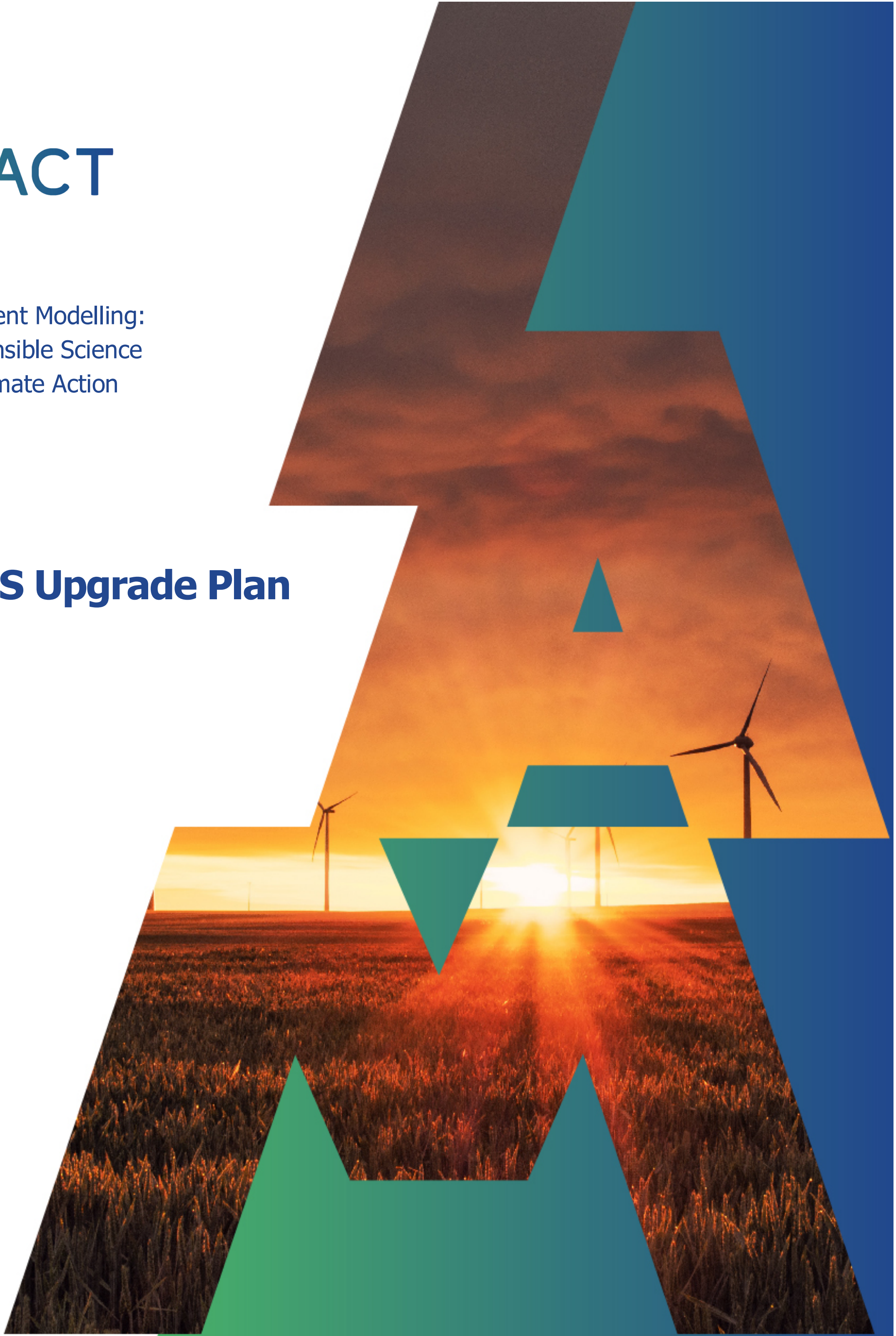
IAM COMPACT

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



D3.1 – I^{2}AM PARIS Upgrade Plan

WP3 – Exchanging

28/12/2022

The IAM COMPACT project has received funding from the European Union's HORIZON EUROPE Research and Innovation Programme under grant agreement No 101056306.

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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

The report will be used to guide the development of the I^{2}AM PARIS platform in the context of IAM COMPACT and can be also beneficial to modellers and other users of the platform, within and beyond the consortium.

3. Short summary of results (<250 words)

I^{2}AM PARIS is an open data exchange platform for climate and energy policy modelling, developed by the Horizon 2020 PARIS REINFORCE project. Drawing from the current capabilities of the platform, this report provides a summary of platform improvements in the context of the IAM COMPACT project. Notably, efforts will be placed in adding validity checks for modelling data that is uploaded to the platform and providing an indication of whether modelling results are credible by comparing them with relevant benchmarks such as the vetting criteria from IPCC AR6 WGIII. We will also develop user-friendly interfaces for data input, allowing modellers from other projects to easily interact with, and add new modelling and scenario information to, the platform. Existing components of the platform will be also improved in term of functionalities. New model documentation will be added, while the existing documentation will be updated, emphasising interpretability by non-experts. In this direction, we will also create a component with videos and training material for new modellers. Finally, the representation of sectoral models will be enhanced in existing components, while new result workspaces will be created to showcase the outcomes of the project's modelling exercises.

4. Evidence of accomplishment

This report.

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Preface

IAM COMPACT supports the assessment of global climate goals, progress, and feasibility space, and the design of the next round of Nationally Determined Contributions (NDCs) and policy planning beyond 2030 for major emitters and non-high-income countries. It uses a diverse ensemble of models, tools, and insights from social and political sciences and operations research, integrating bodies of knowledge to co-create the research process and enhance transparency, robustness, and policy relevance. It explores the role of structural changes in major emitting sectors and of political, behaviour, and social aspects in mitigation, quantifies factors promoting or hindering climate neutrality, and accounts for extreme scenarios, to deliver a range of global and national pathways that are environmentally effective, viable, feasible, and desirable. In doing so, it fully accounts for COVID-19 impacts and recovery strategies and aligns climate action with broader sustainability goals, while developing technical capacity and promoting ownership in non-high-income countries.

NTUA – National Technical University of Athens	EL
Aalto – Aalto Korkeakoulusaatio SR	FI
AAU – Aalborg Universitet	DK
BC3 – Asociacion BC3 Basque Centre for Climate Change – Klima Aldaketa Ikergai	ES
Bruegel – Bruegel AISBL	BE
CARTIF – Fundacion CARTIF	ES
CICERO – Cicero Senter for Klimaforskning Stiftelse	NO
E3M – E3-Modelling AE	EL
KTH – Kungliga Tekniska Hoegskolan	SE
POLIMI – Politecnico di Milano	IT
UPRC – University of Piraeus Research Center	EL
UVa – Universidad De Valladolid	ES
WI – Wuppertal Institut fur Klima, Umwelt, Energie GGMBH	DE
IIMA – Indian Institute of Management	IN
THU – Tsinghua University	CN
USMF – University System of Maryland	US
AAiT – Addis Ababa University	ET
KEI – International Civic Organisation Kyiv Economics Institute	UA
RUSL – Raja Rata University of Sri Lanka	LK
TUM – Technical University of Mombasa	KE
UNIGE – Université de Genève	CH
Imperial – Imperial College of Science, Technology and Medicine	UK

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Executive Summary

I^{2}AM PARIS is an open data exchange platform for climate and energy policy modelling that was developed by the Horizon 2020 PARIS REINFORCE project. This report provides a summary of the improvements of the platform that will be implemented in the context of IAM COMPACT.

To provide tangible support to EU and international climate policy, a major requirement for modelling exercises is to ensure the validity of modelling inputs and the credibility of their results. In the context of IAM COMPACT, we will add automatic validity checks in the platform to promote data quality and consistency with major formats of modelling information for climate change mitigation—for the time being, this mainly refers to the IPCC AR6 cycle format, but we will remain flexible to adapt to any other changes emerging in the AR7 cycle. We will also provide an indication of whether modelling results are credible by comparing them with various scenario benchmarks such as the ones used in the vetting process of the IPCC AR6 WGIII. Both types of checks will be performed whenever new modelling inputs and outputs are uploaded to the platform, and they will be combined with the development of user-friendly interfaces for data input. These interfaces will also allow modelling teams from other projects to automatically add new modelling information to the platform, without needing to send it first to the I^{2}AM PARIS development team, thus ensuring the usability and long-term sustainability of the platform.

Apart from new features, existing components of the platform will be improved in term of functionalities. New model documentation will be added, while the existing documentation and methods for visualising model details will be updated based on the feedback of IAM COMPACT stakeholders, emphasising interpretability by non-experts. The capacity development activities of the project will also feature extensively in the platform, by creating a component with videos and training materials for new modellers and for further supporting the understanding of modelling documentation. The representation of sectoral models will be also enhanced in existing components, complementing the work of the NDC ASPECTS project. Finally, new result workspaces will be created to showcase the outcomes of the project's modelling exercises. All modelling documentation and workspaces will be publicly available, allowing for easy dissemination and adhering to the FAIR principles for data management.

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1 Introduction

I2AM PARIS[1] is an open-access, data exchange platform for modelling information in support of climate action. It was created in 2019 by the Horizon 2020 project PARIS REINFORCE to facilitate understanding of the diverse Integrated Assessment Models (IAMs), energy system models, and sectoral models that were used in that project, as well as to provide interactive interfaces for exploring results of model intercomparisons. Nevertheless, the intention from the very beginning was for the platform to evolve into a vessel for knowledge exchange for the wider modelling community and an authoritative source of modelling information for stakeholders.

Towards this goal and to ensure the sustainability of the platform, the development of the platform will be continued by the IAM COMPACT project as well as three other EU-funded projects, the Horizon 2020 projects NDC ASPECTS[2] and ENCLUDE[3] and the Horizon Europe project DIAMOND[4]. While most new platform development will take place simultaneously among the four projects, each of them has a different scope: NDC ASPECTS focuses on improving the documentation of sectoral models and producing more interfaces to dive into national and sectoral results; ENCLUDE emphasises results on citizen-led climate action; and DIAMOND will develop applications of modelling results for different audiences. In the case of IAM COMPACT, I2AM PARIS will be enhanced in terms of content and features to support model intercomparison exercises and capacity development activities of the project. This report provides an outlook of the envisaged improvements in the context of IAM COMPACT.

These improvements are described in more detail in the next three sections. The final section includes a plan for the roll-out of these improvements in response to other planned activities of the project as well as a short outlook for further work. It is noted that apart from these planned functionalities, more enhancements can be potentially applied in the platform, based on the needs of the project partners and in coordination with the development work of the other projects.

[1] https://www.i2am-paris.eu/
[2] https://www.ndc-aspects.eu/
[3] https://www.encludeproject.eu/
[4] https://www.climate-diamond.eu

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2 Existing functionalities of I²AM PARIS

The platform currently has two main functionalities. First, it provides extensive documentation for more than 40 global, national, and sectoral models that are used to support climate policy. Model details are provided through four diverse interfaces that provide relevant information for different use cases and for differences audiences, such as detailed model descriptions intended for modelling experts and infographic-like visualisations for policymakers and other non-expert stakeholders. The emphasis on user-specific information was an important requirement for the platform and it was co-designed along a variety of stakeholders, including other modelling experts as well as users of modelling information such as EU and national policymakers. Second, I²AM PARIS showcases the outputs of the main modelling exercises of the PARIS REINFORCE project through six workspace components, most of them including links to related publications and modelling data and featuring interactive visualisations of the results, customised for different audiences. These two main functionalities can be accessed directly through the sections 'Documentation' and 'Results' in the homepage of the platform (see Figure 1).

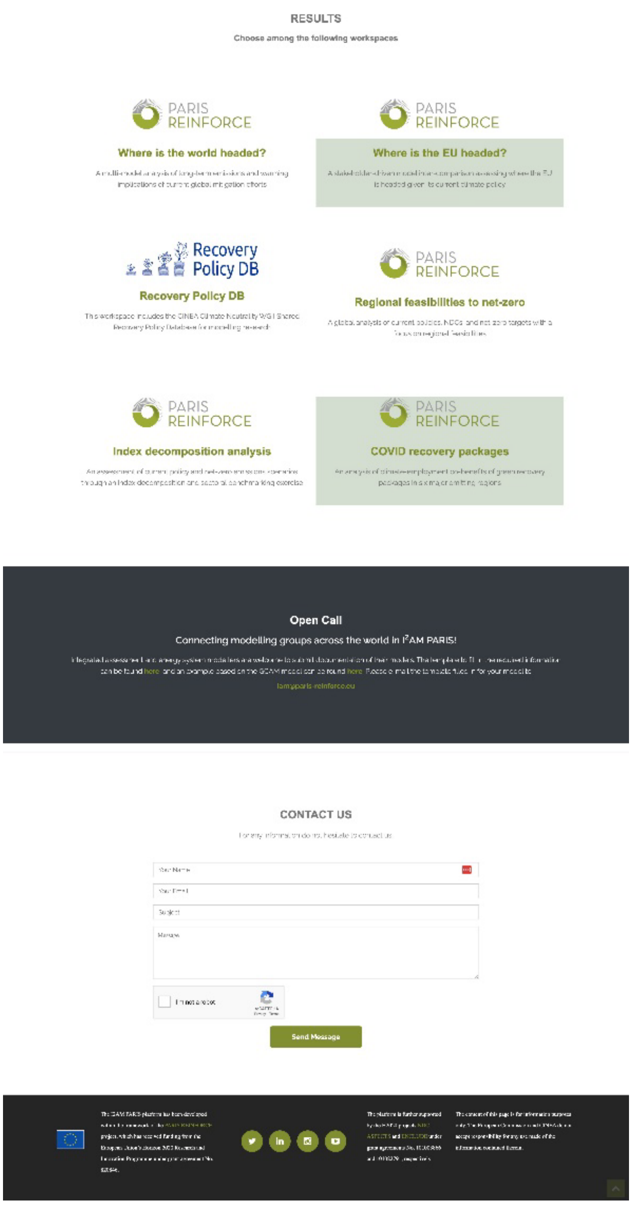

Figure 1. I²AM PARIS homepage (https://i2am-paris.eu)

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The ‘Documentation’ section contains the following four components:

- **Detailed Model Documentation**: a detailed presentation of the modelling tools acting at different geographical scales and based on different underlying theories and principles. This component was developed for more experienced and technical users (e.g., modellers, other researchers/scientists) but strives to be comprehensible for all audiences, including energy and climate policymakers. Along with model details, the component displays information of previous studies that the model has been involved, including research questions and main findings. The documentation component not only includes all models from PARIS REINFORCE but also of models that were provided by other modelling teams (such as EXPANSE[5] and WISEE-ESM[6]) after an open call from the platform’s developers to the wider modelling community. Figure 2 shows the 44 models included in the platform in December 2022.
- **Model Dynamic Documentation**: an interactive library of the documented models, in the form of a responsive “infographic”, including geographical coverage as well as sectoral, emissions, policy, SDG, socioeconomic and mitigation/adaptation measure granularities (Figure 3). This component mainly targets non-expert audiences and aims to inform policymakers and other decision makers (from business to NGOs and civil society) on what models can and cannot do, in a visually appealing way.
- **Overview and Comparative Assessment:** this component draws comparisons between the models of the PARIS REINFORCE project, justifies why we need different models to answer a specific question, and allows users to comprehend model capabilities, strengths, and weaknesses across a modelling ensemble.
- **On-Demand Variable Harmonisation Heatmap**: this component allows users to select specific models of the PARIS REINFORCE project and create a visualisation of the variables that have been harmonised across these models in the context of scenarios produced in PARIS REINFORCE.

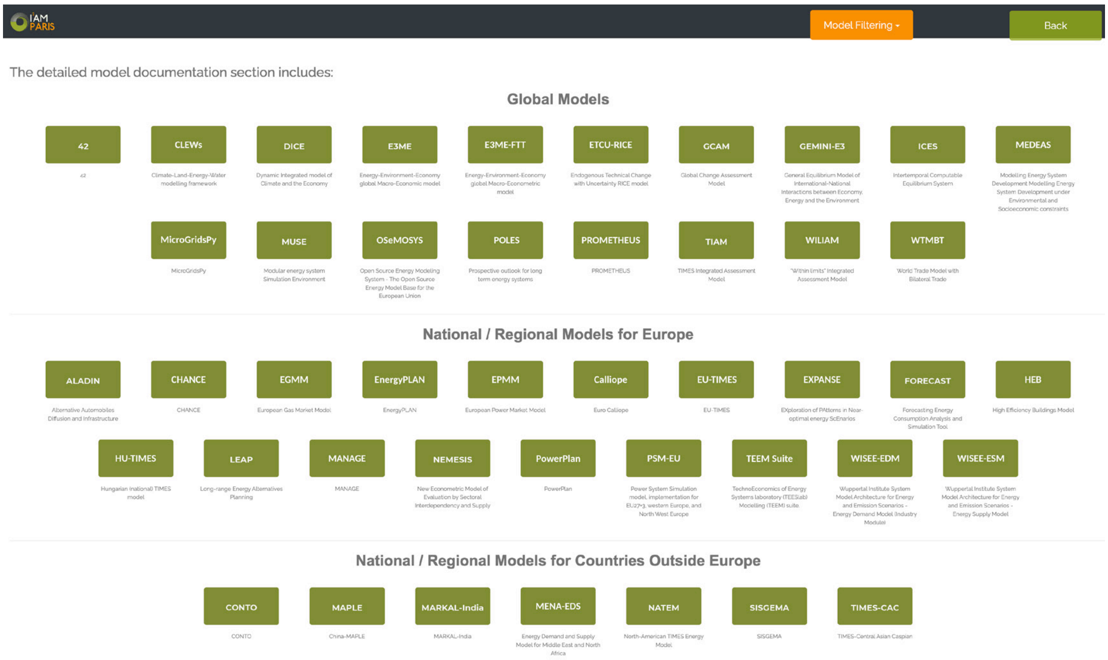

Figure 2. Detailed Model Documentation

[5] https://www.i2am-paris.eu/detailed_model_doc/expanse
[6] https://www.i2am-paris.eu/detailed_model_doc/wisee-esm

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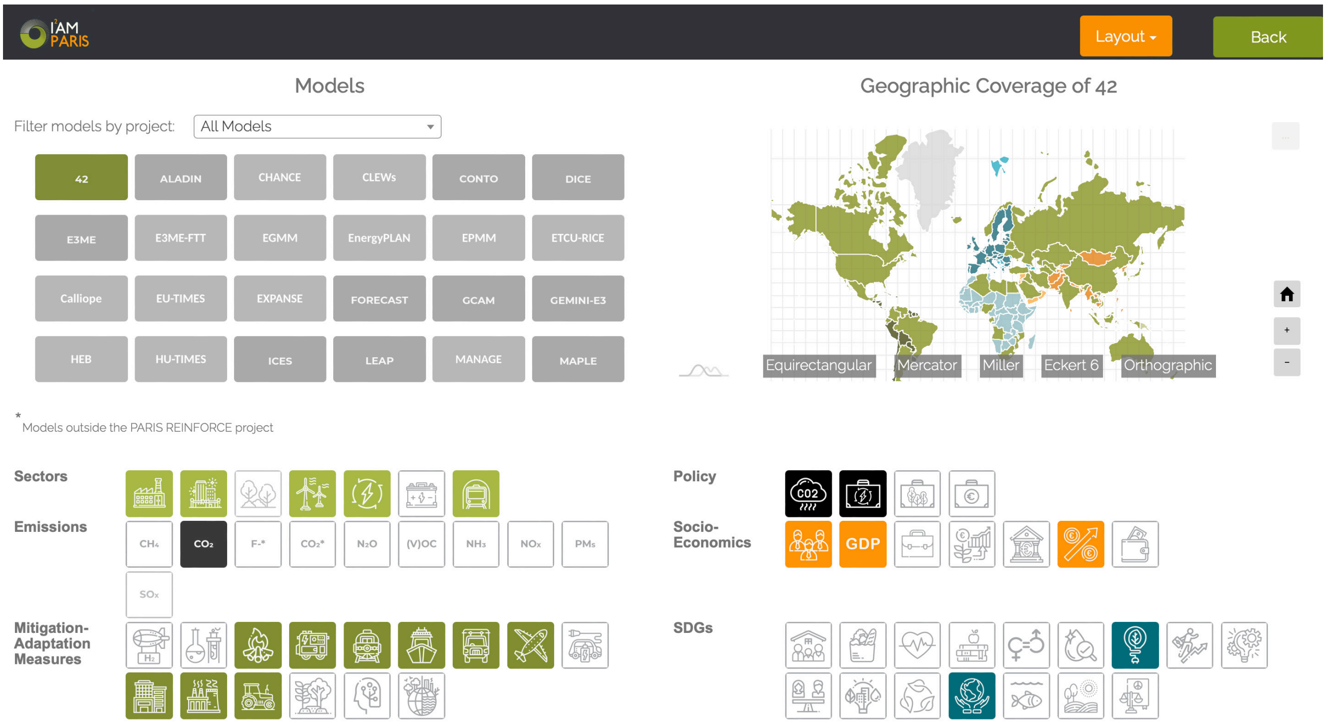

Figure 3. Model Dynamic Documentation

The 'Results' section contains workspaces that show the outcomes of the main modelling exercises of that project as well as other relevant research activities. Each workspace features meaningful, user-friendly, and interactive visualisations that show the input and output data from these activities, including related policy questions as well as links to scientific publications. Most workspaces feature the following modules:

- **Advanced Scientific Module**: providing interactive access to the full dataset of inputs and outputs of modelling exercise hosted in the workspace, allowing the user to produce customised charts (such as line or column charts) in terms of models, variables, and categories and download formatted datasets in easy-to-use formats like .csv or .xlsx files; this module also includes a sub-module with pre-defined interactive visualisations that present the main findings in high detail (Figure 4).
- **Public Interface**: a more explanatory and user-friendly version of the Advanced Scientific Module, structuring the conclusions of each modelling exercise through policy-relevant questions and featuring interactive figures to underpin these conclusions (Figure 5).
- **Variable Harmonisation Heatmap**: showcasing what variables have been harmonised across the models that participate in a specific modelling exercise.
- **Virtual Library**: a repository of information and links related the workspace's modelling exercise or research activity, including scientific and conference publications, policy briefs and deliverables, and datasets.

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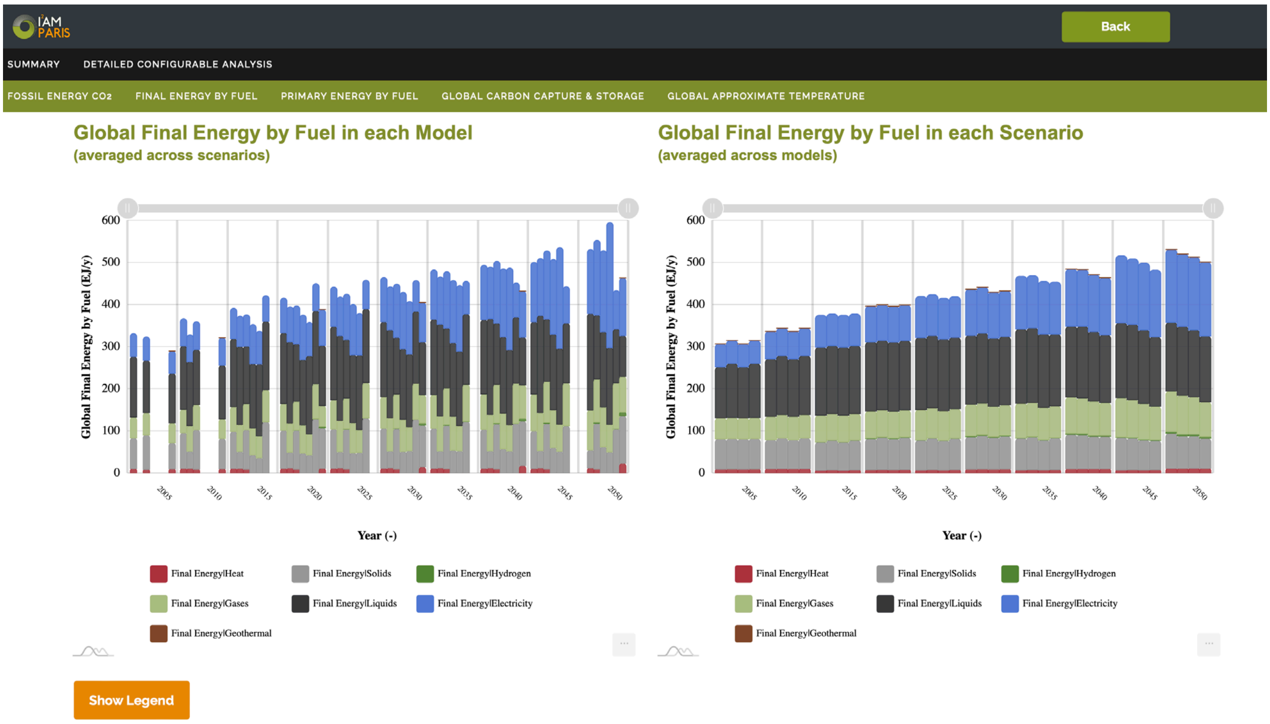

Figure 4. Example of modelling results visualised through the Advanced Scientific Interface

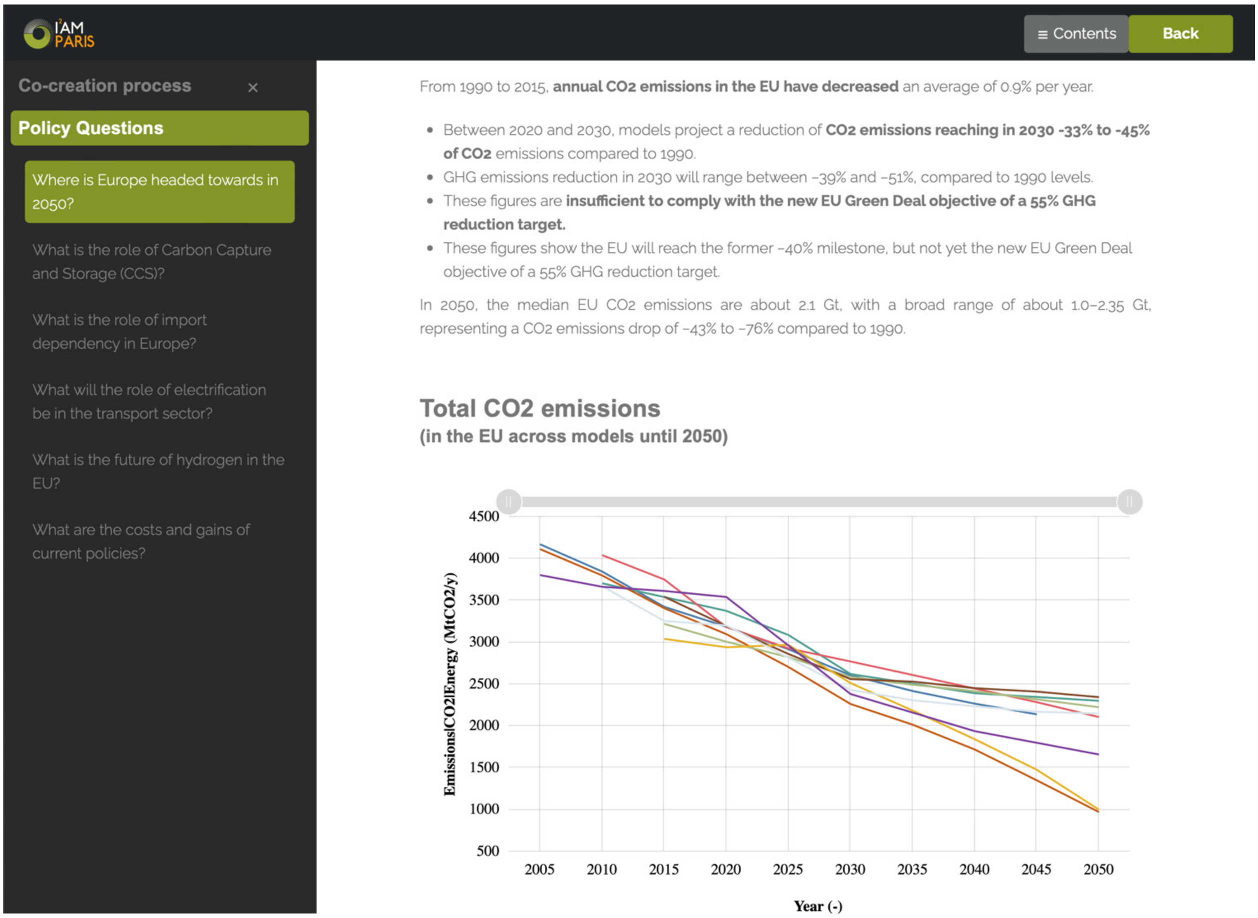

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Figure 5. Example of modelling results visualised through the Public Interface

The following six result workspaces were developed for PARIS REINFORCE:

1. **Where is the world headed?** This workspace[7] presented the results of a large model intercomparison on global scenarios of current climate policies.
2. **Where is the EU headed?** The workspace[8] presented the results of a multi-model analysis on the impacts of current mitigation efforts in Europe.
3. **Recovery policy database:** A shared initiative of PARIS REINFORCE and other Horizon 2020 projects of similar topics, this workspace[9] presented information from a database of recovery policies around Europe. The workspace differed from all other workspaces as it had only one webpage showing an interactive table of database information
4. **Index decomposition analysis:** The workspace[10] described a meta-analysis on the results of the 'Where is the EU headed?' workspace, identifying key driving forces and levers of emission changes over time.
5. **COVID recovery packages:** This workspace[11] presented the results of an analysis of green recovery packages for major countries around the world to find investment portfolios that optimise both climate mitigation and (near- and longer-term) employment benefits.
6. **Regional feasibilities to net-zero:** A workspace[12] showing the results of a multi-model global analysis on the impacts of current climate policies, NDCs, net-zero targets, and regional feasibilities. This analysis was primarily an update of the analysis shown in the "Where is the world headed?" workspace.

All result workspaces as well as the documentation components are powered by technical infrastructure that was created specifically for the platform, comprising three main components: the I^{2}AM PARIS Backend containing the main Database Models/Entities and providing access to them through APIs; the Data Manager, a component for the creation, storage, and execution of detailed queries from these APIs; and the Visualiser, a chart and map visualisation generator for showing data provided by the queries. Additionally, three data parsers were developed for inserting project data into the platform's Database, including model information, analysis of model-based results, and data on variable harmonisation. The infrastructure was mainly built using the Python programming language and the Django web framework. More detailed information on the technical components of the Platform can be found in a report on the final version of the Platform by PARIS REINFORCE[13]. All underlying software code of the platform is open source and can be found in GitHub[14].

The platform, as developed in PARIS REINFORCE, was also presented in the Horizon Results Platform[15].

[7] https://www.i2am-paris.eu/pr_wwh/landing
[8] https://www.i2am-paris.eu/eu_wwh/landing
[9] https://www.i2am-paris.eu/rrf_policy_intro
[10] https://www.i2am-paris.eu/ida/public_module#methods
[11] https://www.i2am-paris.eu/covid/landing
[12] https://www.i2am-paris.eu/feasibility/scientific_module
[13] https://paris-reinforce.eu/sites/default/files/2022-12/D2.6%20The%20I2AM%20PARIS%20platform_Update%202_v1.00_SUBMITTED.pdf
[14] https://github.com/i2amparis/i2amparis_platform
[15] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform/52045

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3 Introduction of validity checks

The validity and credibility of modelling methods, inputs, and outputs are quintessential for providing stakeholders of climate action with the confidence to use modelling information in strategic decision-making, investment planning and policy design. Data quality is even more significant in large modelling exercises, where the volume of modelling and scenario data increases to a level that it becomes difficult to visually keep track, requiring automatic algorithmic checks. While a wide range of validation methods and protocols have been developed in the last decade, the growing modelling community and the wide production of studies require user-friendly and transparent methods for helping modellers to ensure data quality in their results.

During PARIS REINFORCE, an initial level of quality check was achieved by means of a common template for formatting modelling results from the Integrated Assessment Modelling Consortium (IAMC)[16]. The template is prevalent in the community of climate mitigation modelling and was recently used for data input in the scenario database of the Sixth Assessment Report (AR6) of the Intergovernmental Panel for Climate Change (IPCC). The template has index fields for models, scenarios, regions, variables, and units, and then shows data values for specific years following a timeseries format (see Table 1). While the template helped standardise the format of scenario results of the PARIS REINFORCE project, many parsing errors were observed due to mistakes in variable names or model names as well as due to duplicate data.

Table 1. Example of the IAMC template[17] for modelling results of climate change mitigation

Model	Scenario	Region	Variable	Unit	2005	2010	…
GCAM	Baseline	World	Temperature|Global Mean	°C	0.89	1.01	…

Based on a meeting with modelling partners within IAM COMPACT in December 2022 as well as drawing from the experience of PARIS REINORCE and other modelling projects, the following validation checks were suggested:

- **Model name consistency**: Model names in results will be kept consistent with the ones used in the documentation components. In that way, the different platform sections can cross-reference one another, allowing visitors to directly access details of models that were used to create specific results—and vice versa. Model names in the results will include the exact model version used for a specific modelling run, providing a link to version-specific documentation in the platform or in other locations such as code repositories (for instance, the repository of the GCAM model in GitHub[18]).
- **Variable name consistency**: Variable entries will be checked against the typical list of variables used in the IPCC reports. In case that a new variable is added, it will be flagged so that the user can confirm whether it is truly a new variable or a misspelt version of an existing one.
- **Region name consistency**: Like variables, regions will be checked against the typical list of regions used in the IPCC as well as in other major modelling projects, such as the ECEMF or NAVIGATE projects.
- **Unit consistency**: Typical units will be coupled with specific variables to avoid the case that models use different units for the same variable, allowing for easier comparison. Deviations will be reported, and users will be recommended to use the standard unit type. For many standard unit conversions, such as between joule, watt hour, and tonne oil equivalent, a unit converter routine will be developed and automatically apply when new modelling results are added to the platform (subject to confirmation from the user that uploads these results).
- **Duplication checks:** The check will search for entries with the same indices and flag potential

[16] https://www.iamconsortium.org/scientific-working-groups/data-protocols-and-management/iamc-time-series-data-template/
[17] https://pyam-iamc.readthedocs.io/en/stable/
[18] https://github.com/JGCRI/gcam-core

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duplicates.

- **Value format**: Entries under the value columns will be checked as to whether they contain numerical data. Empty entries will be assumed to indicate a N/A value. This will be communicated to all consortium modellers, as some models may indicate zero values as an empty entry. In that case, these cells will need to be changed to a zero numeral before adding data to the platform.
- **Basic sums across variables**: When variables are provided both in a disaggregated and an aggregated form (for instance, total emissions and emissions per sector), the sum of the disaggregated variables will be checked against the aggregated one and flagged when the deviation is larger than ±1-2%.

It is noted that some of these checks may be already present in the nomenclature software package provided by the IAMC[19]. In that case, the code repository of this software will be forked and extended accordingly. Apart from validation checks, data consistency and feasibility checks will be also implemented, based on different benchmarks. Among other metrics, we will evaluate our modelling results against the 'vetting' criteria used at the IPCC AR6 scenario database. This vetting process required key indicators of modelled scenarios to be within reasonable ranges for a historical year (commonly 2019 or 2015); other vetting criteria assessed the feasibility of future scenario projections, indicating, for instance, whether models assumed very high or unrealistic ramp-up rates for specific technologies. The IPCC AR6 vetting criteria mostly relate to emissions and energy sector characteristics and can be seen in Table 1 below.

Table 2. Vetting criteria from the IPCC AR6 scenario database (Annex 3[20], Section 3.1)

Indicators	Reference value	Vetting range for all global scenarios	Vetting range for illustrative pathways
Historical emissions (sources EDGAR v6 IPCC and CEDS, 2019 values)			
CO_2 total emissions (EIP + AFOLU)	44,251 $MtCO_2$/yr	±40%	±20%
CO_2 EIP emissions	37,646 $MtCO_2$/yr	±20%	±10%
CH_4 emissions	379 $MtCH_4$/yr	±20%	±20%
CO_2 emissions EIP 2010-2020 - % change	-	0 to +50%	0 to +50%
CCS from Energy 2020	-	0-250 $MtCO_2$/yr	0-100 $MtCO_2$/yr
Historical energy production (sources IEA 2019; IRENA; BP; EMBERS; trends extrapolated to 2020)			
Primary Energy (2020, IEA)	578 EJ	±20%	±10%
Electricity Nuclear (2020, IEA)	9.77 EJ	±30%	±20%
Electricity Solar & Wind (2020, IEA, IRENA, BP, EMBERS)	8.51 EJ	±50%	±25%
Future criteria (not used for exclusion, only flagged as potentially problematic)			
No net negative CO_2 emissions before 2030	CO_2 total in 2030 > 0	-	-
CCS from Energy in 2030	< 2000 $MtCO_2$/yr	-	-
Electricity from Nuclear in 2030	< 20 EJ/yr	-	-
CH_4 emissions in 2040	100-1000 $MtCH_4$/yr	-	-

Note: EIP stands for energy and industrial process emissions; AFOLU stands for Agriculture, Forestry and Other Land Use.

Apart from the vetting criteria of IPCC AR6, additional data consistency and feasibility checks will be established to evaluate more variables or regional results (e.g., individual values for the EU or China). All data checks will be scripted using the Python programming language. The script will take scenario results from a modelling exercise as an input, using an Excel or CSV format based on the IAMC template. As an output, the script will flag the

[19] https://github.com/IAMconsortium/nomenclature
[20] https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_Annex-III.pdf

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scenarios that do not pass the data consistency and validation process and explicitly show the indicators that fail. The script will then be deployed in the platform and integrated in an interface that will be developed in the future, allowing modellers to insert scenario results to the platform directly (see Chapter 4 for more details). The interface will be interactive, showing first validation results to modellers before submitting their data to the platform and allowing them to upload a corrected version of the results if needed. A version control system will also be developed, to allow modellers to track the versions of results that are within the platform.

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4 Enhancement of documentation components

The documentation section of I^{2}AM PARIS will be enhanced to match the requirements and needs of IAM COMPACT. While many of the project models have already been documented (as part of PARIS REINFORCE work or in response to the platform's previous open calls to the modelling community), many of these will need to be updated while new models will be included. As many sectoral models will be included, the platform faces the pressing need to better showcase the characteristics and level of sectoral detail that is missing from the platform's current documentation templates. Additionally, the capacity development activities of the project will result in the development of training material that must be hosted in the platform, in a way that complements and increases the comprehensibility of the existing model documentation.

Towards this goal, a library of learning resources will be created in the documentation section of the platform, comprising videos, tutorials, and documents. The library component will include the training materials that will be created by the IAM COMPACT project but also link to materials from other projects and modelling fora, such as the SENTINEL project[21] (Figure 6) and the IAMC consortium[22]. The intention will be to create a focal point of learning resources about modelling for climate action (without focusing only on IAMs) to help new modelling teams and support them with the information they need to understand and operate models. In that way, we can also support the exploitation of materials created from other projects, contributing to the sustainability and usefulness of their outputs. An interface will be made to allow researchers outside the consortium to add training materials for their own models, while IAM COMPACT consortium partners will help curate all new content and ensure its quality. Training materials will be then cross-linked to other documentation components, helping visitors find the specific resources that correspond to a specific model.

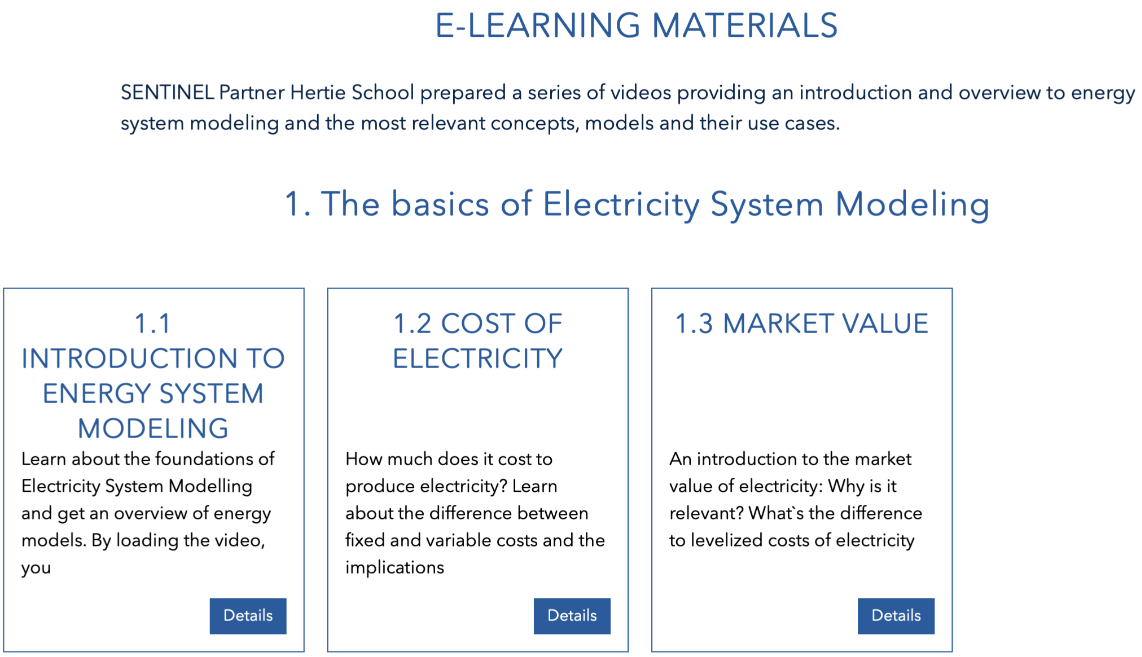

Figure 6. Example of library of training materials from the SENTINEL project

In this direction, IAM COMPACT held a series of modelling seminars throughout November and December 2022 with detailed presentation of the various global, national, and sectoral models included in IAM COMPACT; all presentations were recorded and the slide packs along with the records will be uploaded and provided as

[21] https://sentinel.energy/trainingmaterials/1-1-introduction-to-energy-system-modeling/
[22] https://www.iamconsortium.org/resources/tools-visualization/

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documentation/information material for each IAM COMPACT model in the platform's Documentation components.

The existing documentation components will also be updated to better showcase the characteristics of sectoral models such as on transportation, specific industries (e.g., steel or cement), buildings, water, as well as agriculture forestry, and other land use (AFOLU). A first project meeting among NTUA and sectoral modelling teams on this topic took place in December 2022, helping the platform development team understand what is needed to best represent sectoral models while also allowing associated improvements to align with the current structure, without splitting the documentation section depending on model focus.

While few sectoral models are already present in the platform, it was acknowledged that it is not readily apparent in all documentation components that these are specialised sectoral models. For instance, the infographic-like Model Dynamic Documentation component, featuring an overview of the characteristics of each modelling tool, indicates that the ALADIN sectoral model is simulating only one sector, without showing any other specialised features of the model, such as its high technological granularity for that specific sector. This component will thus be enhanced to show the highlights of sectoral models, such as a more granular representation of sub-sectors and specific technologies that are covered by the models along with other special modelling details such as hourly resolution, subnational granularity, specific impacts examined. These highlights will be shown through icons that will be flexibly created for each model. Sectoral models will be further distinguished by other models by visualising them through different colours and by allowing users to filter them, for instance, in order to find sectoral models for specific sectors, e.g., transport or buildings.

The need to show sectoral model highlights will potentially require changing/updating the template for model documentation that is currently used by the platform, as sectoral models frequently include more variables than global or national models due to their different granularity. The same can be said for the scenario template, which corresponds to IPCC AR6 template for global and national models. A specific template for sectoral models is also provided by the IPCC (in a similar format as the one for global and national models) and can be potentially adapted for use in the platform. A similar adaptation will be made to specific vetting requirements for sectoral models, adding the respective checks to the data validation component described in Chapter 3. Additionally, it will be examined whether there is a need to modify the Variable Harmonisation Heatmap[23] component for showing the harmonisation details between sectoral and global/national models, as it was already done for the models of the PARIS REINFORCE project.

Apart from modifications for sectoral models, existing documentation components will be further updated to match new requirements and ongoing feedback from the modelling community. Most importantly, an interface will be made to allow users to directly add their own models to the platform, without much extra work from the platform developers (apart from the validation of major data entries). In the Detailed Model Documentation, the interface will include a field for adding documents such as detailed documentation, links to scientific publications, and presentation slides. In addition, new sub-sections will be introduced—e.g., one showing an overview of the models' key features. In the Model Dynamic Documentation component, a feature will be developed allowing visitors to hide icons that are not relevant for a model, facilitating understanding of its characteristics. The map of the same component (see Figure 3) will be also modified to show regional or sub-national detail for specific models by zooming in. The Overview and Comparative Assessment will be also updated with comparisons among the specific models of IAM COMPACT. Finally, we will reach out to the ECEMF[24] project and the EFECT[25] forum as well as other new modelling projects and/or networks to discuss potential synergies related to the platform, while encouraging modelling teams beyond the consortium to add their models to the platform.

[23] https://www.i2am-paris.eu/harmonisation_map_tool/harmonisation_manual
[24] https://www.ecemf.eu
[25] https://www.efect.eu/

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5 Enhancement of result components

Similar to the documentation component, a key motivation for the result components includes creating an interface for platform users to add modelling results automatically. Currently, the development team of the platform need to manually initiate the parsing of new modelling results in the database and create the respective workspaces and interactive visualisations to visualise these results. This requires many development hours and iterations between the providers of the modelling data and the development team and can be potentially subject to errors.

In the context of IAM COMPACT, the process of data parsing will be automated and integrated with the validation checks described in Chapter 3. Thus, a platform user will be able to directly initiate data parsing and checks from a special, user-friendly interface and iteratively fix potential problems in the data without the time-consuming intervention by the development team. Similarly, an interface will be made to create a results workspace connected to a specific data stream by choosing specific visualisations and by adding explanations, analysis, and relevant research questions. While such functionality can be partly found in tools such as the Scenario Explorer from IIASA[26] (Figure 7), the added value from adding it to I²AM PARIS is that workspaces can be linked to all available data in the platform (both for modelling documentation and results) and support a rich variety of methods for enhancing modelling results through text, uploaded files, and links to other sources. The interface will be documented extensively to help new users, while the development team will be available for any questions.

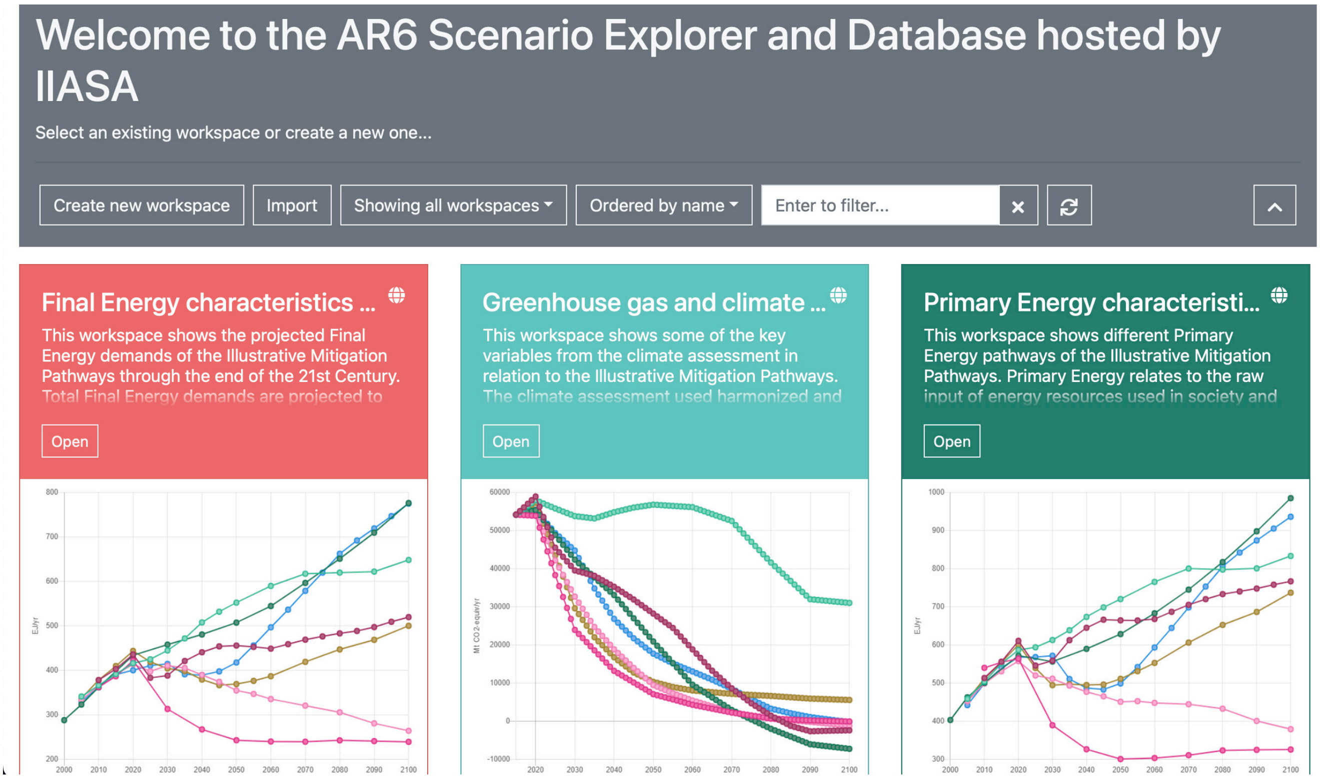

Figure 7. Example of user interfaces to visualise modelling results from the IIASA Scenario Explorer

To ensure data quality and avoid cyber-attacks through data injection, visitors that want to add data will need to provide proof that are related to a specific modelling team or organisations, for instance, by registering with their professional email account. Registered users will be able to add new data and modify data that was added by them. In case of a major data entry or change, a platform admin will be able to check and confirm the change. Registered users will be also able to change the visibility settings of their workspaces, for instance, by keeping

[26] https://data.ece.iiasa.ac.at/ar6/#/workspaces

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the workspace private during its implementation and then releasing it for all users in the platform.

Last but not least, new workspaces related to the modelling work of IAM COMPACT will be developed. The workspaces will be developed throughout the duration of the project. Initially, project partners will need to send their modelling results to the development team to create the workspaces, but gradually the automatic user interfaces will come online, allowing partners to directly upload their modelling results onto the platform. To further support the comprehensibility of results and the rationale between modelling studies, the relevant research questions of each study will be added in the Advanced Scientific Module of new workspaces, similar to policy questions in the Public Interface. Further improvements to the result modules may be also elaborated per request of consortium partners and platform users.

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6 Planning of upgrades and current progress

The platform upgrades that were described in the previous chapters will be implemented gradually over the entire duration of the project. An initial planning is shown in Figure 8. As suggested before, two meetings with project partners have taken place in December 2022 to understand the requirements for the validation and vetting checks as well as for the best representation of sectoral models. Additionally, the project coordinators have requested from all modelling partners to provide updated or new documentation for their models. Most new models will be added in the platform during December 2022 and the rest of the documentation in I^{2}AM PARIS will be updated during the first two months of 2023. Model documentation will be again updated during the last year of the project based on the new features and functionalities developed in WP5.

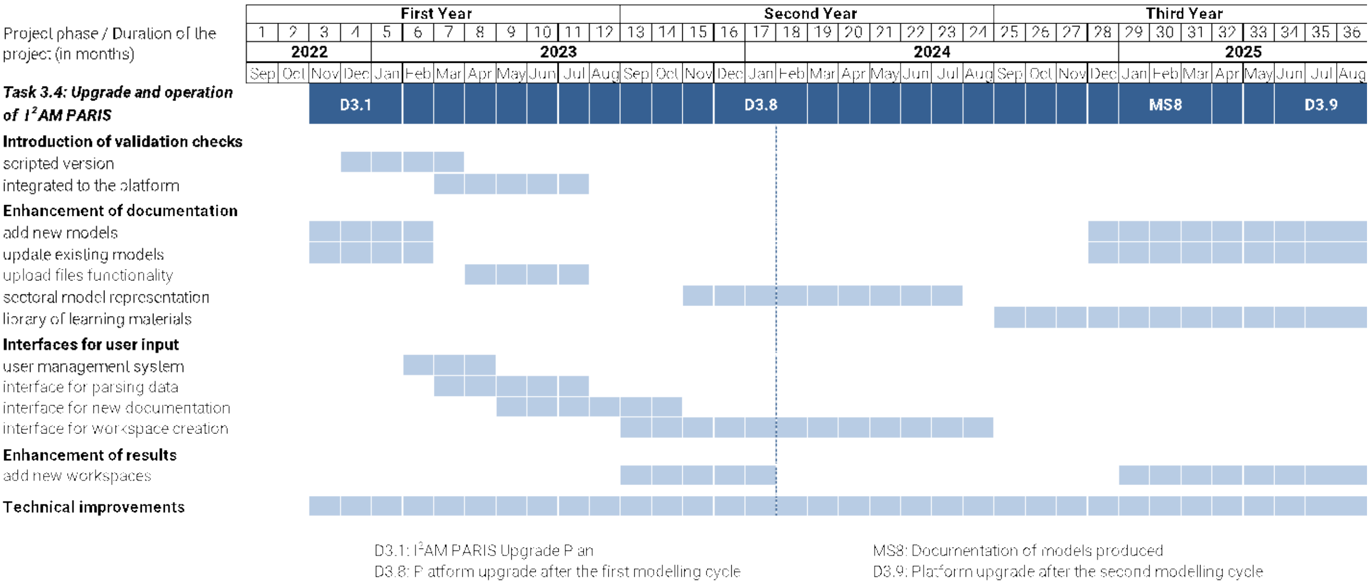

Figure 8. Planning of I^{2}AM PARIS upgrades

In terms of other priorities, validation and vetting checks are expected to be implemented in the form of a script during the first months of 2023 and integrated to the platform by around mid-2023, in parallel with the user interface for parsing data and a user management system to allow other modelling teams to register to the platform. This will be followed by the creation of an interface for new documentation during the second half of 2023, as well as the addition of new workspaces from the first modelling round of the project, in time for the first deliverable on the upgraded I^{2}AM PARIS platform by January 2024. In the second half of the project, we will finalise the interface for workspace creation and the improvement of sectoral model representation (by around mid-2024), followed by the creation of the library of learning materials. During 2025, we expect to update modelling documentation and add the new workspaces from the second modelling round.

Throughout the project duration, technical improvements will be implemented in the platform. The most important changes required will be to update the existing technical framework of the platform to allow for user interfaces and to facilitate the creation of the workspaces. We will follow an API-first and language-agnostic approach to develop components, for instance by keeping the existing technical components for visualisation in Python and creating user interfaces in Node.js. Moreover, we intend to modernise the appearance of the platform and provide it with its own visual identity, independent of the project or organisation that is currently managing or will manage the platform in the user. Nevertheless, we will allow the possibility for future projects to provide their workspaces in their own custom visual identity. Finally, adhering to the FAIR principles for data management, all materials in the platform will remain available at least for five years after the end of IAM COMPACT and the other supporting projects, while efforts will be made within with the wider modelling community to establish the long-term sustainability of the platform.

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