EU–CHINA BRIDGE

Building Roadmaps to Industrial Decarbonisation and Green Economy through EU-China Cooperation

D6.1 – Scenario Protocol Design

WP6 – Net-zero emissions pathways (EU & China)

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EC Summary Requirements

1. Changes with respect to the Description of the Action (DoA)

No changes with respect to the work described in the DoA.

2. Dissemination and uptake

The deliverable will be mostly used within the project in order to develop the new state-of-the-art decarbonization pathways for the EU but it can also be used outside the project to provide insights about the most relevant issues related to the EU's low-carbon transition

3. Short summary of results (<250 words)

The EU–CHINA BRIDGE project develops comparative scenario analyses to inform decarbonisation strategies in the EU and China. Scenario development is carried out through a structured co-creation process involving iterative stakeholder engagement. This deliverable contributes to the development of the scenario protocol that will be then implemented by the modelling framework by documenting and analysing the outputs of the stakeholder workshop held on 10 April 2025, which marked the first stakeholder engagement event within the third co-creation cycle. The workshop aimed to identify stakeholder priorities, transition drivers, main uncertainties, and policy themes to be reflected in qualitative scenario narratives. These elements serve as the conceptual foundation for the narrative protocol and quantitative assumptions for model-based scenario analysis subsequently developed in WP6. The deliverable presents the methodological framework, structure, and objectives of the stakeholder workshop, provides a detailed review of the nine topics introduced for discussion, as well as an in-depth summary of stakeholder input and recommendations on the five priority themes selected through interactive voting. Finally, the report concludes with the presentation of coherent narrative dimensions and scenario design assumptions derived from the co-creation process and the methodological principles used to translate the insights from the stakeholders into structured scenario design elements.

4. Evidence of accomplishment

This report.

History of changes

Date/Version	Status	Changes
01.05.2025	*Draft v.0.0*	Creation of the document, draft text inserted
09.05.2025	*Draft vo.1*	Integration of all sections in the document
12.05.2025	*Draft vo.2*	Authors finalised the full draft of the report
13.05.2025	*Draft vo.2*	Report sent for internal review
20.05.2025	*Draft v1.0*	Reviewers sent back their comments
27.05.2025	*Draft v1.1*	Integration of reviewer comments into the report
30.05.2025	*Draft v2 Final document*	Final editing and submission to the EC portal

Preface

EU-CHINA BRIDGE will support the transition to a climate-neutral and resilient society in both Europe and China by jointly advancing knowledge on technology innovations and roadmaps for decarbonising energy intensive industries, co-creating innovative modelling by combining cutting-edge bottom-up and integrated assessment modelling to quantify net-zero sustainable pathways, and developing the most updated and comprehensive emissions data. It will intensively engage relevant stakeholders from both regions, enhancing dialogues, and fostering mutual learning among policymakers, industries, and experts. It will deliver two open-source EU-China joint technology inventories of promising net-zero emission technology options for the iron & steel and chemical industries, two co-implemented demonstrations of promising technologies in China, and co-created scale-up paths and roadmaps of the selected industrial technologies in both regions. It will also develop the most up-to-date, high-resolution, multi-sectoral, national and regional GHG and short-lived climate pollutant emission inventories as well as dynamic monitoring of key emission sources at high spatiotemporal granularity. A state-of-the-art modelling framework will be developed, exploiting and advancing cutting-edge and established modelling tools for EU and China, using the latest emissions data, representing technology and policy options, enabling assessment of socioeconomic impacts, covering multiple economic sectors and regions, and offering high spatial and technology detail. The enhanced models will be used to co-produce net-zero pathways for the EU and China, explicitly assessing co-benefits and trade-offs of climate policies with other societal goals while exploring cooperation policies and governance to drive the global transformation and assessing the distributional and global-level implications of the two regions' decarbonisation. The pathways will be documented in new workspaces in the I²AM PARIS platform.

WI – Wuppertal Institut Fuer Klima, Umwelt, Energie gGmbH	DE
E3M – E3-Modelling AE	GR
IIASA – Internationales Institut fuer angewandte Systemanalyse	AT
UoB – The University of Birmingham	UK
ICCS – Institute of Communication and Computer Systems	GR
HOL – HOLISTIC IKE	GR
ITE – University of Kassel	DE
THU-SA – Tsinghua University	CN
THU-CE – Department of Chemical Engineering, Tsinghua University	CN
THU-DESS – Department of Earth System Science, Tsinghua University	CN
RUC – Renmin University of China	CN
SDU – Shandong University	CN
CHINACOAL – China National Coal Group Corporation	CN
BITARIM – Advanced Research Institute of Multidisciplinary Sciences, Beijing Institute of Technology	CN
FULONG – Inner Mongolia Fulong Heating Engineering Technology Co., LTD	CN
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Executive Summary

This deliverable sets out the scenario narratives and modelling assumptions for analysing low-carbon transitions in the EU and China, as part of the EU–CHINA BRIDGE project. It draws on the results of the third co-creation cycle, which included the online stakeholder workshop in April 2025. The workshop engaged representatives from European Commission services, international institutions, research and academia, industries, think tanks and NGOs.

For the April 2025 workshop, stakeholder engagement was based on a structured approach that *combined real-time prioritisation and facilitated group feedback,* following the methodology outlined in Deliverable D1.1 of the project. Participants reviewed nine policy and research topics presented by the moderators and used a two-phase voting process to identify the most relevant issues for in-depth discussion. As a result, five priority topics emerged: 1) geopolitical tensions and trade fragmentation, 2) EU–China cooperation in green technologies and decarbonization, 3) socioeconomic and distributional impacts of the net-zero transition, 4) industrial competitiveness within the EU Clean Industrial Deal, and 5) digitalization and electrification driven by AI and data centers. Stakeholders emphasized the impact of trade barriers and geopolitical instability on access to clean technologies and products, the delicate balance between cooperation and competition in EU–China relations and at international level, and the importance of addressing distributional impacts to secure public and political support for climate action. Discussions also considered how alliances and shared governance of clean technologies could enhance mutual trust and enable joint action in emerging green markets. Digital infrastructure, while increasing electricity demand, also creates opportunities for flexibility and system optimisation, and depending on ownership and governance, can influence energy security and resilience.

Building on these insights, the deliverable develops scenario narratives that reflect the range of possible pathways for each topic. For example, the geopolitical tensions dimension encompasses three narratives: an *international cooperation* narrative, a *fragmentation* narrative that assumes increasing protectionism and tariffs, and a *regional rivalry* narrative consistent with SSP3 pathways. Similarly, the EU–China cooperation topic ranges from strong partnerships in green technology to more fragmented interactions.

In the socioeconomic and distributional impacts dimension, the scenarios contrast cost-optimal transitions with equitable and just transition approaches that include revenue recycling and targeted support for the most vulnerable groups. The Clean Industrial Deal narratives explore ways to strike a balance between competitiveness and decarbonization, including the potential role of carbon revenues in supporting low-carbon investments in energy-intensive industries. Finally, the digitalization and electrification narratives consider scenarios where AI and data centers increase system costs, as well as others where digital tools help manage demand and improve flexibility.

These narratives are integrated into four main scenario storylines that vary by climate policy ambition and level of international cooperation: *Low-carbon Collaboration* (S1), *Low-carbon Nationalism* (S2), *Current Trends* (S3), and *Fossil Protectionism* (S4). Additional variants further explore the equity, competitiveness, and the energy system implications of the digital economy, ensuring that the scenarios reflect stakeholder input and broader project objectives.

The deliverable also defines harmonized assumptions for population, GDP, and technology costs, using authoritative sources such as the IPCC, IEA, and EU reference scenarios. The detailed quantification of these assumptions and their translation into model inputs will be finalized in the following deliverable (D6.2).

Overall, D6.1 defines a coherent and robust scenario framework that incorporates stakeholder perspectives and addresses global and regional uncertainties. It captures how competitiveness, equity, technological change

and international cooperation intersect with the low-carbon transition, laying the foundation for the quantitative modelling work in WP6.

Contents

1. Introduction

The EU–CHINA BRIDGE project develops comparative scenario analyses to inform decarbonisation strategies in the European Union and China, with particular attention to socio-technical dynamics, competitiveness effects in the industry sector, and distributional effects. Scenario development is carried out through a structured co-creation process involving iterative stakeholder engagement, as defined in the project's Stakeholder Engagement Plan (D1.1) and the Grant Agreement. These interactions ensure that the Integrated Assessment modelling framework developed in Work Package 6 (WP6) is grounded in current policy debates, addresses region-specific transition challenges, integrates the bottom-up knowledge of industrial experts, and reflects the knowledge and priorities of key stakeholders.

This deliverable contributes to the development of the scenario protocol that will be then implemented by the modelling framework by documenting and analysing the outputs of the stakeholder workshop held on **10 April 2025**, which marked the first stakeholder engagement event within the third co-creation cycle. The workshop aimed to identify stakeholder priorities, transition drivers, main uncertainties, and policy themes to be reflected in qualitative scenario narratives. These elements serve as the conceptual foundation for the narrative protocol and quantitative assumptions for model-based scenario analysis subsequently developed in WP6.

- **Section 2** presents the methodological framework, structure, and objectives of the stakeholder workshop.
- **Section 3** provides a detailed review of the nine topics introduced for discussion, as well as an in-depth summary of stakeholder input and recommendations on the five priority themes selected through interactive voting..
- **Section 4** presents a first version of coherent narrative dimensions and scenario design assumptions derived from the co-creation process and the methodological principles used to translate the insights from the stakeholders into structured scenario design elements

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2. Stakeholders Workshop Structure and Methodology

This section provides information about the positioning of this stakeholder workshop with respect to the co-creation process described in D1.1., as well as the objectives and the structure of the workshop.

2.1 Stakeholder 2025 April Workshop within the Co-creation Process

The stakeholder workshop held on 10 April 2025 online marked the launch of the Co-Creation Cycle 3 of the EU–CHINA BRIDGE project. This cycle focuses on the collaborative development and validation of scenario narratives that will feed into the modelling framework developed under WP6. Following earlier and parallel cycles devoted to technology identification for heavy industries and roadmap elaboration (Cycles 1 and 2), Cycle 3 expands the dialogue to include broader structural drivers, policy uncertainties, and societal trade-offs that influence long-term decarbonisation pathways in the EU and China.

As described in the Stakeholder Engagement Plan (D1.1), this approach aims to ensure relevance, legitimacy, inclusiveness, and credibility in the scenario development process. The April 2025 stakeholder workshop represented the first interaction in this cycle and was designed to support WP6's objective of linking stakeholder knowledge to scenario protocol design.

2.2 Objectives of the Workshop

The workshop had four main objectives:

1. To inform stakeholders about the project in general, the capabilities and limitations of the modelling tools used in EU–CHINA BRIDGE, and clarify the role of qualitative narratives in shaping scenario development.
2. To identify and prioritize the key socio-political, economic and technological issues to be explored in the forthcoming modelling phase.
3. To facilitate in-depth discussion on selected priority topics
4. To guide the co-development of the scenario protocol, by linking stakeholder suggestions to model input assumptions and narrative structures.

2.3 Agenda, Format and Interactive Flow

The workshop was designed as a structured engagement session, using a balance of presentations, interactive tools, and moderated discussions to guide participants through a co-creation process. The design follows Steps from 1 to 6 of the proposed methodology in D1.1. These steps provide a structured framework for scenario co-creation, guiding the process from early planning to the integration of stakeholder input into modelling work. Specifically:

1. Define engagement objectives, aligning them with the needs of the scenario development process;
2. Map and select stakeholders, ensuring diversity of expertise, institutional affiliation, and regional perspective;
3. Design the engagement approach, including session format, facilitation methods, and supporting materials;
4. Frame the engagement session, presenting the policy and modelling context and setting a common ground for dialogue;

5. Explore and prioritise issues, allowing stakeholders to identify key uncertainties and transition drivers;
6. Translate outcomes into modelling guidance, transforming qualitative insights into structured components of the scenario protocol.

All six steps were applied as part of the third co-creation cycle of EU–CHINA BRIDGE and point 6 will be addressed in this deliverable as a final output of the co-creation procedure.

After introductory presentations, covering the project context and objectives, the modelling framework, and a short pitch of nine proposed policy and research topics, participants voted on the three topics they considered most critical. More in detail, Dagmar Kiyar (Wuppertal Institute for Climate, Environment and Energy) presented the project structure, objectives, and activities across different work packages. Sonja Sechi (E3Modelling) gave an overview of what the project's modelling framework can deliver in terms of analysis and results and which are the modelling limitations, highlighting potential ways to overcome them though, for example, the use of credible exogenous assumptions and scenarios design or soft-linking between models. This provided a comprehensive framing for stakeholders to understand the boundaries of model-based scenario design and to target their input accordingly.

Afterwards, Panagiotis Fragkos (E3Modelling) introduced nine potential topics relevant to EU climate, energy, and industrial policy that will be presented in detail in section 2 of the report. Stakeholders were then invited to express three preferences via Mentimeter (www.menti.com) to determine which topics would be discussed in detail and, finally, decide which topics will be relevant for the project's scenarios. While the Mentimeter tool only recorded the numerical preferences, the discussions that followed revealed the reasons behind stakeholder choices. These include concerns about international instability, equity and social feasibility of net-zero pathways, and the importance of aligning EU–China collaboration on clean technology perceived through stakeholders' direct involvement in policy, research, modelling, and industry. A synthesis of these motivations is presented alongside each topic in Section 2.2, where stakeholder recommendations are reported in detail.

The most voted five topics were then discussed in detail with an open and active discussion among project partners and stakeholders, followed by a second voting round to determine additional priority in the selected topics to be integrated in the scenario design. The session concluded with reflections on the main messages and next steps. The detailed agenda in presented in Table 1.

Table 1. Agenda of the Stakeholders' Workshop

Time (CET)	Topic	Organization
10:00 – 10:10	Project Presentation	Wuppertal Institute, Dagmar Kiyar
10:00 – 10:20	What could we expect from the models?	E3Modelling, Sonja Sechi
10:20–10:30	Pitching of key research topics for discussion	E3Modelling, Panagiotis Fragkos
10:30–10:35	Voting via Mentimeter – selection of top 5 topics	E3Modelling, Sonja Sechi
10:35–11:15	Breakout discussions on the selected topics	E3Modelling, Panagiotis Fragkos; ICCS-NTUA, Alexandros Nikas;

		IIASA, Marta Kozicka
11:15–11:20	Voting via Mentimeter – additional topic prioritisation	E3Modelling, Sonja Sechi
11:20–11:50	Open discussion on remaining high-interest topics	E3Modelling, Panagiotis Fragkos; ICCS-NTUA, Alexandros Nikas; IIASA, Marta Kozicka
11:50–12:00	Final reflections and next steps	E3Modelling, Panagiotis Fragkos

2.4 Methodological Framing

The April 2025 workshop was grounded in the methodological approach to stakeholder engagement developed in Deliverable D1.1. This approach conceptualizes stakeholder co-creation as a structured and iterative process designed to support mutual learning, reflexivity, and relevance in model-based analysis.

The process reflected the engagement cycle described in D1.1, from stakeholder identification to post-workshop integration into modelling scenarios and tasks. The stakeholders include policymakers, industry representatives, leading academics, NGOs and think tanks.

The EU–CHINA BRIDGE Stakeholder Engagement Plan (D1.1) defines a structured framework of engagement techniques designed to support different phases of scenario co-creation. These techniques include foresight-oriented tools such as the Three Horizons method and the Future Wheel, aimed at exploring long-term systemic change; interactive formats such as mind-mapping, Fishbowl discussions, and group visualisation to support joint framing; and complementary instruments such as semi-structured interviews, field visits, or scenario stress-testing for more targeted or context-specific insight generation.

For the April 2025 workshop, the method selected was structured engagement with real-time prioritisation and facilitated group feedback, as described in D1.1. This approach combined short framing presentations, interactive topic voting using Mentimeter, and moderated discussions to generate focused input from stakeholders on scenario-relevant uncertainties and priorities. ." It was designed to support critical reflection and scenario framing rather than consensus-building. The design of the engagement approach (Step 3 of the methodology presented in D1.1 and described in the previous paragraph) was carried out in parallel with the stakeholder mapping and selection process (Step 2). These two steps were closely interlinked: the format and level of interaction were tailored to the profile of the invited stakeholders, which included senior representatives from research institutions, government agencies, and industry associations. Given the high-level nature of the audience, the selected method was the one defined in D1.1 as "structured engagement with real-time prioritisation and facilitated group feedback", favouring concise framing, targeted input, and collective prioritisation over more exploratory or participatory formats. The stakeholders were selected for representing different views from academia and research institutions, European Commission and International Institutions (policy advisor), think thank and NGO and industry. Figure 1 reports the statistics about the number of stakeholders involved in each category. Out of 18 confirmed attendees, the majority came from **European Commission services and international institutions**, **academic and research organisations**, and **think tanks or NGOs**. While several industry representatives expressed interest during the preparation phase, participation from the private sector remained limited, primarily due to scheduling constraints or late-stage cancellations.

This underlines the importance of reinforcing industrial engagement in future stages of the co-creation process.

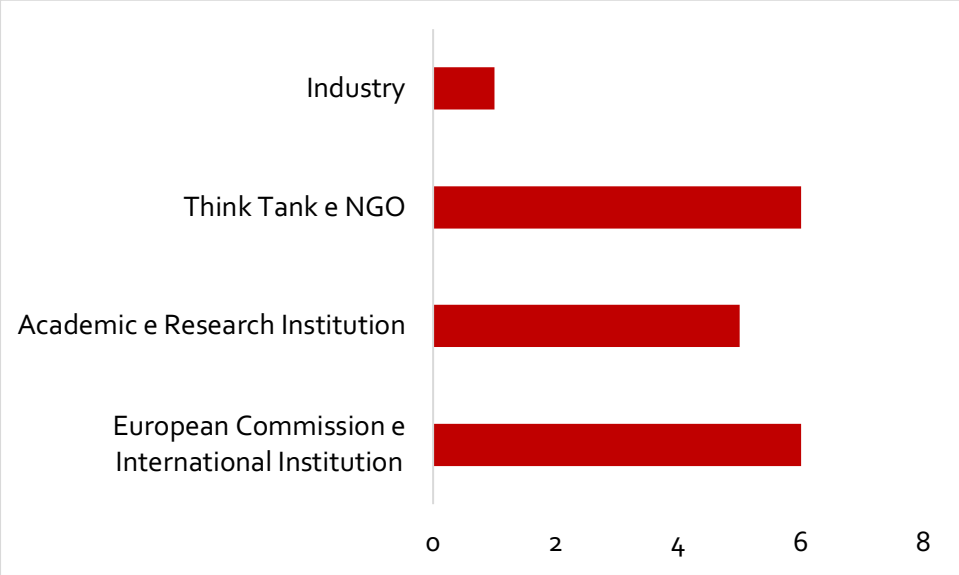

Figure 1 - Number of participants by institutional category. The figure shows the number of workshop participants by institutional category. The majority of attendees came from European Commission services, research organisations, and policy-focused think tanks.

Moreover, an introduction session was carried out before going into the discussion to give the context to all the participants included the presentation of the project, the objectives of the stakeholder workshop, and the IAMs capabilities and limitations. The workshop was part of the co-creation process to define scenario narratives and key research questions for the EU–CHINA BRIDGE project, particularly in relation to future development and stakeholder-informed scenario design towards the EU net-zero goal.

3. Key Topics and Stakeholder Insights

This section summarises the thematic discussions that emerged during the April 2025 stakeholder workshop. Out of nine proposed policy topics, five were selected for in-depth exchange based on two rounds of real-time polling by the workshop participants. Each discussion focused on how emerging policy, market, and technology dynamics could be reflected in future scenario narratives. This section synthesises the stakeholder discussions and presents the resulting recommendations for the scenario protocol design.

3.1 Overview of the presented topics

As starting point for the workshop discussions, nine thematic areas were introduced by the session moderator, Panagiotis Fragkos (E3Modelling). These topics were selected by the modelling team to reflect major structural drivers, key socioeconomic, political and technological uncertainties, and areas of strategic relevance for the EU–CHINA BRIDGE scenario co-creation process. Each topic was briefly presented to all participants to ensure a shared understanding of its scope and rationale. The themes ranged from geopolitical and technological considerations of the EU's decarbonization to distributional impacts and governance structures.

Geopolitical Tensions and Trade Fragmentation

Participants were invited to reflect on the implications of growing global fragmentation and rising emphasis on protectionist policies and domestic competitiveness for the EU's climate and energy targets. The presentation outlined concerns about the introduction of trade restrictions, including tariffs and bans, on energy and industrial commodities, clean technologies and critical materials. The topic also highlighted the potential for shifts in trade alliances and global energy security arrangements to alter the cost and availability of key inputs. The extent to which fragmented global governance may delay, increase the costs or distort decarbonisation pathways was posed as a central uncertainty.

Feasibility and Desirability of EU Climate Targets

This topic introduced a reflection on the gap between ambition and implementation in EU climate policy. The presentation underscored that current climate targets for 2030 and 2040 are highly ambitious, raising the question of whether they are technically and politically feasible under real-world conditions. Participants were invited to consider not only whether these targets can be met in practice, but also whether the policy strategies required are consistent with broader societal priorities and political support in EU Member States.

Land-Based Options and AFOLU Carbon Dioxide Removal (CDR)

This topic concerned the role of land-based mitigation and removal strategies—such as afforestation and bioenergy with carbon capture and storage (BECCS) in achieving climate neutrality. The presentation raised questions about potential trade-offs between land uses and clean energy production (e.g. for food production vs. biomass), the sustainability and permanence of land-based carbon removals, and the challenges of monitoring and verification. Participants were asked to reflect about the realistic potential of these options and their implications for scenario design.

Socioeconomic and Distributional Impacts of the Net-Zero transition

This topic focused on the uneven distribution of the costs and benefits associated with the net-zero transition across countries, households and businesses. The presentation pointed to differences across regions, social groups, and income levels in terms of who is able to finance the transition and who is most exposed to social or

economic risks. Participants were invited to reflect on how such distributional effects could be captured in scenario narratives, and how political feasibility might depend on perceptions of fairness and compensation via the targeted use of the government revenues from the EU Emissions Trading System.

Market and Regulatory Policies Towards Net-Zero

The presentation raised the question of how different types of policy instruments, market-based vs. regulatory, can be combined to achieve net-zero targets. It distinguished between approaches based on price signals (e.g. emissions trading) and those relying on mandates or prohibitions (e.g. technology bans or CO_2 standards). Participants were encouraged to reflect on the balance and sequencing of these policy instruments under different political and institutional conditions.

EU–China Cooperation in Green Technologies and Decarbonisation

This topic introduced the potential implications of closer or more distant cooperation between the EU and China in the fields of green technology development and decarbonisation policy. The presentation noted that the EU is seeking to develop "climate alliances," while also protecting domestic industries. Participants were invited to consider how trust, transparency, and alignment of policy goals might affect the scope for joint action, technology exchange, and competitive dynamics in global clean tech markets.

Decarbonisation Electrification and Grid Investment for AI and Data Centre Needs

This topic addressed the anticipated rise in electricity demand from digital infrastructure, particularly artificial intelligence applications and data centres. Participants were asked to reflect on the implications for grid infrastructure, spatial distribution of loads, and the availability of domestic vs. foreign investment. The presentation suggested that digitalisation may significantly influence power system needs and planning priorities over the coming decades.

The EU Clean Industrial Deal: Decarbonisation and Competitiveness

This topic focused on the compatibility of industrial competitiveness with decarbonisation targets. The presentation noted that state aid and investment support will play a major role in shaping the net-zero transition for energy-intensive industries, as decarbonisation and competitiveness should be strongly interlinked. Participants were invited to consider whether current policy frameworks can deliver sufficient incentives and infrastructure, and whether increased global competition may affect the EU's ability to lead in clean industrial transformation.

Socio-Political Change and National Governance

This topic raised the question of how national-level governance capacity, political culture, and social acceptance may affect the implementation of decarbonisation policies and the speed of the required transformations. Participants were asked to consider whether diverging political trajectories across EU Member States and China could alter the pace, credibility, or coherence of the transition.

3.2 Stakeholders' discussion and recommendations on the selected topics

Following the initial presentation a prioritization exercise was implemented by using the online tool Mentimeter. Five themes were selected (voted) by participants as most relevant for informing scenario design under WP6. The selection was based on two rounds of real-time polling conducted during the workshop. Each participant could select and vote up to **three preferred topics (from the nine identified above)**, allowing for a

balanced reflection of individual and collective priorities.

The five most prioritized topics, as presented in Figure 1 and Figure 2, were:

- **Topic 1**: The impacts of geopolitical tensions and trade tariffs (72%)
- **Topic 6**: The potential of EU–China collaboration in green tech and decarbonisation (50%)
- **Topic 4**: Socioeconomic and distributional impacts of net zero (44%)
- **Topic 7**: Increased electrification and grid investment to meet AI/data centre needs (28%)
- **Topic 8**: The EU Clean Industrial Deal: decarbonisation and competitiveness (28%)

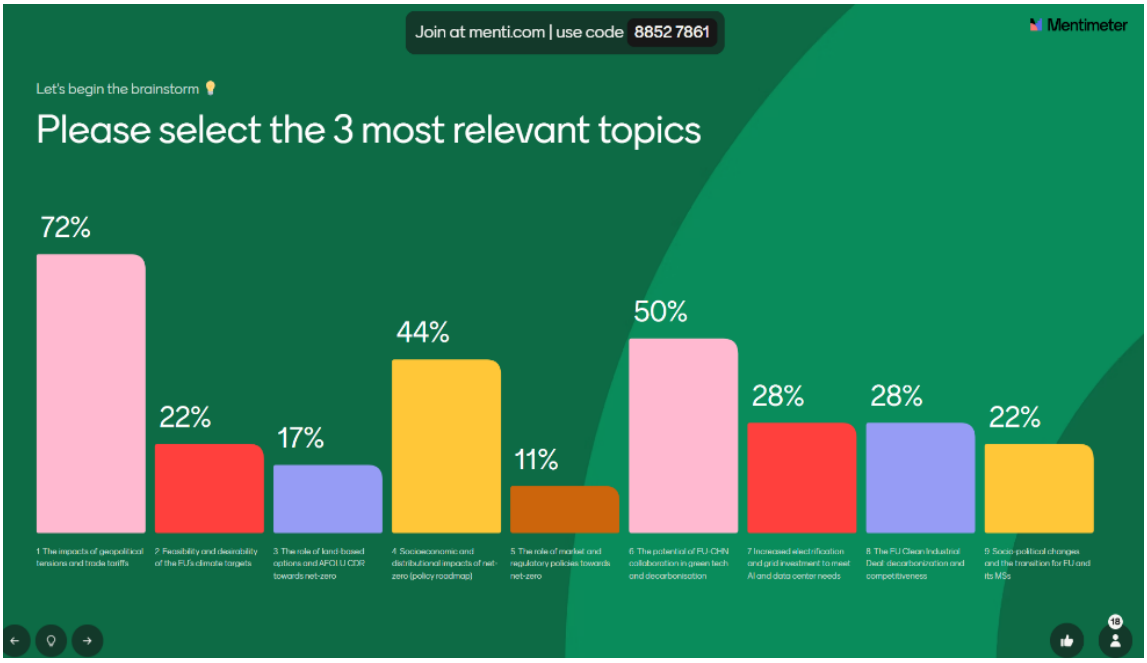

Figure 2 – Results of the first poll used to identify priority topics to be discussed in detail in the second session. Values indicate the percentage of participants who selected each topic (up to 3 selections were allowed)

The voting results show that almost two-thirds of participants selected geopolitical tensions and trade tariffs as a top priority, indicating widespread concern about the implications of global instability and fragmentation especially in the current international political landscape. Half of the participants selected EU–China collaboration in green technologies and decarbonization, highlighting the perceived importance of cooperation dynamics in shaping future industrial decarbonisation pathways. Socioeconomic and distributional impacts were prioritised by just under half of the group, highlighting the increasing relevance of equity considerations in scenario development. Finally, electrification and digital infrastructure and the EU Clean Industrial Deal were each selected by approximately one-third of participants, pointing to growing awareness of digitalisation and industrial competitiveness as emerging transition challenges.

Figure 3 - Results of the first poll used to identify priority topics for the second session. Values indicate the number of participants who selected each topic (up to 3 selections allowed)

3.2.1 Geopolitical Tensions and Trade Fragmentation

Stakeholders underlined that geopolitical instability is increasingly shaping the context in which decarbonisation policies are implemented. Fragmentation of trade relations, tensions around technology sovereignty and industrial competitiveness, and regionalisation of supply chains are no longer abstract risks but observable realities. These dynamics were seen as affecting both industrial policy and energy transitions.

Highlights and recommendations

- Strategic autonomy is becoming a central priority for both the EU and China, creating challenges for clean technology diffusion.
- The imposition of import tariffs from the US and the potential retaliation measures will impact on the costs of clean energy technologies reducing the speed for their uptake
- The deterioration in US and China trade relations was highlighted as a structural shift that could potentially lead to a flooding of trade through other relevant countries
- Military expenditure influences the industrial base: the structure of production changes depending on whether it is geared toward conventional weapons or intelligence and space technologies. Increased military spending might also imply lower financial resources available for the energy transition
- Tariffs will have cost impacts in the energy sector: higher clean tech costs and increased prices of hydrocarbons, esp. gas price that influences electricity prices in the EU Member States
- CBAM was seen as problematic for a broader group of partners, including Korea, Türkiye and other developing countries, potentially complicating EU efforts to build global partnerships
- Higher electricity prices after Ukraine war are difficult to be justified with high level of renewable: possible problems in public acceptance for renewable energy uptake
- Need of Including divergent geopolitical narratives and divergence in international trade and cooperation patterns in scenario framing.
- Assess the implications of trade barriers on industrial and energy transition costs.

- Explore the medium- and long-term implications of tariffs because they have an impact on the industrial structure (including implications for critical components)
- Explore how modelling assumptions, such as reliance on SSP2 baselines, may need revision to reflect more fragmented world narratives (Regional rivalry could push us away from the typical SSP2 assumptions and towards an SSP3 future based on regional rivalries or even in SSP-uncharted territories)
- Modelling approaches must incorporate assumptions on fragmented supply chains, CBAM responses, and risks to technology availability.
- There is a need to consult external expertise from the geopolitical and defence fields when designing scenarios due to the possible change in industrial structure due to possible increasing share of military spending
- Consider global institutional realignments when defining cooperation or fragmentation assumptions.

3.2.2 EU-China cooperation in green technologies and decarbonisation

Participants noted that the EU's external climate and industrial policies increasingly intersect with global power dynamics. While cooperation with China remains essential in many areas, concerns were raised about dependency, strategic competition, and the credibility of partnership frameworks.

Highlights and recommendations

- Scenarios should reflect institutional cooperation asymmetries between the EU and China.
- There is a need to assess the coherence and effectiveness of EU international investment strategies (e.g. Global Gateway).
- The potential for green technology alliances especially between EU and China (as potential frontrunners in energy transition) and their limitations must be explored.
- Stakeholders highlighted the absence of clear KPIs in the EU's global partnership strategies was noted as a potential gap, suggesting the creation of an "EU Alliance"
- Develop scenarios with and without deep EU–China technological cooperation, in particular the potential for the creation of lead markets for green products and first mover advantages for clean technologies for the EU should be assessed
- It is important to evaluate how partnership-based models affect competitiveness, innovation, and carbon leakage.
- Explore different regional combinations for an EU alliance with the modelling frameworks is important
- Model differentiated access to global clean tech markets under competing geopolitical conditions.

3.2.3 Socioeconomic and Distributional Impacts of the Net-Zero Policy Roadmap

Equity and justice emerged as critical dimensions of transition feasibility. Participants argued that without explicit attention to regressive distributional impacts, climate policies could trigger opposition and erode public support especially from the countries, sectors and households that will face the largest costs.

Highlights and recommendations

- Distributional effects should be explicitly integrated into scenario design and not treated as post-processing. The analysis should cover both the costs and benefits of the low-carbon transition for different countries, income groups and sectors.
- The role of EU-level instruments, such as the Social Climate Fund, is essential in mitigating inequality.
- Differences in vulnerability and financial capacity between and within countries should be reflected.
- Additional discussion focused on the relationship between the cost of climate action and climate damages, referencing recent work (e.g. in Nature Climate Change) that underscores their distributional effects
- It is important to develop indicators for transition fairness and political feasibility.
- It is necessary to Include in the models mechanisms such as carbon revenue recycling and targeted compensation in scenario narratives.
- Modelling of regional disaggregation of costs and benefits is needed.
- Modelling the potential role of finance to alleviate possible transition impacts is an important requirement

3.2.4 Electrification and Grid Investment for AI and Data Centre Needs

The rapid expansion of AI and digital infrastructure was highlighted as a structural trend with direct energy system implications. Stakeholders stressed that data centres are already shaping grid investment needs and energy demand trajectories in some EU Member States.

Highlights and recommendations

- The energy demand of digital infrastructure and data centres should be treated as a growing, systemic load as highlighted from IEA recently
- Foreign Ownership (mostly properties of US companies) and location of digital assets such as data centers can affect energy security and autonomy.
- AI and digitisation may also contribute to grid optimisation and enhanced system efficiency.
- Reflect digital infrastructure in sectoral energy demand assumptions. The impacts of digitalisation on the trade of the services sector should be considered (as digital services can be increasingly provided from abroad)
- Modelling efforts should consider also ownership and financing structures of data centers and digital infrastructure
- Scenario assumptions should also consider decentralization and governance implications of data centers including potential grid constraints in highly electrified scenarios, where both load concentration and spatial infrastructure planning become critical.
- It was asked to Include scenarios in which AI both increases electricity demand but also improves power system responsiveness in combination with lifestyle changes that can reduce energy demand.

3.2.5 The EU Clean Industrial Deal: Decarbonisation and Competitiveness

Industrial competitiveness was discussed as a condition for the successful implementation of the low-carbon transition in line with the EU Net-Zero Industrial Act.

Highlights and recommendations

- Energy-intensive sectors face high energy prices (compared to their non-EU competitors) but also investment challenges linked to permitting complexity, and capital constraints.
- Participants raised the issue of trade-offs in funding allocation: supporting industry (i.e. through preferential tariffs) could divert resources from other transition needs
- Possibility to include State Aid into the model-based scenarios and how this may impact energy affordability and security
- The global partnership component of the Industrial Deal was seen as underdeveloped.
- Incorporate specific financial assumptions supporting industrial decarbonization, including EU and national instruments.
- Include strategic EU partners like China and Korea in clean tech collaboration scenarios

3.2.6 Additional cross-cutting insights

Additional cross-cutting topics and further highlights were discussed in the workshop and, in particular:

- There was interest in moving beyond strict cost-optimality in modelling, favouring near-optimal pathways with higher social acceptability and equity or enhanced industrial competitiveness
- Elasticity of demand, behavioral responses, lifestyle changes, and distributional impacts were highlighted as important elements to be represented in the models
- The importance of recycling carbon revenues was emphasized as a mechanism to support a fair transition
- When a stakeholder asked about an "equitable approach," the response underlined the need to ensure both international fairness and equity within the country
- The issue of national security and military expenses (including the military support to other countries) and how this may impact the EU's decarbonisation should also be considered in the scenarios

3.3 Results

A second round of voting was conducted following the stakeholder discussions. The results are provided in Figure 3. Participants were again invited to select up to three topics they considered most relevant for informing the scenario development process of the EU-CHN BRIDGE project.

The results confirmed a clear and increasing consensus around geopolitical tensions and trade fragmentation. Socioeconomic and distributional impacts and EU–China cooperation in green technologies also remained within the top three, reflecting continued stakeholder emphasis on both global uncertainty and internal equity dimensions. The EU Clean Industrial Deal saw a further increase in priority indicating that competitiveness and policy credibility became more prominent concerns following the discussion.

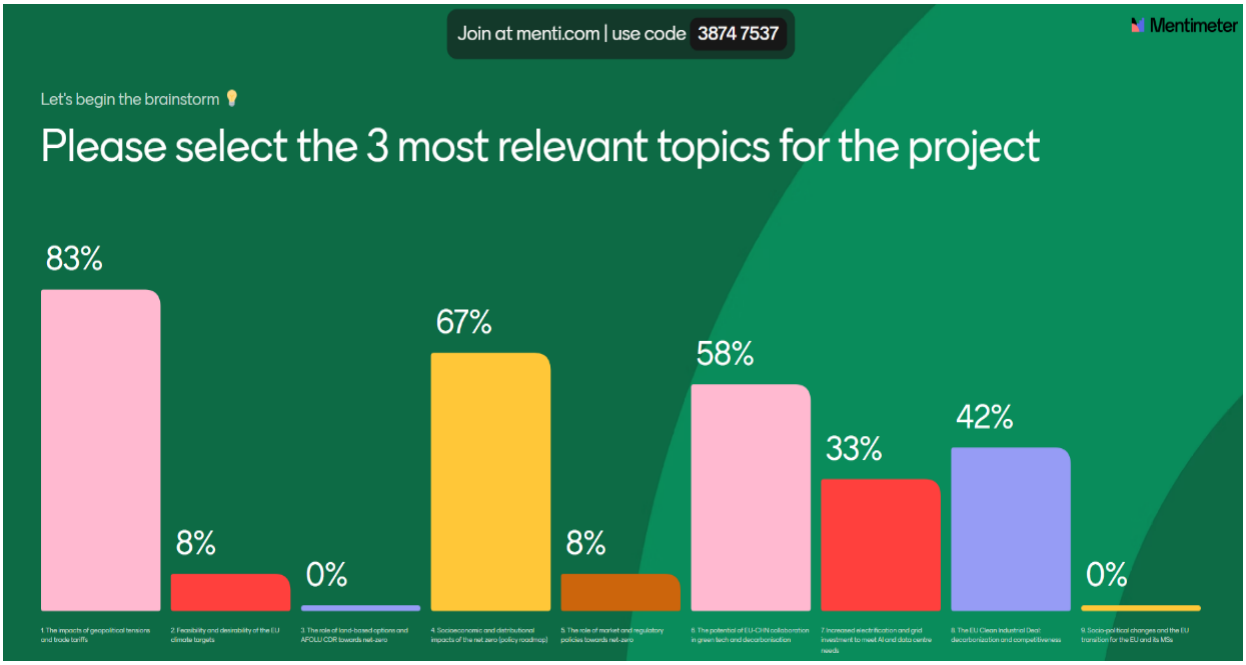

Figure 4 - Results of the final poll used to identify the top three priority topics. Values indicate the percentage of participants who selected each topic (multiple selections allowed, in particular 3). Small shifts observed between the two voting rounds such as the rise in importance of the EU Clean Industrial Deal suggest that peer discussion reinforced or sharpened initial preferences, without altering their overall consistency.

The stakeholder discussions summarised in this section will provide inputs for the structure and development of scenario narratives and their relative protocol.

The selected topics reflect shared concerns around international fragmentation, social equity, infrastructure constraints, and the future of industrial competitiveness. In particular, the strong interest in geopolitical risks and international cooperation needs to move beyond pure country modelling assumptions and analysis different countries cooperation scenarios. At the same time, the focus on distributional impacts and digital infrastructure demonstrates increasing stakeholder sensitivity to the political economy of the transition and the role of emerging demand-side drivers. Through a structured two-phase process—=, initial topic presentation and prioritisation, followed by moderated discussion, the workshop enabled the collection of concrete recommendations on how to represent emerging socio-political, technological, and geopolitical challenges in the scenario protocol. These results confirm the consistency of stakeholder priorities across both sessions and offer clear guidance for the thematic focus of the scenario protocol under WP6, particularly regarding global constraints, distributive implications, and sectoral implementation challenges.

The table below summarizes the main stakeholder messages for each of the five selected topics. These insights will be used to inform the development of narrative dimensions and modelling assumptions.

Table 2. Summary of Stakeholder Recommendations by Topic and ranking

Priority	Topic	Key Messages and recommentation
1	**Geopolitical tensions and trade fragmentation**	Reflect divergent geopolitical narratives; include trade barriers and tariffs, CBAM responses, and fragmented supply chains in scenario narratives;
2	**EU-China cooperation in green technologies and decarbonization**	Model scenarios with and without deep cooperation; consider institutional asymmetries and external

		investment strategies;
3	**Socioeconomic and distributional impacts**	Integrate distributional indicators; explore near-optimal pathways in contrast to pure cost-optimal solutions; include social compensation mechanisms and political feasibility insights.
4	**The Clean Industrial Deal and competitiveness**	Analyse ways to improve EU industrial competitiveness while still meeting net-zero goals; Represent public–private finance mechanisms; include industrial policy divergence; consider global subsidy competition and investor risk.
5	**Electrification and digital infrastructure**	Account for digital energy demand; include data centre location, ownership structures, and grid-system interactions; assess the potential demand reduction and grid optimization effects of AI and digitization

4 Scenario Protocol

4.1 Methodology for Scenario Narratives

Based on the insights emerged from the stakeholder workshop as presented in the previous sections, this section presents how these insights can be transformed into concrete scenario narratives and modelling assumptions. In order to do this, we start from the stakeholder recommendations for the five key policy areas/topics discussed above (and presented in table 3) and we develop qualitative scenario narratives integrating consistently the stakeholder insights.

4.1.1 Geopolitical Tensions and Trade Fragmentation

Based on the stakeholder recommendations discussed in the section above, some distinct scenario narratives can be developed:

- An "International cooperation" narrative: where countries strongly cooperate for climate action, sharing knowledge and innovation, and ensuring green technology transfers globally with limited or no trade tariffs
- A "fragmentation" narrative: where there are strong geopolitical tensions across countries with increasing competition and protectionist policies, including high import tariffs (similar to current announced levels), fragmentation of supply chains of industrial products, increased costs for clean techs and energy products, while the overall economic uncertainty increases (which may also lead to higher risks and WACCs for energy technologies). More severe sub-scenarios within this narrative may involve the introduction of highly targeted tariffs on strategic sectors such as green technologies or critical raw materials leading to reciprocal trade measures, distortion of global markets, and long-term decoupling between major economies.
- A "regional rivalry" narrative: which is based on the "fragmentation" narrative assumptions, but it also includes the ReArmEU provisions *(European Commission, 2025)*, with increased funding for military purposes and changes in industrial structures (to support this) and lack of financing for the transition (leading to increased risks, and high WACCs for energy and climate technologies). This narrative is consistent with the SSP3 (Shared Socioeconomic Pathway) assumptions pointing to regional rivalries.

4.1.2 EU-China cooperation in green technologies and decarbonisation

The EU-CHN cooperation emerged as an important topic during the stakeholder workshop, and some distinct scenario narratives can be developed, as below. While two stylised narratives are presented below, the scenario protocol also considers **intermediate forms of collaboration**, including selective or sector-specific cooperation, particularly under broader global fragmentation.

- An "EU-CHN strong cooperation" narrative: where China and the EU establish close partnerships especially in the field of decarbonisation and low-carbon technologies in order to create common markets (i.e. for carbon emissions with a potential linking of the EU ETS with the Chinese system), foster low-carbon knowledge and innovation sharing, facilitate the trade of green technologies and products (no tariffs and other trade barriers), establish common standards for green products and pursue joint ambitious climate mitigation action trying to incentivize also international climate action
- An "EU-CHN fragmentation" narrative: where the EU and China adopt climate mitigation policies but in a fragmented manner, with each region focusing on its own competitive advantages, setting its own

decarbonisation targets and focusing on energy security, and industrial competitiveness

4.1.3 Socioeconomic and Distributional impacts

The stakeholders pointed to the high importance of distributional impacts of decarbonisation for the public and social acceptance of the low-carbon transition. In this context, two distinct narratives can be developed:

- A "cost-optimal transition" narrative: where countries pursue ambitious decarbonisation efforts with a focus on cost-efficiency, largely based on the adoption of market-based climate policies (i.e. carbon pricing or Emission Trading Systems) to ensure that emissions reductions happen in a cost-optimal manner across regions and sectors. Clean energy technologies are deployed only when cost-optimal and the revenues from carbon pricing are used to further incentivise climate action.
- An "equitable and just transition" narrative: where countries consistently integrate just transition considerations into their decarbonisation planning. In this context, countries prioritize climate action in sectors and activities that do not lead to regressive impacts. As carbon pricing and ETS systems inevitably poses a disproportionately high cost burden to low-income households, governments use the revenue generated from carbon pricing to give it back to households (targeting especially low-income households) as lump-sum transfers aiming to ensure a just transition leaving no one behind. In the modelling framework, equity is reflected through the inclusion of carbon revenue recycling mechanisms, distributional impact indicators (e.g. household cost burden), and in income-based disaggregation of transition impacts

4.1.4 The Clean Industrial Deal and competitiveness

As part of the Clean Industrial Deal, the EU has put competitiveness at the heart of decarbonisation planning, aiming to ensure that the EU industries remain competitive in the global markets despite the introduction of ambitious climate policies and carbon pricing. In this context, two distinct narratives can be developed:

- A "cost-optimal transition" narrative: similar to the narrative presented in 3.1.3 with decarbonisation focusing on the adoption of cost-efficient measures and technologies
- An "industrial competitiveness " narrative: focusing on reconciling the system decarbonisation with ensuring industrial competitiveness in the international markets (especially for the trade-exposed and energy-intensive industries like steel, cement and chemicals). In this narrative, global subsidy competition and investor risk are considered and the EU adopts specific measures to enhance its international competitiveness targeting specific industries with diverging policies, potentially including: implementing the Carbon Border Adjustment Mechanism (CBAM), using ETS revenues to subsidise industrial decarbonisation and low-carbon innovation, reducing the energy costs facing the EU industries, enhance access to critical raw materials, include public private finance mechanisms to ensure industrial access to low-cost finance, and boosting demand for clean products. Within this narrative, alternative assumptions on the use of ETS revenues can be explored for instance, allocating them to direct industrial subsidies, innovation funds, or to demand-side support schemes reflecting the diversity of policy approaches currently under discussion.

4.1.5 Electrification and digital infrastructure

Based on the stakeholder recommendations, we can develop two distinct narratives on the potential role of AI and digitisation on the energy system transformation as below:

- An "AI as a constraint" narrative: large electricity requirements to power data centers, leading to increased requirements for investment in power capacities and grids, extensive grid congestion, higher

energy transition cost, and additional decarbonisation challenges

- An "AI as transition enabler " narrative: where AI and digital tools support grid optimisation and load shifting behaviours, allowing to reduce the transition costs and optimise system management.

The Table 3 below summarises the scenario narratives for each of the five policy topics.

Table 3. How Stakeholder Recommendations are translated into distinct scenario narratives

Priority	Topic	Key Scenario Narratives
1	**Geopolitical tensions and trade fragmentation**	"International cooperation" "Fragmentation" "Regional rivalry"
2	**EU-China cooperation in green technologies and decarbonization**	"EU-CHN strong cooperation" "EU-CHN fragmentation"
3	**Socioeconomic and distributional impacts**	"Cost-optimal transition" "Equitable and just transition"
4	**The Clean Industrial Deal and competitiveness**	"Cost-optimal transition" "Industrial competitiveness"
5	**Electrification and digital infrastructure**	"AI as a constraint" "AI as a transition enabler"

4.2 Scenario definition

This section will first introduce the main exogenous assumptions harmonized across scenarios and models and will also present the alternative scenario definitions emerging from the discussions in the stakeholder workshop and the analysis of scenario narratives developed above.

4.2.1 Harmonised exogenous assumptions across scenarios

This section presents the key exogenous assumptions used during scenario analysis, in order to ensure consistency and comparability across all model-based scenarios. In particular, we describe the key demographic, macro-economic, technological and policy assumptions that are exogenously imposed to the models and do not change among alternative scenarios. These assumptions are taken from selected, widely used studies, reports, analyses from international organizations and relevant databases. Please note that the final quantification of these assumptions will be provided in the next deliverable of WP6 (D6.2) in order to take into account the latest developments in the socioeconomic, technological and policy assumptions.

Population:

- For non-EU countries, the participating models should use either the updated SSP2 population assumptions or the medium fertility variant of the UN World Population *Prospects (United Nations, Department of Economic and Social Affairs, Population Division, 2022); (International Institute for Applied Systems Analysis, 2023).*
- For the EU Member States, models should use either the UN World Population Prospects or the latest population estimated by the EC Ageing Report and EUROPOP (United Nations, Department of Economic and Social Affairs, Population Division, 2022); (European Commission: Directorate-General for Economic and Financial Affairs, 2024).

GDP:

- For non-EU countries, all participating models should use the updated SSP2 socio-economic assumptions for GDP trajectories with updated historical trends (and updated to include short-term trends from the IMF forecasts) and including the COVID-19 shock. The long-term macroeconomic developments should reflect SSP2.
- For the EU Member States, the models should use either a similar approach as the one described above for non-EU countries or the one included in the EC Reference scenario 2020

Technoeconomic costs: The models should use either the technology costs from the EC Reference scenario 2020 *(European Commission, 2020)* and/or those from the IEA's World Energy Outlook (WEO) 2024 and its related free dataset *(International Energy Agency, 2024)* for the power generation, transport, industrial and all other energy-related technologies they include.

As the EU-CHN BRIDGE project has a specific focus on industrial decarbonization, the models will also use the technoeconomic database for industrial technologies as elaborated by WP3 and/or assumptions from IEA technology roadmaps like IEA's Future of hydrogen and its related assumptions *(International Energy Agency, 2019)* ,, and The Future of Petrochemicals *(International Energy Agency, 2018)*. The technology costs for energy and industrial technologies can change in alternative scenarios, especially in case of deep collaboration between regions on climate action.

Climate policies: Two different levels of climate policy intensity would be imposed in the modelling scenarios in line with the more recent IPCC 6th Assessment Report (IPCC, 2023) and the EU's strategic transition roadmaps. In particular, we will develop:

- A "Current Policy" scenario that includes all climate policies and regulations that have been already legislated and implemented in the EU and globally.
- An "NDC-LT" scenario that includes the implementation of the Nationally Determined Contributions (NDCs) by 2030 and the long-term low-carbon development targets in all countries globally including the net-zero targets adopted by 2050 or later. This scenario assumes that the EU meets both its NDC target of 55% GHG emissions reduction by 2030 compared to 1990 levels and its climate neutrality goal by 2050 as part of the EU Green Deal.

A detailed list of climate policies to be used in these two contrasting policy scenarios was developed in the context of the IAM-COMPACT project (*IAM-COMPACT, 2024*) and is provided in the I2AM Paris platform (*I2AM Paris, 2023*). This database includes both currently implemented policies but also information about the NDC and Long-Term targets and will be used by the models in the EU-CHN BRIDGE project, while potential updates can be implemented to integrate more recent climate policies especially in the EU and China. The scenario analysis focuses on the assessment of real-world and policy relevant climate targets decided at the national level (including the NDCs and LTs, although most of them are not legislated yet) instead of the conventional carbon budget-driven scenarios. The latter are of course important for the impact assessment of the Paris goals, but they fail to include national policies, priorities and heterogeneous contexts and thus do not provide relevant information for climate action at the national level, which is the focus of the EU-CHN BRIDGE project.

4.2.2 Definition of alternative scenarios

The scenario definition will emerge through the combination of the scenario narratives developed above (especially for Priority 1 topic as selected by the stakeholders) with the climate targets/policies (as presented in section 3.2.1). As presented in Figure 5, four main scenarios are designed combining two levels of climate policy

with two levels of international cooperation assumptions:

S1) "Low-carbon collaboration": In this scenario, the countries implement their NDC and LT targets through enhanced international collaboration for climate action, based on sharing low-carbon knowledge and innovation, creating common standards for green products and ensuring green technology transfers globally with limited or no trade tariffs

S2) "Low-carbon nationalism": In this scenario, the countries implement their NDC and LT targets but based on their national efforts. There are strong geopolitical tensions across countries with increasing protectionist policies, including high import tariffs, fragmentation of supply chains, increased costs for clean techs and energy products, while the overall economic uncertainty increases (which leads to higher risks and WACCs for energy technologies) and decarbonisation finance is limited as funding is used for other purposes (incl. military or security related).

S3) "Current trends": In this scenario, the countries implement their current climate policies (as specified above) through a continuation of the current levels of international collaboration

S4) "Fossil protectionism": In this scenario, the countries implement their current climate policies (as specified above) but based on their national efforts in a context of increasing protectionist policies, fragmentation of supply chains and trade barriers

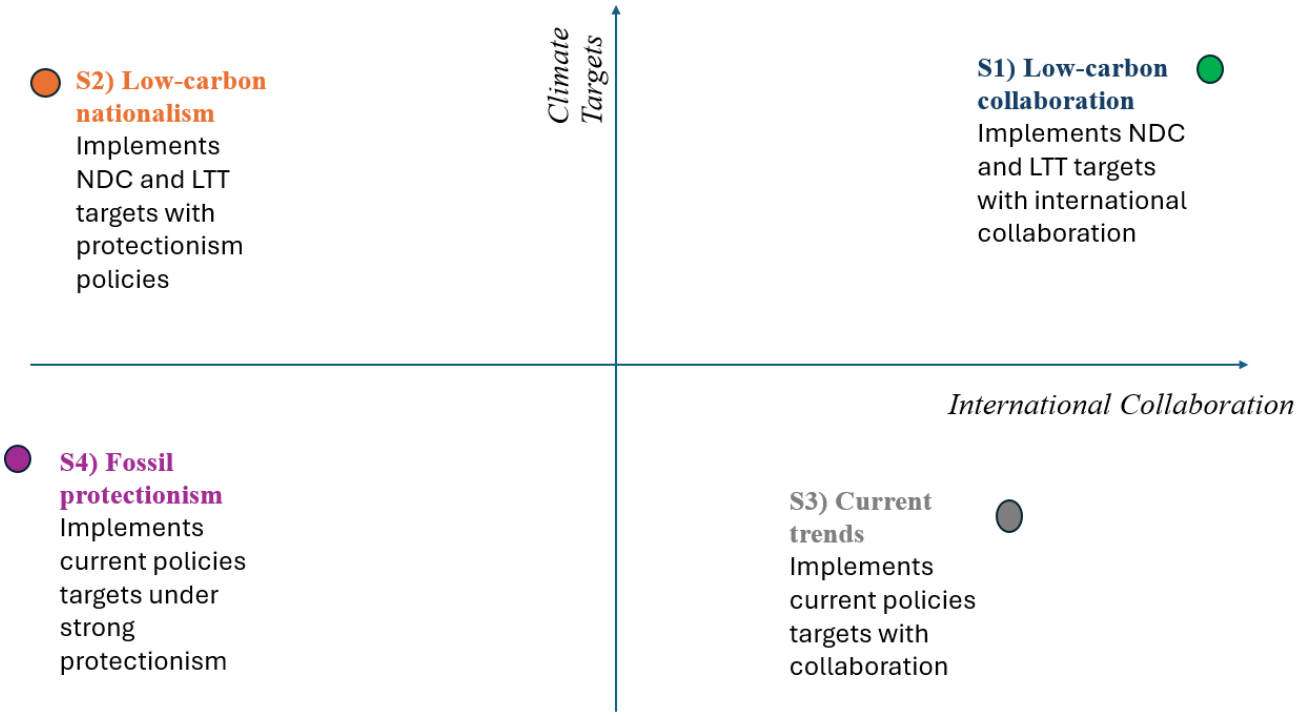

Figure 5 Main scenarios to be explored in the EU-CHINA Bridge project

The scenarios **S1 and S2** will form the basis of additional analysis (combined with the topics selected by the stakeholders) as the focus of the study is the assessment of low-carbon transitions, in line with the NDCs and long-term climate targets. In particular, in line with the current modelling setup, the scenarios S1 and S2 assume cost-optimality based on uniform carbon pricing across sectors in each country. This will lead to distributional effects across sectors and households. To address those effects, we develop additional scenarios trying to balance decarbonisation with societal equity. In particular we develop the below additional scenarios:

S1a) "Low-carbon and equitable collaboration" based on scenario assumptions of S1 (so countries achieve their NDC and LT climate targets) but assuming that revenues from carbon pricing are distributed back to most

vulnerable households that face the highest cost burden from the low-carbon transition through lump-sum transfers and targeted subsidies to incentivise building's renovation, the uptake of renewable energy by households, and the purchase of electric vehicles and heat pumps.

S1b) "Low-carbon and competitive collaboration" based on scenario assumptions of S1 but assuming that carbon revenues are distributed back to most trade-exposed industrial sectors that face the highest cost burden of the transition (i.e. as subsidies for EU steel, cement and chemical industries in order to maintain their international competitiveness) with possible effects on the uptake of low-carbon technologies and the resulting emissions

Similar assumptions hold for scenarios 2a and 2b exploring equity concerns but in a protectionist context

S1c) "EU-CHN Collaboration" based on similar assumptions as the S1 scenario but with even stronger cooperation between EU and China especially on green technology innovation, development and deployment. In this scenario, China and the EU establish close partnerships for climate action, by linking their ETS and carbon pricing systems, fostering low-carbon knowledge and innovation sharing, facilitating the trade of green technologies and products and establishing common standards for green products.

The scenario S2c explores similar assumptions for EU-CHN collaboration as the S1C scenario, but the strong EU-China collaboration for green technologies and decarbonisation happens in a fragmented world despite global tensions. The scenario aims to explore the net impacts and benefits of strong EU-China bilateral collaboration (i.e. in green technology innovation and development, knowledge sharing, establishment of common climate policies and standards for green products), while other world regions follow a fragmentation pathway based on protectionism and policies to promote national interests.

S1d) "Low-carbon collaboration with AI" is based on similar assumptions as the scenario S1 but with additional energy demand for AI and data centers (in line with the IEA report projections), but with some AI-enabled grid and system operation improvement.

Table 1 – Detailed scenario assumptions

	Scenario Name	Climate Target	International Collaborat	EU-CHN Collaboration	Other assumptions
S1	*Low-carbon & collaboration*	NDC + LT	Yes	Strong (esp. for green tech)	Cost-optimal
S1a	Low-carbon & equitable collaboration	NDC + LT	Yes	Strong (esp. for green tech)	As S1, but Carbon revenues back to those facing high costs
S1b	Low-carbon & competitive collaboration	NDC + LT	Yes	Strong (esp. for green tech)	As S1, but Carbon revenues used to subsidise industrial competitiveness
S1c	Low-carbon collaboration & EU-CHN Collaboration	NDC + LT	Yes	Strong (green tech and climate policy alignment)	As S1

S1d	Low-carbon collaboration with AI	NDC + LT	Yes	Strong (green tech and climate policy alignment)	As S1, but with specific assumptions on AI
S2	Low-carbon nationalism (regional rivalry)	NDC + LT	No	Limited (in line with nationalism context)	Cost-optimal
S2a	Low-carbon & equitable nationalism	NDC + LT	No	Limited (in line with nationalism context)	As S2, but Carbon revenues back to those facing high costs
S2b	Low-carbon & competitive nationalism	NDC + LT	No	Limited (in line with nationalism context)	As S2, but Carbon revenues used to subsidise industrial competitiveness
S2c	Low-carbon nationalism & EU CHN collaboration	NDC + LT	No	Strong (green tech and climate policy alignment)	As S2, but with stronger EU-CHN collaboration
S2d	Low-carbon nationalism with AI	NDC + LT	No	Limited (in line with nationalism context)	As S2, but with specific assumptions on AI
S3	Current trends	Current policies	Yes	Strong (esp. for green tech)	Cost-optimal
S4	Fossil nationalism	Current policies	No	Limited	Cost-optimal

Moreover, dedicated narratives for each scenario will be developed based on both the ongoing analytical outputs of the project and a targeted review of relevant literature. As an illustrative example, the table below presents a narrative framework focused on two key enabling infrastructures, green hydrogen production & infrastructure and carbon capture and storage (CCS) and their role in the decarbonisation of two core industrial sectors addressed by the project: iron and steel, and chemicals.

Table 2 – Possible narratives for two enabling technologies and infrastructure in the different scenario: green H2 and CCS

Scenario Code	*Scenario Name*	*Low-carbon Hydrogen Production and infrastructure*	*Carbon Capture Utilization and Storage*
S1	Low Carbon & Collaboration	Global low carbon H_2 trade potentially involving China as exploratory case (depending on cost, infrastructure feasibility and strategic alignment). . This will enable cost-effective uptake in both steel (DRI-EAF) and chemicals. Joint EU–China	Selective deployment in sectors where H_2 is less effective (e.g. cement). Joint R&D reduce barriers.

		deployment and standardisation of low-carbon products, such as hydrogen, steel and chemicals.	
S2	Low-carbon nationalism	Despite limited international cooperation, green H2 becomes a key pillar of national decarbonisation strategies. Deployment is accelerated through domestic production and regional partnerships, including infrastructure corridors such as the Hydrogen Backbone linking to North Africa. Technology choices and standards, however, remain country defined.	CCS becomes the key strategy, in China, with broader integration in industrial hard-to-abate sector and extended infrastructure in the country. In the EU, deployment of CCS continues under national planning, but progress varies by Member State due to permitting, costs, and public acceptance.
S3	Current Trends	Good uptake of H_2, mostly EU-driven. Some pilot projects in China. China is not part of the H2 potential importers for EU	CCS projects proceed in both regions, but remain constrained by infrastructure, costs, and public acceptance. Innovation Fund support in EU continues, with concentration in North Sea region.
S4	Fossil Protectionism	Scarce development of green H2 demand and its infrastructure due to persisting high costs and trade barriers	CCS is selectively used to extend the life of fossil fuel assets (e.g. in power and refining). Industrial CCS deployment remains marginal due to limited climate ambition and lack of infrastructure coordination.

The representation of additional electricity demand and system effects related to artificial intelligence in sub-scenarios S1d and S2d will be informed by the IEA's *Energy and AI* report (IEA, 2024) that offers recent and comprehensive insights into the potential impact of AI on electricity demand, particularly in relation to data centre development, as well as the opportunities for system optimisation through AI-enabled tools, alongside complementary dedicated literature and analysis.

The section above provides a qualitative description of the main scenarios that we want to explore with the available models in the context of the EU-CHN BRIDGE project. This provides an overall, broad framework in order to develop the alternative scenarios in the project. In order to take into account all the latest developments in the socioeconomic, technology and policy fields, the quantification of the specific scenario assumptions will be provided in the next deliverable of the EU-CHN-BRIDGE project (D6.2). In addition, the translation of the broad scenario assumptions into specific (both qualitative and quantitative) assumptions to be used in each of the models of our modelling suite (PROMETHEUS, GEM-E3, PRIMES, GAINS, GLOBIOM) will also be presented in Deliverable D6.

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