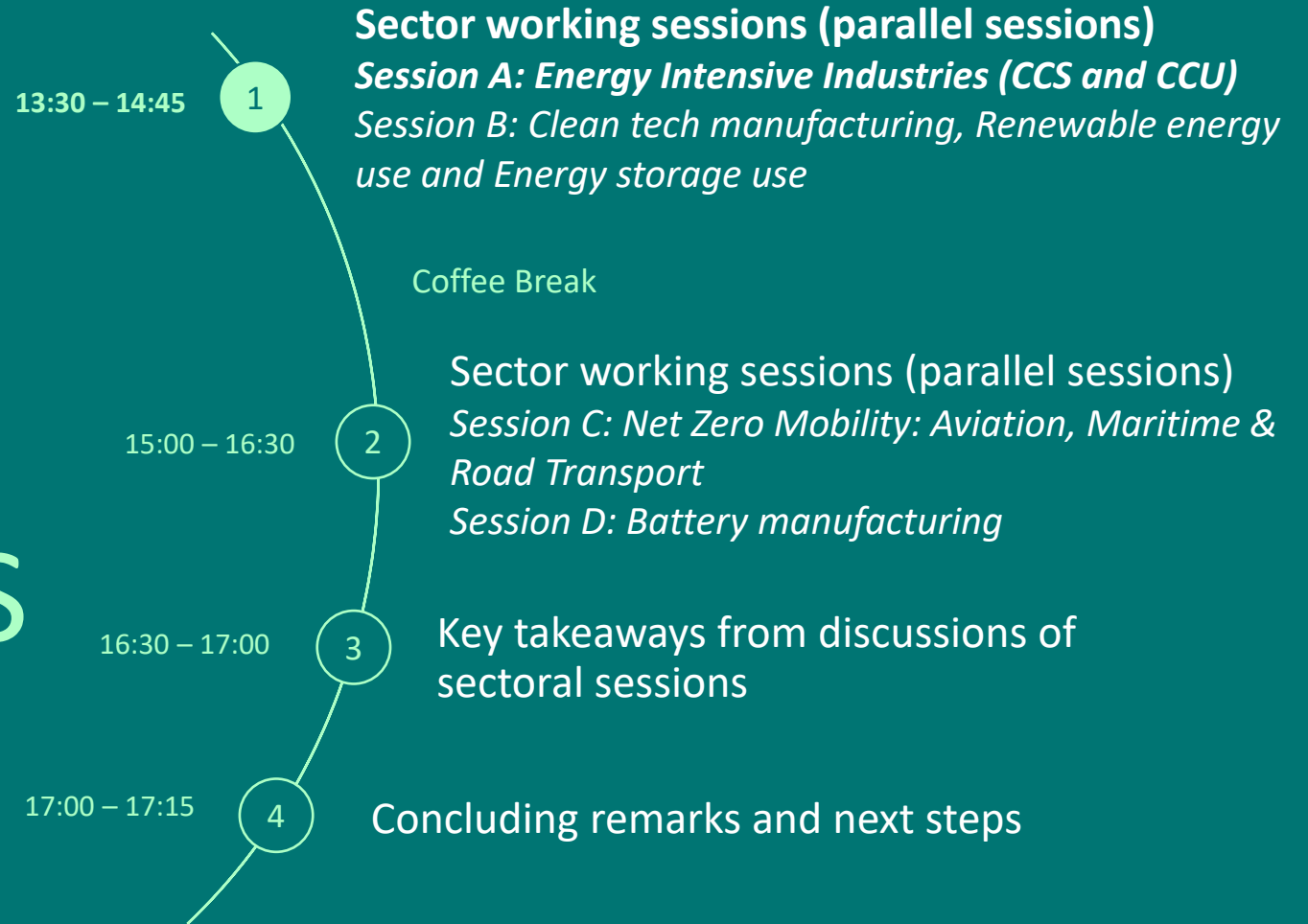


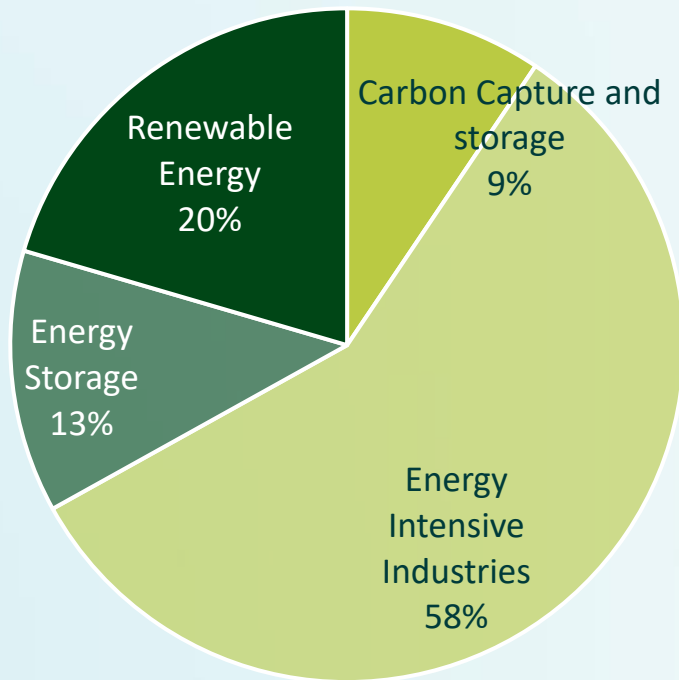
Session A: Energy Intensive Industries (CCS and CCU)



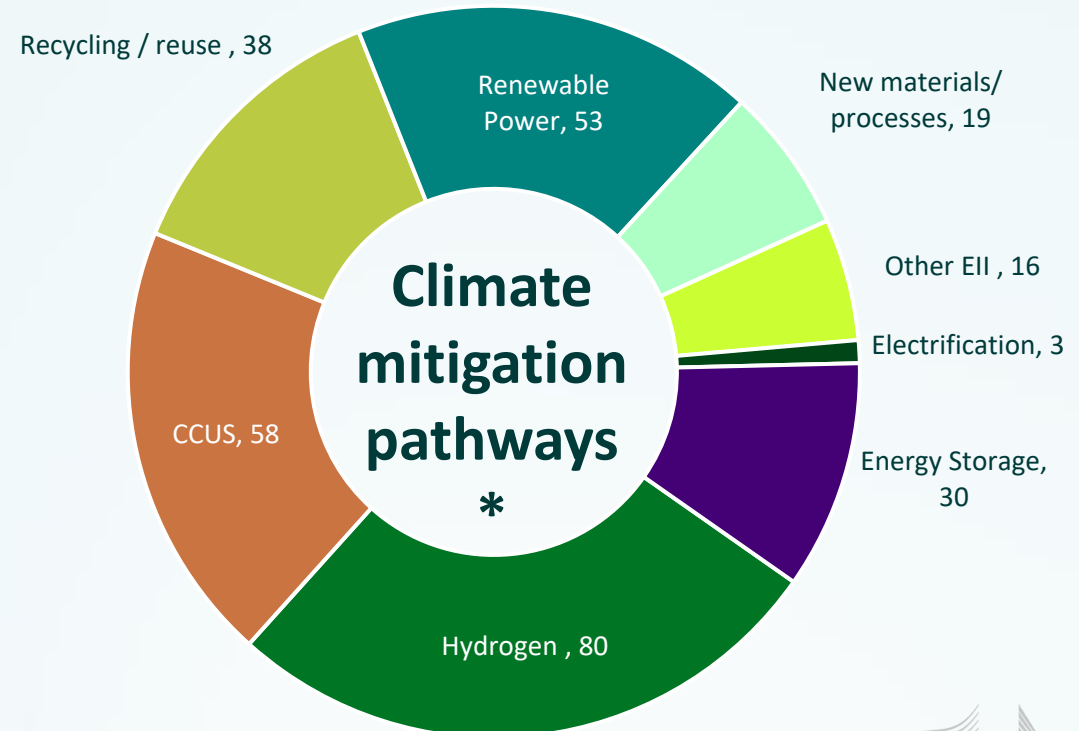
Climate mitigation pathways

Climate mitigation pathways describe the innovative technologies implemented by the projects leading to GHG emissions avoidance. A project can have one or several pathways

Projects by category



Climate mitigation pathways



2 *The climate mitigation pathways describe the technology of the projects leading to GHG emissions avoidance. A project can have one or several pathways

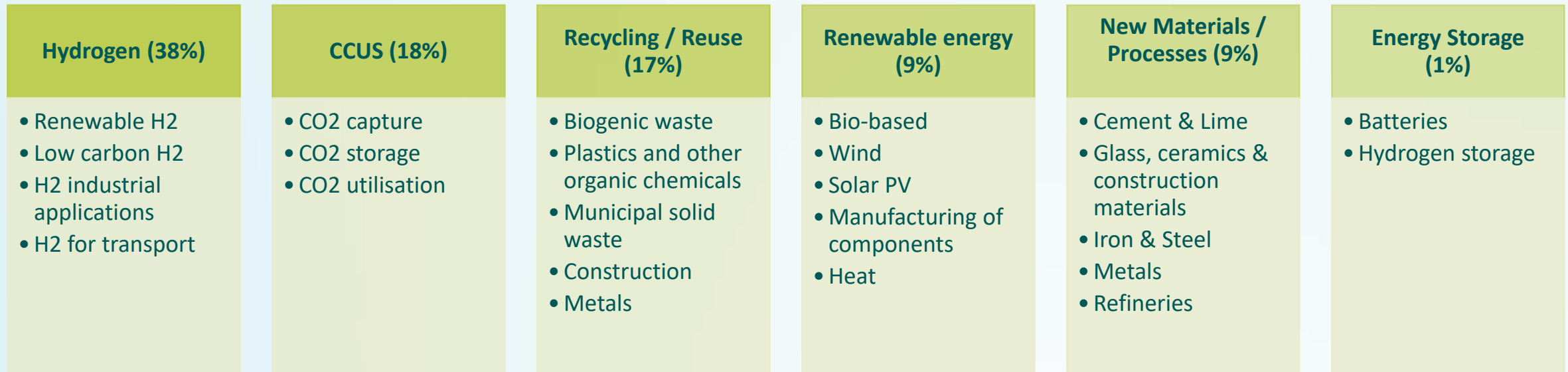
Energy Intensive Industries (EII)

Including CCS and CCU



~304 Mt CO₂ eq to be avoided

Climate mitigation pathways* implemented by projects in the Energy Intensive Industry and CCS categories



*The climate mitigation pathways describe the technology of the projects leading to GHG emissions avoidance. A project can have one or several pathways

Energy Intensive Industries: policy developments

Immavera Sardone, DG GROW, Policy Officer - I.1 – Energy intensive industries and raw materials

EU Energy-Intensive Industries Ecosystem



7.8 million people employed



4.55% of EU value added, (EUR 549 billion)



548,000 firms, 99.4% SMEs

The EIs Ecosystem covers chemicals, steel, paper, plastics, mining, extraction and quarrying, refineries, cement, wood, rubber, non-ferrous metals, glass and ceramics. They represent 17% of EU GHG emissions

Key Challenges	Transformative initiatives
Technology challenge – technologies are not yet available or not demonstrated at industrial scale	The EIs will need a substantial amount of decarbonised energy at an internationally competitive price .
Energy – Cost and availability of clean Energy crucial for the transition of the EIs	Industrial transition requires adequate Infrastructure to supply energy, transport carbon (CCU/CCS), etc.
Investment challenge – high investment needs, long payback periods and no business case	Creating markets and stimulating demand for green and circular products is key for accelerating the twin transition.
Competitiveness challenge – Global overcapacity in some products (steel, aluminium) and emerging, threatening viability of the EIs in the EU. Dumping threats and unfair trade practices.	For green transformation at scale, the policy framework should further support the business case for private investments .
	A level playing field, an effective carbon leakage prevention framework is needed to support competitiveness of the industry during the transition.

EU toolbox to support the EIs transformation



A supportive regulatory framework

Fit for 55 Package 2021

- EU ETS, CBAM, RED, Hydrogen & Gas Package

Circular Economy Package 2022

- Sustainable products, standards

Green Deal Industrial Plan 2023

- Electricity market design
- Critical Raw Materials Act
- Net Zero Industry Act



Funding & Financing

- HorizonEurope
- Process4Planet
- Innovation Fund
- State aid policy (CEEAG; IPCEI)
- Recovery & Resilience Facility



Trade & International Cooperation

- Trade defence Instruments
- International Partnerships
- Global cooperation on climate

European Critical Raw Materials Act

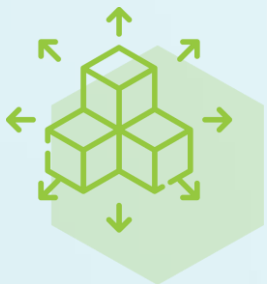
Ensure a secure and sustainable supply of critical raw materials for the Union



Strengthen all stages of the European CRM value chain



Improve EU capacity to monitor and **mitigate risks of disruption** to CRM supply



Diversify EU CRM imports to reduce strategic dependencies



Improve CRM **circularity and sustainability**

Timeline for the STRATEGIC PROJECTS



Net Zero Industry Act

Strengthen and scale-up European clean energy technologies manufacturing



- Fast-track and streamline permitting
- Focus investment on strategic projects along the supply chain
- Access to market: resilience and sustainability criteria in public procurement
- Skills: Net-Zero Industry Academies

Relevance for **Energy intensive Industries**

1. Accelerate decarbonisation

Supports clean technologies key to decarbonise EIs (Hydrogen, CCUS, electricity generation technologies)

2. CO2 storage provisions

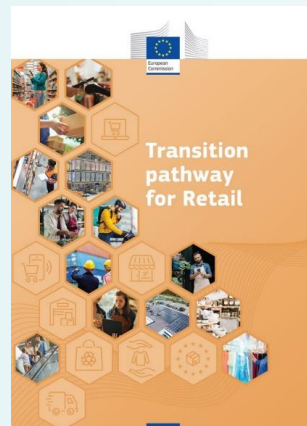
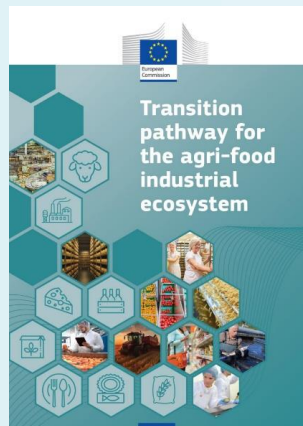
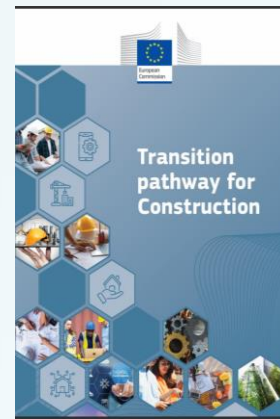
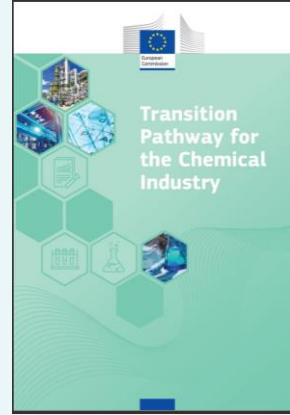
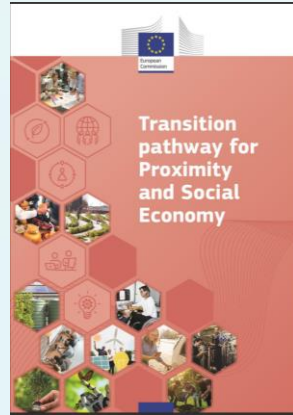
will remove barrier for investment in CO2 capture by industrial sectors that will need CCS/U to decarbonize

3. Components

EIs producing components that go into net-zero technologies fall under NZIA scope & benefit of same advantages

Transition Pathways for Industrial Ecosystems

Goal: an action plan for the twin transition and resilience of industrial ecosystems co-created by the European Commission, Member States and relevant stakeholders (industry representatives, RTO, social partners, NGO, etc..)

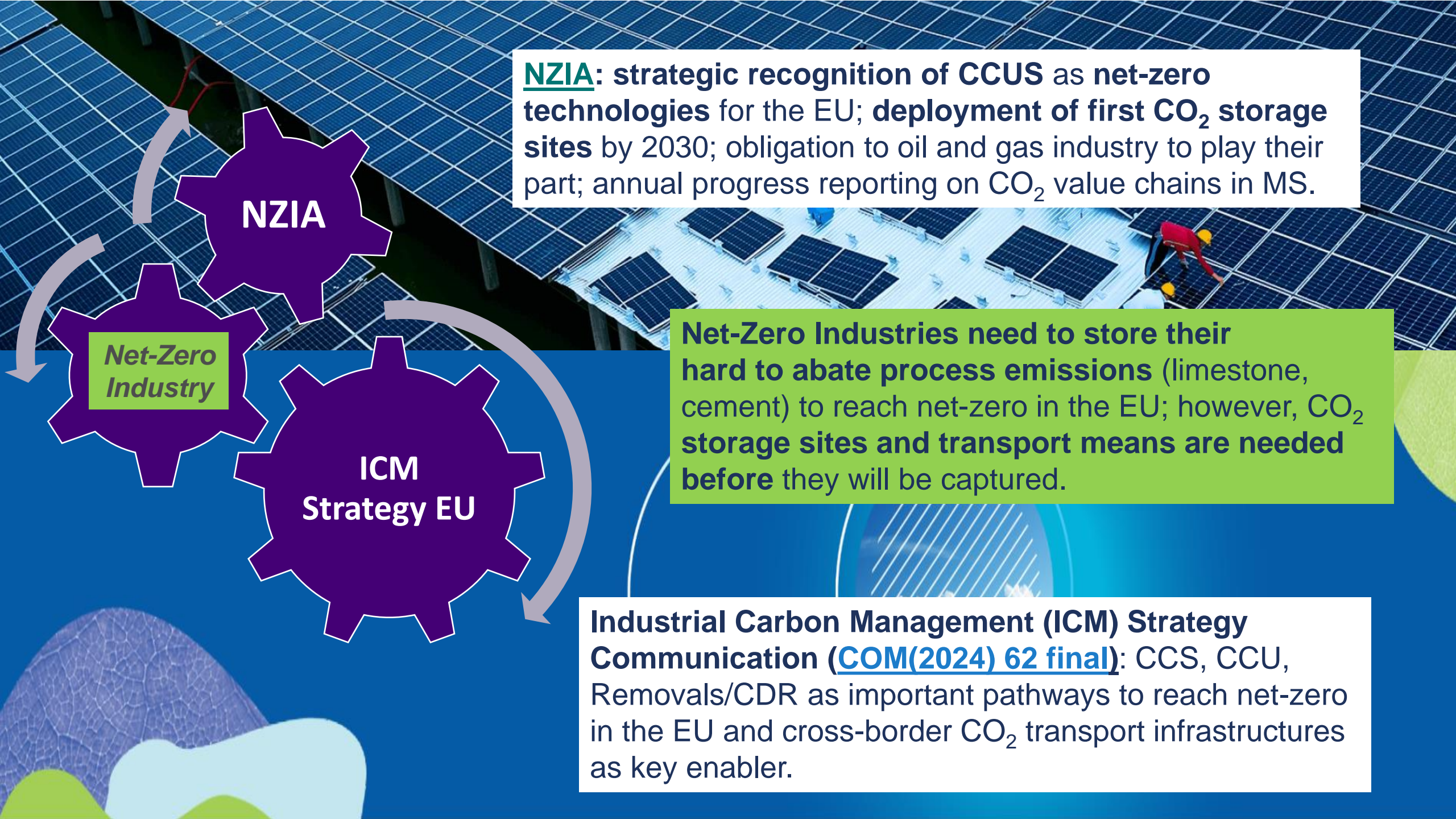


One Transition Pathways in progress

Metals
(Q3 2024)

Industrial Carbon Management (ICM) for the EU

Daniel Kitscha, DG CLIMA, Policy Officer - C.2 – Low Carbon Solutions (II): Research & Low Carbon Technology Deployment



NZIA: strategic recognition of CCUS as net-zero technologies for the EU; deployment of first CO₂ storage sites by 2030; obligation to oil and gas industry to play their part; annual progress reporting on CO₂ value chains in MS.

NZIA

Net-Zero Industry

ICM Strategy EU

Net-Zero Industries need to store their hard to abate process emissions (limestone, cement) to reach net-zero in the EU; however, CO₂ storage sites and transport means are needed before they will be captured.

Industrial Carbon Management (ICM) Strategy Communication (COM(2024) 62 final): CCS, CCU, Removals/CDR as important pathways to reach net-zero in the EU and cross-border CO₂ transport infrastructures as key enabler.

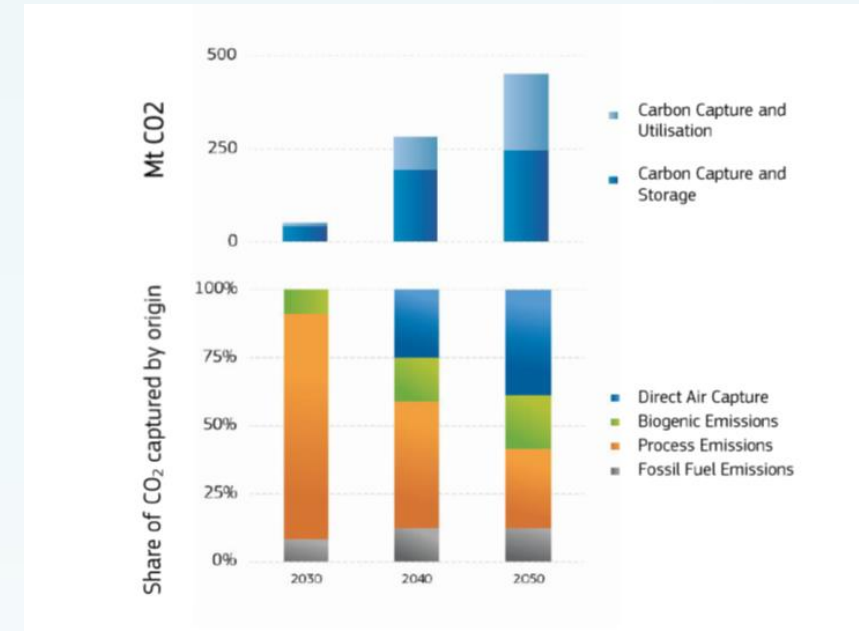
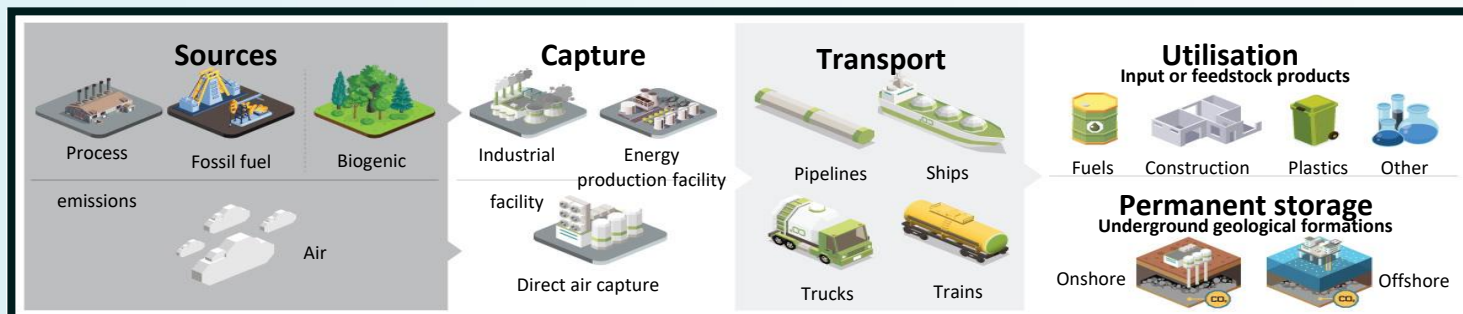
Industrial Carbon Management (ICM)

Commission Communication (6.2.2024)*, with actions for the Union and Member States to implement to reach net-zero

Three “ICM” technological pathways:

- **Capturing CO₂ emissions for storage (CCS)**
- **Removing CO₂ from the atmosphere (BioCCS and DACCS)**
- **Capturing CO₂ for utilisation (CCU)**

Key enabler : CO₂ transport infrastructure



CO₂ capture needs in 2040
Climate Modelling:

2030: ~50 Mtpa
2040: ~280 Mtpa
2050: up to 450 Mtpa

* [COM/2024/62 final](https://eur-lex.europa.eu/eli/comm/communication/2024/62/1)

Key ICM policy actions@ next Commission

Develop EU policy support options:

- **Removals** deployment based on market demand
- **CCU uptake** with accounting in the EU ETS.

Investment and funding:

- Work with MS, to develop **Important Projects of Common European Interest (IPCEI)**
- Consider **market-based funding mechanisms** (i.e. CO₂ competitive bidding auctions as a service)

Creating enabling environment

- **Public awareness: public debate at MS level, rewards for local communities** where storage happens
- **Research and innovation (R&I) based on project knowledge-sharing**

CO₂ Demand Aggregation

Platform matching storage with emitters by 2030

CO₂ Storage Atlas for the EEA

finding storage capacity for 2040

Climate law: 2040 carbon removals objective for climate neutrality by 2050?

Prepare: future CO₂ transport regulatory package & EU-wide infrastructure planning mechanism

Net-Zero Industry Act (NZIA) regulation* = the 1st legal building block for ICM



Legal objective for the EU to enable an **annual 50 million tonnes** of CO₂ to be stored permanently underground by 2030.

European oil and gas producing industries must contribute with their assets and/or their financial resources to develop operational geological CO₂ storage sites.

More **transparency for investors** on:

- **Demand and supply:** CO₂ storage, CO₂ capture, and CO₂ transport in the Member States.
- **Geological data** for future storage sites to be made public
- Annual progress of ongoing CO₂ value chain projects

Support for manufacturing of carbon management technologies & **deployment** of Net-zero strategic projects (capture, transport & storage)

Q&A Section

Innovation Fund – Stakeholder insights – Energy Intensive Industries

Koen Coppenholle, A.SPIRE, Chief Executive CEMBUREAU, The European Cement Association

EU Process Industry Association

Established in July 2012



Cement



Ceramics



Chemicals



Engineering



Non-ferrous
metals



Minerals



Pulp & paper



Refining



Steel



Water



+22

EU Countries



+180

Members
teaming up



+ Industry

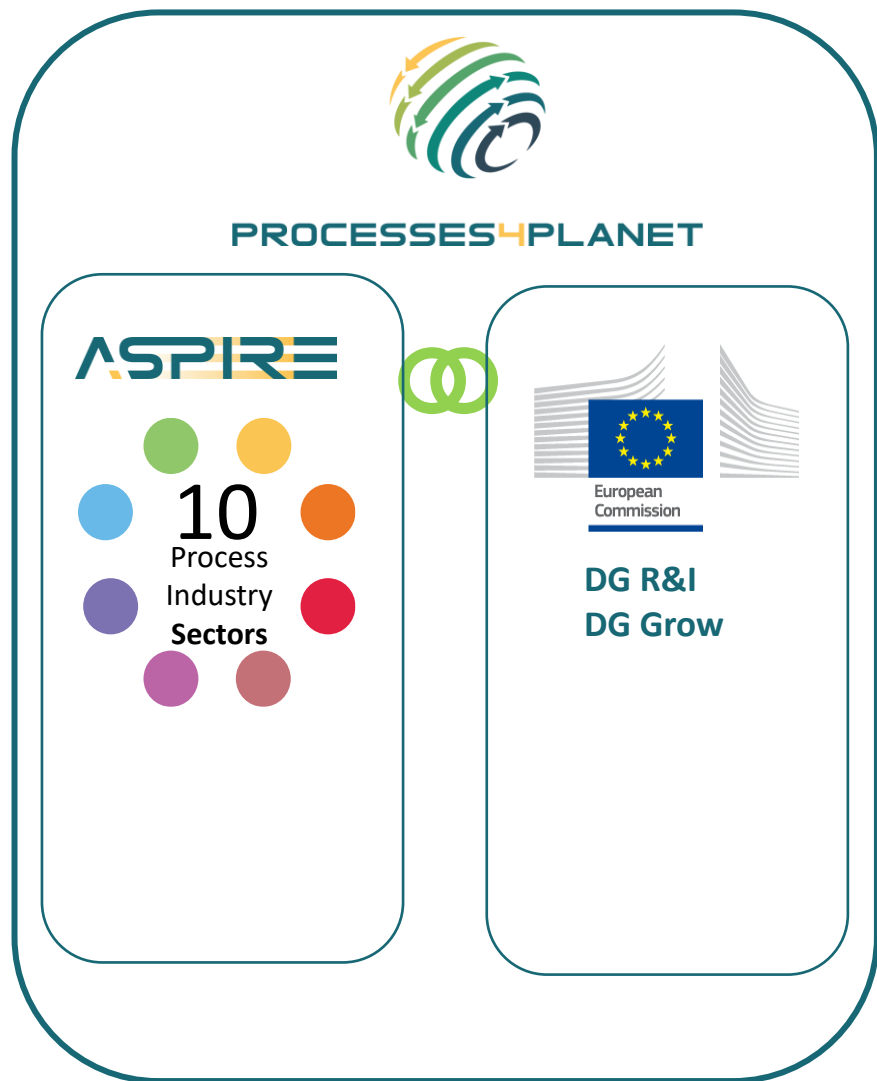
+ RTOs

+ Universities

+ NGOs

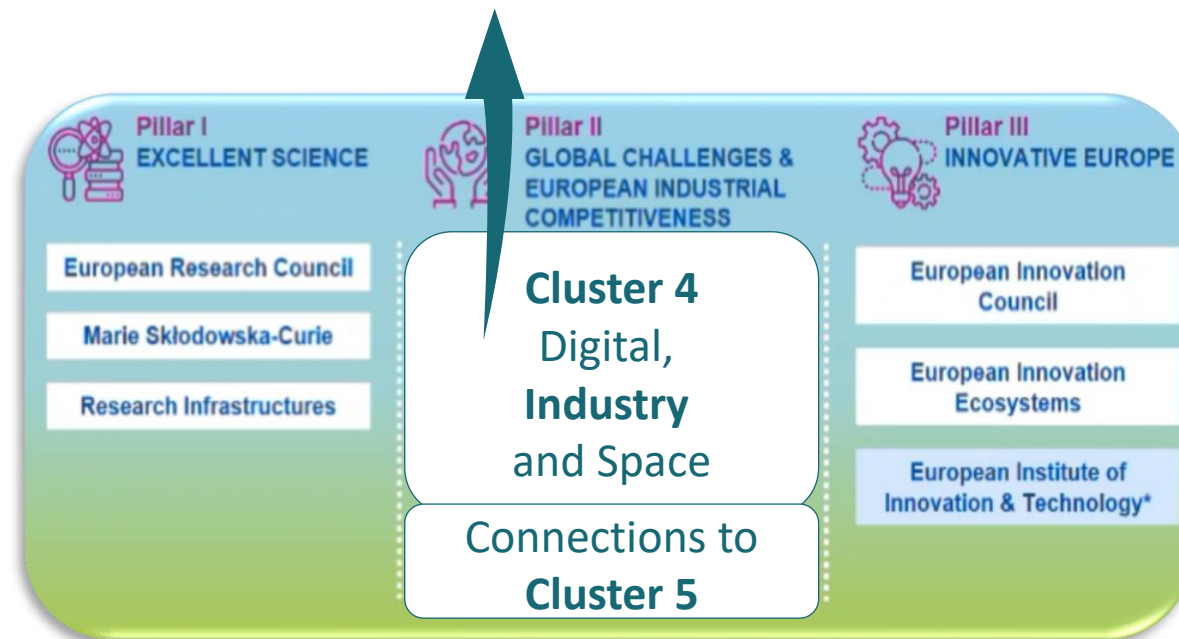
+ Innovation agencies

et al...

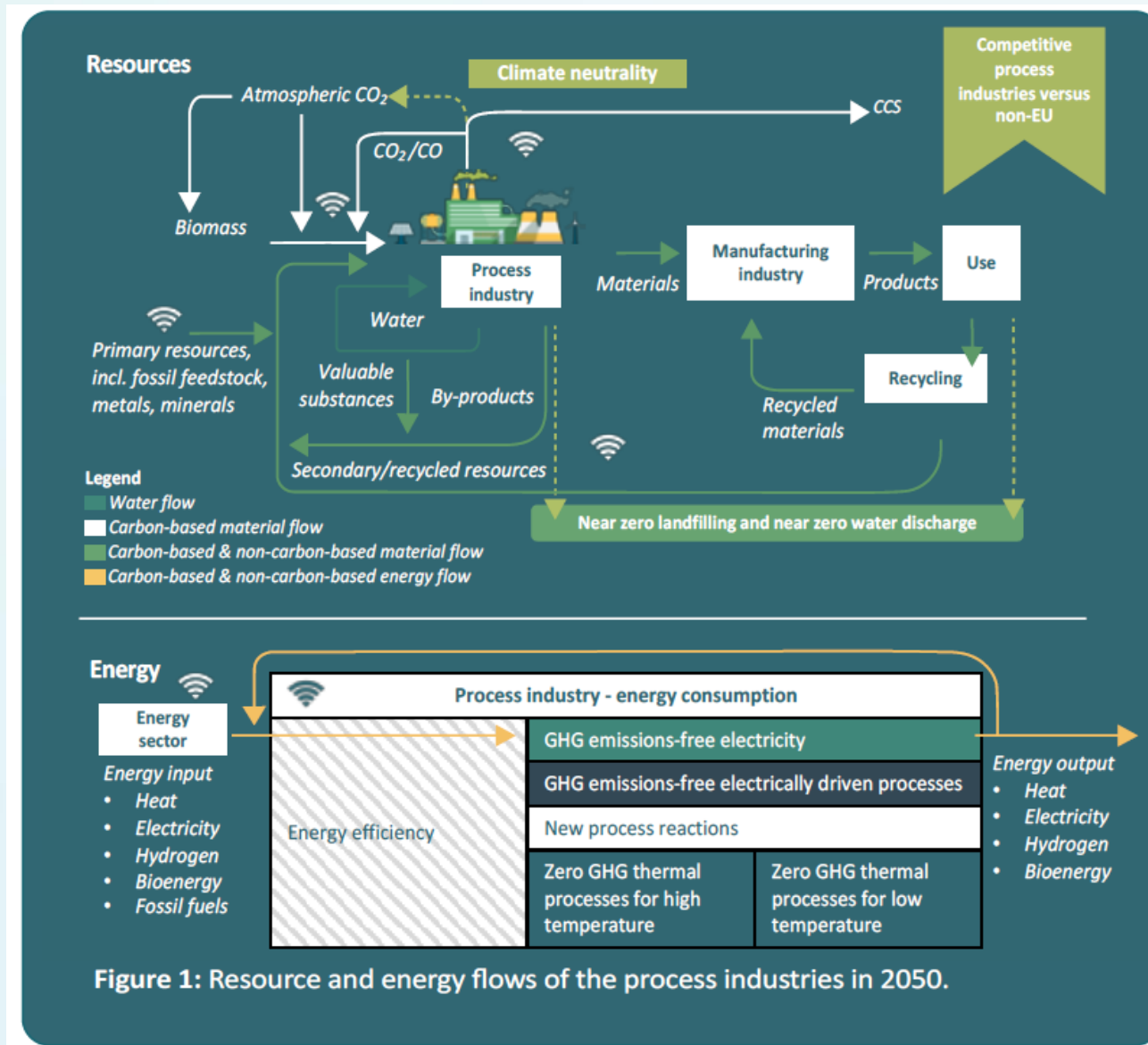


Co-programmed Partnership

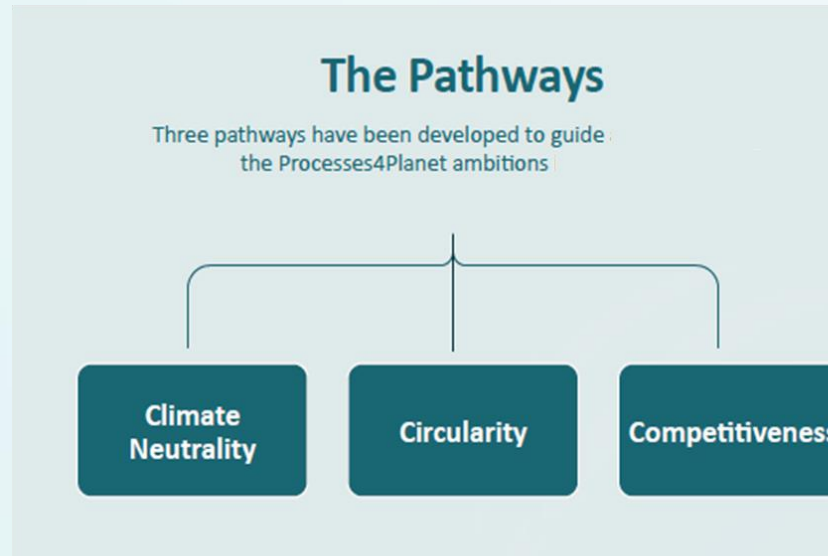
MoU signed:
€1,3 bn exclusively for projects
27% more than in H2020



Overview of the sector and innovative technologies



Overview of the sector and innovative technologies



Innovation Area	Innovation programme	2024	2030	2040	2050
Integrating renewable energy and circular feedstocks as energy source	1a - Integration of renewable heat and electricity	32%	100%	100%	100%
	1b - Integrating circular carbon into energy applications	0%	60%	100%	100%
	1c - Hybrid fuel transition technologies	38%	100%	100%	100%
	1d - Flexibility and demand response	25%	75%	100%	100%
Heat reuse	2a - Advanced heat reuse	13%	38%	100%	100%
Electrification of thermal processes	3a - Heat pumps	15%	54%	100%	100%
	3b - Electricity-based heating technologies	0%	38%	100%	100%
Electrically driven processes	4a - Electrochemical conversion	0%	31%	100%	100%
	4b - Electrically driven separation	0%	60%	100%	100%
Hydrogen integration	5a - Alternative hydrogen production routes	25%	38%	75%	100%
	5b - Using hydrogen in industrial processes	11%	67%	100%	100%
	5c - Hydrogen storage	0%	75%	100%	100%
CO ₂ capture for utilisation	6a - Flexible CO ₂ capture and purification technologies	15%	54%	85%	100%
CO ₂ utilisation in minerals	7a - CO ₂ utilisation in concrete production	0%	50%	100%	100%
	7b - CO ₂ and CO mineralisation to produce building materials	0%	50%	100%	100%
CO ₂ & CO utilisation in chemicals and fuels	8a - Artificial photosynthesis	0%	0%	50%	100%
	8b - Catalytic conversion of CO ₂ to chemicals/fuels	0%	13%	47%	100%
	8c - Utilisation of CO ₂ and CO as a building block in polymers	0%	25%	63%	100%
	8d - Utilisation of CO to chemicals and/or fuels	0%	100%	100%	100%
Energy and resource efficiency	9a - Next-gen catalysis	10%	29%	81%	100%
	9b - Breakthrough efficiency improvement	14%	49%	100%	100%
Circularity of materials	10a - Innovative materials of the process industries	0%	25%	75%	100%
	10b - Inherent recyclability of materials	0%	25%	75%	100%
	10c - Upgrading secondary resources	5%	30%	98%	100%
	10d - Wastewater valorisation	26%	44%	91%	100%
Industrial-Urban symbiosis	11a - Demonstration of Industrial-Urban Symbiosis	0%	67%	100%	100%
Circular regions	12a - European Community of Practice	33%	50%	75%	100%
	12b - Development of Hubs for Circularity	16%	34%	72%	100%
Digitalisation	13a - Digital materials design	18%	100%	100%	100%
	13b - Digital process development and engineering	25%	100%	100%	100%
	13c - Digital plant operation	58%	100%	100%	100%
	13d - Intelligent material and equipment monitoring	73%	100%	100%	100%
	13e - Autonomous integrated supply chain management	32%	100%	100%	100%
	13f - Digitalisation of industrial-urban symbiosis	64%	100%	100%	100%
Non-technological aspects	14a - Integration of non-technological aspects in calls	Integrated in other programmes			
	14b - Human resources, skills, and labour market	29%	52%	76%	100%

14 Innovation areas
36 Innovation programmes to push multiple technologies towards commercial application (TRL9).

Overview of the sector and innovative technologies

A.SPIRE members have indicated their intention to invest in ‘marbles’ to bring them to TRL9, confirming a market pull for the innovations and the relevance of this SRIA. A marble is a first of a kind (FOAK) large scale build-up of one or more new technologies, integrated in its value chain, deployed by leading companies within the Process Industries

In P4Planet SRIA, **94 marbles** were scheduled for launch and deployment in the period 2021-2030

No.	Sectors	Description	Timing demo	Large Scale	
				Budget /mil. €	Timing
M1	Refining	Electric heaters (small-medium)	2023-2025	30	2025-2030
M2	Chemicals	Electrified Cracking (e-Cracker)	2023-2027	200-300	2027-2031
M3	Refining	Green H ₂ (Electrolyser)	2023-2025	70	2025-2030
M4	Chemicals	Methane Pyrolysis	2023-2027	100-200	2027-2031
M5	Refining	CCUS (refining sector) - CO ₂ capture - Amines	2023-2025	500	2025-2030
M6	Chemicals	Sustainable access to CO ₂	2024-2030	2x25-50	2024-2030
M7	Refining	CCUS (refining, power or other sectors) - CO ₂ capture - Chilled ammonia, polymeric membranes, solid sorbents, CF2 technology	2023-2025	40	2025-2030

Illustrative image of the list included in Processes4Planet SRIA (pages 90 – 95)

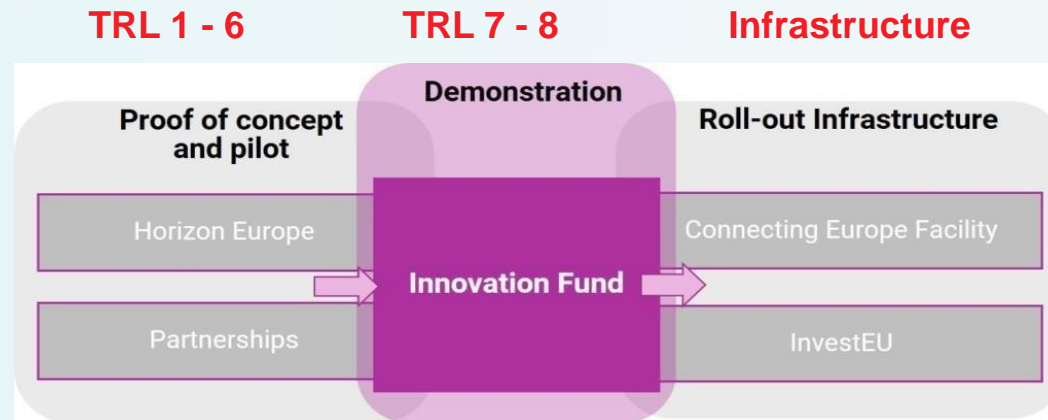
Projects that require further funding

- ✓ **MefCO2/STEPWISE**: TRL 9 / new process compared to standard methanol
- ✓ **DryFiciency**: first-time industrial demonstration of industrial high temperature heat pumps (up to 160°)
- ✓ **Etekina**: waste heat sources and low temperature heat sinks in other EII (steel, ceramics, non-ferrous)
- ✓ **SIMPLIFY**: sonication and micro-wave processing of Material feedstock
- ✓ **ROMEO+MACBETH**: innovative reaction/CMR
- ✓ **HYFLEXPOWER**: world’s first 100% H₂ industrial gas turbine operating at 100% H₂

Feedback from projects

- ✓ Review the level of amounts available in relation to the number of projects with regard to the amount of ETS theoretically available
- ✓ Review the method for assessing the innovative nature of projects: the scopes are so different (from CCS as such to the creation of a complete value chain), the boundaries of 'innovative' are blurred/unclear
- ✓ The impact in terms of GHG reduction on absolute emissions is counterproductive in that it penalises operators who have reduced their emissions as much as possible through conventional measures
- ✓ The concept of scalability/replicability is important for the deployment of projects and technologies. Nevertheless, it is worth considering whether this should not become the essential criterion (rather than expecting innovations every year). However, the scope of these criteria needs to be clarified
- ✓ The ranking and arbitration procedures could do with more transparency
- ✓ Consideration should be given to the merits of thinking in terms of clusters of regions/countries.... since the creation of critical mass for transport and storage infrastructures is essential.

Type of support required



INNOVATION FUND GREAT INSTRUMENT , BUT...

- ✓ 8 times oversubscribed
- ✓ Selection on “degree of innovation”...
- ✓ need for **Deployment** Fund
- ✓ Limited support for OPEX until FID/company does upfront financing/ WACC rate backdrop for EE

OTHER FINANCING INSTRUMENTS HAVE THEIR LIMITS

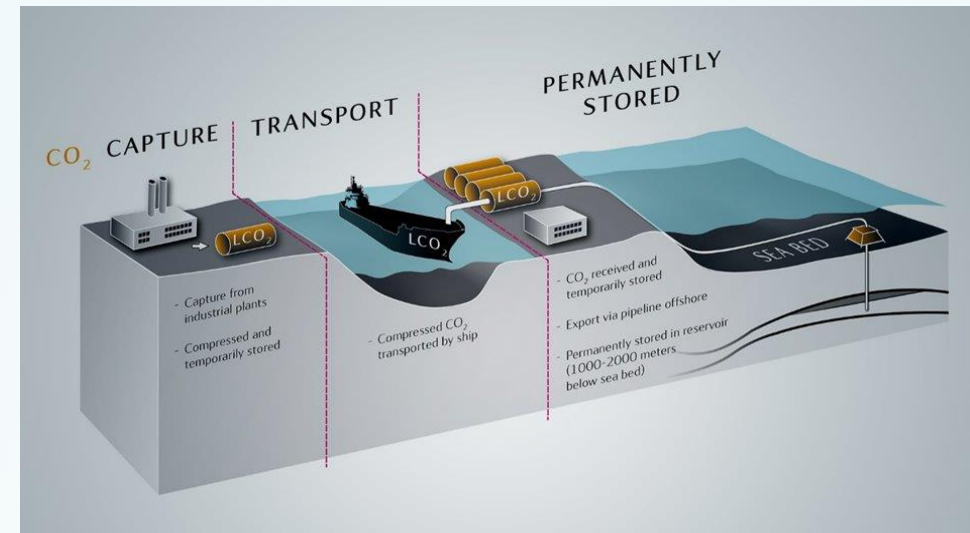
- ✓ IPCEI: find the champion MS...
- ✓ Modernisation Fund: CCUS...?
- ✓ JTF: regional pockets

SUGGESTIONS

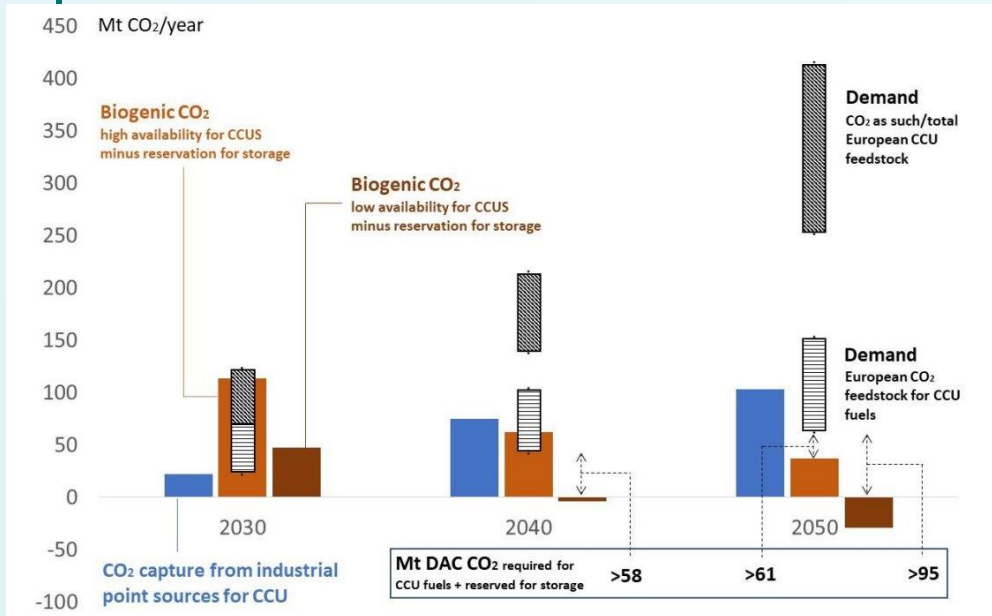
- ✓ Frontload future ETS revenues in sectoral dedicated funds
- ✓ Pool national and EU resources / CCUS needs to be part of NECPs
- ✓ CfD stronger framework
- ✓ One-stop-shop for project applications
- ✓ CAPEX/OPEX coverage throughout funding instruments (support FEED studies)

Type of support required

- The EU cement sector alone will need 12 million tons of CO₂ storage across the EU by 2030
- Critical issues:
 - Avoiding a “two-speed Europe” when it comes to CO₂ storage
 - Specificities of landlocked plants
 - Access to CO₂ infrastructure at reasonable conditions
- NZIA very welcome
- Critical to expedite CO₂ storage mapping
- De-risk full (new) CCS value chain
 (“chicken&egg” emitter/storage operator)
- Reasonable market conditions for access



Type of support required



Source: VITO study for CEMBUREAU

- **Annual CO₂ feedstock needed**
 - 70mt – 120mt by 2030
 - 250mt – 420mt by 2050
- **Estimated CO₂ from biogenic sources by 2050: 21mt - 63 mt annually /DAC?**

Current EU framework is a major obstacle to CCU deployment:

- RFNBO Delegated act prevents the use of industrial CO₂ in synthetic fuels as of 2040 (review clause)
- ETS revision should tackle accounting / needs to be at point of release
- The notion of “permanent” and “non-permanent” use needs to be clarified

Conclusions and recommendations

- ✓ Need to adapt regulation and financing to new value chains
- ✓ De-risk full value chain / everyone needs a business case
- ✓ Accelerate standardisation process to accompany project development
- ✓ Creative thinking on funding for breakthrough technologies
- ✓ Ensure infrastructure development with fair access
- ✓ Eliminate legal uncertainty around innovative projects (e.g. CCU)
- ✓ Ensure consistency and flow along TRL levels

Q&A Section

Discussion Section

Chris Malins, Cerulogy, CEO

We want to hear your views and your experience

1

What measures can be implemented to enhance the attractiveness of the IF to smaller companies and underrepresented sectors?

2

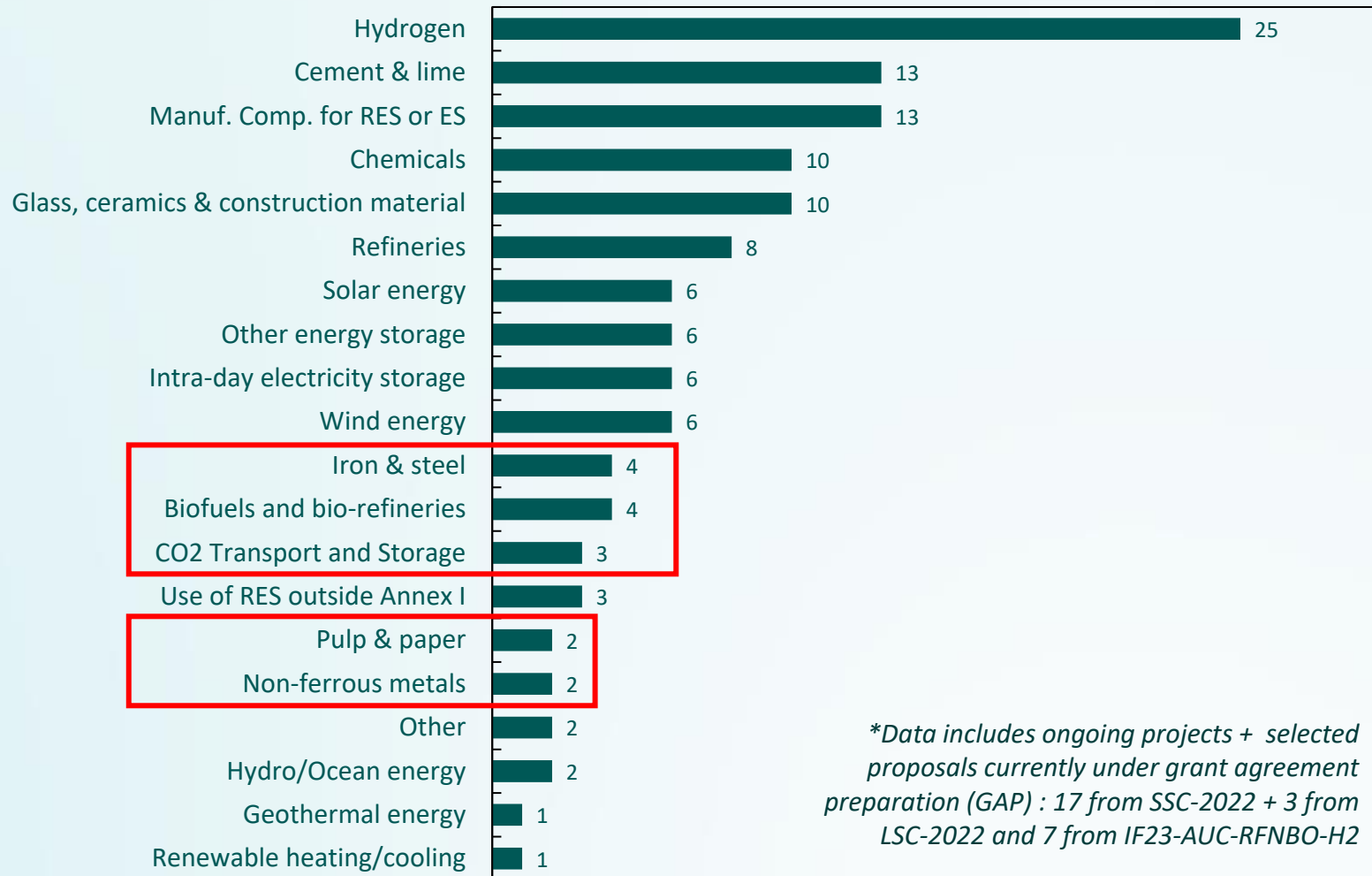
Are there any elements of the GHG calculation that you have found it particularly challenging or burdensome to complete (not including cases where you found the rules unclear)?

3

What have been the most relevant changes in the market conditions during the last year? Which sectors were affected the most? Which types of support have proven to be particularly successful?

What measures can be implemented to enhance the attractiveness of the IF to smaller companies and less represented sectors?

Distribution of ongoing +
selected projects and allocated
EU budget per sector



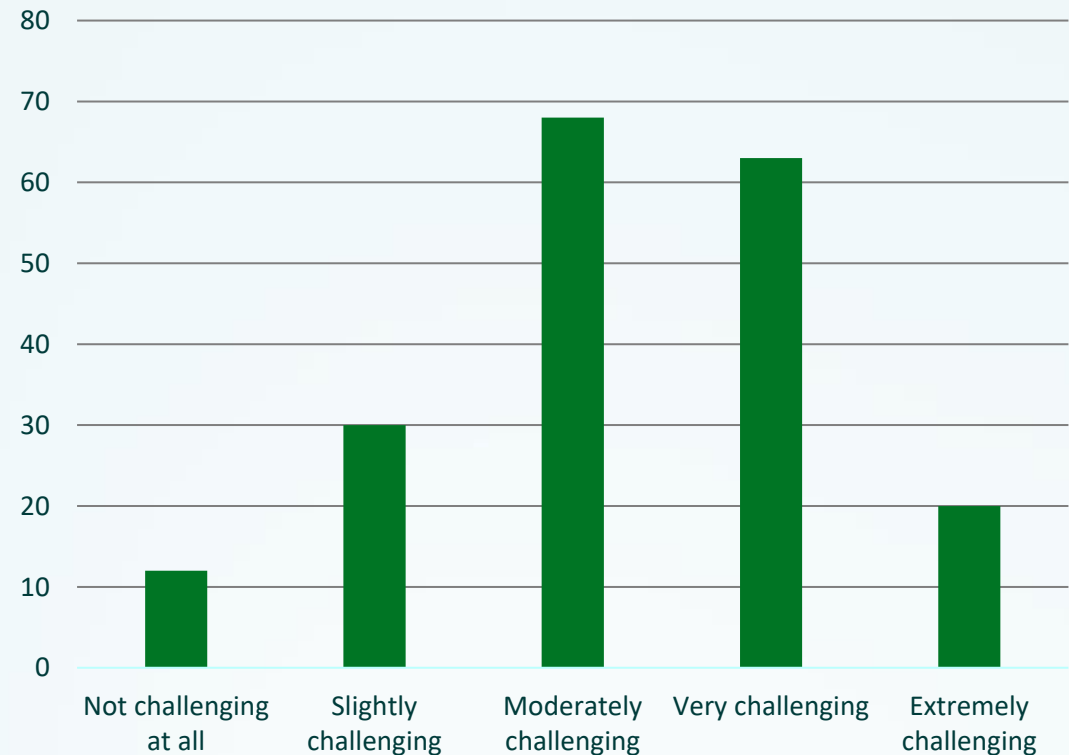
**Data includes ongoing projects + selected proposals currently under grant agreement preparation (GAP) : 17 from SSC-2022 + 3 from LSC-2022 and 7 from IF23-AUC-RFNBO-H2*

Are there any elements of the GHG calculation that you have found it particularly challenging or burdensome to complete?

How would you rate the clarity of the GHG avoidance calculation methodology?



How challenging was it to calculate the absolute GHG emission avoidance?



What have been the most relevant changes in the market conditions during the last year? Which sectors were affected most? Which types of support have proven to be particularly successful?

In last year's consultation you answered...

“which areas would benefit from auctions? Other funding measures required?”

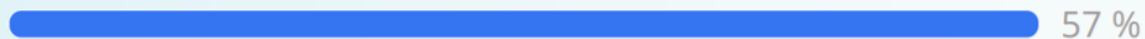
Auctions are useful for the whole sector



Auctions are useful for certain sectoral techs



Public funding other than grants and auctions is required



With respondents from the Chemical (11%), cement and lime (7%), ferrous and non-ferrous metals (7%), pulp and paper (5%), and glass and ceramics (3%).

Slido Poll

1. How can the IF enhance attractiveness to smaller companies and less represented sectors?
2. Which elements of the GHG calculation you have found particularly challenging or burdensome?
3. What subsector are you from?

slido

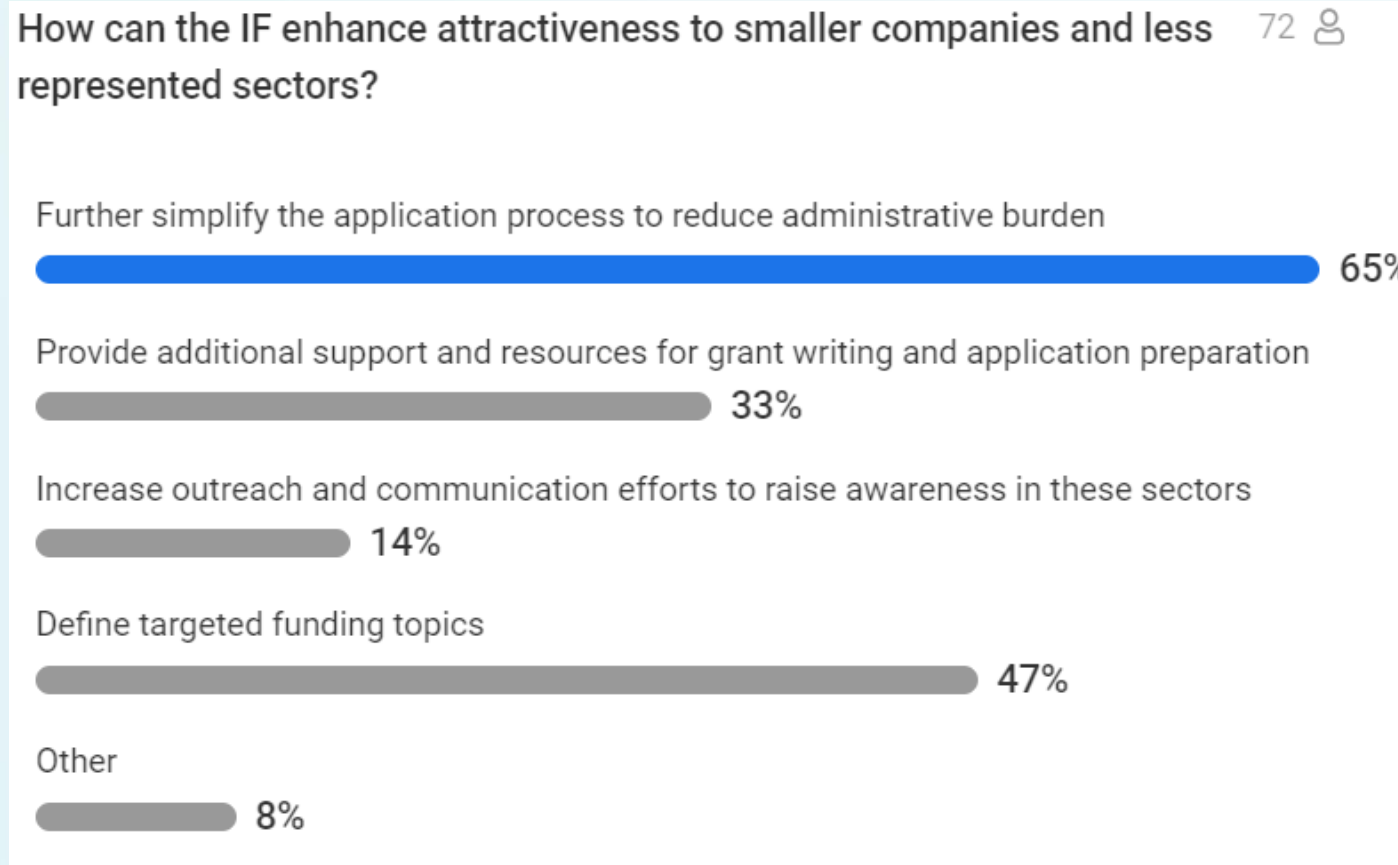
Join at
slido.com
#WGAD



Slido Poll Results

1

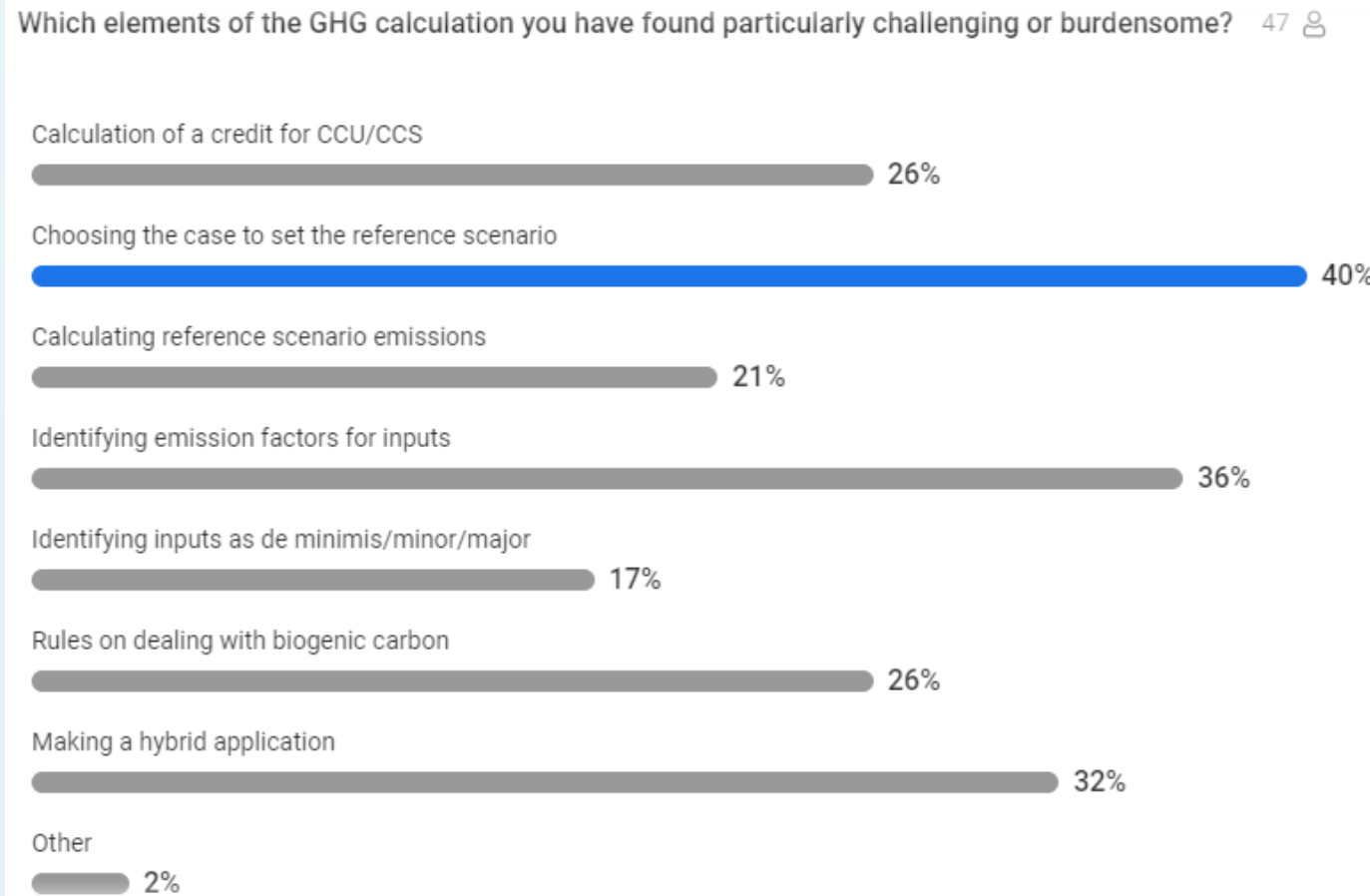
What measures can be implemented to enhance the attractiveness of the IF to smaller companies and underrepresented sectors?



Slido Poll Results

2

Are there any elements of the GHG calculation that you have found particularly challenging or burdensome to complete (not including cases where you found the rules unclear) ?



Slido Poll Results

3

What subsector are you from?

