Introduction Carbon Management

- What is Carbon Management?
- What is Industrial Carbon Management?
- Supportive ecosystem: What is needed to make NL a leader in this field?

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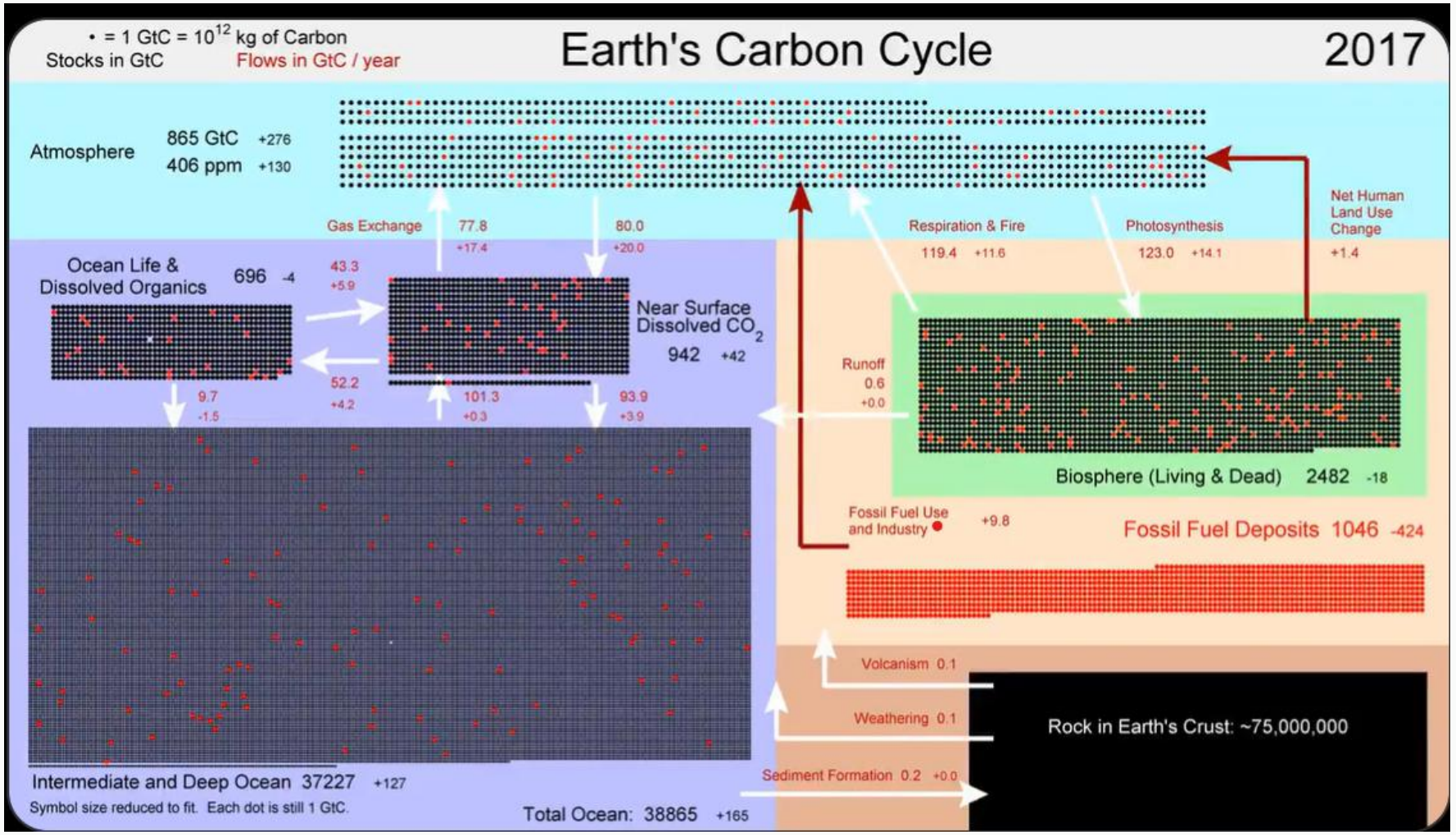
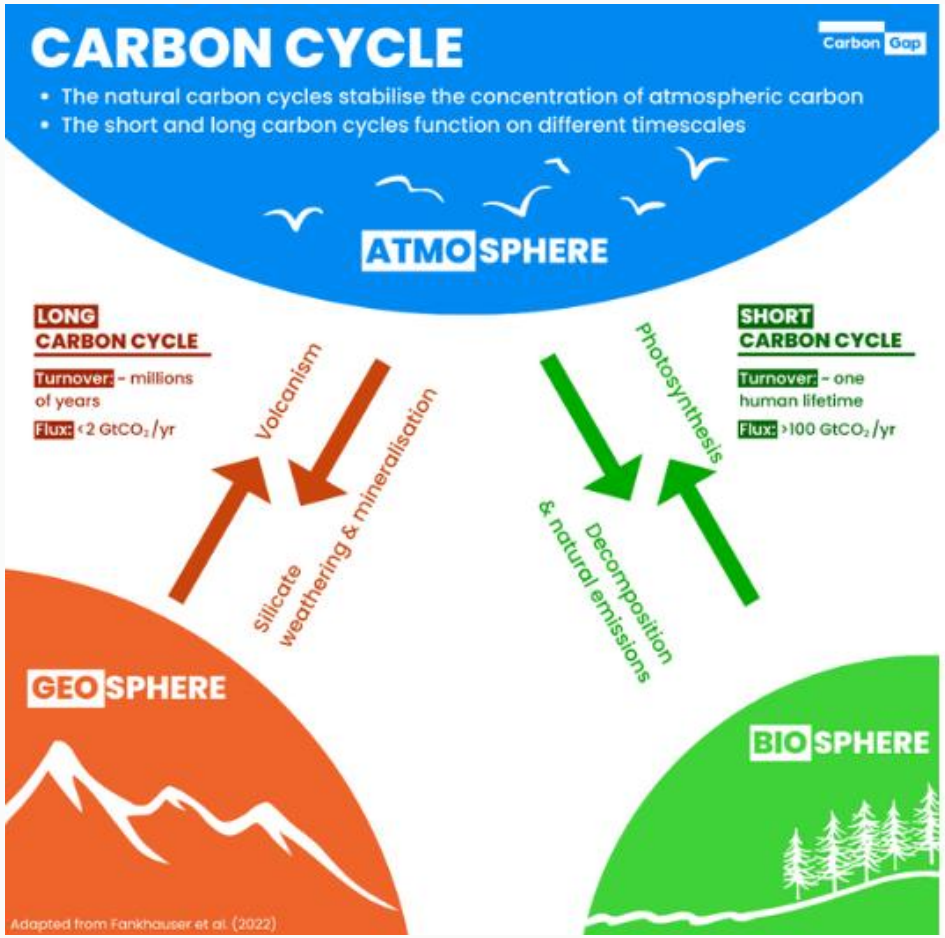
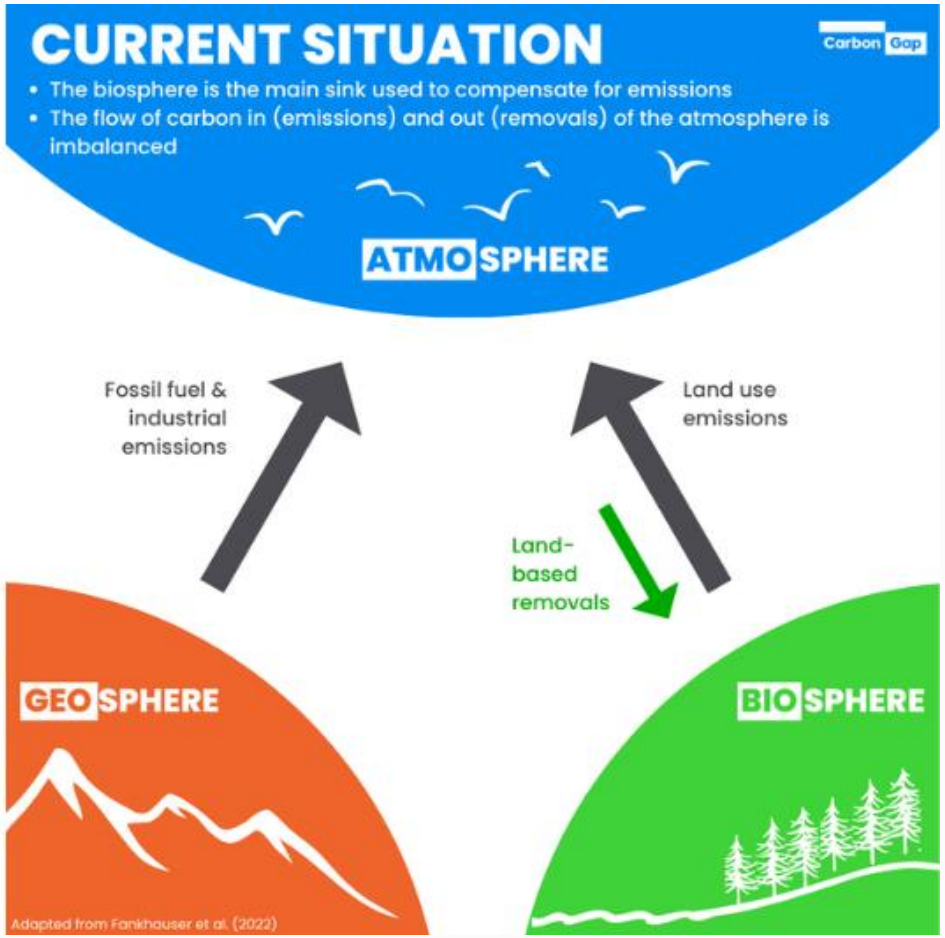
What is Carbon Management?

- https://youtu.be/dwVsD9CiokY



Carbon cycles past and present





Carbon Management

Carbon Management (broadest definition):

Everything we need to do to stop net flows of carbon caused by human activities from the biosphere and the geosphere to the atmosphere.

1. REDUCE fossil fuel use as much as possible

   Renewable & nuclear energy, energy efficiency, etc

2. **BALANCE the long carbon cycle; INDUSTRIAL CARBON MANAGEMENT**

   "Stopping fossil fuels causing global warming"

3. BALANCE the short carbon cycle: Land Use, land use change, forestry, agriculture, etc

Industrial Carbon Management (ICM)

EC definition:

Industrial Carbon Management is the set of technologies used to *manage and reduce CO_2 emissions from industrial facilities, and/or remove CO_2 from the atmosphere*.

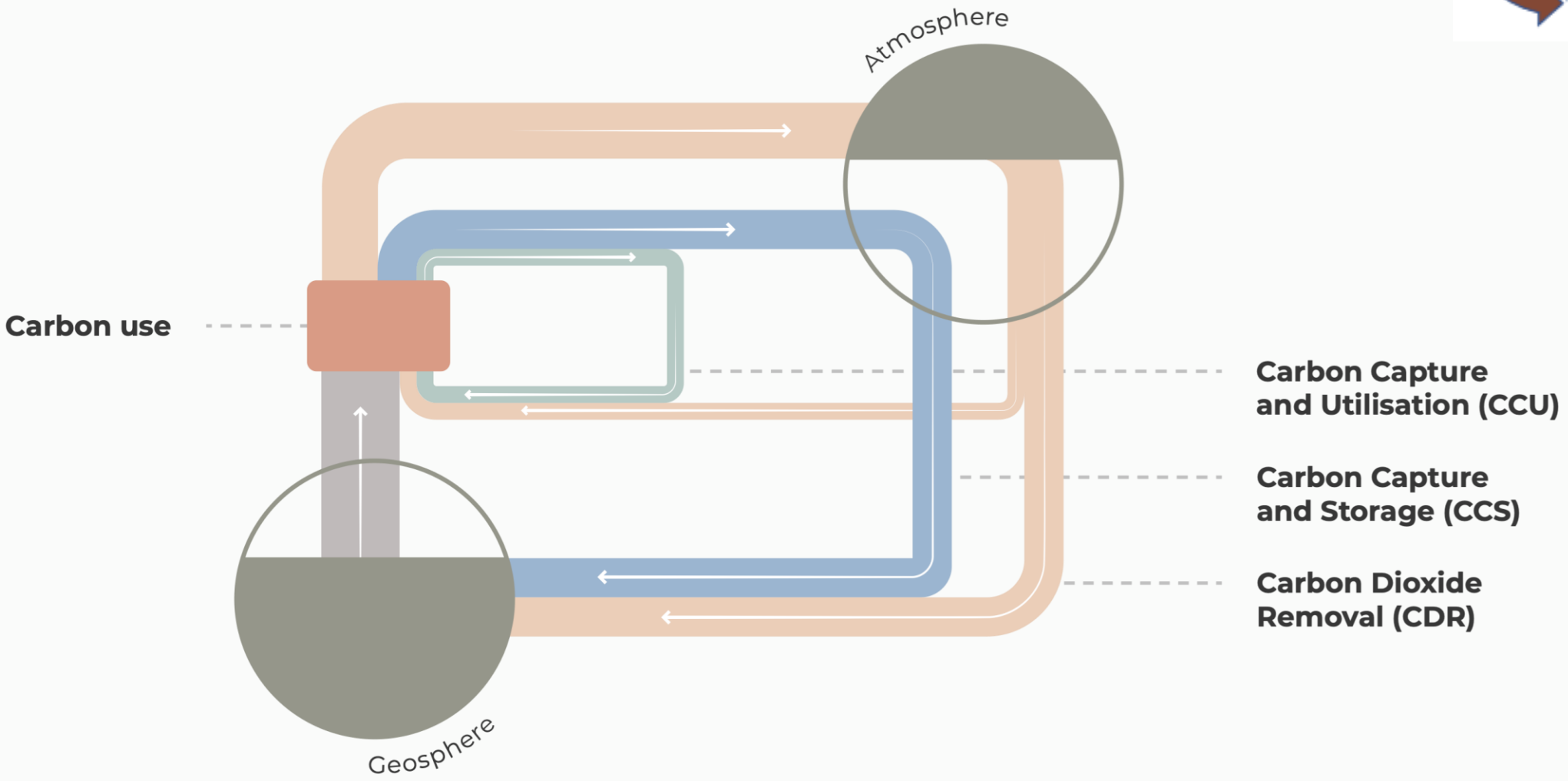
Broader definition:

Carbon management refers to the suite of practices, technologies, and strategies aimed at measuring, controlling, reducing, removing, and — where possible — reusing or permanently storing carbon dioxide (and other greenhouse gas) emissions associated with human activities.

My proposed definition:

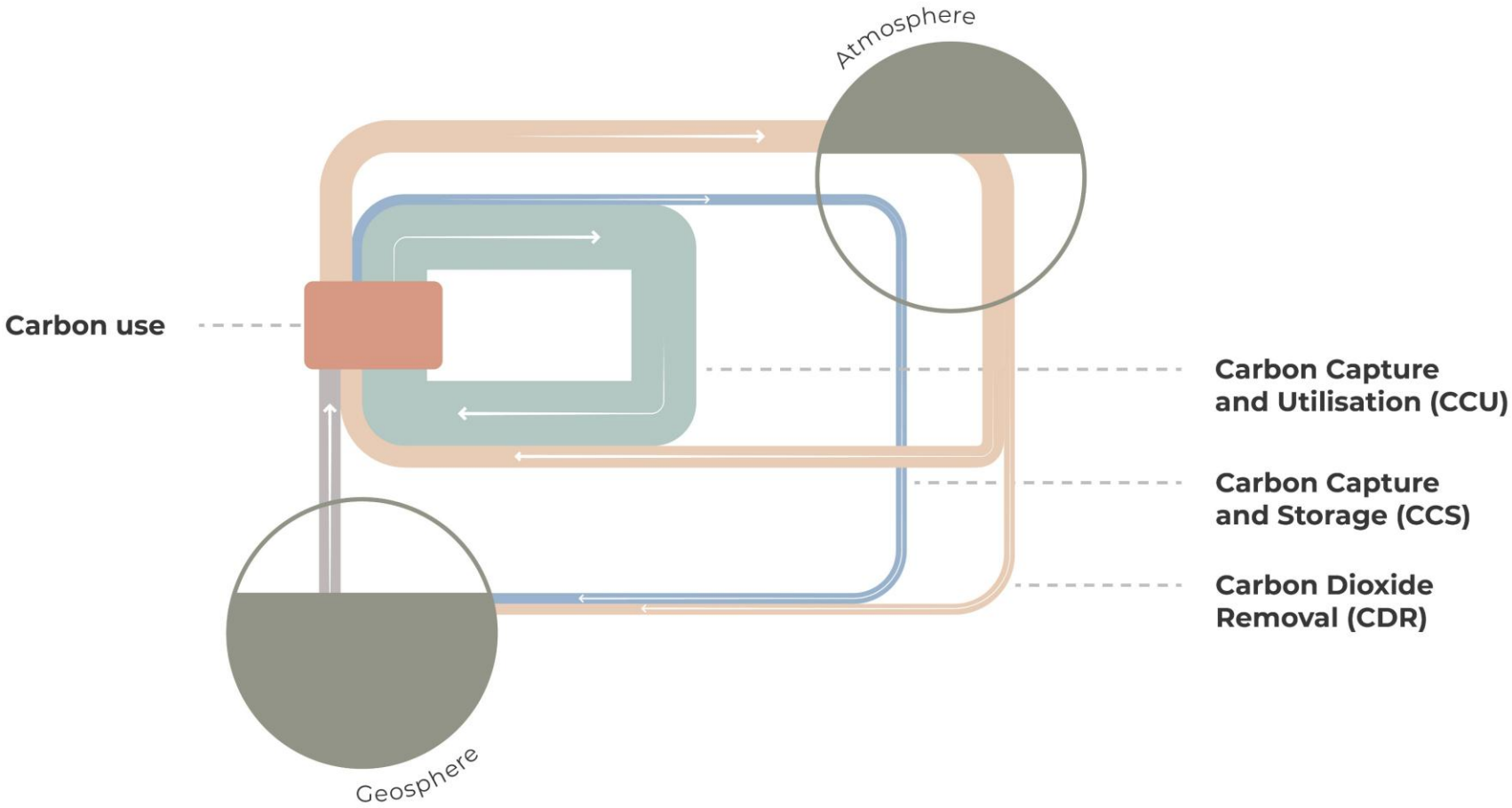
Industrial Carbon Management includes all activities, technologies, and practices needed to deliver *sufficient carbon for material and energy purposes* with a *gradually declining fossil carbon share*, and ultimately (starting in the net zero year) without net carbon removals from the geosphere and without net carbon additions to the atmosphere.

Industrial Carbon Management
(simplified at Net Zero, eg 2050)



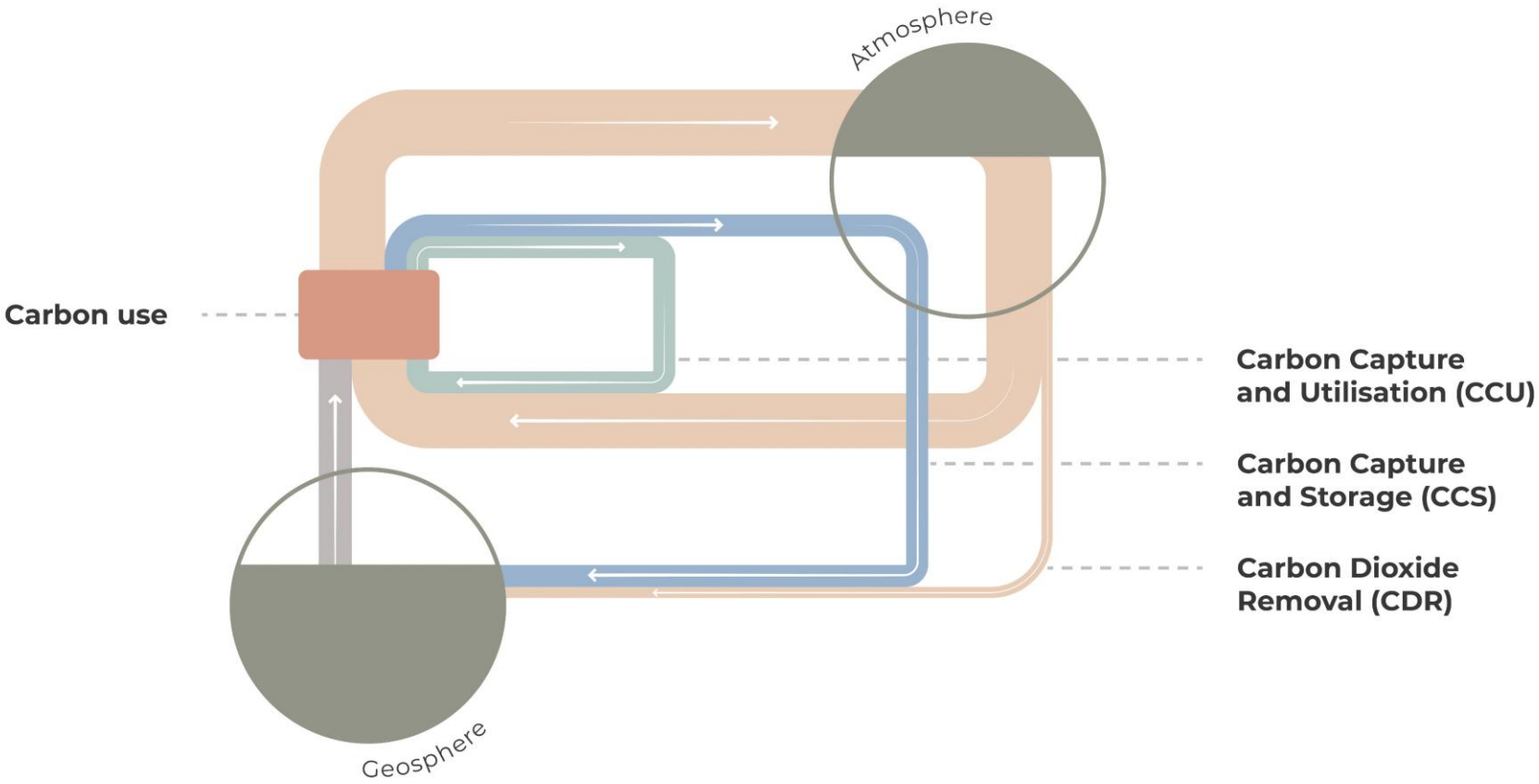
Carbon Recycling and Re-use dominant

Variant 1

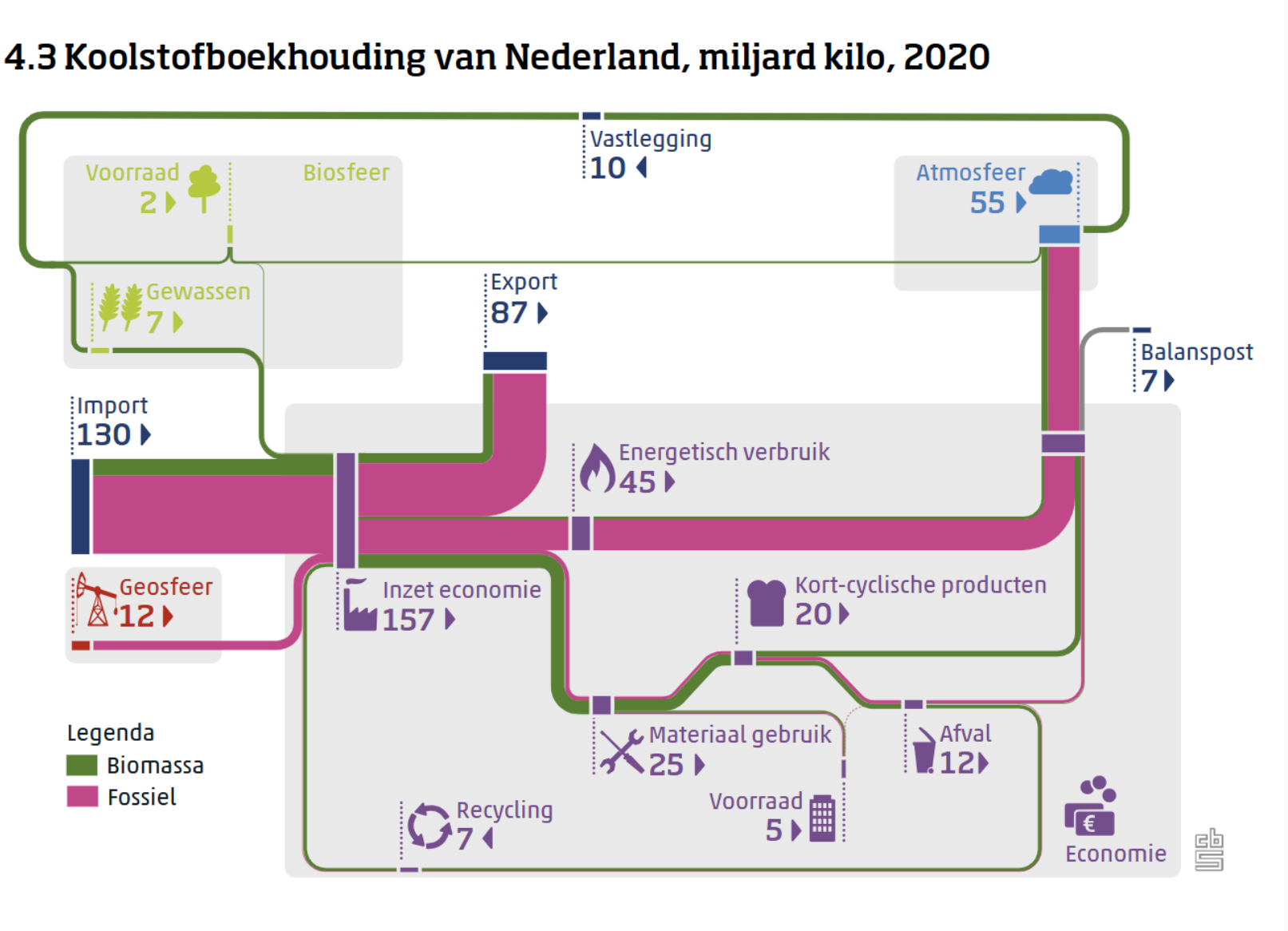


Carbon Removal dominant (probably primarily via biomass)

Variant 2



CBS; Carbon flows NL economy



Global and NL ICM Business potential in 2050

- **Permanent storage 2050 globally:**

  Optimistic: 3-6 Gt/y

- Realistic: 6-12 Gt/y
- Pessimistic: 10-20 Gt/y

Netherlands storage 2050:

30-40 Mt/y total

15-20 CCS (fossil CO2)

20–25: CDR

Current annual flows:

Oil: 5 Gt/y

Gas: 2.5 Gt/y

CO2 emissions: 40 Gt/y

CO2 storage: 40 Mt/y

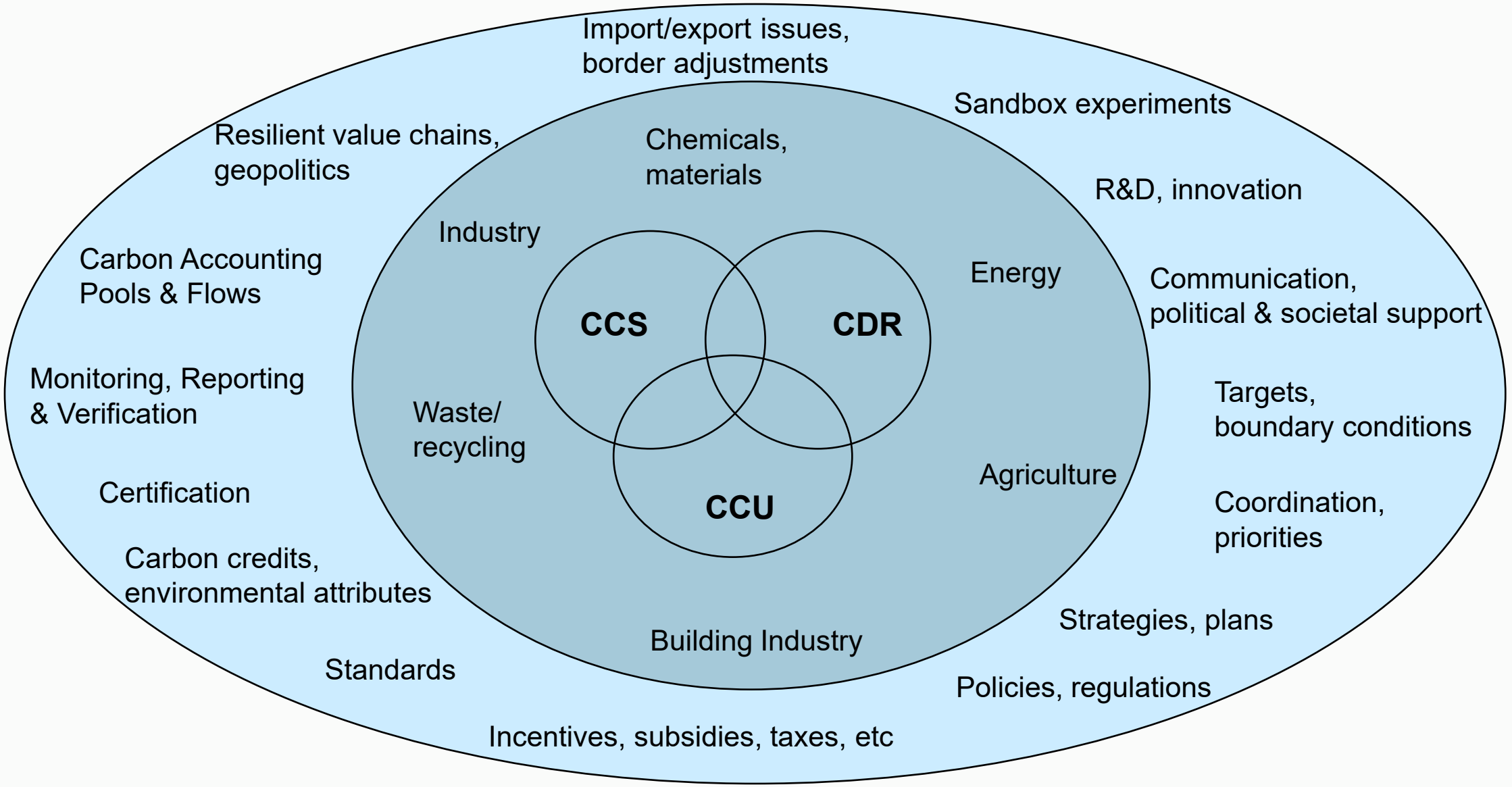
Concluding

- Industrial demand for carbon (materials, energy) will become smaller but remain substantial
- However, a transition from fossil carbon as the main input to other sources of carbon will be required.
- BEFORE that transition can be concluded, the whole system has to become ‘carbon-neutral’ from a climate change perspective
  - Geological Net Zero and Atmospheric Net Zero
- This will require key sectors to work together: chemicals, energy, waste, refineries, agriculture
- This transition will be enabled by industrial carbon management technologies: CCS, CDR and CCU

Critical Success Factors:

- Strong energy, chemicals, agricultural and waste/recycling sectors, including supporting knowledge and expertise
- Short distances to benefit from synergies and enable affordable carbon transport and flows
- Affordable and proven carbon storage capacity for CCS and CDR
- Supportive ICM ecosystem

Ecosystem: Industrial Carbon Management



Links

https://www.energiepodium.nl/artikel/koolstof-als-kans

Climate policy checklist: https://www.linkedin.com/pulse/climate-policy-checklist-margriet-kuijper-hinwe/

Carbon cycle video: https://www.youtube.com/watch?v=dwVsD9CiokY

More articles on Industrial Carbon Management:

https://www.linkedin.com/in/margriet-kuijper/recent-activity/articles/