



Expanding Integrated Assessment Modelling:
Comprehensive and Comprehensible Science
for Sustainable, Co-Created Climate Action



Responsive science in support of climate policymaking
IAM COMPACT Final Conference, Athens, 29 August 2025

Introduction to the IAM COMPACT project

Dr. Alexandros Nikas, National Technical University of Athens

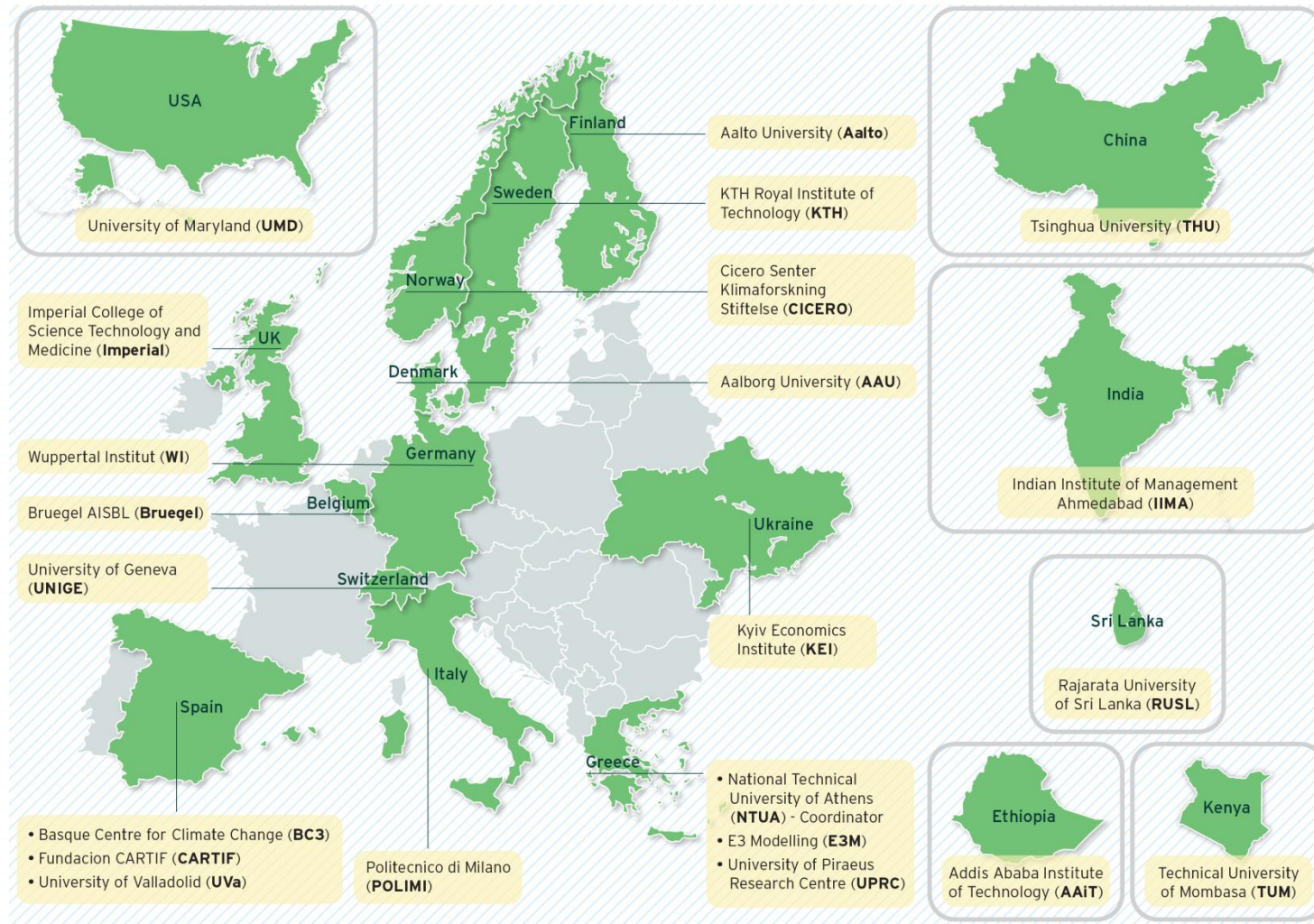


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www.iam-compact.eu

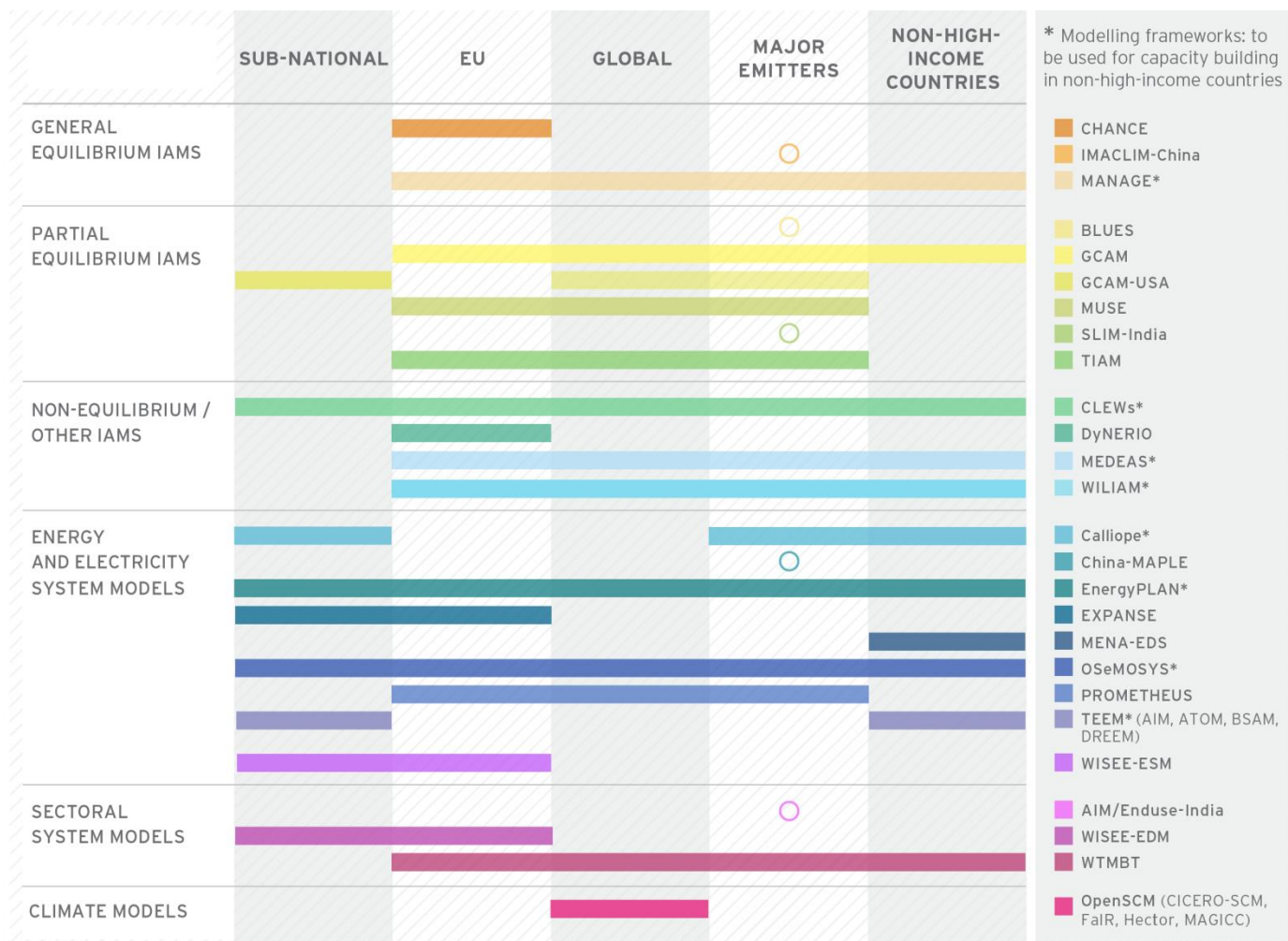
Title:	Expanding Integrated Assessment Modelling: Comprehensive and Comprehensible Science for Sustainable, Co-Created Climate Action (IAM COMPACT)
Funding:	European Union's Horizon Europe Research and Innovation Programme (HE)
Lifetime:	September 2022 - August 2025 (36 months)
Coordination:	Energy Policy Unit, National Technical University of Athens (NTUA)
Participants:	20 beneficiaries; 2 associated partners
Call/Grant:	HORIZON-CL5-2021-D1-01-04/101056306



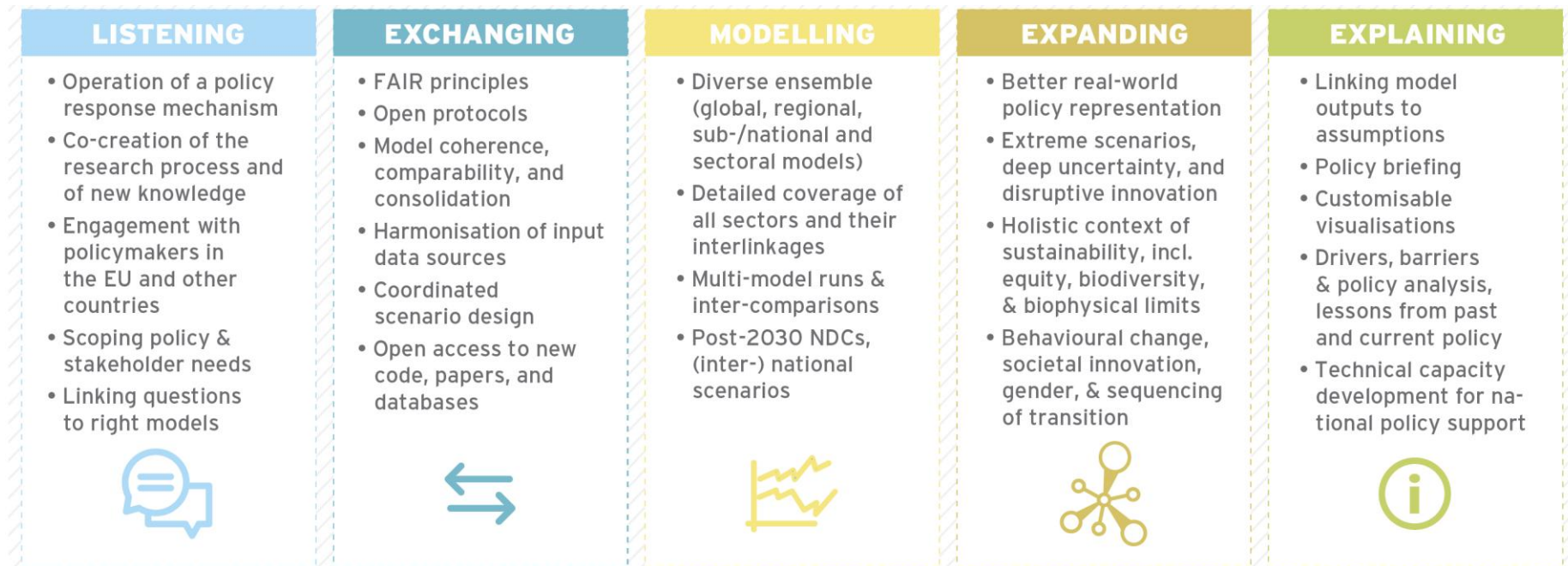


- O₁**. Support climate policies (post-2030 NDCs and long-term strategies)
- O₂**. Place climate action in a holistic sustainable development framework
- O₃**. Enhance robustness (social, political, behavioural, innovation aspects)
- O₄**. Co-create science and enhance mutual learning
- O₅**. Establish an integration process (transdisciplinarity)
- O₆**. Open the 'black box' of models
- O₇**. Engage in the extreme uncertainty space
- O₈**. Boost international cooperation, partnership, and capacity





The project can essentially be broken down into **five highly intertwined components** of activities:





KENYA
Partner:
TUM

Kenya is facing multiple sustainability challenges, revolving around modern energy access, health, nutrition, clean water, etc. Sustainability efforts need to be intensified. However, ahead of its National Climate Change Action Plan update, the country lacks appropriate modelling capacities.

Within IAM COMPACT, we will study, together with national stakeholders and six diverse coast-side counties, the clean energy - clean water - food - health nexus, co-developing a model for multi-SDG analysis.



ETHIOPIA
Partner:
AAiT

In this fast-developing country, the competition for water resources is exacerbated by climatic changes, while livestock and biomass consumption are among the highest contributors to GHG emissions. Capacity development within UK's EEG program supported the creation of an AAiT-led local team of experts in energy analysis. IAM COMPACT will expand this capacity to carry out integrated resource assessments, focusing on sustainable biomass for energy and low-carbon farming.



UKRAINE
Partner:
KEI

With adopted strategies not yet establishing a clear link between the energy sector and climate action, Ukraine's NDC targets are being revised to increase the country's ambition. IAM COMPACT will help develop capacities and produce comprehensive modelling of the energy-climate-environment nexus, toward underpinning data-driven climate policies pertinent to Ukraine's current needs, and integrating a robust hydrogen strategy in the upcoming Integrated Energy and Climate plan.



SRI LANKA
Partner:
RUSL

This island state in South Asia joined a technical assistance programme with UNDP and UNDESA, leading to model applications across climate, land use, energy, and water. IAM COMPACT will further expand acquired capacity, to support the country's NDC and plans for sustainable development (including climate resilience, food security, water use, hydro development, etc.). This will involve deep-dive assessments of existing policies and the current debate on climate neutrality in the country by 2050.

Ethiopia & Kenya:
among fastest developing countries in Africa, with many open sustainability fronts

Sri Lanka:
island state in South Asia, facing severe sustainability threats from climate change

Ukraine:
geopolitically sensitive country with high mitigation and adaptation priorities

Global level:

IAMs were used to explore where emissions are headed (current policies, NDCs, and long-term targets such as net-zero), and resulting warming pathways

EU level:

- insights into energy supply crisis: trade-offs of approaches to replacing RU gas
- cost-optimal scenarios to achieve the EU targets vs. EU-wide modelling of 'Fit for 55'
- potential relocation of the EU industry within the bloc and to other regions
- impacts of implementing increasing wind and solar in terms of raw material demand
- spatially explicit analysis of power-sector transition: air pollution, health, inequalities, jobs
- energy security, resilience, flexibility, costs, and environmental indicators in RES

National level:

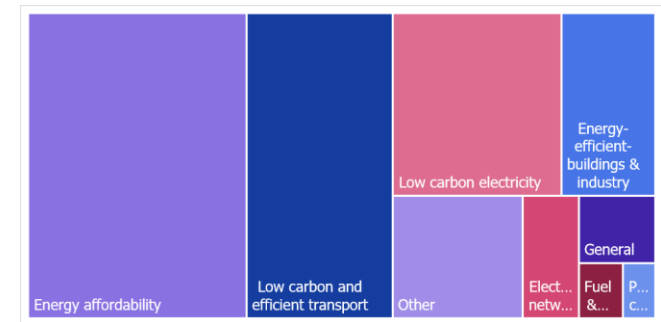
- co-created mitigation strategies for China, India, USA, Ethiopia, Kenya, Sri Lanka, Ukraine
- a series of studies with a focus on Greece: capacity & flexibility requirements of future electricity systems to meet carbon neutrality; multi-model deep dives into the recently updated NECP; building sector decarbonisation



O2: Broader sustainability [examples]



- A comprehensive database of COVID-19 green recovery packages globally
- A report on the distributional consequences of the Energy Taxation Directive
- A study of future within-region inequalities in energy consumption, which is a major concern for decision makers and international policy and scientific discussions
- A tool (**MEDUSA**) for integration with models to perform distributional and social analyses



ENVIRONMENTAL RESEARCH LETTERS

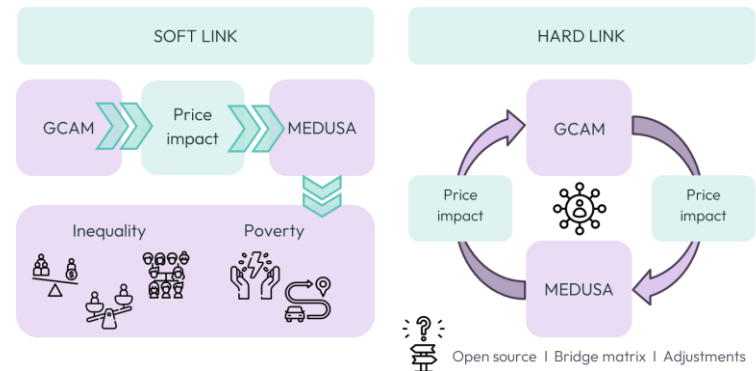


LETTER • OPEN ACCESS

Residential energy demand, emissions, and expenditures at regional and income-decile level for alternative futures

Jon Sampedro, Stephanie T Waldhoff, James A Edmonds, Gokul Iyer, Siwa Msangi, Kanishka B Narayan, Pralit Patel and Marshall Wise

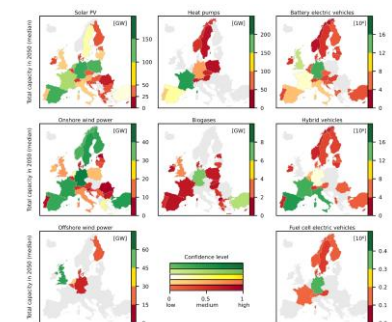
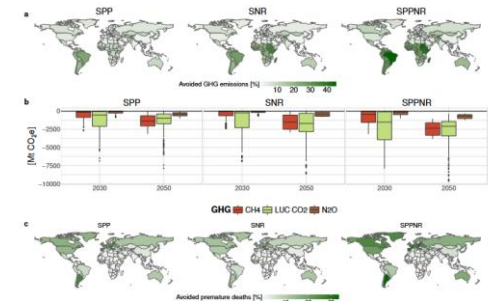
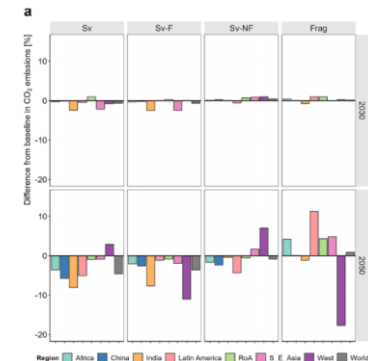
<https://bc3lc.github.io/medusa/>



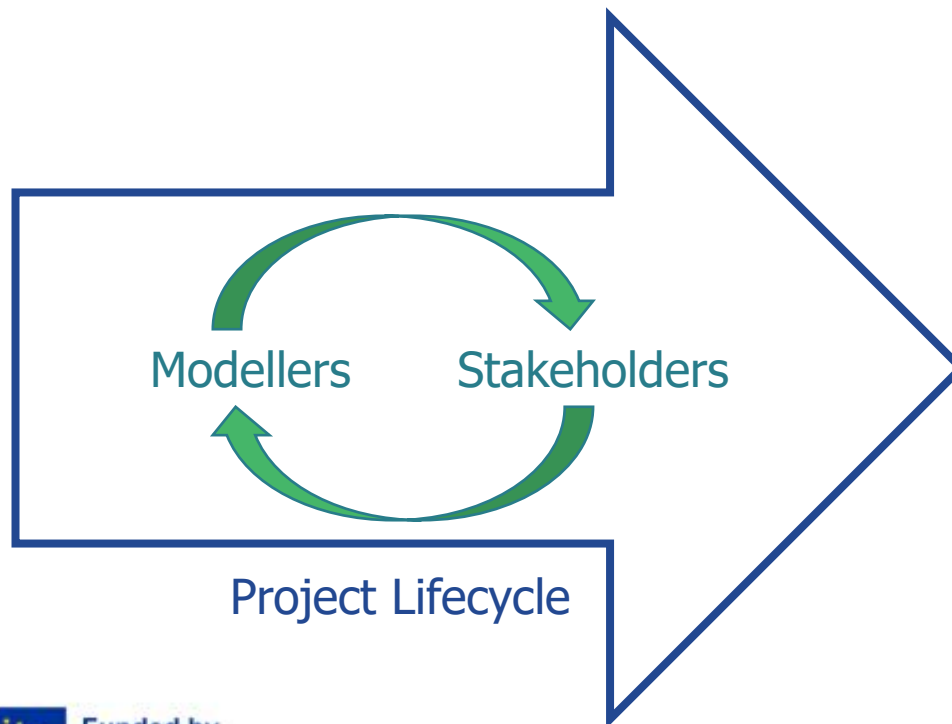
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O3: Sociopolitical, behavioural, innovation aspects [examples]

- A study on more accurate financing assumptions into energy planning models, aiming to contribute toward achieving longer-term climate targets
- A study on sustainable diet transitions and their impact on regional protein and fat intake, dietary energy adequacy, GHG emissions, air pollution-related mortality, water scarcity, and food costs.
- A study on the need for European decision-makers to adopt stronger policies that accelerate the uptake of wind, biogases, and in some countries solar PV and heat pumps to meet energy transition goals.



- **Policy Response Mechanism (PRM)** as a stakeholder engagement strategy, ensuring the policy relevance of our modelling research through a **structured yet flexible approach** to stakeholder engagement.



Structure of the PRM

Organised in **time**: *two cycles*

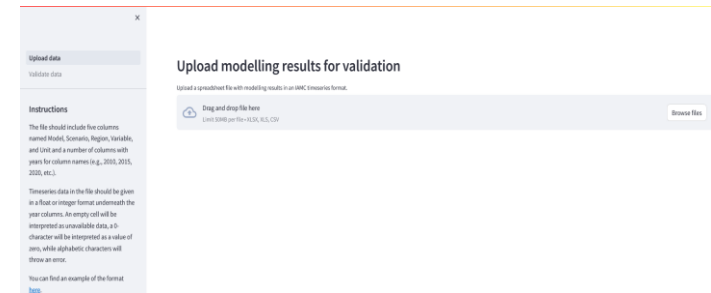
Organised by **stakeholders**:
strategic & technical

Organised **thematically** in EU

Organised **regionally** outside the EU

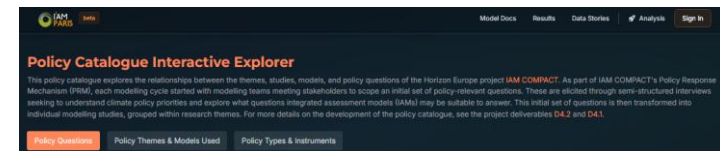


- The creation of a new tool for **validity checks** of model results, which provides an indication of whether modelling results are plausible by comparing them with relevant benchmarks such as the criteria used to vet scenarios in the scenario processes of the Intergovernmental Panel on Climate Change.



<https://validation.i2am-paris.eu/>

- An online **policy catalogue** that explores the relationship between themes, studies, models, and policy questions of the project.

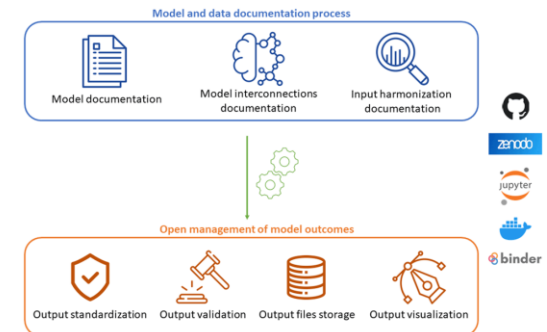


<https://iamparis.eu/datastories/policyCatalog>

- Upgrade and operation of a data exchange platform (IAM PARIS) with new model documentations, workspaces, videos, and notably training material for the younger generations (link to universities).
- A protocol on Open Science Practices in Integrated Assessment Models, which enhances the transparency, accessibility, and reliability of results and facilitates the integration of the FAIR and TRUST principles.
- Access to all scientific papers and underlying datasets via a project-dedicated Zenodo community, with datasets immediately made available in Creative Commons licenses for reusability, and digital object identifiers being assigned to secure their findability.

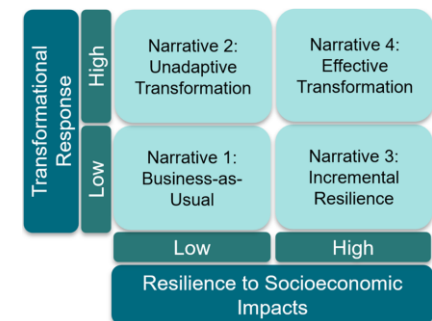
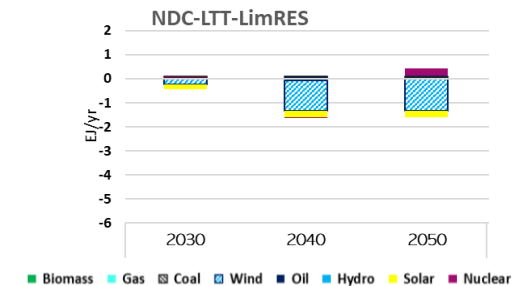
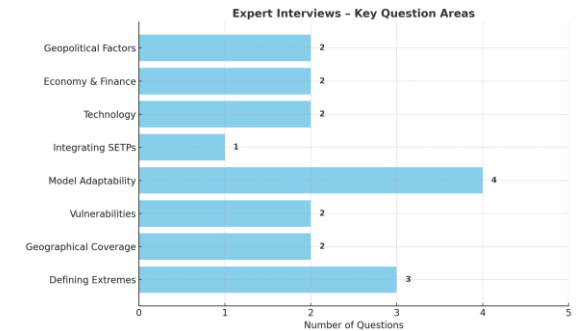


<https://iamparis.eu/>



O7: Extreme uncertainties [examples]

- Expert interviews on how technologies and measures can enhance resilience in transformation pathways during extreme events, and on identifying feasible mitigation trajectories.
- A study on how energy-system transformations can be resilient and capable of withstanding geopolitical and technological disruptions, including policies that prioritise the acceleration of energy efficiency and renewable energy diffusion.
- A framework for enhancing modelling capacity and scenario studies by allowing to explore a broad spectrum of uncertainties and extremes, including environmental, technological, policy, and societal shifts, in IAMs



O8: Knowledge dissemination & capacity development [examples]



- Publication of over 55 papers & participation in over 50 scientific conferences, already (with about half our results and findings not yet published).



- A rich training and teaching kit that covers ground concepts, ontology, and introduction to modelling tools and approaches from our model ecosystem, freely available in our [Zenodo](https://zenodo.org) community (link to universities).



Workshop on modelling tools for sustainable development

AAIT, Addis Abeba, 23/24-01-2024

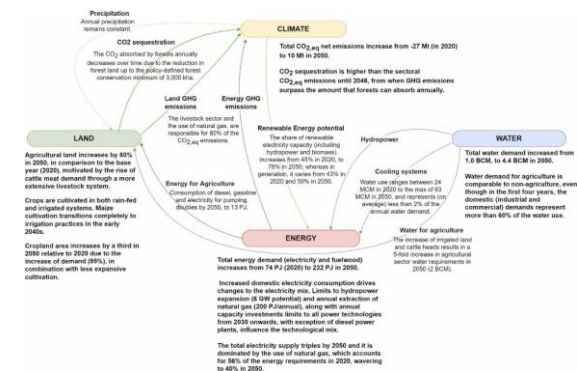
Introduction to Energy Modelling

Dr. Nicolò Stevanato, Department of Energy of Politecnico di Milano

Camilo Ramirez Gomez, Division of Energy Systems of KTH

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- Capacity development workshops in our partner countries: Ukraine, Sri Lanka, Kenya, and Ethiopia. This includes 5 open-access models addressing key policy questions, co-developed with our national partners



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“Bridging the gap between the ‘Fit for 55’ package and the 2050 ambition of a net-zero EU economy”

December 5, 2023
15.00-16.00 GMT+4 (UAE time)
Greek Pavilion, Expo City in Dubai



The panel discussion was moderated by Prof. Ryna Yiyun Cui, (*UMD, US*) and included the following interventions:

- **“Paving the way to net zero in the EU: key technologies, strategic decisions, and a roadmap”** Speaker: Haris Doukas, *Professor at the National Technical University of Athens (NTUA), President of the Society for the Environment and Cultural Heritage (ELLET) Energy Council, Mayor-Elect of the Municipality of Athens, Greece.*
- **“Defining ‘Abated Fossil Fuels’ and identifying their role in the EU’s long-term ambition”** Speaker: Alaa Al Khourdajie, *Research Fellow at the Department of Chemical Engineering of Imperial College London (Imperial)*
- **“The role of gas in the EU’s net-zero trajectory: thinking in the context of the energy crisis”** Speaker: Steve Pye, *Assoc. Professor at the UCL Energy Institute (University College London)*

COP28 aftermath feature article at
by Alaa Al Khourdajie et al

THE CONVERSATION ([link](#))



Highlights: Capacity development workshops across the globe



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IAM COMPACT - Expanding Integrated Assessment Modelling: Comprehensive and Comprehensible Science for Sustainable, Co-Created Climate Action

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Project milestones Open

IAM_COMPACT_MS6_Training_material_on_concepts_&_tools

Gardumi, Francesco¹ · Rinaldi, Lorenzo² · Tonini, Francesco³ · Colombo, Emanuela⁴ · Jayasuriya, Lahiru⁵ · Ferreras Alonso, Noelia^{6,1} · Aliarez Antelo, David⁷ · Lili, Mohamed⁸ · Ramirez Gomez, Camilo⁹ · Stevanato, Nicolò² · Moreno, Diana⁶ · Yuen, Meng⁶ · Frilingou, Natscha⁷ · Karamaness, Anastasia⁷ · Salehu, Fitsum⁸ · Ntostoglou, Eltychia¹

Show affiliations

This milestone consists of a set of open access training and teaching material developed collaboratively, licensed under CC BY 4.0, and available on IAM COMPACT's Zenodo repository, and through the project's website.

The material is in the form of pptx files and includes the following presentations (divided by concept):

- Introduction to energy (and electrification) modelling; DOI: 10.5281/zenodo.10716886
- Introduction to OnBSET; DOI: 10.5281/zenodo.10719078
- Minigrid modelling; DOI: 10.5281/zenodo.10719106
- Use of energy system models and scenarios in policy – Case studies; DOI: 10.5281/zenodo.10719111
- Introduction to input-output analysis; DOI: 10.5281/zenodo.10719199
- Input-output analysis hands-on; DOI: 10.5281/zenodo.10719182
- Energy-economy modelling case studies; DOI: 10.5281/zenodo.10719187
- Integrated resource modelling and examples; DOI: 10.5281/zenodo.10719192
- Designing scenarios; DOI: 10.5281/zenodo.10719218



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A multimodel analysis of post-Glasgow climate targets and feasibility challenges

Climate promises may get us in the vicinity of 'well below 2°C' but are they *realistic*?
Study by Van de Ven et al published in *Nature Climate Change* and making the rounds

THE CONVERSATION

Current emissions targets could keep the planet below a 2°C temperature rise but a turbocharged effort is needed

Published: June 7, 2023 6:34pm SASI

Bloomberg

Climate Pledges Reach Threshold to Keep Warming Below 2C

Staving off a 2C future is still doable, scientists find, but will require all countries to meet their stated goals for slashing pollution through 2030 and beyond.

nature climate change

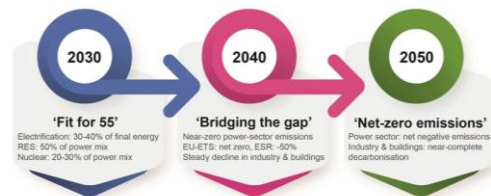
News & Views | [Published: 18 May 2023](#)

Climate action

Increased ambition is needed after Glasgow

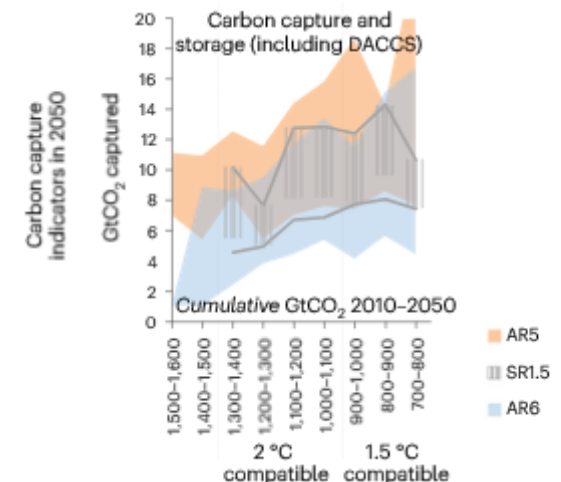
A multi-model analysis of the EU's path to net zero

Strategic roadmaps for the EU
(ahead of 2040 target setting)



Energy and socioeconomic system transformation through a decade of IPCC-assessed scenarios

A decade of transformation (& scenario biases)





Thank you!

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