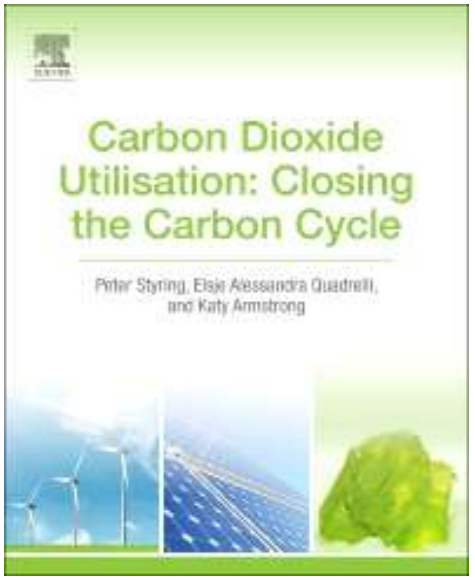


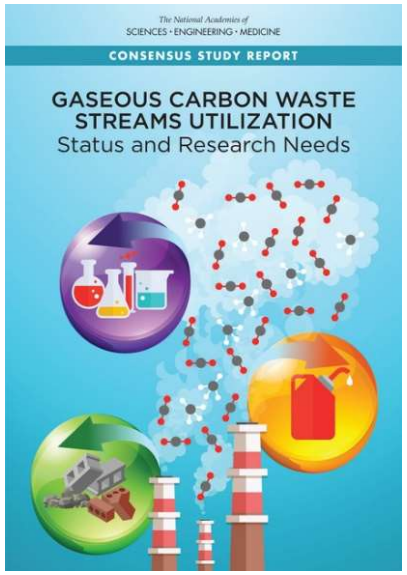


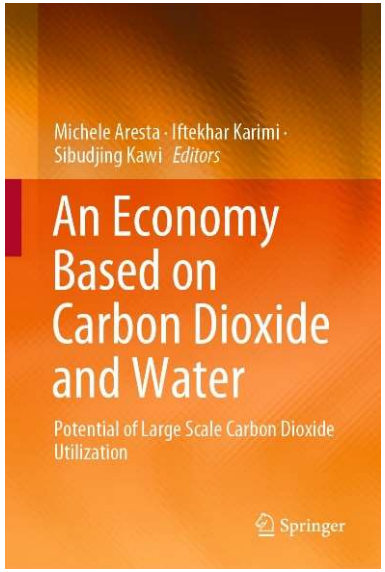


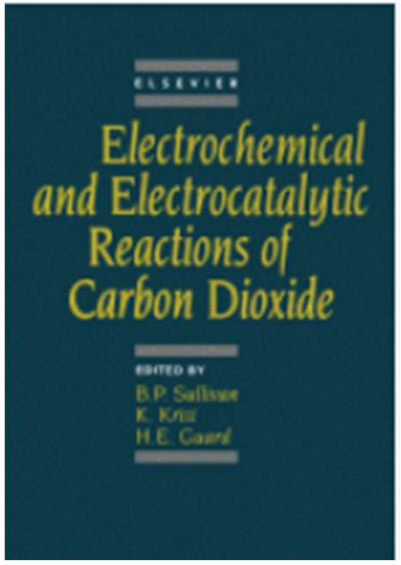
CCU je hlavní téma R&D nefosilní uhlovodíkové chemie

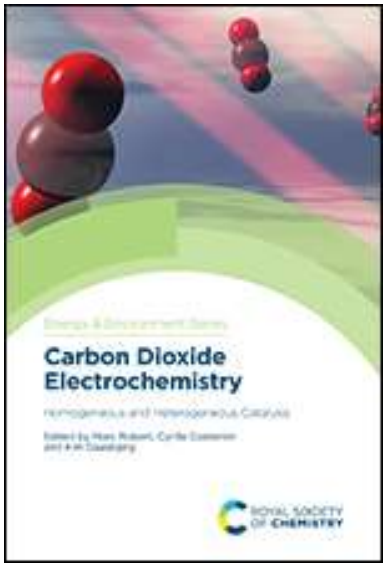


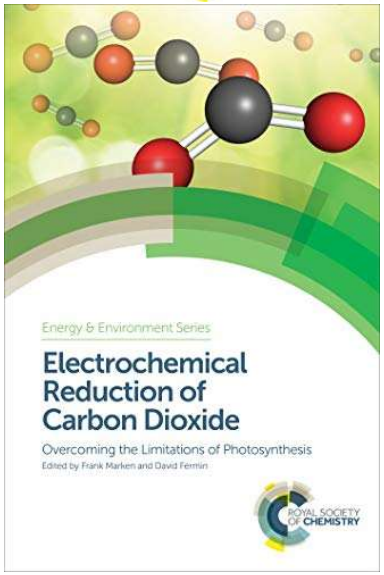


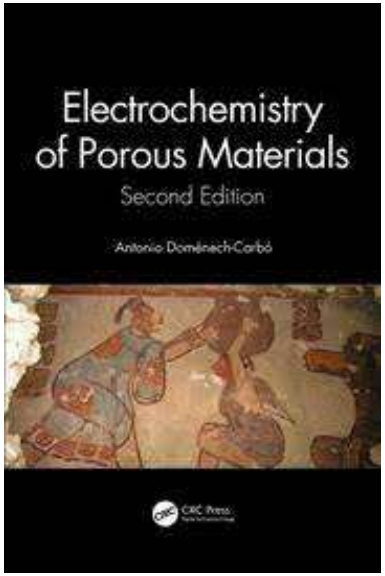












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Spolupráce Power to X

https://www.topsoe.com/hubfs/TCF%202022%20Power-to-X%20Agenda.pdf?hsLang=en-us

Klíčové slová
Electrochemical CO2 reduction (CO2R)
https://iopscience.iop.org/article/10.1088/2515-7655/ac7823/pdf