PARIS
REINFORCE

16/02/2020

D2.3 INTERACTIVE MAP OF MODELS AND TOOLS

WP2 – I^{2}AM PARIS

Version: 1.00

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The PARIS REINFORCE project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 820846.

EC Summary Requirements

1. Changes with respect to the DoA

Aside from the deliverable being ready by M6 (November 2019) instead of M9 (February 2020), no changes are reported with respect to the work described in the DoA.

2. Dissemination and uptake

The interactive map of models and tools, as documented in this report and accessed in the I²AM PARIS platform, is aimed at both researchers/modellers and all other stakeholder groups, including but not limited to policymakers.

3. Short summary of results (<250 words)

This report corresponds to MS3, as part of Task 2.3 and Deliverable D2.4, documenting inter alia the interactive map of models and tools. The map, hereafter named "dynamic documentation", had been prepared by early November 2019, to showcase during the first Stakeholder Council dialogue of the project, i.e. the 1st PARIS REINFORCE regional workshop held in Brussels, Belgium, on the 21st of November 2019. Early design, implementation and demonstration gave us the capacity to gain early feedback from the stakeholders, as a basis to elicit preferences regarding overall functionality, interface and user experience of the I²AM PARIS platform, in a dedicated, dialogue-driven session; and, along with the corresponding policy brief (Deliverable D3.2) helped carry out a session on explaining what our models can deliver, what their capabilities and (geographic, sectoral, emissions, technological, etc.) coverage are, and what research questions they have hitherto been used to answer before scoping whether the PARIS REINFORCE modelling armoury can deliver on what stakeholders need.

4. Evidence of accomplishment

The dynamic documentation of the PARIS REINFORCE models, as hosted in the I²AM PARIS platform prototype: http://paris-reinforce.epu.ntua.gr/dynamic_doc/.

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Preface

PARIS REINFORCE will develop a novel, demand-driven, IAM-oriented assessment framework for effectively supporting the design and assessment of climate policies in the European Union as well as in other major emitters and selected less emitting countries, in respect to the Paris Agreement. By engaging policymakers and scientists/modellers, PARIS REINFORCE will create the open-access and transparent data exchange platform I^2AM PARIS, in order to support the effective implementation of Nationally Determined Contributions, the preparation of future action pledges, the development of 2050 decarbonisation strategies, and the reinforcement of the 2023 Global Stocktake. Finally, PARIS REINFORCE will introduce innovative integrative processes, in which IAMs are further coupled with well-established methodological frameworks, in order to improve the robustness of modelling outcomes against different types of uncertainties.

NTUA - National Technical University of Athens	GR	
BC3 - Basque Centre for Climate Change	ES	
Bruegel - Bruegel AISBL	BE	
Cambridge - University of Cambridge	UK	
CICERO - Cicero Senter Klimaforskning Stiftelse	NO	
CMCC - Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici	IT	
E4SMA - Energy Engineering Economic Environment Systems Modeling and Analysis	IT	
EPFL - École polytechnique fédérale de Lausanne	CH	
Fraunhofer ISI - Fraunhofer Institute for Systems and Innovation Research	DE	
Grantham - Imperial College of Science Technology and Medicine - Grantham Institute	UK	
HOLISTIC - Holistic P.C.	GR	
IEECP - Institute for European Energy and Climate Policy Stichting	NL	
SEURECO - Société Européenne d'Economie SARL	FR	
CDS/UnB - Centre for Sustainable Development of the University of Brasilia	BR	
CUP - China University of Petroleum-Beijing	CN	
IEF-RAS - Institute of Economic Forecasting – Russian Academy of Sciences	RU	
IGES - Institute for Global Environmental Strategies	JP	
TERI - The Energy and Resources Institute	IN	

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Executive Summary

This report corresponds to MS3, as part of Task 2.3 and Deliverable D2.4, documenting inter alia the interactive map of models and tools. The map, hereafter named "dynamic documentation", had been prepared by early November 2019, to showcase during the first Stakeholder Council dialogue of the project, i.e. the 1st PARIS REINFORCE regional workshop held in Brussels, Belgium, on the 21st of November 2019. Early design, implementation and demonstration gave us the capacity to gain early feedback from the stakeholders, as a basis to elicit preferences regarding overall functionality, interface and user experience of the I²AM PARIS platform, in a dedicated, dialogue-driven session; and, along with the corresponding policy brief (Deliverable D3.2) helped carry out a session on explaining what our models can deliver, what their capabilities and (geographic, sectoral, emissions, technological, etc.) coverage are, and what research questions they have hitherto been used to answer before scoping whether the PARIS REINFORCE modelling armoury can deliver on what stakeholders need.

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1 Documentation of the I²AM PARIS platform prototype

In this section, the set of the available services of the first integrated version of the I²AM PARIS platform are presented, along with the ones that are planned to be implemented until the next release.

1.1 Platform services

In the following figure, an overview of the platform services is presented.

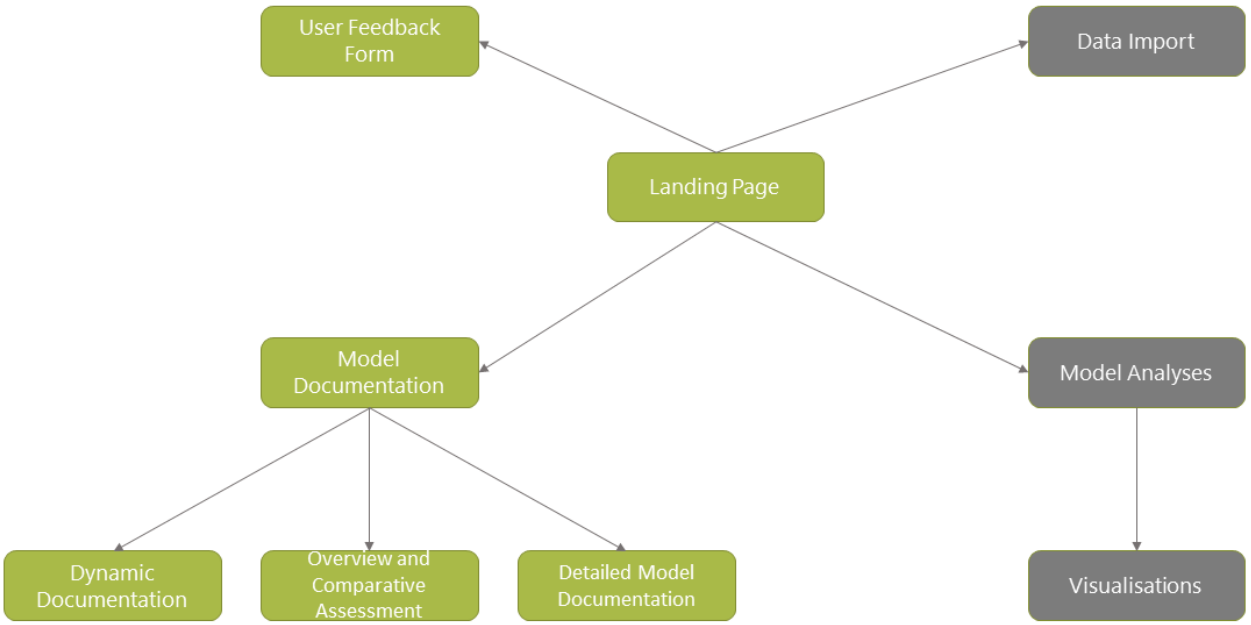

Figure 1: Platform services overview

A first version of the I²AM PARIS platform is available online (http://paris-reinforce.epu.ntua.gr/main), including a landing page that allows navigation throughout the platform, along with services mainly focused on the Model Documentation of the available models. It is a web application based on Django Framework 2.2.5, utilising AM-Charts 4 for the map and chart visualisations. The source code versioning and management is performed through Git version control system and the code is stored in a Github repository[1]. In the figure above, the available parts of the platform are shown in green colour, while the grey boxes represent components that are either currently under development or planned to be implemented in the near future.

The Dynamic Documentation component is an interactive library of the available models, in the form of a responsive "infographic", regarding their features, including geographical coverage as well as sector, emission, policy, SDG, socio-economic and mitigation/adaptation measure granularities. The Overview and Comparative Assessment consists of a collection of information included in Section 2 of PARIS REINFORCE deliverables D5.1, D6.1, D7.1 and aims at providing an overview of the suitability of each model for specific research needs, compared to one other. The Detailed Model Documentation, in essence, includes a detailed presentation of every model currently available on the platform and is composed of information retrieved from the corresponding deliverables. The User Feedback Form is useful for collecting feedback from platform users, including requests for new services,

[1] https://github.com/sskalidakis/i2amparis

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bugs and errors on the platform, new ideas/suggestions, etc. The submitted form is forwarded to the developers and accordingly handled or further forwarded to the Project Coordinator to communicate to the consortium.

Concerning the services that are not yet implemented, the Model Analyses component will be a dynamic representation of data deriving from several runs of the available models, including meaningful visualisations and user-friendly interfaces that will allow the user to examine the results of different scenarios by altering specific parameters on the interface. This component will be introduced and described in detail in the upcoming release of the I^{2}AM PARIS platform. Moreover, the Data Import, as part of the scientific interface, will allow users to upload CSV files consisting of either model documentation information or scenario modelling results, provided in a specific format that will be circulated in the near future to all consortium partners and relevant research projects and the modelling community, in order to ensure that it fulfils every requirement. After it has been uploaded, the file will be automatically parsed in order to populate the I^{2}AM PARIS Database with the submitted data. This service will initially be used for introducing new models to the Dynamic Documentation but could be further developed for importing data for the Analysis part.

1.2 Landing Page

The landing page of the I^{2}AM PARIS at the moment is composed of a carousel containing information about the project (Figure 2), a navigation bar that helps users easily navigate through each section, and an entire section regarding the model documentation service (Figure 3) comprising links that lead to the Dynamic Documentation, the Overview and Comparative Assessment and the Model Detailed Documentation.

The screenshots below show the main parts of the current version of the Landing Page.

Figure 2: Landing page carousel

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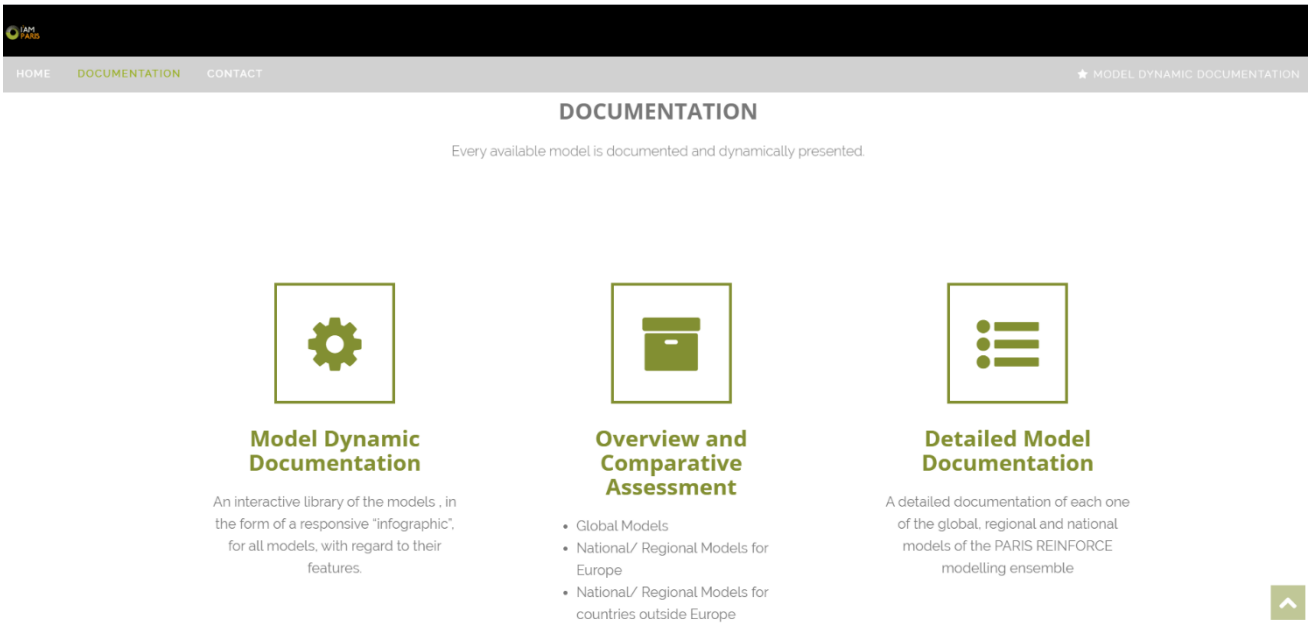

Figure 3: Landing Page- Documentation Section

1.3 Dynamic Model Documentation

The Dynamic Model Documentation is a combination of a backend and a frontend infrastructure and is responsible for presenting the documentation of each model in a user-friendly manner, taking advantage of the information retrieved from the database as well as interactive maps, combined into an elegant user interface.

1.3.1 Backend Services of Dynamic Documentation

1.3.1.1 Django Models

The functionality of the backend services of the Dynamic Model Documentation is based on retrieving and filtering data from the I²AM PARIS database. This database mainly consists of the following entities and its structure is presented in the ER Diagram below:

- Models
- Regions
- Countries
- Sustainable Development Goal (SDG) Categories
- SDG Descriptions
- Mitigation/Adaptation Measure Categories
- Mitigation/Adaptation Measure Subcategories
- Mitigation/Adaptation Measures
- Sector Categories
- Sector Subcategories
- Sectors

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- Emissions
- Emission- Model States
- Socio-Economics Categories
- Socio-Economics
- Socio-Economics - Model States
- Policy Categories
- Policies
- Policy- Model States

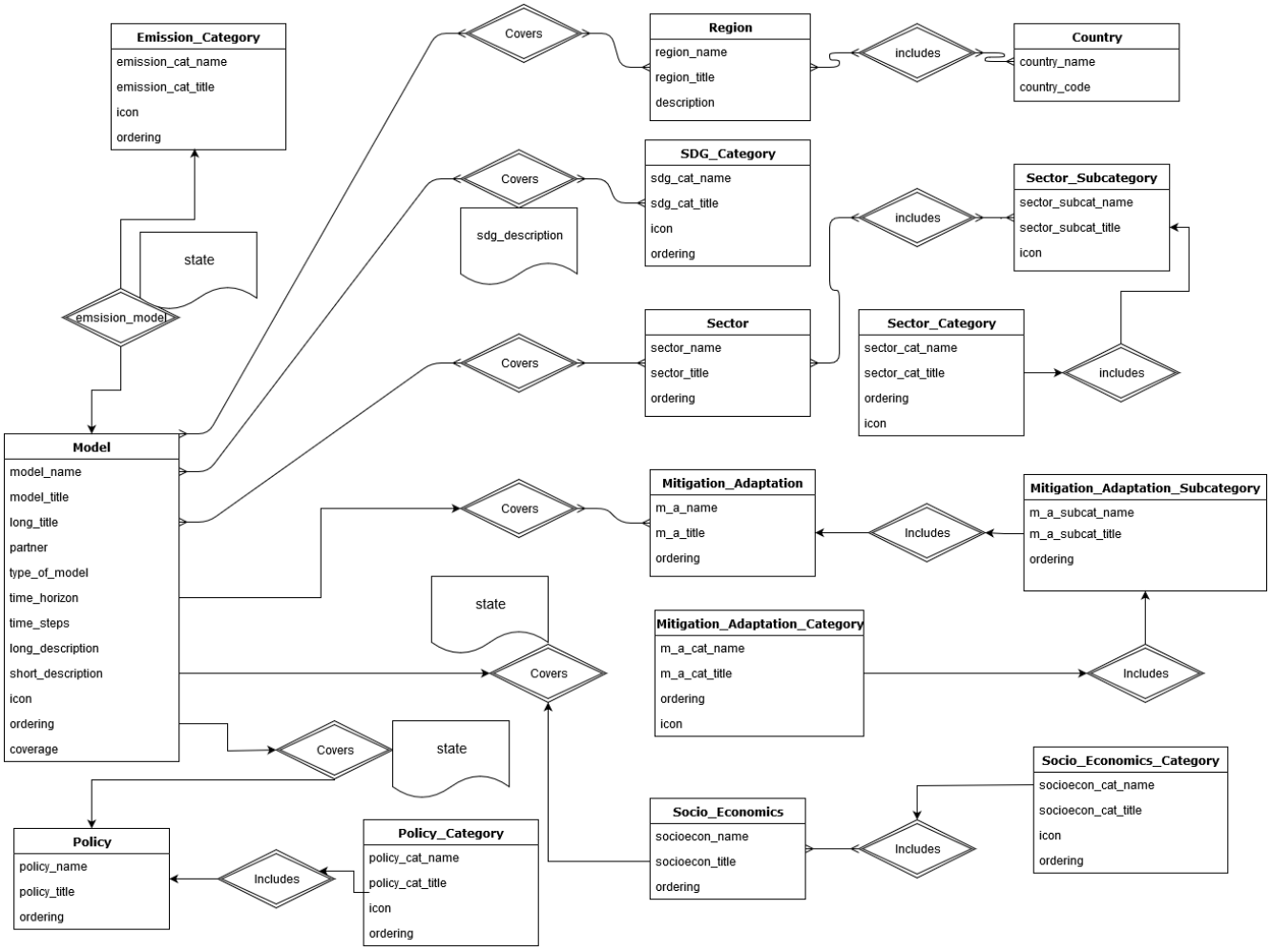

Figure 4: ER Diagram of the I2AM Paris Database

The database has been automatically created utilising Django models and migrations, according to the aforementioned entities. The tables below contain the main information of each Django model:

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Table 1: Model

Field	Description
model_name	The unique name of each model used inside the code
model_title	The title of each model used on the interfaces
long_title	A more descriptive title of each model
partner	The name of the partner that developed the model
type_of_model	The type of the model according to the domain it focuses on
time_horizon	The time horizon of each model
time_steps	The time step that each model uses to produce results
long_description	An extensive description of the model
short_description	A short description of each model used in popovers, popups etc.
icon	It is the path to an image file (icon) used for each model on the interfaces
ordering	The ordering in the list of models as presented on the interfaces
coverage	A field that describes the geographical coverage of each model and takes one of the following values: a) global b) national_EU (for countries inside Europe) c) national_OEU (for countries outside Europe)

Table 2: Region

Field	Description
region_name	The unique name of each region used inside the code
region_title	The title of each region used on the interfaces
description	A list of the countries included in this specific region
model_name	A many-to-many field used for matching models to regions

Table 3: Country

Field	Description
country_name	The unique name (and title) of each country
country_code	A two-letter abbreviation of each country
region_name	A many-to-many field used for matching countries to regions

Table 4: SDG_Category

Field	Description
sdg_cat_name	The unique name of each SDG category used inside the code
sdg_cat_title	The title of each SDG category used on the interfaces
icon	The path to an image file (icon) used for each SDG category on the interfaces
ordering	The ordering in the list of SDG categories as presented on the interfaces
model_id	A many-to-many field that is used for matching models to SDGs

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Table 5: SDG_Description

Field	Description
sdg_cat_id	A foreign key to the SDG category entity
model_id	A foreign key to the model entity
sdg_description	The description of the relationship between an SDG and a model
ordering	The ordering in the list of SDGs as presented on the interfaces

Table 6: Sector_Category

Field	Description
sector_cat_name	The unique name of each sector category used inside the code
sector_cat_title	The title of each sector category used on the interfaces
ordering	The ordering in the list of sector categories as presented on the interfaces
icon	The path to an image file (icon) used for each sector category on the interfaces

Table 7: Sector_Subcategory

Field	Description
sector_subcat_name	The unique name of each sector subcategory used inside the code
sector_subcat_title	The title of each sector subcategory used on the interfaces
sector_cat_id	A foreign key to the Sector category each sector subcategory belongs to
ordering	The ordering in the list of sector subcategories as presented on the interfaces

Table 8: Sector

Field	Description
sector_subcat_id	A foreign key to the Sector subcategory each sector belongs to
sector_name	The unique name of each sector used inside the code
sector_title	The title of each sector used on the interfaces
ordering	The ordering in the list of sectors as presented on the interfaces
model_id	A many-to-many field that is used for matching models to sectors

Table 9: Mitigation_Adaptation_Category

Field	Description
m_a_cat_name	The unique name of each mitigation/adaptation category used inside the code
m_a_cat_title	The title of each mitigation/adaptation category used on the interfaces
ordering	The ordering in the list of mitigation/adaptation categories as presented on the interfaces
icon	The path to an image file (icon) used for each mitigation/adaptation category on the interfaces

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Table 10: Mitigation_Adaptation_Subcategory

Field	Description
m_a_subcat_name	The unique name of each mitigation/adaptation subcategory used inside the code
m_a_subcat_title	The title of each mitigation/adaptation category used on the interfaces
ordering	The ordering in the list of mitigation/adaptation subcategories as presented on the interfaces
m_a_cat_id	A foreign key to the mitigation/adaptation category each mitigation/adaptation subcategory belongs to

Table 11: Mitigation_Adaptation

Field	Description
m_a_name	The unique name of each mitigation/adaptation measure used inside the code
m_a_title	The title of each mitigation/adaptation measure used on the interfaces
ordering	The ordering in the list of mitigation/adaptation measures as presented on the interfaces
m_a_subcat_id	A foreign key to the mitigation/adaptation subcategory each mitigation/adaptation measure belongs to
model_id	A many-to-many field that is used for matching models to mitigation/adaptation measures

Table 12: Emission_Category

Field	Description
emission_cat_name	The unique name of each emission category used inside the code
emission_cat_title	The title of each emission category used on the interfaces
icon	The path to an image file (icon) used for each emission category on the interfaces
ordering	The ordering in the list of emission categories as presented on the interfaces

Table 13: Emission_Model_State

Field	Description
emission_id	A foreign key to the emission entity
model_id	A foreign key to the model entity
state	A field that describes the relationship between a model and a specific emission and takes one of the following values: a) endogenous b) exogenous c) not represented

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Table 14: Socio_Economics_Category

Field	Description
socioecon_cat_name	The unique name of each socio-economics category used inside the code
socioecon _cat_title	The title of each socio-economics category used on the interfaces
icon	The path to an image file (icon) used for each socio-economics category on the interfaces
ordering	The ordering in the list of socio-economics categories as presented on the interfaces

Table 15: Socio_Economics

Field	Description
socioecon _cat_id	A foreign key to the socio-economics category each socio-economics parameter belongs to
socioecon _name	The unique name of each socio-economics parameter used inside the code
socioecon _title	The title of each socio-economics parameter used on the interfaces
ordering	The ordering in the list of socio-economics parameters as presented on the interfaces
model_id	A many-to-many field that is used for matching models to socio-economics parameters

Table 16: Socio_Economics _Model_State

Field	Description
socioecon_id	A foreign key to the socio-economics entity
model_id	A foreign key to the model entity
state	A field describing the relationship between a model and a specific socio-economics parameter and takes one of the following values: a) endogenous b) exogenous c) not represented

Table 17: Policy_Category

Field	Description
policy_cat_name	The unique name of each policy category used inside the code
policy _cat_title	The title of each policy category used on the interfaces
icon	The path to an image file (icon) used for each policy category on the interfaces
ordering	The ordering in the list of policy categories as presented on the interfaces

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Table 18: Policy

Field	Description
policy _cat_id	A foreign key to the policy category each socio-economics parameter belongs to
policy _name	The unique name of each policy used inside the code
policy _title	The title of each policy used on the interfaces
ordering	The ordering in the list of policies as presented on the interfaces
model_id	A many-to-many field that is used for matching models to policies

Table 19: Policy _Model_State

Field	Description
policy_id	A foreign key to the policy entity
model_id	A foreign key to the model entity
state	A field that describes the relationship between a model and a specific policy and takes one of the following values: a) feasible b) feasible with modifications c) not feasible

1.3.1.2 Methods and Functionality

The main functionality in the backend services is based on two classes and their constructor methods:

- **RetrieveDB:**

  It creates an object of a specific model, whose name is provided by the user (if not, a default model is selected). The class utilises its methods, requesting data from the database, to determine the geographical coverage of the selected model, in specific, the regions it covers and the countries that belong to every region. A JSON file is then created containing the necessary information for the creation of an interactive map, using the AMCharts Library. The format of this JSON file is described below:

```
[
    {
        "name": the name of the region,
        "colour": the colour of each region,
        "data": [
            {"title": the name of the country,
            "id": the two-letter abbreviation of the country,
            "descr": a short description for each country that is displayed on the map
            }, ...
            ]
    },
... ,
]
```

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When a model works on national level, the green colour is used on the map for each country. When a model works on a regional level, the colour of each region on the map is determined by the "generate_colour" method, choosing among different colours included in the palette. Last but not least, the "RetrieveGranularities" method is called.

- **RetrieveGranularities:**

  The input of the "RetrieveGranularities" method is the id of the selected model. In turn, this method calls a different method for each granularity describing the selected model, and the retrieved information is returned in the following JSON format:

```
{
        'MitigationAdaptationMeasures': {..} ,
        'Sectors': {..},
        'SDGs': {..},
        'Emissions': {..},
        'Policy': {..},
        'SocioEconomics': {..}
}
```

Mitigation and Adaptation Measures and **Sector** granularities are formatted as shown below:

```
{'category_name':{
        'subcategories':[
                'subcategory_name':{
                        'names': list of names (of Mitigation and Adaptation Measures or Sectors)
                }, ...
        ],
        'icon': a path to an image file (icon) used on the interfaces,
        'is_enabled': True or False,
        'html': the HTML code that will be used in the bootstrap tooltips
        }
}
```

The 'is_enabled' parameter is True if the model covers at least one of the Mitigation and Adaptation Measures or Sectors of a category.

Emissions are formatted as shown below:

```
{'emission_name':
        {'icon': a path to an image file (icon) used on the interfaces,
        'html': the HTML code that will be used in the bootstrap tooltips,
        'is_enabled': True or False
```

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}, …

}

The 'is_enabled' parameter is True if a gas is calculated Endogenously or used Exogenously.

SDGs are formatted as shown below:

{'**sdg_category**':{

'**name'**: **the name of the SDG**,

'**title'**: **a detailed description of the SDG**,

'**icon'**: **a path to an image file (icon) used on the interfaces**,

'**is_enabled**': **True or False**,

'**html**': **the HTML code that will be used in the bootstrap tooltips**

}

}

The 'is_enabled' parameter is True if an SDG name exists for the selected model.

Socio-economics and **Policy** granularities are formatted as shown below:

{'**category**':{

'**names**': [{"**quantity_name**":"**quantity_state**"}, ….],

'**icon**': **a path to an image file (icon) used on the interfaces**,

'**is_enabled**': **True or False**,

'**html**': **the HTML code that will be used in the bootstrap tooltips**

}

}

For socio-economics, the 'is_enabled' parameter is True if at least one socio-economics quantity in a category is covered Endogenously or Exogenously. For policies, the 'is_enabled' parameter is True if at least one policy in a category is Feasible or Feasible with modifications.

Essentially, the "names" parameter is a list of JSON objects, whose key is a granularity quantity and value a Boolean value that shows if the specific quantity is covered by the model.

1.3.2 Frontend Services of Dynamic Documentation

The Dynamic Documentation utilises "Django HTML Templates", "JQuery" and the "AMCharts4 Library" for its user interfaces. In the context of ***co-creation and collaborative thinking***, ideas where provided by several stakeholders and more than one different interfaces have been created for the Dynamic Documentation, with a view to receiving feedback on each of them and satisfying all the needs of every possible user. Some of them are more detailed and descriptive, others are minimal and compact. At the moment, the user may choose any of the available options through a select/dropdown element positioned under the "Dynamic Documentation" icon in the Documentation Section of the Landing Page (Figure 5), but this type of functionality will be available inside the Dynamic Documentation service in the future, in order to allow immediate interface alterations without much effort.

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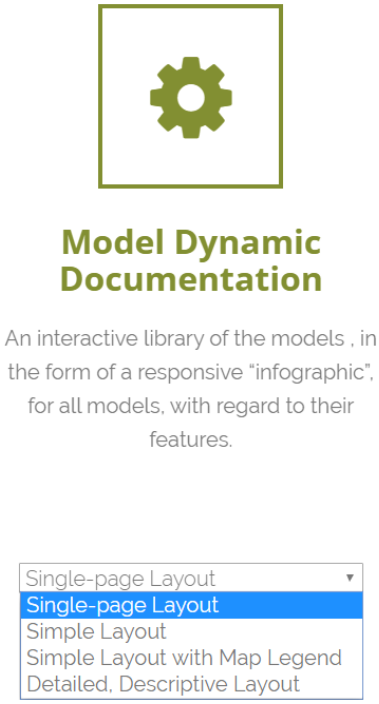

Figure 5: Choosing Different Dynamic Model Documentation Interface

The different interfaces are presented in the screenshots below:

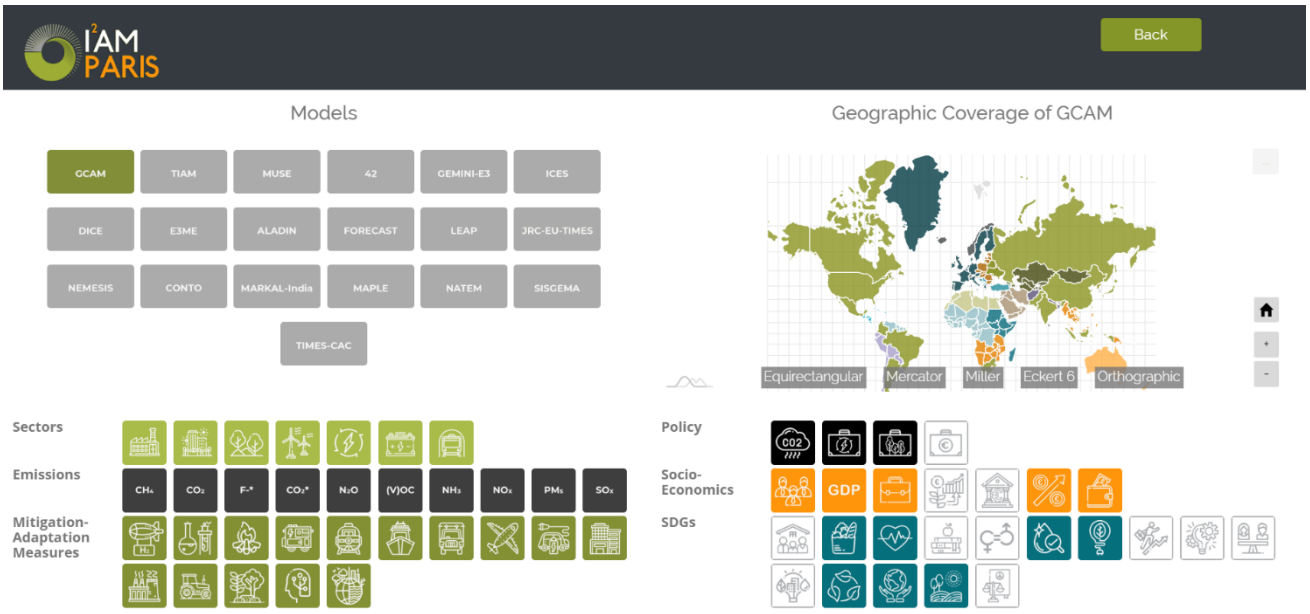

Figure 6: Single-Page layout

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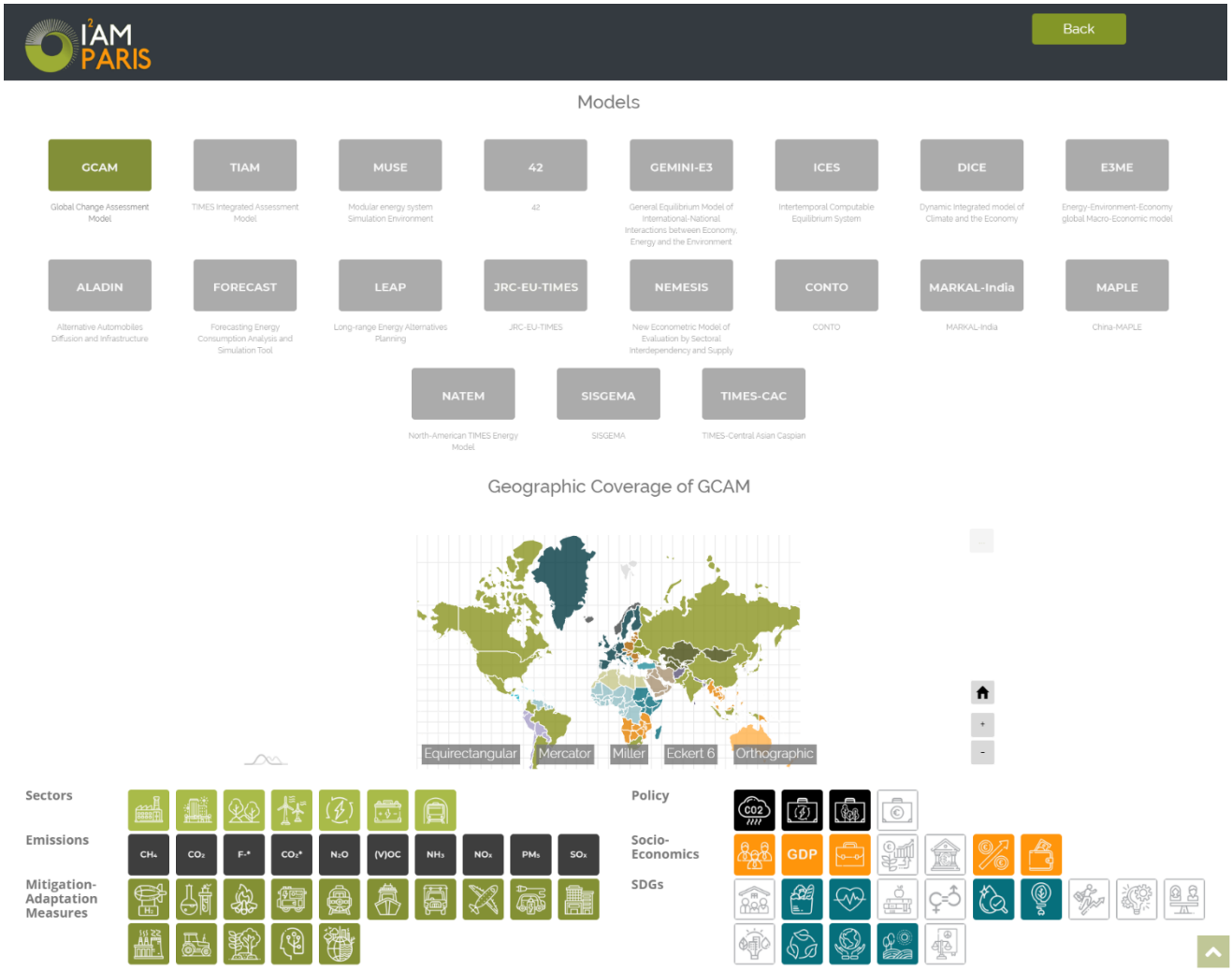

Figure 7: Simple layout

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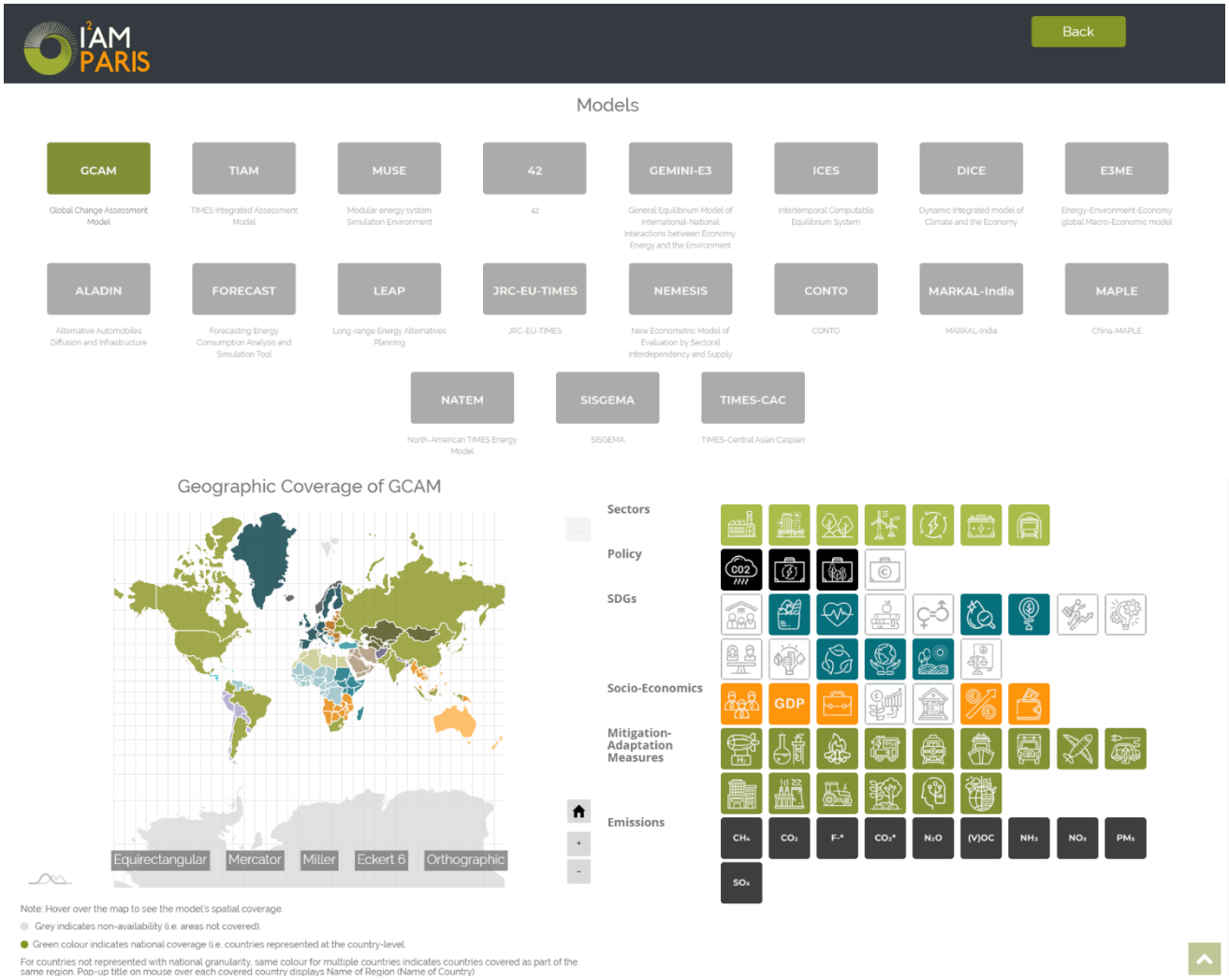

Figure 8: Simple layout with map legend

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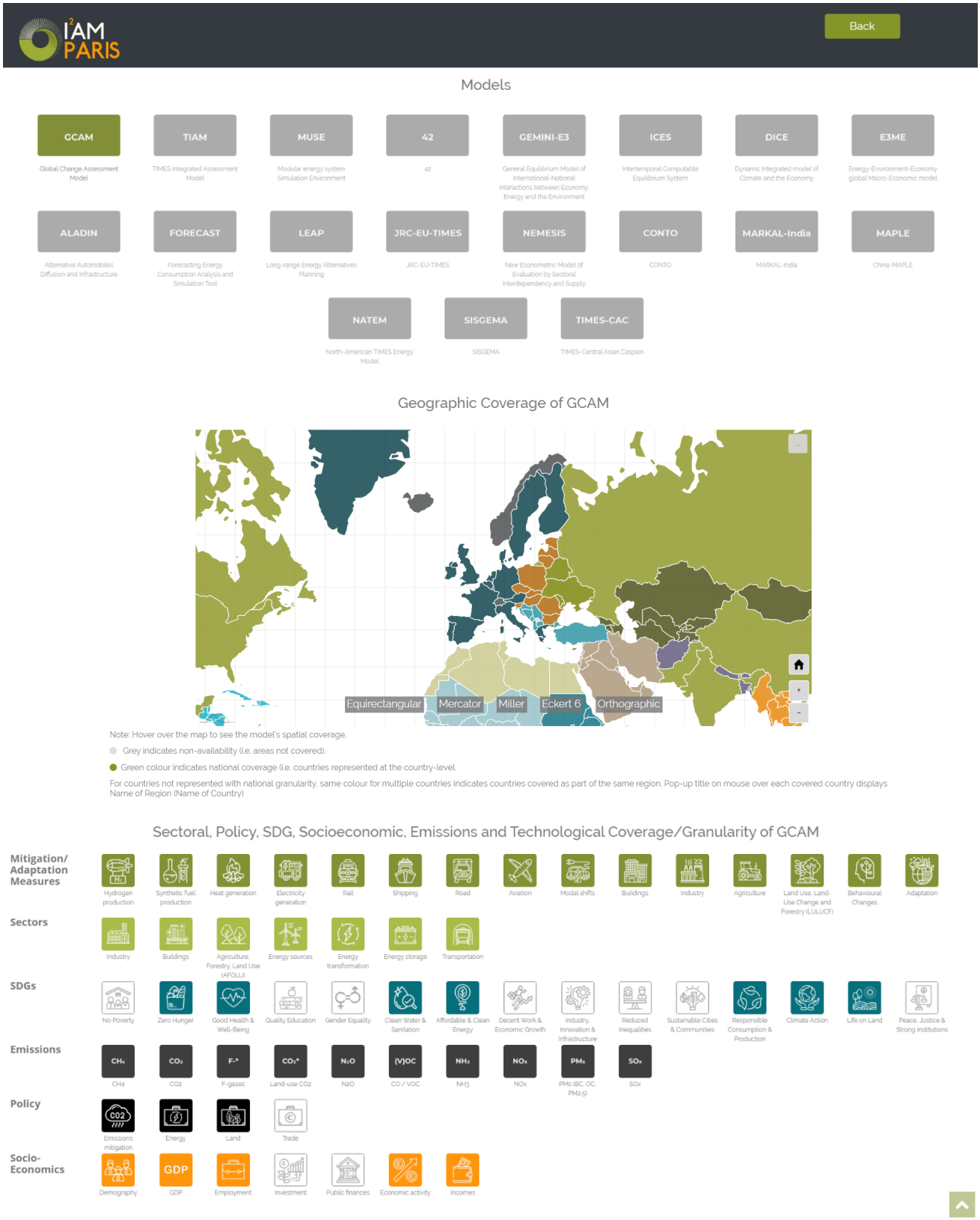

Figure 9: Detailed, descriptive layout

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In every interface the following rules apply:

- The currently selected model appears in green colour, while the remaining are greyed out.
- In the map: Grey colour indicates areas not covered by the model and (olive) green colour indicates national coverage (i.e. countries represented at the country-level). For countries not represented with national granularity, same colour for multiple countries indicates countries covered as part of the same region. Pop-up title on mouse over each covered country displays the name of the region and the name of the country in the parentheses.
- The coloured icons in the granularity section are the categories (of each type) that are covered by the model (or at least a part of them). The greyed-out icons represent the categories that are not covered at all by the selected model.
- The user may select among different map projections according to their preference using the buttons positioned at the bottom of the map. The available options are: Equirectangular, Mercator, Miller, Eckert 6, Orthographic (Figure 10). Zooming in/out as well as dragging and dropping on the map behave according to the selected projection.

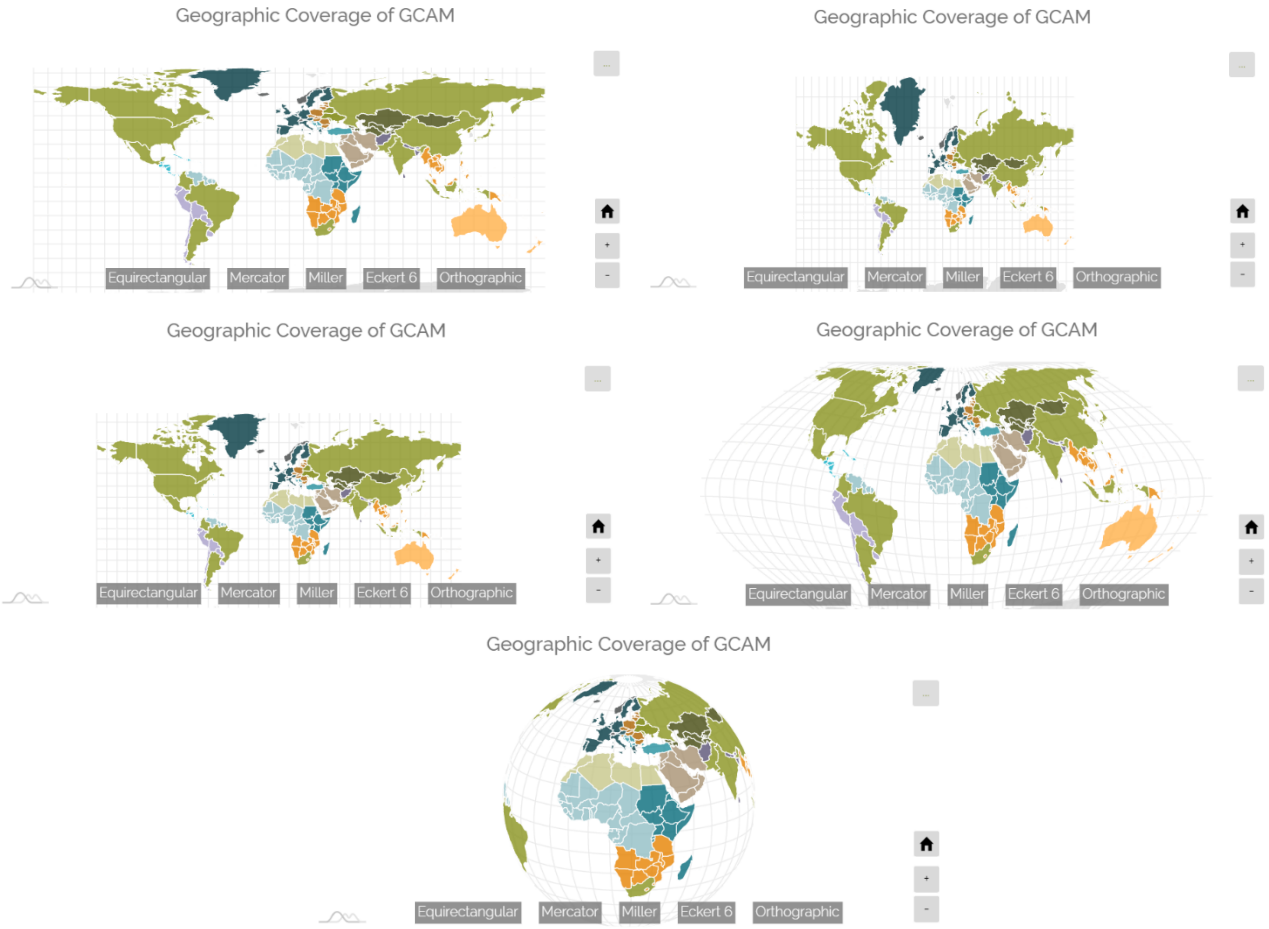

Figure 10: Different Projections (Equirectangular, Mercator, Miller, Eckert 6, Orthographical)

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- By hovering over the granularity icons, a tooltip appears, showing the subcategories and specific quantities covered by the model in green. The rest are crossed out and shown in grey (Figures 11,12).

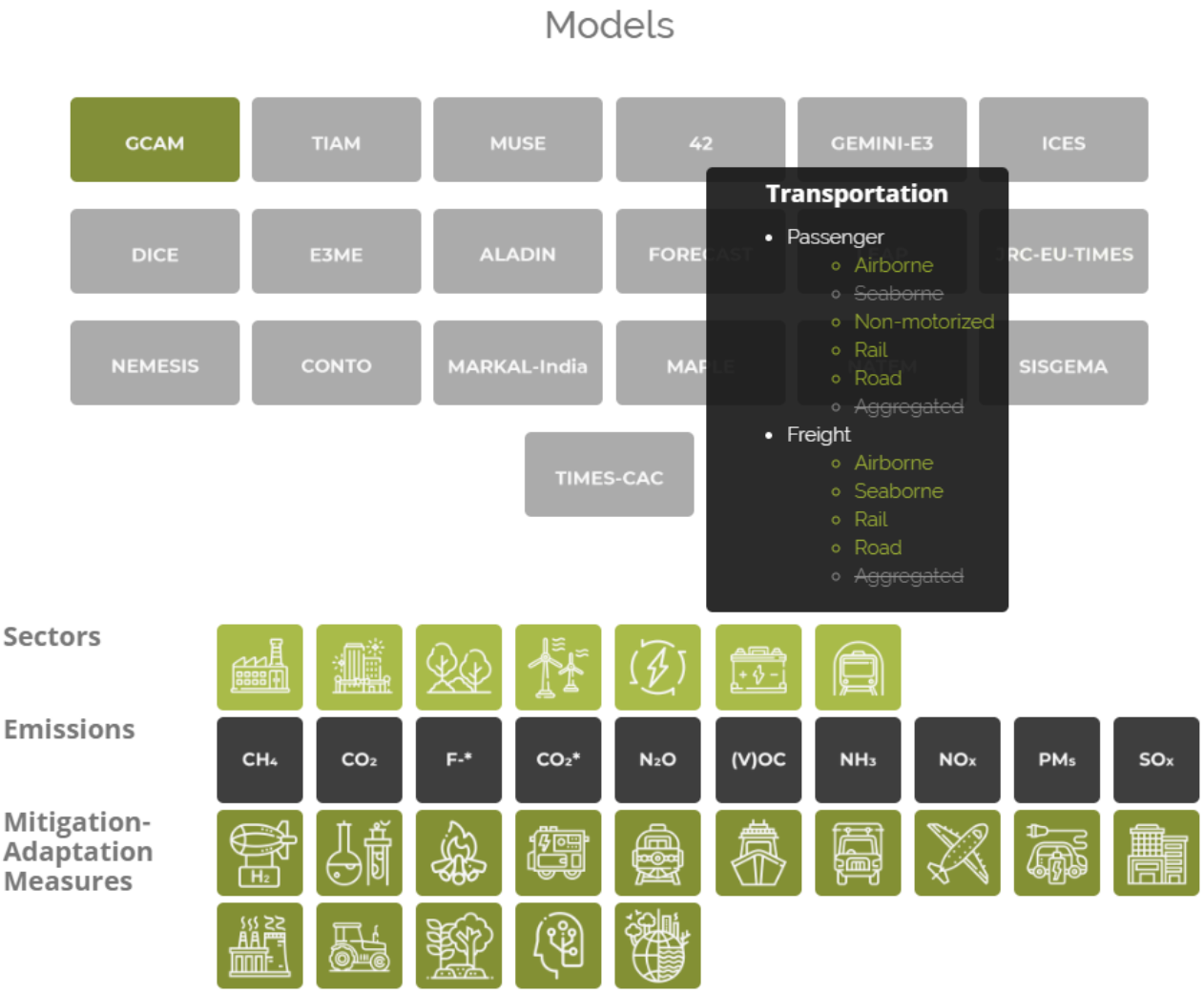

Figure 11: Hovering over the transportation sector

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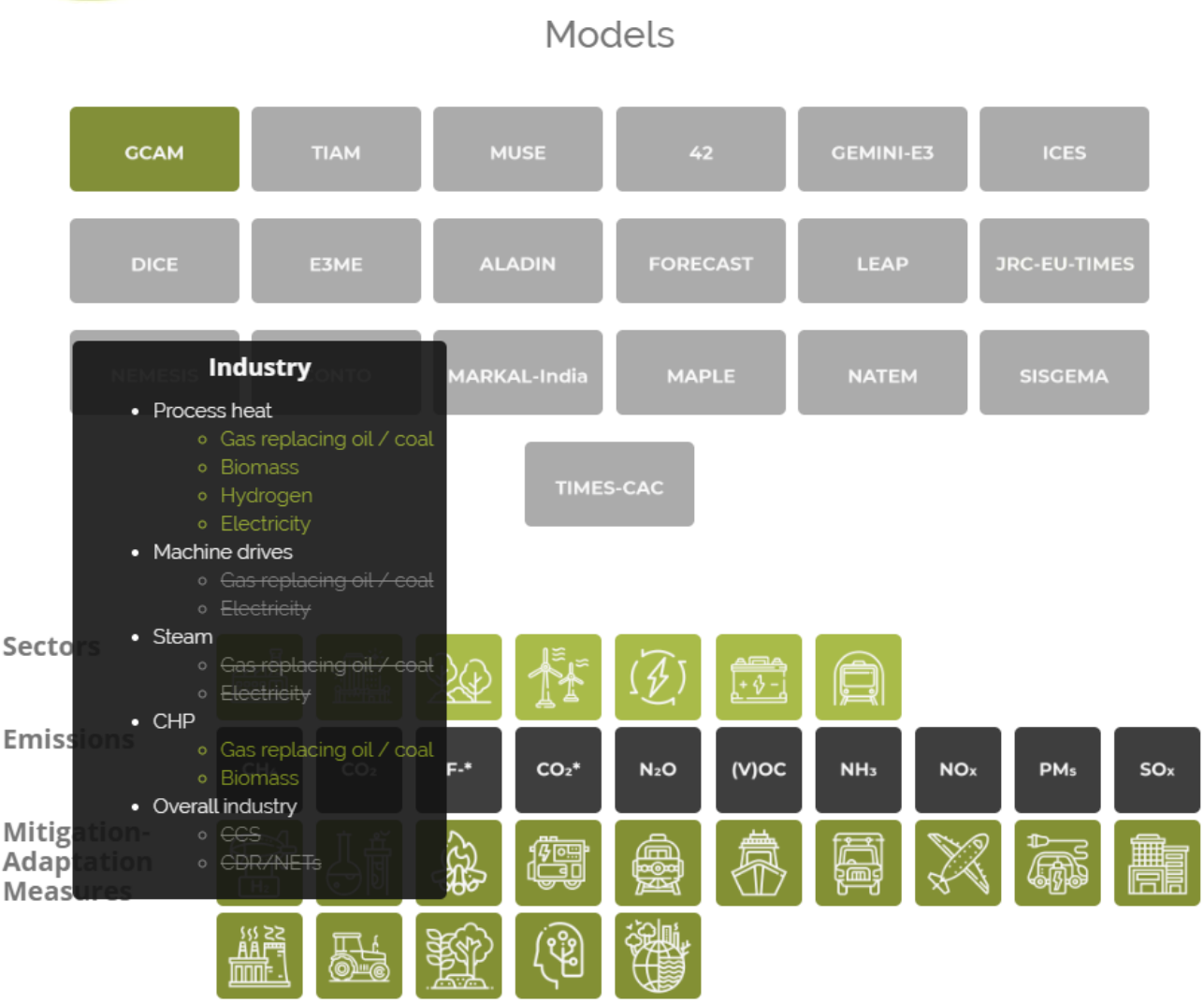

Figure 12: Hovering over the Industry Category of Mitigation and Adaptation Measures

- Hovering over a model button, an "i"-icon appears. Clicking on it, the user is redirected to the corresponding page of the detailed documentation for this specific model (Figure 13).

Figure 13: Information icon on the top-left on hover

1.4 Detailed Model Documentation

The Detailed Model Documentation interface contains detailed information regarding the models included in the I²AM PARIS platform, using a content menu for each model along with a navigation bar in order to seamlessly navigate throughout the entire documentation. The landing page of the Detailed Model Documentation consists of a model catalogue separated by geographical coverage (Global Models, National/ Regional Models for Europe, National/ Regional Models for Countries Outside Europe) as shown in the figure below.

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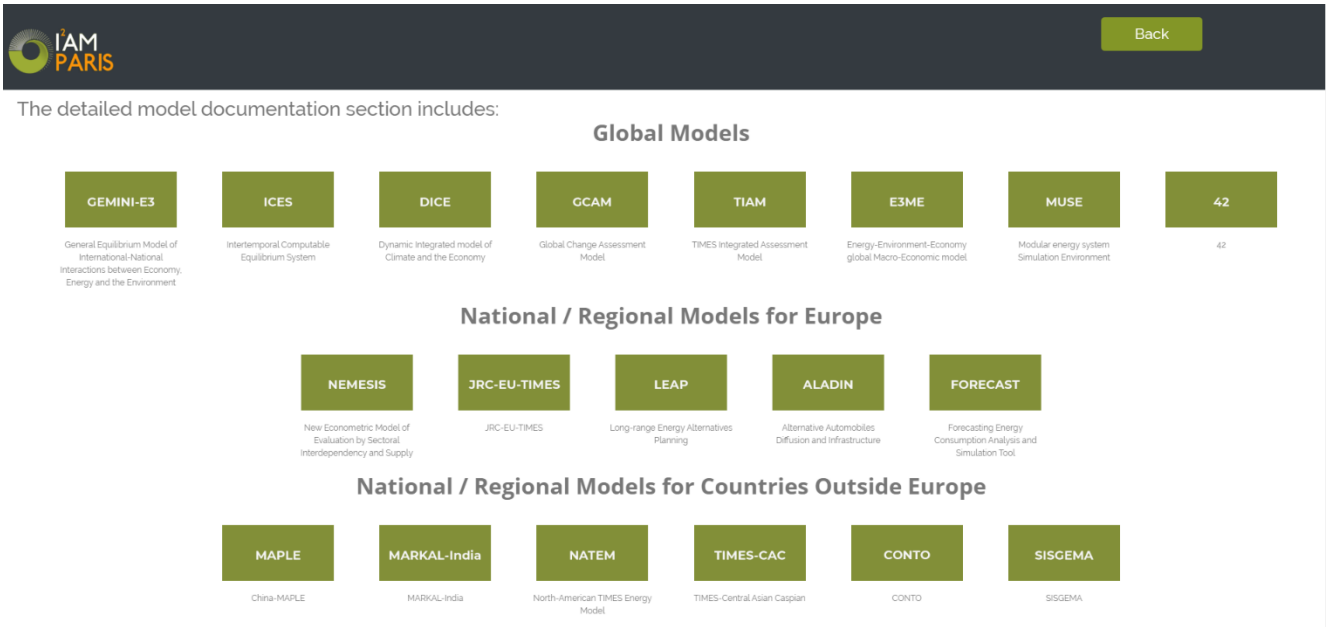

Figure 14: Detailed Documentation Landing Page

Once the user selects the desired model, they are led to the requested page. Each model has its own page, which provides a content menu (by pressing the content button on the top-right of the screen) that can be used to jump to a specific point in the text. Furthermore, a navigation bar is available on the top of each page, providing more flexibility and the ability to switch between models. The screenshots below present the above-mentioned features for the detailed documentation of the GCAM model.

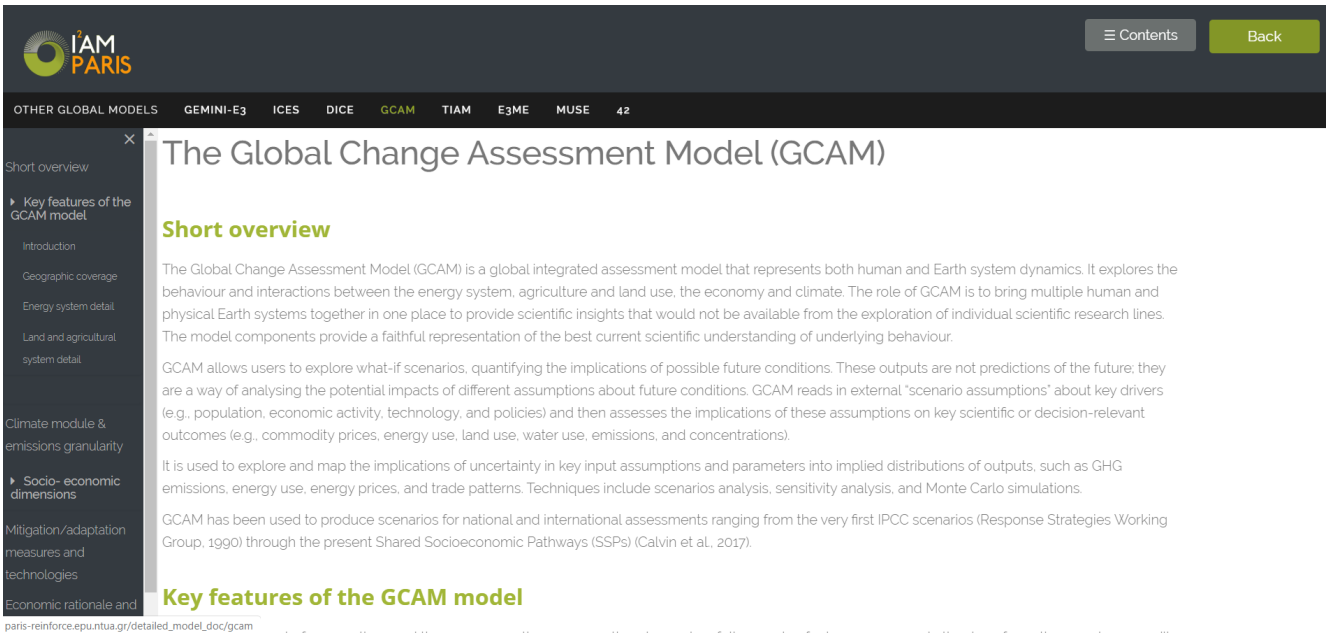

Figure 15: Detailed Documentation of GCAM

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1.5 Overview and Comparative Assessment

The Overview and Comparative Assessment interface follows the same logic as the Detailed Model Documentation in terms of structure and available features, including the results of the comparison between models of the same coverage in the form of expanding headings. The following screenshots are taken from the global models' overview and comparative assessment.

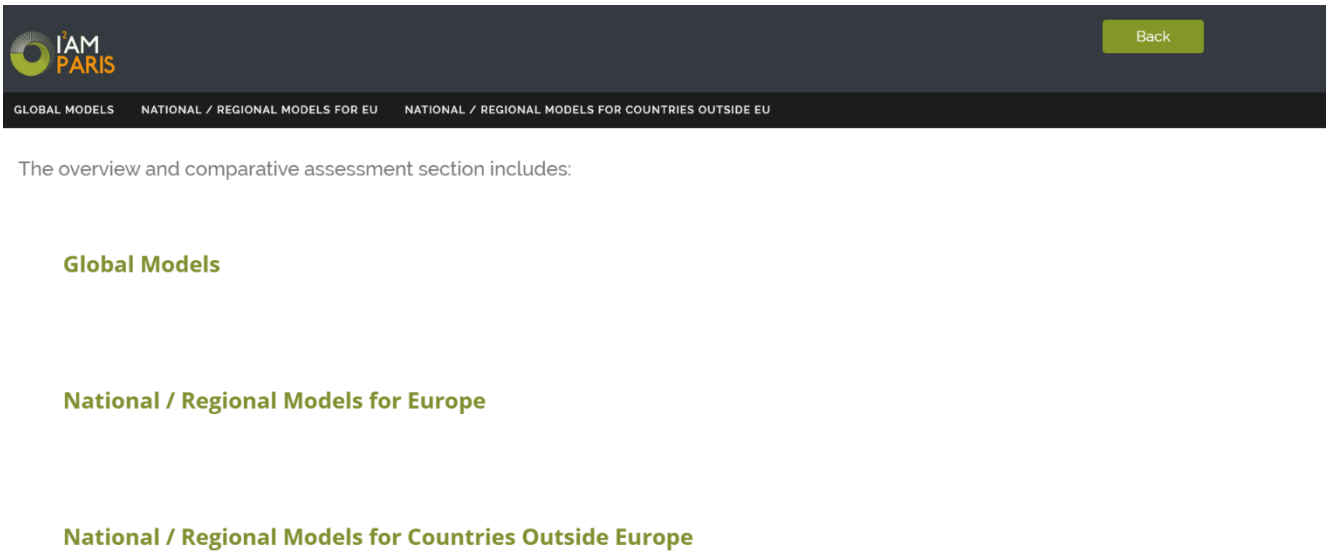

Figure 16: Overview and Comparative Assessment Landing Page

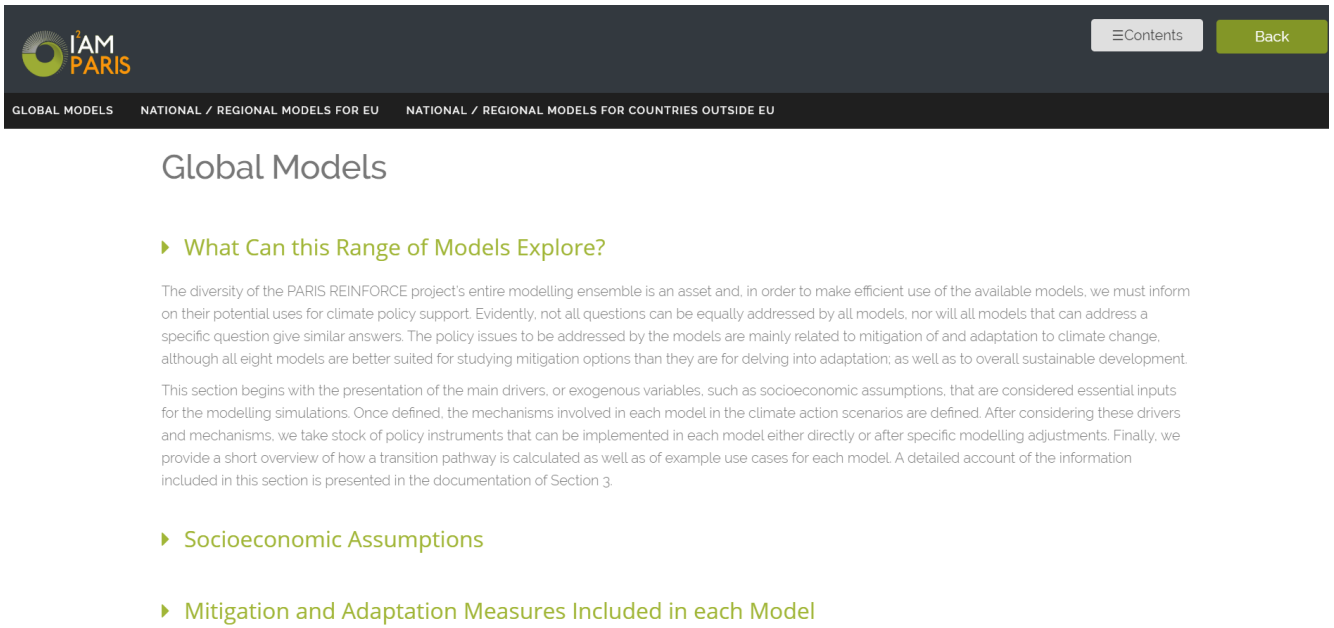

Figure 17: Overview and Comparative Assessment for Global Models

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1.6 User Feedback Form

The User Feedback Form is placed at the bottom of the landing page of the I²AM PARIS platform (Figure 18) and aims at facilitating the feedback collection, in order to improve platform functionality, fix bugs and handle/respond to requests for new services. Once the form is filled in and submitted, its content is sent to the developers using Python's mail sending interface and Django's wrappers over it, specifying the SMTP host and port in the project settings. The Feedback form utilises Google's reCAPTCHA to protect the website against bots and spam.

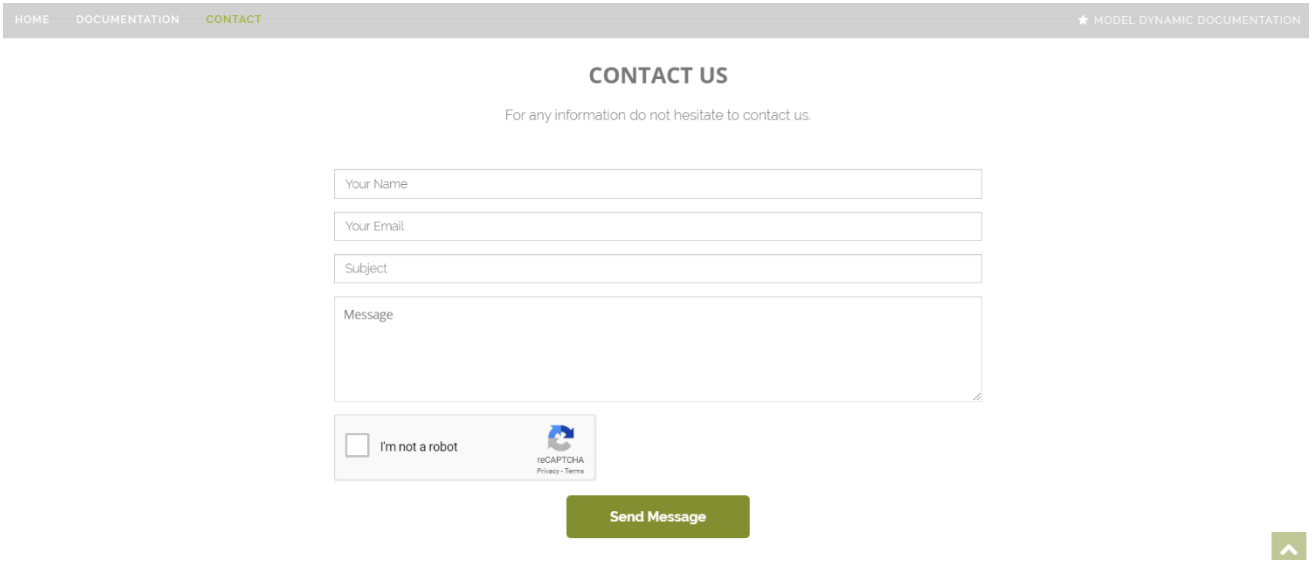

Figure 18: User Feedback Form

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