

Sector coupling and industrial symbiosis strategies between carbon-intensive sectors

Just Transition Platform Conference, 24 October 2022

Sector coupling and industrial symbiosis

Strategies between carbon-intensive sectors



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24th Octobre 2022
Just Transition Platform
Conference, Brussels

... is the **State Agency for Energy and Climate Protection** of the state North Rhine-Westphalia and

... our goal is hence the **transformation to climate neutrality** in North Rhine-Westphalia

 **Start:** January 2022

 **Employees:** >80

 **Stakeholder:** businesses, municipalities, educational institutions, politics



... identifies required **innovations** and **policy frameworks**

... involves **engaged** actors in **scalable** projects

... **informs** and **raises awareness**

... is responsible for the **climate protection activities** of the state of NRW and

... **unites** politics, economy, science and society in a **joint discourse**

NRW.Energy4Climate

**Energy
Sector**

**Industry &
Production**



**Heat &
Buildings**

Transport

Cross-sector topics

Municipal climate protection

International Cooperations

Funding

Energy research initiative

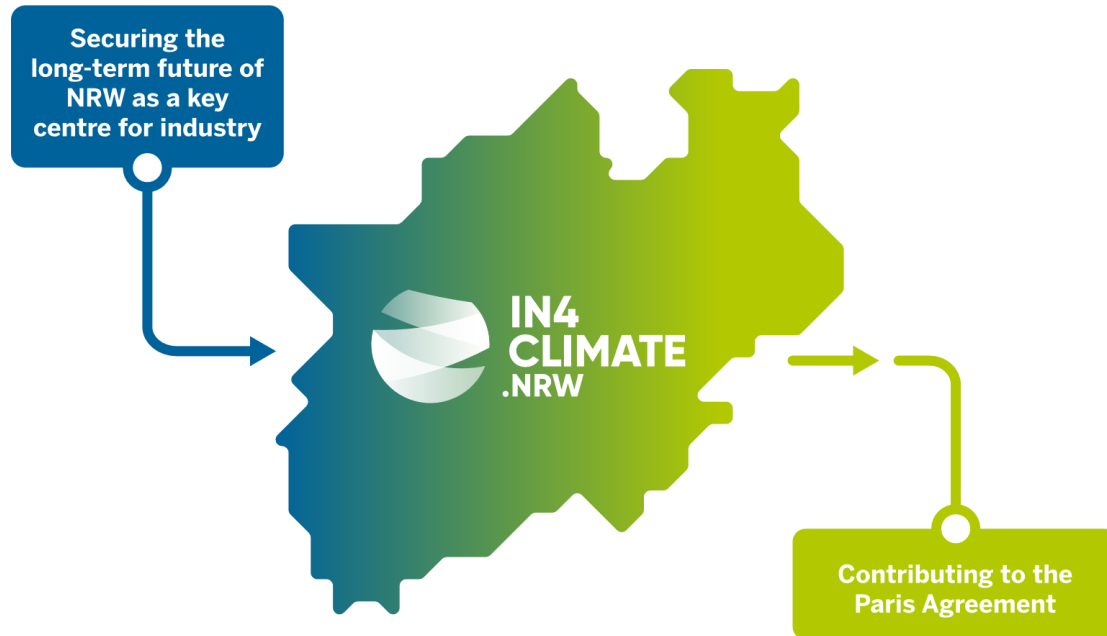
Feedstocks for the energy transition

Climate education

Digitalisation

Initiative IN4climate.NRW

What are our goals?

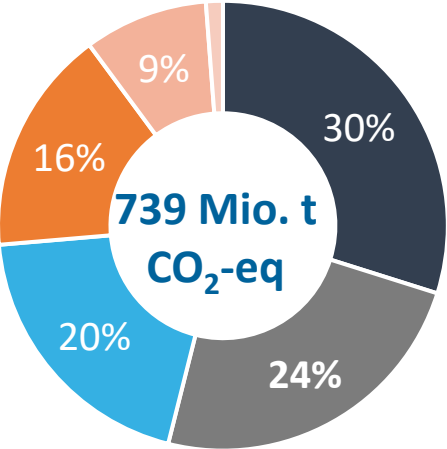


Who are we?



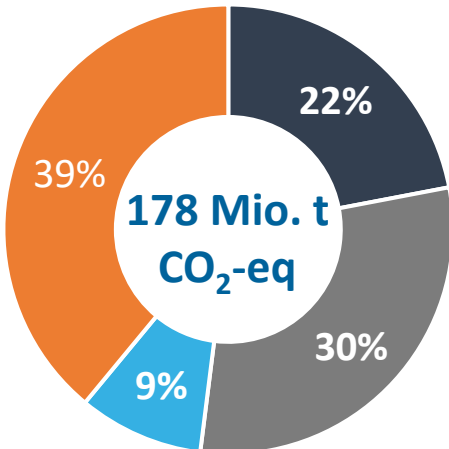
Industry Transformation

GHG emissions from the chemical, steel and cement industries



Greenhouse Gas Emissions in Germany

- Energy Sector
- Industry
- Transport
- Buildings
- Agriculture
- Other



- ca. **5,3 %**
of Germany's GHG emissions are generated in the chemical industry
- ca. **7,2 %**
of Germany's GHG emissions are generated in the steel industry
- ca. **2,2 %**
of Germany's GHG emissions are generated in the cement industry

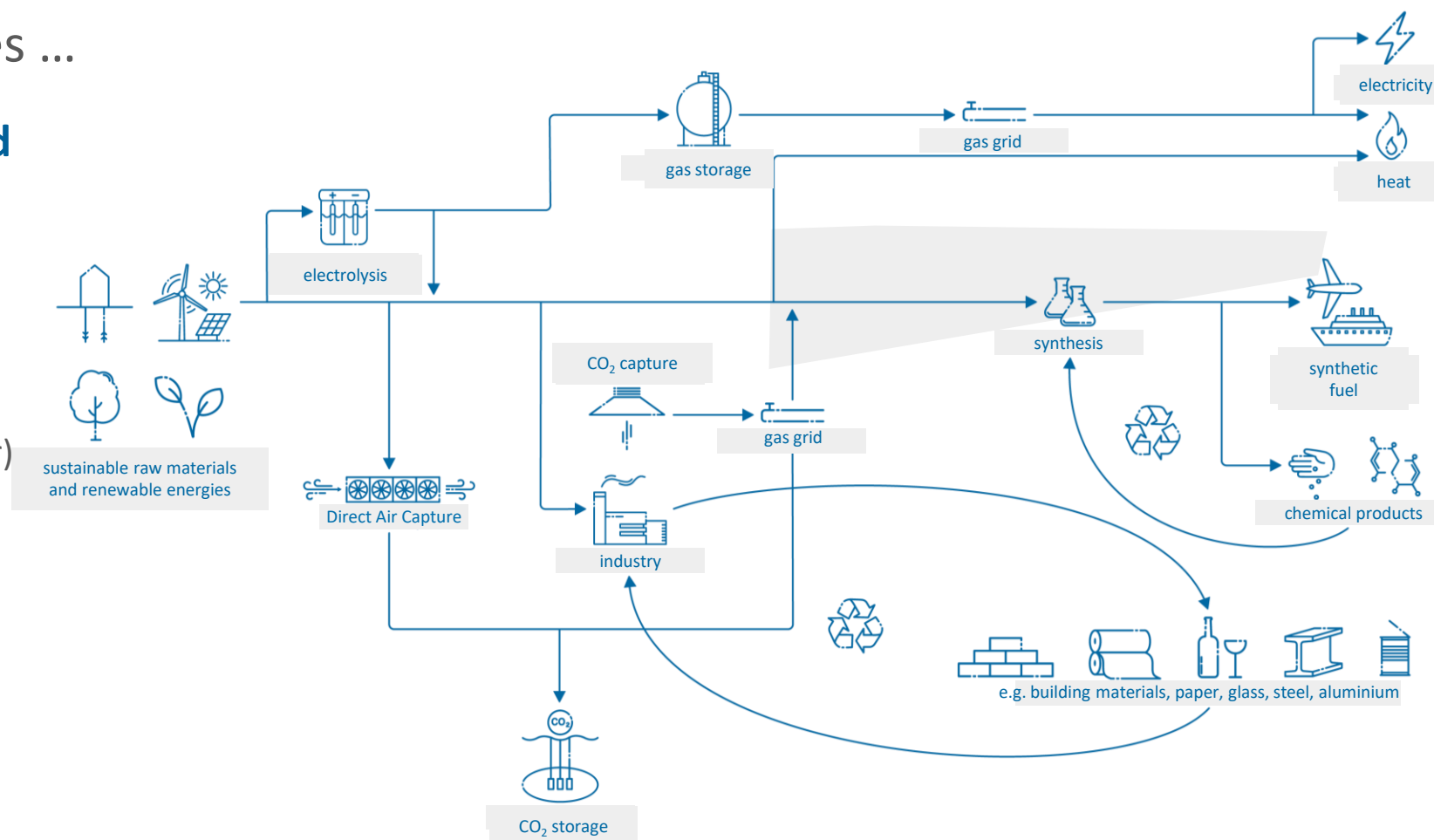


24 %
of GHG emissions are caused by industry

A vision of a climate-neutral basic materials industry

The transformation requires ...

- **Sustainable raw materials and renewable energies**
(basic requirement)
- **Climate-neutral process heat**
- **(Green) Hydrogen Economy**
(H₂ as raw material and energy carrier)
- **Carbon Management**
- **Circular Economy**
- **Political, social and economic framework**



Hydrogen Application

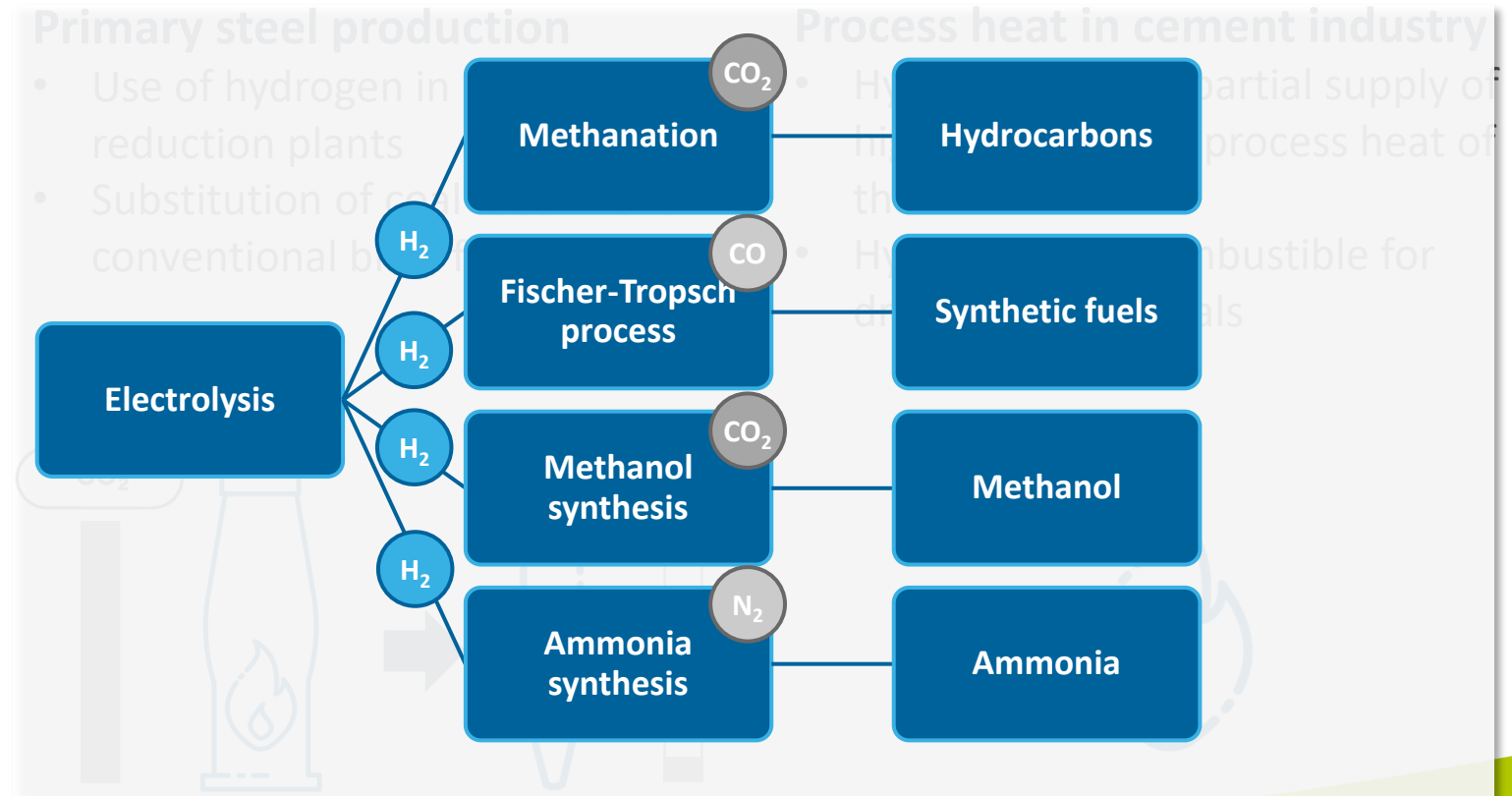
Strategies of the chemical, steel and cement industries

Chemical feedstocks

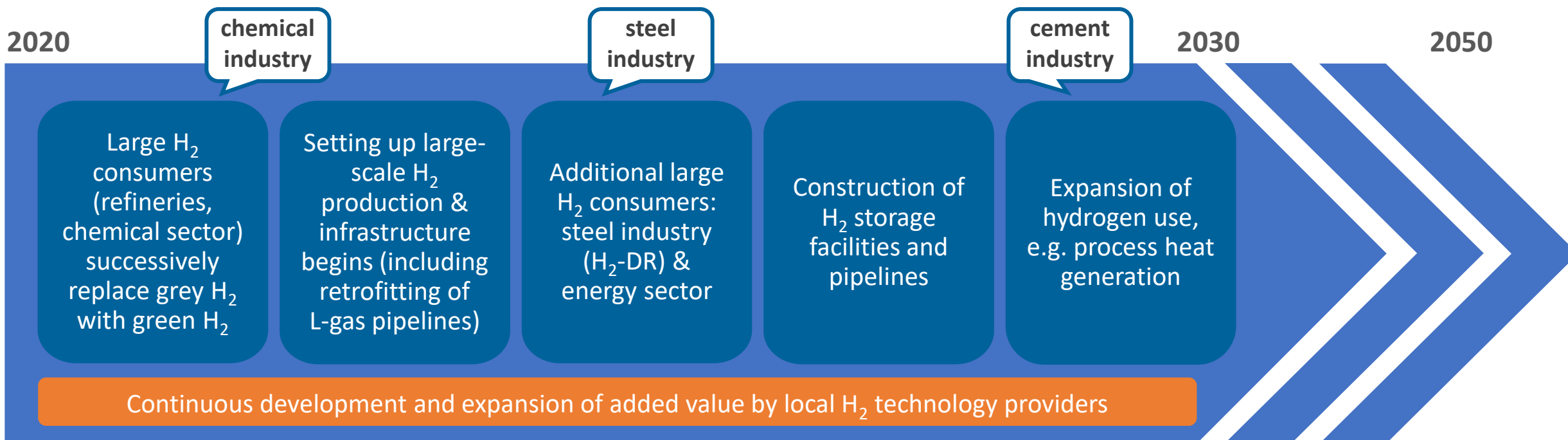
- Hydrogen usage for synthesis of feedstock chemicals

Refineries and petrochemistry

- e.g. hydrocracking with the presence of hydrogen
- Green hydrogen substitute, so far used grey hydrogen



H₂ Economy Ramp-Up



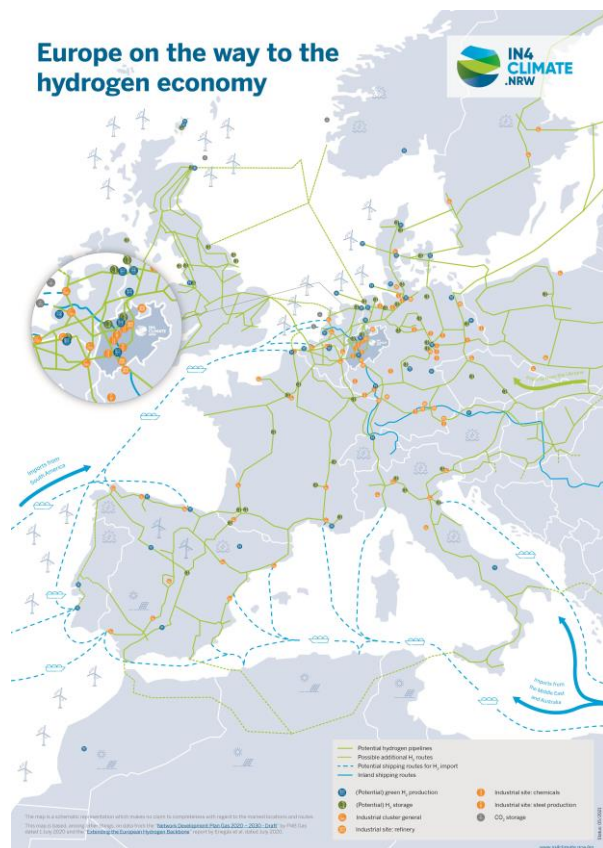
Continuously increasing demand for hydrogen in **NRW...**

16,5 TWh/a

104 TWh/a

Coverage of Hydrogen Demand

National and European infrastructure approaches



Germany's **hydrogen demand** in 2045 is approximately **237¹ – 690² TWh/a**.

Up to 40 %³ is required **in NRW** or at least **104 TWh/a** according to the **Hydrogen Roadmap NRW**.



The **steel and chemical industries** are major consumers and thus play an important role in the development of a hydrogen infrastructure.

NRW, Lower Saxony, the Netherlands and Belgium will form the backbone of the future European hydrogen economy.

Linking of consumption hubs in NRW with production and import hubs in Lower Saxony, Rotterdam and Antwerp.

- GET H₂ Nukleus and H₂ercules
- Innovative large-scale projects at and between ports: H₂-Backbone, H-Vision, RH₂INE, HyPort, HyTruck, HY3, ...

Complemented by import strategies, e.g. ...

- Spain
- Scotland
- Norway
- Morocco
- Chile
- Australia

¹ BDI – Klimapfade 2.0 ("Zielpfade"),
² BMWi – Langfristszenarien ("TN-H2"),
³ Wuppertal Institut

Carbon Management Strategies for defossilisation

Basic chemicals

- Synthesis of hydrocarbons from sustainable instead of fossil carbon sources
- e.g. methanol synthesis, methanation, Fischer-Tropsch process

Primary steel production

- Biogenic carbon instead of coal for basic carburizing in the melter/converter

Secondary steel production

- Graphite electrode from biogenic carbon as reducing agent
- Biogenic carbon instead of coal for basic carburizing and foaming slag formation in the electric arc furnace

Process heat for cement industry

- Process heat from biomass combustion with CO₂ capture and storage (BECCS)



- No complete **decarbonisation**, as carbon is needed as an auxiliary or raw material
- Sustainable sources for **defossilisation** of still required carbon quantities
- **CCU/CCS** solutions as supplement for process-related CO₂ emissions

Carbon Management

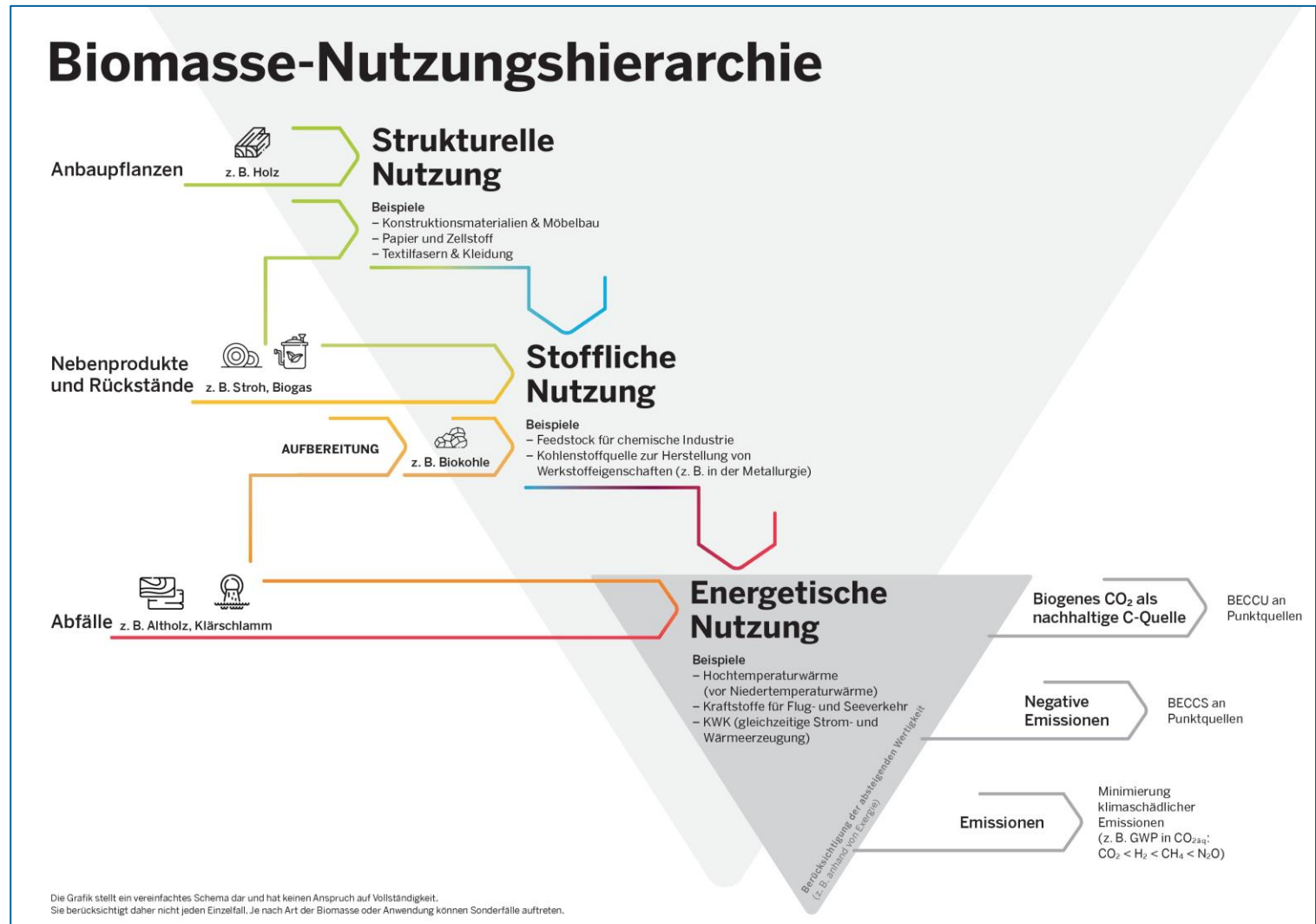
Biogenic carbon for a climate-neutral basic materials industry

Biomass is limited.

The supply of **biogenic carbon** should not come directly from renewable raw materials, but from **by-products and residues**.

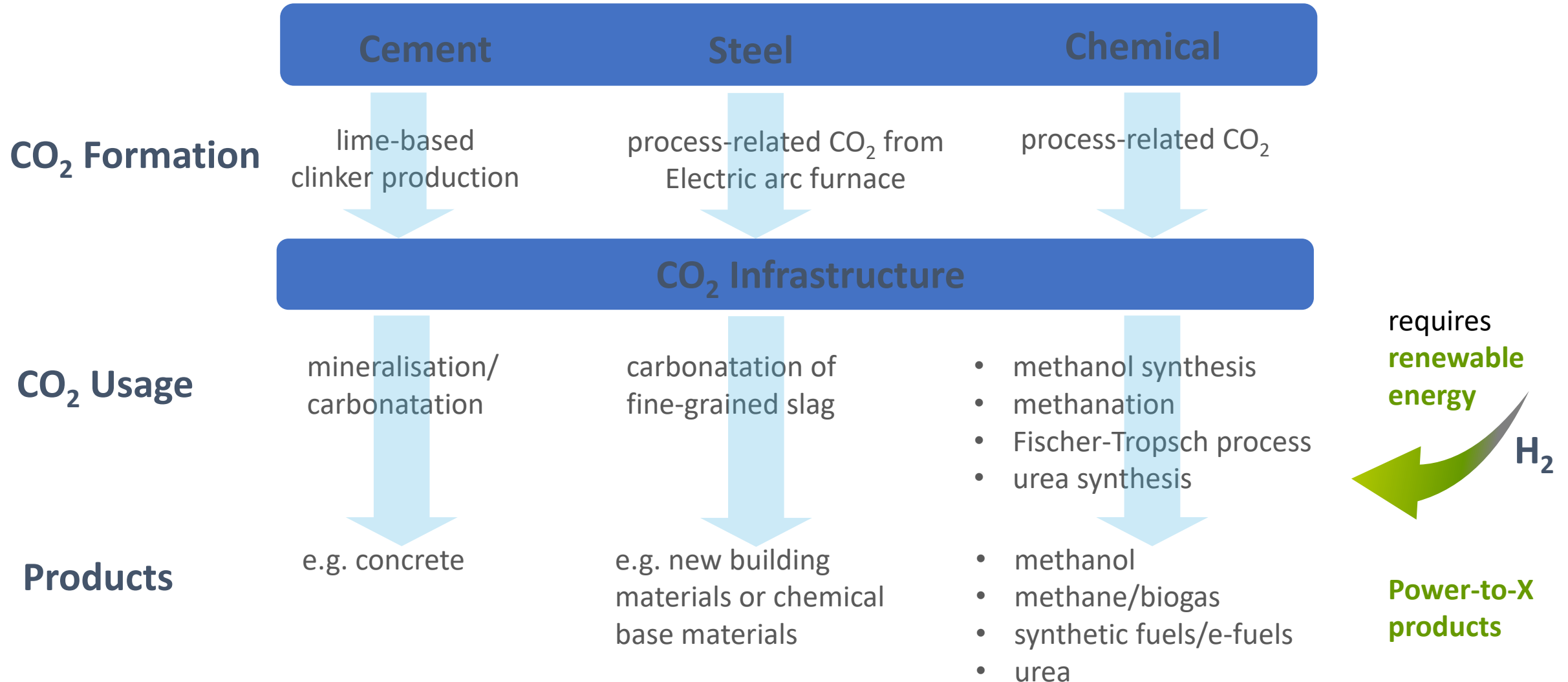
Sustainable, **prioritised use** where it is needed:

1. Structural use
2. Material use, e.g. biogenic CO₂ as a sustainable carbon source
3. Energetic use



Carbon Management

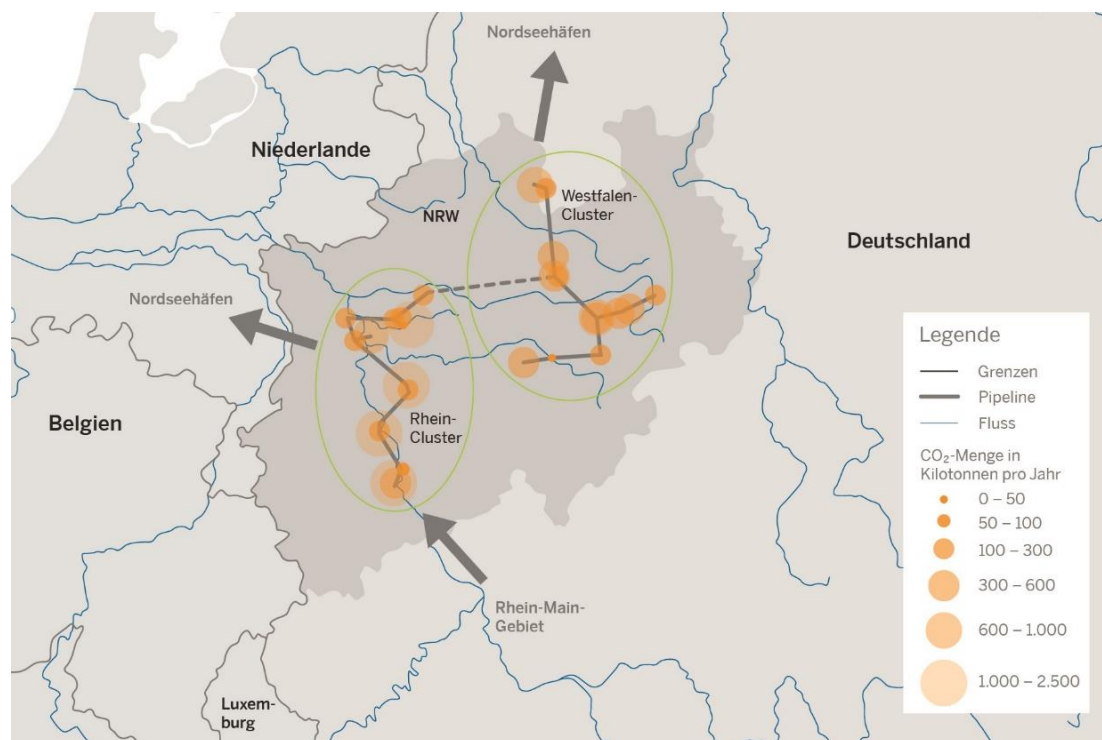
Carbon Capture and Utilization



Establishing a Carbon Dioxide Economy

First steps towards a transport infrastructure

- Capture and transport of unavoidable CO₂, e.g. from the cement industry, becomes necessary
- Design of an infrastructure in NRW, to connect large CO₂ sources with possible CO₂ sinks

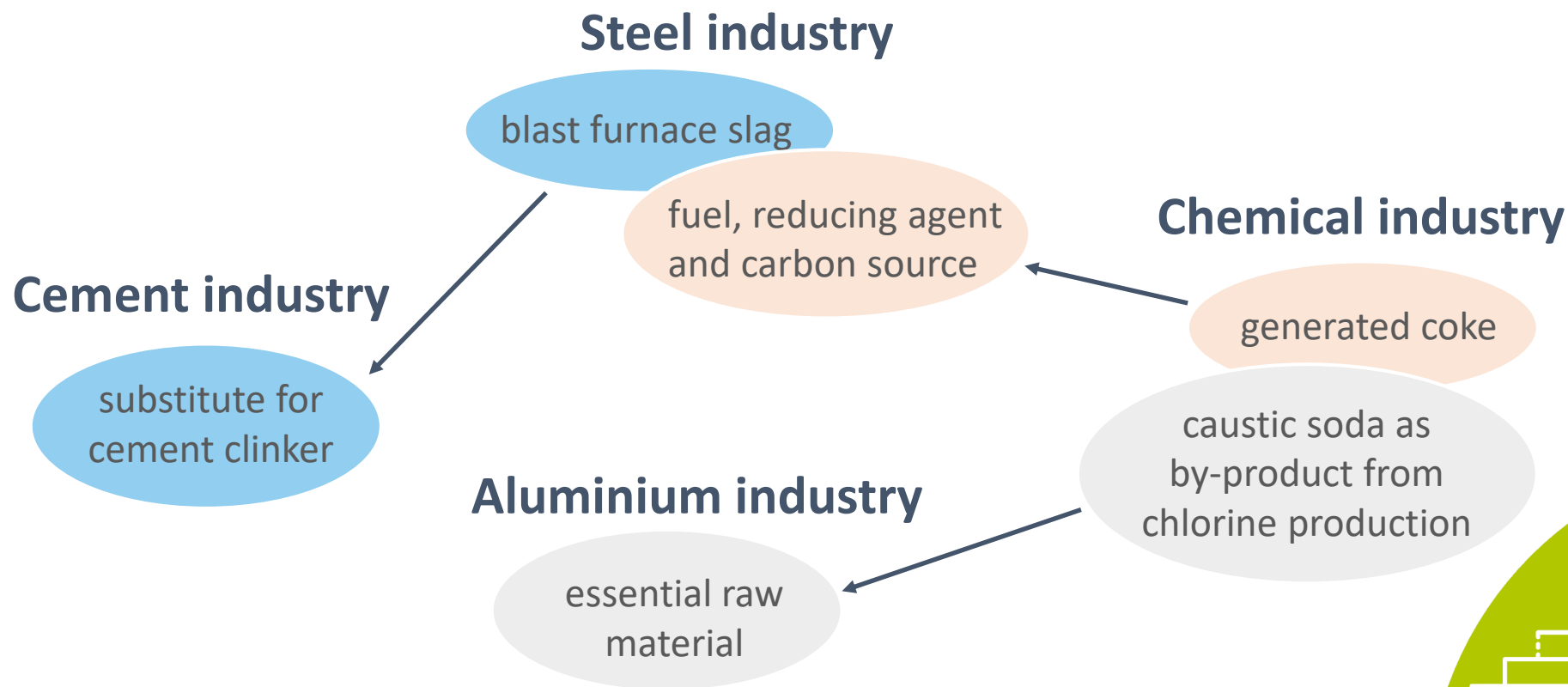


Based on SCI4climate.NRW 2021



- Specific pipeline projects for the realisation of CCU projects and the development of storage sites
- Connection of industrial clusters in the Ruhr area and the Rhineland with Rotterdam („DeltaCorridor“) and Wilhelmshaven („OGE CO₂ Startnetz“)

Material Flows – Industrial Symbiosis



➡ Industries = **interlinked system**
Goal: climate-neutral material flows in entire system
Considering **all scopes of CO₂ emissions**



Industry & Production



Energy-intensive basic materials
industry with high GHG emissions

Processing industry as solution
provider and user



Topics

**Circular
Economy**

**Industrial
Process Heat**

Hydrogen Economy

**Carbon
Management**

**Economy, Politics,
Society**

Activities

Workshops for and
with industrial
companies

Working Groups with
IN4climate.NRW partners

Professional assessment
of project ideas

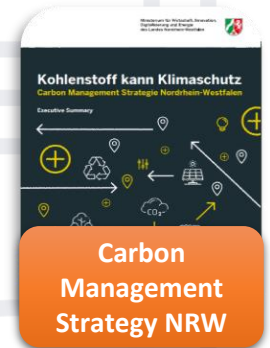
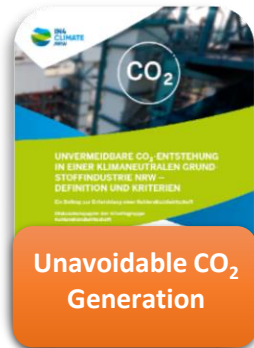
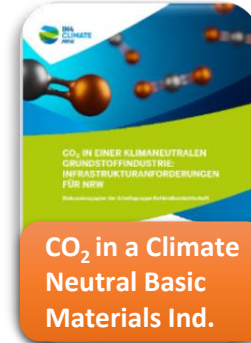
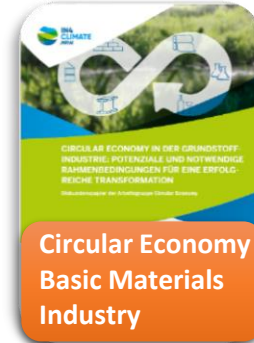
Providing impetus to
state politics

Connecting suitable
project partners

Publications for and with
industry and politics

Advice on suitable
funding

Publications





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Thank you for your attention!

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Panel discussion

- **Monika Banka, Policy & Network Coordinator, European Chemical Regions Network**
- **Jonas Helseth, Director, Bellona Europa**
- **Erwin Cornelis, Programme Manager Energy - Energy Intensive Industries, ECOS**
- **Lidia Greco, Associate Professor, University of Bari**
- **Iris Rieth, IN4climate.NRW / NRW.Energy4Climate**

Thank you

