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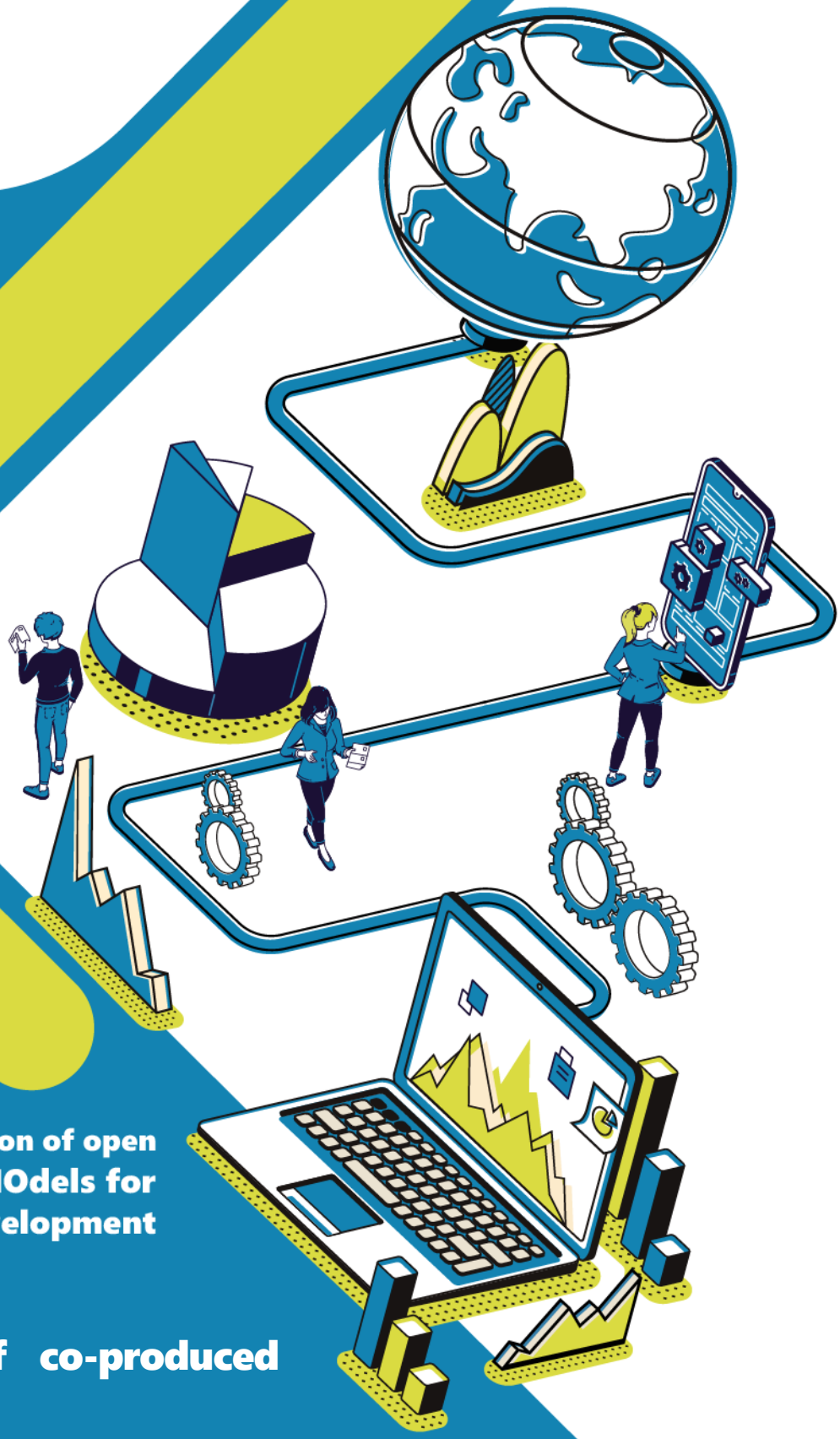

Delivering the next generation of open Integrated Assessment MOdels for Net-zero, sustainable Development

D2.6 – Synthesis of co-produced knowledge

WP2 – Co-design

Funded by the European Union

28/11/2025

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EC Summary Requirements

1. Changes with respect to the DoA

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

2. Dissemination and uptake

This deliverable can be used within DIAMOND to ensure model and scenario developments are socially and policy-relevant and robust. Modellers and climate researchers outside of DIAMOND can also use this publicly available deliverable to inform their model development activities and further incorporate stakeholder insights in their activities based on the findings highlighted herein.

3. Short summary of results (<250 words)

This deliverable (D2.6) presents and synthesises the co-produced knowledge generated across the four foresight workshops organised between September 2024 and November 2025 under the activities of Phase 2 of the DIAMOND project's transdisciplinary stakeholder engagement process. For this synthesis, content analysis and situational analysis are used to explore the multiplicity of perspectives in Integrated Assessment Model (IAM) development in the context of climate change. The workshops show a progression in how participants expect IAMs to evolve. The 'Model Requirements Workshop' highlighted requests to go beyond technoeconomic optimisation, toward higher sectoral and technological detail, explicit representation of specific finance and labour dimensions, and better integration of land–water–food–biodiversity dynamics. Participants underlined the importance of modelling behavioural heterogeneity and household choices, as well as incorporating uncertainty, extremes, and tipping points rather than relying on deterministic pathways. The 'Scenario Foresight Workshop' translated requirements into qualitative narratives across five themes; the results of this workshop highlighted systemic unsustainabilities in the current system (H1) and described viable future configurations (H3), characterised by decentralised community-based energy, sustainable farming and food systems, sufficiency-oriented mobility, circular industrial practices, and lifestyles oriented towards repair, reuse, and reduced material consumption. The 'Citizen Engagement Workshop', further expanded in the citizen-oriented side-event at COP30, elicited and deepened themes from a lived-experience perspective. Citizens emphasised that behavioural change depends on affordability, infrastructure access, administrative simplicity, and participatory governance, rather than on individual will alone. The synthesis of the workshops converges on six result areas: prioritising behavioural and social dimensions; sectoral and narrative priorities; explicit treatment of uncertainty and systemic risk; equity, inclusion, and governance; circularity and resource constraints; and integrated land–water–food–biodiversity considerations as necessary conditions for more legitimate, policy-relevant IAMs.

4. Evidence of accomplishment

This report.

Preface

DIAMOND will update, upgrade, and fully open six Integrated Assessment Models (IAMs) that are emblematic in scientific and policy processes, improving their sectoral and technological detail, spatiotemporal resolution, and geographic granularity. It will further enhance modelling capacity to assess the feasibility and desirability of Paris-compliant mitigation pathways, their interplay with adaptation, circular economy, and other SDGs, their distributional and equity effects, and their resilience to extremes, as well as robust risk management and investment strategies. This will be done via integration of tools and insights from psychology, finance research, behavioural and labour economics, operational research, and physical science. The project will develop a transdisciplinary scientific approach to legitimise the implementation process and co-create research questions that stretch the frontiers of climate science, as well as establish vibrant communities of practice to transparently open model enhancements and to develop capacities, thereby lowering the entrance barriers to the established IAM community.

ICCS	INSTITUTE OF COMMUNICATIONS AND COMPUTER SYSTEMS	EL
BC3	ASOCIACION BC3 BASQUE CENTRE FOR CLIMATE CHANGE - KLIMA ALDAKETA IKERGAI	ES
CESAR	KRATENA KURT	AT
CICERO	CICERO SENTER FOR KLIMAFORSKNING	NO
CYI	THE CYPRUS INSTITUTE	CY
E4SMA	ENERGY ENGINEERING ECONOMIC ENVIRONMENT SYSTEMS MODELING AND ANALYSIS SRL	IT
HOLISTIC	HOLISTIC IKE	EL
COMILLAS	UNIVERSIDAD PONTIFICIA COMILLAS	ES
ISINNOVA	ISTITUTO DI STUDI PER L'INTEGRAZIONE DEI SISTEMI (I.S.I.S) - SOCIETA'COOPERATIVA	IT
SEURECO	SEURECO SOCIETE EUROPEENNE D'ECONOMIE SARL	FR
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ESMIA	ESMIA CONSULTANTS INC.	CA
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EPFL	ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE	CH
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UNIBAS	UNIVERSITAT BASEL	CH
Imperial	IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	UK
Oxford	THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD	UK
UCL	UNIVERSITY COLLEGE LONDON	UK

Executive Summary

The DIAMOND project aims to update, upgrade, and expand six Integrated Assessment Models (IAMs) and their scenario space, using a transdisciplinary approach to better inform decision-making on climate change mitigation, its interplay with other development priorities, such as the circular economy, other SDGs, and associated distributional and equity effects. Within DIAMOND, WP2 facilitates this approach and informs all modelling and scenario developments through an open, responsible engagement process with the wider IAM community, researchers, policymakers, emissions-intensive industries, NGOs, and citizen groups on energy and climate. This deliverable (D2.6) presents and synthesises the co-produced knowledge generated across the four foresight workshops organised between September 2024 and November 2025 under the activities of Phase 2 of the transdisciplinary stakeholder engagement process. Using content analysis and situational analysis, it explores multiple perspectives in IAM development in the context of climate change.

The analysis is based on secondary data from the workshops' documentations, including agendas, internal reports, anonymised attendance lists, and DIAMOND's MS6 report on ethical and strategic foresight. We combined qualitative content analysis with situational analysis (Clarke, 2022) (messy and ordered situational maps, social worlds/arena maps, and positional maps) to identify human and non-human elements in the situation, their relationships, and the major positions in key controversies.

The four workshops form a coherent engagement sequence. Workshop 1 ('Model Requirements Workshop') used plenaries and thematic breakouts to co-define requirements for improving IAMs, focusing on sectoral and technological detail, behavioural representation, finance and labour, land–water–food systems, circular economy, and explicit treatment of uncertainty, extremes, and tipping points. Workshop 2 ('Scenarios Foresight Workshop') applied the Three Horizons framework to explore Horizon 1 (Business as Usual) and Horizon 3 (Viable Future) across power and upstream energy, water–land–biodiversity–food, residential and transport, industry and circular economy, and human behaviour and household choices, translated stakeholder needs and model gaps into qualitative scenario narratives. Workshop 3 (Citizen Engagement Workshop) convened a focus group of experienced climate-assembly participants from Milan and Bologna to elicit lived experiences of climate policies and socially acceptable behavioural changes in mobility, domestic energy, and wellbeing/consumption, underlining the importance of affordability, infrastructure access, and participatory governance. Finally, Workshop 4 ('COP30 Side Event') aimed to bring together policy, citizen and research priorities to inform climate action and promote climate solutions.

The synthesis highlights a converging requirement for IAMs to move beyond purely techno-economic optimisation and to incorporate behavioural heterogeneity, lifestyle shifts, social acceptability, and distributional impacts. Cross-cutting findings emphasise: behavioural and social dimensions in IAMs; sectoral priorities and narrative alignment; explicit representation of uncertainty, extremes, and systemic risk; equity, inclusion, and governance; circularity and resource constraints; and integrated treatment of land, water, food, and biodiversity. Mobility appears as a recurring priority, with stakeholders and citizens alike stressing cost, infrastructure, and planning as decisive for sustainable transport choices.

The analysis shows a progression from expert-led, enriched techno-economic cores (Workshop 1), through models understood as shared tools reflecting co-created futures (Workshop 2), towards expectations that IAMs operate within a space where citizen experiences, rights, and feasibility are central, and where distributional detail and ethical accountability become conditions for legitimacy (Workshops 3, 4).

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Table of Abbreviations

- **IAM(s)**: Integrated Assessment Model(s)
- **CCS**: Carbon Capture and Storage
- **DAC**: Direct Air Capture
- **BECCS**: Bioenergy with Carbon Capture and Storage
- **H1 / H3**: Horizon 1 (Business as Usual) / Horizon 3 (Viable Future)
- **EU**: European Union
- **JRC**: Joint Research Centre (European Commission)
- **WP**: Work Package
- **MS6**: Milestone 6
- **FAO**: The Food and Agriculture Organization of the United Nations
- **GAEZ**: Global Agro-Ecological Zones
- **KNOCA**: Knowledge Network on Climate Assemblies
- **COP30**: 30th UN Climate Change Conference of the Parties
- **SMEs**: Small and Medium-sized Enterprises
- **NGOs**: Non-Governmental Organisations
- **CMCC**: Euro-Mediterranean Center on Climate Change
- **AI**: Artificial Intelligence
- **DG CLIMA**: Directorate-general for Climate Action
- **DG ENER**: Directorate-general for Energy

1 Introduction

The DIAMOND project–*Delivering the next generation of open Integrated Assessment Models towards Net zero, sustainable Development*–aims to update, upgrade, and expand six IAMs along with the scenario space, using a transdisciplinary approach, to better inform decision-making around climate change mitigation and the interplay with broader aspects of climate action and sustainable development (Briers and Vienni-Baptista, 2024). Within DIAMOND, WP2 facilitates this approach and informs all modelling and scenario developments through an open, responsible engagement process with the wider IAM community, researchers, policymakers, emissions-intensive industries, NGOs, and citizen groups on energy and climate.

During the first steps of our activities, modellers, climate stakeholders, and decision makers were invited to attend two workshops aiming to i) co-define the requirements of IAM improvements in order to best respond to relevant concerns of stakeholders; ii) validate realistic reference scenarios describing projections under current policies; and iii) envision and assess alternative, desirable policy scenarios using scenario planning workshops.

Next, through a Citizen-based Workshop and a side-event during COP30, groups of citizens were invited to: (i) define socially acceptable and preferable practices to simulate in the IAMs; (ii) evaluate whether the reference scenarios fit with their perceptions, needs and desires; and (iii) envision practices and behavioural shifts that would support the transition from the reference to more sustainable scenarios, and that would be practical enough to be transformed into bottom-up actions.

Finally, we synthesised the outputs of these workshops using Content and Situational Analysis. Through this interpretative qualitative method, we explore the multiplicity of perspectives and nature of the transdisciplinary process, including discourse data and analyses (Clarke et al., 2015). This deliverable presents three types of maps (position, arena, and situational) and identifies the main gains and relationships established during the process of knowledge co-production. The process will conclude with a co-ownership of the co-produced knowledge using dialogue methods (Hubbs et al., 2021) in the next stages of the transdisciplinary process of the project.

The synthesis presented in this deliverable was created using content analysis and situational analysis methods across the three different workshops hosted between September 2024 and September 2025. The workshops were all hosted online, using a video conferencing tool and a whiteboarding platform where participants placed their inputs. The discussion is then supplemented with insights from the COP30 side-event, which took place in November 2025.

The workshops had three main foci:

1. A model requirements workshop focusing on IAM requirements
2. A strategic foresight workshop focusing on scenario requirements
3. An ethical foresight workshop focusing on citizen perspective on climate action
4. A side-event during COP30 to bring together citizen voices alongside scientific expertise

Apart from this introduction, the report presents the methods used to analyse secondary workshop data (Section 2). In section 3 we provide a synthesis of each of the three workshops, and in section 4, we provide a synthesis of the co-produced knowledge across the workshops. Section 5 presents insights from the final workshop organised as a side-event during COP30. The report concludes with a recap of the findings (Section 6), and the next steps for the final phase (Phase 3: Towards mode co-ownership) of WP2 which will conclude the co-design process in DIAMOND.

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2 Methods

This section outlines the methods used to produce a synthesis of the three main foresight workshops. The fourth workshop was organised on November 21, 2025, as a as a COP30 side-event, hence constituting a major opportunity for the project to link project (and broader research) activities with both the current policy agenda and citizen initiatives. However, this also means that this fourth workshop could not be meaningfully integrated within the detailed synthesis methodology but rather supplements the findings of the previous workshops.

At the same time, typically, in energy and climate policy modelling, the term foresight is associated with co-designing scenarios with stakeholders—e.g., through the three horizons framework (Sharpe et al., 2016). However, considering the DIAMOND project's scope to co-develop models, co-create research questions and priorities with stakeholders, and boost citizen engagement, a broader conceptualisation lying on activating futures knowledge was required (Dufva and Ahlqvist, 2015). Within this framing, the workshops were conceived already in the early stages of planning under two categories: 'strategic foresight' for stakeholder engagement (Workshops 1 & 2) and 'ethical foresight' for citizen engagement (Workshops 3 & 4). As such, even though only the second workshop explicitly applied the three horizons framework, all workshops can be viewed through the foresight prism, with the title of each one reflecting its specific goal.

In the next subsections, we outline data sources, and modes of analysis. The work done has ethical clearance from the ETH Ethics commission (EK-2023-N-54), with an amendment submitted on the use of Generative AI.

2.1 Data collection

The analysis presented in this deliverable is based purely on secondary data sources such as the reports, and documents used and prepared in the aftermath of the workshops. The following documents were used in the analysis:

1. Model Requirements workshop
2. DIAMOND Requirements Workshop: Scope and Agenda
3. DIAMOND – Requirements Workshop- Participants allocation Sessions 1&2 (anonymised)
4. DIAMOND Requirements Workshop: Draft Summary
5. DIAMOND Requirements Workshop: Internal Report
6. MS6- Ethical and Strategic Foresight
7. Strategic Foresight workshop focusing on scenario requirements
8. DIAMOND Scenario Foresight Workshop: Scope and Agenda
9. Scenarios Workshop-Stakeholders allocation (anonymised)
10. DIAMOND Scenario Foresight Workshop: Internal Report
11. MS6- Ethical and Strategic Foresight (official Horizon EU submission)
12. Ethical Foresight workshop focusing on citizen perspective on climate action
13. DIAMOND Climate-friendly Practice Workshop with Citizens: Internal Report
14. DIAMOND Lettera Cittadini: La tua voce per il clima (workshop invitation)

2.2 Data analysis

We used content analysis (Hsieh and Shannon, 2005) and situational analysis (Clarke, 2022) to analyse the data. A semi-automatised process was used with AI-assistance (ChatGPT v5.1) to create summaries of all the internal workshop reports and to identify keywords in the synthesised report, much like an auto-code function in tools such as MaxQDA. Studying and knowing the data well before using any AI-assistance was vital to identify any lost information through the synthesis process. This process of getting to know the data consisted of manually coding a full report into the different categories as defined by Clarke et. al 2022 (see below) and reading through all the

other reports before using AI-assistance to create the synthesis report. Though ChatGPT was helpful to synthesise a series of reports, it was not used for data interpretation and analysis. All AI outputs were checked for accuracy and edited before moving into the data analysis stage using content and situational analysis approaches (more details are provided in Section 2.2.2.2).

2.2.1 Content analysis

A synthesis of the three workshops was done using the above documents. First, a synthesis of each workshop was done, taking note of the workshop objectives, attendance, structure and findings. Once this synthesis was done for each of the three workshops, theses summaries were used to make a synthesis for all three workshops focusing on the attendance across the workshops, cross cutting findings, and a conclusion.

2.2.2 Situational analysis

A situational analysis serves as an extension of a grounded theory analysis (Strauss and Corbin, 1990), developed by Adele Clarke (2003, 2005), focusing on the situation being studied, including human and non-human elements and the relations between them (Clarke et al., 2022, p. 5). A situational analysis consists of doing four maps in order to analyse the relationship between all the human and non-human elements in the given situation. These maps are accompanied by memo notes made while making and analysing the four maps.

The situational map (Map 1) focuses on laying out all relevant human and non-human elements in the situation being studied (Clarke, 2022). This map starts out as messy and can then be ordered into overarching categories (see Annex 2 for this categorisation). The relational map (Map 2) is created by analysing the relations between elements in the situational map and asking what the nature of the connection is between elements, documenting these enquiries as memo notes. The social worlds / arenas map (Map 3) specifically analyses the social, organisational and institutional elements of the situation being studied. The final map, the positional map (Map 4), focuses on major positions taken in particular concerns or controversies that were found in the situational map data, mapping discourses in the situation (Clarke, 2022).

2.2.2.1 Manual coding and memos

A process of manually coding a full report was done to implement Clarke's et al (2022) method. Workshop 1 report was coded by first highlighting any of Clarke's elements, then extracting them to for a messy situational map, and then categorising them into the ordered situational map under the 13 categories. During the process of forming these maps, manual notes and memos were taken to enrich the workshop synthesis further. The synthesis presented in this deliverable is a combination of the content analysis and then refinements made by the situational analysis, presented in the next section.

2.2.2.2 AI-assisted categorising

The process to use AI tools for conducting the situational analysis was guided by Horizon European Union's Living Guidelines on the Responsible Use of Generative AI and by an internal guide, *Information Security and Artificial Intelligence (AI) Guide for Users of AI at ETH Zurich*. No personal data was uploaded to the AI tool, and the tool was instructed to only use the data provided, to give factual and neutral responses, and to avoid using any form of analysis or interpretation of the data. Therefore, the tool was used mainly as a mode of extracting appropriate keywords within a given research context provided by the researchers.

First, we described Clarke's situational analysis in detail referring to direct quotations from Clarke et al (2022). We uploaded all categories along with their definitions to perform the situational map. Once the AI tool understood the method well (this was confirmed by prompting the tool to provide a summary of the method), we created a

structure of analysis, or analysis protocol that the AI tool would use across all data uploaded. After the method was well understood (again by prompting the tool to provide a step-by-step protocol of the method), we moved to the core part of the requested activity. We described what the foresight workshops were, including the number and the types of data that we would upload for the analysis. We also routinely instructed the AI tool to recollect the agreed upon protocol to follow, to ensure no steps were lost or disregarded along the way.

We then uploaded the workshop synthesis and instructed the tool to extract keywords to produce a messy situational map. Then, all the elements were taken to Miro, and ordered manually into the situational analysis categories. We also added and refined keywords to ensure that no elements from the synthesis report were left out. Finally, an ordered situational map was created under the 13 categories provided by Clarke et al (2022). We used ChatGPT v5.1 as a brainstorming tool to formulate the actor map and the positional map, however these two maps were manually produced in the end without AI assistance.

3 Synthesis of individual workshops

This section provides individual syntheses of the three workshops held between September 2024 and September 2025. The workshops form a coherent engagement sequence that links (i) stakeholder requirements for IAM enhancement, (ii) qualitative scenario co-creation through the Three Horizon Frameworks, and (iii) ethical and societal engagement with citizens. Together, they provide structured inputs to guide model updates, scenario development, and communication activities in the next project phases.

Table 1. Overview of the three workshops hosted by ISINNOVA under WP2: Codesign

	Workshop 1	Workshop 2	Workshop 3
Date	September 2024	November 2024	September 2025
Title	DIAMOND Requirements Workshop	DIAMOND Scenario Foresight Workshop	DIAMOND Climate-friendly Practice Workshop with Citizens
Focus	Co-define stakeholder-driven priorities for improving Integrated Assessment Models (IAMs)	Articulate present-state challenges and desirable future characteristics across key systems for scenario development	Elicit lived experiences of climate policies and test ethical/public validation aspects relevant to IAM use
Format	Online (with structured thematic breakouts)	Online (three Horizon Method with structured thematic breakouts)	Online (focus group format)
Duration	2.5 hours	2 hours	1.5 hours
Participant count	36	37	6
Participant overview	DIAMOND modellers, research institutions, modellers, NGO, public authorities, private sector/industry	DIAMOND modellers, research institutions, modellers, NGO, public authorities, private sector/industry	Civil society representatives

3.1 Synthesis of Workshop 1: Model Requirements Workshop

3.1.1 Objectives

The Model Requirements workshop (WS1) aimed to co-define requirements for improving Integrated Assessment Models (IAMs) to better align with stakeholder priorities and policy needs. It provided a forum for dialogue between modellers, policymakers, industry representatives, researchers, and civil society actors. The goal was to ensure that IAM developments address real-world challenges related to climate change mitigation, adaptation, and broader sustainability transitions.

Specific objectives included:

1. Gathering stakeholder input to identify research questions relevant to IAM development.
2. Exploring how model improvements can better support climate policy design and evaluation.
3. Building mutual understanding between scientific modelling teams and end-users.
4. Initiating co-design of modelling questions and identifying priority themes for subsequent workshops.

3.1.2 Attendance

A total of 36 participants attended the workshop, representing a cross-section of DIAMOND partners, modellers, and external stakeholders. Table 2 presents the breakdown of participants according to their background.

Table 2. Representation of workshop 1 participants

Stakeholder groups	Interested stakeholders	WS1 registered participants	WS1 actual participants
DIAMOND modellers	-	-	20
Academia	30	16	9
International institution	4	1	0
Civil society	7	1	0
Government	11	6	5
NGO	7	1	0
Private sector/Industry	12	4	2
Total attendees	**65**	**29**	**36**

3.1.3 Workshop structure

The online workshop followed a participatory format with plenary and breakout sessions, based on the following agenda:

- Plenary opening session (20 min): Welcome, introduction to the DIAMOND project, and framing of workshop themes.
- Breakout Session 1 (45 min): Enhancing analytical capacities for more effective climate policy support (five breakout groups around key themes):
    - High-level and cross-sectoral issues
    - Residential & transport sectors
    - Power and upstream energy systems
    - Industry
    - Water, land, and other sectors
- Plenary group reporting (10 min): Presentation of discussion highlights by rapporteurs.
- Break (10 min)
- Breakout Session 2 (45 min): *Defining requirements aligned with stakeholders' pertinent questions* (three breakout groups around DIAMOND model development areas):
    - Climate change impacts and disruptive events
    - Land use change, forestry, and sustainability
    - Finance and labour
    - Human behaviour and household choices
    - Circular economy and other cross-cutting issues
- Plenary group reporting (10 min): Summaries from each thematic group.
- Plenary concluding remarks (10 min): Overview of key takeaways and next steps.

Mural (online white boarding platform) boards were used to systematically collect and organise participant feedback.

3.1.4 Workshop 1 Findings

3.1.4.1 Session 1: Enhancing Analytical Capacities

Main topics identified in the session at a sectoral basis included:

- **High-level and cross-sectoral:** Participants emphasised incorporating uncertainty and risk (e.g., climate damages, tipping points, and economic impacts of inaction) through probabilistic rather than deterministic models. They called for better regional and sectoral disaggregation, integration of breakthrough technologies, and explicit consideration of education and skill development timeframes in modelling transition readiness.
- **Residential & transport:** Discussions focused on defining and representing energy security, differentiating between public/private and passenger/goods transport, and accounting for behavioural and infrastructural factors affecting mobility demand. Participants highlighted the need to reflect climate impacts on transport infrastructure, price effects of climate policies, and evolving technologies (e.g., Virtual Reality/Augmented Reality) that may reduce travel demand.
- **Power (including upstream):** The group stressed the importance of integrating Carbon Capture and Storage (CCS) and energy storage technologies (batteries, hydro, hydrogen) into IAMs. They noted the need for regional prioritisation based on land and cost constraints, regulatory treatment of energy communities, behavioural and financial constraints on decentralised energy systems, and modelling of intra-EU energy trade dynamics.
- **Industry:** Participants underlined the importance of modelling circular economy approaches that include material efficiency costs, not just recycling benefits. They emphasised improved granularity for high-emission sectors (cement, steel), accurate treatment of CCS, Direct Air Capture (DAC), and Bioenergy with Carbon Capture and Storage (BECCS) technologies, and trade competitiveness (e.g., EU vs. North African green steel). Inclusion of renewable fuels and disruptive technologies (Artificial Intelligence, additive manufacturing) was also suggested.
- **Water, land, and other sectors:** The discussion highlighted integrating agriculture, water, and land-use impacts into IAMs, particularly through crop yield modelling (e.g., The Food and Agriculture Organization of the United Nations' Global Agro-Ecological Zones tool) and considering both yield and nutritional quality under warming conditions. Participants emphasised the energy-water-land nexus and the accurate accounting of bioenergy's CO_2 and energy content.

3.1.4.2 Session 2: Defining Requirements with Stakeholders

The main topics identified, that also defined the breakout focus sessions where: Climate change and disruptive events; Land use change, forestry and sustainability; Finance and labour; Human behaviour and household choices; and Circular economy and other issues. The findings are elaborated below:

- **Climate change impacts and disruptive events:** Participants discussed improving model capacity to represent local temperature variations, heat and humidity impacts, supply chain disruptions, and shifts in energy demand due to extreme events.
- **Land use change, forestry, and sustainability:** The session stressed balancing carbon mitigation and biodiversity goals, realistic modelling of CO_2 absorption by forests, the role of multifunctional land (e.g., agroforestry), and the inclusion of biodiversity indicators and wildfire impacts.
- **Finance and labour:** Discussion focused on modelling labour transitions, reskilling, and financial constraints affecting technology adoption. Participants recommended integrating job displacement, skill differentiation, and capital costs as constraints, as well as representing just transition and social policy measures like the Social Climate Fund.
- **Human behaviour and household choices:** The group discussed representing behavioural diversity and

cooperative dynamics (e.g., energy communities), distributional effects of climate measures, and technology-driven lifestyle changes. Participants recommended modelling scenarios by income group and accounting for health and local environmental co-benefits.

- **Circular economy and other issues:** Participants noted the water demand implications of green hydrogen production, integration of geothermal energy with CCS, and the need to better reflect regulatory barriers and delays in technology implementation within model frameworks.

3.2 Synthesis of Workshop 2: Scenario Foresight Workshop

3.2.1 Objectives

The second workshop (WS2) in the DIAMOND series aimed to initiate the participatory foresight process for co-creating future scenarios of incremental and transformative change in climate and sustainability transitions. Building on the requirements identified in the first workshop, this session applied the *Three Horizons* foresight framework to explore both the *current system (H1 – Business as Usual)* and *desirable future visions (H3 – Viable Future)*. The workshop was focused deliberately on Horizon 1, Business as Usual, and Horizon 3, Viable Future, and did not explicitly address Horizon 2 (*H2- the pathways of transition*), since the principal objective was to identify gaps in existing Integrated Assessment Models rather than to advocate for specific solutions. By unequivocally setting out the current starting point and the desired endpoint, the workshop was able to set the boundary conditions that models will have to address and, in so doing, allowed transition pathways to naturally surface via subsequent IAM simulations, as well as additional engagement activities including with citizens.

Key objectives of the workshop were to:

- Identify key signs of systemic unsustainability in the present (H1).
- Define the core features and "seeds of change" characterising desirable futures (H3).
- Facilitate structured dialogue among modellers and stakeholders to generate qualitative inputs to inform scenario development and subsequent modelling work.

3.2.2 Attendance

A total of 37 participants attended the Scenario Foresight Workshop. Table 3 presents the breakdown of participants according to their background.

Table 3. Representation of Workshop 2 participants

Stakeholder groups	Confirmed stakeholders	WS2 registered participants	WS2 actual participants
DIAMOND modellers	-	-	21
Academia	30	9	8
International institution	4	2	2
Civil society	1	0	0
Government	11	4	4
NGO	7	3	1
Private sector/Industry	12	1	1
Total	**65**	**19**	**37**

Civil society/NGOs were minimally represented within the first stage of the foresight workshops (i.e., with broader stakeholders) as the discussions were intended to be more technical in nature (i.e., discussions on model development, scenario assumptions etc.). Since the second stage of foresights explicitly focused on citizens, this

caveat was addressed through the planned citizen-focused workshops (Workshops 3 and 4) ensuring that civil society perspectives were incorporated in our process. By engaging with experienced climate assembly participants in discussions directly relevant to their lived experiences and practical concerns through these dedicated workshops, we aimed to ensure that their voices are not crowed out by other discussions.

3.2.3 Workshop Structure

The online workshop followed a structured process using interactive Mural boards and breakout discussions based on the following agenda:

- Plenary Introduction (10 min): Presentation of DIAMOND project objectives and workshop scope.
- Plenary presentation of foresight method (10 min): Overview of the *Three Horizons Framework* and practical notes for breakout discussions.
- Breakout Session 1 – Horizon 1: Business as Usual (30 min): Parallel breakout sessions exploring the question:
  "What are the signs that the current system is not viable or sustainable, and what is essential to retain?"
- Plenary reporting (10 min): Breakout group summaries shared.
- Break (10 min)
- Breakout Session 2 – Horizon 3: Viable Future (30 min): Parallel breakout sessions addressing the question:
  "What are the characteristics of the future system we want, and what seeds of change exist today?"
- Plenary reporting (10 min): Breakout group outputs and reflections shared.
- Closing (10 min): Concluding remarks and next steps.

Breakout groups were organized around five thematic areas:

1. Power and upstream energy systems
2. Water, land use, biodiversity, and food
3. Residential and transport systems
4. Industry and circular economy
5. Human behaviour and household choices

3.2.4 Workshop 2 Findings

The findings below from Breakout Session 1 and Breakout Session 2 are presented across the predefined themes, which also formed part of the breakout structure. The insights are provided in a narrative format, following the Horizon approach.

3.2.4.1 Session 1 — H1: Business as Usual (Current System Challenges)

Power and Upstream: The energy sector remains heavily reliant on resource-intensive processes and fossil fuels, generating significant CO_2 emissions and straining water resources. While renewables reduce fossil dependence, large-scale installations raise concerns about land use, ecosystem disruption, and waste management from decommissioned assets. Policy, governance, and geopolitical dependencies continue to challenge a just and equitable transition.

Water, Land Use, Biodiversity, and Food: Unsustainable land and water management practices, intensified by population growth and climate change, are leading to soil degradation, water scarcity, biodiversity loss, and reduced food security. Large energy and agricultural projects disrupt habitats and contribute to inequitable food distribution. Globalised supply chains amplify vulnerability to shocks, market volatility, and food waste.

Residential and Transport Systems: Transport systems remain inefficient, with excessive energy consumption per capita and continued dependence on fossil fuels. Residential infrastructure is inadequately resilient to climate impacts. Energy security concerns, geopolitical instability, and grid stress compound vulnerabilities, while short-

term planning limits sustainable reconstruction and innovation.

Industry and Circular Economy: Industrial systems operate within a linear growth paradigm that externalizes environmental and social costs. Dependence on critical minerals, lack of circularity, and exposure to geopolitical risks threaten sustainability. The absence of systemic circular practices heightens resource depletion and emissions, underscoring the need for regulatory and technological reform.

Human Behaviour and Household Choices: Inequitable access to energy and weak participatory governance hinder behavioural change. Households bear disproportionate environmental and health costs while having limited influence over systemic energy decisions. Lack of resilience and digital tools constrains adaptation to crises and limits the uptake of sustainable practices.

3.2.4.2 Session 2 — H3: Viable Future (Desirable Future Characteristics)

Power and Upstream: The future system combines centralised and decentralized energy production to improve resilience and flexibility. Smart grids, predictive technologies, and automation optimise distribution. Green hydrogen plays a central role in decarbonising hard-to-electrify sectors and providing storage capacity. Community-based energy systems and "efficiency-first" policies enhance equity and reduce overall demand.

Water, Land Use, Biodiversity, and Food: Agriculture adopts sustainable practices—reduced tillage, decarbonised fertilizers, precision irrigation, and biodiversity-enhancing methods such as agroforestry. Integrated water management and AI-driven efficiency systems improve resource use, while education and local planning promote adoption. Sustainable farming generates green jobs and contributes to resilient rural economies.

Residential and Transport Systems: Future systems will prioritise accessibility, affordability, and inclusiveness. Decentralized energy systems will empower local communities and strengthen resilience to disruptions. Smart mobility solutions, digitalised management, and renewable integration will support equitable access to clean transport and housing. Community-led initiatives such as car-sharing and solar cooperatives will reshape ownership models toward collective management.

Industry and Circular Economy: Circular economy principles dominate industrial systems, emphasising resource efficiency, material reuse, and waste minimisation. Distributed manufacturing and additive technologies enable localised, flexible production with traceable supply chains. New materials and energy-efficient processes reinforce sustainability and resilience against market and resource shocks.

Human Behaviour and Household Choices: Future systems emphasise equity, sufficiency, and decentralisation. Households use smart technologies to monitor and reduce energy consumption, supported by policies ensuring affordability for all. Behavioural change aligns with degrowth and sustainability principles, fostering a culture of repair, reuse, and shared resource management. Energy is recognised as a basic human right, underpinning inclusive and just transitions.

3.3 Synthesis of Workshop 3: Citizen Engagement Workshop

3.3.1 Objectives

The third workshop in the DIAMOND series aimed to integrate citizen perspectives and lived experiences into the process of improving Integrated Assessment Models (IAMs). This session represented the culmination of stakeholder engagement activities, focusing on *ethical foresight* within climate transition modelling.

The workshop sought to explore how citizen insights from Climate Assemblies and participatory governance initiatives could inform model design, scenario development, and interpretation of behavioural change

assumptions.

Specific objectives were to:

- Involve citizens with prior experience in Climate Assemblies to ensure deliberative legitimacy and inclusivity.
- Identify socially acceptable and desirable behavioural changes relevant to IAM simulations.
- Assess whether existing model scenarios align with citizens' perceptions, needs, and priorities.
- Generate actionable insights for integrating societal behaviour and value dimensions into IAM structures.

3.3.2 Attendance

The workshop series involved six citizen representatives—three representing Milan, and three Bologna—who had previously taken part in local Climate Assemblies or civic deliberation processes in Italy. While the Italian urban context, with its specific mobility patterns, building stock, and governance structures, has shaped participants' lived experiences, the core themes identified reflect broader concerns relevant across European cities, lending the findings transferability beyond the national context.

3.3.3 Workshop structure

The workshop consisted of a focus group conducted online in September 2025 under the *Chatham House Rule*, ensuring confidentiality and open expression. The session lasted 90 minutes and was structured as follows:

- Introduction: Presentation of DIAMOND project goals and the relevance of citizen engagement for model development.
- Thematic Group Discussion: Participants engaged in interactive dialogue guided by open-ended questions.
- Plenary Synthesis: Rapporteurs summarised group findings in plenary.
- Closing Reflections: Participants discussed how insights could feed into model assumptions and broader policy design.

The session used digital tools (polls, collaborative whiteboards) to capture insights. Thematic areas and guiding questions were as follows:

- **Mobility:** Explored how citizens' transport behaviours can evolve to support sustainable transitions, asking:
  - What factors shape transport choices (convenience, cost, accessibility)?
  - How do participants perceive electric or hybrid vehicles, and what are barriers to adoption?
  - How could citizens be encouraged to shift towards collective or low-impact mobility?
- **Domestic Energy:** Examined energy consumption habits and views on renewable adoption, asking:
  - What are the main household energy uses (heating, cooling, appliances)?
  - How willing are citizens to invest in efficient or renewable technologies (solar panels, heat pumps)?
  - Which incentives or policies could motivate changes in energy consumption?
- **Wellbeing and Consumption:** Investigated lifestyle practices influencing environmental impact, asking:
  - How do participants define a sustainable lifestyle?
  - What are typical dietary and consumption habits, and how might these evolve?
  - What strategies could reduce waste and promote more sustainable consumer behaviour?

3.3.4 Workshop 3 Findings

The findings below offer a blend between higher level findings that emerged through the process of analysing secondary data, and findings per theme directly originating from the workshop, namely mobility, domestic energy, and wellbeing and consumption.

3.3.4.1 High-level findings

Citizen perspectives on climate transition and behavioural change: Participants from citizen assemblies in Milan and Bologna emphasised that effective transition policies must align with daily life realities and socio-economic constraints. They stressed that behavioural change cannot occur without enabling conditions, including affordability, infrastructure access, and social equity.

Citizen participation: Citizens highlighted the importance of participatory governance in shaping fair and effective climate policies. There was strong interest in the continued exchange between modellers, policymakers, and citizens through structured feedback loops. Participants viewed inclusive climate modelling as an ethical responsibility, enabling science to better reflect societal priorities and values.

3.3.4.2 Theme specific findings

Mobility: Citizens generally supported active and public transport but noted that infrastructure, cost, and time barriers could hinder adoption. Electric vehicles were viewed positively but seen as accessible primarily to higher-income groups. Participants proposed expanding incentives for shared mobility, investing in cycling infrastructure, and improving intermodal public transport systems.

Domestic Energy: Participants identified home heating and cooling as primary sources of energy use. While there was interest in renewable solutions (e.g., solar panels, heat pumps), upfront costs, limited technical knowledge, and bureaucratic complexity were seen as key obstacles. Policy proposals included simplified access to subsidies, local community energy cooperatives, and awareness campaigns on energy-saving behaviours.

Wellbeing and Consumption: Sustainable lifestyles were associated with moderation, local food consumption, and reduced material waste. Participants recognised the growing awareness of plant-based diets but expressed concerns about affordability and cultural acceptance. Participants emphasised repairability and product longevity as key aspects of circular consumption and called for stronger regulation against planned obsolescence.

4 Synthesis of co-produced knowledge

This section provides a synthesis of the knowledge co-produced in the three workshops between September 2024 and September 2025. While the previous section summarises each workshop individually, this section brings all workshops together, to reveal cross-cutting findings across model requirements, scenario definition and citizens elicitation and their lived-experiences. It also incorporates the maps and reflections from the situational analysis conducted.

4.1 Overview

The three workshops collectively represent an integrated engagement process that combined technical, strategic, and participatory foresight elements. The process combined structured breakouts and plenaries (Workshop 1), Three Horizons foresight (Workshop 2), and citizen focus groups (Workshop 3). Each workshop built upon the preceding one to refine the alignment between model development, policy relevance, and social legitimacy.

Workshop 1 employed structured dialogues and thematic breakouts to establish a foundation for identifying model improvement priorities from the perspective of scientists, policymakers, and technical experts. Workshop 1 outputs emphasised technical model gaps—sectoral resolution, behavioural representation, and policy granularity. Workshop 2 (Foresight Scenario Co-creation) translated those priorities into shared visions and narratives through the *Three Horizons* foresight framework to explore near-term and long-term transitions through qualitative scenario-building. Workshop 2 outputs added to technical considerations by articulating systemic drivers of unsustainability and possible transformation levers. Workshop 3 extended this process to the public sphere, integrating citizen experience and behavioural insight into the broader model co-design, by contextualising the assumptions identified in the first two workshops.

Together, the three workshops provided a continuum from expert-driven model refinement to societally grounded foresight, ensuring coherence between technical capability and social acceptability.

4.2 Participation across workshops

Table 4 presents the breakdown of participants according to their background.

Table 4. Representation of participants across the three workshops

Stakeholder groups	WS1 participants	WS2 participants	WS3 participants
DIAMOND modellers	20	21	-
Academia	16	8	-
International institution	1	2	-
Civil society	1	0	6
Government	6	4	-
NGO	1	1	-
Private sector/Industry	4	1	-
Total	**36**	**37**	**6**

The Social World's/ Arena map (Figure 1) shows the dominant collective actors (social worlds) and their domain of interaction (arenas) that influenced the Foresight workshop series (*situation*). Arena 1, which encompassed climate research and modelling, was largely explored in WS1 and WS2. This arena largely dominated the *situation*, with the two workshops being positioned there as well. The third workshop brought in Arena 2 and Arena 3, with

participants represented in this space being directly affected by climate change and related policies (i.e., lived experiences). Many social worlds in these two arenas occupy mixed roles: some are actively involved in discussions and decision-making, some are primarily affected by climate change impacts, and others are not involved at all.

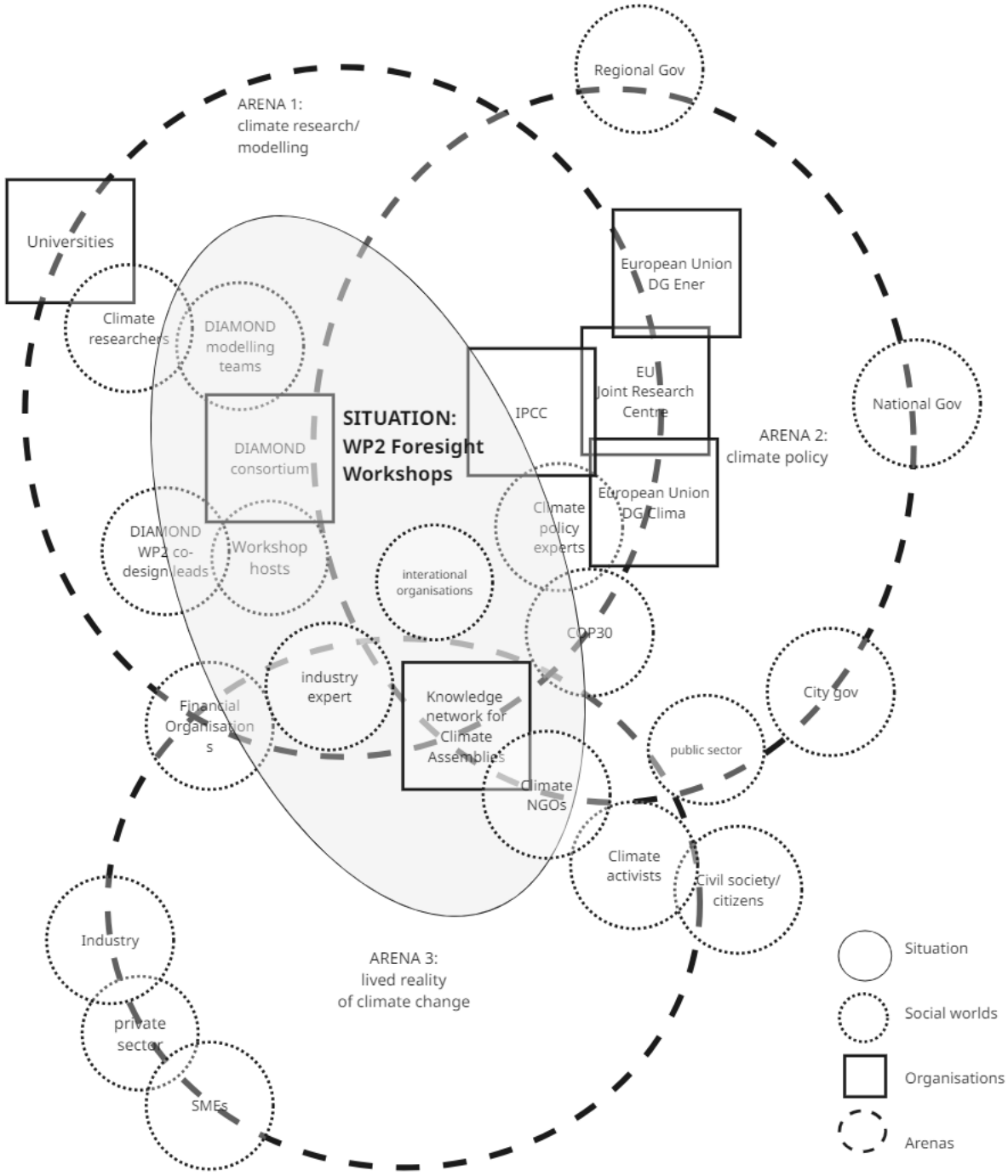

Figure 1. Social worlds / arenas map illustrating the position of different social groups and their organisations they form around in, and how these relate to the three DIAMOND foresight workshops.

4.3 Cross-cutting Findings

The three iterative workshops generated key discussion points and workshop outputs around model requirements, qualitative scenario inputs, and citizen elicitation that can be mapped to specific model modules and scenario parameters, as described below. What models represent, how they are developed, their level of detail and

managing uncertainty is also synthesised across the three workshops presented in the two positional maps, finalising the cross-cutting findings.

Behavioural and social dimensions in IAMs: Across the series, participants asked that models move beyond purely techno-economic pathways to represent how people actually change behaviour and how policy costs/benefits are distributed across income groups. There was strong consensus that IAMs must incorporate behavioural heterogeneity, lifestyle shifts, and social acceptability factors. Workshop 1 framed this as a requirement for modelling behavioural choices, distributional effects, and income-differentiated scenarios to assess feasibility and public support. Workshop 3 provided concrete citizen inputs describing what enables change (affordability, infrastructure availability, simple processes) and where households perceive barriers, supplying grounded evidence to calibrate such behavioural representations.

Sectoral priorities and narrative alignment: Workshop 1 identified priority gaps to address in models across transport, power and storage (including CCS and hydrogen), industry and circular economy, and the land–water–food system. Workshop 2 then organised foresight dialogues around these same domains, producing H1 (present-system problems) and H3 (future-system characteristics) that translate the gaps into qualitative scenario elements. Workshop 3 focused citizens on mobility, domestic energy, and consumption/well-being, mirroring the sectoral scope at household/community scale to inform practical assumptions (e.g., adoption drivers, affordability).

Uncertainty, extremes, and risk: Stakeholders across disciplines emphasised the need for IAMs to explicitly represent uncertainty, disruptive technologies, and system tipping points. Stakeholders in Workshop 1 requested probabilistic treatment of uncertainty, explicit handling of disruptive events and supply-chain shocks, and attention to transition risks within IAMs (not only climate risks). Workshop 2's H1 discussions catalogued present-system vulnerabilities that these probabilistic and shock-aware features should capture (e.g., fossil exposure, resource constraints, governance and equity stresses). Citizens in Workshop 3 asked for city/region-level information to guide collective action, that clarifies what to expect locally and which collective actions are most impactful, indicating the scale and communication needs for risk outputs.

Equity, inclusion, and governance: Participants stressed that climate transitions must address inequalities, accessibility, and the distributive effects of policies. Workshops 1 and 2 stressed the need to assess distributional impacts and just-transition issues when comparing policy packages or technology pathways. Workshop 3 underlined citizen acceptance, reinforcing this with evidence that costs and infrastructure gaps are primary obstacles for households, and that participatory processes such as citizen assemblies, help build acceptance and legitimacy for policies derived from model scenarios.

Circularity and resource constraints: Workshop 1 called for IAMs to model material-efficiency costs and critical resource dependencies explicitly, noting that current practice can overstate benefits if such costs are omitted. Workshop 2's H3 futures described circular industrial systems, distributed production, and traceable supply chains as elements to include in scenario design. Workshop 3 outlined consumer-level priorities such as product longevity, repairability, and action against planned product obsolescence that can be used as parameters for demand-side circularity assumptions.

Land use, water, food and biodiversity: In Workshop 1, participants recommended integrating agronomic tools (e.g., GAEZ outputs) and accounting for both yield and nutritional quality of crops under warming, as well as accurate bioenergy accounting and biodiversity considerations. Workshop 2's H3 visions stressed specific sustainable practices (e.g., reduced tillage, precision irrigation, agroforestry) and biodiversity-positive strategies as part of viable futures. Workshop 3 linked everyday practices such as household consumption choices and food waste reduction to these systemic objectives, highlighting practical feasibility aspects at the citizen level.

Mobility focus: Transport appeared in all workshops but with different emphases: Workshop 1 treated it as a

modelling gap requiring attention to behaviour, pricing, and planning; Workshop 2 developed future mobility features (e.g., accessibility, smart systems, reduced fossil reliance) in H3 future narratives; and Workshop 3 prioritised public/active transport (e.g. biking, walking) and shared mobility, citing cost and infrastructure as decisive for uptake.

Governance and participation: All groups highlighted the need for ongoing dialogue between science, policy, and society to strengthen mutual understanding and accountability, the difference being the level of involvement, form validation of model results favoured in workshop 1, to deep co-production favoured in workshop 2 and 3.

Developing IAMs – what is represented and who participates: When looking at the three workshops together, two main questions around developing IAMs and scenarios arose. First, who shapes IAMs and second, what is included in IAMs? In the Model requirements workshop (Workshop 1), the overall centre of gravity remains: expert-led enriched core, with stakeholders shaping what gets added into the toolbox, (Position 1 and 2 on the map in Figure 2). In the Scenario Foresight Workshops (Workshop 2), the discourse 2 pulls more strongly into the co-production and expanded scope half of the map, shown as Position 3 and 4 on the map. This shows that IAM development is clearly thought of as beyond the narrow techno-economic core and moving towards models as shared tools that must reflect co-created visions. The discourse in the citizen focused workshop (Workshop 3), is positioned mostly in the co-produced / expanded scope corner, with Position 5 and 6, where the importance of models as decision-making tools is questioned. The map does show that in all three workshops the consensus is that models should move away from the techno-economic core to expanded representations of social, behavioural and even ethical aspects.

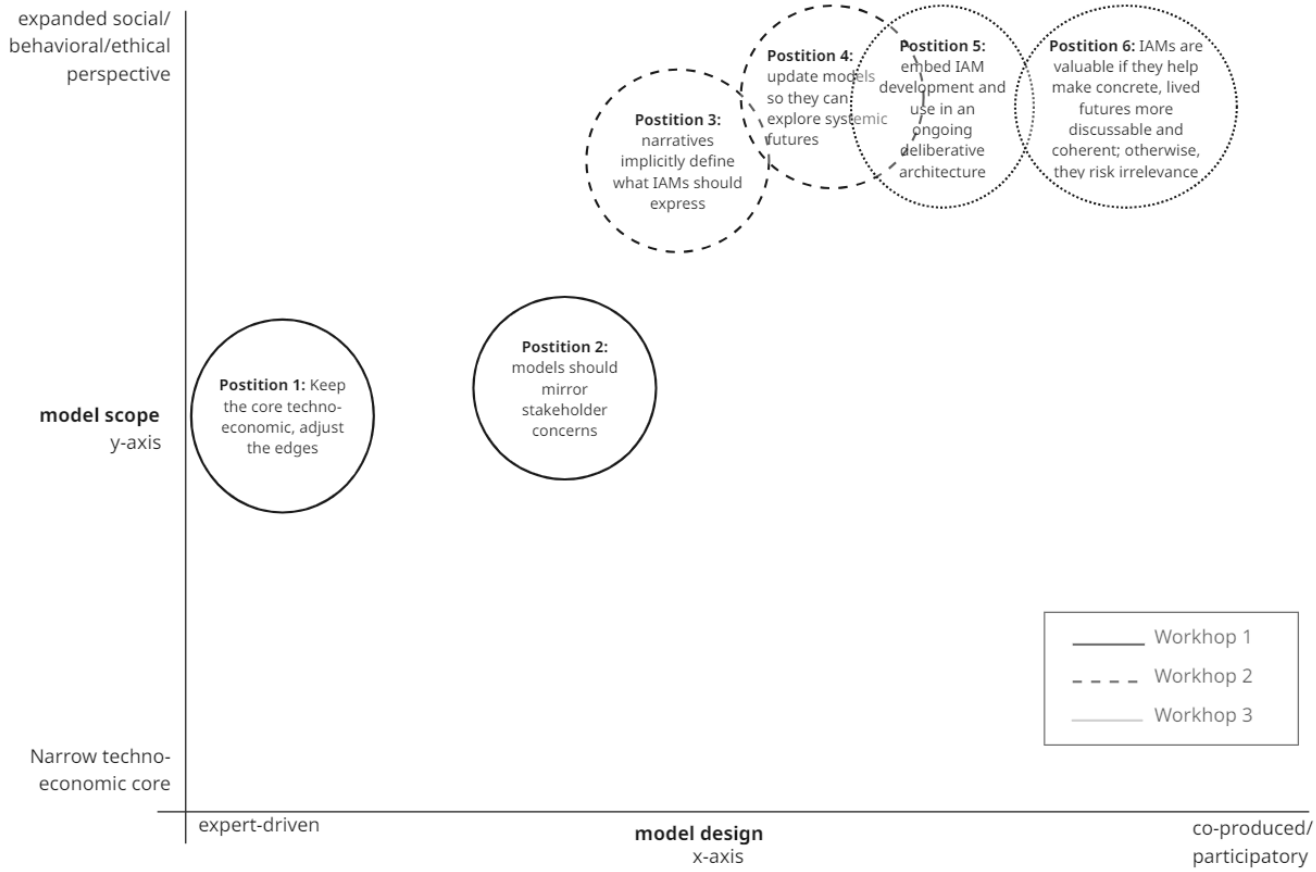

Figure 2. Positional map 1 - Developing IAMs, what is represented and who participates

IAMs dealing with uncertainty, optimisation and granular detail: Position 1 and 2 on the map below (Figure 3) shows how Workshop 1's discourse pushed away from classic optimisation, calling for more detailed sectoral modules, and desire for better spatial resolution as well as richer structural representation (for example representing labour transitions). Requests for probabilistic treatments, explicit extremes and tipping points, and attention to distributional effects (by income groups, health impacts, local air quality) shows a push towards acknowledging uncertainty in models. Therefore, calls to enrich structure and start exposing risk and distribution were highlighted in Workshop 1, but still within an optimisation framing. Workshop 2 shifted focus toward uncertainty and multiple futures, shown in Position 3 and 4 on the map. Position 2 calls for multiple future imaginaries and implicitly supports IAMs that explore sets of futures and robustness, not single deterministic outcomes. Position 4 calls for more equitable, decentralised and less vulnerable futures, expecting models to surface distributional metrics of who wins and who loses. Workshop 3 was less about formal probabilities, and more about granularity and distribution in lived terms, resonating with Position 4 on the map, with citizens wanting to know who is affected, who can afford what and how crises such as heat, or infrastructure damages affect people – pointing to the need to model extremes and shocks. Position 5 on the map shows that citizens in the workshop were concerned about increased granularity and modelling "*risk where it mattered*", without making models too complex.

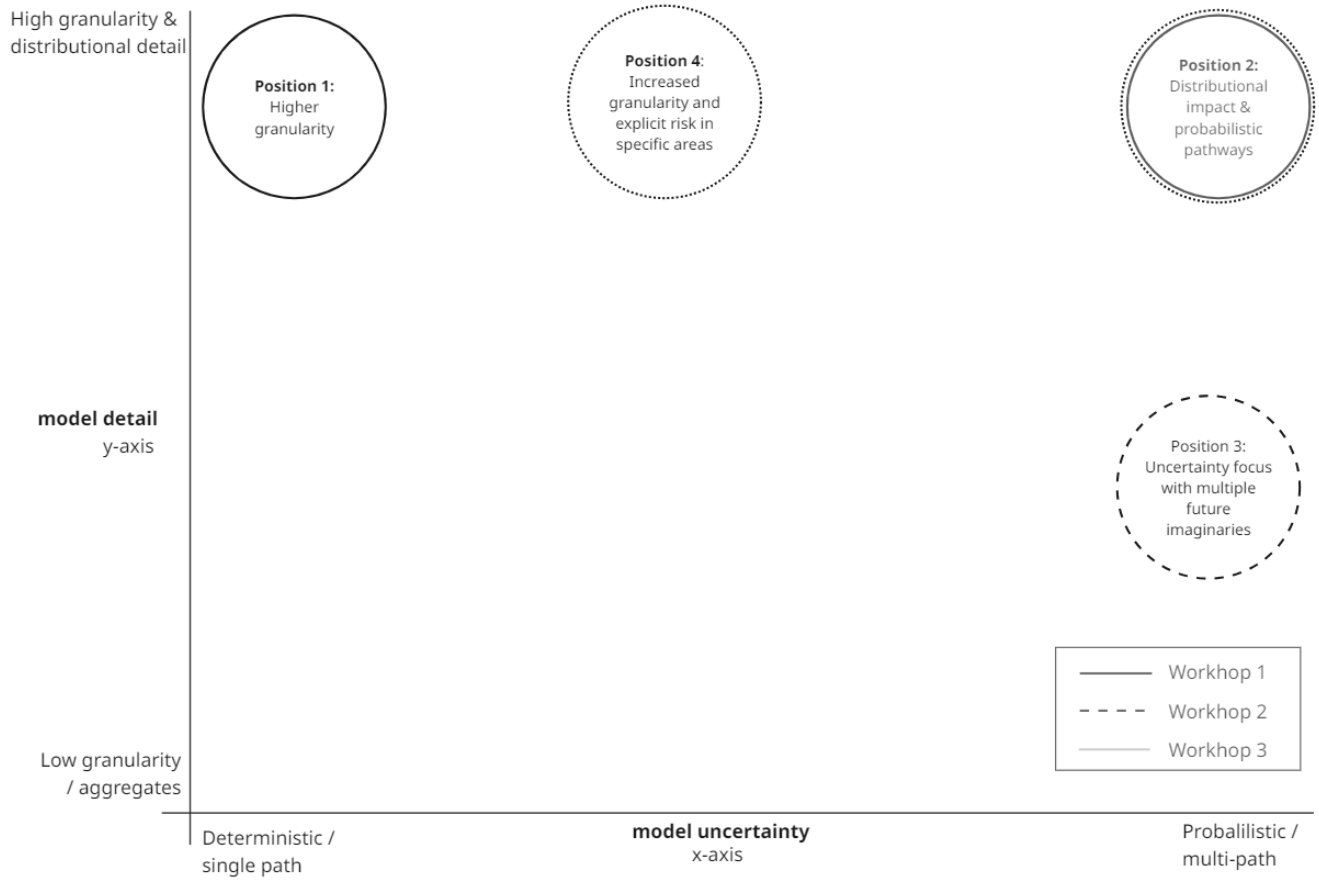

Figure 3. Positional map 2 – IAMs dealing with uncertainty, optimisation and granular detail

5 Workshop 4: COP30 side-event "Bridging Scientists & Citizens for Climate Action"

On November 21st, 2025, DIAMOND co-organized and participated in the COP30 Side Event entitled "Bridging Scientists & Citizens for Climate Action." This was an online event hosted by the Mediterranean Pavilion, and co-organised by ISINNOVA and the Euro-Mediterranean Economists Association (EMEA), bringing together the Milan and Bologna citizens assemblies, the Global Citizens Assembly network, and partners from three EU-funded projects: DIAMOND, C4LA (Community for Living Areas), and CROSSREIS. The event was structured based on the following agenda:

- Opening Remarks by Yara Saab – Director, Euro-Mediterranean Economists Association (EMEA)
- Keynote Speech – The Vision: From Controlling to Caring for Climate by Carlo Sessa – Executive Board Member and Senior Researcher, Euro-Mediterranean Economists Association (EMEA); Former President and Research Director, Institute of Studies for the Integration of Systems (ISINNOVA)
- Panel Discussion – Learning from Experiences. Moderator: Magali Outters – Senior Sustainability Expert – C4LA Manager, Euro-Mediterranean Economists Association (EMEA)
    - Citizens Assemblies on Climate: Experiences in Italy**:**
        - *Giuliana Gemini*, Consorzio Poliedra, Politecnico di Milano
        - *Christina Paci*, Comune di Milano
        - *Ettore Menguzzo*, Citizen of the Milan assembly on climate
        - *Marianna Precone*, Citizen of the Bologna assembly on climate
    - DIAMOND project – Connecting the climate modelling and citizens' assembly communities: *Konstantinos Koasidis*, Institute for Communications and Computer Systems (ICCS), National Technical University of Athens (NTUA), DIAMOND project manager
    - Global Citizens Assembly: *Iñaki Goñi*, Iswe Foundation
    - Exploring new participatory frameworks beyond traditional consultation models: *Anja Prislan*, E-Zavod, BAUHAUS4MED lead partner, Thematic project of the Green Living Areas Community (C4LA)

The event was streamed live via YouTube, while the recording of the event is already publicly available[1].

The main focus of the workshop was the transformation of climate governance from centralised, top-down approaches to more democratic, participatory models that include citizen voices alongside scientific expertise. Notably, drawing from climate governance approaches that face challenges and a lack of mechanisms to translate citizen recommendations into implementation, the participants inter alia talked about the docking problem, defined as the critical gap between citizen deliberations and concrete policy action. During the keynote speak the notion of moving beyond controlling to caring for a resilient climate was introduced.

[1] https://www.youtube.com/watch?v=WXCtBELZCII

5.1 Insights

Citizens demonstrated sophisticated understanding of how different layers of action interconnect:

- **micro-level:** individual or household actions to reduce footprint and vulnerability;
- **meso-level:** community and organisational actions requiring collective coordination;
- **macro-level:** systemic changes requiring policy intervention.

They emphasised that individual actions alone are not enough, and that enabling policies and infrastructure are needed to make sustainable choices accessible and affordable.

Process insights were shared over the most efficient ways for citizens assemblies to operate. Notably an implementation gap was highlighted, related to citizens assemblies successfully co-designing actions in about two months, while actual implementation through municipal administrations may take years, with processes that remain largely obscure to citizens. This observation can transcend the boundaries of citizen assemblies and resonate with experiences at the global level that IAMs typically operate. Notably, climate pledges during COP26 put the Paris Agreement target within reach (van de Ven et al., 2023), yet with significant implementation challenges still remaining (). Three critical questions emerged:

- How to achieve a faster and more efficient implementation?
- How can citizens play a catalysing role during the implementation phase?
- How to keep citizen engagement beyond ex-post monitoring?

Several success factors emerged from the Italian experiences: i) the Milan and Bologna assemblies included training and listening phases ensuring everyone started from the same knowledge level; ii) structured deliberation moving through clear stages; iii) permanent structures like Milan's ongoing assembly rather than one-off consultations; iv) transparent mechanisms connecting local decisions to higher governance levels; and v) multi-stakeholder engagement with citizens in dialogue with policymakers, businesses, and technical experts.

The viability of this model has been demonstrated: Milan's permanent assembly has produced recommendations annually for three years; Bologna's monitoring committee successfully tracks implementation progress with quantitative metrics; and citizens showed clear capacity to constructively engage with complex scientific scenarios.

Tens of thousands of participatory processes have been mapped all over the world in the past five years, highlighting that the problem may not lie in a lack of solutions or processes but in the absence of connective infrastructure. Approaches such as the Global Citizens Assembly may contribute towards constructing a connecting tissue that brings processes together.

The DIAMOND approach focuses on co-development (i.e., developing models with openness and transparency to ensure both policy relevance and societal legitimacy) and co-design (i.e., working with stakeholders to formulate the research questions our models will address). This ensures DIAMOND operates at the intersection of quantitative modelling and meaningful engagement. Concretely, this means that there are opportunities for the IAM model community to contribute to local efforts by integrating citizen insights as boundary conditions, constraints, and assumptions in models; modelling specific interventions proposed by bottom-up initiatives; scaling up local observations to inform global-level modelling; and providing feedback to citizens on how their local actions connect to global climate impacts. By doing that, the complex knowledge of the models can be potentially put at the service of citizens.

The event concluded by reinforcing that global climate decisions must be grounded in both scientific evidence and citizen voices to be truly effective.

5.2 Path forward

As a final note, the creation of permanent deliberative infrastructures that couple citizens' assemblies with living labs and climate models to systematically address COP30 objectives could be explored. Such an initiative would directly align with Brazil's COP30 "Granary of Solutions" framework, which has 6 thematic axes and 30 key objectives. This would ensure that citizens and local communities actively co-create, implement, and transfer these solutions from the ground up. By coupling citizens' assemblies with living labs, we could create permanent deliberative infrastructures that can systematically address COP30 objectives.

6 Recap and Outlook

The foresight workshops were convened to co-produce content that improves Integrated Assessment Models (IAMs) by aligning model development with stakeholder priorities, qualitative futures, and citizen perspectives; the overarching aim was to generate clear, usable inputs for model updates and scenario design across sectors and scales. Participants spanned academia and research, public authorities at local, national and EU levels, civil society/NGOs, private sector/SMEs, and citizen assemblies, with citizens bringing lived-experience evidence on behavioural feasibility and equity. A limitation that should be acknowledged is that participation was somewhat unbalanced in favour of researchers, policy makers, and industry, However, the structure of the foresight workshops (i.e., two focusing on general stakeholders, and two on citizens), aimed to ensure that all different perspectives can be heard and be reflected in our research activities.

The series mainly comprised three online events: the Requirements Workshop in September 2024, which elicited stakeholder-driven priorities for IAM improvements; the Foresight Workshop in November 2024, which developed present/future narratives using the Three Horizons method; and a citizen focus group held in September 2025 gathering inputs on mobility, domestic energy, and wellbeing/consumption. These were supplemented by a citizen-based side-event during COP30 in November 2025, aiming to bridge the gap between policy, citizen initiatives and research.

Across the series, the substantive outcomes cluster around seven themes, namely: behavioural and distributional realism in IAMs; transport and mobility; power and upstream energy; industry and the circular economy; land–water–food and biodiversity; uncertainty, extremes and systemic risk; equity, inclusion and governance.

Regarding the development process and focus of IAMs, the workshops called for a structural expansion of IAMs (i.e., more sectors, feedbacks, constraints) including representation of uncertainties and distributional impacts (Workshop 1). Workshop 2 showed that IAMs should also be re-imagined as tools that reflect co-created futures, supporting multiple pathways rather than single trajectories, and connecting to systemic visions (justice, sufficiency, decentralisation). The third workshop called for IAMs to be invited into a space where citizen experiences, rights, and feasibility play a central role, and where distributional detail and ethical accountability become necessary conditions for legitimacy. Finally, the fourth workshop called for bringing together both robust scientific evidence and multiple citizen perspective to ensure effective policy implementation.

We should note that the foresight workshops analysed in this report constitute only part of the transdisciplinary process followed in DIAMOND. Extensive engagement has already taken place through multi-stakeholder discussion groups to provide co-created research questions of interest to a wide range of stakeholders (see D2.5 for more details). The two processes supplement each other, with the foresight workshops offering insights on model development and high-level scenario conceptualisation, while multi-stakeholder discussion groups provide tangible questions of relevance to stakeholder. As such it should be acknowledged that not all stakeholder and citizen insights presented in the report can be meaningfully taken on board within the activities of DIAMOND. It is therefore important to also view this report as valuable for further research beyond the DIAMOND project.

The synthesis and situational analysis, along with the research question presented in D2.5 will inform the final phase (Phase 3: Towards model co-ownership) of the co-design process, which is focused on integrating all co-produced knowledge, including the gaps identified for further development. During Phase 3, all insights and outputs that form part of the co-design process will be discussed considering stakeholder interests and DIAMOND's initial research goals. In this final phase, we will jointly assess the quality, social robustness and practical relevance of outputs, uncovering further areas for research and identifying potential impacts that the DIAMOND transdisciplinary process achieved, which will be reported in *D2.7,* concluding the co-design efforts.

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Annex 1: Messy Situational Map

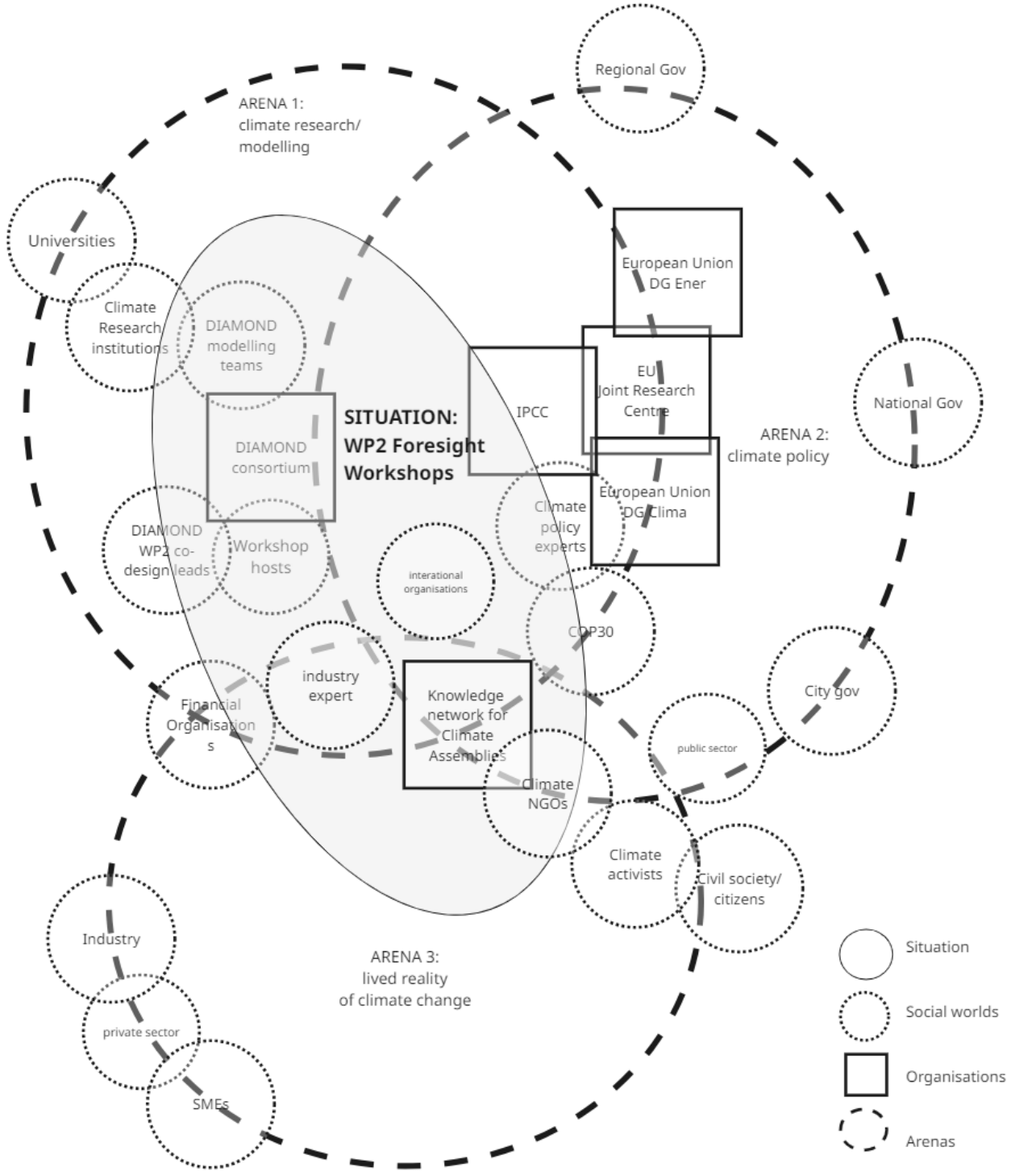


Annex 2: Ordered situational map

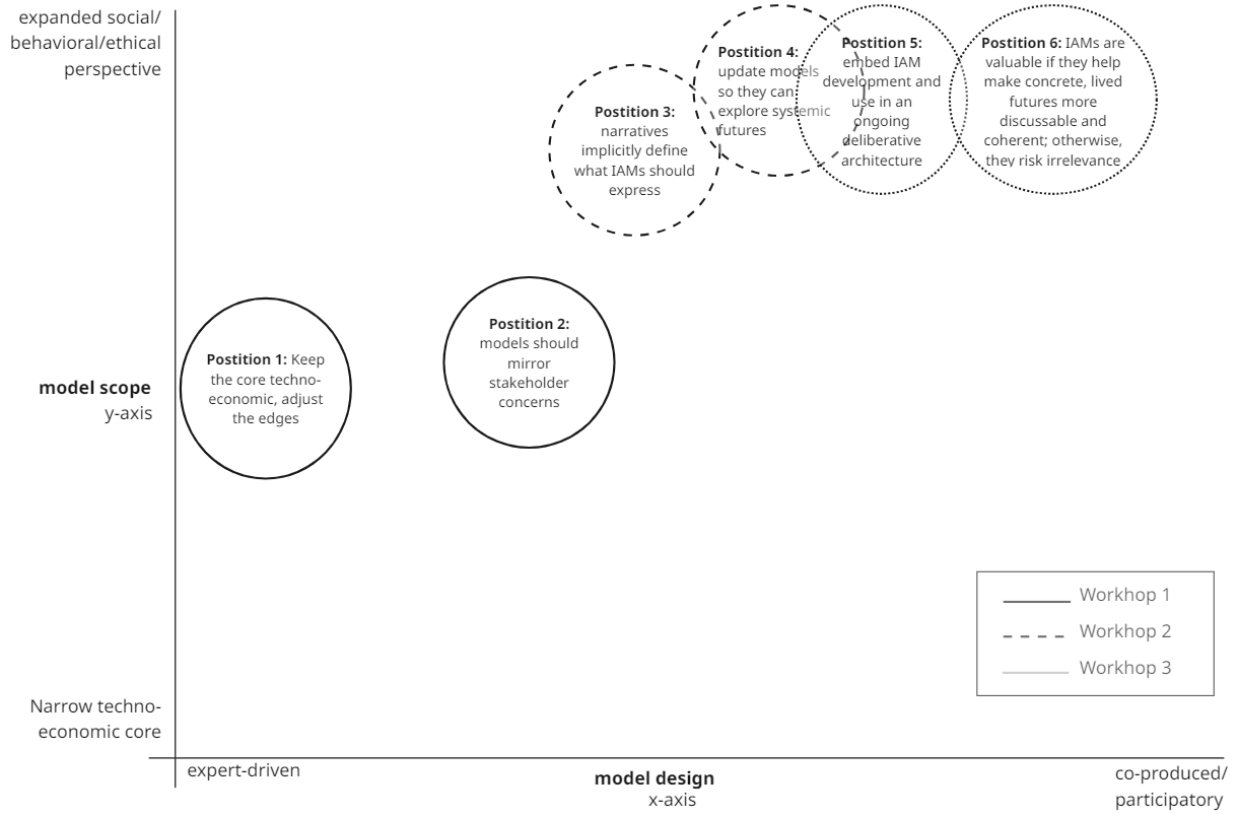
Category	Element	
individual human elements	Climate policy experts	industry expert
	IAM modeller	Sustainability scientist
	workshop host/facilitator	Government officials
	Climate researcher	citizen
	business owner	
collective human elements	JRC	NGO
	KNOCA	Climate Assemblies
	COP30	Research institutions
	DIAMOND WP2 co-design leads	International organisations
	City gov	IPCC
	European Union	National Gov
	Regional Gov	SMEs
	Financial Organisations	Industry
	Finance/Labour module	DIAMOND consortium
	DIAMOND modelling teams	
non-human elements	Ships	Mural boards
	Airplanes	Online polls
	Trains	Breakout rooms
	Freight transport	Zoom
	Public transport	Circular Economy Module
	Bicycles	Finance/Labour module
	Public transport	Land-use module
	Electric Vehicles	Agriculture
	smart grids	Foresight tools
	Heat pumps	Energy models
	Carbon Capture and Storage	Behaviour module
	Hydrogen	Agendas
	Energy storage	Direct Air Capture
	Three Horizons H1/H3 Scenarios	Heating systems
	IAMs	Cooling systems
	Augmented Reality	Virtual Reality
Implicated/silent actors/actants	Water	Informal settlement residents
	Forests	Nature/ecosystems
	Global South publics	Elderly
	Future generation	Youth
	Low-income groups	Climate Refugees
discursive constructions of human actants	Scenarios as co-created narratives—linking daily practices (mobility, energy, consumption) to policy packages and model levers.	IAMs moving beyond “black box” to openness and transparency
	Data/tools (Mural/polls) as inclusivity enablers capturing diverse inputs.	IAMs should show distributional outputs
	IAMs should make extremes and tipping	IAMs should include multiple views

	points explicit	
	IAMs need more granularity	IAMs should be probabilistic
sociocultural/ symbolic elements	Repair/reuse cultures	Just transition
	Valuing biodiversity	Sustainability practices related to value systems
	Citizen voice for the climate	Sufficiency
	Efficiency first	Sustainable diets/lifestyles
	Energy as a human right	
political and economic	Policy instruments as enablers of behaviour change.	trade competitiveness (e.g., green steel)
	subsidies	cost of capital
	incentives	labour transitions/reskilling
	COP30/GCA arenas shaping attention, legitimacy, and coalition building.	Geopolitics
	Distributional impacts, affordability	cross border trade agreements
Temporal elements	urgency amid climate extremes	trust/mistrust in models
	H1 present situation	need shorter term horizons
	H3 ideal future scenario	bureaucratic delays
	adoption lags (skills, capex cycles)	sudden shocks
	frustration with bureaucracy/cost barriers	adoption
	Climate anxiety	political cycles
spatial elements	scalability of local actions to EU/global pathways	transnational networks (Global Citizen Assemblies)
	Regional/EU land/water constraints	cross-border agreements
	availability of land	carbon leakage
	Global: COP30	energy autonomy
	regional cost differentials	energy decentralisation
	EU regional diversity	City-scale climate action
Major issues/debates	Bioenergy accounting	model trade-offs
	modelling uncertainty and tipping points	centralised vs decentralised systems
	deterministic vs probabilistic IAMs	Tech-centric vs behaviour/sufficiency pathways
	land-use trade-offs	Ambition/speed vs equity/feasibility
related discourses	Citizens-at-COP discourse via GCA; “from city halls to global halls” storyline connecting local deliberation to UN venues.	EU evidence-based governance and open science narratives around IAM improvement.
	EU evidence-based policymaking norms;	Ethical foresight & public validation as normative expectations for model legitimacy.
	climate justice narratives	
discursive human	“Networks as multipliers”—GCA/KNOCA amplifying citizen voice and peer learning.	“Municipal actors as enablers of supportive environments (infrastructure, subsidies, process continuity).”
	“Modellers need stakeholder input”—to align assumptions with real-world constraints and uncertainties.	“Citizens as ethical validators”—providing feasibility, fairness, and legitimacy.

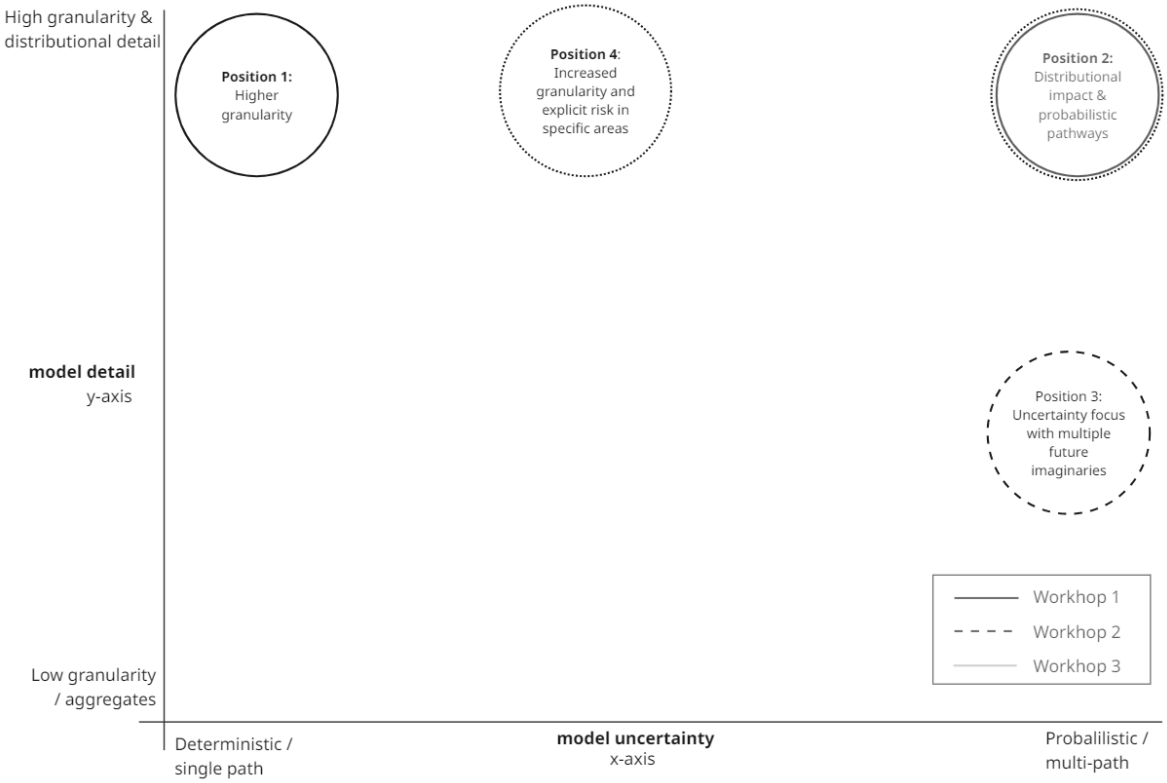
Annex 3: Social worlds/Arena Map



Annex 4: Positional Maps



Positional map 1 - Developing IAMs, what is represented and who participates



Positional map 2 – IAMs dealing with uncertainty, optimisation and granular detail

Annex 5: Detailed reports on the organisation of the Requirements and Scenario Foresight Workshops (MS6)

Requirements Workshop

An initial workshop with the stakeholders was held online on September 13, 2024. In this workshop, tasked with aligning stakeholder needs and expectations with modelling objectives, a first aim was to co-define the requirements for IAM improvements to best respond to their most pertinent concerns. In practice, 36 modellers and stakeholders worked together to mutually understand which issues are useful and feasible to analyse with the available IAM capabilities and/or planned improvements, and co-design the priorities to be addressed later in the research.

Participants were able to actively contribute to group discussions—see agenda below—designed to explore broad and overarching questions related to climate action. The workshop featured interactive breakout rooms aiming to elicit views and ideas, inter alia by means of Mural boards and efforts to ensure that all voices are heard. At the end of the workshop, a plenary discussion was held to compare and summarise each group's discussions, ensuring that key takeaways were collectively presented and integrated into a comprehensive overview.

The outcome of the workshop was a clear set of stakeholder-driven priorities to be used by DIAMOND to guide model upgrades and scenario design, ensuring that research efforts are aligned with stakeholder interests and priorities.

Agenda of DIAMOND's Requirements Workshop

15′	**Introduction to the project and the workshop's themes** *Daniel Cassolà, Carlo Sessa (ISINNOVA)*
5′	**Introductory/practical notes on the breakout rooms**
45′	**Enhancing analytical capacities for more effective climate policy support** ***Parallel, interactive sessions**:* *a. High-level and cross-sectoral* *b. Residential & transport* *c. Power (including upstream)* *d. Industry* *e. Water, land, and other sectors*
10′	**Outcomes of the first group discussion** *One speaker per group (project team)*
10′	**Short break**
45′	**Defining requirements aligned with stakeholders' pertinent questions** **Parallel interactive sessions focusing on DIAMOND model development fields:** *a. Climate change impacts and disruptive events* *b. Finance and labour* *c. Human behaviour and household choices* *d. Circular economy* *e. Land use change, forestry, and broader sustainability dimensions*
10′	**Outcomes of the second group discussion** *One speaker per group (project team)*
10′	**Concluding remarks**

Takeaways from the Requirements Workshop

The participants recommended to consider a wide range of research themes, aimed to provide more effective and reliable simulations of the energy and climate policies for both the supply and demand energy sectors, and the conservation of natural ecosystems. Stakeholders' suggestions are summarised below focusing on four supply and demand sectors: residential and transport sectors, energy sector, industry, and water, land, and agriculture sectors:

- ***For the transport sector*** the stakeholders addressed issues around energy security and costs, distinguishing between public and private, passenger and goods transport, while focusing on the economic impacts of climate change. It was also highlighted how climate policies could make certain transport options, such as flying, more expensive, thereby incentivising greener alternatives. The importance of models reflecting behavioural choices and changes in transport needs was also discussed. Finally, urban planning considerations, such as household demand shifts and behavioral changes in response to climate risks, were noted as important variables to model.
- ***For the energy production sector,*** it was highlighted the importance of the integration of Carbon Capture and Storage technologies with energy storage solutions as well as the relevance of regional priorities and regulatory challenges, particularly around decentralised energy generation and hydrogen transport infrastructure. Regarding storage technologies, it was emphasised the importance of considering factors such as cost and land use constraints at the regional level, as well as the importance of time granularity in models to fully capture storage benefits. Regulatory challenges, particularly concerning energy communities, were also highlighted, with participants suggesting that such communities be treated as distinct forms of energy generation with unique economic factors. Finally, the importance of accurately modelling intra-EU electricity trade and the reliance of renewable energy sources on weather conditions was underscored, reinforcing the need for interconnected grids across Europe.
- ***For the industry sector,*** it was emphasised the need for circular economy policies and decarbonisation strategies, like Carbon Capture and Storage, especially in high-emission sectors like cement and steel. Regarding circular economy, it was noted that it should extend beyond simple recycling and consider material efficiency costs, which are often overlooked or treated as costless in current models. Participants noted that many Integrated Assessment Models (IAMs) overestimate the economic benefits of efficiency by not fully capturing these associated costs. On CCS technologies, it was suggested considering the potential roles of Direct Air Capture (DAC) and Bioenergy with Carbon Capture and Storage (BECCS). Trade dynamics, especially in the steel sector, were another key topic. To this end the group highlighted the need for accurate cost modeling to compare the competitiveness of EU-produced green steel with that from regions with cheaper green hydrogen, such as North Africa. Finally, the session underscored the importance of increasing model granularity to better account for industry-specific challenges, such as material efficiency costs, trade dynamics, and carbon storage potential, to ensure more accurate and feasible decarbonisation pathways.
- ***For the water, land and other natural resources,*** participants discussed the importance of considering the impact of climate change on agriculture, including crop yields and nutritional value, as well as the interaction with energy and water systems. To this end it was suggested the use of tools like FAO's Global Agro-Ecological Zones (GAEZ) to simulate yield under different climate scenarios, and incorporating these outputs into Integrated Assessment Models (IAMs) for more accurate future projections. Another critical issue was the degradation of crop nutritional value due to rising temperatures, which is often overlooked in models that focus mainly on yield quantity. Finally, participants emphasised the need for accurate representation of the energy content and CO_2 emissions from biomass, ensuring that bioenergy's contribution to climate mitigation is properly reflected in integrated climate scenarios.

On how the models can be applied for supporting policymakers in the design and assessment of different policy packages, the participants recommended considering some landscape factors, from climate change impacts and natural resources to economics and technologies, which models should consider when designing the impacts of energy and climate transition policies:

- ***The impact of crucial natural events on the supply chain and the shifts in energy demand.*** To this end one significant issue was the models' ability to represent temperature variations at a local level, especially regarding the effects of heat and humidity on human health, survival, resources, and migration. Another critical point was the modelling of supply chain shocks due to climate events: while models can calculate some impacts, integrating the full complexity of cascading effects remains a challenge.
- ***The contribution of the natural ecosystem to the CO_2 production/absorption balance.*** To this end one major concern was the need to balance land use for climate mitigation with the preservation of biodiversity. Participants emphasised establishing clear thresholds between land dedicated to carbon mitigation efforts (such as afforestation) and areas needed for biodiversity conservation, to prevent mitigation strategies from causing biodiversity loss. On the calculation of the CO_2 emissions and the absorption capacity of forests and agroforestry systems, participants questioned whether models account for geographical variations and complex dynamics in land use and forestry, expressing concern that these complexities might be oversimplified, potentially leading to inaccurate assessments of CO_2 absorption
- ***The labour market transitions due to the energy shift, including job displacement, reskilling, and financial constraints.*** Here a key issue was whether models can adequately capture the effects of reskilling and job displacement when industries move to greener technologies. Participants stressed the importance of addressing labor transitions, especially considering capital costs that could limit the development of competing technologies, thereby affecting the pace and distribution of job creation. The group also recommended exploring how climate change impacts the economy, particularly the chain reactions it triggers in sectors like power generation. On the financial side, it was suggested to use the technology costs as proxies for modeling financial constraints, taking into account factors such as the cost of capital, risk premiums, and regional economies of scale.
- ***The complex interactions between individual and collective actions and their impact on energy demand and technology adoption.*** To this end the group stressed the need for models to better capture the distributional impacts of climate measures, including ongoing costs, investment requirements, and associated inconveniences. These factors can influence public support and the feasibility of implementing policies, and there was a call for comparing the effects across different impact groups to understand these dynamics more thoroughly. Another important recommendation was to design scenarios that account for income disparities, allowing for nuanced analyses of how policies affect low, medium, and high earners differently. Finally, participants emphasised the need for high-resolution data to accurately assess the health impacts of pollutants on local populations, reflecting the intersection of environmental and public health policy.

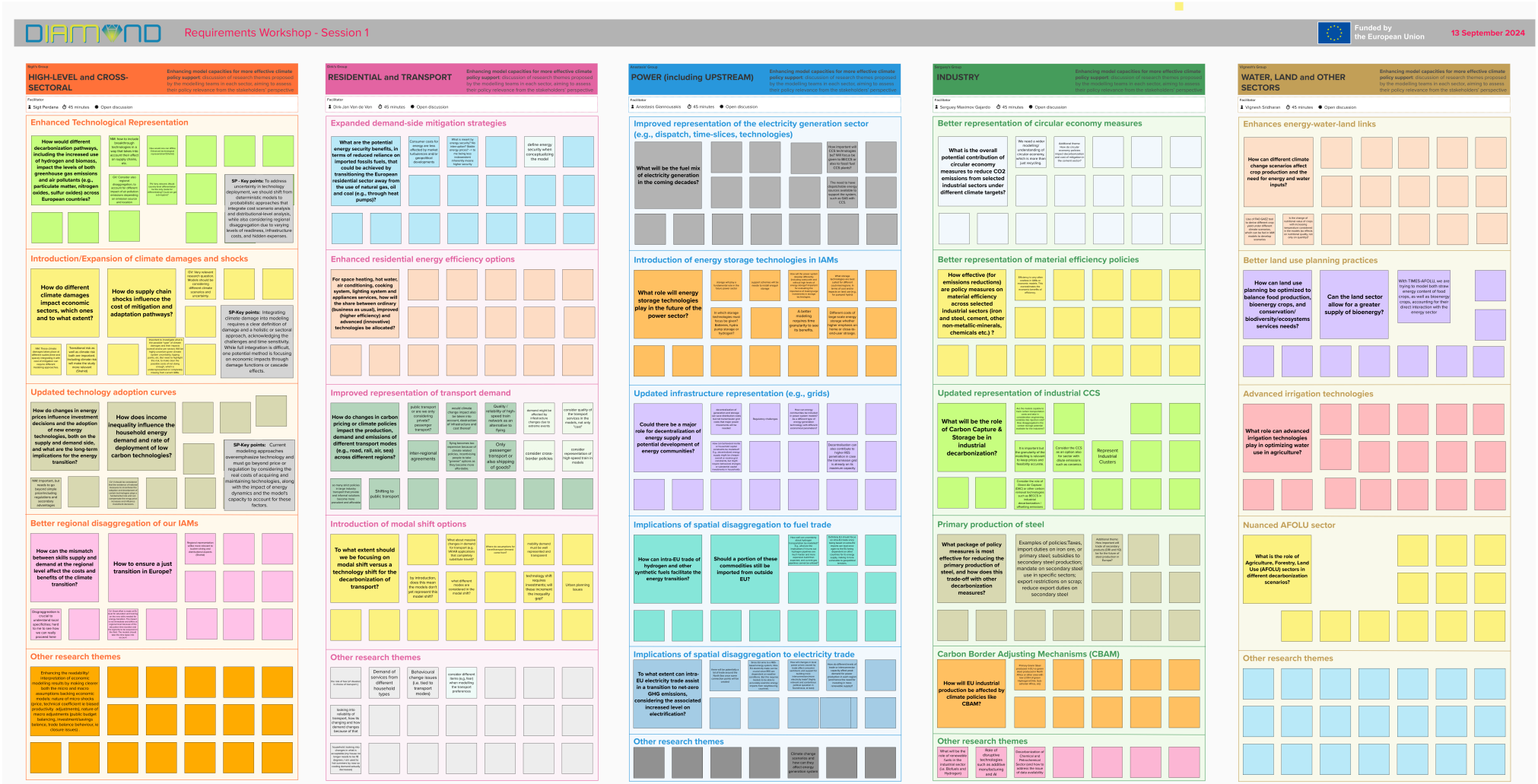
In almost all discussion rooms the participants stressed the need to increase the granularity of the models both in spatial and temporal directions as well as to increase the technological (e.g., CCS, hydrogen) and sectoral coverage including the sectors description (e.g., transport). In addition, they highlighted the importance of integrating emerging technologies and managing uncertainty in climate models pointing out the need to move from deterministic to probabilistic models and to include both climate and transition risks.

The feedback elicited by the stakeholder was provided to the modelling teams, which were asked to identify elements that could influence their updates of the initial model development strategies. The teams were asked to Use stakeholder information to identify the most crucial aspects to be improved, including:

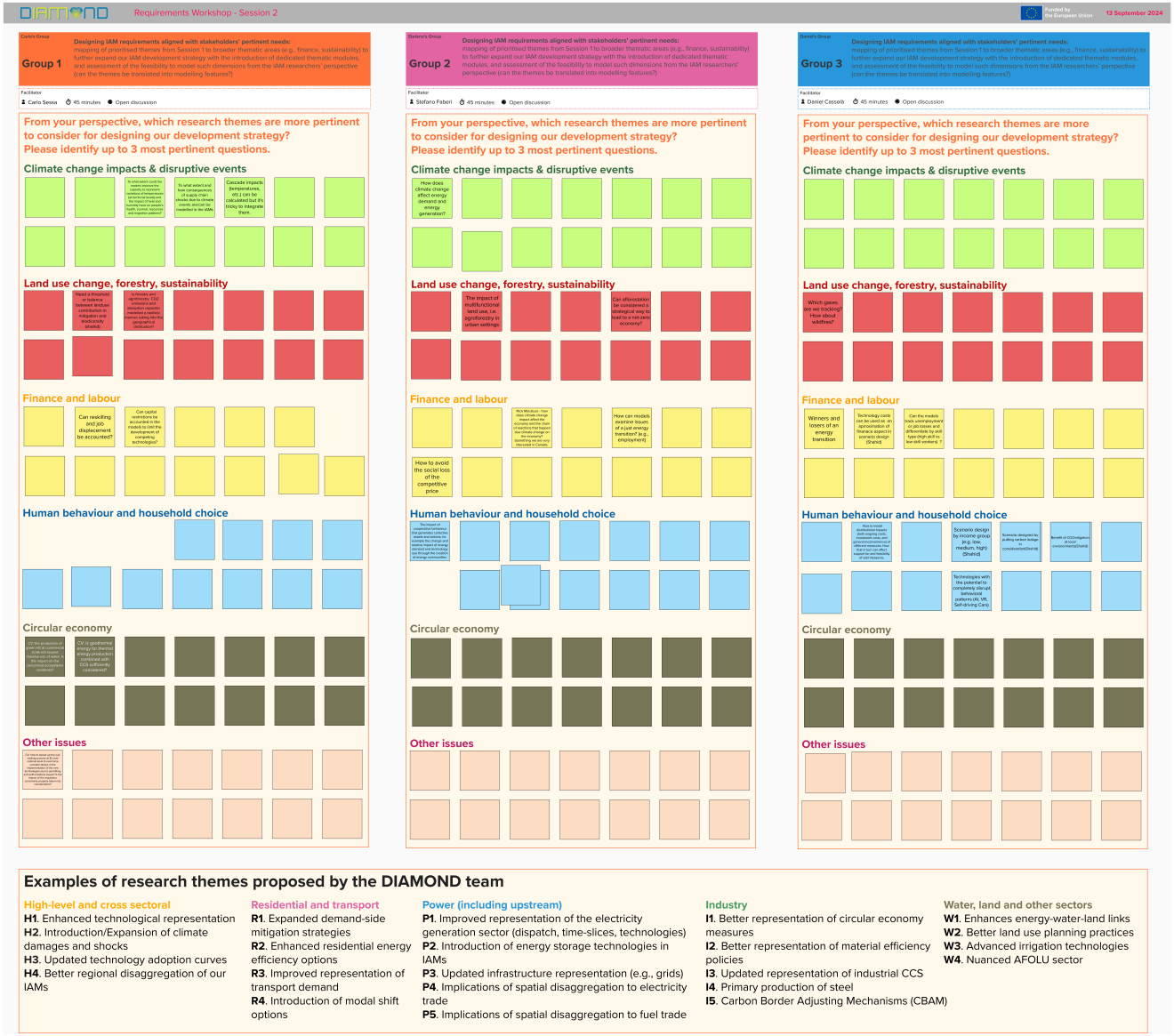
- Geographical and temporal scales
- Sectoral coverage
- Input information and assumptions
- Misrepresented dynamics and uncertainties
- Potential interconnection with additional sectoral models (to widen the modelling scope)

Detailed results of this process are provided in the updated model development strategy (D3.2).

Mural board from the 1st session



Mural board from the 2nd session



Examples of research themes proposed by the DIAMOND team

High-level and cross sectoral

H1. Enhanced technological representation
H2. Introduction/Expansion of climate damages and shocks
H3. Updated technology adoption curves
H4. Better regional disaggregation of our IAMs

Residential and transport

R1. Expanded demand-side mitigation strategies
R2. Enhanced residential energy efficiency options
R3. Improved representation of transport demand
R4. Introduction of modal shift options

Power (including upstream)

P1. Improved representation of the electricity generation sector (dispatch, time-slices, technologies)
P2. Introduction of energy storage technologies in IAMs
P3. Updated infrastructure representation (e.g., grids)
P4. Implications of spatial disaggregation to electricity trade
P5. Implications of spatial disaggregation to fuel trade

Industry

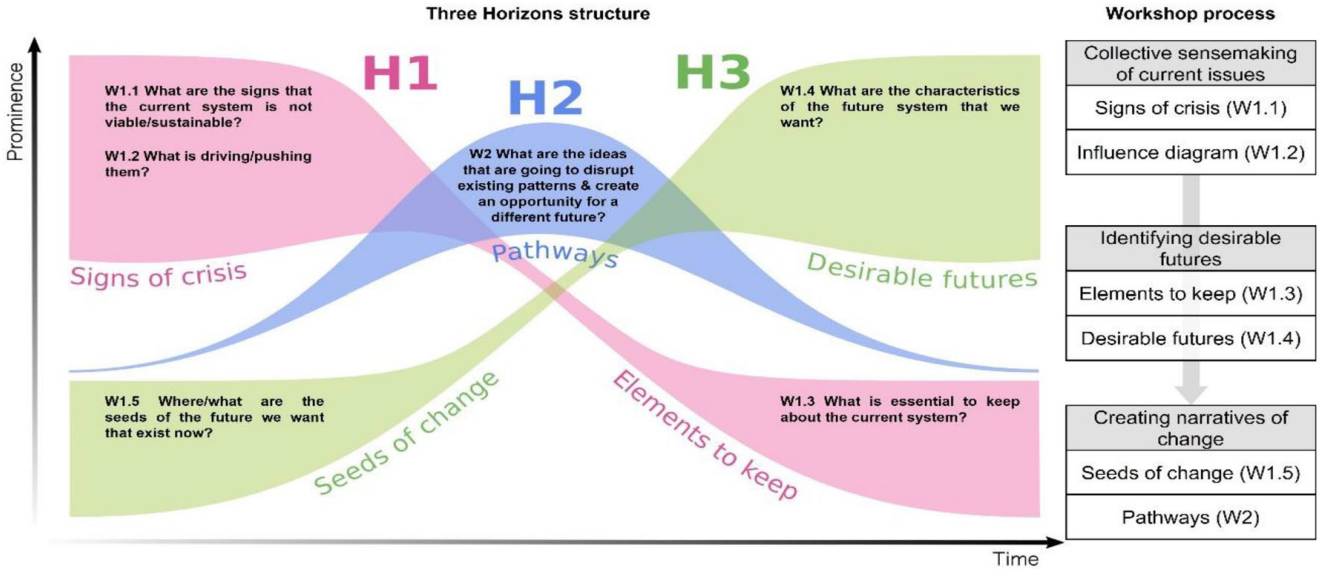
I1. Better representation of circular economy measures
I2. Better representation of material efficiency policies
I3. Updated representation of industrial CCS
I4. Primary production of steel
I5. Carbon Border Adjusting Mechanisms (CBAM)

Water, land and other sectors

W1. Enhances energy-water-land links
W2. Better land use planning practices
W3. Advanced irrigation technologies
W4. Nuanced AFOLU sector

Scenario Foresight Workshop

The Scenario Foresight Workshop was held online on November 12, 2024. During the workshop, we invited stakeholders to think about their desired futures towards climate change mitigation and adaptation. The 37 participants were guided through a structured process to think about their desired futures without imposing any previous assumptions on them, e. g. in terms of potential economic and political development (e.g., based on researchers' beliefs and values, or worldviews about political or economic systems). By using the Three Horizons methodology, briefly illustrated in the figure[2] below, the transformation scenarios are set up by following three conceptual pathways: H3, concerning the identification of a desirable vision of the future (a system we want to transform to), H1, focused on the undesirable features of the current system, (a system we want to transform from) and H2 regarding the necessary changes to shift from the current undesirable features to the desirable vision. The focus of this workshop was on pathways H1 and H3, to avoid anchoring to specific paths as explained in the main text.



The sessions of this scenario foresight workshop – see agenda below – were facilitated in breakout rooms using a Mural board, where the participants could post their comments and contribute to the description. After the two sessions, an online poll was conducted with the help of Slido to further refine the elements of future visions.

10′	**Introduction to the project and the workshop's scope** *Carlo Sessa (ISINNOVA), Konstantinos Koasidis (ICCS)*
10′	**Presentations of the 3 Horizons Framework and practical notes on the breakout rooms** *Carlo Sessa, Daniel Cassolà (ISINNOVA)*
30′	**Horizon 1 - Business as Usual** ○ **What are the signs that the current system is not viable/sustainable?** ○ **What is essential to keep about the current system?** *Parallel interactive sessions.*
10′	**Plenary: Outcomes of the first group discussions**

[2] Schaal-Lagodzinski, Tamara & Mitchell, Michael & Scheele, Ben & Ryan, Paul & Hanspach, Jan. (2023). *Using the three horizons approach to explore pathways towards positive futures for agricultural landscapes with rich biodiversity*. Sustainability Science. 18. 1-19. 10.1007/s11625-022-01275-z.

10′	**Short break**
30′	**Horizon 3 – Viable Future** ○ **What are the characteristics of the future system that we want?** ○ **Where/what are the seeds of the future we want that exist now?** *Parallel interactive sessions.*
10′	**Plenary: Outcomes of the second group discussions**
10′	**Concluding remarks** *Carlo Sessa (ISINNOVA)*

Takeaways from the Scenario Foresight Workshop.

The following tables summarises, for each of the topics covered in the workshop, the main insights provided in the breakout rooms by comparing the description of the present with the vision of the future. This comparison clearly shows the different and conflicting visions, present and future, of the various ecosystems and sectors of activity analysed.

Discussion topics	Pathway H1	Pathway H3
	What are the signs that the current system is not viable, sustainable?	**What are the characteristics of the future system that we want?**
Power and upstream	The energy sector faces challenges in resource use, sustainability, and technology. In addition to the big amount of CO2 and other harmful emissions provided by the fossil fuel power plants, the energy sector's reliance on water for cooling and hydrogen production adds pressure on water resources, highlighting the need to balance energy and water demands to avoid resource conflicts. Governance is critical for equitable low-carbon transitions, though AI advancements might lower fossil fuel costs, complicating their phase-out As for renewable energy, while it reduces fossil fuel reliance, it poses environmental challenges, such as ecosystem disruptions from land use and waste management issues from decommissioned solar panels and wind turbines. Addressing these requires better design, recycling, and land efficiency	The future energy system will combine centralised and decentralised energy production. Centralised plants will meet large-scale demands, while decentralised sources like solar and wind will be integrated to reduce transmission losses and improve grid flexibility. Digital technologies, including smart grids, will optimise energy distribution with real-time monitoring, predictive maintenance, and automation, ensuring reliability and environmental sustainability. Green hydrogen, produced via renewable-powered electrolysis, will play a key role in decarbonising industries and enabling energy storage. An efficiency-first approach will focus on reducing demand and fostering energy communities to enhance resilience and equitable access to renewable energy. This decentralised model will empower communities and align with the just transition principle, ensuring widespread social and economic benefits.

Discussion topics	Pathway H1	Pathway H3

	What are the signs that the current system is not viable, sustainable?	What are the characteristics of the future system that we want?
Water, Land Use, Biodiversity, and Food	The intersection of water scarcity, land management, and food systems is a critical challenge, exacerbated by climate change and unsustainable practices. Water-intensive energy projects like hydropower dams and biofuel cultivation disrupt ecosystems, leading to habitat loss and reduced biodiversity. Unsustainable land use, including improper ploughing, overgrazing, urbanisation, and groundwater over-pumping, further degrades soil health and productivity, driven by population growth and rising resource demands. Climate change intensifies these issues, with reduced crop yields, increased water consumption, and growing food insecurity, particularly in vulnerable regions. Globalised food supply chains increase vulnerability to price fluctuations and disruptions caused by geopolitical tensions or extreme weather, worsening food waste and inequities in distribution. Biodiversity loss from agricultural and energy projects weakens ecosystems' ability to recover, undermining their capacity to support both human and wildlife populations.	The future of agriculture will prioritise sustainability, emphasising resource conservation, biodiversity enhancement, and reduced environmental impact. Techniques like reduced tillage, biochar application, and decarbonised fertilisers will improve soil health, boost carbon sequestration, and cut greenhouse gas emissions, supporting long-term food security while protecting the environment. Addressing systemic challenges, including market shifts, political barriers, and resource competition, will be essential to sustain this transition. Water management will play a critical role, with precision irrigation and AI-powered systems optimising water use, particularly in water-scarce regions. Biodiversity will be integral to resilient agricultural ecosystems. Practices such as agroforestry and intercropping will enhance adaptability to climate fluctuations, improve crop yields, and strengthen food system resilience against climate change and resource scarcity. Economic viability will drive the adoption of sustainable farming, fostering rural growth and creating green jobs. Education and integrated planning aligned with local climate strategies will further support these practices, making them financially attractive and practical

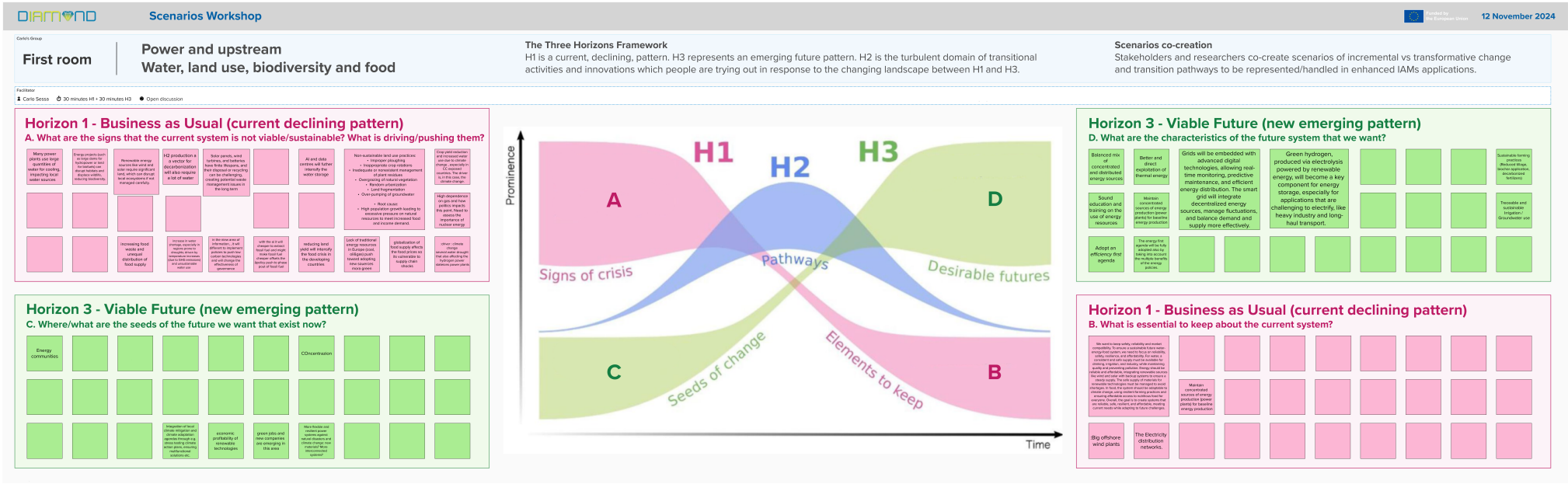
Discussion topics	Pathway H1	Pathway H3
	What are the signs that the current system is not viable, sustainable?	**What are the characteristics of the future system that we want?**
Residential and Transport Systems	Transport systems face clear signs of unsustainability, notably the inefficiency of using heavy vehicles for individual travel. This energy-intensive practice, coupled with fossil fuel reliance, underscores the need for transformative investments in green technologies like	The future of residential and transport systems will focus on affordability, accessibility, and equity. Ensuring universal access to energy and mobility, particularly for underserved communities, will require a decentralised approach. Empowering local communities to manage their energy resources will reduce reliance on

	electric vehicles (EVs), hydrogen transport, and public transit. Residential infrastructure is also vulnerable, lacking resilience against natural disasters, which are increasing in frequency and severity due to climate change. Current rebuilding efforts often focus on short-term fixes rather than sustainable, long-term solutions. Rebuilding often focuses on short-term fixes instead of integrating long-term sustainability and renewable energy solutions, like solar PV	centralised systems, enhance resilience to natural disasters, and promote inclusive decision-making in resource distribution Smart mobility systems, electric vehicles, and mobility-as-a-service platforms will bridge accessibility gaps, particularly in rural areas, while reducing dependence on fossil fuels. Energy efficiency will be a cornerstone of sustainability, with technologies like smart meters and building retrofits reducing waste and long-term costs. Innovations such as AI-driven mobility planning and renewable energy storage will improve system flexibility and resilience, ensuring preparedness for climate challenges and fluctuating demands. Community-led initiatives will reshape residential and transport systems through localised solutions like solar cooperatives, car-sharing programs, and cycling infrastructure. These efforts will reduce consumption, foster cooperative models, and align with non-consumption-based growth strategies, offering effective alternatives to traditional ownership models

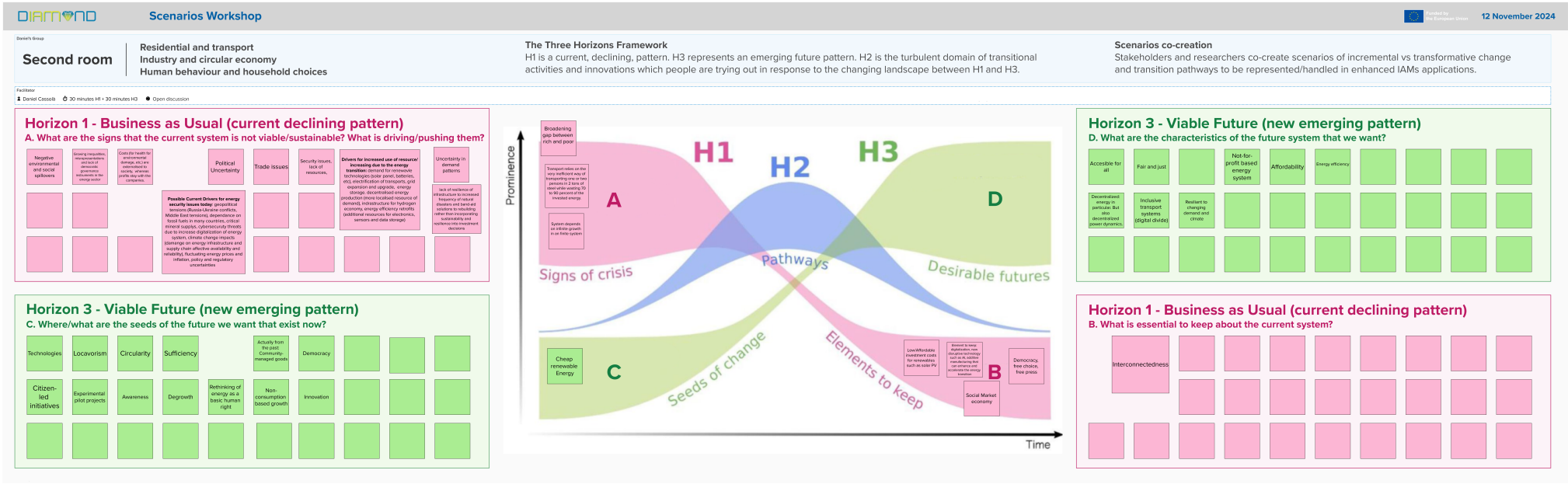
Discussion topics	Pathway H1	Pathway H3
	What are the signs that the current system is not viable, sustainable?	**What are the characteristics of the future system that we want?**
Industry and Circular Economy	Industrial systems are currently unsustainable, relying on infinite growth in a finite world. This model externalises environmental and social costs while privatising profits, creating significant spillover effects and leaving industries vulnerable to global challenges. Political instability and trade disruptions further expose industrial supply chains to external shocks. The transition to renewable energy technologies, such as solar panels and batteries, increases dependency on critical minerals, raising concerns about sustainable extraction, recycling, and resource availability. The lack of circular economy practices exacerbates resource depletion and environmental harm, highlighting the need for systemic reform. Investments in green technologies and supportive policies are essential to facilitate this transition and ensure long-term sustainability.	The future industrial system will embrace circular economy principles, prioritising resource efficiency, waste reduction, and sustainability alongside economic profitability and social responsibility. Circular practices, such as material reuse, design for durability, and closed-loop production, will reshape industrial processes to align with environmental goals while maintaining long-term economic viability. Resilience will define future industries, requiring adaptability to fluctuating demand, climate impacts, and resource scarcity. Distributed energy systems and flexible production processes will enhance this resilience, supported by an "efficiency first" approach that optimises resource use before expanding output. Early adoption of circular practices, such as reducing reliance on virgin resources and designing for longevity, is already transforming industrial and consumer behavior toward favoring sustainable, long-lasting products. Technological innovation will drive this transition, with advances like 3D printing, additive manufacturing, and blockchain enabling localised production, traceable supply chains, and better waste repurposing. New materials that are infinitely recyclable and energy-efficient processes will further accelerate the shift to circularity. Distributed manufacturing and decentralised production systems will also play a critical role, reducing reliance on global supply chains, enhancing local flexibility, and mitigating geopolitical risks.

Discussion topics	Pathway H1 What are the signs that the current system is not viable, sustainable?	Pathway H3 What are the characteristics of the future system that we want?
Human Behaviour and Household Choices	Household behavior and decision-making play a critical role in perpetuating or addressing unsustainable systems. Rising inequalities, coupled with inadequate democratic governance in the energy sector, hinder equitable access to essential resources. Principles of energy democracy and fair energy distribution are essential to ensure households have access to affordable and sustainable energy solutions, addressing the externalised costs they often bear, such as health and environmental impacts, without sufficient influence on systemic change. Uncertainties in demand patterns and limited resilience in household and community decision-making create vulnerabilities, especially in response to natural disasters or supply chain disruptions. Digitalisation and interconnected residential systems can mitigate these issues through technologies like smart meters and AI-powered tools, enabling households to optimise energy consumption and adopt sustainable practices.	Human behavior and household choices will be pivotal in transitioning to a sustainable system. Empowered by tools and knowledge, individuals will increasingly adopt energy-efficient appliances and low-carbon technologies. Smart technologies providing real-time feedback on energy use will enable households to make informed, sustainable decisions, reducing environmental impacts and enhancing energy efficiency across sectors. Achieving sustainable living for all requires addressing structural inequalities. Policies ensuring affordability and accessibility of energy-efficient technologies for low-income households will be essential to a just transition. Equity will be central, ensuring the benefits of sustainability are shared widely and not concentrated among privileged groups. Decentralisation will characterise future systems, with household-level energy management enabling greater autonomy and resilience. Communities will gain the ability to adapt to energy demand changes or disruptions, fostering an inclusive, people-centered energy model. This aligns with sufficiency and degrowth principles, shifting household consumption patterns toward ecological sustainability and well-being rather than economic growth through excessive consumption. Finally, households will continue embracing second-hand goods, repairs, and durable products, reflecting a commitment to reducing consumption and supporting sustainable practices. The transition will redefine energy as a basic human right, emphasising clean, affordable energy as a shared resource rather than a commodity.

Mural board from the 1st room



Mural board from the 2nd room



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